CITY OF ISSAQUAH

STORMWATER MANAGEMENT PLAN

YEAR 2002

Prepared by
City of Issaquah Public Works Engineering Department
June 2004 Final

Acknowledgements

The Stormwater Management Program plan was prepared by the City of Issaquah Public Works Engineering Department, Issaquah, Washington. Kerry Ritland, P.E., was the primary author.

Mayor
Ava Frisinger

City Council
Nancy Davidson, President
Fred Butler
Russell Joe
David Kappler
Bill Conley
Joe Forkner
Hank Thomas

Public Works Department Project Staff
Bob Brock, P.E., Public Works Director
Bret Heath, Public Works Operations Director
Sheldon Lynne, P.E., Deputy Public Works Director
Kerry Ritland, P.E., Senior Water Resources Engineer

For Additional Information

Updated information on stormwater management activities in the City of Issaquah can be found at the City's web site: www.ci.issaquah.wa.us. Various topics are located on the Public Works Engineering and Resource Conservation Office home pages.

Table of Contents

PAGE

EXECUTIVE SUMMARY

1. INTRODUCTION 1-1

2. PLANNING AREA DESCRIPTION 2-1

2.1 Overview 2-1
2.1.1 Land Use 2-1
2.1.2 Population 2-2

2.2 Streams and Drainage Basins 2-2
2.2.1 Stream Features 2-3
2.2.2 Stormwater Drainage Sub-basins 2-4
2.2.3 Fish Usage 2-7
2.2.4 Issaquah Creek Hatchery 2-8

2.3 Stormwater System 2-9
2.3.1 Stormwater Requirements for New Development 2-10
2.3.2 Issaquah Highlands Development 2-10
2.3.3 TALUS Development 2-11

2.4 Floodplains and Floodways 2-11

2.5 Flooding History 2-12
2.5.1 Flood Frequency 2-13
2.5.2 Historical Flood Accounts 2-13
2.5.3 Magnitudes of Historical Floods 2-16
2.5.4 Flood Damage Costs 2-18
2.5.4.1 Survey of 1996 Flood Event 2-18
2.5.4.2 FEMA Flood Insurance Claims 2-18
2.5.4.3 Repetitive Loss Properties 2-20

2.6 Water Quality and Habitat 2-21
2.6.1 Issaquah Creek Basin Plan Evaluation 2-21
2.6.2 Water Quality 2-21
2.6.3 Fish Habitat 2-22

3. STORMWATER POLICIES 3-1

4. FLOODING AND STORMWATER EVALUATION 4-1

4.1 City of Issaquah Comprehensive Plan and the Growth Management Act 4-1

4.2 Regulations 4-2
4.2.1 State and Federal Stormwater Programs 4-2
4.2.1.1 Puget Sound Water Quality Management Plan 4-3
4.2.1.2 ESA 4(d) Rule 4-7
4.2.1.3 NPDES Municipal Stormwater Permitting Phase II 4-12
4.2.1.4 Issaquah Creek Fecal Coliform TMDL 4-13
4.2.2 City Ordinances 4-14

4.2.2.1 Areas of Special Flood Hazards (IMC Chapter 16.36) 4-14
4.2.2.2 Stormwater Management Policy (IMC Chapter 13.28) 4-16
4.2.2.3 Clearing and Grading Code (IMC Chapter 16.26) 4-16
4.2.2.4 Stormwater Management Utility (IMC Chapter 13.30) 4-16
4.2.2.5 Critical Areas Ordinance (IMC Chapter 18.10.340) 4-17
4.2.2.6 Shoreline Management Program (IMC Chapter 18.10.940) 4-17
4.2.3 National Flood Insurance Program 4-17
4.2.3.1 Community Rating System 4-18
4.2.3.2 Flood Insurance Rate Maps 4-18

4.3 Issaquah Creek Flood Control Program 4-19
4.3.1 Gilman Area Channel Improvements 4-20
4.3.2 Pickering Area Channel Improvements 4-21
4.3.3 Bridge Replacements 4-21
4.3.4 Property Acquisition 4-22

4.4 Tibbetts Creek Greenway Project 4-22

4.5 Groundwater 4-23
4.5.1 Wellhead Protection Plan 4-25
4.5.2 Issaquah Creek Valley Groundwater Management Plan 4-27

4.6 Other Studies 4-28
4.6.1 FEMA Flood Insurance Studies 4-28
4.6.2 The 1993 Comprehensive Floodplain and Drainage Management Plan 4-29
4.6.3 1996 Issaquah Creek Basin Plan 4-29
4.6.4 Flood Protection Alternatives for the Issaquah Creek Basin 4-30
4.6.5 Lake Sammamish Water Quality Management Project 4-31
4.6.6 Lake Sammamish Water Quality Management Plan 4-32
4.6.7 Miscellaneous Monitoring and Water Quality Reports 4-33

4.7 Summary of Alternatives 4-33

5. CAPITAL PROJECTS 5-1

5.1 Recently Completed Projects 5-1

5.2 Capital Project Descriptions 5-1
5.2.1 Issaquah Creek – Cherry Area 5-1
5.2.2 Issaquah Creek – Sycamore Area 5-5
5.2.3 Tibbetts Creek Greenway 5-6
5.2.4 Water Quality Retrofits 5-6
5.2.5 Stormwater Conveyance Improvements 5-7

6. MANAGEMENT PROGRAMS 6-1

6.1 Overview 6-1

6.2 Stormwater Management Ordinance 6-2

6.3 Stormwater Maintenance Program 6-3
6.3.1 Public Maintenance Program 6-3
6.3.2 Stormwater Facility Inventory 6-4
6.3.3 Private Stormwater Maintenance Program 6-5
6.3.4 Maintenance Stardards 6-6

6.4 Water Quality Program 6-7
6.4.1 Aquatic Resource Monitoring Program 6-7
6.4.2 Emergency Water Quality Response 6-10
6.4.3 Water Quality Investigations and Stormwater Facility Retrofitting 6-11
6.4.3.1 Identification and Ranking of Significant Pollution Sources 6-11
6.4.3.2 Storm Drain Retrofitting 6-12

6.5 Floodplain Management and Flood Fighting 6-12
6.5.1 Regulatory Codes 6-12
6.5.2 Flood Warning System and Flood Fighting 6-12
6.5.3 Education and Outreach 6-16
6.5.4 FEMA Floodplain Map Update Project 6-16
6.5.5 Repetitive Flooding Loss Reports 6-16

6.6 Public Education and Outreach 6-17
6.6.1 Water Quality Education & Outreach Programs 6-17
6.6.1.1 Flow Newsletter 6-17
6.6.1.2 Issaquah Businesses for Clean Water 6-17
6.6.1.3 Storm Drain Stenciling 6-18
6.6.1.4 Residential Water Quality Education 6-18
6.6.1.5 Smart & Healthy Landscape Program 6-18
6.6.1.6 Green Car Wash Program 6-19
6.6.1.7 Green Gardening Classes (1997-1998) 6-19
6.6.1.8 Watershed Signage 6-19
6.6.1.9 Household Hazardous Wastemobile 6-19
6.6.2 Stewardship Programs 6-19
6.6.2.1 Issaquah Stream Team 6-20
6.6.2.2 Restoration Site / CIP Maintenance and Monitoring 6-20
6.6.2.3 Issaquah Community Link Program 6-21
6.6.2.4 Other Stewardship Activities 6-21

6.7 Habitat Enhancement and Acquisition 6-21
6.7.1 Property Acquisition 6-21
6.7.2 Other City Property Acquisitions 6-22

6.8 Stormwater Resource Action Plan 6-23

6.9 Special Studies 6-23

7. CAPITAL IMPROVEMENT PROGRAM 7-1

7.1 Capital Improvement Program 7-1

7.2 Funding Alternatives 7-1

8. REFERENCES 8-1

Appendices

Appendix A Flood History Data
Appendix B Stormwater Management Code
Appendix C Standard Operating Procedure - Hazmat Spill, Hazardous Waste, and Water Quality Response
Appendix D Flooding Repetitive Loss Plan, Annual Progress Report – 2002
Appendix E Adopting Resolution

Maps

Map 1 Surface Water and Drainage Features in Issaquah Map Pocket

Figures

Figure 2-1 Surface Water Features in Issaquah 2-5
Figure 2-2 Stormwater Drainage Sub-basins in Issaquah 2-7
Figure 2-3 Issaquah 100-Year Floodplains 2-14
Figure 2-4 Historical Flood Peaks, 1946-1999 2-17
Figure 2-5 Comparison of Issaquah Creek Flooding History to Longer-Term Cedar River History 2-17
Figure 5-1 Completed and Proposed Stormwater and Flood Improvement Projects in Issaquah 5-3
Figure 6-1 Water Quality and Streamflow Gauging Monitoring Locations 6-8
Figure 6-2 Flood Fighting Brochure 6-14
Figure 6-3 Open Space Acquisitions and Preserved Areas along Issaquah Streams 6-24

Figure A-1 Historical Precipitation Trends at Landsburge A-8
Figure A-2 Comparison of Issaquah Creek Flooding History to Longer-Term Cedar River History A-8
Figure A-3 Comparison of Historical Floods on Issaquah Creek and Raging River A-9

Tables

Table 2-1 Issaquah Land Use Summary 2-2
Table 2-2 Streams in Issaquah 2-3
Table 2-3 Stormwater Drainage Sub-basin Data 2-4
Table 2-4 Fish Presence in Issaquah Streams 2-7
Table 2-5 Flood Frequency Estimates for Issaquah Streams 2-13
Table 2-6 Estimated Flood Damages from February 1996 Flood 2-18
Table 2-7 Summary of NFIP Flood Insurance Claims by flood event, 1980 - 1999 2-19
Table 2-8 Summary of NFIP Flood Insurance Claims by Stream Reach, 1980-1999 2-19
Table 3-1 Stormwater Policies from City Comprehensive Plan 3-2
Table 4-1 Comparison of Puget Sound Plan, ESA, and NDPES Phase 2 Stormwater Requirements 4-4
Table 4-2 Puget Sound Plan Requirements for Local Government Planning and Stormwater Programs 4-8
Table 4-3 ESA 4(d) Rule Stormwater Elements 4-10
Table 4-4 Minimum Control Measures Required under NPDES Phase II 4-13
Table 4-5 Current (2002) Stormwater Utility Rates 4-17
Table 4-6 Summary of Basin Plan Flood Control Alternatives 4-30
Table 4-7 Summary of Capital Improvement And Programmatic Alternatives 4-34
Table 5-1 Recently Completed Stormwater and Floodplain Capital Projects 5-2
Table 6-1 Floodplain Management, and Stormwater Management, and Public Education and Outreach Programs 6-2
Table 6-2 Public Stormwater Maintenance Service Levels and Staffing 6-4
Table 6-3 Development and Implementation of Private Stormwater Maintenance Program 6-6

Table 6-4 Issaquah Sampling Locations and Events....6-9
Table 6-5 Sampling Parameters for Ongoing Monitoring Programs....6-10
Table 6-6 Spill Response Summary....6-11
Table 6-7 Flood Warning System Flood Phases....6-13
Table 6-8 Community Involvement in Outreach Programs during 1999-2000....6-17
Table 6-9 Summary of Floodplain Acquisitions for Flood Hazard Mitigation....6-22
Table 7-1 Approved 2002 and 2003 Budgets and Recommended Projects from the 2003-2008 Capital Improvement Program....7-3
Table 7-2 Summary of Stormwater CIP Projected Costs (2002-2008)....7-4

Table A-1 Precipitation associated with Historical Flood Events....A-2
Table A-2 Rainfall Depth-Duration-Frequency Estimates....A-3
Table A-3 Recorded Annual Maximum Floods on Issaquah Creek....A-3
Table A-4 Flood Frequency Estimates....A-5
Table A-5 Effects of Urbanization on Peak Flow Rates in Issaquah Creek....A-7

(page left intentionally blank)

EXECUTIVE SUMMARY

The City of Issaquah's Stormwater Management Plan was prepared to guide the City in planning, funding and implementing a comprehensive program for addressing current and future regulatory and policy requirements for managing stormwater runoff, flooding problems, and the City's natural resources. This Executive Summary presents a brief overview of the various programs described in the Plan.

The City's stormwater program currently consists of many separate programs, conducted by the Public Works Operations and Public Works Engineering Departments and the Resource Conservation Office. These programs are typically implemented to respond to regulatory requirements, the need for public services and safety, and the City's commitment to protect and improve the quality of its natural resources. Examples include capital improvement projects for stormwater and flood control, maintenance of public stormwater systems, flood control program to reduce flood impacts and associated flood damages along Issaquah and Tibbetts Creeks, flood management programs to control development in floodplains and mitigate impacts, flood warning and flood fighting, resource monitoring of streams to assess and respond to water quality problems, private stormwater facility inspection, and public involvement and education.

PURPOSE AND NEED FOR THIS PLAN

The purpose of the Stormwater Management Plan is to comprehensively address how to meet the many different but related regulations, adopted plans and programs, and policies that affect urban stormwater, flooding and associated water-dependent resources. Because many of these requirements from different sources affect the same activities, an overall stormwater plan is needed to address the interrelationships of the programs and efficient approaches for meeting requirements and implementing policy, consistent with long-term goals, objectives and policies as outlined in the City of Issaquah Comprehensive Plan.

Stormwater issues and problems that create the need for action are described later in this Executive Summary. To address current problems the City of Issaquah is faced with many regulatory and policy obligations, including:

- **Federal Stormwater Permitting.** The Phase II National Pollution Discharge Elimination System (NPDES) stormwater permitting program, a Federal Clean Water Act requirement delegated to the State Department of Ecology, requires cities with municipal stormwater systems to implement stormwater maintenance and management programs as a means to control polluted discharges. Permit applications are due in March, 2003.
- **Growth Management.** The Growth Management Act (GMA), as implemented through the City's Comprehensive Plan, requires consistency of capital facilities – including stormwater – with current and projected land use plans. It also requires cities to address water resources through adequate development regulations, protection of water quality and anadromous fisheries, and conservation and protection of resource lands.
- **Stormwater Utility Level of Service**. GMA also requires that level of service standards be established for all utilities, and must be implemented consistently in the service area and in response to growth. This not only affects capital improvement programs, but also

operations and maintenance to keep existing facilities operating at established levels of service.

- **Floodplain Management.** The City participates in the National Flood Insurance Program (NFIP), which makes Federally subsidized flood insurance available to the community. In addition, participation in the NFIP's Community Rating System program provides residents with discounted flood insurance in exchange for the City implementing flood hazard management activities that exceed the minimum NFIP standards.
- **Endangered Species Act**. In response to the March 1999 listing of Puget Sound Chinook salmon under the Endangered Species Act (ESA), the Federal Government is developing new requirements to address impacts of stormwater on salmon and its habitat. In general, these requirements are being incorporated into other regulatory programs that have a Federal nexus, such as the Department of Ecology's updated Stormwater Management Manual and the Shoreline Master Program. Additional local requirements may be forthcoming as part of the Tri-County response to the ESA 4(d) rule.
- **City Codes**. Over the years the City has adopted many codes that promote responsible development, sustainability of resources, and environmental protection. Implementation of those requirements is typically through private development permits, but some affect City programs and operations.
- **Resource Action Plan**. Several previous plans that addressed stormwater management were adopted by the City Council in 1995 as part of the Resource Action Plan. Several current City programs have their origins in that plan. The Issaquah Creek Basin and Non-Point Action Plan recommended a series of programmatic and capital improvement projects for flooding reduction, water pollution control, habitat preservation, and stream channel stabilization. The Resource Action Plan also incorporated the recommendations of the Wellhead Protection Plan, the Issaquah Creek Valley Groundwater Management Plan, and the Lake Sammamish Water Quality Management Plan.

City Policies

Policies provide official guidance on approaches and likely courses of action for meeting City goals, objectives, and obligations. The Utilities and Public Services element of the City of Issaquah Comprehensive Plan identifies policies that guide the City's stormwater utility and associated projects and programs.

Draft stormwater policies to support the Stormwater Management Plan were initially proposed in 2002 during development of this plan. Those policies were reviewed by the Planning Department and the Rivers and Streams Board, and incorporated into the Planning Policy Commission's recommended amendments for the 2001 Update to the City of Issaquah Comprehensive Plan. Following the public workshop and hearing process those policies were adopted by the Issaquah City Council on September 3, 2002.

Programs and projects that are referenced in the Stormwater Management Plan are consistent with the policies adopted in the 2001 Update to the City Comprehensive Plan. Polices are grouped into these nine subject categories:

- Design and permitting;
- Flood protection;

- Flood hazard management;
- Stormwater management and water quality protection;
- Funding of capital improvement projects and programs;
- Land use and critical area regulations;
- Public education and outreach;
- Regional coordination and ESA; and
- Fish and wildlife habitat**.**

In addition, the City over the years has also adopted other plans, such as the Issaquah Creek Basin and Non-Point Action Plan, and is obligated to follow policies required by the Growth Management Act (GMA). Those policies are included or adopted by reference in the City Comprehensive Plan and incorporated into the Stormwater Management Plan as appropriate.

Table ES-1 cross-references the various stormwater program activities to the adopted policies and other regulatory requirements, as well as the implementation status of those activites. Further description of the activities in Table ES-1 is provided below under *STORMWATER PROGRAM ACTIVITIES*.

Council Goals

In addition to adopted policies, Council goals help guide the identification, selection and prioritization of city government activities that are established during each budget year. In 2002 the council identified two goals that relate to stormwater management:

- Protection of ground water and surface water by implementing a water resource management and protection plan (No. 2), and
- Implementation of the Tibbetts Greenway Projects and Bianco mine tailing remediation (No. 7).

STORMWATER ISSUES

The City of Issaquah has implemented many stormwater and flood control programs and projects in recent years in response to past regulatory requirements, need for public services and safety, and protecting and improving the quality of its natural resources. Nevertheless, many issues remain that create a need for coordinated and focused action, a few of which are described below.

- **Flooding**. Flooding along Issaquah Creek, Tibbetts Creek and other streams continues to be a significant issue. Flooding is a natural occurrence and, because much of the City is located in a floodplain, it affects many low-lying areas along Issaquah Creek that were developed before floodplain development standards were implemented about 20 years ago. Since flooding cannot be eliminated, a variety of floodplain management strategies are typically employed to mitigate these hazards.
- **Stormwater Quality and Quantity**. New developments are required to mitigate the impacts of stormwater quantity and quality. However, older areas of the City were developed without effective stormwater runoff and water quality controls. As a result stormwater continues to impact the City, area streams and Lake Sammamish.

- **Stream Habitat.** The City is also faced with degraded stream corridors. The listing of Chinook salmon under the Endangered Species Act (ESA) has increased the need for actions aimed at preservation, acquisition and restoration of stream and riparian habitat.
- **Groundwater and Water Supply.** Sustainability of the City's groundwater supply, in terms of being able to meet Water Utility supply needs without adversely impacting groundwater resources and stream base flows, has been a concern for many years. Stormwater is linked to this issue because the creation of impervious surfaces by development activities reduces the ability of stormwater to recharge the aquifer. (Groundwater sustainability is currently being addressed through water supply planning studies that are funded through the Water Utility).
- **Maintenance and Operations**. Stormwater runoff in the City consists of two components: runoff from City streets and properties, and runoff from private property that enters the City's stormwater system (including drainage facilities and streams). Conducting routine maintenance on both public and private stormwater facilities is essential for ensuring that stormwater facilities operate as designed to minimize stormwater quality and quantity impacts on receiving waters. This requires accurate as-built information on the stormwater infrastructure, to effectively and efficiently manage the maintenance operations, and sufficient operations and maintenance staff as the City increases in size and population.
- **Water Quality Response and Public Education**. Many water quality and stream issues are associated with the conduct of property owners, businesses, and our citizens. While most people are probably supportive of efforts to control pollution and preserve the natural features of stream corridors, a few are probably not aware of ordinances that prohibit certain conduct, such as clearing vegetation along streams or dumping pollutants down storm drains. In addition, businesses and property owners have an obligation to maintain their stormwater systems and control pollutant sources. This requires enforcement of regulations on pollution control and maintenance of stormwater systems, a response plan to address spill incidents, plus aggressive public education efforts.

STORMWATER PROGRAM ACTIVITIES

Evaluation of flooding, stormwater runoff, and water quality has been the subject of many studies over the years. In response, the City will implement capital improvement projects, stormwater and floodplain management programs, and natural resource programs to improve flooding conditions and preserve and restore stream corridors that pass through the City. The Public Works Operations staff also provides maintenance and repair to the public stormwater infrastructure.

Actions for the next several years – as categorized into the capital projects, management and regulatory programs, and public education and outreach – are summarized in Table ES-1. This table is an overall summary of the City's current stormwater program; detailed descriptions of each activity are included in the Stormwater Management Plan document in Table 4-7 and Chapters 4 through 7 (references to the specific sections in the document are included in Table ES-1). Existing policies and regulatory requirements that prompt the City to implement the activities are also identified in this table.

An overview of these projects and activities are provided below.

Capital Improvement Program

Following the flood of February 1996, which was about a 20-year flood event, the City began an aggressive capital improvement program to improve flooding conditions in the city. The City is also investing heavily in restoring the stream corridors of Issaquah Creek and Tibbetts Creek. Proposed capital projects in the 6-Year CIP include:

- **Bridge Replacements** to remove constrictions and improve flood conveyance: NW Dogwood and NW Juniper Streets on Issaquah Creek;
- **Channel Improvements** to improve flood conveyance and habitat, including follow-up on the 1998 Gilman Reach and Pickering Reach Channel Improvements and other restoration projects, the 2003 Tibbetts Creek Greenway Project in Tibbetts Valley Park, the Squak Valley Park habitat improvements, and other local flood and habitat improvements.
- **Stormwater Rehabilitation,** including TV videoing of drainage system to identify maintenance and repair needs, capital projects to alleviate localized drainage problems, and water quality retrofits.
- **Floodplain Mitigation** through purchase of high-risk floodplain properties and removal of flood prone homes with site restoration.
- **Stormwater System Surveying and Mapping**. Updating of system utility maps and development of information to aid in capital project development, maintenance activities, and stormwater utility rate calculation.

Management and Regulatory Programs

Several on-going programs are directed at managing stormwater runoff, water quality, habitat and flooding, many of which are the day-to-day responsibilities of staff in the Public Works Engineering and Public Works Operations Departments, and the Resource Conservation Office. A few examples include:

- Public maintenance of stormwater facilities and inspection of private facilities to verify maintenance is being performed;
- City ordinances that regulate where and how development occurs;
- National Flood Insurance Program that sets standards for floodplain development in exchange for providing flood insurance for residents;
- Water Quality Response including responding to spills and enforcement of water quality regulations;
- Aquatic Resource Monitoring Program that monitors the health of our streams and tracks progress of programs that are designed to improve ecosystem health; and
- Regional watershed planning efforts in the Cedar – Lake Sammamish Watershed (Water Resource Inventory Area, or WRIA, 8) to develop a long-term recovery plan for chinook salmon.
- Flood warning system and flood fighting.

Public Education and Outreach

The City has implemented, primarily through the Resource Conservation Office, many public education and outreach projects. These projects are aimed at educating the public on water resources issues, providing educational materials to residents and businesses, and recruiting volunteers to participate in water quality monitoring and habitat restoration efforts. The benefits obtained from such activities go a long ways toward heightening the public's awareness of pollution and natural resource issues in the City, and changing their behaviors to help reduce non-point stormwater impacts and improve the health of stream corridors. A few examples of these activities include the Issaquah Stream Team, Businesses for Clean Water Program, restoration site stewardship, and residential water quality public education.

FUNDING AND IMPLEMENTATION

Stormwater capital projects, operation and maintenance activities, and regulatory and management programs are funded by the Stormwater Management Utility, which is supported by the stormwater service charge that is paid by property owners in the City. Grants also provide additional supplemental funding for studies and capital projects, especially those that provide regional benefit such as water quality improvements and stream habitat restoration. The utility also pays the staffing costs in Public Works Engineering and Public Works Operations that are involved in these stormwater programs. Periodic utility rate studies, conducted about every five years, identify what service charge is needed to support recommended programs. Actual implementation of the recommended programs and staffing levels within the departments is subject to the Council's adoption of utility rates and the authorizing budget.

Table ES-1. Summary of Stormwater Management Program Activities

Projects and Program Elements	Description	Status	Supporting Policy and Regulatory Requirements[1]	Report Section Reference
1. CAPITAL PROJECTS				
Tibbetts Creek Greenway Project	Construction of City-lead portion of the Tibbetts Creek Greenway Project at Tibbetts Valley Park, providing flooding and habitat improvements.	Constructed in 2003-2004.	Policy U4.2, U4.3, U4.5, U4.9 Council Goal #7 Basin Plan BW 7, 22	Sections 4.4, 5.2.3
Bianco Mine Tailings Stabilization	Stabilization of eroding mine tailings deposits along upper Tibbetts Creek, a component of Tibbetts Creek Greenway Project.	Constructed in 2002.	Policy U4.5, U4.9 Council Goal #7 Basin Plan BW 22	Sections 4.4, 5.2.3
Flooding Improvements	Flood improvements along major Issaquah – including Issaquah Creek, North Fork Issaquah Creek, East Fork Issaquah Creek, and Tibbetts Creek – such as: • Replacement of NW Juniper and NW Dogwood Street bridges, which are constrictions to floodwater. • Flood enhancements at City-owned acquisition properties. • Other flood improvements shown to provide benefits to multiple properties and/or public facilities.	Juniper and Dogwood bridge replacements scheduled for 2005 and 2006, respectively. Other activities are ongoing.	Policy 4.3.1, U4.5 Basin Plan BW 7	Section 4.3, Table 4-7
Streamside Property Acquisition	Purchase of developed and undeveloped properties along streams, including: • Properties with repetitive flood damage losses or would exhibit hazardous flooding conditions if developed; • Properties required to facilitate a capital project; • Properties having high value for future habitat preservation and improvements.	Five parcels have been purchased and houses removed since 1994. Another nine undeveloped lots were acquired to prevent future development.	Policy U4.3.1, U4.5 Basin Plan BW 7	Sections 4.3.4, 6.7

Table ES-1. Summary of Stormwater Management Program Activities

Projects and Program Elements	Description	Status	Supporting Policy and Regulatory Requirements[1]	Report Section Reference
Stream Habitat Restoration	Construction of stream habitat improvements on City property, including: • Large restoration projects, such as the Corps of Engineers Squak Valley Park restoration project, which have regional or federal funding assistance. • Small restoration and enhancement projects (ongoing).	Squak Valley Park restoration scheduled for 2005. Other projects are ongoing.	Policy U4.5, U4.9 Basin Plan BW 22	Section 5.2.2
Water quality retrofits	Construction of water quality and stormwater recharge facilities along existing City stormwater systems, if found to be feasible and effective.	Demonstration project constructed in 2000.	Policy U4.4.2, U4.5 Basin Plan BW 17	Sections 5.2.4, 6.9
Storm Drainage Rehabilitation and Improvements	Fix existing drainage problems, repair deteriorating lines, and respond to new problems as they are identified and evaluated.	CIP program began in 2002 with annual funding.	Policy U4.4.2, U4.5 GMA	Section 5.2.5, Table 4-7
2. MANAGEMENT AND REGULATORY PROGRAMS – STORMWATER				
Stormwater Resource Action Plan	Support of education and outreach programs in coordination with Resource Conservation Office; participation in regional ESA planning efforts; special studies related to flooding, water quality and fish resources; support to Issaquah Creek Basin Steward; and aquatic resource monitoring program.	Ongoing programs.	Policy U4.4.1, U4.4.2, U4.5 Basin Plan BW 29, BW30	Sections 6.8, 6.9
Regulatory Codes, Construction Inspection and Enforcement for New Construction	Day-to-day development project review to verify compliance with City stormwater and floodplain ordinances, construction inspections to verify permit conditions are met and best management practices for erosion and sediment control are implemented, and enforcement actions on code violations.	Ongoing programs.	Policy U4.1 IMC 13.28, 16.36, 18.10.340 Puget Sound Plan NPDES NFIP/CRS	Sections 6.2, 6.5.1
Emergency Water Quality Response	Response procedures, responsibilities and enforcement of water quality problems such as hazardous materials spills, illegal dumping, and water quality violations. Includes preparation and maintenance of spill response plan.	Enforcement is ongoing. Development of Spill Response Plan scheduled for 2004.	Policy U4.4.2 Basin Plan BW 18 Puget Sound Plan	Sections 6.4.2, 6.8, 6.9

Table ES-1. Summary of Stormwater Management Program Activities

Projects and Program Elements	Description	Status	Supporting Policy and Regulatory Requirements[1]	Report Section Reference
Water Quality Problem Identification, Ranking, and Retrofitting Evaluation	Following up on data collected by the Aquatic Resource Monitoring Program, conduct targeted evaluations to identify specific sources of pollutants and response actions to eliminate them.	Ongoing program.	Policy U4.4.2, U4.5 Basin Plan BW 17 Puget Sound Plan NPDES	Sections 6.4.3, 6.8
Stormwater System Inventorying and Mapping	Develop accurate maps and facility inventory of public and private stormwater systems to support management, maintenance, and CIP programs.	Ongoing program.	Policy U4.4.2, U4.5 Puget Sound Plan NPDES GMA	Section 6.3.2
TV inspection of stormwater lines	Identify high priority maintenance and repair needs in aging underground conveyance systems.	Program began in 2002 with annual funding.	Policy U4.4.2, U4.5 GMA	Section 5.2.5
Aquatic Resource Monitoring Program	Monitoring of natural resources including water quality, instream and riparian habitat, streamflows and mactoinvertibrates to monitor the health of our streams and track progress of programs that are designed to improve ecosystem health	Monitoring program began in 1998.	Policy U4.4.2, U4.5, U4.7 Puget Sound Plan Basin Plan BW 30	Sections 6.4.1, 6.8
Stormwater Utility	Support to Finance Department by providing accurate data for utility accounts for existing and new accounts. Includes impervious surface and parcel mapping.	Ongoing program. Major account updates occurred in 2002. Conversion to new accounting system in 2004 or 2005.	Policy U4.5 IMC 13.30	Section
Public Stormwater Facility Maintenance	Maintenance of public stormwater facilities by the Public Works Operations Department.	Ongoing program.	Policy U4.4.2, U4.5 GMA Puget Sound Plan NFIP/CRS NPDES	Section 6.3.1
Private Stormwater Facility Inspections	Inspection program of private facilities to verify required maintenance is performed and conveyance, detention and water quality facilities continue to operate as designed.	Program began in 2002.	Policy U4.4.2 Basin Plan BW 13 Puget Sound Plan NPDES	Section 6.3.3

Table ES-1. Summary of Stormwater Management Program Activities

Projects and Program Elements	Description	Status	Supporting Policy and Regulatory Requirements[1]	Report Section Reference
Comprehensive Stormwater Planning	Develop and implement a comprehensive stormwater management program that addresses stormwater runoff and water quality.	Updates planned every five years.	Policy Objective U4 Policy U4, U4.8 Council Goal #2 Puget Sound Plan	This document Section 4.2.1.1
NPDES Phase 2 Stormwater Permitting Compliance	Submit application forms for NPDES Phase 2 municipal stormwater permit in March 2003 and follow-up on subsequent requirements as Ecology develops program.	Program began in 2003.	Policy U4.4.1 NPDES	Section 4.2.1.3
3. MANAGEMENT AND REGULATORY PROGRAMS – FLOODING AND HABITAT				
Floodplain and Floodway Mapping	Update inaccurate floodplain maps to make them more effective for flood hazard management programs, City Code, and flood insurance.	Ongoing program. Major FEMA floodplain map update to be adopted in 2004.	Policy U4.3.2 IMC 16.36, 18.10.340 Basin Plan BW 9 NFIP/CRS	Section 6.5.4
Flood Warning System and Flood Fighting	System of stream gauges, public information dissemination, and flood fighting efforts to warn residents of impending flood conditions and mobilize City crews to ensure safety of residents and property to the maximum extent feasible.	Ongoing program initiated after 1996 flood.	Policy U4.3.2, U4.5, U4.7 Basin Plan BW 10 NFIP/CRS	Section 6.5.2
FEMA Flood Insurance Program and Community Rating System	Enforcement of flood hazard management ordinance, public information program to inform residents of flood hazards and availability of flood insurance, and increased management efforts in return for reduced insurance premiums.	Ongoing program. CRS Rating improved to Class 5 in 2003.	Policy U4.3.2, U4.7 NFIP/CRS IMC 16.36, 18.10.340	Sections 4.2.3, 6.5.4, 6.5.5
Channel Improvements Maintenance and Monitoring	Post-construction permit compliance requirements for constructed City capital improvement projects	Ongoing program.	Policy U4.3.1, U4.5	Sections 4.2.1, 4.2.2
Regional Watershed Planning	Participation in Cedar – Lake Sammamish Watershed (WRIA 8) development of a long-term recovery plan for chinook salmon.	Ongoing program.	Policy U4.8	Sections 4.2.2, 6.8

Table ES-1. Summary of Stormwater Management Program Activities

Projects and Program Elements	Description	Status	Supporting Policy and Regulatory Requirements[1]	Report Section Reference
4. PUBLIC EDUCATION AND OUTREACH				
Issaquah Stream Team	Implementation of Aquatic Resource Monitoring Program field efforts by volunteers at many Issaquah-areas streams	Ongoing program began in 1998.	Policy U4.4.2, U4.5, U4.7 Puget Sound Plan NPDES	Sections 6.6.2.1, 6.8
Business for Clean Water Program	Education and technical assistance to Issaquah businesses in stormwater pollution prevention responsibilities and best management practices	Ongoing program with assistance from King County staff.	Policy U4.4.2, U4.5, U4.7 Puget Sound Plan Basin Plan BW13	Sections 6.6.1.2, 6.8
Water Quality Education	Residential water quality education, smart and healthy landscape, green car wash, watershed signage, storm drain stenciling, and other education efforts.	Ongoing program.	Policy U4.5, U4.7 Puget Sound Plan NPDES	Sections 6.6.1, 6.8
Restoration Site Stewardship	Volunteer program for monitoring and maintenance of City CIP and volunteer-initiated restoration sites, with activities including vegetation plantings, weed control, and field surveys to monitoring restoration success.	Ongoing program.	Policy U4.5, U4.7 Puget Sound Plan Basin Plan BW20	Sections 6.6.2, 6.8

[1] Key for policies and regulatory requirements:

Policy:	2002 City Comprehensive Plan policy (Local)
Council Goal:	2002 Council Goal (Local)
IMC:	Issaquah Municipal Code (Local)
Basin Plan:	Issaquah Creek Basin and Nonpoint Action Plan (Local)
Puget Sound Plan:	Puget Sound Water Quality Management Plan (State)
GMA:	Growth Management Act (State)
NPDES:	NPDES Phase 2 Stormwater Permitting (State)
NFIP/CRS:	National Flood Insurance Program and Community Rating System (Federal)

Note: Potential ESA requirements are not included in this table because proposed Tri-County regional response proposal has not been finalized and accepted by Federal agencies.

Section 1
INTRODUCTION

This Stormwater Management Program plan was prepared to guide the City of Issaquah in planning, funding and implementing a comprehensive program for managing stormwater runoff, flooding problems, and the City's natural resources.

In recent years the City of Issaquah has responded to a changing regulatory environment prompted by State and Federal stormwater management programs and laws. These new regulations – including the Endangered Species Act (ESA) 4(d) rule and the National Pollution Discharge Elimination System (NPDES) Phase II Program for small municipal separate stormwater systems – affect all aspects of stormwater management, including stormwater controls for new and redevelopment projects; maintenance of existing stormwater systems; best management practices (BMPs) at commercial, industrial, and multi-family developments; improvements to existing stormwater systems; and preservation, acquisition and restoration of stream and riparian habitat.

In addition to these regulatory drivers, the City of Issaquah should continue other stormwater and flood control programs that were previously implemented in response to past regulatory requirements, need for public services and safety, and goals for protecting and improving the quality of its natural resources. These programs include:

- Flood control program to reduce flood impacts and associated flood damages, principally along Issaquah Creek and Tibbetts Creek, through implementation of Capital Improvement Program (CIP) projects.
- Flood management programs, including flood hazard ordinances, participation in the National Flood Insurance Program, acquisition of flooding repetitive loss properties, floodplain mapping, and flood management tools implemented under the Federal Emergency Management Agencies (FEMA) Community Rating System
- Other water quality mitigation, habitat restoration, and habitat acquisition efforts.

The City must be prepared to face these new and ongoing responsibilities and related work efforts through adequate ordinances and codes, stormwater planning efforts, coordination with other jurisdictions and agencies, staffing within the Public Works Engineering and Public Works Operations and Maintenance departments, and Capital Improvement Program (CIP) budgeting.

This document provides the detailed written information that the City of Issaquah is implementing the required efforts, with those activities being consistent with long-term goals, objectives and policies as outlined in the City of Issaquah Comprehensive Plan.

(page left intentionally blank)

Section 2
PLANNING AREA DESCRIPTION

2.1 Overview

The City of Issaquah is located at the south end of Lake Sammamish on Interstate 90 about 15 miles east of Seattle. The City is bounded on the north by Lake Sammamish and the East Lake Sammamish (Pine Lake) Plateau, on the east by Tiger Mountain, on the south by the Hobart Valley and Squak Mountain, and on the west by Cougar Mountain and parts of Bellevue. Because of Issaquah's easy accessibility to the greater Seattle metropolitan area, along with its magnificent natural setting, the area has and will continue to experience rapid growth.

Issaquah's original inhabitants were primarily farmers and fishermen. In 1862 the first coal claim was made with coal mining starting on a large scale in about 1887. The story of coal mining is a major part of Issaquah's early history through the 1920's, and many traces of mining are still present. Timber was also a dominant industry in the early part of this century, but diminished as timber was depleted from the local hills. Population growth accelerated in the 1960's in response to regional growth in Puget Sound, leveled off in the 1970's, but then increased again starting in the mid-1980's. The City was incorporated as Gilman in 1892, and changed its name in 1899 to the present Issaquah, which is a rough translation of the Native American word "Squak".

2.1.1 Land Use

Issaquah is located at the lower end of the Issaquah Creek watershed. More than 75% of the 61-square mile Issaquah Creek watershed is forested, with the remainder in wetlands, pastures, urban (less than 10%), and cleared areas. The streams, wetlands, and forests provide habitat for a great variety of fish and wildlife species, including eight species of salmonids, six of which are anadromous (i.e., live part of their life in the ocean). This includes ESA-listed Chinook salmon and Bull trout. Currently, 30% of the basin is zoned forest production, 12% within the urban growth boundary (including Issaquah), and the remaining in rural zoning (58%). Over 40% of the land is owned by the public, including Washington Department of Natural Resources, Washington State Parks, King County Parks, and City of Issaquah Parks (King County 1996).

The total area of Issaquah as of 2003 is 6,643 acres (10.4 square miles). Land use within the City, based on the 5,244 acres of City that existed prior to the 2000 annexations, is summarized in Table 2-1.

Table 2-1 Issaquah Land Use Summary

Land Use Designation	Acres	Percent of Total
Conservancy (open space)	748	14%
Community Facilities (including parks)	219	4%
Low Density Residential	1,780	34%
Multi-Family Residential	331	6%
Retail/Office	552	11%
Commercial	145	3%
Urban Village	1,469	28%
SUBTOTAL	**5,244**	**100%**
North Annexation Area and other (no zoning available)	1088	-
TOTAL	**6,332**	**-**

Source: City of Issaquah 1999 Comprehensive Plan. Does not include 2000 North Issaquah annexation area.

2.1.2 Population

The population of Issaquah in 1994 was 8,420 persons within the City limits that were in effect at that time, and about 22,000 persons within the total Potential Annexation Areas (PAAs) of Issaquah (City of Issaquah 1999). Following the annexations of the North Annexation Area, Issaquah Highlands, TALUS (Cougar Mountain East Village), and Providence Point/Hans Jensen, the 2003 population within the City is about 15,000.

Population growth in Issaquah has consistently been greater than the County average, and in the future it is likely that population growth within the PAAs of Issaquah will grow at a greater rate because of the large amount of land that is potentially available for development or is already planned for development. Based on King County's projected 2% annual background growth rate and taking into consideration planned developments that are in the development "pipeline," the population within the current City limits is expected to grow to about 25,000 by 2022. Most of this growth is attributed to the TALUS and Issaquah Highlands planned developments, and multi-family development in the North Annexation Area. With the added population within the remaining Potential Annexation Areas – including Greenwood Point/South Cove, Klahanie, and others – the projected 2022 population of Issaquah could reach 41,300.

2.2 Streams and Drainage Basins

Issaquah is located within the Lake Sammamish watershed, and is part of Water Resource Inventory Area (WRIA) 8, which includes the Lake Sammamish, Cedar River, and Lake Washington drainages. The Issaquah Creek watershed with its major tributaries – Tibbetts Creek, East Fork Issaquah Creek, and North Fork Issaquah Creek – is a primary regional stream that drains about 61 square miles of land in Issaquah and King County. The City of Issaquah occupies 9.9 square miles, or about 16 percent of the watershed. These streams flow from steep headwaters on Tiger, Squak, and Cougar Mountains into Lake Sammamish. Elevations range from more than 3,000 feet on Tiger Mountain to about 30 feet at Lake Sammamish. In terms of natural resources, King County rates Issaquah Creek as one of the three most significant in the county (along with Soos Creek and Bear Creek).

Most streams in Issaquah have been impacted by past farming, logging, mining and urbanization activities, both physically and indirectly through stormwater runoff. In past years it was common practice to use rock rip-rap to stabilize the banks of these streams and prevent meandering from impacting property and structures. Straightening of the channel, dredging of

streambeds, ditching and draining of wetlands, and construction of levees also occurred in certain areas. For example, Issaquah Creek between the southern city limits and the Fish Hatchery dam intake was dredged and straightened by King County in response to the 1933 flood, and Tibbetts Creek between Maple Street and Lake Sammamish was straightened by Drainage District No. 4 in the early 1900s to reclaim farmland. The adoption of stricter environmental regulations in the 1960s and 1970s, as well as the increased inability of public agencies to fund flood protection works, has significantly reduced these types of activities.

2.2.1 Stream Features

Surface water drainage features within the City of Issaquah are shown on Figure 2-1 and on Map 1 (map pocket). Features on Map 1 are categorized into storm drainage systems and streams. The storm drainage system includes the remains of Drainage District No. 4, which conveys mostly storm drainage but also receives minor inflow from a few small intermittent streams on Squak Mountain, springs and wetlands.

A list of the primary streams in Issaquah, organized by major drainage Sub-basins, and their total areas within the City is contained in Table 2-2. The stream numbers for non-named tributary streams are based on the 1975 Catalog of Washington Streams and Salmon Utilization (Washington Department of Fisheries 1975).

Table 2-2 Streams in Issaquah

Name	Total Drainage Area/ City Drainage Area	Tributaries
Issaquah Creek	61 square miles total 3.2 square miles in City	Tributary 178A Mine Hill Creek Tributary 0196 Cabin Creek Lewis Lake Creek Waterfall Creek Kees Creek (Tributary 0199) Tributary 0200 Crystal Creek
North Fork Issaquah Creek	4.5 square miles total 1.6 square miles in City	Black Nugget Creek Pole Creek
East Fork Issaquah Creek	8.8 square miles total 1.9 square miles in City	Lost Creek Boomerang Creek KGB Creek
Tibbetts Creek	5.7 square miles total 2.6 square miles in City	Schneider Creek Tributary 0170 Anti-Aircraft Creek Tributary 0196H Tributary 0196I Tributary 0196G Wetland 1b Tributary North Tributary West Fk Tibbetts Creek Clay Pit Creek Newcastle Creek

2.2.2 Stormwater Drainage Sub-basins

Figure 2-2 illustrates the stormwater drainage Sub-basin delineation for Issaquah. Stormwater drainage Sub-basins are areas of local runoff that discharge to the major streams along a relatively distinct segment of stream. Partitioning of drainage areas in Issaquah into these drainage Sub-basins helps the management of stormwater in many ways. For example, the Sub-basins identify where stormwater runoff from particular point in the City enters Issaquah Creek, and how much land area contributes runoff to the various small tributaries and drainage courses.

Table 2-3 summarizes data for these Sub-basins, in order from west to east. Issaquah Creek receives the largest amount of runoff from the city – approximately 31% of the total city area.

Table 2-3 Stormwater Drainage Sub-basin Data

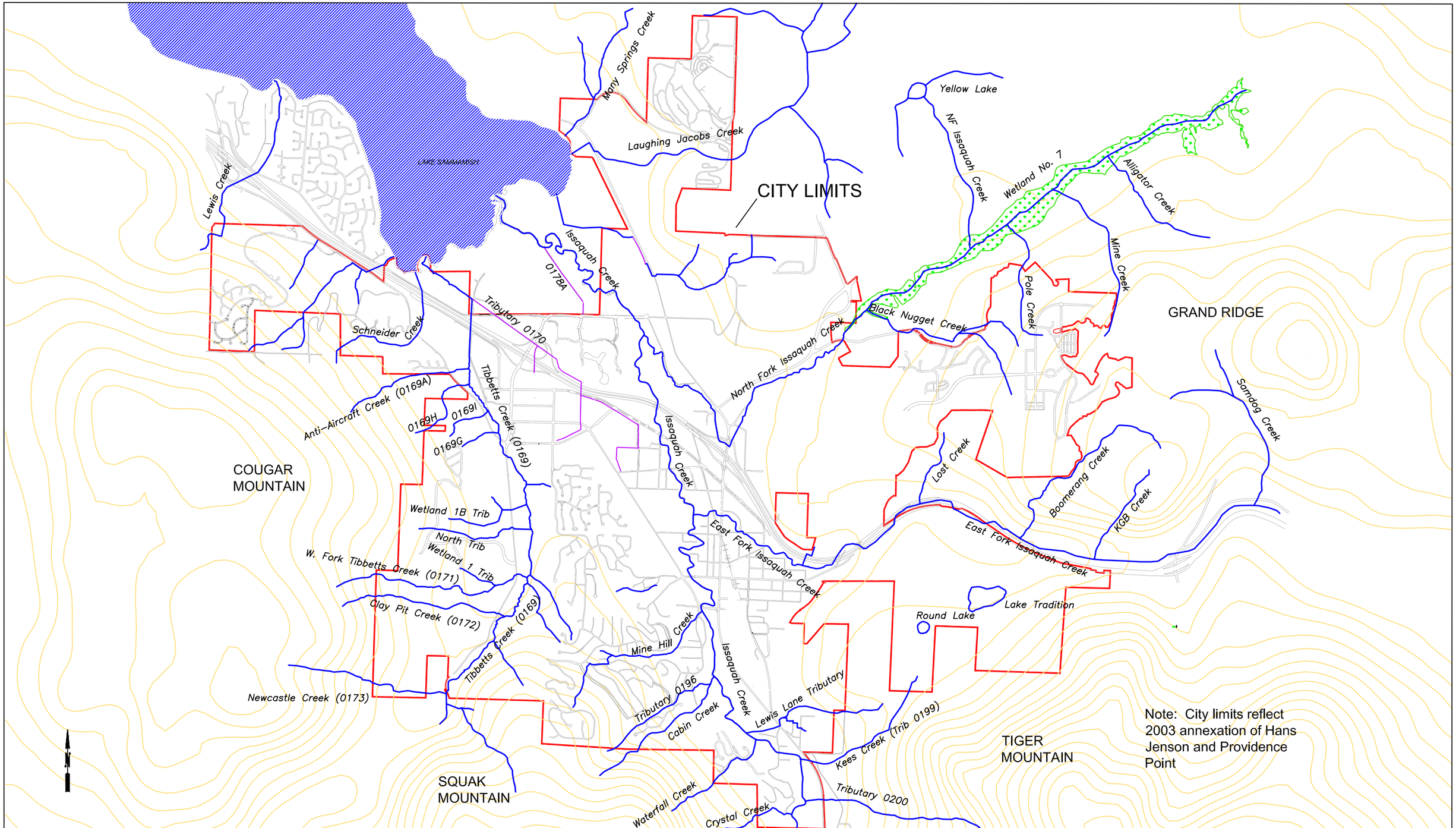
Num.	Sub-basin Name [a]	Total Area		Impervious Area [b]		Receiving Water				
		Acres	Percent of City	Acres	Percent Impervious	Lake Samm.	Tibbetts Creek.	Issaquah Creek	North Fork	East Fork
1	Montreux	300	5.2%	52	17%	◆				
2	Summerhill	220	3.8%	36	17%	◆	◆			
3	TALUS	672	11.5%	121	18%		◆			
4	Pickering	177	3.0%	98	55%		◆	◆		
5	I-90	188	3.2%	73	39%	◆	◆	◆	◆	◆
6	Downtown West	269	4.6%	174	65%		◆			
7	Squak Mt. West	541	9.2%	87	16%		◆			
8	Squak Mt. East	689	11.8%	135	20%			◆		
9	Freegard	507	8.7%	151	38%	◆		◆	◆	
10	Overdale	276	4.7%	37	13%			◆	◆	
11	Lakeside	360	6.2%	58	16%				◆	
12	Downtown Central	300	5.2%	146	49%			◆	◆	◆
13	Downtown South	467	8.0%	127	27%			◆		
14	Highlands [c]	857	14.7%	362	42%				◆	
15	Providence Point	n/a	n/a	n/a	n/a	◆				
Total City – Acres		5823		1657		529	1674	2026	1010	1203
Total City – Percent			100%		28%	8%	26%	31%	16%	19%

[a] Does not include Lake Sammamish State Park and Lake Tradition Plateau.

[b] Source: Preliminary Geographic Information System coverage developed from aerial mapping and as-built drawings. Highlands and TALUS estimates are based on Master Drainage Plan information, which may not reflect as-built conditions.

[c] The majority of Highlands stormwater is infiltrated. However, facilities are being modified to allow runoff from much of the site to be diverted to North Fork Issaquah Creek.

[d] Includes all areas of Issaquah, with exception of 2003 annexation area (Providence Point/Hans Jenson)

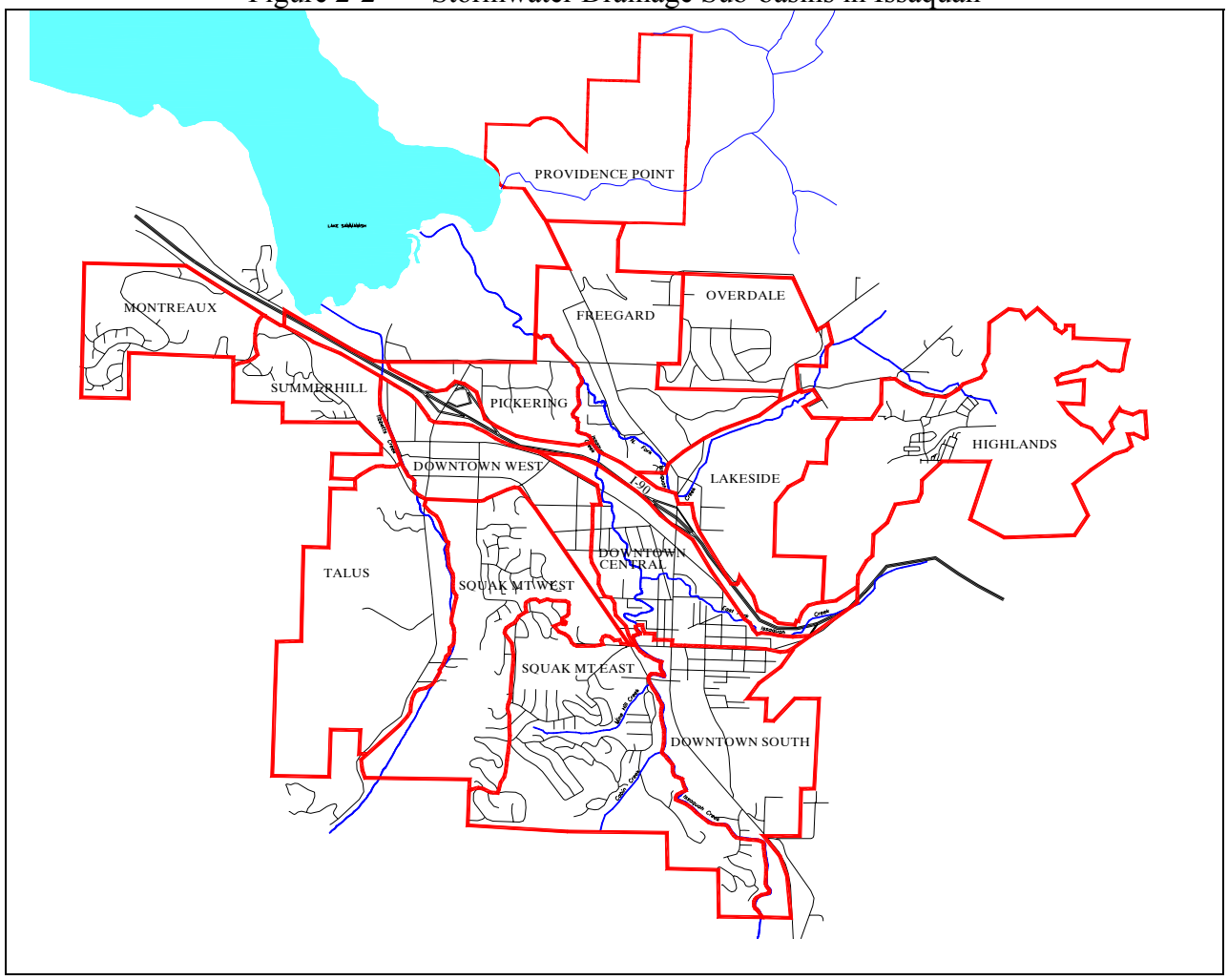


CITY OF ISSAQUAH

FIGURE 2-1. SURFACE WATER FEATURES IN ISSAQUAH

(page left intentionally blank)

Figure 2-2 Stormwater Drainage Sub-basins in Issaquah



2.2.3 Fish Usage

Table 2-4 summarizes the important fish species that are present in the principal streams in Issaquah, as reported by the Final Issaquah Creek Basin and Non-point Action Plan and the Issaquah Creek Basin Draft Sub-Area Summary.

Table 2-4 Fish Presence in Issaquah Streams

Stream	Species
Issaquah Creek	Chinook, Sockeye, Steelhead, Dolly Varden, Coho, Cutthroat, Rainbow, Kokanee, Bull trout
North Fork Issaquah Creek	Sockeye, Coho, Cutthroat
East Fork Issaquah Creek	Sockeye, Coho, Cutthroat, Chinook, Rainbow
Tibbetts Creek	Coho, Sockeye, Cutthroat

Major species of salmon are described below:

- **Chinook salmon**, also called "king," is the largest of the Pacific Salmon. Chinook have been observed spawning 11 miles upstream on Issaquah Creek in Holder and Carey creeks. They are often found spawning in rivers or larger streams, and are usually one of the earlier salmon species to spawn in the fall. Chinook salmon in Issaquah Creek is entirely of hatchery origin,

derived from Green River stock. The Issaquah Salmon Hatchery supplements the Chinook run in Issaquah Creek. Puget Sound Chinook salmon have been listed as threatened under the Endangered Species Act (ESA) and are the primary focus of salmon recovery efforts.

- **Coho,** also called "silver," often spawn in the smaller streams and don't tend to use the larger rivers like Chinook. They can jump falls that most salmon cannot negotiate. The Issaquah Salmon Hatchery supplements the Coho run in Issaquah Creek. The Coho stock in Issaquah Creek is of mixed wild and hatchery origin, and usually arrive in area streams in November after the Chinook and Sockeye runs.

- **Sockeye**, also called "red," require a lake for part of their lifecycle, where they spend anywhere from a few months to a couple of years. Sockeye can spawn on the shores of a lake or in the tributary streams. Lake Washington supports the largest Sockeye run in the state, with most spawning in the Cedar River, although Issaquah Creek also supports a significant run.
- **Kokanee** are the land-locked form of Sockeye salmon. Kokanee are smaller than Sockeye, but otherwise look very similar. They are usually seen spawning near the edge of a lake or in tributaries feeding Lake Sammamish. Both an early run (spawning in late summer primarily in Issaquah Creek) and a late run (spawning in early winter) exist within the Lake Sammamish system.

Surveys of Chinook, Coho, Sockeye, and Kokanee salmon have been conducted on Issaquah Creek and East Fork Issaquah for many years by King County and the Washington State Department of Fish and Wildlife (WDFW). Salmonid population estimates for the period 1986-1996, from WDFW and King County, are as follows:

- Chinook: Average 3,049 (range 648 - 6,340)
- Bull trout: A char was observed in Carey Creek in late 1980's
- Coho: Average 1,348 (range 11 - 4,023)
- Cutthroat trout: unknown
- Sockeye: Average 1,959 (range 4 - 6,548)
- Steelhead: Average 55 (range 0 - 228)
- Kokanee: Average 19 (range 4 - 39)

It is noted that salmon counts at the Issaquah Creek hatchery report over 35,000 fish returning to the hatchery (see below). Thus, the counts listed above represent only a portion of the entire runs.

2.2.4 Issaquah Creek Hatchery

The Issaquah Creek Hatchery was constructed in 1936 and is operated by the Washington Department of Fish and Wildlife. The hatchery, which is located three miles upstream from the mouth of Issaquah Creek, currently produces Chinook, Coho, and Lake Washington steelhead. During the fall spawning period, hatchery personnel retrieve the eggs from females and fertilize them with milt from the males. In addition, state fisheries biologists examine the fish for growth and epidemiological studies.

The facility also has an important public education function due to its close proximity to the Seattle urban area. A private, non-profit group, Friends of the Issaquah Salmon Hatchery

(FISH), provides educational services such as volunteer guides and school presentations. The City of Issaquah has contributed $500,000 for improvements to the hatchery, while the state has provided several million more for improvements and operations. The Issaquah hatchery is the most visited of the Washington Department of Fish and Wildlife's hatcheries with about 350,000 visitors a year.

The hatchery nurtures five to six million eggs each winter. Fish spend about 18 months at the hatchery before being released. Approximately half of them are released directly into Issaquah Creek; in 1999 this included approximately 500,000 Coho and 2 million Chinook. The rest are distributed as eggs or fry to supplement naturally spawning fish in the Lake Washington basin, or given to educational or cooperative projects. Their life cycles range from two to five years before they return to spawn.

Adult salmon begin to return to the hatchery in late August and early September. Over the last several years between 10,000 to 35,000 salmon return to the hatchery before the runs are over in December. In 2000, this amounted to about 4,200 Chinook, 24,500 Coho, and 8,400 Sockeye (Griffin, M., Issaquah Fish Hatchery, personal communication in Issaquah Press, November 11, 2000). Fish not needed for hatchery production purposes – about 1,200 Chinook, 3,300 Coho, and zero Sockeye in 2000 – are allowed to pass upstream. Fish runs in 2000 were exceptionally high throughout the Pacific Northwest.

Changes in operation of the hatchery in recent years have allowed more Chinook to spawn in Issaquah Creek above the hatchery than were collected. In addition, starting in 2000, all fry leaving the hatchery will be marked so that returning hatchery fish can be distinguished from naturally produced fish. The Corps of Engineers is currently evaluating improvements to the water supply intake dam to improve fish passage through that facility.

2.3 Stormwater System

Stormwater runoff from developed areas of Issaquah is conveyed to natural streams via ditches, culverts, and piped drainage systems. Map 1 (map pocket) show the general layout of the stormwater system with the City and where it discharges to natural streams. Included within the this system is the former Drainage District No. 4, which constructed a network of agricultural drainage ditches through the valley in the early 1900s. Examples of the former agricultural drainage network include Tributary 0170 on the north side of I-90, the large drainage channel along the south side of NW Gilman Boulevard and adjacent to The Commons, and two branches from that channel that run south toward Squak Mountain. The City took over the District in the early 1980s and continues to maintain these ditches as part of the stormwater system.

Currently, the status of the existing stormwater system is not well documented. Because Issaquah was incorporated over 100 years ago, much of the stormwater infrastructure is fairly old and not well documented. However, a project to compile much more complete mapping, database, and video inspection information on Issaquah's stormwater system was initiated in 2000 and is expected to take several years to accomplish, as budget allocations allow.

Stormwater detention and water quality treatment facilities in Issaquah are relatively few in number, due to the fact that much of the City was constructed prior to the adoption of the first stormwater drainage ordinance by King County in 1979. Prior to that date stormwater detention and treatment facilities were not required for new development. Since then development has

been regulated to mitigate stormwater impacts; see below for current requirements. In recent years, two large urban village developments – Issaquah Highlands and TALUS – were proposed and are currently under construction. These developments have site-specific requirements that were approved under Master Drainage Plans, as described below.

2.3.1 Stormwater Requirements for New Development

New construction in the City must meet the stormwater standards contained in the 1998 King County Surface Water Design Manual (see Section 6.2 for description of City stormwater management ordinance). As of 2002, stormwater requirements for new development and redevelopment are generalized as follows (exemptions and exceptions may apply in certain cases):

- New development that adds 5000 square feet or more of new impervious surface requires stormwater detention and treatment
- Stormwater detention must meet either the Level 1 or Level 2 flow control standard, using stormwater ponds, underground vaults, or infiltration, based on the site location:
    - Level 1 – Valley floor areas. Detention of the 2-year and 10-year storms to pre-developed conditions.
    - Level 2 – Hillside areas. Detention of all flows between 50% of the 2-year and the 50-year event to pre-developed conditions, based on matching flow duration characteristics.
- Stormwater treatment must meet the Sensitive Lake Protection Menu to control phosphorus loading to Lake Sammamish. A target of 50% phosphorus removal is assumed for this standard. The Sensitive Lake Protection Menu includes options for using Basic Menu water quality facilities that are sized larger, or a combination of two facilities in series. Examples include large wet ponds, large sand filters, and proprietary filter media treatment devices such as the Stormfilter leaf compost filter.

Changes to the King County Surface Water Design Manual are forthcoming to make it equivalent to the new Department of Ecology's Stormwater Management Manual for Western Washington (Ecology 2001). Those changes may include requiring the Level 2 flow control standard for all areas, and specifying a forested pre-developed condition (the King County manual currently specifies 1979 as the pre-developed condition, which has the effect of not requiring detention for impervious surfaces that existed at that time). The City of Issaquah adopts the manual by reference in the stormwater code, and thus the new manual will become effective when the King County Council approves the manual.

2.3.2 Issaquah Highlands Development

The Issaquah Highlands is northeast of downtown Issaquah on the southern end of the Sammamish Plateau. Development of the Highlands, including stormwater management, is covered by the 1996 three-party developer agreement between the developer (Port Blakely), King County, and the City of Issaquah. This urban village covers 580 acres that will eventually contain 3250 residential units and 3.5 million acres of commercial space. Another 2288 acres were dedicated to the County as permanent open space.

The Stormwater system is designed to mimic predevelopment hydrology through extensive use of stormwater infiltration. The site covers two distinct drainage basins: the Lower Issaquah Valley (LIV) aquifer recharge sub-basin that covers most of site and the Black Nugget Creek

sub-basin on the northern side. Stormwater from 80% of Issaquah Highlands site recharges the LIV, either directly through deep aquifer recharge at the main infiltration system above the Lakeside gravel pit, or indirectly through interflow into wetlands and surficial soil infiltration. Stormwater from the remaining 20% discharges to Black Nugget Creek through wetland discharges to support stream flows.

Four separate infiltration systems have been constructed within the LIV recharge sub-basin: two subterranean systems and two surface pond systems. They are designed to allow flexibility, such as changing the amount of water recharged to the aquifer vs. discharged to North Fork Issaquah Creek, and minimize the possibility of plugging or fouling. (A water management plan to guide future operations will be developed after construction of all facilities is completed). Within the Black Nugget Creek recharge sub-basins, stormwater discharges to strategically located wetlands and creek spreaders. The discharges are attenuated to match predevelopment hydrology. In addition, clean stormwater from roofs is discharged directly to the closest wetland.

All Stormwater is detained and treated prior to discharge. The preferred treatment method uses wet ponds with a design standard of 50% phosphorus removal. Other contaminants are controlled at the source, i.e. no galvanized materials are allowed, no copper roofs, no fertilizers, no on-site fueling, etc.

2.3.3 TALUS Development

TALUS (formerly Cougar Mountain East Village) is southwest of downtown Issaquah on the northeast face of Cougar Mountain. The site contains several small tributaries that drain to Tibbetts Creek. This urban village covers 159 acres that will eventually contain 1725 residential units and 800,000 square feet of commercial space. Another 475 acres were dedicated as permanent open space.

The stormwater system for TALUS is designed to mimic predevelopment hydrology, in terms of both peak discharges and flow duration, by discharging to on-site wetlands and streams. Water in excess of pre-developed conditions is piped down the hillside to an outfall on Tibbetts Creek.

All Stormwater is detained and treated prior to discharge. The detention standards comply with the Level 1 detention standard, which controls up to the 10-year event. Flows in excess of the 10-year event are discharged to Tibbetts Creek. Downstream improvements being made along Tibbetts Creek (partially funded by the developer) are designed to mitigate flooding impacts that may result from additional flows up to the 100-year event.

Two large stormwater ponds are located at the base of the hill to detain runoff from development parcels and the road system. In addition, each development parcel will contain additional detention and treatment facilities to manage runoff from those specific sites. The preferred treatment method is via sand filters with a goal of 80% phosphorus removal. Other contaminants are controlled at the source, i.e. no galvanized materials are allowed, no copper roofs, no fertilizers, no on-site fueling, etc. In addition, clean stormwater from roofs is discharged directly to nearby wetlands.

2.4 Floodplains and Floodways

Flooding along Issaquah Creek, Tibbetts Creek and other nearby streams is a natural phenomenon due to the fact that much of the City is located in a floodplain. Recognizing that the City had a history of flooding, and local and state officials needed information to identify

flood hazard areas, the Corps of Engineers conducted the first floodplain mapping project in 1971 (U.S. Army Corps of Engineers 1971).

In 1979 the Federal Emergency Management Agency (FEMA) issued a Flood Insurance Study in accordance with the National Flood Insurance Program (NFIP) in order to produce flood insurance rate maps and other information for the NFIP (FEMA 1979). Those maps, with occasional revisions in localized areas, formed the basis for flood insurance applications and the City's floodplain development restrictions, as contained in the flood hazard ordinance, until year 2000. The City's regulation of floodplain areas was supplemented by floodplain mapping information prepared in the early 1990's as part of the Issaquah Creek Basin and Non-point Action Plan. The FEMA Flood Insurance Study for King County incorporated the City of Issaquah in the 1995 update (FEMA 1995), but this document did not include any map revisions for Issaquah.

Recognizing that the 1977 FEMA maps were not accurate in many areas, the City of Issaquah in 2000 contracted with a consultant to completely re-map the floodplains and floodways in Issaquah (except for the North Fork, which was redone by FEMA in the mid-1990's). The draft report, including draft work maps and a Technical Support Data Notebook, was completed in September 2001 (Montgomery Water Group, 2001). Official FEMA adoption of the revised maps is scheduled in about January 2004, following the review, public comment, and appeal process.

Current 100-year floodplain boundaries, based on the mapping update project, are shown in Figure 2-3.

2.5 Flooding History

Historically, areas within Issaquah that are located along streams and prone to flooding were developed as farmlands. As such, the farm properties were only minimally affected by high water. Early newspaper accounts generally wrote of flooded farmlands, washed out roads, and an occasional flooded basement. However, as development progressed to the edges of the streams and bridges were built for roads, flood impacts and damages increased. Flooding now affects large areas of Issaquah, which until only a few decades ago was farmland, impacting commercial and residential properties alike.

The recent history of significant flooding along Issaquah Creek and Tibbetts Creek began in 1975 with a flood event that was then called the largest since 1933. However, it was not until 11 years later, in 1986, that the next major event occurred. This flood event was then followed by two large events in 1990 and another in 1996. Thus, the frequency of large events – or at least those that cause significant damage to urban areas – appeared to be increasing. However , examination of long-term records indicate that much more significant floods have occurred in the late 1800's and early 1900's (see Section 2.5.3)

The pattern of increased flooding, and associated damages, in Issaquah is due to several factors:

- Continued development within the floodplain, which makes floods more likely to cause greater damage due to closer proximity and greater numbers of structures near the stream channel.
- Increased flood elevations due to reduced channel capacity, which is caused by sedimentation in the stream channel and fill in the floodplain and along streambanks.

- Larger peak flows due to additional impervious surface area within the watershed. Hydrologic modeling conducted by King County for the Issaquah Creek Basin Plan concluded that current levels of urbanization has caused flood peaks to increase by 8%, and under future unmitigated land use the flood magnitudes could increase by 33% over forested conditions if stormwater detention is not provided at new development. However, future land use would include stormwater detention that would mitigate a large portion, but not all, of the predicted future increase; and
- Larger peak flows caused by greater total storm precipitation in recent years, the product of an apparent upward trend in the long-term cycle of weather patterns.

During recent major flood events, total rainfall in the Issaquah area was typically 7 to 8 inches over 7 days, 4 to 6 inches over 72 hours, and 3.5 to 4 inches over 24 hours. If snowmelt is present, this would add to the total water available for runoff if melt occurs during the peak 24-hour intensity. See Appendix A for additional data and discussion of flood history and patterns.

2.5.1 Flood Frequency

Current flood frequency estimates for Issaquah streams are summarized in Table 2-5. These estimates were developed for the City's Issaquah Creek Flood Insurance Study update project. As discussed in Appendix A, these estimates, which used 1964 - 1999 streamflow data from the USGS Issaquah Creek stream gauge, are consistent with, or are slightly lower, than the estimates prepared in the 1970s for the first Flood Insurance Study. Thus, the several large floods in the 1980s and 1990s did not result in higher estimates of the 100-year flood magnitude.

Table 2-5 Flood Frequency Estimates for Issaquah Streams

Stream and Location	Drainage Area (sq mi)	Peak Discharge (cfs)[a]			
		10-Year	50-Year	100-Year	500-Year
Issaquah Creek at Mouth	56.6	2,820	4,140	4,670	5,890
East Fork Issaquah Creek	9.5	560	900	1,050	--
North Fork Issaquah Creek	4.8	176	269	315	445
East Fork Issaquah Creek	9.5	440	725	850	1,100
Tibbetts Creek at Mouth	3.9	330	460	520	670

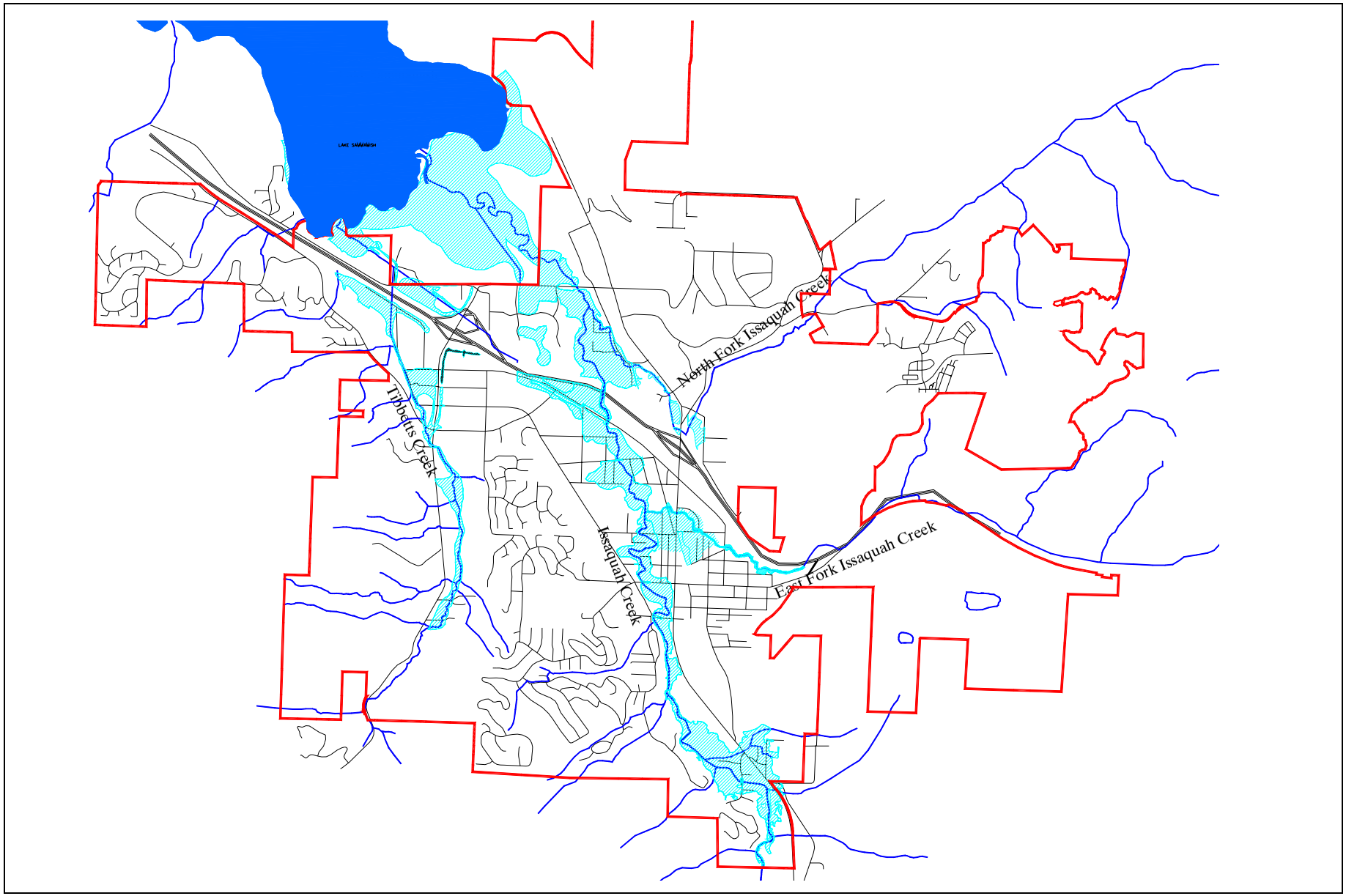
[a] See Appendix A for sources of estimates

2.5.2 Historical Flood Accounts

The following are descriptions of flooding conditions during the largest floods in Issaquah history. These accounts were obtained from the Issaquah Press and (for more recent events) City files.

- **November 1911**. Streamflow records from the Cedar River indicate that a very large flood occurred on November 19, 1911. Accounts of that flood indicated that, whereas much damage was reported in surrounding areas, there were only minor reports of flooding in Issaquah.

Figure 2-3 Issaquah 100-Year Floodplains



- **December 1933**. This flood occurred during one of the wettest Decembers on record. The Issaquah Press stated, "Not a farm situated on any stream is not being materially damaged, part of them through floods caused by log jams and part just through washed away land through unprecedented high water." The principal damage in town was due to flooding of cellars and basements. After this event, King County and other agencies implemented several flood control actions, including dredging the Issaquah Creek channel between Sycamore and Newport Way, and constructing dikes along Issaquah Creek at the Erickson property and Sycamore neighborhood (L. Hjelm, personal communication, 1996). The Sycamore dike was apparently removed when the Sycamore development began.
- **February 1951**. The largest recorded flood event occurred February 1951 and had an estimated magnitude of between 4,000 and 4,800 cfs. This estimate is based on extrapolation of the flow rate that was measured at a former USGS gauge located upstream at May Valley Road. Only a few homes were seriously at risk during this flood, which primarily affected homes along the south end of Front Street bordering Issaquah Creek. The sewage plant (now the City shop site) survived the flood through a considerable flood fight effort by city crews.
- **December 1975**. This flood was then termed the worst flood in 40 years (since the 1933 flood). The hardest hit areas included homes in the Sycamore neighborhood and those above the Clark Street bridge (now Newport Way). In Sycamore, floodwaters surrounded many homes but only a few had water in them. Most damage was to landscaping. A slide dammed the East Fork of Issaquah Creek, washing out a 96-inch culvert at I-90 and diverting the stream to the north side of I-90. Following the flood, a councilman suggested that too many homes were being built in the floodplain.
- **November 1986**. As in the 1975 flood, this flood was deemed the worst since 1933. Sycamore was particularly hit hard. Water covered Front Street at Newport Way, and areas were flooded that were never before flooded, including the Pickering Barn area and the area around SE 56th Street and East Lake Sammamish Parkway (near the lumber store). The Maplewood Apartments were also flooded, and the Woods detention pond overflowed onto 12th Avenue – the first of many such overflows. Flood elevations at Gilman Square came very close to the floor elevations of some businesses, and overbank flooding along lower Tibbetts Creek was a problem upstream of I-90. This storm also demonstrated that the FEMA flood insurance rate maps (FIRMs) were inaccurate, in that this flood produced flood elevations that were close to the 100-year levels predicted by the FEMA maps.
- **January 1990**. This flood was worse than the 1986 flood, with more urban area affected. Water from Tibbetts Creek flooded the Rowley Center and nearby grocery store. Gilman Boulevard was closed by floodwaters, and stores in Gilman Square were flooded for the first time with one foot of water. Two multi-family structures – the Maplewood Apartments and Eastridge House – were evacuated due to flooding of ground floor units. Newport Way from Front Street to 12th Avenue and the Clark Street bridge was closed due to water over the roadway. Total damages were in excess of $500,000.
- **November 1990**. This flood event occurred on November 24 and was part of the infamous Thanksgiving Day storm that sank the Lake Washington Floating Bridge on I-90. This event was less severe than the January 1990 event but nevertheless caused flooding problems in several areas of the City. Clark Street bridge was closed, and water flowed over the Rainier Boulevard bridge over the East Fork. This event followed a lesser flood that occurred on November 9th.

- **February 1996**. This event caused flooding that was similar in magnitude to the January 1990 and November 1986 floods. Although recorded at 2,420 cfs by the USGS, it was concluded that the magnitude of this event was around 3,500 cfs (about a 20-year event) based on similarities with the 1986 and 1990 events (Montgomery Water Group, 1996). However, damages were considerably higher than those events, causing particularly heavy damage at a few notable locations. These include Gilman Square, which was flooded for the third time since January 1990, the Holiday Inn/City Hall Northwest area, and a large number of residential properties along Issaquah Creek. Other areas that were flooded in 1986 and 1990 were flooded as well. Total flood-related costs were in excess of $3 million (see below).

2.5.3 Magnitudes of Historical Floods

The U.S. Geological Survey installed the first stream gauge on Issaquah Creek in 1946 at a site approximately 3.5 miles south of Issaquah, at S.E. May Valley Road. In 1964 the gauge was moved to its present location at S.E. 56th Street, which is a short distance upstream of the mouth at Lake Sammamish. A second USGS gauge was established on Issaquah Creek in 1986 near Hobart. On Tibbetts Creek, a stream gauge provided intermittent data between 1964 and 1977, but was abandoned after problems with sedimentation at the gauge site (located at S.E. 56th Street).

More recently, King County established permanent streamflow recording gauges on North Fork Issaquah Creek and on East Fork Issaquah Creek. These gauges were installed in 1987. Also, the City of Issaquah installed stream gauges on Issaquah Creek near Sycamore and Tibbetts Creek at Tibbetts Manor in 1999.

Figure 2-4 illustrates the historical peak annual flow events on Issaquah Creek at SE 56th Street for the period 1946-1999. A 54-year record of annual floods is obtained by combining the records of 1946-1963 for the May Valley gauge with the records of 1964-1999 for the SE 56th Street gauge. A multiplication factor of 1.56 was used to estimate the downstream flow rate from the upstream flow rate. The factor was calculated by the ratio of drainage areas raised to 0.60 power; this exponent is based on simultaneously gauged floods recorded at Hobart and SE 56th Street between 1986 and 1999. Adjustments were also made to the recorded flood peaks in 1986, 1990, and 1996 to reflect floodwater that bypassed the stream gauge during those events (Montgomery Water Group, 2000).

Long-term trends in flooding can also be evaluated by examining streamflow records on nearby rivers that have a longer gauging history. Stream gauging on Cedar River, which began in 1896 and represents the longest record of river flows in this area, illustrates flood conditions in the first half of this century. Figure 2-5 shows the comparison of Issaquah Creek flood history, which began in 1946, with the longer record of the Cedar River. This graph shows that major flood events appears to occur in long-term cycles, with a period of large flooding events in the early part of the century, followed by relatively benign conditions in the middle part of the century, followed by increased flood activity in the latter part of the century. Of particular note are the major floods that occurred between 1903 and 1911 on the Cedar River. These floods were similar or higher in magnitude to the floods experienced in the 1990s. Thus, it is concluded that the floods in the 1990's were not unusual, and the floods in the early part of this century were probably more severe.

Figure 2-4 Historical Flood Peaks, 1946-1999

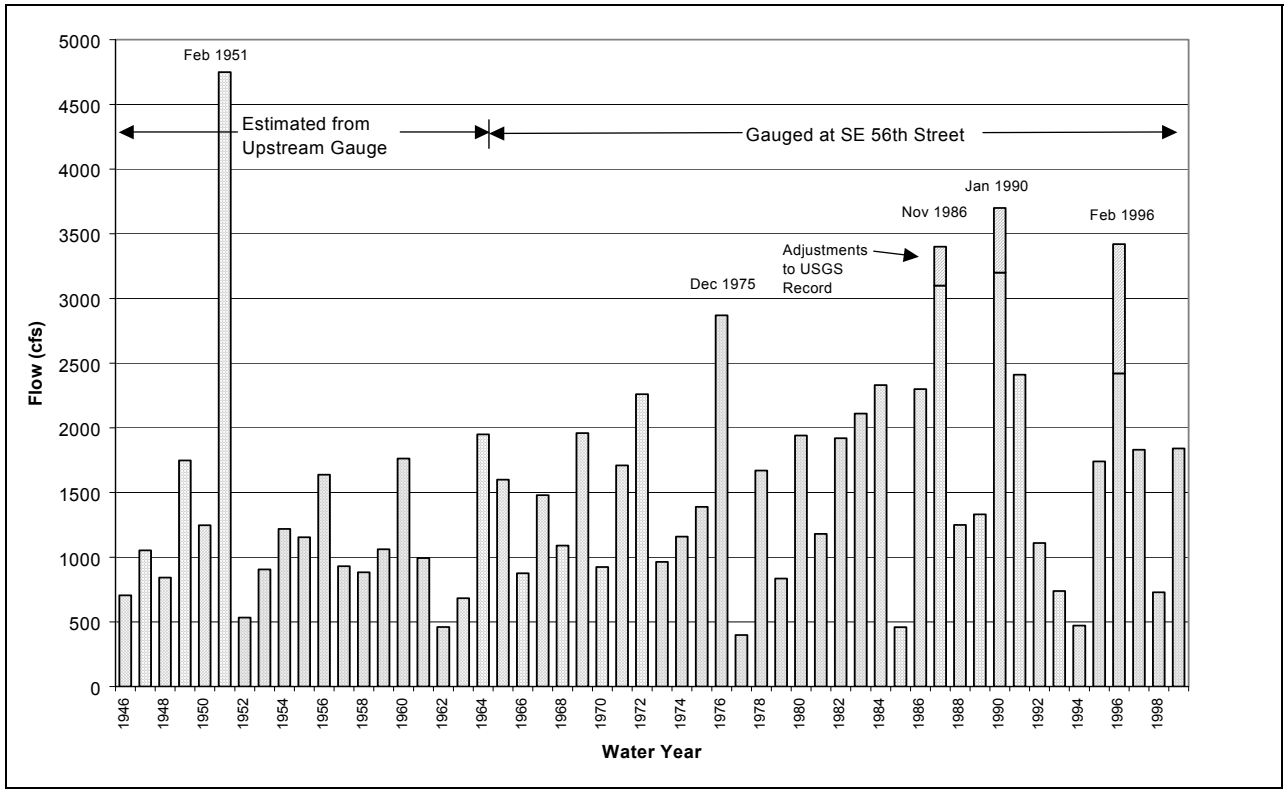
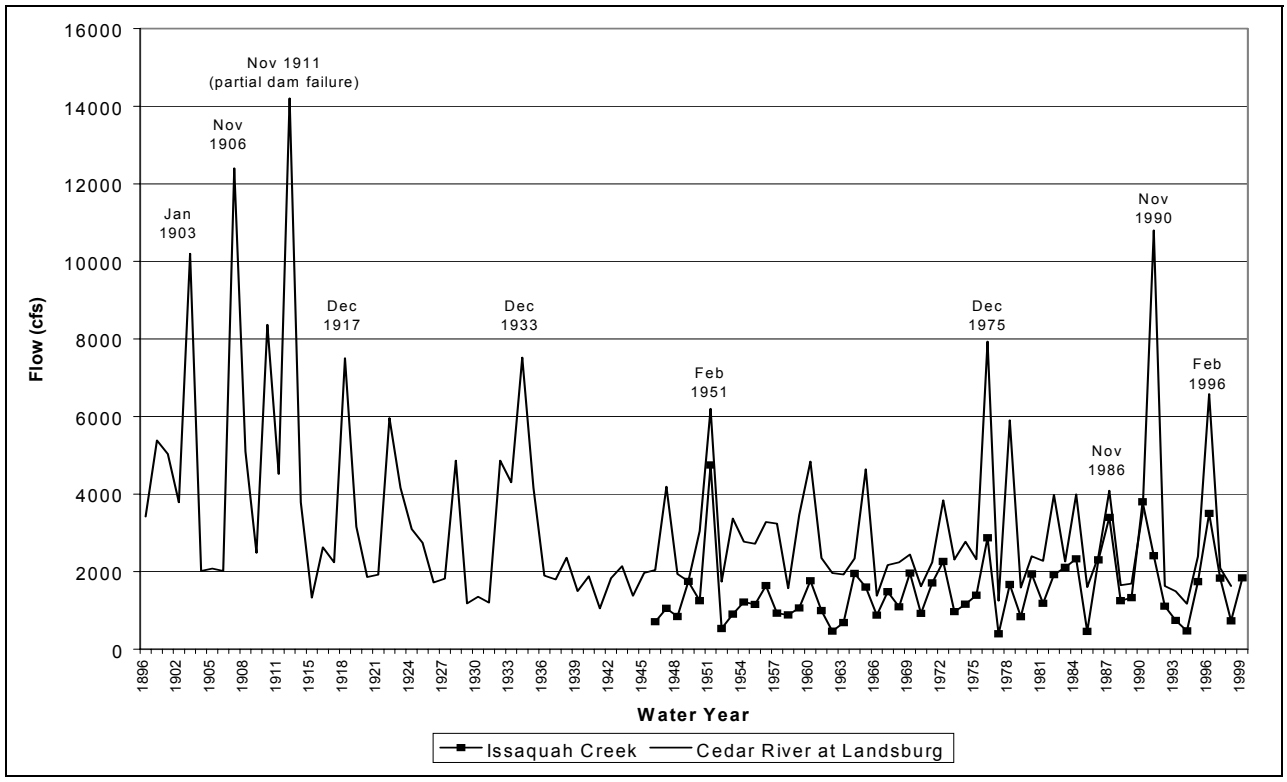


Figure 2-5 Comparison of Issaquah Creek Flooding History to Longer-Term Cedar River History



2.5.4 Flood Damage Costs

The most readily available data for historical flood damage costs are from FEMA flood insurance claims, but these represent only a portion of losses for a given flood. For example, following the 1996 flood the City prepared a comprehensive inventory of flood-related costs in support of applications to FEMA for hazard mitigation grants. That inventory estimated a total flood damage loss of $3.6 million, whereas the FEMA-reported flood insurance payments were only $1.1 million for that flood. In general, FEMA pays for damages to structures and building contents only.

2.5.4.1 Survey of 1996 Flood Event

Table 2-6 summarizes the estimated total damages from the February 1996 flood event. Damages include direct costs from flood damage, costs to replace items destroyed by the flood, cost to plan and react to flood events, and lost opportunity costs for businesses impacted by floods.

Table 2-6 Estimated Flood Damages from February 1996 Flood

Location	Damage
Gilman Area (primarily commercial properties, including Gilman Square, Gilman Village, and Gilman Blvd)	$1,170,000
Cherry Area (primarily residential properties)	$490,000
Sycamore Area (primarily residential properties)	$540,000
Pickering Area (residential and commercial properties)	$310,000
School District Administration Area (residential and school properties)	$180,000
SR900 Area (Holiday Inn, City Hall Northwest and Dairy Queen)	$960,000
TOTAL	$3,650,000

Sources: FEMA Hazard Mitigation Grant Applications prepared in May, 1996 (City of Issaquah1996a,b,c,d,e,f).

2.5.4.2 FEMA Flood Insurance Claims

The NFIP, through partnerships with communities, the insurance industry, and the lending industry, helps reduce flood damage in the United States by nearly $800 million a year. Further, buildings constructed in compliance with NFIP building standards suffer 77 percent less damage annually than those not built in compliance. The NFIP is self-supporting for the average historical loss year, which means that operating expenses and flood insurance claims are not paid for by taxpayers, but through premiums collected for flood insurance policies.

In 2000 approximately 168 properties had flood insurance coverage in Issaquah under the NFIP. This included 140 residential and 28 commercial and other policies. The total annual insurance premium paid by these properties is approximately $78,000, which provides insurance coverage for over $30 million. Insurance coverage is obtained separately for building structures and building contents. Insurance coverage is available for all insurable property in a community participating in the NFIP, which includes the City of Issaquah, regardless of whether the property is located in a mapped flood hazard area. Renters may also purchase coverage for building contents only.

In Issaquah, annual premiums in 1998 ranged from about $150 to $2,100. The average premium in 2001 was $442. Flood insurance coverage for building structures is limited to $250,000 for residential property and $500,000 for commercial property. Coverage for contents is limited to

$100,000 and $500,000 for residential and commercial, respectively. A number of factors are considered in determining the premium for flood insurance coverage. They include the amount of coverage purchased; location; age of the building; building occupancy; design of the building; and, for buildings in special flood hazard areas, elevation of the building in relation to the 100-year flood elevation (also termed the base flood elevation).

The total amount of money paid out by the National Flood Insurance Program during the period 1979 - 1997 was $2,176,000 for 108 separate damage claims. This total includes $1,842,000 for damage to buildings and $334,000 for damage to building contents. Total NFIP claims by flood event are summarized below in Table 2-7, and total claims by stream reach are summarized in Table 2-8. Also summarized in Table 2-8 are the past flood damage claims associated with properties that have been acquired by the City in the last several years for flood mitigation purposes.

Table 2-7 Summary of NFIP Flood Insurance Claims by flood event, 1980 - 1999

Flood Event	Total Insurance Payout
January 1, 1997	$500
February 8, 1996	1,099,052[a]
November 30, 1995	40,740
February 8, 1995	8,926
November 24, 1990	382,622
November 9, 1990	20,460
January 9, 1990	367,755
November 24, 1986	212,178
January 16, 1986	7,996
January 25, 1984	15,676
January 23, 1982	3,692
December 15, 1979	16,725
Total	$2,176,322

[a] Actual total flood damage for 1996 event was estimated at $3.6 million, as summarized in Table 2-5.

Table 2-8 Summary of NFIP Flood Insurance Claims by Stream Reach, 1980-1999

Stream Reach	Location	Total Insurance Payout	
		Total Loss	Claims Associated with Acquired Properties[a]
Pickering	Issaquah Creek – below I-90	$32,457	$0[b]
Gilman	Issaquah Creek – I-90 to Juniper	786,257	0[b]
Cherry	Issaquah Creek – Juniper to Sunset	466,508	329,055
Sunset-Front	Issaquah Creek – Sunset to Front St.	767,144	28,176
Sycamore	Issaquah Creek – Sycamore area	119,247	0
East Fork	East Fork Issaquah Creek	4,709	0
Tibbetts Creek	Tibbetts Creek	0	0
Total		$2,176,322	$357,231

[a] Includes properties purchased by City: 220 NW Dogwood, 300 NW Birch Pl., 75 Clark St, and 85 Clark Street.

[b] Properties along the Gilman and Pickering reaches now benefit from channel improvement projects that were constructed after the last major flood event in 1996.

Much of the historic NFIP damage claims are associated with a few properties. For example:

- Along the Cherry reach, $274,000 (or 60%) of the flood claims were associated with a single property, 300 NW Birch Place, which was acquired by the City in 1998.
- Along the Sunset-Front reach, $271,000 (or 35%) was associated with 385 Front Street South, a residential property.
- Also along the Sunset-Front reach, $333,000 (or 43%) was associated with 200 SW Newport Way, an apartment complex.
- Along the Gilman reach, $574,000 (or 73%) was associated with 605 - 715 NW Gilman (Gilman Square). This area now benefits from the Gilman Area channel capital improvement project that was constructed by the City in 1998. Significant flood hazards in this area still remain, however, since that project was designed to protect up to the 1996 flood magnitude, which was about a 20-year event.

The $2,176,000 in flood losses that were paid for out by the NFIP between 1979 and 1997 represent only a portion of flood damages experienced by these floods. This is because not all properties carry flood insurance (only those properties mortgaged by a federally insured mortgage lender must obtain flood insurance coverage), many property owners who experience light damage do not file flood insurance claims, damage claims do not cover damage to landscaping or indirect costs such as loss of business and traffic delays, and all public properties and some commercial properties are covered by different insurance programs. In addition, even FEMA's database on flood insurance payments is incomplete because some private insurers who sell policies for the NFIP (termed "write your own" policies) do not accurately provide all cost information on their reporting forms to the government. Thus, unless an extensive survey is conducted to ask all property owners what their flood damages were, it is very difficult to determine total flood damages for a flood. A detailed assessment was conducted on the 1996 flood event, however, as summarized above.

2.5.4.3 Repetitive Loss Properties

Repetitive loss properties are properties for which two or more claims of at least $1,000 have been paid by the NFIP within any 10-year period since 1978 (e.g., two claims during the periods 1978-1987, 1979-1988, etc.). Over 2.5 million buildings are insured by the National Flood Insurance Program (NFIP), but only a tiny fraction of them (less than 2%) account for 33% of the flood insurance claims paid since 1978. This is because these few properties have been flooded more than once, and some of them have been flooded numerous times.

As of 2002, 22 properties in Issaquah are classified as repetitive loss properties. Nineteen of these have structures and the other three had their structures removed through purchase and demolition by the City. However, because the FEMA database does not have dollar loss figures for all claims in their database, there are probably additional properties that would also be classified as repetitive loss. Total claims from repetitive loss properties that did have dollar losses recorded in the database amounted to $1,914,307, or 88% of all FEMA flood insurance claims from Issaquah for the period 1980-2000.

The City submits an annual Flooding Repetitive Loss Report to FEMA as part of the CRS recertification process (see Section 6.5.5).

2.6 Water Quality and Habitat

2.6.1 Issaquah Creek Basin Plan Evaluation

The Issaquah Creek basin was the subject of a comprehensive review and assessment as part of Issaquah Creek Basin and Non-point Action Plan (King County 1996; see Section 4.4.3 for additional background on this study). The goal of that plan was to develop a program for the basin of effective actions to prevent and reduce flooding, non-point source pollution, habitat degradation, and stream channel erosion.

With respect to habitat and water quality, the major findings of the plan are:

- The lower portions of Issaquah Creek through the city are subject to widespread flooding that is expected to worsen with future basin development
- Existing water quality in the Issaquah Creek basin, while generally good in current conditions, is predicted to deteriorate markedly with clearing and development in the upper basin
- Deterioration of habitat with the basin has resulted in loss of fish and wildlife populations, and habitat and populations are predicted to decline further with continued basin development.

The major recommendations of the plan are:

- Reduce flood hazards by removing homes from the stream corridor, acquiring easements on undeveloped property, and restoring channel and floodplain capacity
- Regulate the location and characteristics of new development to reduce impacts on stormwater runoff, water quality, and fish and wildlife habitat.
- Solve discrete drainage problems through capital improvement projects.
- Restore disturbed fish and wildlife habitat through capital improvement projects and public programs
- Reduce pollution from non-point sources through capital improvement projects, monitoring, enforcement, and education.

2.6.2 Water Quality

The City of Issaquah currently implements an aquatic resource monitoring program to collect information regarding the status and health of the area streams. A summary of that program is contained in Section 6.4. A report entitled *State of Our Waters, Issaquah Creek Water Quality Monitoring, 1999 and 2000* has been prepared to summarize the program results for the first two years of operation (City of Issaquah 2000).

General observations on water quality conditions are as follows:

- Chemical contamination/nutrients: Fecal coliform contamination appears to be the dominant water quality problem in area streams. Issaquah Creek, North Fork Issaquah Creek, and Tibbetts Creek are all listed on the EPA 303(d) for impaired water bodies for fecal coliforms. Fecal coloforms are considered a non-point source of pollution, in that it originates from dispersed activities and is transported to streams primarily by rainfall runoff. Phosphorus concentrations exceed recommended limits in Issaquah and Tibbetts creeks during storm flow conditions, mainly because these basins are both naturally sediment-rich basins. Tibbetts Creek has also elevated conductivity in lower reaches.

- Sediment/turbidity is very high throughout the basin during storm events. Sediment transport is high off of the steep forested areas as well as other land uses in the basin. A sediment budget study by the University of Washington concluded that 50% of sediment loading is derived from natural landslides, 11% from instream erosion, and 11% from logging and rural roads.
- The water quality of runoff from urban areas is poor, as found from monitoring of Tributary 0170, which drains much of the downtown area west of Issaquah Creek. This drainage ditch had the most exceedences of water quality criteria of all sampling stations (the others were all natural streams).
- Temperatures in streams do not appear to be a problem. A portion of Issaquah Creek below the hatchery was found to have higher temperatures than Class A standards.

Current water quality monitoring data only give a partial picture of current water quality problems. For example, runoff from urban storm drains is not well characterized, and many toxic substances (such as pesticides) are not sampled. Water quality monitoring may be expanded over the next few years to target specific urban runoff sources and to correlate land use data with monitoring results.

2.6.3 Fish Habitat

Issues relating to status and quality of habitat in the stream and riparian zones are at the forefront due to the recent listing of Chinook salmon under ESA. Preliminary evaluations of current conditions, issues of concern, and habitat needs have been conducted as part of the response to the ESA 4(d) rule (see Section 4.1.1.2 for discussion of the 4d rule). Over the next several years the WRIA planning process and shoreline management program update will result in much more comprehensive studies and recommendations. Recent products by the WRIA 8 technical groups include *Draft Reconnaissance Assessement – Habitat Factors that Contribute to the Decline of Salmonids, Greater Lake Washington Watershed Water Resource Inventory Area 8* (WRIA 8 Technical Committee, 2001) and *Lake Washington/Cedar/Sammamish Watershed Near-Term Action Agenda for Salmon Habitat Conservation* (WRIA 8 Technical Committee, 2002).

As part of the initial 4(d) rule response by the WRIA 8 governments to the National Marine Fisheries Service (NMFS), a sub-area summary for the Issaquah Creek basin was prepared for the King County biological review panel by Tina Miller of King County (King County 2000). The biological review panel was created to review King County programs and regulations as impacted by the 4(d) rule. The sub-area summaries were incorporated into *Draft Reconnaissance Assessment*.

Principal conclusions on the status of habitat conditions in area streams are:

- Habitat elements
  - **Substrate** in middle and upper Issaquah Creek provides excellent spawning gravel; lower Issaquah Creek, Tibbetts Creek and lower North Fork have some problems with embeddedness.
  - **Large Woody debris** is greatly lacking and **pool frequency** is below standards in all areas except in Carey and Holder creeks.
  - **Pool quality** is good in lower Issaquah Creek. Smaller systems have few deep pools and more problems with cover and sediment.

- Large amounts of the stream systems have few **off-channel habitat and refugia habitat**, particularly lower Issaquah Creek.

- Channel Condition and Dynamics
  - **Streambank condition** for most of the basin is less than 80% stable, although riprapped banks are the exception and are present in the residential areas.
  - **Flooding** is a major issue in lower Issaquah Creek with a large amount of development in the 5-year floodplain.
- Flow-Hydrology
  - **Changes in peak flow** are estimated to be about 7% higher compared to forested pre-development conditions. Currently, 75% of the basin is forested and this helps to maintain a low alteration of flow rates. Because the system is so mountainous, it has always been very flashy during larger storm events.
- Watershed Conditions
  - **Disturbance history**. Most of the basin was logged within the past 50 years, and upper basin within the past 20 years. The stream systems are still responding to logging impacts. Development has occurred in valley bottoms, with urban development in the lower 5 miles of Issaquah Creek.
  - The **riparian corridor** is good to excellent in the upper and middle portions of Issaquah Creek. Agriculture, roadways, and urban development have resulted in highly disturbed riparian areas throughout most of the rest of the basin.

(page left intentionally blank)

Section 3
STORMWATER POLICIES

The Issaquah Comprehensive Plan established the following goals for utilities and public services, including the stormwater utility (City of Issaquah 2001):

1. Facilitate the development of all utilities and public services at the appropriate levels of service to accommodate Issaquah's planned growth.
2. Facilitate the provision of reliable utility and public services that balance public concerns over the potential safety and health impacts of utility and public service infrastructure, consumers' interest in paying a fair and reasonable price for the utility and public service provider's product or service, the natural environment and the potential impacts of utility or public service infrastructures, and the community's desire that utility and public service projects be aesthetically compatible with surrounding land uses.
3. Process permits and approvals for utility facilities in a fair and timely manner and in accord with development regulations that encourage predictability.

Specific to the stormwater system, Issaquah has two primary objectives:

> **Objective U1: Service Provision.** Ensure that utility services are available to support development that is consistent with the Land Use Plan.
>
> **Objective U4: Storm Water.** Manage the quantity and quality of storm water runoff to protect public health and safety, surface and groundwater quality, natural drainage systems, natural aquifer recharge areas, and fish habitat through implementation of the 1996 Issaquah Creek Basin and Non-Point Action Plan (Issaquah Creek Basin Plan) and Comprehensive Stormwater Management Plan policies.

To achieve the above goals and objectives, the Utilities and Public Services element of the City of Issaquah Comprehensive Plan identifies policies to guide the City's work programs and budget (see Table 3-1). Policies provide official guidance on approaches and likely courses of action for meeting City goals, objectives, and obligations. These policies – developed and reviewed during the 2001 update to the City of Issaquah Comprehensive Plan (concurrently with the development of this plan) and subsequently adopted by the City Council on September 3, 2002 – were compiled from several previous plans, investigations and studies, including:

- The 2002 Update to the City of Issaquah Comprehensive Plan;
- Current and previous stormwater plans and programs, including the 1995 Resource Action Plan (City of Issaquah 1996), the 1996 Issaquah Creek Basin Plan, the 1996 Basin Flood Control Program (RH2 1996), the 1993 Well Head Protection Plan (Golder 1993), and the 1993 Comprehensive Floodplain and Drainage Management Plan (Ch2M Hill 1993); and
- Additional regulatory policies and requirements that the City is currently obligated to comply with, including the 1994 Puget Sound Water Quality Management Plan (PSWQMP) (Puget Sound Water Quality Authority, 1994) and it's 2001 update (Puget Sound Water Quality Action Team, 2001), as well as impending regulatory programs such as the ESA 4(d) rule promulgation and NPDES Phase II municipal stormwater permitting.

Table 3-1 Stormwater Policies from City Comprehensive Plan

Policy U4.1 Design and permitting

4.1.1 New development or redevelopment shall:

- 4.1.1.1 Use the King County Surface Water Design Manual, as amended, as design standards for stormwater and water quality facilities; and
- 4.1.1.2 Mitigate, through the development review process, any related increase in City storm drainage service needs.

4.1.2 Storm drainage facilities shall be designed to:

- 4.1.2.1 Minimize potential erosion and sedimentation;
- 4.1.2.2 Encourage retention of natural vegetation;
- 4.1.2.3 Infiltrate stormwater wherever feasible;
- 4.1.2.4 Maintain stream base flows;
- 4.1.2.5 Preserve natural drainage systems such as rivers, streams, lakes, and wetlands; and
- 4.1.2.6 Provide adequate capacity for future planned growth consistent with the Comprehensive Plan

Policy U4.2 Flood Protection. Coordinate with property owners adjacent to the Issaquah and Tibbetts Creeks to increase flood protection, to the greatest extent feasible through both public and private projects, at the following levels of protection:

4.2.1 Issaquah Creek. The level of protection within the immediate stream corridor is the February 1996 flood event (approximately the 20-year event); and

4.2.2 Tibbetts Creek. The level of protection, as provided by the Tibbetts Creek Greenway Project, is the 100-year event.

Policy U4.3 Flood Hazard Management

4.3.1 Creek Improvements. Reduce flood hazards by using the following design approaches:

- 4.3.1.1 Removal of homes from the floodplain or acquisition of undeveloped parcels;
- 4.3.1.2 Removal of fill or bank stabilization structures and, if necessary, replacement with biostabilization techniques for protection of existing structures;
- 4.3.1.3 Removal of floodplain constrictions caused by bridges as bridges are replaced;
- 4.3.1.4 Installation of localized riprap as necessary to protect bridge foundations and bioengineering for bank stabilization;
- 4.3.1.5 Excavation of widened or overflow channels on City-owned property or on easements granted by private property owners; and
- 4.3.1.6 Revegetation of floodplain and riparian corridor.

4.3.2 Citywide Programs. Promote and provide continued support to the following flood hazard management programs:

- 4.3.2.1 Flood warning and public information system, flood response standard operating procedures, and sand bag delivery;
- 4.3.2.2 Public education programs to warn citizens of risks and dangers of flooding, including the flood preparedness workshops, and detrimental environmental effects;
- 4.3.2.3 Flood insurance program, including preparation of revised FEMA maps of Issaquah Creek and Tibbetts Creek 100-year floodplains and participation in the Community Rating System;
- 4.3.2.4 Technical assistance with floodproofing and elevating of structures within the floodplain; and
- 4.3.2.5 Private- and interagency-sponsored projects such as the Tibbetts Creek Greenway Project, which provide measures to reduce flooding.

Table 3-1 Stormwater Policies from City Comprehensive Plan

Policy U4.4 Stormwater Management And Water Quality Protection

4.4.1 Implement and ensure the compliance of stormwater programs with National Pollution Discharge Elimination System Phase II stormwater permitting by incorporating the following elements:

- 4.4.1.1 Public education and outreach;
- 4.4.1.2 Public involvement/participation;
- 4.4.1.3 Illicit discharge detection and elimination;
- 4.4.1.4 Construction site stormwater runoff control;
- 4.4.1.5 Post-construction stormwater management in new development and redevelopment; and
- 4.4.1.6 Pollution prevention/good housekeeping for municipal operations.

4.4.2 Promote, support and participate in programs that improve the quantity and quality of stormwater runoff, stream flows, and groundwater, including:

- 4.4.2.1 Source control best management practices (BMPs), which control pollution at its source through physical improvements and good housekeeping practices, at existing commercial and industrial properties;
- 4.4.2.2 Retrofitting of storm drain systems to improve water quality and aquifer recharge;
- 4.4.2.3 Inclusion of water quality mitigation in applicable capital projects;
- 4.4.2.4 Control of non-point source pollution sources, such as fecal coliform contamination, to streams, through capital improvement projects, monitoring, enforcement, and education;
- 4.4.2.5 Enforcement against illegal discharge of contaminants and illicit connections to surface water, stormwater, groundwater, and stream corridors;
- 4.4.2.6 Continuation of the Comprehensive Aquatic Resource Monitoring Plan;
- 4.4.2.7 Spill response, including the Spill and Water Quality Response Standard Operating Procedure for responding to complaints or emergencies such as spills, fish kills, illegal connections, and other water quality related problems on both public and private property;
- 4.4.2.8 Development of a Spill Response Plan that includes interagency coordination and equipping of City crews with necessary equipment to allow quick response and action to spill events on both public and private property;
- 4.4.2.9 Inspection and maintenance of private facilities at appropriate intervals;
- 4.4.2.10 Maintenance of public drainage systems to maximize their effectiveness in stormwater conveyance and pollutant removal; and
- 4.4.2.11 Inventory and surveying the existing storm drainage system to provide accurate and complete information for operations and maintenance, water quality investigations and response, and capital improvements.

Policy 4.5 Funding Of Capital Improvement Projects and Programs

4.5.1 Identify, prioritize, and provide sufficient funding, for capital improvement projects and programs based on the following criteria:

- 4.5.1.1 Improve flood and stormwater drainage conveyance;
- 4.5.1.2 Repair failing or deteriorated public stormwater systems;
- 4.5.1.3 Routine maintenance of public stormwater facilities;
- 4.5.1.4 Improve stormwater runoff water quality and aquifer recharge;
- 4.5.1.5 Acquire, preserve or restore stream and riparian habitat;
- 4.5.1.6 Acquire repetitive loss and flood prone properties;
- 4.5.1.7 Monitor physical, chemical and biological conditions of streams;
- 4.5.1.8 Implement public involvement and education programs for floodplain, water quality, stormwater and habitat activities;
- 4.5.1.9 Maintain flood warning system;
- 4.5.1.10 Maintain and upgrade the stormwater system inventory; and

Table 3-1 Stormwater Policies from City Comprehensive Plan

4.5.1.11 Manage the stormwater utility.

Policy 4.6 Land Use And Critical Area Regulations

4.6.1 Regulate the location and characteristics of new development to reduce impacts on stormwater runoff, aquifer recharge, water quality, and fish and wildlife habitat using methods such as:

- 4.6.1.1 Encourage development proposals that incorporate stormwater design principles of low impact development;
- 4.6.1.2 Support development of land use regulations that promote open space retention and reduce impervious surface areas to lessen stormwater impacts and improve aquifer recharge;
- 4.6.1.3 Enforce aquifer recharge regulations to ensure that development proposals do not reduce recharge to the Lower Issaquah Valley aquifer; and
- 4.6.1.4 Enforce existing shoreline management and critical areas regulations that provide protection to wetlands and streams and their buffers.

Policy 4.7 Public Education And Outreach. Provide continued support to public education and outreach programs, including:

4.7.1 Issaquah Stream Team;
4.7.2 Issaquah Businesses for Clean Water (or equivalent City program);
4.7.3 Riparian Restoration Stewardship;
4.7.4 Sammamish Watershed Stewardship; and
4.7.5 Flood Preparedness Workshop;
4.7.6 Other public information and workshop efforts for flood hazard management, stormwater quality, and stream habitat restoration.

Policy 4.8 Regional Coordination and ESA. Coordinate local storm drainage and flooding programs as well as coordinate with regional jurisdictions on regional floodplain, stormwater and habitat management programs such as the Puget Sound Water Quality Management Plan (Puget Sound Plan) and response to the Endangered Species Act (ESA) 4(d) Rule. Modify existing or implement new City programs, to the greatest extent feasible, to incorporate regionally approved recommendations.

Policy U4.9 Fish and Wildlife Habitat

4.9.1 Promote and support private- and interagency-sponsored projects such as the Tibbetts Creek Greenway Project, which provide measures that improve the stream environment.
4.9.2 Adopt "fish friendly" design principals in all capital improvement projects:

- 4.9.2.1 Include protective measures and beneficial features for salmonid habitat in all projects;
- 4.9.2.2 When prioritizing projects include within the process a means to rank "fish friendly" projects; and
- 4.9.2.3 Restore disturbed fish and wildlife habitat through capital improvement projects and ongoing programs.

Section 4
FLOODING AND STORMWATER EVALUATION

Flooding is a naturally occurring phenomenon along Issaquah Creek and other streams in Issaquah. The creek and the basin provide many examples of natural stream processes and flooding that are typical of small river systems in the Puget Sound basin. The steep slopes and less pervious soils in the upper watershed contribute to rapid runoff of stormwater. In recent times, these natural processes have been altered by land uses and development within the basin. Two primary changes have resulted from development: increases in runoff due to forest clearing and development in the headwaters, and, more importantly, development within the floodplain areas along the valley flood and adjacent to hillside tributaries. This has resulted in increased threats to public safety and property.

Control and treatment of stormwater runoff from new development is regulated through local ordinances and the King County Surface Water Design Manual, which the City adopts in the stormwater code. However, those requirements were initially adopted in 1979, only started to become effective in 1990 with improved analysis methods, and then upgraded again in 1998. Thus, nearly all of downtown Issaquah, the I-90 freeway and all primary roadways, and a majority of the residential areas within Issaquah were developed without stormwater quantity and quality controls. Although probably not contributing greatly to the magnitude of flood peaks on Issaquah Creek, uncontrolled runoff and associated degraded water quality can have a large impact on the ecological health of area streams and Lake Sammamish.

Evaluation of flooding, stormwater runoff, and water quality has been the subject of many studies over the years. Studies that have evaluated current conditions and proposed projects to improve the impaired conditions of area streams and Lake Sammamish are summarized below. Regulations to reduce impacts of new development have also been adopted by the City; current and potential new requirements that are being developed in response to ESA and other recent developments in the regulatory arena are also summarized below.

4.1 City of Issaquah Comprehensive Plan and the Growth Management Act

The City of Issaquah Comprehensive Plan primary purpose is as the City's guide for land use planning and zoning. It also provides the framework for land use regulations that protect sensitive and natural environments. This plan was written and adopted in accordance with the Growth Management Act (GMA), which was passed in 1990 by the Washington State Legislature.

GMA covers many aspects of City planning to ensure consistency of transportation, capital facilities, parks, and other elements of City infrastructure with current and projected land use plans. The Utilities and Public Services element of the Comprehensive Plan addresses the utility planning requirements of GMA (City of Issaquah 2001). It addresses the City's desire to have safe, reliable and cost effective utility and public services, and to ensure utility projects are as aesthetically compatible with adjacent land use as possible. It also provides guidance for focusing future utility facilities where they will be most needed and for targeting future development in areas where utilities and services are available. The overall goal (known as concurrency) is to *ensure that those facilities and services necessary to support development shall be adequate to serve the development at the time the development is available for*

occupancy and use without decreasing current levels of service below locally established minimum standards [RCW 36.70A.020(12)]. Thus, level of service standards that are established for a stormwater utility must be maintained in response to growth. This not only affects capital improvement programs, but also operations and maintenance to keep existing facilities operating at established levels of service.

The GMA also requires cities and counties to address water resources in a variety of ways. It requires all cities and counties in the state to ensure that:

- Their development regulations, including shoreline master programs, are consistent with and carry out their comprehensive plan.
- Building permits are conditioned on evidence of an adequate quantity and quality of water.
- Subdivisions are approved only after findings of adequate quantity and quality of water.
- Critical areas – including wetlands, aquifer recharge areas, frequently flooded areas, and fish and wildlife conservation areas – are designated and protected using best available science. Special consideration needs to be given to conserve and protect anadromous fisheries (RCW 36.70A.172), which has a bearing on land use and stormwater programs.

GMA also provides cities and counties the responsibility and authority to plan water quality and water systems through comprehensive plans and development regulations. The basic architecture of GMA defines a strategy for watershed protection and salmon recovery that is consistent with best available science. The strategy is to:

- Protect all streams and wetlands that are now healthy. First, keep intact what we have.
- Conserve rural and resource lands. Minimize new impervious surfaces.
- Direct most new urban growth to urban areas.
- Provide for open space corridors within and between urban growth areas.

While much of GMA pertains to land use planning, utility infrastructure, and critical area protection, stormwater management is integrally related to resource protection. Local governments are instructed to develop comprehensive plans that "provide guidance for corrective actions to mitigate or cleanse those discharges that pollute waters of the state" (RCW 36.70A.070). Stormwater policies in Section 3 were developed to address the various requirements of GMA.

4.2 Regulations

The discussion of principal regulations and regulatory programs that affect stormwater runoff, water quality, habitat and flooding are divided into the following three groups:

- State and Federal Stormwater Programs (Puget Sound Plan, ESA and NPDES)
- City ordinances
- National Flood Insurance Program

4.2.1 State and Federal Stormwater Programs

The Puget Sound Water Quality Management Plan, ESA 4D Rule, and NPDES Phase II programs currently define the scope and requirements of the City's stormwater management program. The Issaquah Creek Fecal Coliform TMDL, still under development, may create additional future obligations. Although the regulatory impact of these programs on the City

won't really begin until the NPDES Phase II program begins to be implemented by the Department of Ecology in early 2003, many local jurisdictions including the City of Issaquah have started to meet the intent of these programs several years ago under the guidance of the Puget Sound Water Quality Management Plan.

All three programs have common elements, as summarized in Table 4-1. Because of this overlap, it is likely that a single agency (e.g., Department of Ecology) will assume the enforcement entity for most if not all of these requirements.

The City of Issaquah already has many existing stormwater management requirements and programs that meet or exceed the Puget Sound Plan, NPDES, and ESA 4(d) rule requirements, including:

- **Stormwater inspection and maintenance program**. The revised Stormwater Management Code provides the necessary City authorization to inspect and require maintenance of public and private stormwater facilities (see Section 6.3).
- **Source control inspections**. Inspection and enforcement of source control BMPs at existing development is conducted as part of stormwater inspection and maintenance program (see Section 6.3) and the Business for Clean Water Program (see Section 6.6).
- **Water quality investigations**. Detection of illicit discharges, source control problems, and other water quality problems is conducted in conjunction with existing work programs such as stormwater facility mapping, stream and outfall monitoring, and inspections (see Section 6.4.3).
- **Resource monitoring**. The City's existing aquatic resource monitoring program is currently being conducted on many streams and tributaries in Issaquah, and will be modified as necessary to help identify sources of pollutants (see Section 6.4.1).
- **Capital improvement program (CIP).** Efforts to improve flooding conditions in Issaquah will continue, and existing stormwater facilities will also require ongoing repairs and upgrades (see Section 7.1). Depending on the outcome of monitoring studies, future CIP projects may need to include funding for stormwater retrofitting projects within the City (see Section 7.1). Due to their high costs, external funding will be required to implement or participate on regional projects such as detention, retention, habitat enhancements, water quality facilities, and other mitigation projects (as evaluated and prioritized by WRIA planning). Other City CIP projects will continue to incorporate fish-friendly designs to the extent practicable.
- **Habitat restoration and acquisition program**. The City currently acquires streamside parcels to the extent possible using available City funds and grant opportunities. Regional funding through salmon recovery efforts will allow expansion of these efforts.

4.2.1.1 Puget Sound Water Quality Management Plan

The goal of the Puget Sound Water Quality Management Plan, also termed the Puget Sound Plan, is to enhance the health of Puget Sound's aquatic species and habitat, natural hydrology and processes, and water quality by managing stormwater runoff and reducing combined sewer overflows. The plan was first developed in 1986 and then updated in 1991 and 1994. In 2001 the plan was restructured to consolidate the various program elements (separated into basic and comprehensive programs) in the previous plans into a single, comprehensive program (Puget Sound Water Quality Action Team, 2001)

Table 4-1 Comparison of Puget Sound Plan, ESA, and NDPES Phase 2 Stormwater Requirements

Comprehensive Stormwater Program Element	Overall Requirement	City Program for Implementation	Applicable Regulatory Programs		
			Puget Sound Plan	ESA 4(d) Stormwater	NPDES Phase 2
1. Ordinances containing minimum requirements for new development and redevelopment	Adopt ordinance that includes minimum requirements equivalent to Ecology's model ordinance	Stormwater Management Policy Ordinance IMC 13.28 (see Section 6.2 and Appendix B).	SW-1.3a. Stormwater controls for new development and redevelopment	1. Technical standards	5. Post construction runoff control
2. Stormwater technical manual	Adopt technical manual containing erosion and sediment control (ESC), runoff control and control of pollution from urban areas that are equivalent to Ecology's technical manual	Stormwater Management Policy Ordinance IMC 13.28 (see Section 6.2 and Appendix B).	SW-1.3a. Stormwater controls for new development and redevelopment, and SW-1.4. Alternative technical manuals.	2. Source controls for stormwater runoff	4. Construction runoff control for sites >1.0 acre
3. Operation and maintenance program	Establish O&M program and ordinance for public and private facilities	City has O&M program for pubic facilities and has implemented private facility inspection program (see Section 6.3).	SW-1.3d. Maintenance of permanent facilities	10. Maintenance standards/ programs	6. Pollution prevention and good housekeeping
4. Water quality monitoring and assessment	Implement ongoing programs to provide baseline water quality data, and assess and identify water quality problems	City has implemented comprehensive aquatic resources monitoring program (see Section 6.4.1).	SW-1.3k. Monitoring	9. Monitoring	*(not addressed)*
5. Problem storm drain correction and illicit discharge elimination	Implement corrective actions for identified stormwater water quality problems, including elimination of illicit discharges	Water quality investigations are ongoing and will benefit from improved system mapping (see Section 6.4.3).	SW-1.3g. Identification and ranking of problems	6. Illicit discharge elimination	3. Illicit discharge detection and elimination
6. Water quality response program	Respond to citizen complaints or emergencies such as spills, water quality problems and illegal discharges	City has developed standard operating procedures for spill response (See Section 6.4.2 and Appendix C)	SW-1.3f. Illicit discharges and water quality response	*(not addressed)*	*(not addressed)*

Table 4-1 Comparison of Puget Sound Plan, ESA, and NDPES Phase 2 Stormwater Requirements

Comprehensive Stormwater Program Element	Overall Requirement	City Program for Implementation	Applicable Regulatory Programs		
			Puget Sound Plan	ESA 4(d) Stormwater	NPDES Phase 2
7. Inspection and compliance	Adopt ordinance to allow adequate inspection and enforcement of stormwater facilities	City conducts plan reviews to verify compliance with ordinances (see Section 6.2) and has implemented inspection program for private facilities (see Section 6.3).	SW-1.3b. Stormwater site plan review and SW-1.3c. Inspection of construction sites	3. Inspection and enforcement, including complaints	*(not addressed)*
8. Public education	Implement public education programs aimed at residents, businesses, and industries in the urban area	City has implemented many public education and outreach programs (see Section 6.6).	SW-1.3h. Public education and involvement	4. Public education	1. Public education and outreach
9. Public involvement and outreach	Create opportunities for public participation in decision making and environmental activities	City has implemented many public education and outreach programs (see Section 6.6).	SW-1.3h. Public education and involvement	5. Public involvement/out-reach	2. Public participation and involvement
10. Land use, growth management, and watershed planning	Incorporate goals of stormwater programs into comprehensive plans and other land use decisions; use watershed planning to evaluate regional programs to reduce stormwater impacts; and adopt low impact development (LID) policies	City participated in Issaquah Creek Basin Plan and other studies (see Section 4.4) and is actively involved in WRIA 8 watershed planning for salmon recovery (see Section 4.1.1.2).	SW-1.1. Growth Management Planning and SW-1.2. Watershed or Basin Planning.	8. Land use decisions/regu-lations, including innovative techniques 12. Basin planning efforts	*(not addressed)*
11. Interlocal coordination	Issues associated with shared water bodies and drainage basins shall be coordinated with neighboring jurisdictions	City actively coordinates with other local jurisdictions as part of GMA, watershed planning, and other activities.	SW-1.2. Watershed or Basin Planning.	7. Intergovern-mental coordination	*(not addressed)*

Table 4-1 Comparison of Puget Sound Plan, ESA, and NDPES Phase 2 Stormwater Requirements

Comprehensive Stormwater Program Element	Overall Requirement	City Program for Implementation	Applicable Regulatory Programs		
			Puget Sound Plan	ESA 4(d) Stormwater	NPDES Phase 2
12. Adequate funding	Conduct funding analyses for staff, equipment and capital improvements needed to implement stormwater management program	City has stormwater utility to fund stormwater programs and capital improvement projects (see Section 4.1.2.4)	SW-1.3j. Funding	*(not addressed)*	*(not addressed)*
13. Low impact development	Adopt ordinances that allow and encourage low impact development, by improving infiltration of stormwater and reducing offsite discharge	LID proposals are allowed in Stormwater Management Policy IMC 13.28 (see Section 6.2 and Appendix B).	SW-1.3a. Stormwater controls for new development and redevelopment	*(not addressed)*	*(not addressed)*
14. Capital improvement projects	Incorporate fish friendly design principals for all capital projects, and implement new projects to provide stormwater benefits	City has stormwater capital improvement program that incorporates fish friendly design principals (see Section 7).	*(not addressed)*	11. Capital improvement programs	*(not addressed)*
15. Habitat enhancement	Implement program for constructing habitat enhancements, with stewardship programs to ensure long-term viability and protection	City stormwater capital improvement program has implemented restoration projects (see Section 7) and has stewardship programs (see Section 6.6.2).	*(not addressed)*	13. Habitat enhancement	*(not addressed)*
16. Habitat acquisition	Establish program to acquire and manage lands for salmonid habitat, with stewardship programs to ensure long-term viability and protection	The City has acquired many streamside parcels along Issaquah Creek, including developed parcels as part of flood mitigation (see Section 6.7).	*(not addressed)*	14. Habitat acquisition	*(not addressed)*

The Plan was prepared to guide the water quality protection efforts of state and local governments, resulting in a more comprehensive and effective strategy for preventing and managing pollution sources to Puget Sound. Originally developed by the Puget Sound Water Quality Authority, management of the program to protect the Puget Sound estuary was restructured in 1996, when the Authority was replaced by the Puget Sound Water Quality Action Team. The Action Team now prepares biennial work plans to protect Puget Sound. The goals of the current work plan are to achieve measurable improvements in Puget Sound over a two-year period and continue implementing the Puget Sound Water Quality Management Plan.

The Puget Sound Plan called on all cities and counties in census urbanized areas in the Puget Sound basin to develop and implement comprehensive stormwater programs to manage stormwater runoff. Under Element SW-1, the 2000 Plan calls on local governments to implement five critical tools that relate to growth management and watershed planning, development regulations, capital investment, and stormwater management programs. Table 4-2 summarizes these tools, including the specific elements of the local Comprehensive Stormwater Program (Element SW-1.3), and how Issaquah has met, or plans to meet, these requirements.

Based on a schedule developed by the Department of Ecology in 1996, Issaquah was to have submitted an implementation schedule by June 1998 and implemented a Comprehensive Stormwater Program by the end of 1999. The City presented the City's response on the status of Issaquah's stormwater program to Ecology on November 5, 1999. Based on that meeting, Ecology was satisfied with Issaquah's progress in developing and implementing a Comprehensive Stormwater Program. For the draft 2000 Puget Sound Plan, Ecology has given a deadline of December 2002 for cities to revise their programs with the new program elements.

4.2.1.2 ESA 4(d) Rule

In response to the March 1999 listing of Puget Sound Chinook salmon under the Endangered Species Act, new federal requirements are being developed to address impacts of stormwater on salmon and its habitat. A general framework of these rules appears in the July 2000 Federal Register publication by the National Marine Fisheries Service (NMFS) of the final West Coast Salmon 4(d) Rule. This rule prohibits the "take" of 14 groups of salmon and steelhead listed as threatened under ESA, including chinook that inhabits Issaquah-area streams. The take prohibition makes it illegal for anyone to harm a listed salmon or steelhead, except in cases where the take is associated with an approved program. The 4(d) rule creates a means for NMFS to approve these programs if they meet the standards set out in the rule (i.e., achievement of properly functioning conditions).

The portion of the 4(d) rule that contains stormwater management regulations is the section referring to "municipal, residential, commercial, and industrial (MRCI) development (including redevelopment) activities." While the final 4(d) rule did not contain specific regulations for stormwater management or other activities conducted by governments (such as development permitting), the MRCI rule essentially created a placeholder allowing local jurisdictions until January, 2001 – the effective date of the 4(d) rule – to negotiate a specific 4(d) rule for that jurisdiction.

Table 4-2 Puget Sound Plan Requirements for Local Government Planning and Stormwater Programs

Puget Sound Plan Element	City of Issaquah Stormwater Program
SW-1.1 Growth Management Planning	City actively adopts comprehensive plans and policies, zoning, capital facility plans, and development regulations to ensure that development does not degrade water quality, aquatic species and habitat, and natural hydrology and habitat.
SW-1.2 Watershed or Basin Planning	City has conducted basin planning (i.e., Issaquah Creek Basin Plan) and participates in current basin planning activities (i.e., WRIA 8 salmon recovery planning).
SW-1.3 Comprehensive Stormwater Programs	City is implementing a comprehensive program through the following actions:
a. Stormwater Controls for New Development and Redevelopment	City's stormwater ordinance requires best management practices to control stormwater flows, provide treatment, and prevent sedimentation and erosion.
b. Stormwater Site Plan Review	Public Works conducts plan review to verify compliance with local requirements
c. Inspection of Construction Sites	Public Works inspectors regularly inspect construction sites.
d. Maintenance of Permanent Facilities	City's stormwater ordinance requires maintenance of both public and private stormwater facilities. Inspection program will be implemented in 2002.
e. Source Control	City's stormwater ordinance requires implementation of source control BMPs. Inspection program will be implemented in 2002.
f. Illicit Discharges and Water Quality Response	City's stormwater ordinance contains prohibitions on illegal discharges. Spill Control Standard Operating Procedures define spill response actions.
g. Identification and Ranking of Problems	City is currently conducting inventorying of all stormwater facilities. Combined with resource monitoring this will allow more effective problem investigation and ranking.
h. Public Education and Involvement	City has many public education and involvement programs relating to the City's natural resources.
i. Low Impact Development Practices	City's stormwater ordinance contains allowances for low impact development proposals. The Urban Villages (Issaquah Highlands and TALUS) contain developments that are consistent with low impact development (e.g., clustering, open space).
j. Funding	City has stormwater utility that funds stormwater programs and capital projects.
k. Monitoring	City has implemented comprehensive aquatic resources monitoring program.
l. Schedule for Implementation	The schedule for implementation of comprehensive stormwater program activities is contained in this Plan.
SW-1.4 Alternative Technical Manuals	City has adopted King County Surface Water Design Manual as its technical manual, which has been approved by Ecology.
SW-1.5 Local Program Evaluation, Reporting and Modification	City will have adopted the Puget Sound Plan program elements in time for the December 2002 deadline. Updates to this Plan will occur as appropriate to meet Ecology reporting requirements.

The Tri-County process was formed to develop specific regulations for jurisdictions in the King-Snohomish-Pierce County areas. The Tri-County Model 4(d) Rule Response Proposal, as it is called officially, was drafted in 2001 to assist not only jurisdictions seeking a take limit under the NMFS 4(d) Rule, but also those jurisdictions that simply want to build operational programs, regulatory programs, or both which are protective of salmonids and their habitat in order to reduce the risk of ESA Section 9 violations. It addressed the requirements of the 4(d) rule through the 14 elements summarized in Table 4-1. Table 4-3 further describes these requirements. Since the entirety of the 4(d) rule is very complex and often not very specific, it will likely take several years for the agencies to clear up the ambiguities in the 4(d) rule, and for jurisdictions to plan, budget, and adopt the necessary programs. A program can be approved by NMFS as qualifying under the 4(d) rule after review by NMFS and the public comment period.

The regulatory effects of the 4(d) rule will likely work itself into other State programs, such as the NPDES Phase II permitting process and the Shoreline Master Program update, to a level that may be up to local jurisdictions to decide. The 4(d) rule's principal function is to prohibit actions that *take* without federal authorization. NMFS is not requiring states, local governments, or private parties to change their practices to conform to any of the take limits described in the final rule, nor will these entities be required to seek direct review and approval of their programs by NMFS. The limits provide one way to be sure an activity or program does not risk violating the take prohibitions. Simply because a program is not within a limit *does not* mean that it automatically violates the ESA. However, it *does* mean that any program or jurisdiction would risk ESA penalties if the activity in question takes a listed fish. By qualifying for a limit, governments and individuals receive assurance that their activities, when implemented in accordance with the criteria in the 4(d) rule, do not violate the take prohibitions and will not be subject to enforcement actions.

Table 4-3 ESA 4(d) Rule Stormwater Elements

Element	Description	Required Response	Current Status
1. Technical Standards	Approved stormwater technical standards for new and redevelopment.	• Adopt King County's update to their 1998 stormwater manual (req'd by 2001) or adopt Ecology's 2000 manual	City will amend Stormwater Management Code upon approval of updated King County manual.
2. Source Control Standards	Source control standards to reduce runoff pollution from new and existing developed sites.	• Adopt King County source control BMP manual • Implement source control site inspection program of existing commercial, industrial, and multifamily properties	Requirements are included in revised Stormwater Management Code that was adopted in 2000. Private inspection program began in 2002.
3. Inspection and Enforcement	Adequate program for plans review and construction inspection, response to code compliance and complaints, and enforcement actions.	• Plans inspection procedures by trained staff • Response to complaints on water quality and quantity problems or code violations	Requirements are consistent with current City plan review procedures. Additional training for erosion/sediment control certification may be required.
4. Public Education	Educate citizens about how their activities affect water quality, stormwater runoff and endangered species.	• Distribute educational materials • Implement formal educational program	City currently has water quality educational programs aimed at residences and businesses.
5. Public Involvement/ Outreach	Incorporate public involvement in decision-making process.	• Create opportunities for involvement in boards and commissions, watershed planning groups • Develop outreach programs for environmental activities	City currently has active participation through Rivers and Stream Board and has implemented several outreach programs through the Resource Conservation Office.
6. Illicit Discharge Elimination	Program for preventing, detecting and eliminating illicit discharges.	• Adopt ordinances making illicit discharges illegal • Develop program to investigate, detect, eliminate and enforce illicit connections	Current water quality program includes monitoring, mapping and water quality response to identify illicit discharges.
7. Inter-Governmental Coordination and Watershed Planning	Coordination of stormwater-related policies, programs, and projects among jurisdictions sharing similar responsibilities in the watershed.	• Establish program or policy directive for ensuring intergovernmental and intragovernmental coordination	City participates in WRIA 8 ILA for watershed planning. City has existing interlocal agreement with King County relating to stormwater support services, and coordinates on other regional plans and projects.
8. Land Use Decisions/Regulations	Minimize adverse impacts resulting from area zoning and land use regulations and policies.	• Adopt policy for ensuring ecosystem impacts are assessed before zoning and other land-use decisions are made • Adopt low impact ordinance that encourages developments to reduce stormwater runoff and related impacts • Implement other WRIA-recommended programs for reducing stormwater impacts	Land-use decisions must follow SEPA rules to evaluate impacts. City allows for low impact development proposals in revised Stormwater Management Code. Land use policies (by Planning Department) may need to be revised to ensure compliance with ESA-specific requirements.

Table 4-3 ESA 4(d) Rule Stormwater Elements

Element	Description	Required Response	Current Status
9. Monitoring	Program for monitoring the implementation of stormwater management activities, and for gathering, maintaining and using adequate information to conduct planning, priority setting and program evaluation activities.	• Participate in regional and/or watershed monitoring • Implement local monitoring program	City currently conducts an aquatic resource monitoring program that meets the requirements.
10. Maintenance Standards/ Programs	Inspection, maintenance and enforcement of public and private stormwater facilities to ensure that they function as designed.	• Adopt inspection and maintenance ordinance that provides regulatory authorities • Adopt maintenance standards • Develop and implement inspection and maintenance program	Requirements are included in current Stormwater Management Code. Inspection program began in 2002.
11. Capital Improvement Programs	Design CIP projects so that protective measures for salmon habitat are incorporated to the maximum extent practicable.	• Adopt fish-friendly design principles for all CIP projects • Rank CIP projects using criteria that reflect importance of fish-friendly projects when competing with other CIP funds • Implement stormwater CIP projects to mitigate for past land disturbing practices • Participate in regional CIP projects as identified and prioritized through WRIA planning	City currently maximizes habitat improvement potential in all projects affecting streams. City CIP projects are intended to mitigate existing stormwater problems, and the City participates in WRIA planning to identify, assess and prioritize regional projects.
12. Basin Planning Efforts	Participate in planning efforts within watersheds to ensure integration among departments, jurisdictions and other entities conducting planning efforts.	• Participate in and help fund basin planning (WRIA 8) planning efforts	City currently participates in WRIA 8 planning efforts as authorized and funded by *Interlocal Agreement for the Watershed Basins within Water Resource Inventory Area 8*.
13. Habitat Enhancement	Program for constructing habitat enhancements and ensuring their long-term viability and protection.	• Establish necessary funding for habitat enhancements and stewardship programs • Implement enhancement program	City currently implements habitat enhancement and acquisition projects in coordination with flood mitigation and other CIP projects. Future programs will benefit from regional funding through WRIA 8 process.
14. Habitat Acquisition	Program for acquiring and managing lands in a manner supporting the long-term ecosystem processes that create and maintain salmon habitat.	• Establish necessary funding for habitat acquisitions and stewardship programs • Implement acquisition program	See 13, above.

[a] 65/10 standard requires that 65% of a site or basin must be left in native vegetation and no more than 10% of a site or basin be developed with impervious surfaces.

4.2.1.3 NPDES Municipal Stormwater Permitting Phase II

The Phase II National Pollution Discharge Elimination System (NDPES) stormwater permitting program is a continuation of Phase I program that began several years ago. The NPDES program is implemented under the Clean Water Act by the Environmental Protection Agency. In the State of Washington, NPDES permitting and regulatory powers are delegated to the Department of Ecology.

The following are regulated under the Phase II program, and therefore must apply for a stormwater permit by March 10, 2003:

- Communities with populations less than 100,000 and located in a census urbanized area
- Construction activities that disturb 1 to 5 acres of land
- Municipally owned industrial facilities that discharge to streams
- Other industrial sources designed by the permitting authority (and not covered under Phase I)

Under Phase I, all communities with 100,000 population or more (termed "medium" and "large" municipal separate storm sewer systems, or MS4s) were required several years ago to implement a stormwater management program as a means to control polluted discharges. The Phase II program extends this program to communities in census-identified urban areas having fewer than 100,000 in population ("small" MS4s). In addition, Phase II will require permitting of construction activities that will disturb between 1.0 and 5.0 acres of land. Currently, the NPDES Phase I program requires permitting of all construction sites over 5 acres in size. Finally, municipally owned industrial facilities, such as vehicle maintenance facilities, are now required to obtain a permit (they were temporarily exempt from the Phase I requirements through Congressional actions). The City shop site falls under this category.

Table 4-4 summarizes the principal requirements of the NPDES Phase II stormwater program. Municipalities (MS4s) must specify BMPs for these six minimum control measures and implement them to the "maximum extent practicable." The municipalities must also identify measurable goals for control measures, show an implementation schedule, and define the entity responsible for implementation. The NPDES Phase II permit application also requires submittal of a stormwater system map that identifies stormwater system facilities and outfalls to streams.

As shown in Table 4-1, the NPDES Phase II program is actually a subset of the requirements of the Puget Sound Plan. Therefore, it is unlikely to present an additional burden to the City's stormwater program since all elements should be implemented by the time the NPDES permit application is due in March 2003. Future requirements of the permit program are unknown.

Table 4-4 Minimum Control Measures Required under NPDES Phase II

Control Measures	Requirements
Public Education and Outreach on Storm Water Impacts	• Distribute educational materials to community • Inform public about the impacts of stormwater discharges to water bodies and steps needed to decrease pollution
Public Involvement/Participation	• Involve public in stormwater program development • Examples include public hearings, citizen advisory boards, and citizen volunteers
Illicit Discharge Detection and Elimination	• Maintain adequate information on stormwater systems, such as stormwater inventory maps • Prohibit illicit discharges, enforce restrictions, and inform citizens of hazards associated with illegal discharges and disposal of waste • Develop and implement plan to detect and address illicit discharges
Construction Site Storm Water Runoff Control	• Develop, implement and enforce a program to reduce runoff from construction sites of more than one acre • Adequate ordinance to provide authority, including site inspections and enforcement • Include procedures for pubic input
Post Construction Storm Water Management in New Development and Redevelopment	• Develop, implement and enforce a program to address stormwater runoff from new and redevelopment projects so that water quality impacts are minimized • Adequate long-term maintenance of BMPs
Pollution Prevention/Good Housekeeping for Municipal Operations	• Develop and implement operation and maintenance programs and employee training with the goal of reducing pollutant runoff from municipal operations

4.2.1.4 Issaquah Creek Fecal Coliform TMDL

Section 303(d) of the Clean Water Act mandates that the State of Washington establish Total Maximum Daily Loads (TMDLs) for surface water that do not meet state standards after application of technology-based pollution controls. Based on measurements made between 1985 and 1999, fecal coliform criteria were found to exceed State criteria at Issaquah Creek, North Fork Issaquah Creek, and Tibbetts Creek, and thus were included on the Washington 1998 Section 303(d) list. The 303(d) list also identifies that a TMDL is required to address temperature exceedences on Issaquah Creek at the inflow to the hatchery (based on WDFW data). A TMDL document for temperature may be forthcoming.

A draft proposed Issaquah Creek Basin Fecal Coliform TMDL was issued in December, 1999 (Washington Department of Ecology, 1999). An updated draft TMDL will be issued by 2004. A TMDL, or water cleanup plan, entails an analysis of how much pollution a waterbody can take and still remain healthy for its intended uses. The cleanup plan also includes recommendations for controlling the pollution and a monitoring plan to test the plan's effectiveness. The TMDL proposes the many implementation strategies to reduce fecal coliform loadings. Because sources of fecal coliform are normally non-point, the strategies rely on a number of various programs

that address the various land uses that could contribute to fecal coliform pollution, availability of effective management tools and best management practices, and responsible jurisdictions.

The strategy for implementation of the Issaquah Creek Fecal Coliform TMDL will be guided under Washington's *Water Quality Management Plan to Control Non-Point Source Pollution*. The plan was developed to include all non-point pollution control efforts by federal, state, tribal, and local governments as well as volunteer programs carried out by the general public. The plan requires a collaborative effort of a wide variety of entities. A detailed implementation plan will be developed using the following goals:

- Reduce water pollution from urban sources
- Reduce water pollution from agricultural sources
- Reduce water pollution from forestry sources
- Reduce water pollution from industrial sources
- Reduce water pollution from road runoff and the potential for pollutant spills from roads
- Reduce water quality degradation associated with future basin development

The programs and BMPs needed to reduce fecal coliform loadings follow the recommendation of the Issaquah Creek Basin and Non-point Action Plan. Implementation of the recommendations is ongoing through existing programs. In addition, much of the future programs being developed in response to the ESA 4(d) rule and the NPDES Phase II stormwater permitting are identical or very similar to the actions recommended in the TDML document.

It is unknown at this time if the final Issaquah Creek Basin Fecal Coliform TMDL will contain specific program requirements that the City must adopt. A more likely scenario is that it will rely on voluntary efforts or other stormwater programs such as NPDES Phase II.

4.2.2 City Ordinances

Several City of Issaquah ordinances regulate activities relating to floodplain development, stormwater runoff control, and water quality. These ordinances, described below, include the following:

- Areas of Special Flood Hazard (IMC Chapter 16.36)
- Stormwater Management (IMC 13.28)
- Clearing and Grading Ordinance (IMC Chapter16.26)
- Stormwater Management Utility (IMC Chapter 13.30)
- Critical Areas Ordinance (IMC Chapter 18.10.340)
- Shoreline Management Program (IMC Chapter 18.10.940)

In addition, the Land Use Code (IMC Chapter 18) contains requirements pertaining to stormwater and flooding if critical areas are involved.

4.2.2.1 Areas of Special Flood Hazards (IMC Chapter 16.36)

The City of Issaquah flood hazard ordinance (Areas of Special Flood Hazard, IMC Chapter 16.36) identifies the restrictions on development within floodplains. This ordinance identifies what type of development is allowed in the floodplain and floodway, the standards that structures

in the floodplain must be designed to, and how development impacts are mitigated. Many elements of this ordinance are required as part of the City's participation in the National Flood Insurance Program, as stated in 44 CFR Part 60.3. In addition, Washington State law RCW 86.16.041 requires certain higher standards (i.e., prohibition of construction or substantial reconstruction of residential structures in the FEMA floodway). FEMA and the State encourage local communities to adopt additional higher regulatory standards for floodplains. For example, several cities in Oregon do not allow <u>any</u> new structures in floodplains.

In general, construction of residential and other structures are allowed in 100-year floodplains if first floor elevations and utilities (ductwork, wires, etc.) are elevated above the 100-year flood elevation by a minimum of 1.0 foot, and the structure and fill does not cause flood elevations to increase on neighboring properties. Restrictions on fill within the 100-year floodplain are stated as follows: "No displacement of floodwaters by structures or foundation systems for structures shall be permitted except where it can be shown that provision has been made on the subject property to balance the capacity to store floodwaters and accommodate potential surface flow in an amount equal to the amount of floodwater likely to be displaced." In other words, this code requires:

- Compensatory storage must be provided for any fill that displaces floodwaters (i.e., below the 100-year flood elevation), and
- Compensatory conveyance capacity must also be provided so that flow of floodwaters across the property is not impeded.

The last requirement is similar to the zero-rise ordinance that is adopted by King County and many other local jurisdictions, in that it does not allow development activities to cause any increase in the 100-year flood elevations.

The flood hazard ordinance also contains restrictions on development in the floodway, which is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachments so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit the maximum increase in floodplain elevations due to fill to 1.0 foot, which is used to define the FEMA regulatory floodway boundary (based on hydraulic modeling). Within the floodway itself no structures are allowed, except for bridges, streets, utilities and other necessary facilities provided that they do not cause flood heights to increase.

In 2001 or 2002 an update to the flood hazard ordinance is recommended. Authorities and procedures need to be updated. In addition, a depth-velocity floodway standard will be investigated to determine if this method would be appropriate for regulating high hazard areas that are currently located outside of the floodway (the floodway only reserves a portion of the floodplain for conveyance preservation, it doesn't necessarily identify hazardous areas with deep or fast flowing waters. The City recognizes that certain areas in the City are hazardous flooding areas that are not regulated under existing code, and therefore can be developed for residential use. Currently, Pierce County has a floodway standard based on a depth and velocity limits, and the Department of Ecology is looking into this standard as well for inclusion in the Washington Model Flood Damage Prevention Ordinance.

4.2.2.2 Stormwater Management Policy (IMC Chapter 13.28)

In late 2000 a revised stormwater management ordinance was approved to replace the old Stormwater Runoff Policy, IMC Chapter 13.28. The new code is referred to as Stormwater Management Policy. A copy of the approved ordinance is contained in Appendix B. See Section 6.2 for additional information on the ordinance update. With these revisions, the City's stormwater code meets the minimum requirements of Ecology's model ordinance.

The stormwater ordinance specifies the standards for stormwater runoff control, water quality treatment, erosion and sediment control at new developments, pollution source controls, illegal discharge to surface and groundwaters, low impact development, and maintenance. The City adopts the minimum technical requirements and standards contained in the most recent version of the King County Surface Water Design Manual. In general, stormwater controls must be installed if a project adds or replaces 5,000 square feet or more of new impervious surfaces or proposes a certain amount of redevelopment.

4.2.2.3 Clearing and Grading Code (IMC Chapter 16.26)

The clearing and grading code (IMC Chapter 16.26) requires an erosion and sediment control plan be prepared for a clearing and grading permit. The City will be preparing draft revisions to the clearing and grading ordinance in 2002 to make it consistent with the Puget Sound Water Quality Management Plan. These revisions include requiring erosion and sedimentation controls for all projects exceeding 1.0 acre in size, regardless of whether a permit is required. Also, the revised code will reference erosion and sediment control BMPs contained in Appendix C of the King County Surface Water Design Manual.

4.2.2.4 Stormwater Management Utility (IMC Chapter 13.30)

The stormwater management utility code authorized the creation of the stormwater utility in 1988. The utility provides the City with revenues, paid for by property owners in the form of a service charge, needed to implement the City's stormwater program, which includes maintenance of public facilities, construction of capital projects, and implementation of various programs (described below). For commercial properties, the service charge is based on the relative contribution of increased surface and stormwater runoff from a given parcel, as determined on the percentage of impervious surface on the parcel and the total parcel acreage, to the surface and stormwater management system. Residential property assessments are based on a fixed charge. The current stormwater utility rates are summarized in Table 4-5 (the 2001 rates were unchanged).

The amount of service charges collected by the stormwater utility in 2002 was $1,932,000. Of this amount, approximately 38% was from residential properties and 62% was from commercial properties.

A stormwater rate study was conducted in 2001 to determine the rate structure for upcoming years. It recommends that the rate structure be changed to an equivalent service unit (ESU)-based structure when the City's EDEN utility management software is upgraded in late 2003.

Table 4-5 Current (2002) Stormwater Utility Rates

Customer Classification	Impervious Surface Percent	Rate
Residential	N/A	$141.24 per parcel/year
Very Light	0-10	$141.24 per parcel/year
Light	>10-20	$329.62 per acre/year
Moderate	>20-45	$682.79 per acre/year
Moderately Heavy	>45-65	$1,318.42 per acre/year
Heavy	>65-85	$1,671.56 per acre/year
Very Heavy	>85	$2,189.53 per acre/year
City Roads	N/A	Set in accordance with WAC 90.03.525
State Highways	N/A	

4.2.2.5 Critical Areas Ordinance (IMC Chapter 18.10.340)

Critical Areas Regulations include development standards to protect environmentally critical areas, including; wetlands, streams, steep slopes, flood hazard areas, mine hazard areas, landslide areas, and seismic hazard areas. The regulations require protective buffers to minimize impacts and disturbance of streams, wetlands and steep slopes. The buffer widths for wetlands and streams vary and are based on the class of a wetland or stream. For major streams the stream buffer is 100-feet wide on both sides of the stream. All development activities and uses that affect identified environmentally critical areas are evaluated according to the critical area regulations. The regulations also set standards for mitigation of development impacts.

4.2.2.6 Shoreline Management Program (IMC Chapter 18.10.940)

The Shoreline Master Program sets management policies and development standards for land use activities and development located within 200 feet of Issaquah Creek, East Fork Issaquah Creek and Lake Sammamish. The Shoreline Master Program supplements the Zoning Code and Critical Area Regulations with additional policies, shoreline environment designations, development standards, and permit requirements that are specific to protecting water resources in shoreline areas.

4.2.3 National Flood Insurance Program

In 1968, Congress created the National Flood Insurance Program (NFIP) in response to the rising cost of taxpayer funded disaster relief for flood victims and the increasing amount of damage caused by floods. The NFIP makes federally backed flood insurance available in communities that agree to adopt and enforce floodplain management ordinances to reduce future flood damage. The City of Issaquah entered the NFIP on May 1, 1980. The community number for Issaquah is 530079.

The NFIP provides flood insurance coverage for private properties located in flood hazard areas. As a prerequisite to providing insurance, the NFIP requires communities to implement floodplain management activities to minimize flood hazards and, therefore, reduce claims arising from flood damages. Floodplain management is the operation of an overall program of corrective and preventative measures for reducing flood damage, including but not limited to, emergency

preparedness plans, flood control works, and floodplain management regulations. Examples include mapping communities to identify flood prone areas, prohibiting buildings and fill within the floodway, elevating buildings above the 100-year flood elevation and requiring minimum construction standards, and relocating structures out of the floodplain.

4.2.3.1 Community Rating System

The National Flood Insurance Program's (NFIP) Community Rating System (CRS) was implemented in 1990 as a program for recognizing and encouraging community floodplain management activities that exceed the minimum NFIP standards. The National Flood Insurance Reform Act of 1994 codified the Community Rating System in the NFIP. Under the CRS, flood insurance premium rates are adjusted to reflect the reduced flood risk resulting from community activities that meet the three goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote the awareness of flood insurance. Specific activities are discussed in Section 6.5.

There are ten CRS classes: class 1 requires the most credit points and gives the largest premium reduction; class 10 receives no premium reduction. The CRS recognizes 18 types of flood management activities that can be credited under the CRS, organized under four categories numbered 300 through 600: Public Information, Mapping and Regulations, Flood Damage Reduction, and Flood Preparedness. The CRS does not provide credit for structural flood control projects.

Up to 2002 the City of Issaquah had a CRS classification of 7, which provided flood insurance policy holders in the City with a 15% reduction in insurance premiums. Following the 5-year CRS recertification in Fall, 2001, FEMA improved the City's CRS classification to Class 5, which will provides a 25% reduction of premiums. This classification was effective in Fall, 2002.

4.2.3.2 Flood Insurance Rate Maps

Since the passage of the National Flood Insurance Act of 1968, the Federal Emergency Management Agency (FEMA) has identified many floodplain areas nationwide on Flood Insurance Rate Maps (FIRMs). The FIRMs identify "special flood hazard areas," which include areas inundated by the 100-year flood. For floodplain management applications, the FIRMs show the 100-year and 500-year floodplains, the floodways, and the locations of selected cross-sections used in the hydraulic analyses and floodway computations. The 500-year floodplain boundary identifies areas of moderate flood hazards, and is used to identify additional areas of flood risk in the community, but this area is not subject to any regulations.

The FIRM is also used to identify flood insurance rate zones. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

The City of Issaquah's FIRMs were prepared in the 1970's as part of the original Flood Insurance Study (FEMA 1979). During recent floods it was recognized that 100-year flood

elevations shown on the FIRMs are not accurate in certain areas, in that the predicted 100-year flood elevations were being reached during much lower magnitude floods. This inaccuracy is likely due to lack of detail, possible calibration problems with the original hydraulic modeling studies prepared in the 1970s, and physical changes to the channel and floodplain during the last few decades. The increased flood elevations are not directly due to greater flood peaks (see Section 2.5.1 and Appendix A). The City received preliminary updated maps in September, 2001 (Montgomery Water Group, 2001) and FEMA approval of final regulatory maps is expected by the end of 2003. See Section 6.5.4 for additional information on the FEMA map update project.

4.3 Issaquah Creek Flood Control Program

Following the serious flood of February 1996, the City embanked on a multi-year program to implement flood control projects in the City to reduce flood impacts from major floods. At that time the City still had recent memories of the heavy damages caused by the January 1990 flood. Very shortly after the 1996 flood the Mayor and City Council requested a proposal from the Public Works Department for reducing future flood damage. The following reports and other documents were prepared in 1996 and 1997 in response to this program:

- Proposed Basin Flood Control Program, March 1996 (RH2 1996)
- Preliminary Hydraulic Modeling Analysis of Issaquah Creek for Proposed Basin Flood Control Program (Montgomery Water Group 1996)
- Hazard Mitigation Grant Program Grant Applications for channel improvements (City of Issaquah 1996a,b,c,d,e,f):
  - Project Priority Number 1: Gilman Area
  - Project Priority Number 2: Cherry Area
  - Project Priority Number 3: Sycamore Area
  - Project Priority Number 4: Pickering Farm Area
  - Project Priority Number 5: School District Administration Area
  - Project Priority Number 6: State Route 900 Area
- Issaquah Creek Channel Improvements, Gilman Area Hydraulic Model and Analysis (Shannon & Wilson 1996).

The proposals that were developed under this program were consistent with the recommendations of Issaquah Creek Basin Plan, which (in Basin Wide recommendation BW-7 for Issaquah Creek and T-3 for Tibbetts Creek) called for establishment of a channel and floodplain restoration program to restore streams and channels in areas where homes and businesses have been constructed within the corridors of Issaquah Creek and its major tributaries. Specifically, recommendation BW-7 identified the following tools to restore the flood carrying capacity of the stream and enhance the fish and wildlife habitat of the corridor:

- Removal of homes from within the floodplain
- Purchase of easements to prevent further floodplain development
- Purchase of property or development rights
- Removal of fill and bank stabilization projects
- Revegetation of the floodplain
- Improvements to public access

Presently, this program has resulted in the construction of the Gilman Area and Pickering Area Channel Improvements, the several bridges replacements, and acquisition of flood-prone properties along Issaquah Creek (see below). Implementation of additional projects along Issaquah Creek as well as the Tibbetts Creek Greenway Project is continuing. Current planning recommendations for these projects are described later in this section.

4.3.1 Gilman Area Channel Improvements

The Gilman Area Channel Improvement project was constructed during the summer and fall of 1998. Planning for the project began shortly after severe flooding during the February 1996 event, which caused over $3 million in flood damages in Issaquah. The flood was declared a federal disaster, which allowed the City to obtain a Federal Emergency Management Agency (FEMA) hazard mitigation grant to fund most of the project. Although permits were issued in 1997 for the project, difficulties in obtaining construction easements delayed construction until 1998. Funding of Gilman channel project was assisted by $895,000 in FEMA hazard mitigation grants (in response to the 1996 federally declared disaster).

Specific objectives of the Gilman Area project included:

- Reduce flooding in the Issaquah Creek valley by providing increased capacity within the channel to convey flows (equivalent to the 1996 flood).
- Improve the fish and wildlife habitat of the stream and riparian corridor by adding large woody debris (LWD) in the creek, planting shrubs and trees along the channel, and creating backwater pooled areas.
- Protect the water quality of the stream by providing streambank stabilization to prevent erosion and planting trees to shade the creek.

Project features included clearing and grubbing, excavation, riprap and bioengineered bank protection, instream habitat, and landscaping along approximately 2,100 lineal feet of Issaquah Creek from NW Juniper Street downstream to Interstate 90. The bank was excavated back to a slope of 2:1 and a nearly flat stream bench was created between the bank and the edge of stream. Restoration included planting a total of 359 trees and shrubs, 4700 live cuttings and stakes, and 1,500 live posts. To enhance fish habitat, 82 logs (large woody debris) were installed in the stream.

Post-construction monitoring, a requirement of permits, will continue for 10 years following construction. Monitoring reports have been prepared for the first three years (Watershed Company, 2002). Two of the overall project goals (improvement of fish and wildlife habitat, and protection of water quality by providing trees to shade the creek) are not being realized, while the vegetation performance standards are also in jeopardy of failure. Plant survival has been affected by a number of different factors, including loss of many initial plantings as a result of the 1998 storm, lack of watering, and later clearing of vegetation by property owners in some areas. Areas of exposed riprap need to be restored to provide consistent vegetative cover and wildlife habitat. On-going removal of invasive weeds, particularly Himalayan blackberry and Japanese knotweed, needs to continue throughout the project area. Outside of the vegetation and

fish habitat components, stream banks have remained stable and the channel is functioning as designed. A comprehensive revegetation plan was developed to increase the relative component of the originally planted species, to address native plant coverage goals, and functions and values of the riparian plant community. These improvements are scheduled for 2003, contingent on funding approval.

4.3.2 Pickering Area Channel Improvements

The Pickering Reach of Issaquah Creek extends from I-90 to S.E. 56th Street, and was the second phase of channel improvements for Issaquah Creek (after the Gilman Reach). The project included a new 1000-foot long channel to relieve floodwaters in the main channel when flows exceed 300 cubic feet per second (cfs), up to a capacity of at least 3,500 cfs. The work was completed from S.E. 56th Street to south of the Pickering Barn in autumn 1998. Funding of the Pickering Area Channel Improvement Project was through the City's stormwater capital fund.

Severe flooding occurred less than two weeks after the last plants were installed (on Thanksgiving Day, 1998), washing away the emergent plants (sedges, rushes, and spikerushes) and some woody vegetation, as well as changing the channel configuration and position of many habitat features. The side channel that was designed to receive water only during floods became a permanent channel, sharing flow with the original channel. Emergency work, including the installation of additional bank protection (logs and rocks) and hundreds of willow stakes was performed in January 1999 to prevent further erosion and sedimentation. As a result, post-flood conditions differed markedly from designed and as-built conditions.

Post-construction monitoring, a requirement of permits, will continue for 10 years following construction. Monitoring reports have been prepared for the first three years (Taylor Associates 2001; Watershed Company, 2002). These reports concluded that vegetation has vigorous growth of both installed and volunteer species. The plant communities have met the native plant cover performance standard, but have exceeded the acceptable level of non-native plant cover (as is common in all restoration projects). Ongoing removal of Himalayan blackberry, Japanese knotweed, butterfly bush, and reed canarygrass is recommended, along with thinning of alder saplings and replanting of shrub species for specific reaches. In general, stream banks have remained stable and the channel is functioning as designed. Although the channel has undergone some redirection, the overall function of improved flood storage and conveyance, limited erosion, and improved fish and wildlife habitat was achieved.

4.3.3 Bridge Replacements

Starting in 1995, the City of Issaquah embarked on an aggressive program to replace substandard bridges. Bridges replaced in recent years include the following:

- Issaquah Creek: NW Sammamish Road (SE 56th Street), 1995
- Issaquah Creek: Sunset Way, 1997
- Issaquah Creek: Newport Way (Clark Street), 1999
- East Fork Issaquah Creek: NE Dogwood Street, 1997
- Tibbetts Creek: NW Sammamish Road (2001)
- Tibbetts Creek: Newport Way (2001)

While part of this effort was prompted by bridge safety or traffic improvement concerns, most of the older bridges in the City were significant flood conveyance constrictions. With replacement, flooding conditions in areas upstream of the bridges were significantly improved.

Future bridge replacements will include Rainier Boulevard, NW Dogwood Street, and NW Juniper Street (see Section 7).

4.3.4 Property Acquisition

As part of the flood mitigation program, the City budgets money in the Stormwater CIP to acquire developed residential property, including repetitive loss properties. The acquisition program also supports the habitat restoration program for Issaquah Creek. Properties acquired through this program are retained as permanent open space. The City informs residents of this program as part of the fall Flood Preparedness Workshop outreach project. The City also actively pursues acquisition of undeveloped parcels along Issaquah Creek, particularly the larger ones that face significant development pressures, for open space preservation. Given their high cost, the larger parcels would need to be funded through bond issues or grants.

Past acquisitions include two houses at SW Clark Street (Dodge and Ryan) that were acquired in 1994. The Hansen house on NW Birch Place, located along 600 feet of creek-front on Issaquah Creek that flooded twice in 1990 and again in 1996, was acquired in 1997 and removed in March 1998. The Reudink house on NW Dogwood Street, acquired in 1998, also flooded twice in 1990 and again in 1996, and the Darst house on NW Cherry Place was acquired in 2000. Those houses were removed in 2001. Nine undeveloped parcels in the Sycamore neighborhood were also acquired in 1997, and this area is now called the South Issaquah Creek Greenway.

4.4 Tibbetts Creek Greenway Project

Land use activities within the Tibbetts Creek watershed has resulted in increased flooding, a high level of sediment loading and subsequent deposition, degradation of fish habitat within the stream channel, and degradation of wetland and other wildlife habitat within the Tibbetts Creek riparian corridor. These impacts have adversely affected the usefulness to humans and wildlife of land adjacent to the creek; has limited or threatened to limit commercial, residential and public property uses; and has contributed to a reduction in aesthetic appeal and recreational and educational opportunities along the Tibbetts Creek corridor.

King County, the City of Issaquah, Washington State Department of Transportation, and key property owners have been working cooperatively for several years to implement solutions to these problems, resulting in the Tibbetts Creek Greenway Project. Support of the project by the City of Issaquah was given by City Council Resolution Number 98-9, passed on July 6, 1998.

The primary goals of the Greenway Project are to provide measures that would help reduce flooding and improve the stream environment. Specific objectives include:

- Decrease the frequency and severity of flooding in developed areas along the creek.

- Improve the water quality of the stream and restore the productivity of the stream and corridor.
- Restore the quality of fish and wildlife habitat within and adjacent to the stream, including improving fish passage conditions at roadway crossings.
- Provide a trail system and recreational and interpretive facilities to improve public access and recreational use of the lower Tibbetts Creek area.

The proposed project has been divided into the following reaches:

Reach 1: restoration of 0.4 miles of the stream within Lake Sammamish State Park.

Reach 2: I-90: replacement of undersized culverts with bridges, to be implemented by WSDOT.

Reach 3: restoration of 0.7 miles of stream between I-90 and Maple Street, to be implemented by Rowley Enterprises.

Reach 4: restoration of 0.2 miles of stream in the vicinity of Tibbetts Valley Park and replacement of the Newport Way culvert, to be implemented by City of Issaquah and Intercorp (developer of TALUS).

Reach 5: restoration of sediment sources in the upper basin, to be implemented by the City of Issaquah with possible support of the Corps of Engineers.

Reaches 1, 2, 3, 4, and 5 have also been referred to as Reaches A, B, C, D, and E (respectively) in various reports.

A Final Environmental Impact Statement for the Greenway Project was prepared by the City of Issaquah for this project and issued on August 1, 1995. Funding for implementing the City's portion of this project is provided by the City's stormwater capital fund and a grant from the Department of Ecology's Centennial Clean Water Fund.

Construction of the first portion of the project, Reach 3, was completed in 2001. Also in 2001 the City of Issaquah replaced the NW Sammamish Road culverts (part of Reach 1) and Intracorp replaced the Newport Bridge culverts (Reach 4). In 2002 the Bianco Mine Tailings were stabilized (in Reach 5). In 2003 the City constructed the Reach 4 improvements (Tibbetts Valley Park). In 2004 WSDOT will construct the Reach 1 improvements (as part of the SR-900 road widening mitigation) and replace the I-90 culverts with a bridge (Reach 2). See Section 7 for additional information on the capital improvement program schedule and funding.

4.5 Groundwater

Groundwater management has been the subject of separate investigations and plans and is therefore not specifically addressed in detail in this Plan. However, groundwater resources in the Issaquah Valley are fundamentally linked to surface waters because precipitation is the source of aquifer recharge, impervious surfaces and stormwater facilities typically intercept that precipitation causing reduced recharge, base flows in streams are often linked to groundwater

levels that are affected by well pumping, and stormwater is a potential source of contamination to the aquifer. Thus, stormwater has both water quantity and quality issues with respect to groundwater. A brief discussion of groundwater resources and associated management efforts is provided below.

The Lower Issaquah Valley (LIV) aquifer underlies the lower Issaquah Valley and supplies groundwater to the City of Issaquah, the Sammamish Plateau Water and Sewer District (SPWSD), several smaller water systems and industrial users, and numerous wells serving individual residences and farms. Of these, the District is the largest groundwater user; the recent annual consumption from the District's lower valley wells – Well Nos. 7 & 8 – is about 675 million gallons, compared to the City's withdrawal of about 560 million gallons from its four wells (CH2M-Hill 2001; Roth Hill 2002).

The LIV aquifer is estimated to be approximately 300 feet thick, and, on a regional scale, behaves as a single unconfined aquifer (Golder 1993). Water supply by the major users is tapped by major production wells ranging from 100 to 250 feet in depth, and smaller wells at shallower depth. Groundwater modeling conducted for the 1993 Wellhead Protection Plan conducted a water balance to estimate the source of recharge to the lower Issaquah Valley Aquifer. Several conclusions were made from that analysis:

- Hydrologic analysis of precipitation runoff and streamflow in the subbasins in the LIV indicates total groundwater recharge to the LIV of 22 cfs. Total pumping from the aquifer in early 1990's was approximately 5 cfs.
- Average annual groundwater discharge to Lake Sammamish and adjacent wetland area is approximately 15 cfs.
- Groundwater recharge occurs primarily on the Eastern Plateau areas (Grand Ridge and Lake Tradition) and along both margins of the Issaquah Valley between the East Fork and Issaquah Gap. The contribution to the aquifer system from precipitation occurring within the valley floor is much less than that entering along the margins of the Valley, due to less permeable soils on the valley floor.
- Based on stream gauging, piezometer readings, and well tests, there appears to be limited stream/aquifer interaction in the central LIV area.

The LIV aquifer is not designated as a sole source aquifer under U.S. Environmental Protection Agency regulations. EPA defines a sole or principal aquifer as one that supplies at least 50% of the drinking water consumed in the area overlying the aquifer. These areas can have no alternative source that could physically, legally, and economically supply all those who depend on the aquifer for drinking water. A sole source aquifer designation provides limited federal protection of ground water resources, by allowing EPA to review and condition federally funded projects that have the potential to contaminate the aquifer, such as highway projects. With the regional water supply pipeline now constructed, making Seattle water available to Issaquah, a sole source designation for the LIV aquifer may not be obtainable.

The City in 2003 will be developing a Water Supply Operation Plan for the City's Water Utility. The purpose of the overall study is to develop a water supply strategy for the Water Utility that

optimizes the benefits of available groundwater aquifer and regional supplies while minimizing environmental and water rate impacts.

4.5.1 Wellhead Protection Plan

The Lower Issaquah Valley Wellhead Protection Plan, prepared through a joint effort of the City of Issaquah and the SPWSD, is a technical assessment of groundwater resources in the Issaquah Valley area with an emphasis on groundwater quality protection (Golder 1993). The intent of the State's Wellhead Protection Program is to protect potable groundwater supplies through resource management strategies aimed at pollution prevention. The plan provides several recommended strategies that would be implemented through the local jurisdictions.

Specific concerns regarding groundwater quality include the following:

- **Transportation**. The wells serving the City and the SPWSD are directly adjacent to I-90. A traffic-related spill of hazardous substances could jeopardize city wells, which are located adjacent to I-90, as well as area streams and Lake Sammamish.
- **Underground storage tanks**. Many underground storage tanks are located in Issaquah. Past leaks have highlighted the issue of potential groundwater contamination from these sources.
- **Stormwater runoff**. Increased urbanization has resulted in increased stormwater runoff in the LIV. Stormwater is a potential chronic source of groundwater contamination, particularly nitrates, metals, and petroleum products.
- **Zoning/Density**. Increased growth in the area could affect groundwater quality.

The Plan developed a wellhead protection area, which is broadly defined as that area in the vicinity of a well or wellfield in which certain restrictions and/or plans have been enacted to protect the well or wellfield from groundwater protection. Wellhead protection zones were mapped are based on the calculated 1-, 5- and 10-year well capture limits.

Specific wellhead protection strategies, and response actions implemented by the City, include:

- **Land use restrictions or prohibitions**. The City has implemented protective measures within the wellhead protection area as part of zoning restrictions in the Land Use Code, which preclude or condition otherwise permitting commercial and industrial land uses (e.g., new dry cleaners are prohibited.)
- **Emergency spill response**. Capabilities for emergency spill response is recommended. Spill response training of Fire Department personnel, purchase of basic spill response materials, and contracting with a clean-up contractor are immediate needs. More detailed aspects of spill response planning, such as hazard analyses and agency coordination, can be addressed in a more detailed spill response plan.
- **Contingencies for groundwater supply**. Development of alternative water supply sources, and verification of existing sources, should continue. The 2003 Water Supply Operation Plan and the City's participation in the Cascade Water Alliance to secure a long-term regional water supply addressed those concerns.

- **Public involvement**. Consistent and persistent messages should be conveyed regarding the value of the groundwater resource and the rationale behind management strategies.
- **Monitoring.** Physical and water quality monitoring of the LIV aquifer and area streams should be conducted to help aid in evaluating the interaction between stream and the aquifer, as well as obtaining aquifer water level and water quality data.

4.5.2 Issaquah Creek Valley Groundwater Management Plan

The purpose of the Issaquah Creek Valley Groundwater Management Plan is to protect groundwater quality and assure ground water quantity for current and future uses (Issaquah Creek Groundwater Advisory Committee 1999). This plan was developed during the period 1989-1995. To achieve this the plan recommends a broad range of groundwater management strategies that can be taken into consideration when making land use decisions; designing surface water facilities; regulating hazardous materials, onsite sewage disposal, and well construction; and retrofitting existing infrastructure. Eighteen specific goals intended to provide direction for programs that protect groundwater quality and quantity are presented.

The Issaquah Creek Groundwater Advisory Committee adopted 66 management strategies in the Plan. High priority strategies that address the water quality vulnerability of the aquifer system include:

- Incorporate assessments of water quality impacts from specific land uses in land development reviews
- Assess impacts of chemical use in street maintenance
- Develop ways to assist water purveyors in their wellhead protection efforts
- Assist King Conservation District in helping small farmers prepare farm plans for groundwater protection
- Develop a sole source aquifer petition for the Lower Issaquah Valley aquifer
- Assess impact of stormwater facilities on ground water quality

Strategies that primarily address water quantity and (when the study was conducted) the sole source nature of the aquifer include:

- Incorporate assessment of reduced groundwater recharge impacts in land development reviews.
- Adopt general aquifer protection policies to provide a basis for implementing specific recommendations
- Provide information to decision makers relating to land and water use
- Provide education for citizens and local governments
- Map physically susceptible and recharge areas to provide visual tools for decision makers and the public when discussing groundwater concerns.

The Plan recommended formation of an Aquifer Protection Area, through public ballot, which would assess fees on property owners and/or utility customers to pay for implementing the recommendations. That recommendation was not implemented.

In 2003 the Issaquah Creek Valley Groundwater Protection Committee (ICVGPC) was established by King County Ordinance No. 14214 to assist implementation of the Plan (the Issaquah Creek Groundwater Advisory Committee disbanded after the Plan was adopted). King County Department of Natural Resources and Parks provides staff support to the ICVGPC. In general, the ordinance calls upon the ICVGPC to advise State and local agencies and elected officials on all aspects of groundwater protection planning and implementation; assist King County in development and implementation of programs and policies concerning groundwater protection; assist and interact with other King County groundwater protection committees to

facilitate coordinated groundwater protection rules, policies and procedures throughout King County; and review and comment on proposed groundwater protection-management ordinances, rules, policies and/or procedures affecting Issaquah Creek Valley prior to their adoption.

4.6 Other Studies

The following studies have been conducted to identify and assess flooding and water quality problems in the City of Issaquah and in the downstream receiving water of Lake Sammamish, and to evaluate alternatives and propose potential solutions to these problems.

4.6.1 FEMA Flood Insurance Studies

The Federal Emergency Management Agency (FEMA), through the National Flood Insurance Program (NFIP), conducts floodplain hydraulic studies for floodplain management and flood insurance purposes. The NFIP encourages state and local governments to adopt sound floodplain management programs. Therefore, flood insurance studies (FIS) provide 100-year floodplain and floodway maps to assist communities in developing floodplain management measures and to provide information to set premiums for flood insurance policies.

The following flood studies have been prepared:

- Special Flood Hazard Information, Issaquah and Tibbetts Creeks (U.S. Army Corps of Engineers 1971).
- Flood Insurance Study, City of Issaquah (FEMA 1979).
- Flood Insurance Study, King County and Incorporated Areas (FEMA 1995).

The 1971 study was conducted prior to the FIS and provided flood management information only. This study, sponsored by the Department of Ecology, was conducted before much of the development occurred in the Issaquah area and contains interesting aerial photos showing the 100-year floodplain delineation. At that time the 100-year flood magnitude at SE 56th Street was determined to be 4,750 cfs, compared to the current estimate of 4,670 cfs (see Section 2).

The 1979 FIS documents the hydraulic modeling studies that form the basis for the current flood insurance rate maps. That study updated the 1971 Corps of Engineers study, although the extent to which this study relied on information from the 1971 study is unknown. A comparison of the 1979 flood profiles with the 1971 flood profiles shows significant drops in flood elevations, even though the 100-year flood discharge remained unchanged. For example, in the 1979 FIS flood elevations dropped by 2.5 feet at Juniper Street, 1 foot at Dogwood Street, and 4 feet at Clark Street (now Newport Way). After the November 1986 flood, it was recognized that the FEMA flood insurance maps significantly underestimated the flood heights (floods nearly reached the predicted 100-year flood elevation, even though that flood ranked much lower). It is likely that the 1979 FIS contained inaccurate hydraulic modeling.

The 1995 King County FIS merely incorporated the 1979 FIS without any revision to the previous hydraulic models. Revisions to the flood insurance rate maps are made occasionally to reflect FEMA-approved special studies. For example, the North Fork of Issaquah Creek was completely revised in 1998 following a study performed under the Limited Map Maintenance

Study program, and Letters of Map Revisions were made to modify the floodplain on lower East Fork Issaquah Creek and lower Tibbetts Creek in the vicinity of the auto dealerships. No other significant map revisions have been made in Issaquah since the 1979 FIS was prepared.

The City of Issaquah is in the process of re-mapping the floodplains in Issaquah (See Section 4.1.3.2).

4.6.2 The 1993 Comprehensive Floodplain and Drainage Management Plan

This plan was developed by the City using grant funds provided by Ecology's Flood Control Assistance Account Program (FCAAP) (CH2M Hill 1993). The Drainage Plan was designed to compliment the Issaquah Basin Plan, in that it focused on the storm drainage system within the City limits (issues with main-stem Issaquah Creek, North Fork and East Fork flooding and habitat problems were addressed by the Basin Plan). The Drainage Plan addressed local drainage system problems that were identified by City staff, as well as by the public at a series of four workshops conducted in April 1992. Capital improvements were proposed by the plan, as well as non-structural management measures. The plan addressed requirements of the Puget Sound Water Quality Management Plan (Ecology 1994), which had only been recently issued by Ecology at that time. A limited amount of hydraulic modeling of the City's storm drainage system was also conducted.

The comprehensive list of both major and minor drainage problems and recommendation that was developed by this plan is incorporated into the recommendations summarized in Section 5.2.

4.6.3 1996 Issaquah Creek Basin Plan

The Issaquah Creek Final Basin and Non-point Action Plan was prepared by King County during the early 1990s. It was adopted by the Metropolitan King County Council on July 10, 1995, the Issaquah City Council on October 10, 1995 as part of the Water Resources Action Plan, followed by Department of Ecology approval on October 16, 1996. This study is documented in three reports:

- Issaquah Creek Final Basin and Non-point Action Plan (King County 1996), containing the principal outcome of the planning process including a basin plan that focuses on stormwater management and protection of stream and wetland habitats, and a non-point action plan that is intended to identify actions to prevent and remedy pollution from non-point sources in the basin.
- Current/Future Conditions and Source Identification Report (King County 1991), which documents current water quality, aquatic resources, watershed characterization, and surface-water conditions in the basin and examines potential impacts resulting from future land use changes.
- Appendix to the Watershed Management Committee Proposed Issaquah Creek Basin and Non-point Action Plan (King County 1994), which contained additional technical analyses that were conducted for the 1992 Draft Issaquah Creek Basin and Non-point Action Plan.

King County Surface Water Management Division (KCSWM, now Water and Land Resources Division) was the lead agency for developing the Issaquah Creek Basin Plan. This plan was developed for the purpose of giving guidance for effective protection of the surface water resource and improving the resources where it has been degraded. Additionally, recommendations for reducing impacts to properties and facilities from flooding are included. Two committees were formed to give guidance to the County during development of the Plan. These committees were 1) Watershed Management Committee (WMC) and 2) Basin Advisory Team (BAT). The WMC was composed of managers representing the City of Issaquah, King County, King Conservation District, Washington State Department of Natural Resources, and the Muckelshoot Tribe. The BAT was composed of citizens who live within the Issaquah Creek Basin. Combined, these two committees provided citizen and agency input for use in developing the plan.

The Issaquah Creek Basin Plan resulted in a series of Basin-Wide (BW) and Sub-basin recommendations covering a wide range of programmatic and capital improvement improvements for flood management and reduction, non-point pollution control, habitat preservation, and stream-channel erosion control.

Recommendations developed by the Basin Plan that are applicable to the City of Issaquah are incorporated into the Summary of Alternatives table in Section 4.5.

4.6.4 Flood Protection Alternatives for the Issaquah Creek Basin

This document was included as a technical appendix to the Issaquah Creek Basin Plan (King County 1993). That study presented and evaluated several alternatives for solving flooding problems along Issaquah Creek. Options evaluated by this study are summarized in Table 4-6.

Table 4-6 Summary of Basin Plan Flood Control Alternatives

Alternative	Description	Conclusions (1993 costs)
Bypass Pipeline	Intercept high flows at the fish hatchery intake weir using two 9-foot diameter pipes for diversion to Lake Sammamish.	Very effective, but cost-probative (over $100 million).
Channel Dredging	Excavate channel by 2 feet, removing 125,000 cubic yards of sediment.	Average reduction in water surface is 1 foot (ranged between 0.4 to 2.0 feet). Very difficult project with high environmental damage and high cost ($35-50 million).
Floodproofing and Elevating Structures	Floodproofing and/or elevating of all structures within the 25-year floodplain.	Effective for individual property owners, but flood hazards would still exist. Approx. $3 million cost, or about $15,000 per structure.
Upstream Storage Reservoirs	Construction of one or more upstream reservoirs to store floodwaters during high flows.	Infeasible because no favorable sites exist to accommodate huge amount of storage needed to create any benefit.
Removal of Structures from Floodplain	Acquisition of developed property within floodplain and removal of structures and fill.	Effective on a large scale, but very expensive. On a smaller scale, targeting those properties having recurring flood damages is cost effective.

All of the alternatives evaluated for solving flooding problems have consequences associated with them. Those offering the highest benefits in flood protection – the bypass pipeline and the widespread removal of floodplain structures – are very expensive. The limited removal of floodplain structures is less expensive, but provides no flood protection beyond the immediate stream corridor. Based solely on flood protection, the floodproofing and elevation program has an appealing benefit/cost ratio, but does little to improve the habitat and water quality of the stream.

The task of the Issaquah Creek Basin Plan was to balance flood protection with the protection and enhancement of habitat and water quality. This balance of objectives is best met through removal of structures from the floodplain, an alternative that combines a moderate-to-high level of flood protection with restoration of the Issaquah Creek stream corridor. At the same time, the Basin Plan recognized that the high cost of acquisition and removal of structures dictated that this tool be used sparingly, and only where it is clearly justified (e.g., at properties exhibiting high flood insurance claims). As a result, the Basin Plan recommended a combination of removal of a limited number of structures with elevation and floodproofing of adjacent structures within the 25-year floodplain.

4.6.5 Lake Sammamish Water Quality Management Project

This study is currently being conducted under an Interlocal Agreement between King County and the Cities of Bellevue, Issaquah, and Redmond. Two committees that were formed under the Interlocal Agreement – the Lake Sammamish Management Committee, composed of department directors or designees of the local jurisdictions; and the Lake Sammamish Technical Committee, composed of key staff from the jurisdictions – were responsible for local decisions and technical oversight of water quality projects for Lake Sammamish.

The committees currently operate under the inter-jurisdictional direction of the Lake Sammamish Forum, which was established in 1996 as the result of the Regional Needs Assessment (King County 1995). The Forum is an advisory board to the Councils of various jurisdictions that share the Sammamish watershed and the Metropolitan King County Regional Water Quality Committee. The role of the Forum is to advise the local and regional governments on the appropriate interjurisdictional management of water quality, floods, and fisheries habitat of the surface waters within the Sammamish watershed.

In the late 1980's, METRO commissioned a study of nutrient loading to Lake Sammamish, resulting in the Lake Sammamish Water Quality Management Report (Entranco 1989), also called the Phase 1 Restoration Project. The study concluded that phosphorus loading to the lake was creating problems for its water quality, and proposed water quality goals for the lake that appeared to be consistent with the lake's recreational users and ecological health. The report also proposed a variety of structural and non-structural controls to reduce or minimize future degradation of the lake.

A follow-up study for the Lake Sammamish Water Quality Management Project documented the findings of nine research projects that were undertaken as part of a Phase 2 Lake Restoration project to evaluate different management alternatives for controlling phosphorus inputs to the

lake (King County 1998). The alternatives evaluated included structural methods, such as various chemical or physical phosphorus removal strategies that could be used to treat stormwater runoff in stormwater facilities in the basin; and non-structural including improved erosion control at construction sites, education concerning non-point phosphorus controls for homeowners, real estate agents and builders, and the identification of possible point sources of phosphorus throughout the basin.

4.6.6 Lake Sammamish Water Quality Management Plan

This plan is a product of the Lake Sammamish Initiative, which was started in 1995 to evaluate long-term goals for the lake, to develop a management plan to achieve these goals, and to recommend a financing strategy to pay for the plan. The initiative is an interjurisdictional effort begun by County Executive Gary Locke and supported by the mayors of Bellevue, Issaquah, and Redmond. Recommendations of the Lake Sammamish Initiative are contained in the 1996 *Lake Sammamish Water Quality Management Plan* (Entranco 1996) and *Report and Recommendations, Lake Sammamish Initiative* (Partners for a Clean Lake Sammamish, 1996).

King County was the lead agency for development of the 1996 Plan. Other agencies involved included several planning team members, including Partners for a Clean Lake Sammamish Task Force, Lake Sammamish Management Committee, and the Lake Sammamish Technical Committee. Involved in this process were executives and staff from King County Surface Water Management, City of Issaquah, City of Bellevue, City of Redmond, and King County Water Pollution Control Department. Executive Locke also appointed eight citizens who live in the area to form a citizen task force, Partners for a Clean Lake Sammamish.

The Lake Sammamish Initiative was prompted, in part, by a 1995 nutrient loading modeling analysis that was conducted to quantify loading rates and projected future conditions for the lake (King County 1995). The 1995 study concluded that phosphorus loading from existing development and new development would result in decreased water quality in the lake as the drainage basin developed fully, even with the current regulatory and programmatic control programs in place.

Based on the 1989 and 1995 studies, the Management Committee approved a preferred list of phosphorus control technologies, which were then subjected to a detailed cost and phosphorus load reduction benefit analysis. From this, a majority of the Partner's Task Force members selected Alternative 2a as the recommended alternative for implementation. This alternative recommended a forest management program, higher levels of stewardship and source control programs, higher levels of regulatory compliance and enforcement, higher levels of road and facility maintenance, implementation of the Sensitive Lake Protection Standard (50% phosphorus removal for new development), and a management tracking system to track implementation and effectiveness of these programs.

4.6.7 Miscellaneous Monitoring and Water Quality Reports

Several past and current hydrologic and water quality monitoring programs have been implemented on Issaquah Creek and other local streams, either as individual programs or as part of development activities. These studies include:

- METRO Freshwater Monitoring Program, which has collected water quality data from Issaquah Creek, Tibbetts Creek, and North Fork Issaquah Creek since the 1970's. Sampling results are presented in several reports (Metro 1989, 1990, 1994) and in data files provided by King County staff.
- King County Stream Monitoring Program, which operates numerous stream gauges in the county including Issaquah Creek, North Fork Issaquah Creek and East Fork Issaquah Creek. Data are summarized in a hydrologic monitoring report (King County 1995).
- City of Issaquah Resource Monitoring Program, which includes operation of several stream gauges within the City, water quality sampling, habitat and benthic sampling, and other monitoring [see Section 6.4.1 for more complete description of the monitoring program and City of Issaquah (2000) for the 1999-2000 monitoring summary report].
- Development monitoring programs, including Issaquah Highlands Comprehensive Monitoring Plan (Herrera 1997) and TALUS Monitoring Plan (Montgomery Water Group 2001). These programs collect water quality and streamflow data for tributaries in the vicinity of these development projects.

4.7 Summary of Alternatives

The previous chapters summarized the recent studies that assessed flooding and water quality problems in the City of Issaquah and in the downstream receiving water of Lake Sammamish, and potential solutions to these problems. Based on this information, and also updated information provided by City staff, a comprehensive list of capital improvement project and programmatic alternatives was developed. This information is summarized in Table 4-7. These alternatives are referenced to previous studies and current regulatory programs using the following acronyms:

Reference	Study or Program
BP, EF, NF, LI	1996 Issaquah Creek Basin Plan recommendation (basin wide, East Fork, North Fork, Lower Issaquah Creek)
BP#	1996 Issaquah Creek Basin Plan CIP project
DP	1993 Comprehensive Floodplain and Drainage Management Plan recommendation
LKCIP	1996 Lake Sammamish Water Quality Management Plan CIP recommendation
FCP	1996 Proposed Basin Flood Control Program recommendation
PSWQ	Puget Sound Water Quality Management Plan requirement
NPDES	Proposed NPDES Phase 2 Stormwater Permitting requirement
ESA	Potential stormwater requirement for 4(d) rule or other ESA issue
City	Other City-identified project

Table 4-7 Summary of Capital Improvement And Programmatic Alternatives

No.	References	Name	Description	Priority[a]	Estimated Cost[b]	Comments
STORMWATER CIP						
S-1	DP 2-1	Lower Cabin Creek stabilization	Stabilize existing channel and banks of lower Cabin Creek	Completed	$0 (City cost)	Constructed in 1998 by Rowley Enterprises in conjunction with Kelkari development. 100% private funding.
S-2	DP 2-2	Tributary 196	Pipeline to relieve localized flooding due to insufficient channel capacity downstream of Wildwood	Low	N/A	Infrequent flood problem; no recurring maintenance issues reported.
S-3	DP 2-3	Wildwood at Ridgewood	Insufficient capacity of culvert at intersection; replace with larger pipe running down Sunrise or Wildwood to existing drainage system	Low	N/A	Infrequent flood problem; no recurring maintenance issues reported.
S-4	DP 3-1	Mine Hill Creek – Upper	Increase detention storage in Forest Rim to reduce downstream flooding and channel erosion	Low	$1,200,000	Not recommended due to high cost.
S-5a	DP 3-1	Mine Hill Creek – Middle	Bypass pipeline to relieve flooding due to insufficient channel capacity below Wildwood and Cedarglade	Low	N/A	Not recommended due to high cost.
S-5b	DP 3-1	Mine Hill Creek – Cedarglade	Replacement of culvert under Cedarglade that becomes clogged with sediment, causing property damage to residence	**Moderate**	N/A	Creek that was rerouted around homes on Wildwood and Cedarglade has contributed to problem. An alternative is to return creek to a straighter alignment.
S-5c	DP 3-1	Mine Hill Creek – Middle	Stabilization of stream banks below Wildwood and Cedarglade to control erosion	Low	N/A	Erosion has been stabilized.
S-6	DP 3-1	Mine Hill Creek – Lower	Culvert replacement to fix frequent sedimentation of lower culverts before entering Issaquah Creek	Completed	$0	City CIP project constructed in 1998.
S-7	DP 3-2	Mine Hill Creek at Idylwood	Install subsurface drains to intercept subsurface seepage that affects road and houses	Low	N/A	
S-8	DP 4-1	21 Big Bear Court	Repair separating culvert joint and route drainage away from unstable slopes below	Low	N/A	
S-9	DP 5-1	East Sunset Way	Solve nuisance flooding along East Sunset by improving drainage system along south shoulder	**Other**	Included in Trans. CIP	Likely to be included in future transportation improvement project for East Sunset Way.
S-10	DP 6-1	2nd and Birch Place	Provide a lower elevation invert for conveying local runoff to Issaquah Creek to solve localized flooding	Low	N/A	Currently not identified as a problem.

Table 4-7 Summary of Capital Improvement And Programmatic Alternatives

No.	References	Name	Description	Priority[a]	Estimated Cost[b]	Comments
S-11	DP 7-1	Front and Gilman	Solve water quality contamination problems that caused fish kill in 1990	**Stormwater Program**	Staff support	Maintenance problems to be addressed by Public Works under private storm facility maintenance program that will begin in 2002, or under water quality retrofit program.
S-12	DP 8-1	Newport Way	Localized flooding along roadway	**Other**	Included in Trans. CIP	To be addressed by future transportation improvement project.
S-13	DP 8-2	Holly and 4th	Local grading and conveyance ditch along Holly between 4th and 5th to solve localized flooding.	**Moderate**	$67,000 (1992 est)	Storm drainage along Holly may be included in Newport Way improvements.
S-14	DP 8-3	7th and Gilman	Provide oversized culvert to reduce existing restriction for Issaquah Creek overflow	Completed	--	Installed as part of 7th Avenue improvements. Issaquah Creek - Gilman Area improvements also reduced potential for creek overflows.
S-15	DP 9-1	Woods detention pond	Enlarge or modify existing detention pond to relieve localized flooding at 12th and Newport, with water quality retrofits.	Completed	$163,000 (City cost)	Constructed in 2001. Partially funded using Opus stormwater mitigation.
S-16	DP 10-1	I-90 Dairy Queen culvert	Localized flooding from Issaquah Creek overflow	Low	N/A	To be addressed by eliminating the Issaquah Creek overflow at 7th and Gilman, Woods pond expansion, Tibbetts Creek overflow elimination, and other local drainage projects.
S-17	DP 11-1 DP 11-2 DP 11-3	Mt. Park Heights and Mt. Si outfall erosion	Gully erosion below stormwater outfalls	Low	N/A	
S-18	DP 12-1	Newport Way crossing of Bergsma's drain	Control of sedimentation or conveyance improvement at Newport Way culvert	**High**	N/A	
S-19	EF5 LKCIP2	I-90 Water Quality Retrofits	Install stormwater quality facilities at existing stormwater outfalls to East Fork Issaquah Creek along I-90.	Cancelled	$30,000 (City cost)	Project cancelled due to inability to obtain permission from WSDOT.
S-20	City	Almak Ct Storm drain replacement	Replace and/or in-situ line the damaged storm drain between Almak Ct and Dorado Drive	Constructed	$25,000	Constructed in 2001.
S-21	City	Forest Rim outfall	Control of gully erosion using tight-lined storm drain from current outfall to Tibbetts Valley (Mt. Pilchuck)	**High**	N/A	
S-22	BP6712A	Newport Way crossing of Anti-aircraft Creek	Replace culvert on Newport Way at Anti-aircraft Creek (0169A)	**High**	N/A	
S-23	City	Storm drain inspections	Video inspections of older storm drain systems in City	**High**	$15,000 per year	

Table 4-7 Summary of Capital Improvement And Programmatic Alternatives

No.	References	Name	Description	Priority[a]	Estimated Cost[b]	Comments
S-24	City	Miscellaneous improvements to stormwater system	Small capital project improvements to repair or replace failing or failed stormwater conveyance facilities	**High**	N/A	Includes many projects identified above.
S-25	BW17	Swirl concentrator	Retrofit stormwater quality facilities at existing drainage system	Completed	$36,000 (City) $108,000 (Ecology)	Two swirl concentrators installed 1999-2000 at NW Birch Place and at Wildwood, funded by Department of Ecology Centennial Clean Water grant.
S-26	BW-17 ESA	Improvement of water quality from road drainage systems	Future stormwater retrofit projects at City outfalls to area streams	**High**	$100,000 per facility (City)	Requirements under ESA not identified. Assumes grant matches are available.
S-27	ESA	Aquifer recharge study	Determine feasibility of stormwater retrofits to recharge stormwater runoff into shallow aquifer to mitigate base flow impacts in area streams	Completed	$50,000	Study completed in 2002.
S-28	City	Construct storm drainage system in SE section of City	Construct conveyance facilities where they currently don't exist, such as SE Bush, NE Birch, NE Alder, SE Andrews, etc.	**Moderate**	N/A	Required improvements include curb, gutters and sidewalks
S-29	City	I-90/WSDOT Stormwater Improvements	Miscellaneous stormwater improvements to I-90 runoff.	**High**	$35,000 per year	State Law requires that stormwater utility fees collected from WSDOT be utilized for projects directly affecting I-90 stormwater runoff.
S-30	City	SE 56th at East Lake Sammamish Pkwy drainage problem	Flooding of interchange during heavy rainfall; maintenance of ditch leading from this area to Lake.	**High**	N/A	King County conducted ditch maintenance along railroad right-of-way in Fall, 2002.
STREAM FLOODING CIP						
F-1	BW7	Issaquah Creek – Pickering Reach floodway restoration	Channel widening, habitat improvements and long-term monitoring for flood conveyance improvement	Completed	$870,000 (city cost)	Phase 1 constructed in 1998. Ongoing costs for 2000-2005 for monitoring and maintenance. Phase 2 (upper section) is a low priority future project.
F-2	BW7	Issaquah Creek – Gilman Reach floodway restoration	Channel widening, habitat improvements and long-term monitoring for flood conveyance improvement	Completed	$71,000 (City) $895,000 (FEMA)	Constructed in 1998. Ongoing costs for 2000-2005 for monitoring and maintenance. Additional improvements possible from Juniper Bridge replacement (Transportation CIP project).
F-3a	BW7,8	Issaquah Creek – NW Dogwood Bridge replacement	Eliminate bridge constriction to improve flood conveyance	**High**	$600,000	Replacement of Dogwood bridge scheduled for 2005.

Table 4-7 Summary of Capital Improvement And Programmatic Alternatives

No.	References	Name	Description	Priority[a]	Estimated Cost[b]	Comments
F-3b	BW7,8	Issaquah Creek – NW Juniper Bridge replacement	Eliminate bridge constriction to improve flood conveyance	**Other**	State bridge funds	Replacement scheduled for 2006, subject to availability of State bridge replacement funds.
F-4	City	Issaquah Creek – Newport Way bridge replacement	Replace flood-prone bridge, create flood overflow channel, provide habitat improvements.	Completed	$1,199,000	Constructed in 1999.
F-5	BW7,8	Issaquah Creek – Sycamore conveyance improvements	Conveyance improvements	**High**	$25,000	Miscellaneous conveyance improvements, including removal of old bridge abutment and floodplain planned for 2004.
F-6	City	Issaquah Creek – Squak Valley Park Side Channel	Side channel for fisheries enhancement and flood improvements	**High**	N/A	Funding by Corps of Engineers. Scheduled for 2004 construction.
F-7	BW7	Issaquah Creek – East Fork floodway restoration	Channel widening, property acquisition, habitat improvements and long-term monitoring for flood conveyance improvement	Low	N/A	Flood mitigation on East Fork is a low priority.
F-8a	BW22	Tibbetts Creek Greenway Project – State Park reach	Channel widening, habitat improvements and long-term monitoring for flood conveyance improvement	**Other**	N/A	Funding of channel improvements in Park has been provided by WSDOT with construction planned for 2004.
F-8b	BW22	Tibbetts Creek Greenway Project – NW Sammamish Road Bridge	Replacement of NW Sammamish Road culverts with bridge	Completed	$500,000 (City cost for bridge)	Bridge replacement constructed by City in 2001 using Stormwater capital funds.
F-9	BW22 BP6711A	Tibbetts Creek Greenway Project – I-90 Reach	Replacement of I-90 culverts with bridge	**Other**	$0 (City cost)	To be constructed by WSDOT in 2004.
F-10	BW22 BP6711C BP6713B	Tibbetts Creek Greenway Project – Rowley Reach	Channel relocation and widening, habitat improvements for flood conveyance improvement	Completed	$0 (City cost)	Funded and constructed by Rowley Enterprises in 2000-2001.
F-11	BW22 BP6711D	Tibbetts Creek Greenway Project – Maple to SR900 reach	Newport Way bridge replacement and habitat improvements for flood conveyance improvement	Completed	$0 (City cost)	Bridge replacement in 2001 funded by Intracorp. Completion of stream restoration schedule for 2004.
F-12	BW22 BP6713C	Tibbetts Creek Greenway Project – Tibbetts Manor reach	Channel widening, habitat improvements and berm for flood conveyance improvement	**High**	$340,000 (city cost) $146,000 (grant)	Construct in 2003. Funding supported by $146,000 Centennial Clean Water Fund Grant.

Table 4-7 Summary of Capital Improvement And Programmatic Alternatives

No.	References	Name	Description	Priority[a]	Estimated Cost[b]	Comments
F-13	BP6716	Tibbetts Creek Greenway Project – Kelly Ranch	Riparian restoration and habitat improvements	**High**	$0 (City cost) $100,000 (Intracorp)	Implementation scheduled in 2003 as part of Tibbetts Manor Reach Greenway Project.
F-14	BW22	Tibbetts Creek – Bianca Mine Tailing stabilizatoin	Stabilization of mine tailing deposit to control sediment source to Tibbetts Creek	Completed	$60,000 (City cost) $150,000 (Intracorp)	Constructed in 2002.
F-15	BW7	Property Acquisition Fund	Fund for purchase of houses and/or property for flood mitigation or for future CIP projects	**High**	$250,000+ per year	Implemented in 1994-2005, subject to funding in CIP.
F-16	BP1411	NE Dogwood reconstruction	Reconstruct bridge to improve conveyance on East Fork	Completed	$0	City CIP project constructed in 1996
F-17	BP1412	Bar scalping on East Fork Issaquah Creek	Conduct bar scalping at RM 0.75 and 1.00 to remove 200 cy of sediment accumulation	Low	N/A	Bridge replacement solved sedimentation problem.
F-18	BW22 ESA	Habitat restoration and enhancement	Implement habitat improvements and restoration projects along City streams	**High**	N/A	Requirements under ESA not yet determined. Assumes regional or federal sources will provide most funding.
PROGRAMMATIC						
P-1	BW20 PSWQ ESA NPDES	Stormwater Resources Action Plan – Stewardship and education by Resource Conservation Office	Long-term City program supporting stewardship and education programs.	**High**	varies (City cost)	Implemented and ongoing. .
P-2	PSWQ ESA	Stormwater Resources Action Plan – WRIA 8 and Sammamish Watershed Forum Support	Support of regional coordination of Lake Sammamish Forum, Tri-County ESA, and other regional programs	**High**	--	Implemented and ongoing.
P-3	BW13 PSWQ ESA NPDES	Stormwater Resources Action Plan – Source control for urban areas (Businesses for Clean Water)	Long-term City program providing education, technical support and enforcement of urban land use source controls (best management practices)	**High**	--	Implemented and ongoing. .
P-4	BW29 C5 ESA	Stormwater Resources Action Plan – Basin Steward	Support to Issaquah Creek Basin Steward	High	$10,000/yr (City cost)	Stewardship coordinator employed by King County.

Table 4-7 Summary of Capital Improvement And Programmatic Alternatives

No.	References	Name	Description	Priority[a]	Estimated Cost[b]	Comments
P-5	BW30 ESA	Water Resources Action Plan –Resource monitoring	Long-term basin monitoring of stream flow, water quality, stream habitat, benthic, wetlands, near-stream, septic systems, and other	**High**	varies	Implemented and ongoing. Funded under Water Capital program.
P-6	BW13, C3 PSWQ ESA NPDES	Private stormwater facility maintenance	Develop program and ordinance for maintenance, inspection and enforcement of public and private facilities.	**Stormwater Program**	Staff support	Ordinance adopted in 2000. Maintenance program began in 2002.
P-7	C4 PSWQ ESA NPDES	Stormwater facility inventory	Inventory of City and private drainage facilities, update of inventory maps, and development of impervious surface coverages	**High**	$130,000	Ongoing effort, subject to funding.
P-8	C4 PSWQ ESA NPDES	Stormwater system surveying	Ongoing surveying and mapping support for stormwater facility inventory, including parcel mapping for the stormwater utility.	**High**	$45,000	Implemented over 2000-2005.
P-9	PSWQ ESA NPDES	Comprehensive Stormwater Plan and stormwater ordinance update	Update Comprehensive Stormwater Plan and stormwater ordinances to comply with PSWQMP and other requirements	Completed	Staff support	Ordinance update completed in 2000.
P-10	PSWQ ESA	Utility rate update	Periodic update of the stormwater utility rates.	**High**	$70,000	Implemented in 2001-2002. Change in EDEN billing software scheduled by end of 2003.
P-11	C7 PSWQ NPDES	Water quality mitigation	Require water quality mitigation in applicable capital projects	**Stormwater Program**	Staff support	Ongoing
P-12	BW10	Flood Warning System	Improve flood warning system to warn people of flooding conditions in the Issaquah Creek basin	**Stormwater Program**	Staff support	Implemented and on-going.
P-13	BW18 PSWQ NPDES	Spill Response Program	Develop a spill response program to improve spill response	**Stormwater Program**	Staff support	Implemented and on-going. Preparation of Spill Response Plan scheduled for 2003.
P-14	BW8	Floodproofing and elevation program	Technical and financial assistance to residents and business owners	Low	$376,000	Unfunded.
P-15	BW9	Floodplain/Floodway mapping	Remapping of 100-year floodplain and floodway for FEMA map revisions	**High**	$245,000	Primary work completed in 2002, to be adopted by FEMA in 2004. Update proposed in 2006 for Tibbetts Creek as-built condition.
P-16	BW23	Bank stabilization program	Program to encourage use of bioengineering techniques for stabilizing eroding streambanks	**Stormwater Program**	$0	Incorporated into current and future CIP projects.

Table 4-7 Summary of Capital Improvement And Programmatic Alternatives

No.	References	Name	Description	Priority[a]	Estimated Cost[b]	Comments
P-17	City	Channel Improvements Monitoring and Maintenance	Monitoring and maintenance activities for Gilman Reach, Pickering Reach, and other restoration projects	**High**	$25,000 per year	Required for permit compliance, post-project maintenance, and other purposes.
P-18	City	GIS program development	Development of GIS system for stormwater and utility management	Low	unknown	Under development.

[a] Priority: Completed: Previously implemented or constructed.
Low: Not recommended
Moderate: Moderate priority in 6-year CIP program.
High: High priority in 6-year CIP program.
Stormwater Program: Ongoing non-CIP project in stormwater program.
Other: Funded project implemented by others.
Unknown: Funding or status unknown.

[b] Costs are very preliminary, and many are based on initial evaluations that are up to 10 years old. Updated cost estimates are prepared during the 6-year CIP program development.

- Recommended project (implemented through CIP or other programs)

- Completed or low priority project

Section 5
CAPITAL PROJECTS

This chapter summarizes capital projects that have been proposed and/or constructed during the last decade to address flooding, stormwater, water quality, and related problems in Issaquah.

Based on experience with the 1990 and 1996 floods and subsequent follow-up investigations, the City has developed a good understanding of the extent of current problems and the potential solutions to reduce or eliminate these problems. The City has made significant progress in the last few years to implement capital improvement projects, resulting in improved conditions in many areas of the City (see below). Furthermore, current regulatory standards now require that new development incorporate extensive stormwater runoff control and treatment into their plans; these areas generally do not experience flooding problems. With few exceptions, current flooding problems are located in older areas of Issaquah that were developed prior to the adoption of effective stormwater and floodplain regulations.

5.1 Recently Completed Projects

The City has implemented several significant stormwater and floodplain capital projects and programs during the last several years to address stormwater and flooding problems. These projects are summarized in Table 5-1 and shown on Figure 5-1. (Figure 5-1 also shows proposed projects). Additional discussions of these projects are provided below and in preceding sections of this document.

Most of the projects shown in Table 5-1 were funded and implemented by the City. The fish hatchery improvements were completed by the State Department of Fish and Wildlife, and Rowley Enterprises completed the Lower Cabin Creek stabilization and portions of the Tibbetts Creek Greenway.

5.2 Capital Project Descriptions

5.2.1 Issaquah Creek – Cherry Area

This project involves implementation of the Issaquah Creek Basin Plan to restore the ability of the channel and floodplain to convey and store floodwater, and enhance the fish and wildlife habitat of the corridor. The Cherry Area was defined as the reach of Issaquah Creek between about Juniper and Dogwood streets upstream to Newport Way.

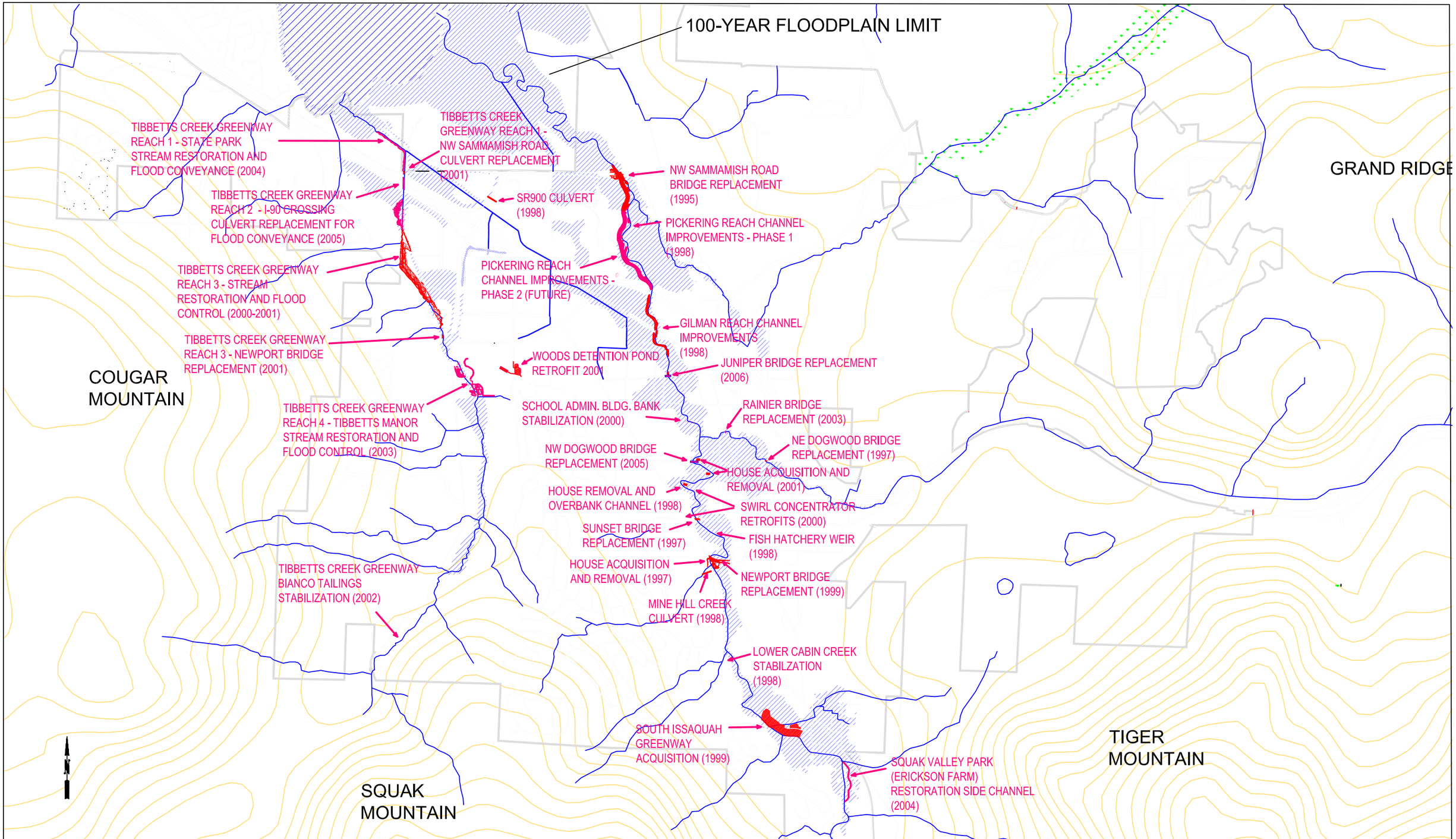
Residential structures in this area are subject to flooding when large flow events occur. As discussed in Section 2.5, this area incurs significant flood damages and resulting payments of flood insurance claims. A range of options are available for this project, including:

- Acquisition of flood-prone homes and fill (at Newport Way, NW Dogwood, NW Cherry Place and NW Birch Place).

Table 5-1 Recently Completed Stormwater and Floodplain Capital Projects

Project	Description	Year Completed
SE 56th Street Bridge Replacement	Replaced bridge that formed a floodplain obstruction on Issaquah Creek.	1995
NE Dogwood Bridge Replacement	Replaced bridge that formed a floodplain obstruction on the East Fork of Issaquah Creek.	1995
Sunset Bridge Replacement	Replaced bridge that formed a constriction to floodwaters.	1997
Lower Cabin Creek Stabilization	Stabilization of eroding streambanks on lower Cabin Creek, a significant source of sediment to Issaquah Creek.	1998
Lower Mine Hill Creek Culvert	Replacement of undersized culvert that was frequently obstructed with sediment.	1998
Fish Hatchery Weir	Hatchery weir was reconstructed wider and lower to become less of an obstruction to floodwaters.	1998
SR900 Culvert Replacement	New 36" culvert installed under SR 900 next to existing culvert to increase capacity of drainage from office and retail areas near Pickering Place.	1998
Gilman Area Channel Improvements	Channel enlargement and bank stabilization between Juniper Street and Gilman Blvd..	1998
Pickering Area Channel Improvements	Channel enlargement and bank stabilization upstream of NW Sammamish Road (near Pickering Barn).	1998
Newport Way Bridge Replacement	Replaced bridge that was frequently closed by floodwaters.	1999
Swirl Concentrator Retrofits	Installation of high-efficiency particulate removers on two City stormwater outfalls to Issaquah Creek.	1999
Floodplain Property Acquisitions	Purchase of five flood-prone residential properties along Issaquah Creek, with removal of houses, and eight undeveloped parcels in the Sycamore neighborhood for preservation under the South Issaquah Greenway Project.	1994-2001
Issaquah Creek Park Bank and Habitat Improvements	Bank protection to stop channel migration towards Issaquah School District administration building.	2000
Tibbetts Greenway: NW Sammamish Bridge	Bridge replacement to improve flood conveyance and fish passage.	2001
Tibbetts Greenway: Newport Way Bridge	Bridge replacement to improve flood conveyance and fish passage.	2001
Tibbetts Greenway: Rowley Reach Restoration	Stream restoration to improve flood conveyance and habitat.	2000-2001
Woods Detention Pond retrofit	Construction of secondary detention vault, water quality filter vault, and modification of overflow pipe in existing pond to eliminate past overflows.	2001
Tibbetts Greenway: Bianco Mine Tailings stabilization	Move 10,000 cubic yards of eroding material from streambanks to reduce sediment source to Tibbetts Creek	2002

- Bank stabilization using bioengineering techniques (e.g., school administration building).
- Localized channel improvement projects incorporating excavation of bank areas or fill to increase conveyance areas (if supported by property owners).
- Removal of channel constrictions at bridges (e.g., Dogwood and Juniper bridges).
- Removal of bank stabilization structures and replacement with biostabilization techniques and log and rock placement.
- Fish habitat enhancements.
- Revegetation of the floodplain and riparian corridor.



CITY OF ISSAQUAH

FIGURE 5-1. COMPLETED AND PROPOSED STORMWATER AND FLOOD IMPROVEMENT PROJECTS IN ISSAQUAH

(page left intentionally blank)

The primary capital improvement project proposed in the near future for the Cherry Area is replacement of the NW Dogwood Bridge. Past flooding and hydraulic modeling has shown that this bridge creates a significant constriction to floodwaters in Issaquah Creek. Construction is tentatively scheduled for 2006, contingent on funding approval and coordination with street improvements funded through the Street Fund. Replacement of the Juniper Bridge is also proposed (for 2005), but is contingent on obtaining State bridge replacement funds.

5.2.2 Issaquah Creek – Sycamore Area

This project also involves implementation of the Issaquah Creek Basin Plan to restore the ability of the channel and floodplain to convey and store floodwater, and enhance the fish and wildlife habitat of the corridor. Many residential structures in this area are subject to flooding when large flood events occur. Specific options that have been identified for Sycamore Area include:

- Purchase and removal of homes from the floodplain.
- Purchase of undeveloped land through the South Issaquah Creek Greenway (i.e., Sycamore area).
- Removal of fill causing obstructions to floodwaters.
- Floodproofing of existing homes.
- Improvements at Erickson property, including flood storage and fish habitat.
- Removal of fill or bank stabilization structures and replacement with biostabilization techniques;
- Fish habitat enhancement.
- Revegetation of the floodplain and riparian corridor.

Acquisition of properties through the South Issaquah Creek Greenway project was completed in late 1999. The City is now embarking on an effort to identify opportunities for those properties, which could include passive recreation, a trail, creek restoration, habitat enhancement, and other uses in addition to flood conveyance improvements.

The Corps of Engineers, through the Lake Washington Ecosystem Restoration Study, is proposing the habitat improvement project for the Erickson site, a City-owned land parcel located just upstream of Sycamore (also known as Squak Valley Park). A levee was constructed along Issaquah Creek in the 1930's to protect 10 acres of the property and Issaquah-Hobart Road from flooding. The study evaluated breaching, removal, or setback of the levee to allow the river to meander more significantly and gain flood storage; construction of a rearing channel for juvenile salmon plus other fish habitat structures; and creation of wetland habitat. The selected project consists of a side channel along the west side of the open field, connected at the upstream and downstream ends to the stream channel through breaches in the levee. This will provide flood refuge for salmon during winter months (refuge habitat is in very short supply in lower Issaquah Creek due to past channelization and bank hardening of the stream), rearing habitat and wetland/riparian habitat for other species. Project construction is projected for 2003, and will be funded by the Federal government.

The City is also evaluating a small floodplain improvement project in Sycamore to mitigate past floodplain filling activities. This includes removal of an old bridge abutment upstream of Sycamore Drive (from the original road access to an old farm in Sycamore) and removal of streambank fill on City-owned property along the east bank of Issaquah Creek downstream of Sycamore Drive. Both of these projects should result in lower flood elevations. Habitat improvements, including revegetation and

large woody debris placement, will also be included in this project. A grant from King Conservation District was obtained in 2001 to assist funding of this project.

5.2.3 Tibbetts Creek Greenway

This project involves implementation of the Tibbetts Creek Greenway project for those components that are the responsibility of the City (see Section 4.3). The Tibbetts Creek Greenway Project was prompted by flooding of roadways and properties during floods in the late 1980's and early 1990s. The creek was also relocated by past straightening and dredging, thereby reducing its habitat value. The project is recommended in the Issaquah Creek Basin and Non-point Action Plan, adopted in 1995, and is a good example of how public-private partnerships can be formed to address common goals. Parties currently involved in the project include the Washington State Department of Transportation, Washington State Parks, Rowley Enterprises, Intracorp, and the City.

The Greenway project involves restoring the natural configuration of the stream channel, recreating a floodplain, enhancing habitat and improving public access. City-funded CIP projects include replacement of the NW Sammamish Road culverts (completed in 2001), stabilization of the Bianco mine tailings (completed in 2002), and Greenway improvements at Tibbetts Manor (2003).

WSDOT's replacement of the I-90 culverts with a bridge structure was originally budgeted in the State budget, but has now been deferred without a firm construction date. The proposed bridge will have a span of 40 feet, identical to the immediately downstream NW Sammamish Road Bridge that the City replaced in 2001. WSDOT will construct the Reach 1 improvements in Lake Sammamish State Park in 2004 as part of floodplain and wetland mitigation for the SR-900 road improvement project, and will also replace the culverts under I-90 with a bridge in 2004.

5.2.4 Water Quality Retrofits

Much of the City was developed before stormwater water quality facilities were required by the City drainage code. Thus, the majority of stormwater runoff is not treated, except for removal of course sediment by catch basins in the storm drain system. To help improve water quality and habitat in area streams and Lake Sammamish, the City is evaluating cost-effective measures to improve the water quality in stormwater runoff and fix stormwater problem areas.

As an initial effort to retrofit stormwater treatment devices on City storm drains, the City in 2000 installed CDS Technologies swirl concentrator units on two stormwater outfalls to Issaquah Creek. These units, installed at NW Birch Place and NW Wildwood Boulevard, remove pollutants by trapping sediment in stormwater runoff. The special design of the unit creates hydraulic conditions that are favorable for settling sediment into a sump chamber, and also contains screens to trap debris. Based on the results of the monitoring program, however, it was found that treatment efficiencies were very low: in the order of 4-15% removal of suspended sediment and 2-6% of phosphorus (Herrera 2002). The reason for this was that fine sediment, which represents most of the sediment load and solid-form pollutants, as well as all dissolved pollutants passed through the unit without being trapped. In addition, much of the courser-grained sediment that could be trapped by the CDS unit is trapped before reaching the facility in upstream catch basins. Catch basins are routinely cleaned by Public Works Operations using vactor trucks; this maintenance effort is apparently very effective in reducing sediment and

pollutant loadings in urban runoff. It was concluded that, while appropriate for other areas whether sediment is courser or trapping of debris is a primary concern, the runoff in Issaquah's stormwater contains very fine sediment that cannot be effectively trapped by vortexing-type treatment devices.

Currently, no additional water quality retrofit projects have been identified. Additional installations of water quality facilities will be proposed as more information on water quality investigations indicates where additional improvements are appropriate and effective. Given their large expense, funding of large water quality retrofit projects will need to rely on external grant sources, such as Ecology's Centennial Clean Water Fund, to help leverage local funds.

5.2.5 Stormwater Conveyance Improvements

Table 5-1 identified many stormwater facility problems that can be categorized as miscellaneous small projects. Currently, Public Works Operations constructs several small repair projects every year, primarily manhole and catch basin replacements. However, staffing and operation budgets are limited, and Public Works are generally incapable of constructing large projects.

To accommodate the construction of small improvement projects, the six-year stormwater CIP budget includes recommendations for funding of these activities:

- TV videoing of storm drains to assess current conditions and identify needed repairs.
- Mapping of the stormwater system to provide needed information for Public Works Operations for maintenance and Public Works Engineering for system evaluation and designing improvements.
- CIP funding for drainage improvements, such as replacement of deteriorated pipe and inlets, construction of new drainage systems in areas without such facilities, large maintenance projects, and other improvements.

(page left intentionally blank)

Section 6
MANAGEMENT PROGRAMS

This chapter summarizes stormwater and floodplain management programs that are currently in effect, or are proposed for implementation over the next few years.

6.1 Overview

Programs relating to floodplain and stormwater management and public education of the City's natural resources are summarized in Table 6-1.

Floodplain and stormwater management programs in the City of Issaquah covers a broad range of activities. These include:

- Operation, maintenance and small project improvements of public stormwater facilities within the City boundaries, conducted by Public Works Operations and Maintenance Department.
- Management and regulation of flood hazard areas using FEMA floodplain maps, standards contained in the flood hazard critical areas ordinances, flood warning system, flood fighting assistance, and public education.
- Engineering support and management of major capital improvements to stormwater facilities and stream flooding projects, as well as support and response to other City department and public inquiries, conducted by Public Works Engineering Department.
- Design review, permitting, inspection and enforcement of new development projects, conducted by Public Works Engineering. The City has four full-time inspectors, a plans examiner, and support staff to ensure that new development complies with all applicable regulations and standards.
- Development review of Issaquah Highlands and TALUS developments and other projects proposing development of large tracts of land by the Major Development Review Team, which is part of Public Works Engineering.
- Public education, stewardship, resource monitoring, technical assistance, and other programs designed to promote the sustainable use of Issaquah natural resources, conducted by the Resource Conservation Office of the Public Works Engineering Department.

With flooding conditions continuing to be a major concern along with the listing of the Chinook salmon under ESA, the Public Works Department is actively pursuing local and regional solutions to flooding, water quality and fisheries. The stormwater program is also continuing the monitoring program for stream flow and water quality.

Table 6-1 Floodplain Management, and Stormwater Management, and Public Education and Outreach Programs

Category	Activity	Description
Floodplain Management	National Flood Insurance Program	Mapping and regulation of flood hazard areas; participation in Community Rating System to reduce insurance premiums.
	Floodplain ordinances	Standards for floodplain development.
	Flood preparedness workshops	Annual workshops for citizens describing flood hazards and response activities.
	Flood Response Plan	Standard operating procedures for City response to flooding events.
	Flood Warning System and Flood Fighting	Flood warning system to warn residents of impending flooding conditions, help with flood fighting.
	Comprehensive Planning	Stormwater Management Plan to ensure that City has up-to-date information on current conditions, and recommendations on improvements to management and capital projects.
Stormwater Management	Stormwater ordinances	Standards for stormwater control and treatment, illegal discharges.
	Maintenance program	Maintenance of public stormwater facilities.
		Inspection and enforcement of private stormwater facilities.
	Stormwater facility mapping	Inventory of facilities to assist maintenance and problem assessments.
	Water Quality program	Stream gauging and water quality monitoring of City streams.
		Water quality response (Hazmat SOP).
		Spill Response Plan.
		Water quality investigations, pollutant source ranking and retrofitting.
		Stormwater source control inspections and retrofits.
	ESA Response	In-house planning, studies, and other efforts to support ESA compliance.
Public Education and Outreach	Businesses for Clean Water	Education and assistance to business in implementing water quality controls.
	Issaquah Stream Team	Volunteer program of water quality and habitat monitoring along City streams.
	Restoration Site Stewardship	Volunteers engaged in restoration site maintenance and monitoring.
	Sammamish Watershed Stewardship	Coordination of watershed-wide volunteer activities and public information.
	Water Quality Education	Biannual newsletter on water resource issues, storm drain stenciling, Smart & Healthy Landscape Program, Green Car Wash Program, Green Gardening Classes, Watershed Signage, and others.

6.2 Stormwater Management Ordinance

The Stormwater Management Ordinance, as codified in IMC 13.28 (Appendix B), contains regulatory requirements for control of stormwater that new development and redevelopment projects must meet when projects require permitting through the City of Issaquah. The City adopts the most recent edition of the King County Surface Water Design Manual for its technical standards.

The City recently revised the stormwater management ordinance to bring it into compliance with several upcoming stormwater and ESA requirements. This includes the upcoming NPDES Phase 2 Municipal Stormwater Permitting and the ESA 4(d) Rule that became effective in early 2001. In addition, the 1994 Puget Sound Water Quality Management Plan recommended cities and counties in Puget Sound to develop and implement comprehensive stormwater programs by year 2000.

A principal element of a comprehensive stormwater program is an adequate stormwater ordinance that specifies requirements for 1) standards for new and re-development, 2) maintenance of both public and private drainage systems, and 3) pollution source control at existing development. The previous stormwater ordinance only identified requirements for new and re-development (i.e., the King County Surface Water Design Manual). The new stormwater code also includes regulatory requirements and allowances that are consistent with other jurisdictions in the region.

Significant changes to the ordinance included the following:

- Clarifies many parts of the code. For example, procedural requirements relating to use of the King County Surface Water Design Manual in Issaquah are clarified.
- Identifies prohibited discharges to surface water. City code currently does not prohibit many types of discharge to storm drains and stream, and State regulations are not comprehensive.
- Authorizes the City to inspect drainage facilities on private property and require maintenance.
- Requires pollution source control best management practices (BMPs) for existing development, initially through voluntary actions but then by enforcement if problems are not corrected.
- Adds allowance for low impact development proposals (i.e., no offsite discharge of stormwater).
- Revises the bonding and insurance requirements to bring them up to date.

6.3 Stormwater Maintenance Program

6.3.1 Public Maintenance Program

The Public Works Operations and Maintenance Department (PW-Ops) manages the City's stormwater maintenance program for publicly owned drainage facilities. Activities conducted include maintenance of catch basins, manholes, ditches, control structures, and other facilities; repair of existing facilities; small improvement projects (such as manhole or catch basin replacement); and flood control. The City maintains facilities located on public property and within utility easements that are dedicated to the City; private facilities are the responsibility of the property owner.

PW-Ops relocated to a new, state-of-the-art maintenance facility in late 2002. The new shop, located on the north side of I-90 near NE Juniper Street, includes much improved facilities for maintenance activities, including office space, vehicle storage and repair, vactor waste disposal, and equipment storage, as well as providing room for a larger work force to serve newly incorporated areas of the city, including Issaquah Highlands and the North Annexation area. The new facility is designed to meet or exceed all current development standards, including stormwater runoff and source controls.

The annual stormwater maintenance Work Plan, prepared by the Director of the Public Works Operation and Maintenance Department, outlines the budgeted allocation of City maintenance staff and resources to stormwater maintenance activities. The Work Plan is based on the number of facilities that must be maintained, the desired frequency of maintenance of those facilities (known as the standard service level), the cost of supplies, overhead costs, and other expenses. Budget for stormwater maintenance is allocated by the City Council based on revenues obtained from the stormwater utility and prioritization of those funds to the various stormwater fund expenditures. The budgeted service level is termed the actual service level.

Table 6-2 summarizes a general overview of stormwater maintenance for the years 1998-2001, including the actual service level (in labor hours) and the budgeted full time equivalents (FTEs) for stormwater maintenance. The actual level of service is compared to the standard service level for maintenance (i.e., the number of hours needed to meet the ideal standard service level for stormwater maintenance) and the estimated number of FTEs needed to achieve the standard service level, based on the ratio of maintenance hours to FTEs in 2000. The standard service level during that period was assumed to be constant until 2000, when it was increased by 25% to account for the North Issaquah annexation. Upon completion of the stormwater inventory project (Section 6.3.2), improved information will be available to more accurately determine the standard service level. Staffing increases in 2000 were made in anticipation of the North Issaquah annexation, as reflected in the FTEs.

Table 6-2 Public Stormwater Maintenance Service Levels and Staffing

Service Level and Staffing	Year			
	1998	**1999**	**2000**	**2001**
Actual Service Level (hours)			3,592	
Actual Maintenance FTEs [a]	2.56	2.38	3.65	3.87
Ratio: service hours/FTE			984	
Standard Service Level (hours) [b]	5,028	5,028	6,285	6,285
Required FTEs			6.4	

[a] FTEs include the following personnel: Utility Maintenance Leads and Workers, Administrative Assistants, and Shop Aide.
[b] 2001 standard service level assumes a 25% increase over 1999 due to North Issaquah annexation. 1998 and 1999 values are based on pre-annexation estimates.

As shown in Table 6-2, the stormwater maintenance budget provides staffing to achieve only 60% of the standard level of service. That is, the 2000 budget provides for about 3,600 hours of maintenance, but the target level of service requires about 6,300 hours. To achieve the target level of service, funding for stormwater maintenance staff would need to be increased by nearly three individuals.

6.3.2 Stormwater Facility Inventory

The City's current inventory of public or private facilities is severely deficient. The stormwater inventory project is the first step in the development of an improved program to address inspection and maintenance of stormwater facilities. The City and developers that build subdivisions and commercial structures have constructed many stormwater facilities that require maintenance to function optimally. Through this one-time inventory it will be possible to bring the City's facility management system up to a comparable level with nearby local governments.

This project, which began in 2000, involves inventorying of all existing (public and private) stormwater facilities in the City. This includes detention facilities (such as ponds, vaults, and tanks), infiltration facilities, and water quality facilities (such as biofiltration swales, wetponds, sand filters, and constructed wetlands). A comprehensive database and mapping system will be developed to contain design, inspection, and maintenance information about the facilities, and provide for continuous updating of as-built information (record drawings). A map will also be generated showing all facility locations.

6.3.3 Private Stormwater Maintenance Program

The City will expand the stormwater inspection and maintenance program in 2002 to include private facilities, which include most facilities located outside of public rights-of-way or easements. Historically, little maintenance has been performed on private systems because City maintenance was confined to public systems and there was minimal incentive for private property owners to maintain their own systems. Typically, maintenance was performed only if a failure caused a noticeable drainage problem. Continual maintenance is necessary in order for the facilities to achieve their intended function of removing pollutants from storm drainage and providing unobstructed conveyance. Deferred maintenance usually results in increased sediment transport due to filled catch basin sumps, localized flooding due to plugged drains and culverts, and ineffective water quality treatment due to poorly maintained swales, treatment ponds, oil-water separators, and other facilities.

The City's proposed program is modeled after a successful program developed by the City of Redmond in 1997. Redmond found that requiring maintenance of private systems resulted in a reduction of sediment loading to the public system (which receives drainage from the private systems). This in turn results in reduced maintenance needs in the public system and improved water quality discharging to the Sammamish River and Bear Creek.

A summary of how the proposed private facility maintenance program will be developed and implemented is contained in Table 6-3. In general, the City's role will be to notify property owners of an upcoming inspection, inspect drainage facilities to determine whether maintenance or repairs are required, issue an inspection report with compliance letter or order identifying required work, and perform a re-inspection if necessary. The property owners will be required to contract with a drainage maintenance company to do the actual maintenance and repair work. Redmond's experience was that companies come and locate in the area to fill the need for this type of service, so there should be no shortage of qualified contractors to perform the work.

Over the short term, the four current Public Works inspectors, with the assistance of the water resources engineer, can implement the private stormwater inspection program during periods when construction inspections fall off. Additional staff will likely be needed as Issaquah Highlands and TALUS are built out and the City annexes adjacent county land. By comparison, the City of Redmond, which has a population of 45,000 (four times that of Issaquah) has a staff of four running their program: a supervisor, two inspectors, and one water quality specialist. The City of Kent, with a population of 70,000 (six times that of Issaquah) has determined that it needs six inspectors to facilitate a 3-year inspection cycle.

To facilitate the implementation of the private facility maintenance program, revisions to the stormwater ordinance were required (Section 6.2). Specific items in the new ordinance that pertain to private stormwater facility maintenance include:

- Property owners are responsible for continual performance, operation and maintenance of stormwater facilities in accordance with maintenance standards developed by Public Works.
- City personnel are allowed to access private property for inspections upon adequate notice.
- Property owners must provide and maintain access to stormwater facilities for City inspectors.
- When maintenance or repair is required, it must be performed within a set time period.
- Violations of the requirements are subject to the code enforcement provisions of IMC 1.36, including up to $250/day civil penalty plus criminal penalties, if warranted.

6.3.4 Maintenance Standards

Stormwater maintenance standards describe the type and frequency of work that must be performed on stormwater structures. It describes specific measurements of required maintenance for all types of installations, including catch basins and manholes, retention/detention ponds, water quality ponds, swales, pipes, ditches and oil-water separators. Adequate maintenance is needed to ensure that these facilities perform as designed for stormwater conveyance, water quality treatment, and infiltration. Standard operating procedures for stormwater facility maintenance have been developed and are available from the Public Works Engineering Department.

Table 6-3 Development and Implementation of Private Stormwater Maintenance Program

Activity	Description	Schedule
Development of drainage and land parcel database	• Develop detailed drainage facility inventory and database, including private facilities. • Partition City into management units or drainage basins. • Develop database of private parcels with ownerships or management contacts. • Identify staffing requirements for budgeting purposes.	2001
Development of administrative procedures and standards	• Prepare maintenance requirements and standards manual. • Develop administrative procedures, including letter templates (notification, inspection, re-inspection, compliance), timing cycle for covering the City, and procedures for updating drainage system and ownership databases. • Prepare referral list containing local private maintenance contractors.	2002
Implementation	• Send notification letters informing date of upcoming City inspection of their facilities. • Conduct inspection. • Send inspection summary report, which includes required corrective actions. • Conduct re-inspection, to verify that required maintenance was performed, and issue compliance letter.	2002 and beyond
Maintenance Program Database Upkeep	• Maintain database of parcels, owners, inspection dates, maintenance actions, and compliance. • Update drainage system inventory database as necessary. • Update property ownership database as necessary.	2002 and beyond

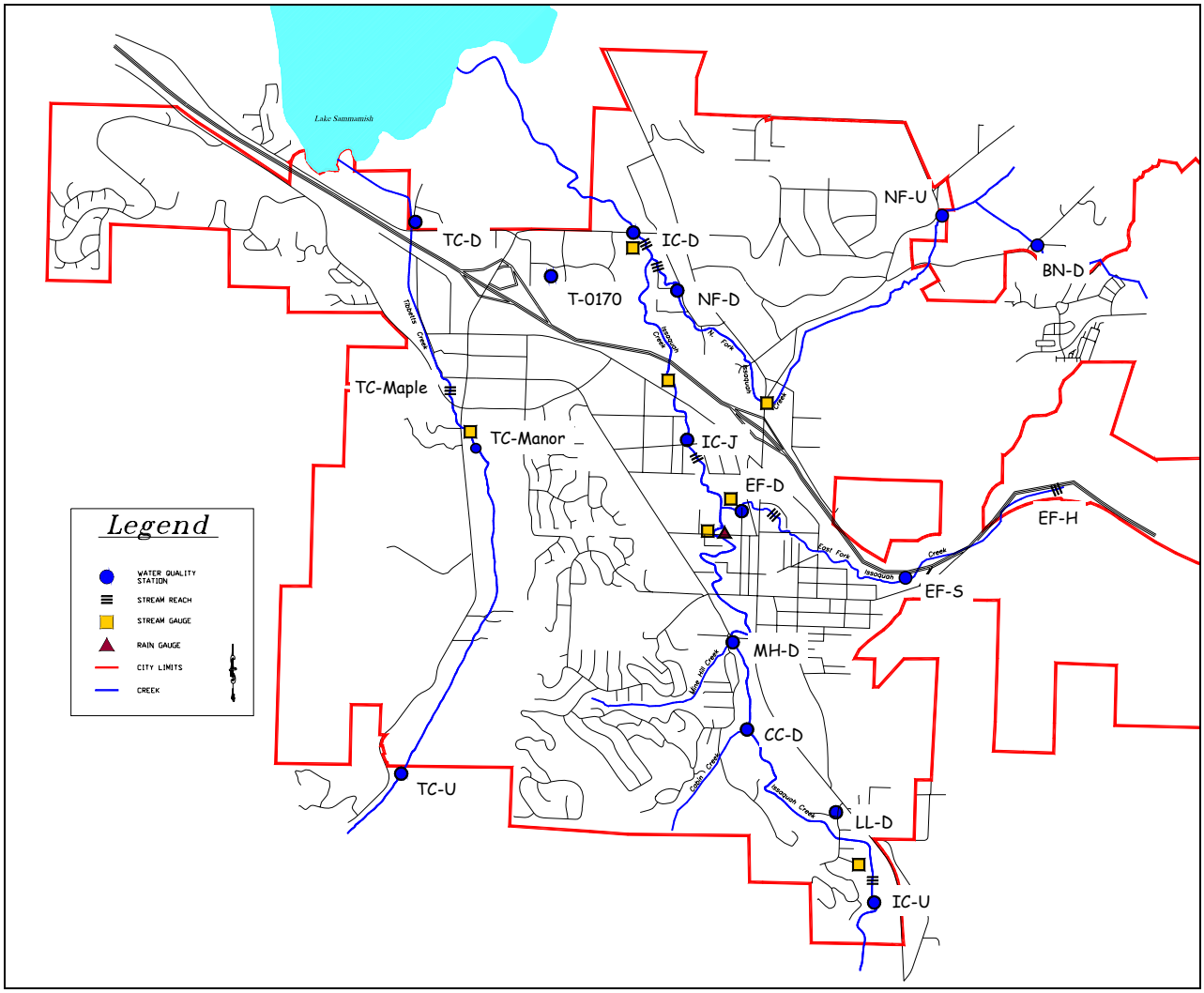
6.4 Water Quality Program

6.4.1 Aquatic Resource Monitoring Program

The City's aquatic resource monitoring program includes a broad range of monitoring activities, including water quality, instream and riparian habitat, streamflows, and macroinvertibrates. Monitoring is conducted for several purposes, including collection of baseline data to assess current conditions and health of the City's natural resources, detect future trends in these conditions, and evaluate the effectiveness of stream, habitat, and stormwater mitigation projects.

Monitoring is conducted through a combined effort of City staff, volunteers recruited through the Stream Team and other programs (see Section 6.7.2), monitoring programs conducted as part of large development projects (e.g., Issaquah Highlands and TALUS), and other local agencies. A map of monitoring locations is shown in Figure 2-6.

Figure 6-1 Water Quality and Streamflow Gauging Monitoring Locations



Sampling locations and event types are summarized in Table 6-4, and sampling parameters are summarized in Table 6-5. As shown in Table 6-4, the monitoring program was expanded to include six new monitoring locations for base and stormflow samplings (conducted by Public Works staff) and three new locations for field analyses (conducted by volunteers). A summary report of the City's 1999-2002 aquatic resource monitoring program is contained in City of Issaquah (2003). Copies of other data are maintained by Public Works Engineering staff.

Table 6-4 Issaquah Sampling Locations and Events

Location (from upstream to downstream)	Station ID	Sampling Events					
		Water Quality Field Analysis	Water Quality Storm Flows	Water Quality Base Flows	Macro-Invertebrates	Physical Habitat	Streamflow Gauging
City of Issaquah Resource Monitoring Program							
Issaquah Creek – Upstream	IC-U	●	●	●	●	●	●
Issaquah Creek – above East Fork	IC-M						●
Issaquah Creek – at Juniper	IC-J	●	●	●	●	●	
Issaquah Creek – at Gilman	IC-G						●
Issaquah Creek – Downstream	IC-D	●	●	●	●	●	
Tibbetts Creek – Upstream	TC-U	●	●	●	●		
Tibbetts Creek – at Manor/Maple	TC-M	●	●	●	●	●	●
Tibbetts Creek – Downstream	TC-D	●	●	●			
East Fork Issaquah Cr. tributary – Highpoint	EF-H				●	●	
East Fork Issaquah Creek – Sunset	EF-S	●	●	●	●	●	
East Fork Issaquah Creek – Downstream	EF-D	●	●	●	●	●	
North Fork Issaquah Creek – Upstream	NF-U	●	●	●	●	●	
North Fork Issaquah Creek – Downstream	NF-D	●	●	●	●	●	
Black Nugget Creek – Downstream	BN-D	●	●	●	●	●	
Lewis Lane – Downstream	LL-D	●	●	●			
Lewis Lane – Upstream	LL-U	●					
Cabin Creek – Downstream	CC-D	●	●	●	●	●	
Mine Hill Creek – Downstream	MH-D	●	●	●	●	●	
Tributary 0170	T-0170	●	●	●			
City of Issaquah Master Drainage Plan Monitoring							
Black Nugget Creek	46SL	●	●	●			●
Pole Creek	46R	●	●	●			●
West Fork Tibbetts Creek[a]	1S	●	●	●			●
King County Water Quality Monitoring							
Issaquah Creek at Hatchery	A631	●		●			
Issaquah Creek at SE 56th	631	●	●	●			
N. Fork Issaquah Creek	A632	●		●			
Tibbetts Creek at Park	A630	●	●	●			
USGS and King County Streamflow Gauging Stations							
Issaquah Creek at SE 56th Street	12121600						●
Issaquah Creek at Hobart	12121000						●
E. Fork Issaquah Creek – Lower	14A						●
N. Fork Issaquah Creek – Lower	46A						●

[a] Additional minor tributaries on Cougar Mt. are also monitored under TALUS MDP

Table 6-5 Sampling Parameters for Ongoing Monitoring Programs

Sample Type	Sampling Frequency	Sampler	Parameters
Water quality – field analysis	Monthly	Issaquah Stream Team	Dissolved oxygen Conductance Turbidity pH Temperature
Water quality storm and base flow	8-10 per year	Public Works staff	Zinc Total phosphorus Fecal coliform Turbidity TSS
Benthic macroinvertebrates	Annual	Issaquah Stream Team	Benthic macro-invertebrates
Habitat and cross-sectional surveys	Bi-annual	Issaquah Stream Team	Stream profile Riparian vegetation Erosion Large organic debris Pools Stormwater structures
King County Aquatic Resource Monitoring	Monthly and storm event	King County Dept. of Natural Resources	Water quality (conventional and metals) and annual sediment
Streamflow gauging	Continuous	Public Works, King County and USGS	Stream stage and flow
Issaquah Highlands MDP Monitoring Program	Storm and baseflow	Port Blakely Communities (done by consultant)	Turbidity TSS Total-P
TALUS MDP Monitoring Program	Grab and continuous sampling	Intracorp (done by consultant)	Total-P Turbidity TSS, pH, DO, temp., conductivity

6.4.2 Emergency Water Quality Response

The City has prepared procedures on how to respond to hazardous material (hazmat) spills, illegal dumping of hazardous wastes, and water quality violations. These procedures define the roles and responsibilities of City departments and outside agencies that must respond to these types of occurrences. A copy of *Standard Operating Procedure - HAZMAT SPILL, HAZARDOUS WASTE, AND WATER QUALITY RESPONSE* is contained in Appendix C. A summary of the SOP is contained in Table 6-6.

The Hazmat SOP in Appendix C describes the responsibilities of City staff in the immediate response to a spill event. It does not describe how the City should be prepared in advance for a spill event, such as having standby equipment ready or having spill kits in City vehicles, nor does it have information helpful in containing spills, such as storm drain maps with critical manholes and outfall identified (to plug the drainage from a spill area). Interjurisdictional coordination should also be established. A Spill Response Plan will be prepared in 2003 to address these needs.

Table 6-6 Spill Response Summary

Nature of Spill	Description	Response Procedures
1. Major Hazmat Spill	Spills of high-risk nature (hazardous or unknown materials, or large quantity). Risk to public and/or environment.	• **Fire Department**: Response and limited containment. • **PW-Ops**: Support if requested by Fire Department • **Department of Ecology**: Primary spill response and cleanup.
2. Minor Spills – Public	Spills of low-risk nature (identifiable material and small quantity) on public property. Spill can be contained and cleaned up by City.	• **Fire Department and/or PW-Ops:** Response, containment and cleanup.
3. Minor Spills – Private	Spills of low-risk nature (identifiable material and small quantity) on private property. Spill can be contained by City during initial response, followed by cleanup by responsible party.	• **Fire Department and/or PW-Ops**: Response and containment (if required). If urgent response is needed, follow #2. • **Responsible Party**: Spill cleanup. • **PW-E Inspectors:** Response observation and verification of cleanup. • **Code Enforcement:** Enforcement actions if necessary (e.g., non-responsive private party or code violation).
4. Construction-related water quality problems	Erosion and sedimentation water quality problems at permitted construction sites.	• **PW-E Inspectors:** Construction inspection and permit compliance. • **Code Enforcement:** Enforcement actions if necessary (e.g., code violation).
5. Other water quality problems	Pollution source control at businesses, failing or improperly maintained stormwater facilities, illegal dumping and discharge.	• **PW-E Inspectors and Engineers:** Determination of source, hazards, and required response action; response observation and verification. • **Code Enforcement:** Enforcement actions if necessary (e.g., code violation).

6.4.3 Water Quality Investigations and Stormwater Facility Retrofitting

The Puget Sound Plan requires municipalities to perform the following actions as part of a comprehensive stormwater management program:

- Identify and rank significant water pollution sources
- Investigate and correct problem storm drains

In addition, the ESA 4(d) rule may require communities to commit to stormwater retrofitting by identifying funding sources in their CIP program. Actions that will be performed by the City over the next few years as described below.

6.4.3.1 Identification and Ranking of Significant Pollution Sources

The City, through its aquatic resource monitoring program, conducts regular water quality sampling of major streams, tributaries, and a primary drainage ditch to assess the nature and extent of water quality problems within the City. From that effort it has been concluded that significant pollutant sources exist

within the City (see City of Issaquah, 2003). However, it is not known to what degree the sources are associated with storm drainage systems as opposed to non-point sources such as stream bank erosion, sheet flow runoff from stream side areas, and runoff from dispersed land use activities such as yard maintenance and pet wastes.

In order to further identify the nature and extent of pollutant loading from the City's storm drainage system, the following additional water quality sampling efforts are recommended:

- Water quality sampling at major stormwater outfalls on Issaquah Creek, North Fork Issaquah Creek, East Fork Issaquah Creek, and Tibbetts Creek. Sampling will target runoff events during different seasons.
- To supplement the water quality sampling, sediment sampling from manholes sumps can be conducted to further characterize the water quality conditions within the City's major stormwater drainage systems.
- Geographic information system (GIS) coverages of stormwater drainage basins, land use, and impervious surfaces can be analyzed to correlate land use to water quality in stormwater runoff.
- Based on sampling results and land use data, possible pollutant sources can be identified investigated further.

6.4.3.2 Storm Drain Retrofitting

The City will continue to pursue retrofitting opportunities for the storm drainage system. Factors that influence when and where new facilities will be constructed include the results of the monitoring program, site conditions at or near the stormwater outfalls that could limit the size or design of treatment facilities, and availability of funding.

6.5 Floodplain Management and Flood Fighting

6.5.1 Regulatory Codes

Management of development within floodplains and floodways are strictly regulated by City code through IMC Chapter 16.36, Areas of Special Flood Hazard, and IMC Chapter 18.10, Critical Areas Regulations (see Section 4.1.2). In general, construction of new residential or commercial structures is prohibited in floodways. Floodways are located within and immediately adjacent to the stream channel. Within floodplains outside of the floodway, new construction is allowed but must meet several standards to minimize flood hazards. In general, the major standards include raising the first floor of buildings (and any subfloor ductwork or utilities) to one-foot above the 100-year flood elevation, no increase in earthen or other fill within the parcel that would reduce the flood storage capacity, and no obstructions that would reduce the ability of the property to convey floodwaters through it (in order to prevent flood elevations from increasing at neighboring properties).

6.5.2 Flood Warning System and Flood Fighting

A brochure has been prepared that describes the City's flood warning system, appropriate flood preparedness activities that should be done before the flood season approaches, flood fighting actions that the City and its residents should follow, emergency contact information, and procedures for requesting and placing sandbags. The brochure is shown in Figure 6-2.

The City's Flood Fighting Standard Operating Procedure provides details on how City crews and staff respond to floods.

The Issaquah Flood Warning System provides residents with a way to obtain information on impending floodwaters so that they can take proper defensive actions and prepare themselves before serious flooding occurs. The flood warning system consists of a water stage gauge located upstream in Hobart at the U.S. Geological Survey's stream gauge. This gauge is telemetered into the City Shop and an automatic warning system, which can notify on-call Public Works Operations staff or police. Depending on the location, the system provides 3-4 hours of lead time to residents before arrival of the flood peak. Flood information is available to citizens by calling the City's Emergency Information Line (837-3028) or by watching TV Channel 21.

A flood phase system was developed, based on the flood stage depth at the upstream gauge, to represent different levels of flooding potential and the appropriate flood-fighting response by City crews and residents. The four phases are summarized in Table 6-7.

Table 6-7 Flood Warning System Flood Phases

Phase	Extent of Flooding	Actions by City	Actions by Citizens	Flood Stage at Hobart Gauge
I	Insignificant	Public Works and Police notified; emergency information line activated	Monitor City Emergency Information Line	6.0 feet and rising
II	Minor to moderate. High water in flood-prone areas	Flood fighting activities begin	Above, plus initiate household flood strategy	7.0 feet and rising
III	Major flooding, including most creekside areas	Full flood fighting effort in effect	Above, plus block basement drains	8.0 feet
IV	Extensive flooding, similar to February 1996 event	Maximum flood effort, preparation for major disaster	Above, plus be prepared for full extent of maximum flooding	8.5 feet

The City provides, at no cost, delivery of sandbags and sand to residents who request it. These materials can be delivered during the flood season (October-April) or during a flood event. Guidelines on sandbag placement and removal must be followed.

Figure 6-2 Flood Fighting Brochure

CITY OF ISSAQUAH

Public Works Operation
P. O. Box 1307
Issaquah, WA 98027-1307
425-837-3470 FAX 425-837-3479

ISSAQUAH FLOOD INFORMATION SYSTEM

The purpose of the Issaquah Flood Information System is to provide residents with a way of obtaining information on impending flood- waters so they can take proper defensive action and prepare themselves before serious flooding occurs. Depending on a resident's location and the extent of the flooding, the system can usually provide 3 to 4 hours lead-time.

The City of Issaquah posts flood phase information on the City's Emergency Information Line. This information is updated as conditions change.

The Issaquah Flood Information System does not take the place of individuals and neighbor- hood groups making their own flood disaster plan.

High water and flooding most commonly occur from October through April during periods of intense rainfall or rapid snowmelt. Issaquah Creek is independent from other rivers and streams.

When other rivers in the area are flooding, it does not necessarily mean that Issaquah Creek will flood. Conversely, Issaquah Creek may flood, while other rivers in the area may not.

Issaquah residents are encouraged to keep informed of changing stream conditions and make early preparations in case of major flooding.

The City delivers sand and bags upon request during normal working hours (7:30 – 4:00) from October through April. This service is also available during phases II, III, and IV of a flood event. See this flyer for flood phase system and sandbag guidelines.

Citizens are encouraged to request and place sandbags prior to flooding.

INDIVIDUAL FLOOD PREPAREDNESS

MAKE SURE YOU HAVE PROVISIONS:

PROCEDURES	SUPPLIES
Family Rendezvous Location	Food & Drinking Water
Evacuation Routes	First Aid Kit
Emergency Housing	Medicines
Pets/Livestock	Blankets, Warm Clothing
Flood Insurance	Raingear/Waterproof tarp
Emergency Info	Portable Radio, Batteries
Phone numbers near phone	Candles, Flashlight
Sand and Bags	Shovels

BEFORE THE FLOOD

1. Know if you are in a flood-prone area. Call the Issaquah Building Department at 425-837-3100.
2. Each year, update flood procedures to be followed by your family or business. This includes:
   - Make sure all family members know the emergency phone numbers.
   - Learn the safest route from your home or business to safe, high ground.
   - Get familiar with the Issaquah Flood Warning System, as outlined in this brochure.
   - Set up your own neighborhood notification network.
3. Find out the timing and extent of flooding in your neighborhood based on the readings at the gauge.
4. Talk to neighbors and share information on preparedness and previous experiences. Remember, the next flood may be greater than anything you have seen before.
5. Minimize flood damages:
   - Store valuables at higher elevation (second story if possible).
   - Store household chemicals above flood levels.
   - Ensure that underground storage tanks are fully sealed and secure.
6. Keep a portable radio, emergency cooking equipment, flashlights, fresh batteries, non-perishable food and drinking water on hand.
7. Keep drains and grates on catch basins free of leaves and debris.
8. Purchase flood insurance to protect your property. (Homeowner's insurance may not cover flood loss.)
9. Fill in additional information on the Flood Warning System chart (reverse) for your own flood emergency plans.
10. Place sandbags around home. See sandbagging guidelines in this flyer.

DURING THE FLOOD

1. Keep a battery-powered radio tuned in to a local station. Follow all emergency instructions.
2. If you are caught in your building by rapidly-rising waters, call 911 for help, then move to a higher floor. Take warm, weatherproof clothing, a flashlight, and a portable radio with you.
3. Do not walk or wade in flooded areas.
4. If you evacuate by car:
   - Do not drive where there is water over the road.
   - If your car stalls in a flooded area, abandon it as soon as possible and walk to safety from the direction you came.
5. Block basement drains to prevent sewage and flood waters from entering your home.
6. When flooding is imminent, and only if time permits, close the main gas valve.
7. Do not touch any electrical equipment unless it is in a dry area.

AFTER THE FLOOD

1. Before re-entering your home, check for structural damage that could cause building collapse. Be cautious of potential gas leaks, electrical shorts, and live wires.
2. Document your losses, both in writing and with photographs.
   - Contact your insurance agent for flood loss claims.
   - Follow procedures for safe cleanup of household items, food, water supply, and property. The King County Health Department has a brochure on cleanup procedures entitled "Emergency Measures for Flood-Stricken Premises."
3. Contact the Building Department at 425-837-3100 regarding any questions on repairs which normally require a building permit such as foundation repairs, drywall and insulation replacement.

Figure 6-2 Flood Fighting Brochure (continued)

PHONE NUMBERS

Emergency: 911

Public Works Operations: Weekdays 7:30 – 4:00, 425-837-3470.

Sandbags & Stream Information: 24 hours a day when Phase II is entered, 425-837-3470.

Flood Phase Information: Up-to-date information available on City Emergency Information Line, 425-837-3028, or on TV Channel 21.

King County Health Department: Cleanup Procedures, 206-296-4932, or call King County Household Hazards, 206-296-4692.

When phoning, be prepared to give your name, address, and delivery location. Please remain calm and patient

SANDBAGGING GUIDELINES

1. Place sandbags close (3 to 5 feet) to your structures.
2. Fill bags 2/3 to 3/4 full and interlock when stacking.
3. Plan ahead for bag placement. Do not create a problem for your neighbors.
4. Do not place bags or divert water onto a roadway or reroute a stream.
5. Sandbag placement locations are subject to City approval.
6. Sand and bag deliveries will be made as long as access to your property is safe.
7. Sandbags are provided for the protection of your structures only. Do not attempt to divert waters from your property.
8. Do not dump sand into the creek or on its banks—store for future use.
9. The City does not collect used sandbags or sand on private property.

Failure to comply with these guidelines may result in the termination of sand bag service to your property.

THANK YOU

THE FLOOD PHASE SYSTEM FOR THE CITY OF ISSAQUAH

THE FLOOD PHASE SYSTEM CONSISTS OF FOUR PHASES IN INCREASING ORDER OF SEVERITY:

	EXTENT OF FLOODING	ACTION BY CITY	ACTION BY RESIDENT	ISSAQUAH CREEK LEVEL
PHASE I	• Insignificant • Flood Watch Phase	• Public Works & Police Department notified • Stand-by monitoring begins • City Emergency Information line activated	• Always be prepared with household flood strategy • Monitor City Emergency Information line • Monitor weather reports	• Upstream gauge reads **6.0 feet** with a rise trend • Rains expected to continue
PHASE II	• Minor to moderate flooding • High water in flood-prone areas	• Public Works Operations & Maintenance Department begins flood fighting activities • Truck route closed—use detour	• Initiate household flood strategy • Monitor City Emergency Information line • Monitor weather reports	• Upstream gauge reads **7.0 feet** and rising
PHASE III	• Major flooding on Issaquah Creek, Tibbetts Creek, and the East Fork of Issaquah Creek • Flooding in most creekside areas	• Full flood fighting effort in effect	• Evacuate if necessary • Monitor City Emergency Information Line • Block basement drains	• Upstream gauge reads **8.0 feet** regardless of trend
PHASE IV	• Extreme flooding similar to February 1996 or greater • Extensive flooding throughout Issaquah and Tibbetts Creek Valleys	• Maximum flood fighting effort in effect • City prepares for possible disaster	• Evacuate if necessary • If not, make sure that you are ready to withstand the full extent of the flood with ample supplies	• Upstream gauge reads **8.5 feet** regardless of trend

6.5.3 Education and Outreach

The City conducts annual Flood Preparedness Workshops in November. Items discussed during these public meetings include the flood warning system, use of sand bagging and floodwalls in flood fighting, emergency management operations at the City, and current status of the City's flood mitigation program. Specific projects that were discussed in recent workshops include the recently completed channel improvement projects at the Gilman and Pickering reaches of Issaquah Creek, replacement of the Newport Bridge, the City's floodplain re-mapping program, and the property acquisition fund.

The City conducts several other education, awareness and public involvement activities as part of the floodplain management program. These activities, which are designed to complement the programs called for in FEMA's Community Rating System (Section 4.1.3), include the following:

- Provide flood insurance rate maps, flood protection assistance, and other information to citizens who request it.
- Advise people who are looking to purchase property of the availability of flood hazard information.
- Notify repetitive loss properties of flood hazard management activities conducted by the City, including notification of flood preparedness workshops.

6.5.4 FEMA Floodplain Map Update Project

The FEMA and Basin Plan floodplain maps showing 100-year floodplain and floodway boundaries and elevations are recognized to be inaccurate in many areas of the City. They have also been regularly criticized by citizens who believe that certain properties are inaccurately shown to be either in or out of the floodplain/floodway. In addition, the City has completed several projects in recent years, including the Gilman and Pickering Channel Improvements and several bridge replacements, resulting in significant changes to 100-year flood elevations in those project areas.

This project, scheduled for 2000-2002, would result in up-to-date mapping that reflects the best available information, and revision to the FEMA flood insurance rate maps. This project involves hydraulic modeling to define the floodplain and floodway under current conditions along Issaquah and Tibbetts Creek. It also includes a flood audit, surveying, resident interviews, and re-mapping of the Issaquah Creek floodplains within the City. This work would be coordinated with FEMA.

This project will make development and mitigation requirements in the floodplain more predictable. Areas that are currently shown outside the floodplain that are actually in the floodplain will be required to provide adequate mitigation (such as compensatory storage).

6.5.5 Repetitive Flooding Loss Reports

The City submits an annual Flooding Repetitive Loss Report to FEMA as part of the CRS re-certification process. These reports contain details on identification of repetitive loss properties, mitigation projects, acquisitions, and other efforts conducted by the City to reduce losses at these properties. The report submitted for year 2002 is contained in Appendix D.

6.6 Public Education and Outreach

The City of Issaquah organizes numerous public education and outreach programs. Summaries of these programs are provided below. The Resource Conservation Office is credited for much of this work. Table 6-8 summarized the amount of time that has been contributed by volunteers in outreach programs during 1999-2000.

Table 6-8 Community Involvement in Outreach Programs during 1999-2000

Activity	Time Frame	Measures of Involvement
Issaquah Stream Team	Annually	425 hours
Restoration Maintenance and Monitoring:		
Issaquah Basin Earth Day 2000	April 2000	188 hours
On-going teams	September, 1998 – May, 2000	648 hours
One day weed control parties	Summer, 1999 – May, 2000	287 hours
Total		1,123 hours
Residential Water Quality Education:		
Stormdrain Stenciling	May, 2000	79 hours, 94 stencils
Watershed Sign Placement	Spring, 2000	14 signs placed
IPM postcards	May – July, 2000	1,000 postcards distributed 3X

6.6.1 Water Quality Education & Outreach Programs

6.6.1.1 Flow Newsletter

Flow is a newsletter designed specifically to build the community's knowledge of local water resource issues from a conservation perspective. Readers are provided with current information about City projects, regional issues, tips and resources, connections with events, trainings and volunteer opportunities and other related information. The newsletter is produced two times per year and is distributed to all businesses and residents within the City.

6.6.1.2 Issaquah Businesses for Clean Water

The Business Water Quality Initiative was started in 1998 through grant funding from the King County Business Action Grant program. The purpose of the program is to educate and engage Issaquah businesses in local stormwater water pollution prevention activities through a cooperative partnership with local businesses, business organizations and community groups.

The program increases awareness of local water pollution concerns, improves knowledge and understanding of business impacts to water quality, provides solutions and on-site technical assistance to manage water quality problems through source controls and develops incentives for businesses to minimize impacts.

The City is currently working with the landscape industry and property owners in Issaquah to identify landscaping related issues that have an impact upon water quality. Staff works with a professional landscape auditor to review existing conditions and management practices while onsite with the landscape contractor. During this assessment, a variety of components are assessed, including: herbicide/pesticide use, fertilizer use, erosion, organics disposal and storm water facility maintenance (those that are landscape related– ie., bioswales, retention/detention ponds).

6.6.1.3 Storm Drain Stenciling

The City's Storm Drain Stenciling program was recently updated with four new, assembled storm drain stenciling kits. Stormdrain stencils remind residents of the watershed to avoid dumping wastes into stormdrains, as they discharge to local bodies of water. Door hangers are distributed to adjacent property owners to explain the project and to provide information about watershed protection. A database of stenciling activities helps track the activities of community members. Kits including stencils, paint, traffic vests, cones, and signs will continue to be promoted to the Issaquah community (seasonally) and are a part of the City's Environmental Resource Library.

6.6.1.4 Residential Water Quality Education

The Residential Education element focuses on disseminating educational pollution prevention / watershed awareness messages. In 2000, the following major items have been completed:

- Placement of stream / watershed signs at road crossing of streams (partnership with WRIA 8 jurisdictions).
- Distribution of three integrated pest management postcards (one monthly from May – July) to streamside, Overdale and Montreaux neighborhood residents, Eco-Team members and Smart and Healthy Landscape program and Natural Lawncare workshop participants (partnership with King County Local Hazardous Waste Management).
- Volunteer stenciling of stormdrains with "Dump no Waste – Drains to Stream" message.
- Partial funding of the Smart and Healthy Landscape Program that will provide customized audits of 40 residences' landscaping and watering practices this year (multi-agency effort).

6.6.1.5 Smart & Healthy Landscape Program

In 1999, the Smart and Healthy Landscape program provided free landscape assessments to 59 Issaquah households. Through the program, landscape auditors evaluated residential landscapes and provided homeowners with feedback about landscape design, maintenance, irrigation and use of fertilizers and lawn chemicals and other hazardous gardening products. Households were selected on the basis of summer water consumption and proximity to local water bodies.

Homeowners using traditional fertilizers were advised to use organic fertilizers or other alternative products or plant species. In addition, educational brochures describing the relationship between residential areas, non-point source pollution and water quality were provided to each participant. Houses close to streams and water bodies were given more detailed recommendations regarding water quality protection. Turf alternatives, vegetative buffers and native species are just some of the design recommendations given to these households.

Preliminary results from a post-program survey indicate the pollution and water quality message has been well received. More than half of the participants who received specific fertilizer advice indicated switching to more environmentally sensitive products. In addition, several recipients have decided to make specific design changes in light of environmental concerns. This program is being evaluated for continuation in 2000.

6.6.1.6 Green Car Wash Program

Pollutants from charity car washes typically discharge wash water (containing dirt, road grime, oils and soaps) directly to storm drains. The Green Car Wash Program seeks to educate these groups and encourage them to utilize a green car wash kit. Included with the kit are brochures, a patron survey, event signage, a catchbasin insert, pump and hose. As a result, wash water is collected and diverted to the sewer system. Temporary catchbasin inserts allow fundraising and community efforts to continue while minimizing impacts to local water quality. The green car wash kit was developed in partnership with the King County Conservation District.

6.6.1.7 Green Gardening Classes (1997-1998)

The City presented a series of green gardening classes for Issaquah residents over a two-year period. The purpose of the classes was to educate residents about alternative landscaping techniques that would help them to reduce their use of chemical fertilizers and pesticides, build wildlife habitat and conserve resources. Classes included such topics as naturescaping, a series on selection, propagation and maintenance of native plants, and natural lawn care.

6.6.1.8 Watershed Signage

In 1999, the Resource Conservation Office inventoried existence of stream crossing signs and has ordered new signs from King County with *"This stream is in your care"* message, stream name and watershed sign (*"Within the greater Lake Washington basin"*). The signs help to build awareness of local waterways and regional interconnections of major drainage basins. Similar signage improvements are being made in neighboring areas and unincorporated King County. In Issaquah signs were placed at road crossings for Tibbetts, Issaquah and East Fork Issaquah Creek.

6.6.1.9 Household Hazardous Wastemobile

The City coordinates the siting of the Household Hazardous Wastemobile in the Issaquah region at least once per year.

6.6.2 Stewardship Programs

The City of Issaquah has an active stewardship program that recruits volunteers from the community to engage them in various monitoring, restoration, and educational activities. The goals of the Issaquah Stewardship Program include:

- Determine baseline conditions and track changes over time of water quality, biological components and habitat of the aquatic resources in the City of Issaquah.
- Increase the success of restoration sites in meeting their identified goals.
- Involve citizens and community groups in monitoring and restoration activities to educate the citizenry about resource and water quality issues and increase the sense of ownership of our aquatic resources.
- Decrease the polluting practices of City of Issaquah residents and visitors.

The Issaquah Stewardship Program receives funding from the City of Issaquah, Washington Department of Ecology Centennial Clean Water Program, King County Water Works and the King County Conservation District.

The primary elements of the Issaquah Stewardship Program are described below.

6.6.2.1 Issaquah Stream Team

Approximately 30 volunteers from Issaquah and the surrounding communities are currently members of the Issaquah Stream Team. They participate in monthly chemical water quality sampling, annual habitat surveys, and macroinvertebrate sampling at 16 points in Issaquah-area streams. See Section 6.4.1 and City of Issaquah (2000) for detailed information on this program.

Monitoring methods are adapted from the City of Bellevue Stream Team Program, the Clallam County Water Watchers Program and King County Water and Land Resources Monitoring Division. Parameters include:

- Monthly water quality (dissolved oxygen, pH, turbidity, conductivity, temperature)
- Annual benthic macroinvertebrates (collected by volunteers, analyzed by lab)
- Bi-annual habitat and cross section surveys along specific reaches (stream profile, riparian vegetation, erosion, logs, pools, culverts and pipes)

In 2000, the habitat survey component was adapted to monitor capital improvement projects post in-stream habitat changes at the Gilman and Pickering Reach and pre-construction condition at the Johnson site. Characterization of second year stream reaches will continue as planned. Future cross section data will be tied into cross sections established by a consultant earlier this year.

6.6.2.2 Restoration Site / CIP Maintenance and Monitoring

Under this program volunteer teams are engaged in restoration monitoring and maintenance at three restoration sites along Issaquah Creek. This element was designed to have teams adopt a particular restoration site and do all monitoring and maintenance elements at each site. As of 2000, three sites have been adopted. Given the number of sites in the City and the varied interests of community members, the program is evolving to funnel all weed control efforts to one-day weed control parties with school groups, businesses, clubs and other interested community members.

Maintenance and monitoring elements include:

- Invasive weed control
- Watering
- Potential replanting as needed
- Bird surveys
- Wildlife surveys
- Seasonal photo points
- Annual plant survival and invasive weed surveys

6.6.2.3 Issaquah Community Link Program

The Community Link program has three goals related to improving water quality: educating and involving community members in wetland assessment, restoration and neighbor education efforts, reducing polluting behaviors at single and multi-unit residences through a workshop series, and decreasing septic system failures through a door-to-door education and survey program. This project targets not only pollution sources but also a range of public participation. It recognizes that different types of education are necessary for causing behavior change across a diverse population. The following are the principal elements of this program:

- Wetland Assessment, Restoration and Neighbor Education. Community members are recruited and trained to monitor five wetlands based on the methods used during "King County Watershed Community Link."
- Pollution Prevention through Education. Educational materials (including *The Watershed Waltz and the Sammamish Swing* and *Sustainable Lifestyles*) will be used for a hands-on home assessment and educational workshop that would help 30 or more participants identify their own water quality impacts and make changes where needed.
- Septic Operation and Maintenance Program. The Septic Operation and Maintenance Program will assist in improving septic systems in high risk Sycamore and Cherry Lane neighborhoods, including a Neighborhood Pumpout.
- Project Effectiveness Monitoring / Evaluation to measure the effectiveness of the above programs.

6.6.2.4 Other Stewardship Activities

Sammamish Watershed Stewardship Facilitation. The City of Issaquah housed the Sammamish Watershed Stewardship Coordinator who:

- Maintains a clearinghouse of watershed-wide volunteer opportunities
- Assists other jurisdictions in developing needed restoration monitoring and maintenance teams
- Creates a speakers bureau program
- Pursues funding for future regional stewardship programs
- Produces *Many Hands*, a newsletter that lets volunteers know the results of their efforts.

(Note: this stewardship coordinator position has been discontinued).

Volunteer Vegetation Planting. The City, through the combined efforts of the Planning and Parks Departments as well as the King County Department of Natural Resources, recruits large groups of volunteers (100 or more) twice a year to plant native vegetation along Issaquah Creek in areas where projects have cleared non-native vegetation. Plants are purchased through grant funds from King County, available City funds, and other sources.

6.7 Habitat Enhancement and Acquisition

6.7.1 Property Acquisition

The property acquisition fund would be used to purchase houses and/or property to implement the Issaquah Creek Basin Plan and the City's Flood Mitigation Program. This includes houses that regularly flood, structures that need to be removed or moved to facilitate a capital project (e.g., bridge

replacement, channel project), or vacant land that is a critical link for a capital project. This concept was envisioned when the Issaquah Creek basin plan was developed as a way to facilitate purchase of houses and vacant land subject to flooding or that had key habitat value along Issaquah Creek and its tributaries. Funding for this program is from the Stormwater capital fund.

To qualify for purchase by the City, a flood hazard mitigation benefit must be shown. Developed properties that have been impacted by past flooding and undeveloped properties within flood hazard areas that are threatened by development generally rank the highest.

Houses that have been purchased through the flood mitigation program the last five years are summarized in Table 6-9.

Table 6-9 Summary of Floodplain Acquisitions for Flood Hazard Mitigation

Purchase Date	Name and Location	Repetitive Loss Property?	Status
1994	Dodge 75 SW Clark Street	Yes	House removed in 1994. Parcel maintained as open space.
1994	Ryan 85 SW Clark Street	No	House removed in 1994. Parcel maintained as open space.
October 1997	Hanson 300 NW Birch Place	Yes	House removed in March 1998, site restored in Fall 1998; parcel maintained as open space.
November 1997	Sycamore lots	No	Nine undeveloped residential lots located in floodplain acquired; parcels maintained as open space.
September 1998	Reudink 200 NW Dogwood St.	Yes	Demolition completed in 2001.
July 2000	Darst 180 NW Cherry Place	No	Demolition completed in 2001.

Property acquisition is included in the 6-year CIP, but funding is contingent on approval in annual city budgets. Key houses or parcels that would greatly benefit the stream CIP projects described above will be targeted. Additionally, several residents have expressed interested in selling their flood-prone home to the City.

The City also acquires vacant properties as a means to preserve open space, protect sensitive areas and fish habitat, and provide land for passive recreation parks. These acquisitions are funded through several means, primarily through mitigation for major development projects and grants.

6.7.2 Other City Property Acquisitions

The City has purchased several large properties along Issaquah Creek in past years for open space preservation purposes, aided by grants from state and local sources. The City has also been successful in preserving open space as part of development agreements and SEPA mitigation. These open space tracts are deeded to the City or have been preserved using conservation easements. In combination, these acquisitions provide prime opportunities to prevent further development from occurring along stream banks and in riparian corridors, and restore degraded stream and riparian habitats.

Figure 6-3 shows land parcels along Issaquah-area streams that have been acquired during the last few decades, plus other privately-owned parcels that are currently being sought for acquisition.

6.8 Stormwater Resource Action Plan

Several stormwater management activities are conducted under the Stormwater Resources Action Plan. This project supports a variety of efforts aimed at stewardship, education, regional support and aquatic monitoring related to storm and surface waters in the City of Issaquah. Specific project elements include:

- Stewardship and education in coordination with the Resource Conservation Office;
- Regional support to WRIA 8 ESA efforts, including Interlocal Agreement for watershed planning;
- Support to Issaquah Creek Basin Steward (King County staff position);
- Special studies related to flooding, water quality and fish resources; and
- Implementation of the City's Comprehensive Aquatic Resources Monitoring Program.

This project enables the City to implement the Issaquah Creek Basin Plan and Water Resource Action Plan, and coordinate with other local governments in the implementation of regional surface and stormwater programs and response to the ESA listings for Chinook.

6.9 Special Studies

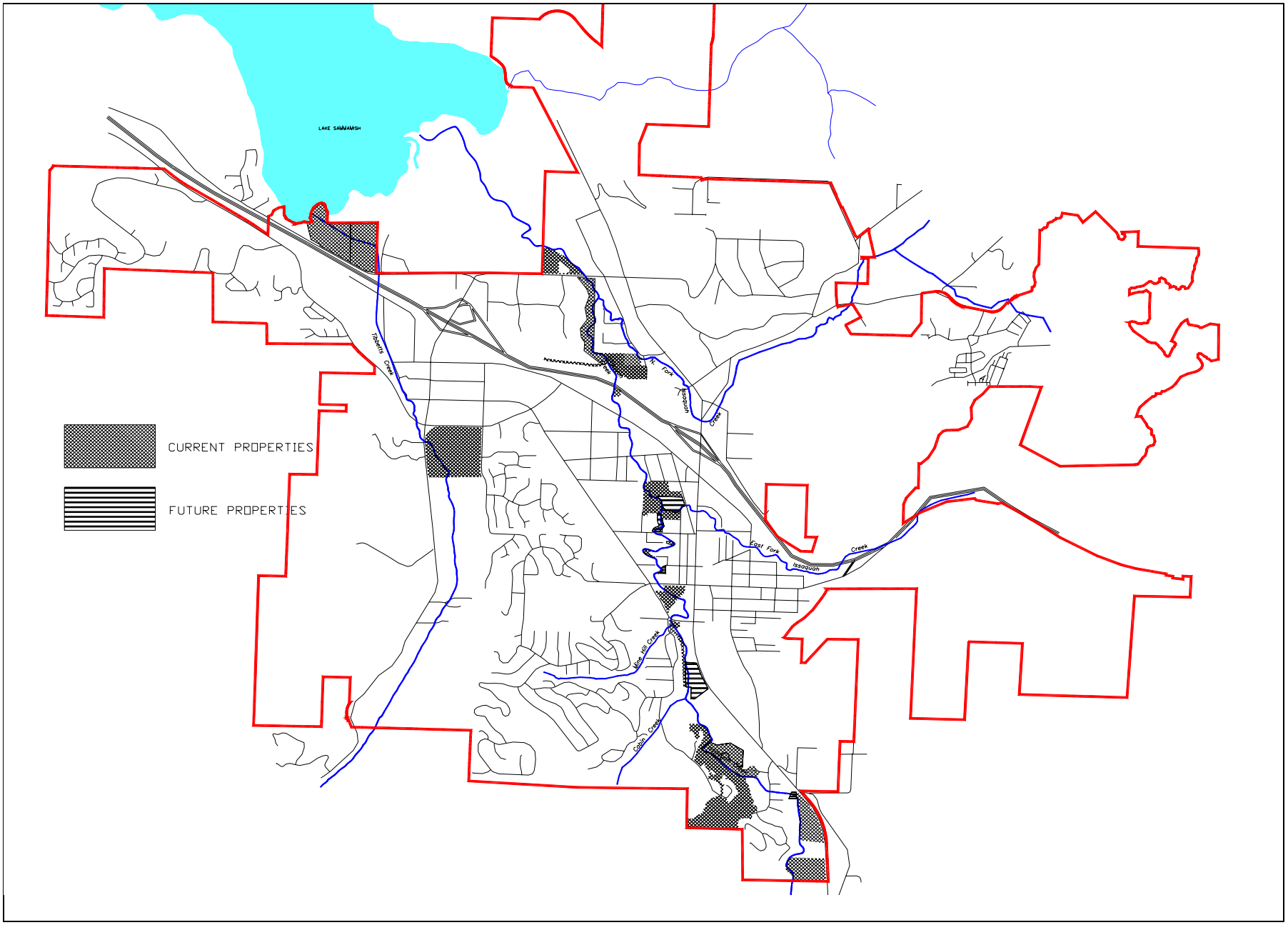
Special studies are occasionally conducted to address specific issues related to improving water quality, instream habitat, and streamflow conditions in area streams. At this time the following studies are planned in the near future:

- Integrated Pest Management (IPM) Plan. This plan is designed to recommend policy on use of pesticides on City property, determine levels of service to determine quantities of chemicals (or other pest-control methods) needed to achieve desired landscape appearances, and prepared standard operating procedures for use of chemicals at different City landscapes. This project is being conducted jointly with the Parks and Recreation Department and Public Works Operations Department. Funding was allocated in late 2001 to for a consultant to initiate this project. Parks will complete the plan under their ongoing work program.

- Stormwater Infiltration Evaluation. This study was conducted to determine the feasibility of retrofitting City stormwater systems to recharge stormwater to the shallow aquifer. Recharge of stormwater will help mitigate losses of base flows in area streams caused by the increased imperviousness within the City. Funding was allocated in the 2002 budget for this project, and a report was issued in early 2003. The Planning Department will also be developing a Critical Aquifer Recharge Area (CARA) ordinance to provide critical area designation to aquifer recharge areas of the City.

- Development of a Spill Response Plan (see Section 6.4.2).

Figure 6-3 Open Space Acquisitions and Preserved Areas along Issaquah Streams



Section 7
CAPITAL IMPROVEMENT PROGRAM

This chapter summarizes projects approved in the 2002 and 2003 budgets and those recommended in the 6-year Capital Improvement Program (CIP) for the period 2004 to 2008 based on the capital improvement recommendations described in Chapter 5 and the programmatic recommendations in Chapter 6. The projects listed herein are those proposed for consideration during the budgeting and utility rate assessment process. Due to limitations on available funding and changing priorities, it is likely that not all projects identified in current CIP planning documents will be adopted by future budgets.

The CIP categorizes the stormwater needs as follows:

- Stormwater Improvements – maintenance and improvements to stormwater runoff conveyance facilities
- Flooding and Habitat Improvements – improvements to flood flow conveyance and habitat conditions along Issaquah Creek and other streams
- Programmatic – programs implemented by City staff to improve management of stormwater and floodplain resources

The project information presented below is intended to assist in the planning process. Much additional work and evaluation must be conducted before any of these projects can be implemented. For example, projects often rely heavily on the cooperation of property owners to sell their property to the City or grant an easement, or are dependent on grant assistance; whether a project can go forward sometimes cannot be determined until detailed studies are conducted to determine which properties are needed and whether funding is sufficient.

7.1 Capital Improvement Program

Descriptions of the major capital projects in the Stormwater CIP are summarized in Tables 7-1. This table summarizes projects approved in the 2002 and 2003 budgets and recommended projects from the 6-year CIP for 2003-2008. Figure 5-1 shows the locations of many of these projects. Cost estimates for these projects are based on very gross funding "goals" based on experience with similar projects. Detail cost estimates will be conducted upon development of annual capital budgets and other budget requests.

7.2 Funding Alternatives

CIP funding alternatives include external and internal funds. External funds include sources such as potential federal, state and local grants, developer mitigation, and other sources that do not require payment. The following grant sources will be particularly sought after:

- Department of Ecology Centennial Clean Water Fund: funding of stormwater quality, property acquisition, and habitat enhancements
- Department of Ecology Flood Control Account Assistance Program (FCAAP): floodplain mapping, property and habitat acquisition, and flood control projects

- FEMA flood disaster mitigation: acquisition and flood control project funding (post-flood only)
- ESA: Funds from local watershed (i.e., WRIA 8) for habitat acquisition and enhancements (actual grant sources to be determined). Includes King Conservation District funds obtained through Sammamish Watershed Forum.

Table 7-2 identified the assumed grant funds that will be available to support the CIP in Table 7-1. The anticipated funding sources shown should not be construed as a commitment by the City to fund individual projects in accordance with the percentages indicated. Funding for only the 2002 and 2003 projects have been approved by the City Council. All future projects will be reviewed prior to their implementation to determine the best method of financing, including the availability of potential grant sources and cost sharing from developer mitigation monies, in order to minimize the costs borne by the City.

Table 7-1 Approved 2002 and 2003 Budgets and Recommended Projects from the 2003-2008 Capital Improvement Program

No	CIP Item (See Table 4-7 for description)	Projected Capital Improvement Program Costs (thousands of dollars)							Total	Comments
		2002	2003	2004	2005	2006	2007	2008		
Stormwater Improvements										
1	City Drainage Rehabilitation and Improvements	75	75	200	200	200	200	200	$1,150	Yearly program for improvements
2	TV Inspection of Storm Drain Lines	0	15	15	15	15	15	15	$90	Condition assessment
3	Water Quality Retrofits (S-26)	0	0	0	25	200	0	0	$225	Grants will provide additional funds
Flooding and Habitat Improvements										
4	Issaquah Creek – Dogwood bridge replacement (F-3a)	0	0	40	850	300	5	5	$1,200	
5	Issaquah Creek – Sycamore conveyance improvements (F-5)	0	25	0	0	0	0	0	$25	$25k grant
6	Issaquah Creek – Squak Valley Park side channel (F-6)	0	815	200	5	5	5	0	$1,030	100% federal funding for $1m construction.
7	Tibbetts Creek Greenway – Manor/Kelly Reach (F-12, 13)	140	865	25	15	15	0	0	$1,060	$246k from grant and mitigation funds
8	Tibbetts Creek – Bianco Mine tailings stabilization (F-14)	210	10	5	2	2	0	0	$229	$150k in mitigation funds
9	Property Acquisition and Habitat Enhancement/Restoration (F-15)	0	0	250	0	300	300	300	$1,150	
Programmatic and Other										
10	Stormwater Resources Action Plan (P-1, P-2, P-3)	70	90	92	94	96	98	100	$640	Portion of funding for RCO projects
11	Stormwater System Surveying (P-8)	50	0	100	10	10	10	10	$190	Ongoing updating of stormwater inventory
12	Utility Rate Update (P-10)	35	0	0	0	0	100	0	$135	Complete Project started in 2001
13	Floodplain/Floodway Mapping (P-15)	0	0	50	0	0	0	0	$50	
14	Channel Improvements Monitoring and Maintenance (P-17)	0	0	16	17	18	19	20	$90	Ongoing program
15	Aquifer Recharge study (S-27)	50	0	0	0	0	0	0	$50	
16	Gilman/Pickering Monitoring and Maintenance (F-1, F-2)	5	40	2.5	20	2.5	2.5	20	$92	
	TOTAL	635	1935	995	1253	1163	754	670	$7,406	

Table 7-2 Summary of Stormwater CIP Projected Costs (2002-2008)

No.	CIP Item (See Table 4-7 for description)	Revenue Source (percent)		Estimated Cost ($1000's)			Funds for "Other"
		City	Other	City	Other	Total	
Stormwater Improvements							
1	City Drainage Rehabilitation and Improvements	100%	0%	$1150	$0	$1150	
2	TV Inspection of Storm Drain Lines	100%	0%	$90	$0	$90	
3	Water Quality Retrofits (S-26)	100%	0%	$225	$0	$225	Future grants not yet identified (assumed to cover 2/3 of cost).
Flooding Improvements							
4	Issaquah Creek – Dogwood bridge replacement (F-3a)	100%	0%	$1200	$0	$1200	
5	Issaquah Creek – Sycamore conveyance improvements (F-5)	0%	100%	$0	$25	$25	King Conservation District grant
6	Issaquah Creek – Squak Valley Park side channel (F-6)	3%	97%	$30	$1000	$1030	Federal funding through Corps of Engineers
7	Tibbetts Creek Greenway – Manor/Kelly Reach (F-12, 13)	78%	22%	$874	$246	$1,120	$146K Ecology grant, $100k Intracorp mitigation
8	Tibbetts Creek – Bianco Mine tailings stabilization (F-14)	34%	66%	$79	$150	$229	Intracorp mitigation.
9	Property Acquisition and Habitat Enhancement/Restoration (F-15)	100%	0%	$1150	$0	$1150	Future grants not yet identified.
Programmatic							
10	Stormwater Resources Action Plan (P-1, P-2, P-3)	100%	0%	$640	$0	$640	
11	Stormwater System Surveying (P-8)	100%	0%	$190	$0	$190	
12	Utility Rate Update (P-10)	100%	0%	$135	$0	$135	
13	Floodplain/Floodway Mapping (P-15)	100%	0%	$50	$0	$50	
14	Channel Improvements Monitoring and Maint. (P-17)	100%	0%	$90	$0	$90	
15	Aquifer Recharge study (S-27)	100%	0%	$50	$0	$50	
16	Gilman/Pickering Monitoring and Maintenance (F-1, F-2)	100%	0%	$92	$0	$92	
	TOTAL	**81%**	**19%**	**$5985**	**$1421**	**$7406**	

Section 8
REFERENCES

CH2M Hill. 1993. Draft Comprehensive Floodplain and Drainage Management Plan. Prepared for City of Issaquah by CH2M Hill, Inc., Bellevue, Washington. January 1993.

CH2M Hill. 2001. Sammamish Plateau Water and Sewer District Water Comprehensive Plan. CH2M Hill, Inc., Bellevue, Washington. May 2001.

City of Issaquah. 1995. City of Issaquah Resource Action Plan. City of Issaquah, Washington. August 8, 1995.

City of Issaquah. 1996a. FEMA Hazard Mitigation Grant Application (February 1996 Floods), Priority No. 1: Gilman Area Channel Improvements. City of Issaquah, Washington. May 1996.

City of Issaquah. 1996b. FEMA Hazard Mitigation Grant Application (February 1996 Floods), Priority No. 2: Cherry Area Channel Reconstruction. City of Issaquah, Washington. May 1996.

City of Issaquah. 1996c. FEMA Hazard Mitigation Grant Application (February 1996 Floods), Priority No. 3: Sycamore Area Channel Reconstruction. City of Issaquah, Washington. May 1996.

City of Issaquah. 1996d. FEMA Hazard Mitigation Grant Application (February 1996 Floods), Priority No. 4: Pickering Farm Area Channel Reconstruction. City of Issaquah, Washington. May 1996.

City of Issaquah. 1996e. FEMA Hazard Mitigation Grant Application (February 1996 Floods), Priority No. 5: School District Administration Area Channel Reconstruction. City of Issaquah, Washington. May 1996.

City of Issaquah. 1996f. FEMA Hazard Mitigation Grant Application (February 1996 Floods), Priority No. 6: State Route 900 Area Channel Reconstruction. City of Issaquah, Washington. May 1996.

City of Issaquah. 1996a. FEMA Hazard Mitigation Grant Application (February 1996 Floods), Gilman Area Channel Improvements. City of Issaquah, Washington. May 1996.

City of Issaquah. 1999, 2001. City of Issaquah Comprehensive Plan. City of Issaquah Planning Department, Issaquah, Washington. Prepared in 1996 and updated in 1999 and 2001.

City of Issaquah. 2003. State of Our Waters, Issaquah Creek Water Quality Monitoring Report, 1999-2002. City of Issaquah Public Works Department, Issaquah, Washington.

Entranco. 1989. Lake Sammamish Water Quality Management Project, Summary Report. Entranco Engineers, Bellevue, Washington. October 1989.

Entranco. 1996. Lake Sammamish Water Quality Management Plan. Entranco Engineers, Bellevue, Washington. October 1989.

FEMA. 1977. Flood Insurance Study, City of Issaquah, Washington. Federal Emergency Management Agency, Flood Insurance Administration. November 1979.

FEMA. 1995. Flood Insurance Study, King County, Washington and Incorporated Areas. Federal Emergency Management Agency, Flood Insurance Administration. May 16, 1995.

Golder. 1993. Lower Issaquah Valley Wellhead Protection Plan. Prepared for City of Issaquah and Sammamish Plateau Water and Sewer District by Golder Associates, Redmond, Washington. November 1993.

Griffin, M., 2000. Personal communication in Issaquah Press. Issaquah Fish Hatchery, Issaquah, Washington. November 11, 2000.

Herrera. 1997. Issaquah Highlands (Grand Ridge): Comprehensive Monitoring Plan. Prepared for Grand Ridge Limited Partnership. Herrera Environmental Consultants, Seattle, Washington.

Herrera. 2002. Issaquah Stormwater Treatment, Continuous Deflective Separation Performance Monitoring Report. Prepared for City of Issaquah. Herrera Environmental Consultants, Seattle, Washington.

Issaquah Creek Groundwater Advisory Committee. 1999. Issaquah Creek Valley Groundwater Management Plan. Issaquah Creek Groundwater Advisory Committee, Issaquah, Washington.

King County. 1991. Issaquah Creek Basin Current/Future Conditions and Source Identification Report. King County Department of Natural Resources, Seattle, Washington. October 1991.

King County. 1993. Draft Technical Appendix 1: Flood Protection Alternatives for the Issaquah Creek Basin. King County Department of Natural Resources, Seattle, Washington.

King County. 1993. Draft Technical Appendix 2: Floodproofing and Removal of Floodplain Structures in the Issaquah Creek Basin. King County Department of Natural Resources, Seattle, Washington.

King County. 1994. Appendix to the Watershed Management Committee Proposed Issaquah Creek Basin and Non-point Action Plan. King County Department of Natural Resources, Seattle, Washington.

King County. 1995. Regional Needs Assessment, Report and Recommendations. King County Department of Natural Resources, Seattle, Washington. July 25, 1995.

King County. 1995. Hydrologic Monitoring Report. King County Department of Natural Resources, Seattle, Washington. March 1995.

King County. 1995. Lake Sammamish Total Phosphorus Model. Report to King County Department of Metropolitan Services and Surface Water Management Division. July 1995

King County. 1996. Issaquah Creek Final Basin and Nonpoint Actin Plan. King County Department of Natural Resources, Seattle, Washington. December 1996.

King County. 1998. Lake Sammamish Water Quality Project, Final Report. King County Department of Natural Resources, Seattle, Washington. July 1998.

King County. 1999. Issaquah Creek Valley Ground Water Management Plan. Prepared for the Issaquah Creek Valley Ground Water Management Committee by King County Department of Natural Resources, Seattle, Washington. March 1999.

King County. 2000. Issaquah Creek Basin Draft Sub-Area Summary. King County Department of Natural Resources, Seattle, Washington. March 2000.

METRO. 1989. Quality of Local Lakes and Streams, 1987-1988 Status Report. Municipality of Metropolitan Seattle, Water Resources Section. Seattle, Washington. August 1989.

METRO. 1990. Quality of Local Lakes and Streams, 1989-1990 Status Report. Municipality of Metropolitan Seattle, Water Resources Section. Seattle, Washington.

METRO. 1994. Quality of Local Lakes and Streams, Western King County 1990-1993. King County Department of Metropolitan Services, Water Resources Section. Seattle, Washington. February 1994.

Montgomery Water Group. 1996. Preliminary Hydraulic Modeling Analysis of Issaquah Creek for Proposed Basin Flood Control Program. Prepared for City of Issaquah by Montgomery Water Group, Kirkland, Washington. April 30, 1996.

Montgomery Water Group. 2001. Cougar Mountain East Village Monitoring Plan. Montgomery Water Group, Kirkland, Washington.

Montgomery Water Group. 2001. Issaquah Creek Flood Insurance Study Revisions, Technical Support Data Notebook. Montgomery Water Group, Kirkland, Washington. September 2001.

Partners for a Clean Lake Sammamish. 1996. Lake Sammamish Initiative, Report and Recommendations. Cities of Bellevue, Issaquah, Redmond, and King County. July 10, 1996.

Puget Sound Water Quality Authority. 1994. 1994 Puget Sound Water Quality Management Plan. Puget Sound Water Quality Authority, Olympia, Washington. Adopted May 18, 1994.

Puget Sound Water Quality Action Team. 2001. 2001-2003 Puget Sound Water Quality Work Plan. Puget Sound Water Quality Authority, Seattle, Washington. July 2001.

RH2. 1996. City of Issaquah Proposed Basin Flood Control Program. March 1996. Prepared for City of Issaquah by RH2 Engineering, Redmond, Washington.

Roth Hill. 2002. City of Issaquah Draft Water Conservation Plan. Roth Hill Engineering Partners, Inc., Bellevue Washington.

Shannon & Wilson. 1996. Issaquah Creek Channel Improvements, Gilman Area Hydraulic Model and Analysis. Shannon & Wilson, Seattle, Washington.

Taylor Associates. 2001. Issaquah Creek Channel Improvements: Pickering Reach First and Second Year Monitoring Report (1999 and 2000). Taylor Associates, Seattle, Washington.

Washington Department of Ecology. 1999. Draft Issaquah Creek Basin Fecal Coliform Total Maximum Daily Load. Washington Department of Ecology, Olympia, Washington. December 1999.

Washington Department of Ecology. 2001. Stormwater Management Manual for Western Washington. Washington Department of Ecology, Olympia, Washington. August 2001.

Washington Department of Fisheries. 1975. Catalog of Washington Streams and Salmon Utilization. Washington Department of Fisheries, Olympia, Washington.

Watershed Company, The. 2002. Issaquah Creek Channel Improvements: Gilman Reach 1st Through 3rd Year Monitoring Report. The Watershed Company, Kirkland, Washington.

Watershed Company, The. 2002. Issaquah Creek Channel Improvements: Pickering Reach 3rd Year Monitoring Report. The Watershed Company, Kirkland, Washington.

WRIA 8 Technical Committee, 2001. Draft Reconnaissance Assessement – Habitat Factors that Contribute to the Decline of Salmonids, Greater Lake Washington Watershed Water Resource Inventory Area 8. Prepared for the WRIA 8 Steering Committee. King County Department of Natural Resources, Seattle, Washington.

WRIA 8 Technical Committee, 2002. Lake Washington/Cedar/Sammamish Watershed (WRIA 8) Near-Term Action Agenda for Salmon Habitat Conservation. Prepared for the WRIA 8 Forum. King County Department of Natural Resources, Seattle, Washington.

U.S. Army Corps of Engineers. 1971. Special Flood Hazard Information, Issaquah and Tibbetts Creek, Issaquah and Vicinity, Washington. U.S. Army Corps of Engineers, Seattle, Washington District. June 1971

Appendix A
Flood History Data

(this page intentionally left blank)

1. PRECIPITATION

1.1 Historical Precipitation

The largest floods in Issaquah are typically associated with heavy winter rainfall lasting up to a week, cumulating in an intense 24-hour rainfall. Over this period soils become extremely saturated, resulting in highly efficient runoff if the sequence of storms cumulates in a particularly wet rainfall event. Snowmelt from the upper elevations of the Issaquah Creek watershed often accompanies the largest rainfall events because the moisture in these storms originate from the warmer regions of the central Pacific ocean; these storms are termed the "pineapple express."

Table A-1 summarizes the total amounts of precipitation at various locations in the Issaquah Creek watershed during recent storm events. Storm rainfall is presented for three durations: 24 hours, 72 hours, and 7 days. These data were recorded at King County monitoring stations, the records for which begin in the late 1980's. Precipitation amounts at two National Weather Service stations -- SeaTac and Landsburg -- are also listed in Table A-1. Historical hourly precipitation data from these stations are available dating back to October 1948.

During recent major flood events, total rainfall in the Issaquah area was typically 7-8 inches over 7 days, 4-6 inches over 72 hours, and 3.5-4.0 inches over 24 hours. If snowmelt is present, this would add to the total water available for runoff if melt occurs during the peak 24-hour intensity. Precipitation at SeaTac, where most weather reporting occurs in Western Washington, is considerably less than in Issaquah. Precipitation amounts in the Issaquah Creek watershed are more similar to Landsburg than to SeaTac, particularly in the longer-duration totals. Landsburg is located along the Cedar River about 10 miles south of Issaquah.

1.2 Precipitation Frequency

Rainfall depth-duration-frequency estimates for three locations in the Issaquah Creek watershed and also SeaTac Airport are summarized in Table A-2. The 100-year/24-hour precipitation for Issaquah is in the range of 5.3-5.7 inches. The greatest amount of 24-hour precipitation recorded during recent flood events has been 4.1 inches, recorded at the Highlands in January 1990. This is equivalent to about a 25-year rainfall event. Rainfall depths during the February 1996 flood event varied widely, with the Tibbetts Creek 24-hour rainfall near the 5-year event and the Hobart 72-hour and 7-day rainfall between the 10- and 25-year events.

Table A-1 Precipitation associated with Historical Flood Events

Event	Issaquah Creek Flow (cfs)	Location	Total Precipitation (in)		
			24-Hour	72-Hour	7-Days
February 9, 1951	4,000-4,800	Landsburg	4.63	6.92	8.12
		SeaTac	3.56	5.32	6.23
December 3, 1975	2,870	Landsburg	2.46	4.63	6.13
		SeaTac	1.81	3.04	3.78
November 24, 1986	3,100	Landsburg	4.10	6.00	8.60
		SeaTac	3.32	4.15	5.82
January 9, 1990	3,200	Landsburg	3.90	5.90	7.70
		SeaTac	3.00	4.60	5.96
		Tibbetts Creek	3.77	5.56	7.33
		Hobart	3.77	5.43	7.26
		Issaquah Highlands	4.10	6.00	8.22
November 24, 1990	2,410	Landsburg	4.21	4.74	5.28
		SeaTac	3.58	4.27	4.63
		Tibbetts Creek	3.53	4.37	5.26
		Hobart	3.84	5.13	6.51
		Issaquah Highlands	3.39	4.53	5.61
November 29, 1995	2,160	Landsburg	2.30	4.10	6.00
		SeaTac	2.30	3.00	4.53
		Tibbetts Creek	2.42	3.99	6.09
		Hobart	2.70	4.97	7.51
		Issaquah Highlands	2.58	4.46	6.17
February 8, 1996	3,500	Landsburg	4.00	6.40	7.30
		SeaTac	3.29	5.12	5.92
		Tibbetts Creek	3.35	5.05	6.99
		Hobart	3.72	6.41	7.84
		Issaquah Highlands	3.35	5.03	6.70

Data Sources: King County DNR HSPF file for 1949-1998 Landsburg and SeaTac;
King County Gauges 67U – Tibbetts Creek, 25Y – Hobart, and 46U – Issaquah Highlands

Table A-2 Rainfall Depth-Duration-Frequency Estimates

Return Period	Location	Total Precipitation (in)		
		24-Hour	72-Hour	7-Day
100-Year	SeaTac	4.4	6.1	7.8
	Tibbetts Creek	5.7	7.9	10.1
	Hobart	5.3	7.9	10.6
	Issaquah Highlands	5.3	7.3	9.4
50-Year	SeaTac	4.0	5.5	7.2
	Tibbetts Creek	5.2	7.2	9.4
	Hobart	5.0	7.5	9.7
	Issaquah Highlands	4.8	6.6	8.6
25-Year	SeaTac	3.5	4.9	6.5
	Tibbetts Creek	4.6	6.4	8.5
	Hobart	4.4	7.0	8.9
	Issaquah Highlands	4.2	5.9	7.8
10-Year	SeaTac	3.0	4.2	5.7
	Tibbetts Creek	3.9	5.5	7.4
	Hobart	3.9	5.8	7.8
	Issaquah Highlands	3.6	5.0	6.8
5-Year	SeaTac	2.6	3.6	5.1
	Tibbetts Creek	3.4	4.7	6.6
	Hobart	3.6	5.2	6.8
	Issaquah Highlands	3.1	4.3	6.1
2-year	SeaTac	2.0	2.9	4.2
	Tibbetts Creek	2.6	4.9	5.5
	Hobart	2.9	4.2	5.6
	Issaquah Highlands	2.4	3.5	5.0

Data source: King County DNR, 1996.

1.3 Historical Floods Peaks

Table A-3 summarizes the peak annual flood events recorded at the USGS gauges on Issaquah Creek at SE 56th Street for the period 1946-1999 (a figure with these flood peaks is contained in the main report in Figure 2-4). A 54-year record of annual floods is obtained by combining the records of 1946-1963 for the May Valley gauge with the records of 1964-1999 for the SE 56th Street gauge. A multiplication factor of 1.56 was used to estimate the downstream flow rate from the upstream flow rate. The factor was calculated by the ratio of drainage areas raised to 0.60 power; this exponent is based on simultaneously gauged floods recorded at Hobart and SE 56th Street between 1986 and 1999.

Table A-3 Recorded Annual Maximum Floods on Issaquah Creek

Water Year	Date	Peak Annual Flood Flow (cfs)			
		Issaquah Creek at Hobart	Issaquah Creek at SE May Valley Road	Issaquah Creek at Mouth (SE 56th Street)	Issaquah Creek at Mouth – Extended Record
Drainage area:		**17.6 sq mi**	**27 sq mi**	**56.6 sq mi**	**56.6 sq mi**
1946	12/28/1945	--	452	--	705
1947	12/14/1946	--	675	--	1,053
1948	2/26/1948	--	540	--	842
1949	2/17/1949	--	1,120	--	1,747
1950	3/4/1950	--	800	--	1,248
1951	2/9/1951	--	2,610	--	4,000
1952	2/4/1952	--	342	--	534
1953	1/31/1953	--	580	--	905
1954	12/9/1953	--	781	--	1,218
1955	2/8/1955	--	740	--	1,154
1956	12/11/1955	--	1,050	--	1,638
1957	2/25/1957	--	596	--	930
1958	1/17/1958	--	566	--	883
1959	1/24/1959	--	680	--	1,061
1960	12/15/1959	--	1,130	--	1,763
1961	11/24/1960	--	637	--	994
1962	12/24/1961	--	296	--	462
1963	2/3/1963	--	438	--	683
1964	1/1/64	--	750	1,950	1,950
1965	1/29/65	--	--	1,600	1,600
1966	1/7/66	--	--	876	876
1967	12/13/66	--	--	1,480	1,480
1968	12/25/67	--	--	1,090	1,090
1969	1/5/69	--	--	1,960	1,960
1970	1/24/70	--	--	824	824
1971	1/9/71	--	--	1,710	1,710
1972	2/28/72	--	--	2,260	2,260
1973	12/26/72	--	--	964	964
1974	1/16/74	--	--	1,160	1,160
1975	2/20/75	--	--	1,390	1,390
1976	12/3/75	--	--	2,870	2,870
1977	12/26/76	--	--	398	398
1978	12/15/77	--	--	1,670	1,670
1979	12/1/78	--	--	836	836
1980	3/6/72	--	--	1,940	1,940
1981	12/26/80	--	--	1,180	1,180
1982	1/24/82	--	--	1,920	1,920
1983	1/5/83	--	--	2,110	2,110
1984	1/25/84	--	--	2,330	2,330
1985	12/14/84	--	--	460	460
1986	1/19/86	460	--	2,300	2,300
1987	11/24/86	1,210	--	3,100	3,100
1988	2/17/82	462	--	1,250	1,250
1989	12/1/64	576	--	1,330	1,330
1990	1/9/90	1,350	--	3,200	3,200

Table A-3 Recorded Annual Maximum Floods on Issaquah Creek

1991	11/24/90	1,360	--	2,410	2,410
1992	1/28/92	324	--	1,110	1,110
1993	3/23/93	353	--	739	739
1994	3/3/94	170	--	471	471
1995	2/19/95	658	--	1,740	1,740
1996	2/8/96	1,470	--	3,000	3,000
1997			--	1,830	1,830
1998			--	729	729
1999			--	1,840	1,840

Data source: U.S. Geological Survey. The February 1996 event is reported as 2,420 cfs. Since observations indicated that this event was only slightly lower than the January 1990 event, the City of Issaquah estimates that this flood was likely in the 3000-3500 cfs range.

2. FLOOD FREQUENCY

Flood frequency estimates from available sources are summarized in Table A-4. The first entries, from a 1964-1999 stream gauge analysis, was developed recently for the City's FEMA Flood Insurance Rate Map update project. The other estimates were developed from previous flood insurance, basin plan, and flood hazard studies. It is noted that past flood insurance studies have all used the same flood frequency estimates that were derived in the 1970's using relatively short periods of streamflow records. However, the updated flood frequency estimates using 1964-1999 data are consistent with, or are slightly lower than, the earlier estimates.

Table A-4 Flood Frequency Estimates

Stream and Location	Drainage Area (sq mi)	Peak Discharge (cfs)			
		10-Year	50-Year	100-Year	500-Year
1964-1999 Stream Gauge Analysis (City of Issaquah Flood Insurance Rate Map update)					
Issaquah Creek at Mouth	56.6	2,820	4,140	4,670	5,890
East Fork Issaquah Creek	9.5	560	900	1050	--
1979 and 1995 Flood Insurance Studies					
Issaquah Creek at Mouth	56.6	2,580	3,980	4,700	6,700
Issaquah Creek at Cedar Gr.	27.0	1,300	2,050	2,430	3,500
North Fork Issaquah Creek	4.8	270	425	510	750
East Fork Issaquah Creek	9.5	440	725	850	1,100
Tibbetts Creek at Mouth	3.9	220	355	425	600
North Fork Limited Map Maintenance Study (NHC 1995)					
North Fork Issaquah Creek	4.8	176	269	315	445
Issaquah Creek Basin Plan (1989 modeled conditions)					
Issaquah Creek at Mouth	56.6	2880	3940	4420	5630
North Fork Issaquah Creek	4.8	140	220	260	370
East Fork Issaquah Creek	9.5	600	850	970	1260
Tibbetts Creek at Mouth	3.9	330	460	520	670
1971 Corps of Engineers Flood Hazard Study (adjusted to forecasted 1990 land use)					
Issaquah Creek at Mouth	56.6	--	--	4,750	--
North Fork Issaquah Creek	4.8	--	--	450	--
East Fork Issaquah Creek	9.5	--	--	850	--
Tibbetts Creek at Mouth	3.9	--	--	425	--

3. LONG-TERM TRENDS IN FLOODING

The question of whether flooding in Issaquah is getting worse is often discussed in past public meetings in Issaquah and, in general, in flood studies that evaluate trends in urban flooding. Long-term residents and experts alike have stated the opinion that urban development within the Issaquah Creek watershed is the primary contributor to increased flood peaks. The recent record of flooding supports this conclusion, in that several major floods occurred in the 1986-1996 period, whereas prior to 1986 only the December 1975 event ranked to any significance. Prior to that event, one must go back to 1951 to find a significant flood event.

3.1 Effects of Urbanization

An evaluation of the effects of urban development on peak flood rates was performed as part of the Issaquah Creek Basin Plan (King County 1994). Hydrologic modeling using the Hydrologic Simulation Program – Fortran (HSPF) was used to predict peak flood flow rates under three watershed conditions representing different levels of urbanization: 100% forested (pre-developed), 1989 land use, and future land use assuming maximum development under current zoning but without stormwater detention at new development (unmitigated land use). The results of that analysis, in terms of 100-year peak flow rates at the mouth of Issaquah Creek, is summarized in Table A-5.

Table A-5 Effects of Urbanization on Peak Flow Rates in Issaquah Creek

Land Use Scenario	100-Year Peak Flow Rate (cfs)
Forested Pre-Developed	4,110
1989 Land Use	4,420
Future Unmitigated Land Use	5,470
Future Mitigated Land Use	4,900

From this evaluation it is concluded that current levels of urbanization has caused flood peaks to increase by 8%, and under future unmitigated land use the flood magnitudes could increase by 33% over forested conditions if stormwater detention is not provided at new development. However, future land use would include stormwater detention that would mitigate some, but not all, of the predicted future increase. A reasonable estimate of the actual increase under maximum build-out in the watershed would be about half-way between the current and future maximum, or about 4,900 cfs, due to the fact that stormwater regulations do not require 100% mitigation of stormwater runoff.

Thus, under current development in the Issaquah Creek watershed, it is estimated that flood peaks have increased in magnitude by about 8% increase over that which existed prior to any development within the watershed. This change is equal to 350 cfs at the 100-year flood magnitude, but only about 200 cfs at the 10-year flood magnitude. These increases are relatively small in comparison to the annual variability in flooding on Issaquah Creek. More importantly, they do not fully account for the large increases in flooding in Issaquah during the 1986-1996 period as compared to the decades preceding 1986.

3.2 Effects of Climate Change

While increased urban development has been shown to be one cause of increased flooding in Issaquah, natural climatic variation is possibly a more important reason why the period 1986-1996 has particularly high levels of flooding. To show how significant climate change can affect flooding, Figure A-1 is a graph of maximum annual 24-hour and 72-hour precipitation events at Landsburg during the period 1949-1998. This graph shows a clear upward trend in storm precipitation during the last 50 years. For example, with the exception of 1951, prior to about 1978 the Landsburg monitoring station did not record a single 24-hour storm event with more than 3 inches of precipitation. After 1978 there were eight such events. The trend in 72-hour precipitation totals is similar. In fact, the four largest precipitation events during the last 50 years are associated with the four largest recorded flood events: 1951, 1986, 1990 and 1996. Thus, it could be demonstrated that flooding would have been particularly severe in Issaquah even with no increase in urban development.

Long-term trends in flooding can also be evaluated by examining streamflow records on nearby rivers that have similarly gauging history, but with lesser urban development or with longer gauging history. Figure A-2 is a comparison of Issaquah Creek annual floods to those recorded on the Raging River, which drains the north side of Tiger Mountain and Grand Ridge. This figure shows that high-magnitude flood events on the Raging River were much more frequent during the 1975-1996 period than during the 1949-1974 period. In fact, the Raging River experiences several major floods during the 1975-1996 that were less significant on Issaquah Creek; this is probably due to different rainfall and/or snow pack conditions in the Raging River watershed, which is at a higher average elevation. Thus, recent floods on Issaquah Creek were also experienced in nearby watersheds that have not experienced significant urban development.

Stream gauging on Cedar River, which began in 1896 and represents the longest record of river flows in this area, can be used illustrates flood conditions in the first half of this century. The Cedar River is partially regulated by Cedar Falls dam. Figure A-3 shows the comparison of Issaquah Creek flood history, which began in 1946, with the longer record of the Cedar River. This graph shows that major flood events appears to occur in long-term cycles, with a period of large flooding events in the early part of the century, followed by relatively benign conditions in the middle part of the century, followed by increased flood activity in the latter part of the century. Of particular note are the major floods that occurred between 1903 and 1911 on the Cedar River. These floods were similar or higher in magnitude to the floods experienced in the 1990s. Thus, the 1990 floods were not unusual, and in fact were not representative of the largest floods in this century.

In conclusion, while the major floods that were experienced in Issaquah during the last decade may have been made larger due the effects of development within the watershed, it is very likely that they are not unusual where viewed with respect to long-term climatic trends and cycles. While flooding in Issaquah Creek was more severe in the 1986-1996 period than in the several decades prior to 1986, these events were associated with large rainfall events that have been increasing in magnitude during the last 50 years. This pattern is likely part of a long-term climatic cycle, which also shows a period of greater flooding activity in the first few decades of this century as shown by streamflow records on the Cedar River.

Figure A-1 Historical Precipitation Trends at Landsburg

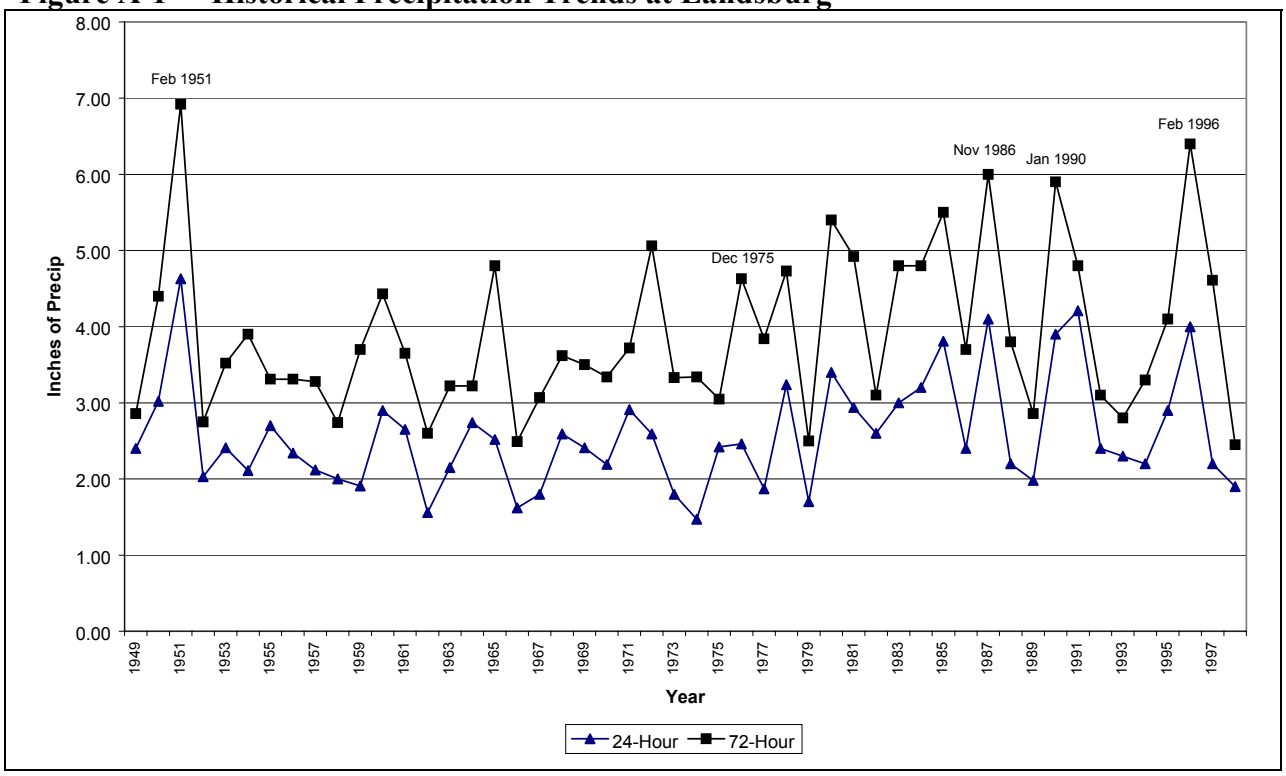


Figure A-2 Comparison of Issaquah Creek Flooding History to Longer-Term Cedar River History

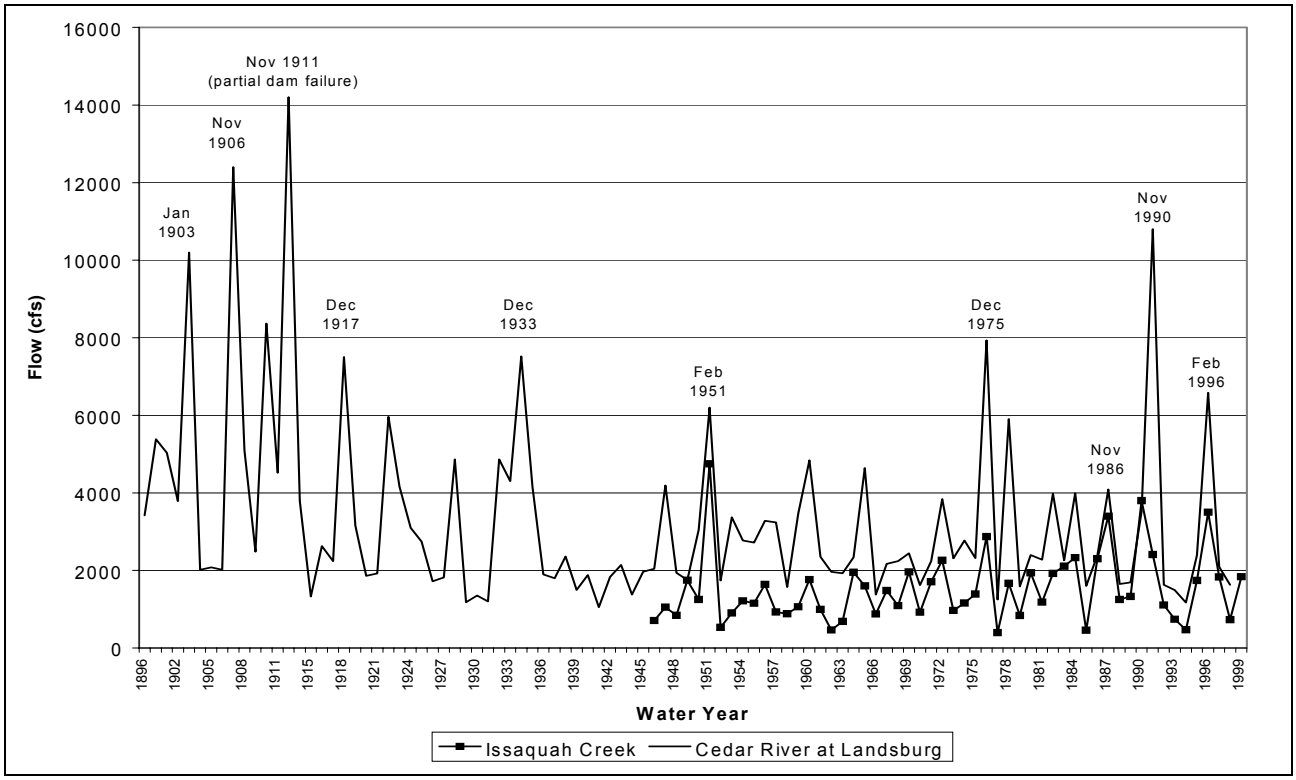
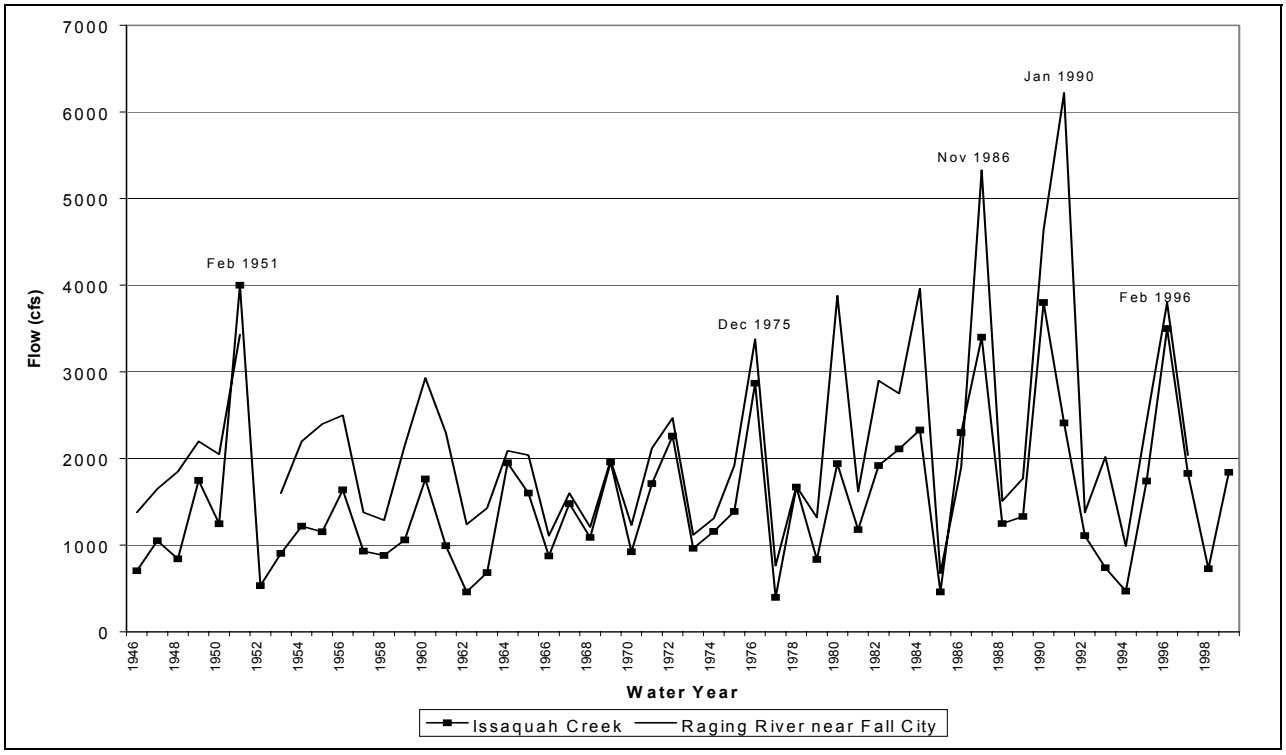


Figure A-3 Comparison of Historical Floods on Issaquah Creek and Raging River



(this page intentionally left blank)

Appendix B
Stormwater Management Ordinance

(this page intentionally left blank)

Chapter 13.28
STORMWATER
MANAGEMENT POLICY

Sections:

13.28.010 Purpose.
13.28.020 Definitions.
13.28.025 Prohibited discharges.
13.28.030 Drainage review – When required.
13.28.040 Drainage review – Requirements, review and approval.
13.28.050 Drainage review – Variances.
13.28.055 Drainage review – Deviations for low impact development proposals.
13.28.060 Construction – Timing.
13.28.070 Construction – Required bonds and liability insurance.
13.28.080 Maintenance – Maintenance of public drainage facilities.
13.28.090 Maintenance – Maintenance of private drainage facilities.
13.28.100 Maintenance – Minimum standards.
13.28.115 Best management practices for pollution source control.
13.28.120 Hazards.
13.28.130 Administration.
13.28.140 Appeals.
13.28.150 Severability.

13.28.010 Purpose.

The Council finds this chapter is necessary in order to promote the public health, safety and welfare by providing for the comprehensive management of surface and stormwaters, erosion control, and flooding. The Council also finds that this chapter is necessary in order to minimize water quality degradation; prevent flood damage, siltation and habitat destruction in the City's creeks, streams and other water bodies; to protect property owners adjacent to developing land from increased runoff rates which could cause stream erosion and damage to public and private property; to promote sound development and redevelopment policies which respect and preserve the City's watercourses and aquatic habitat; to promote low impact development strategies that reduces impervious surface and stormwater runoff; to insure the safety of City roads and rights-of-way; prevent water quality degradation and ground water recharge through the implementation of comprehensive and thorough permit review, construction inspection, enforcement, and maintenance programs in order to promote the effectiveness of the requirements contained in this chapter. (Ord. 2288 2, 2000).

13.28.020 Definitions.

The following definitions shall apply in the interpretation and enforcement of this chapter:

A. "Adjustment," a term used by King County in the Surface Water Design Manual, is equivalent to the term "variance."

B. "Applicant" means a property owner or a public agency or public or private utility which owns a right-of-way or other easement or has been adjudicated the right to such an easement pursuant to RCW 8.12.090, or any person or entity designated or named

in writing by the property or easement owner to be the applicant, in an application for a development proposal, permit or approval.

C. “Basin plan” means the 1996 Issaquah Creek Basin and Nonpoint Action Plan.

D. “Best management practices” or “BMPs” mean the best available and reasonable physical, structural, managerial, or behavioral activities, that when used singly or in combination, eliminate or reduce the contamination of surface and ground waters.

E. “Construct or modify” means to install a new drainage pipe or ditch or make improvements to an existing drainage pipe or ditch (other than routine maintenance, repair or emergency modifications, excluding driveway culverts installed as part of single-family residential building permits) that either serves to concentrate previously unconcentrated surface and stormwater runoff, or serves to increase, decrease and/or redirect the conveyance of surface and stormwater runoff.

F. “Conveyance system” means the drainage facilities and features, both natural and constructed, which collect, contain and provide for the flow of surface and stormwater from the highest points on the land down to receiving water. The natural elements of the conveyance system include swales and small drainage courses, streams, rivers, lakes and wetlands. The constructed elements of the conveyance system include gutters, ditches, pipes, channels and most flow control and water quality treatment facilities.

G. “Department” means the City of Issaquah Public Works Engineering Department or its successor organization.

H. “Development” means any activity that requires a permit or approval, including, but not limited to, clearing and grading permit, short plat approval, subdivision approval, building permit, and planned unit development approval.

I. “Director” means the Director of Public Works Engineering Department, or any duly authorized representative of such Director.

J. “Drainage” means the collection, conveyance, containment and/or discharge of surface and stormwater runoff.

K. “Drainage facility” means a constructed or engineered feature that collects, conveys, stores or treats surface and stormwater runoff. Drainage facilities shall include, but not be limited to, constructed or engineered streams, pipelines, channels, ditches, gutters, flow control or water quality treatment facilities, source control best management practices, infiltration facilities, erosion and sediment control facilities and other structures and appurtenances that provide for drainage.

L. “Drainage review” means an evaluation by City of Issaquah permit review staff of a proposed project’s compliance with the drainage requirements in the Surface Water Design Manual, references in the Surface Water Design Manual such as basin plans and critical drainage areas, other requirements stated in this chapter, other applicable requirements of the Issaquah Municipal Code including the critical areas regulations (Chapter 18.10 IMC), and conditions of development or environmental permits issued for the project.

M. “Erosion and sediment control” means any temporary or permanent measures taken to reduce erosion, control siltation and sedimentation and ensure that sediment-laden water does not leave the site.

N. “Flow control facility” means a drainage facility designed to mitigate the impacts of increased surface and stormwater runoff generated by site development pursuant to the drainage requirements in this chapter. Flow control facilities are designed either to retain water for a considerable length of time and then release it by evaporation, plant

transpiration and/or infiltration into the ground or to detain runoff for a short period of time and then release it to the conveyance system.

O. “High-use site” means a commercial, industrial or road intersection site that has characteristics that generate the potential for chronic oil accumulation. High-use sites include:

1. Commercial or industrial sites subject to:

a. An expected daily traffic count greater than 100 vehicles per 1,000 square feet of gross building area;

b. Petroleum storage or transfer in excess of 1,000 gallons per year, not including routine fuel oil storage or transfer; or

c. Use, storage or maintenance of a fleet of 25 or more diesel vehicles each weighing over 10 tons; or

2. Road intersections with average daily traffic counts of 25,000 vehicles or more on the main roadway and 15,000 or more vehicles on any intersecting roadway (excluding pedestrian or bicycle use improvement projects).

P. “Illicit connection” means a pipe or other drainage facility that conveys anything not composed entirely of surface and stormwater directly to a storm drainage system or water body, except connections containing allowable discharges as defined in IMC 13.28.025, connections conveying discharges pursuant to a NPDES permit or a State Waste Discharge Permit, and connections conveying effluent from on-site sewage disposal systems to subsurface soils.

Q. “Impervious surface” means a hard surface area which either prevents or retards the entry of water into the soil mantle as under natural conditions prior to development. Common impervious surfaces include, but are not limited to, roofs, walkways, patios, driveways, parking lots, storage areas, areas which are paved, graveled or made of packed or oiled earthen materials or other nonvegetated surfaces which similarly impede the natural infiltration of surface and stormwater. Open uncovered flow control or water quality treatment facilities shall not be considered as impervious surfaces.

R. “Improvement” means streets (with or without curbs or gutters), sidewalks, crosswalks, parking lots, water mains, sanitary and storm sewers, drainage facilities, street trees and other appropriate items.

S. “Low impact development” means use of innovative or creative approaches to site design, using methods such as retention of natural vegetation, significant reduction of effective impervious surface, enhanced infiltration, and changes in traditional site features such as roads and structures, to achieve dramatically reduced or zero drainage discharge from the site after development.

T. “Low impervious surface” or “low effective impervious surface” means impervious surface reduction to a small fraction of that resulting from traditional site development techniques such that usual manmade drainage collection systems are not necessary.

U. “Low impervious surface project” or “low effective impervious surface project” means those projects characterized by a reduction of total impervious surface to a small fraction of that which would result from traditional development. Such projects will place impervious surfaces in increments such that runoff travel distance to a vegetative buffer is minimized and does not exceed a maximum of 15 feet. Further, the landscaped areas within such projects will be minimized and buffered on the down-slope side by a forested area. A forested area shall comprise at least 60 percent of the land area upon which the project is located, shall be maintained in perpetuity and shall substitute for a

traditional drainage system. It is preferred that the site for such projects be characterized by a predominance of Soils Conservation Service Class C or D soils.

V. “Master drainage plan” means a comprehensive drainage control plan intended to prevent significant adverse impacts to the natural and constructed drainage system, both on-site and off-site.

W. “Pollution-generating impervious surface” means an impervious surface considered to be a significant source of pollutants in surface and stormwater runoff. Such surfaces include those subject to vehicular use or storage of erodible or leachable materials; wastes or chemicals and which receive direct rainfall or the run-on or blow-in of rainfall. Thus, a covered parking area would be included if runoff from uphill could regularly run through it or if rainfall could regularly blow in and wet the pavement surface. Metal roofs are also considered pollution-generating impervious surface unless they are treated to prevent leaching.

X. “Pollution-generating pervious surface” means a nonimpervious surface with vegetative ground cover subject to use of pesticides and fertilizers. Such surfaces include, but are not limited to, the lawn and landscaped areas of residential or commercial sites, golf courses, parks and sports fields.

Y. “Project” means any proposed action to alter or develop a site, which may also require drainage review.

Z. “Project site” means the portion of a site subject to proposed project activities, alterations and improvements including those required by this chapter.

AA. “Redevelopment project” means a project that proposes to add, replace and/or alter impervious surface for purposes other than routine maintenance, resurfacing, regrading, or repair on a site that is already substantially developed (35 percent or more existing impervious surface coverage).

BB. “Replaced impervious surface” means replacement of existing impervious surface during a redevelopment project for purposes other than routine maintenance, resurfacing, regrading or repair. Temporary removal of pavement for installation of utilities is not considered replaced impervious surface under this definition.

CC. “Runoff” means water originating from rainfall and other precipitation that is found in drainage facilities, rivers, streams, springs, seeps, ponds, lakes and wetlands as well as shallow ground water.

DD. “Site” means the legal boundaries of the parcel or parcels of land for which an applicant has or should have applied for authority from the City to carry out a development activity including any drainage improvements required by this chapter.

EE. “Stream channel” means the area of a natural or manmade drainage course between the tops of banks, where deposited contaminants would erode into the stream or become in contact with floodwaters during floods.

FF. “Surface and stormwater” means water originating from rainfall and other precipitation that is found in drainage facilities, rivers, streams, springs, seeps, ponds, lakes and wetlands as well as shallow ground water.

GG. “Surface Water Design Manual” means the September 1998 King County Surface Water Design Manual (and supporting documents as appropriate), as subsequently amended, prepared by King County Department of Natural Resources or its successor organization describing surface and stormwater design and analysis requirements, procedures and guidance.

HH. “Water quality treatment facility” means a drainage facility designed to reduce pollutants once they are already contained in surface and stormwater runoff. Water

quality treatment facilities are the structural component of best management practices (BMPs). When used singly or in combination, water quality facilities reduce the potential for contamination of surface and/or ground waters. (Ord. 2288 2, 2000).

13.28.025 Prohibited discharges.

A. Unlawful Discharges. It is unlawful for any person to discharge any contaminants into surface and stormwater, ground water, or within a stream channel. Contaminants include, but are not limited, to the following:

1. Illicit connections to storm drainage systems and surface water bodies, including sanitary sewers, process waste water discharge, sump overflows, internal building drains, floor drains not exposed to rainfall runoff, or other similar connections;

2. Chemicals, petroleum products, paint, solvents, detergents and degreasers, or other toxic or deleterious materials;

3. Trash, debris, food waste, animal wastes, street cleaning waste, or similar refuse;

4. Unstabilized soil, sand, gravel, pavement debris, or construction materials that can erode in an uncontrolled manner into a drainage facility or stream channel;

5. Lawn clippings, leaves, branches or other landscaping and yard debris deposited in a stream channel or drainage facility;

6. Turbid water from construction site runoff, dewatering, soil boring or other excavation activities, except if such discharge is permitted under an approved temporary erosion and sediment control plan, a State Discharge Permit for construction activities, or other similar permit, and the water treatment facilities required under the approved permit are properly designed, constructed and maintained;

7. Any other material that is considered harmful to humans, animals, or aquatic life and its habitat.

B. Allowable Discharges. The following types of discharges shall not be considered prohibited discharges for the purpose of this chapter unless the Director determines that the type of discharge is causing significant contamination of surface and stormwater or ground water.

1. Drainage from landscape watering, landscape maintenance and gardening activities at single-family residences, foundation drains and crawlspaces, roof drains, and natural groundwater and spring seepage as long as it is not causing erosion or sedimentation;

2. Water from well, reservoir, and water supply disinfection and flushing activities;

3. Dechlorinated swimming pool and spa water;

4. Car and boat washing, and other similar maintenance activities, conducted at a single-family residence; provided, that cleaning agents are biodegradable, nonphosphate, and nonsolvent based (such as engine or wheel cleaners);

5. Dye used in dye testing of stormwater drains and streams;

6. Contaminants resulting from emergency response activities or other actions that must be undertaken immediately or within a time too short to allow full compliance with this chapter, to avoid an imminent threat to public health or safety;

7. Pavement and street washing, but only after sweeping or vacuuming has first collected all debris, dirt and other material to the extent practicable; and

8. Runoff of roadway anti-icing and deicing agents; provided, that they are applied according to best management practices. (Ord. 2288 2, 2000).

13.28.030 Drainage review – When required.

A. Stormwater Management Manual Adopted. The City hereby adopts the Surface Water Design Manual, containing stormwater management design standards, methods, and procedures.

B. When Required. Drainage review is required when any proposed project meets or exceeds the threshold conditions defined in the Surface Water Design Manual (e.g., new impervious area, drainage system modifications, redevelopments, etc.) and is subject to a City development permit or approval. (Ord. 2288 2, 2000).

13.28.040 Drainage review – Requirements, review and approval.

A. Unless otherwise specified in this chapter, all standards, methods and requirements shall be in accordance with the Surface Water Design Manual.

B. Plan and Report Submittal. Drainage plans, supporting technical analyses and other required documentation shall conform to the reporting requirements contained in the Surface Water Design Manual.

C. Where to Submit. All storm drainage plans prepared in connection with any of the permits and/or approvals listed in IMC 13.28.030 shall be submitted for review and approval to the Permit Center.

D. All plans, drawings and calculations designed to control surface water and subsurface water, submitted to the City, will be prepared by a licensed professional engineer, registered in the State of Washington, and those plans, drawings and calculations will be stamped showing that engineer's registration.

E. Interpretation. The provisions of this chapter shall be held to be minimum requirements in their interpretation and application and shall be liberally construed to serve the purposes of this chapter.

F. More Strict Standard Applies. When any provision of any other ordinance of the City's regulations conflicts with this chapter, that which provides greater environmental protection shall apply unless otherwise provided for in this chapter. (Ord. 2288 2, 2000).

13.28.050 Drainage review – Variances.

A. Duties and Responsibilities. Except as provided for elsewhere in this chapter, variances (also know as adjustments) from this chapter may only be granted by the Director. The decision to grant, deny or modify the proposed variances shall be based upon evidence that the request meets the following criteria:

1. The variance is necessary to overcome a particular hardship caused by special circumstances relating to size, shape, topography or location of the subject property;

2. The variance is consistent with the intents and purposes of this chapter and other relevant City ordinances;

3. The variance shall not constitute a grant of special privilege inconsistent with limitations placed upon other properties;

4. Granting the variance will not result in harm or damage to other properties, waterways, or drainage facilities, and the variance will not be otherwise materially detrimental to public welfare;

5. The variance will produce a compensating or comparable result that is in the public interest;

6. The variance meets the objectives of safety, function, appearance, environmental protection, and maintainability based on sound engineering judgement.

B. Process. Variance application, review and approval procedures are provided in the Surface Water Design Manual, except that applications shall be submitted to the Director.

C. Conditions may be imposed upon the granting of any variance. Unless otherwise specified, the granting of a variance shall be subject to all plans, specifications and conditions set forth in the application.

D. If meeting the provisions of IMC 13.28.040 will deny reasonable use of a property, the best practicable alternative shall be obtained as determined by the Director according to the adjustment process defined in the Surface Water Design Manual.

E. The City may require monitoring of experimental designs and technology or untested applications proposed by the applicant in order to determine compliance with this section and the approved plans and conditions. (Ord. 2288 2, 2000).

13.28.055 Drainage review – Deviations for low impact development proposals.

A. Authorized Deviations from Design Standards. In order to achieve the goals of low impervious surface development, the Director may approve deviations from the standards referenced in this chapter, the Issaquah Street Standards, and other chapters of the IMC under which the Director is authorized to approve such deviations, as appropriate and necessary to achieve the goals. Deviations that require approval under the Land Use Code, such as parking and landscaping standards, will require an administrative adjustment of standards as allowed for in the appropriate section of IMC Title 18, Land Use Code.

B. Requirements. The applicant shall provide justification, in a deviation request to the Director, for each deviation requested by demonstrating that the project meets all other requirements of the IMC except for such specific deviations and that such project has a reasonable assurance of long-term success. Deviations shall be based on the following criteria:

1. The deviations will produce a compensating or comparable result in stormwater flow control and treatment that is in the public interest;

2. The deviations contribute to and are consistent with the goal of achieving low effective impervious surface area within a development;

3. The proposed development project offers reasonable assurances that low impervious surfaces will be achieved and maintained;

4. The deviations do not threaten public health or safety;

5. The deviations are consistent with generally accepted engineering and design practices;

6. The deviations promote one or more of the following:

a. Innovative site or housing design;

b. Increased on-site stormwater retention using native vegetation;

c. Retention of at least 60 percent of natural vegetation conditions over the site;

d. Improved on-site water quality beyond that required by current applicable regulations;

e. Retention or re-creation of pre-development and/or natural hydrologic conditions to the maximum extent possible;

f. The reduction of effective impervious surfaces to the maximum extent practicable;

7. The deviations do not allow density greater than what would otherwise be allowed under city regulations then in effect;

8. The deviations do not present significantly greater maintenance requirements at facilities that will be eventually transferred to public ownership;

9. There shall be submitted in conjunction with each such project, covenants, conditions and restrictions which will be binding upon the property all necessary native growth protection easements, impervious surface restrictions and such other critical features as the Director may require.

C. Evaluation and Monitoring. The Director may require that applications for approval of a project pursuant to the terms of IMC 13.28.055 be accompanied by a proposed monitoring and evaluation process designed to measure the performance of specific elements addressed in the deviations sought for the project. (Ord. 2288 2, 2000).

13.28.060 Construction – Timing.

A. Erosion and sediment control measures associated with both the interim and permanent drainage systems shall be:

1. Constructed in accordance with the approved plan prior to any grading or land clearing other than that associated with an approved erosion and sediment control plan;

2. Satisfactorily sequenced and maintained until all improvements, restoration, and landscaping associated with the permit and/or for the project are completed, and the potential for on-site erosion has passed.

B. Prior to the construction of any improvements and/or buildings on the site, those portions of the drainage facilities necessary to accommodate the control of surface and stormwater runoff discharging from the site shall be constructed and in operation. Recording of formal and administrative subdivisions may occur prior to the construction of drainage facilities when approved in writing by the Director only to minimize impacts that may result from construction during inappropriate times of the year. (Ord. 2288 2, 2000).

13.28.070 Construction – Required bonds and liability insurance.

A. The Public Works Engineering Department is authorized to require all persons constructing drainage facilities that are to be maintained by the City as provided for under IMC 13.28.080 to post with the Director cash and surety bonds to cover the cost of defects in materials, workmanship, and installation, and to correct maintenance deficiencies during the initial 2-year maintenance period following satisfactory completion of the facilities. Posting of such bonds shall be consistent with the City of Issaquah administrative policy for security deposits.

B. The person constructing the facility shall maintain a liability policy during the initial 2-year maintenance period, up until the point in time when the City assumes maintenance responsibilities (in accordance with IMC 13.28.080), with limits no less than $1,000,000 combined single limit per occurrence and $2,000,000 aggregate for personal injury, bodily injury and property damage, and shall name the City of Issaquah as an additional insured. A copy of the endorsement naming the City as additional insured shall be attached to the certificate of insurance, and shall be provided to the City prior to commencement of the work. (Ord. 2288 2, 2000).

13.28.080 Maintenance – Maintenance of public drainage facilities.

The City is authorized to assume the maintenance of drainage facilities after the expiration of the 2-year maintenance period in connection with the subdivision of land if:

A. All of the requirements of IMC 13.28.070 have been fully complied with;

B. The facilities have been inspected and approved by the Department after their second year of operation;

C. All necessary easements or dedications entitling the City to properly maintain the facility have been conveyed to the City;

D. A drainage facility, which does not meet the criteria of this section, shall remain the responsibility of the applicant required to construct the facility and persons holding title to the property for which the facility was required. (Ord. 2288 2, 2000).

13.28.090 Maintenance – Maintenance of private drainage facilities.

A. The person or persons holding title to the property and the applicant required to construct a drainage facility shall remain responsible for the facility's continual performance, operation and maintenance in accordance with the standards and requirements of the Department and remain responsible for any liability as a result of these duties. This requirement shall apply to all facilities not otherwise accepted by the City for maintenance in accordance with IMC 13.28.080.

B. Prior to the issuance of any of the permits and/or for any multifamily or commercial project required to have a flow control and/or water quality treatment facility, the applicant shall record a declaration of covenant as specified in the Surface Water Design Manual. The restrictions set forth in such covenant shall include, but not be limited to, provisions for notice to the persons holding title to the property of a City of Issaquah determination that maintenance and/or repairs are necessary to the facility and a reasonable time limit in which such work is to be completed. The restrictions set forth in such covenant shall be included in any instrument of conveyance of the subject property and shall be recorded with the King County records division.

C. The City is authorized to inspect private stormwater facilities and issue orders requiring maintenance and/or repair in accordance with IMC 13.28.130. In the event that the titleholders do not effect such maintenance and/or repairs, the City may perform such work. The City may enforce the restrictions set forth in the declaration of covenant provided in the Surface Water Design Manual.

D. The duties specified in this section with regard to payment of inspection fees and reimbursement of maintenance costs shall be enforced against the person or persons holding title to the property for which the drainage facility was required.

E. Where not specifically defined in this section, the responsibility for performance, operation and maintenance of drainage facilities and conveyance systems, both natural and constructed, shall be determined on a case-by-case basis. (Ord. 2288 2, 2000).

13.28.100 Maintenance – Minimum standards.

A. Maintenance Required. All drainage facilities, including both private and public, shall be maintained in accordance with this chapter and the Surface Water Design Manual.

1. The Director shall establish inspection, scheduling, standards and compliance procedures for maintenance of all publicly and privately owned stormwater facilities. At a minimum, for all publicly and privately owned stormwater facilities, the base frequency

for inspection and maintenance shall be annually. The Director may establish, upon review of past inspection results and experience, different frequencies of inspection based on site conditions, such as more intensive maintenance at facilities exhibiting recurring maintenance problems or high sediment loading, or reduced maintenance at facilities with low sediment loading or minimal drainage area.

2. Maintenance shall include removal of debris, sediment and vegetation, facility repairs or improvements, and other activities that are needed to ensure continued performance of the stormwater facility at a level commensurate with the original approved facility design. Maintenance standards for public and private facilities shall conform to the operation and maintenance plan contained in the latest version of the City's Stormwater Management Plan. The Director may develop additional maintenance requirements as necessary to comply with new Federal or State regulatory programs.

3. Where maintenance or repair is found necessary to correct health or safety problems, to control harmful or prohibited materials entering the stormwater system, or to remove harmful or prohibited materials that have entered the stormwater system, remedial work necessary to correct the problem shall be completed by the owner or operator of the stormwater system or stormwater facility within 24 hours. When maintenance and repair is found necessary to prevent water quality degradation, the repair shall be completed within 14 calendar days. For nonurgent problems or general maintenance, repair or maintenance shall be the completed within one month of notification by the City.

B. Disposal of Waste from Maintenance Activities. Disposal of waste from maintenance activities shall follow all applicable Federal, State and local regulations. (Ord. 2288 2, 2000).

13.28.115 Best management practices for pollution source control.

A. BMP Requirements.

1. Stormwater Pollution Control Manual Adopted. The 1995 edition of the King County Stormwater Pollution Control Manual, Best Management Practices for Businesses, as subsequently amended, is hereby adopted by the City and is hereinafter referred to as the BMP Manual. This manual provides detailed technical information on source control pollution prevention practices at commercial, industrial, multifamily and government sites that shall be implemented in accordance with this chapter to reduce the contamination of stormwater, surface water, and groundwater.

2. All proposals for new development and redevelopment shall include source control pollution prevention BMPs as required by the Surface Water Design Manual.

3. Source control BMPs shall be implemented at existing commercial, industrial, multifamily and government sites as follows:

a. In applying the BMP manual to existing developments, the Director shall first require the implementation of source control BMPs through voluntary measures using public education and informational assistance. The Public Works Engineering Department will provide, upon reasonable request, available technical assistance materials and information.

b. If, after 60 days from providing technical assistance, a request for voluntary compliance of the BMP requirements at an existing development is not adequate to prevent contaminants, as defined in IMC 13.28.025, from entering surface and stormwater or ground water in sufficient quantities such that a hazard as defined in IMC

13.28.120 is present, due to a lack of appropriate BMPs to contain the contaminants on-site, the Director may serve notice to the property owner that immediate action is required to correct the problem. Within one month the Director shall revisit the facility to ensure that BMPs have been implemented.

c. In the event that the property owners of the development site fail to implement the BMP requirements, the City may perform such work upon due notice. The titleholders of the property are required to reimburse the City for any such work.

B. Exemptions.

1. Persons implementing BMPs through another approved Federal, State, or local program will not be required to implement the BMPs prescribed in the BMP manual, unless the Director determines that the other program's BMPs are ineffective at reducing the discharge of contaminants. If the other program requires the development of a best management practices plan, the person shall make their plan available to the City upon request. Persons who qualify for exemptions include, but are not limited to, persons who:

a. Have obtained and are complying with a general or individual permit under the NPDES Stormwater Permit Program;

b. Are a public facility implementing BMPs in compliance with the stormwater management program of a NPDES municipal stormwater permit;

c. Are voluntarily implementing other BMPs, which are equivalent measures, methods, or practices to the BMPs in the BMP manual;

d. Are implementing required BMPs for new construction projects, pursuant to this chapter and the Surface Water Design Manual. However, projects that are exempt from implementing water quality BMPs in this chapter are not exempt from the BMP requirements in the Surface Water Design Manual.

2. Persons conducting normal single-family residential activities will not be required to implement the BMPs prescribed in the BMP manual, unless the Director determines that these activities pose a hazard to public health, safety, or welfare; adversely impact aquatic life or its habitat; endanger any property; or adversely affect the safety and operation of City right-of-way, utilities, and/or other property owned or maintained by the City. (Ord. 2288 2, 2000).

13.28.120 Hazards.

Whenever the Director determines that any existing construction site, erosion and sedimentation problem, developed parcel with runoff containing contaminants, and/or drainage facility poses a hazard to life and limb, endangers any property, endangers the health of aquatic life and/or habitat, and/or adversely affects the condition or capacity of other drainage facilities, the safety and operation of public right-of-way, utilities, waters of the State, and/or other property owned or maintained by the City, the applicant/person to whom the permit was issued pursuant to IMC 13.28.030, the owner of the property within which the drainage facility is located, the applicant/person responsible for maintenance of the facility, and/or other person or agent in control of said property, upon receipt of notice in writing from the Director shall within the period specified therein repair or otherwise address the cause of the hazardous situation in conformance with the requirements of this chapter.

Should the Director have reasonable cause to believe that the situation is so adverse as to preclude written notice, the Director may take the measures necessary to

eliminate the hazardous situation; provided, that the Director shall first make a reasonable effort to locate the owner before acting. In such instances the applicant of whom a drainage plan was required pursuant to IMC 13.28.030, the owner of the property and/or the person responsible for the maintenance of the facility shall be obligated for the payment of all costs incurred. If costs are incurred and a financial guarantee pursuant to this chapter or other City requirement has been posted, the Director shall have the authority to collect against the financial guarantee to cover costs incurred. (Ord. 2288 2, 2000).

13.28.130 Administration.

A. Administration.

1. Director. The Director of Public Works Engineering or a designee shall administer this chapter and shall be referred to as the Director. The Director shall have the authority to develop and implement administrative procedures to administer and enforce this chapter.

2. Review and Approval. The Director may approve, conditionally approve, or deny an application for activities regulated by this chapter.

B. Enforcement. The Code Enforcement Officer shall enforce violations of this code, as provided for in Chapter 1.36 IMC, Code Enforcement. The violation or failure to comply with any of the provisions of this chapter is unlawful. The remedies provided in this section, whether civil or criminal, shall be cumulative and shall be in addition to any other remedy provided by law.

C. Inspections.

1. Authority. The Director is authorized to gain access to private property, make such inspections of drainage facilities, and take such actions as may be required to enforce the provisions of this chapter.

2. Procedures for Entry to Private Property. Whenever necessary to make an inspection to enforce any of the provisions of this chapter, monitor for proper function of drainage facilities or whenever the Director has reasonable cause to believe that violations of this chapter are present or operating on a subject property or portion thereof, the Director may enter such premises at all reasonable times to inspect the same or perform any duty imposed upon the Director by this chapter; provided, that if such premises or portion thereof is occupied, the Director shall first make a reasonable effort to locate the owner or other person having charge or control of the premises or portion thereof and request entry. If after reasonable effort, the inspector is unable to locate the owner or other person having charge or control of the premises or portion thereof, and has reason to believe the condition of the stormwater system creates an imminent hazard, the inspector may enter.

3. Property Owners Responsibility to Provide and Maintain Access to Drainage Facilities. Proper ingress and egress to any stormwater facility shall be provided to the Director to inspect, monitor or perform any duty imposed upon the Director by this chapter. The Director shall notify the responsible party in writing of failure to comply with this access requirement. Failing to obtain a response within 7 days from the receipt of notification the Director may order the work required completed or otherwise address the cause of improper access. The obligation for the payment of all costs that may be incurred or expended by the City in causing such work to be done shall thereby be imposed on the person holding title to the subject property.

D. Orders.

1. Authority. The Director is authorized to issue to an owner or persons representing an owner an order to maintain or repair a component of a drainage facility to bring it into compliance with this chapter.

2. Procedure. The order shall include:

a. A description of the specific nature, extend and time of the violation and the damage or potential damage that reasonably might occur;

b. A notice that the violation or the potential violation cease and desist and the specific corrective action to be taken;

c. A reasonable time to comply, depending on the circumstances;

d. Penalties that may be incurred by any owner of a stormwater system not in compliance with this chapter; and

e. Any required structural repairs to a drainage facility are subject to approval by the Director.

E. Penalties for Violations.

1. Persons Subject to Penalty. Any person who violates or fails to comply with the requirements of this chapter or who fails to conform to the terms of an approval or order issued by the Director shall be subject to the civil and criminal penalties provided in Chapter 1.36 IMC, Code Enforcement. Each day of continued violation shall be considered a separate violation for purposes of penalty.

2. Reinspection Fees. In addition to criminal and civil penalties, the Director may impose a reinspection fee for any account or storm drainage facility found not to be in compliance of this chapter. The inspection fee shall be independent of any current or future penalties that may be incurred by the property owner for noncompliance of this chapter. (Ord. 2288 2, 2000).

13.28.140 Appeals.

The final decision of the development permit under which drainage review is required in accordance with IMC 13.28.030, including the specific requirements and conditions of this chapter, is appealable. Guidelines and procedures for such appeals shall follow the appeal process contained in Chapter 18.04 IMC, Procedures. (Ord. 2288 2, 2000).

13.28.150 Severability.

If any provision of this chapter or its application to any person or property is held invalid, the remainder of the chapter or the application of the provision to other persons or property shall not be affected. (Ord. 2288 2, 2000).

(this page intentionally left blank)

Appendix C
Standard Operating Procedure - Hazmat Spill, Hazardous Waste, and Water Quality Response

(this page intentionally left blank)

CITY OF ISSAQUAH

PUBLIC WORKS DEPARTMENT

STANDARD OPERATING PROCEDURE

ACTIVITY: *HAZMAT SPILL, HAZARDOUS WASTE, AND WATER QUALITY RESPONSE*

DATE: 12/04/01 **FILE**: *HAZMAT.SOP.DOC*

OVERVIEW

This SOP is intended to provide direction to Public Works Operations, Public Works Engineering, and Code Enforcement on responding to hazardous material (hazmat) spills, illegal dumping of hazardous wastes, and water quality violations. These responses are applicable to public, private and state highway property. Spill response is summarized in Table 1.

Table 1. Spill Response Summary

Nature of Spill	Description	Response Procedures
1. Major Hazmat Spill	Spills of high-risk nature (hazardous or unknown materials, or large quantity). Risk to public and/or environment.	• **Fire Department**: Response and limited containment. • **PW-Ops**: Traffic support if necessary. • **Department of Ecology**: Primary spill response, cleanup and enforcement.
2. Minor Spills – Public Property and Right-of-Way	Spills of low-risk nature (identifiable material and small quantity) on public property. Spill can be contained and cleaned up by City.	• **Fire Department and/or PW-Ops:** Response, containment and cleanup.
3. Minor Spills – Private	Spills of low-risk nature (identifiable material and small quantity) on private property. City will assist to prevent entry into public drainage system, followed by cleanup by responsible party.	• **Fire Department, PW-Ops or other Staff**: Response and containment to prevent entry to public system. • **Department of Ecology**: Primary spill response, cleanup and enforcement (if Ecology determines spill is significant and response by their haz-mat team is appropriate). • **Code Enforcement:** Enforcement of follow-up actions if conducted under oversight of City (i.e., Ecology determines City should respond because spill is minor). • **Responsible Party**: Spill cleanup.
4. Construction-related water quality problems	Erosion and sedimentation water quality problems at permitted construction sites.	• **PW-E Inspectors:** Construction inspection and permit compliance. • **Code Enforcement:** Enforcement actions if necessary (e.g., code violation).
5. Other water quality problems	Pollution source control at businesses, failing or improperly maintained stormwater facilities, illegal dumping and discharge.	• **PW-E Inspectors and Engineers:** Determination of source, hazards, and required response action; response observation and verification. • **Code Enforcement:** Enforcement actions if necessary (e.g., code violation).

OPERATING PROCEDURES

1. Major Hazmat Spills

a. Report spill to Fire Department (Eastside Fire and Rescue) at 911 and Department of Ecology at 649-7000 (24-hour number).

b. Fire department (with assistance of Eastside Hazmat Team) will assess nature of spill and risk to public safety per Fire Department standard operating procedures. If unable to easily identify as low-risk, immediately clear the area.

c. PW-Ops to assist with traffic control if needed.

d. For major spills requiring follow-up actions, Ecology will take over response efforts when their spill response team reaches site.

2. Minor Spills – Public Property or Right-of-Way

a. Report spill to Fire Department (911) or PW-Ops (837-3470). During off-hours and weekends, call Police Dispatch (837-3200) to contact on-call City personnel.

b. PW-Ops and Fire: Contain material – prevent entry to stormwater system.

c. Use appropriate absorbent materials to contain and collect contaminants.

d. Dispose of material in accordance with regulations (see Disposal Section).

e. Report incident and response actions to Ecology. Follow-up with permanent site cleanup if necessary.

3. Minor Spills – Private

a. Report incident to Ecology to determine if Ecology's spill response team should be called out (649-7000, 24-hour number). If Ecology responds, verify whether Ecology will conduct all follow-up actions such as property owner notification and cleanup.

b. Fire Department, PW-Ops and other responding City staff: Contain material – prevent entry to stormwater system. If possible, locate property owner or tenant and have them take over the cleanup response as soon as possible.

c. Report spill to Code Enforcement Officer to help with property owner notification or if follow-up enforcement action is required. During off-hours and weekends, call Police Dispatch (837-3200) to contact on-call City personnel.

d. If City conducts follow-up actions, refer to Code Enforcement Officer for code violations and if enforcement actions are required, such as non-responsive private party. Public Works Engineering inspectors shall observe cleanup actions and verify cleanup.

4. Construction-related water quality problems (erosion and sedimentation)

a. Report problem to Public Works Engineering (837-3400) for site inspection and determination of actions needed to comply with permit conditions. During off-hours and weekends, call Police Dispatch (837-3200) to contact on-call PW-Ops personnel, who will verify that problem is construction-related. Public Works Engineering inspector will be then called out.

b. Public Works Engineering inspector to determine if corrective measures are needed, and will contact property owner or contractor.

c. Refer to Code Enforcement Officer if enforcement actions are required, such as illegal construction activity or code violations.

5. Other water quality problems

a. Report problem to Public Works Engineering (837-3400). During off-hours and weekends, call Police Dispatch (837-3200) to contact on-call City personnel.

b. Public Works Engineering Inspectors, with assistance of Public Works engineers, will determine of source, hazards, and required response action, as required by stormwater code requirements.

c. Refer to Code Enforcement Officer if enforcement actions are required.

DISPOSAL

1. All wastes shall be disposed of in accordance with state regulations. For City response actions, seal all non-dangerous wastes (such as oils) and all dangerous wastes in drums for disposal by PW-Ops contractor.
2. When in doubt, contact Ecology for disposal instructions.

NOTIFICATION

1. The City department responding to the spill alert is responsible for notifying other City departments. Records shall be maintained of all spill responses.
2. Ecology should be notified immediately of all major spills and all significant petroleum spills. Call 425-649-7000 (24-hour number).
3. Ecology will notify the City of minor spills that they expect the City to respond to and clean up. Ecology will notify the City as follows:
   - Business hours: Public Works Operations (837-3470).
   - Off-hours and weekends: Police Dispatch (837-3200).
4. The National Response Center (1-800-424-8802) should be notified if a major spill occurs that requires a federal response action, such as pipeline and tanker spills.

(this page intentionally left blank)

Appendix D
Flooding Repetitive Loss Plan, Annual Progress Report – 2002

(this page intentionally left blank)

CITY OF ISSAQUAH
Department of Public Works/Engineering
PO Box 1307 / Issaquah, WA 98027
(425) 837-3400 Fax (425) 837-3409

City of Issaquah
Flooding Repetitive Loss and Flood Mitigation Plan
Annual Progress Report - 2002

This progress report is submitted annually to the Federal Emergency Management Agency (FEMA) to document the City of Issaquah's progress towards reducing flood damages at properties that incur frequent flooding. A repetitive loss plan is a requirement of the Community Rating System (CRS), a voluntary FEMA program that reduces National Flood Insurance Program (NFIP) flood insurance premiums if the City implements certain flood hazard management activities. This plan also summarizes flood conveyance improvement projects that have been constructed in recent years, and projects that are planned for the next few years.

CHANGES SINCE 2001

Based on the 2001 CRS recertification process, **the City's CRS Classification was improved from Class 7 to Class 5**. This improvement reflects the considerable effort and progress made by the City towards reducing flood losses, facilitating accurate insurance ratings, and promoting the awareness of flood insurance. The Class 5 rating results in residents and businesses in the City obtaining a 25% discount in their flood insurance premiums (the discount was 15% under the previous Class 7). As of October 2001, only 15 of the 938 communities in the U.S. had a CRS classification of 5 or better. King County is one of those communities, having a Class 4 CRS certification that results in a 30% premium discount.

Other changes made to this 2002 plan include the inclusion of the 2002 Bianco Mine Tailings Stabilization project to the constructed flood conveyance improvements Table 3, schedule updates in the future flood conveyance improvements Table 4, and revised flood insurance statistics.

BACKGROUND

The Issaquah Creek Basin and Nonpoint Action Plan, adopted by both the City of Issaquah and King County Councils in 1995 and approved by the Washington Department of Ecology in 1996, recommends several actions to address flooding and fish habitat problems in the basin. The basin plan serves as the repetitive loss plan for the City of Issaquah. Major recommendations in the basin plan include reducing flood hazards by removing homes from the stream corridor, acquiring or obtaining easements on undeveloped property, and restoring channel and floodplain capacity.

This report summarizes the recent history of actions taken by the City of Issaquah to implement these recommendations, including (1) acquisition of properties and removal of structures that have experienced repetitive losses, and (2) flood conveyance improvement projects to restore the ability of the channel and floodplain to convey floodwater and reduce flood damages.

CURRENT FLOOD INSURANCE POLICIES

As of September 2002, there were 113 NFIP policies in the City, providing over $20 million in flood insurance coverage. These policies, which cover buildings and contents for owner-occupied properties and building contents for rentals, paid a total of $69,300 in annual premiums. Individual premiums range between $127 and $2612 per year and the average was $600. Total payment by FEMA during the period 1978-2002 for 83 separate claims was approximately $2,133,000. (Note: changes from the 2001 report reflect a new database provided by FEMA; the 2001 report used statistics provided by FEMA that apparently overstated the number of policies by included properties outside of Issaquah).

REPETITIVE LOSS PROPERTIES

Repetitive loss properties are defined by FEMA as properties that had two or more flood insurance claims of at least $1,000 within any 10-year period since 1978. The current repetitive loss list for Issaquah is summarized in Table 1. Data in this table is unchanged from 2001 because no flood claims have been paid in the City by FEMA since January 1, 1997.

Historic flood damage claims are summarized in Table 1. It is noted that FEMA does not pay for property or landscaping damages and not all buildings subject to flooding (including City-owned buildings) are insured by FEMA. Therefore, actual flood damage costs in the City are likely higher.

There are 22 total repetitive loss properties in Issaquah, of which 19 currently have structures (three were previously purchased by the City and the houses demolished). For the period 1980-1999, total claims from repetitive loss properties amounted to $1,959,000, or 92% of all FEMA flood insurance claims in Issaquah. (Nationally, repetitive loss properties represent less than 2% of the insured properties but account for 33% of the insurance claims paid since 1978). Thus, a relatively few number of properties account for nearly all of the FEMA flood damage claims in the City.

Table 1. Flooding Repetitive Loss Properties in Issaquah as of Year 2002

Address and Owner	Still Subject to Flooding?	Loss Dates	Damages	Actions to Reduce Flooding (implemented actions in bold)
237 SW Newport Way (75 SW Clark Street) (Dodge)	No	11/23/86 1/24/84 1/23/82 12/15/79	$15,281 2,809 3,692 1,549	**Purchased by City and house removed in 1994**
200 NW Dogwood Street (Reudinck)	No	11/21/90 1/9/90	34,894 8,156	**Purchased by City and house removed in 2001**
300 NW Birch Place (Hansen)	No	2/8/96 11/24/90 1/9/90	197,721 12,909 63,054	**Purchased by City and house removed in 1998.**
245 NW Birch Place (Reichce)	Yes	2/8/96 11/29/95	2,320 4,352	Will benefit from Dogwood Bridge replacement scheduled in 2005
360 NW Holly (Herrin)	Yes	11/24/90 1/9/90	7,831 10,504	Will benefit from Juniper Br. Replacement scheduled in 2005
340 NW Holly (Gulin)	Yes	2/8/96 1/9/90	2,375 17,206	**Building elevated in 1991.** Will benefit from Juniper Bridge Replacement scheduled in 2005
385 Front Street (Ricketts)	Yes	2/9/96 11/24/86 1/24/84	235,734 30,091 7,546	High priority for acquisition.
455 Front Street South (Buadromo)	Yes	2/9/96 1/9/90	3,525 4,362	Target of floodproofing program
220 Newport Way SW (Maplewood Apts)	Yes	11/23/90 11/9/90 1/9/90 11/24/86 12/15/79	102926 20460 112125 82081 15176	Structure has limited potential for additional floodproofing.
230 Newport Way SW (Parkshore Apts)	Yes	2/7/96 11/25/90 1/9/90	3,683 5,610 1,746	Target of floodproofing program
195 West Sunset Hwy (Shreve)	Yes	11/24/86 1/11/86	7,692 7,996	**Benefited from Sunset Bridge replacement in 1997**
1260 Sycamore Drive (Hughes)	Yes	11/24/90 1/10/90 11/23/90	2,732 6,927 3,915	**Building was raised after 1990 flood.** Target for additional floodproofing or acquisition.
440 SE Sycamore Lane (Bates)	Yes	2/8/96 11/25/90 1/9/90 11/23/86	11,044 7,283 3,124 6,067	Target of floodproofing program or future acquisition.
485 SE Sycamore Place (McCormack)	Yes	2/7/96 11/24/90 1/9/90 11/23/86	3,102 10,487 2,532 18,580	Target of floodproofing program or future acquisition.
501 SE Sycamore Place (Henselman)	Yes	11/24/86 1/25/84	11,983 4,875	Target of floodproofing program or future acquisition.
505 SE Sycamore Lane (O'Neill)	Yes	2/8/96 11/24/90 1/9/90	4,980 2,277 1,001	Target of floodproofing program or future acquisition.
990 5th Ave NW (Folkman, Dental lab)	Yes	1/9/90 11/23/86	7,533 2,276	**Benefited from 1997 Gilman Reach Channel Improvement project**
605-715 NW Gilman Blvd. (KIN Partnership)	Yes	2/8/96 11/23/90 1/10/90	368,744 119,419 85,825	**Benefited from 1997 Gilman Reach Channel Improvement project**
607 W. Gilman Blvd. (Shucks Auto)	Yes	11/24/90 1/8/90	11,382 27,802	**Benefited from 1997 Gilman Reach Channel Improvement project**
719 NW Gilman Blvd (Lombardi's)	Yes	2/8/96 11/24/90	116,579 30,609	**Benefited from 1998 Gilman Reach Channel Improvement project**
22075 SE 61st Street (Ellis)	Yes	2/8/96 11/22/90 1/9/90 11/24/86	9,879 4,658 2,057 1,229	Site proposed for redevelopment to current flood mitigation standards
22017 SE 61st Street (Brekke)	Yes	2/8/96 11/21/90 1/9/90 11/23/86	18,458 11,254 3,025 12,369	Site proposed for redevelopment to current flood mitigation standards

Commercial properties in the Gilman Square area accounted for about 40% of the historical flood insurance claims. This area received significantly improved flood protection from the 1997 Gilman Reach Channel Improvement Project; therefore, future flood damages in this area are predicted to decrease. Two single-family residences – Hansen and Ricketts – accounted for another 29%. The Hansen house was purchased by the City in 1997 and removed, and Ricketts is targeted for future acquisition. Although the Sycamore neighborhood has five residential properties subject to frequent flooding, claim amounts for those and most other residential properties in the City are relatively small.

ACQUISITION OF PROPERTY AND REMOVAL OF FLOOD-PRONE STRUCTURES

The City occasionally budgets money in the six-year Stormwater Capital Improvement Program to purchase developed and undeveloped residential property. Properties acquired through this program are retained as permanent open space. The City informs residents of this program as part of the fall Flood Preparedness Workshop outreach project. The City is also actively pursuing the acquisition of the remaining undeveloped parcels along Issaquah Creek, particularly the larger ones that face significant development pressures, for open space preservation.

Repetitive loss properties are identified for acquisition as part of the City's flood mitigation program. The acquisition program also supports the habitat restoration program for Issaquah Creek, which supports chinook salmon, a listed species under the Endangered Species Act. Over the last few years several properties have been purchased using City funds. Table 2 below provides a summary of past acquisitions.

Table 2. Summary of Floodplain Acquisitions

Purchase Date	Name and Location	Repetitive Loss Property?	Status
1994	Dodge 75 SW Clark Street	Yes	House removed in 1994. Parcel maintained as open space.
1994	Ryan 85 SW Clark Street	No	House removed in 1994. Parcel maintained as open space.
October 1997	Hanson 300 NW Birch Place	Yes	House removed in March 1998, site restored in Fall 1998; parcel maintained as open space.
November 1997	Sycamore lots	No	Nine undeveloped residential lots located in floodplain acquired; parcels maintained as open space.
September 1998	Reudink 200 NW Dogwood St.	Yes	House removed in 2001. Parcel maintained as open space.
July 2000	Darst 180 NW Cherry Place	**No**	House removed in 2001. Parcel maintained as open space.

Past acquisitions include the Hansen house, located along 600 feet of creek-front on Issaquah Creek that flooded twice in 1990 and again in 1996. That house was removed in March 1998 and site restoration occurred in fall 1998. The Reudink house, acquired in 1998, also flooded twice in 1990 and again in 1996. That house was removed in 2001.

The Darst home, which was demolished in 2001, is located on the inside of a meander bend and has a floodwall that constricts the floodplain. While not a repetitive loss property, removal of the house, floodwall, and fill will provide significant conveyance improvements

to Issaquah Creek in the vicinity of the Cherry Place neighborhood. Purchase of undeveloped floodplain lots target those located in high flood hazard areas, but where current floodplain regulations do not prohibit development.

The City continues to negotiate with property owners to acquire undeveloped lots in the floodplain. Acquisition of these properties is dependent on funding availability.

FLOOD CONVEYANCE IMPROVEMENT PROJECTS

The City of Issaquah has an aggressive program to improve the flood conveyance capacities of Issaquah Creek, East Fork Issaquah Creek, and Tibbetts Creek. In recent years this included replacement of four old bridges that were significant constrictions in the floodplain, two major channel improvement projects that excavated overbank areas to increase conveyance capacity, and a bank protection project to protect the Issaquah School District administration building. Table 3 summarizes these projects.

Table 3. Constructed Flood Conveyance Improvement Projects in Issaquah

Year	Name	Location	Benefit/Status
1995	NW Sammamish Road Bridge Replacement	Issaquah Creek at northern City boundary	Reduced flood hazards on arterial and adjacent commercial area
1997	Gilman Reach Channel Improvements	Issaquah Creek near Gilman Boulevard	Reduced flood hazards in Gilman area, including repetitive loss properties.
1997	Sunset Bridge Replacement	Issaquah Creek at Sunset Way	Reduced flood hazards at Sunset Way
1997	NE Dogwood Bridge Replacement	East Fork Issaquah Creek	Reduced flood hazards on East Fork
1998	Pickering Reach Channel Improvements	Issaquah Ck. upstream of NW Samm. Road	Reduced flood hazards in Pickering Place commercial area
1999	Newport Way Bridge Replacement	Issaquah Creek at Newport Way	Reduced flood hazards at road crossing and nearby residences
2000	Issaquah Creek Park Bank and Habitat Improvements	Issaquah Creek at Holly	Bank protection to stop channel migration towards school district building
2001	NW Sammamish Road Bridge Replacement (Tibbetts Creek)	Tibbetts Creek	Replacement of inadequately sized culverts
2001	Newport Way Culvert Replacement (Tibbetts Creek)	Tibbetts Creek	Replacement of inadequately sized culverts, which contribute to 12th Ave/Gilman flooding
2001	Tibbetts Creek Greenway – Maple Street to I-90 (Rowley Enterprises)	Tibbetts Creek	Restore creek and floodplain of Tibbetts Creek (previously a roadside ditch that flooded nearby businesses)
2002	Bianco Mine Tailings Stabilization	Tibbetts Creek	Stabilize source of sediments that contributes to stream capacity problems in downstream reaches

Issaquah Creek Channel Improvement Projects

The current program for restoration of Issaquah Creek is based on implementation of Basin Plan recommendation BW-7, *Establishment of a Channel and Floodplain Restoration Program*. The objectives of these projects are to: (1) restore the ability of the channel and

floodplain to convey and store floodwater, and (2) enhance the fish and wildlife habitat of the corridor, while ensuring that the benefit is greater than the cost as it relates to flood damage. Two phases of this program were implemented in 1998 in the Gilman and Pickering areas, totaling about 3000 feet of creek length along Issaquah Creek. These projects will help to reduce the frequency of future flooding for at least four of the repetitive loss properties along Gilman Blvd. and 5th Avenue NW. Specific project objectives include the following:

- Reduce flooding along Issaquah Creek by providing increased capacity through channel widening.
- Improve the fish and wildlife habitat of the stream and riparian corridor through the addition of large woody debris (LWD), planting of shrubs and trees along the channel, and creation of backwater pool areas for winter rearing habitat.
- Protect the water quality of the stream by providing streambank stabilization to prevent erosion and planting trees to shade the creek.

The Gilman channel improvements were designed to contain flood flows comparable to those experienced during the February 9, 1996 flood, which caused significant damage in the area. The peak flow during this event was 3,500 cfs. The Pickering channel improvements were designed to contain flood flows up to 4,700 cfs.

FUTURE FLOOD MITIGATION

The current program for acquisition of repetitive loss properties and construction of channel improvement and bridge replacement projects will continue in the future as planned in the City's six-year stormwater capital improvement program. Over the next few years the focus of flood improvements will be on Tibbetts Creek, where over 10 years of planning will transition into construction. Other projects are planned for Issaquah Creek, including replacement of two bridges that create flood constrictions. Table 4 summarizes the significant future projects.

Table 4. Future Flood Improvement Projects in Issaquah

Year	Name	Location	Benefit/Status
2004	Rainier Bridge Replacement	East Fork Issaquah Creek	Replacement of deteriorating and constricting bridge
2003	Tibbetts Creek Greenway Project	Tibbetts Creek at Tibbetts Manor (upstream of SR-900)	Channel restoration to contain flooding that impacts commercial areas on 12th Ave., Gilman Blvd, and west of SR-900.
2005	I-90 Tibbetts Creek Culvert Replacement (Wash. Department of Transportation project)	Tibbetts Creek at I-90 crossing	New bridge or culverts on I-90 to eliminate conveyance constriction, eliminating flooding of commercial areas.
2005	NW Dogwood Bridge Replacement	Issaquah Creek at NW Dogwood Street	Replacement of inadequately sized bridge, which contributes to flooding in Cherry Place area
2005	NW Juniper Bridge Replacement	Issaquah Creek at NW Juniper Street	Replacement of inadequately sized bridge, which contributes to flooding in Holly Street area

Appendix E
Adopting Resolution

RESOLUTION NO. 2004-08

A RESOLUTION OF THE CITY OF ISSAQUAH ADOPTING THE 2002 STORMWATER MANAGEMENT PLAN

WHEREAS, the Administration presented the City Council with a Draft 2002 Stormwater Management Plan on June 3, 2002; and

WHEREAS, the Council Utilities Committee has reviewed the Stormwater Management Plan and has considered comments from the public; and

WHEREAS, the Draft 2002 Stormwater Management Plan is consistent with and supports the policies set forth in the adopted Comprehensive Plan, (utility element 2002); and

NOW THEREFORE, the City Council of the City of Issaquah hereby resolves as follows:

1. The City of Issaquah Draft 2002 Stormwater Management Plan, dated April 2003, is hereby adopted as the Final 2002 Stormwater Management Plan.

2. The City of Issaquah Final 2002 Stormwater Management Plan shall be used as a guide for developing City budgets, developing and implementing stormwater management programs, for location and sizing of capital improvements, and as a basis for the exercise of substantive authority under SEPA.

PASSED by the City Council of the City of Issaquah, this 6th day of July, 2004.

APPROVED

Nancy Davidson

NANCY DAVIDSON, COUNCIL PRESIDENT

APPROVED by the Mayor this 6th day of July, 2004.

Ava Frisinger

AVA FRISINGER, MAYOR

FILED this 6th day of July, 2004.

ATTEST:

Cathleen A. Koch

CATHLEEN A. KOCH, CITY CLERK

APPROVED AS TO FORM:
OFFICE OF THE CITY ATTORNEY:

Wayne Tanaka

AB NO. 4898
PASSED BY COUNCIL ON 7-6-2004