

APPENDIX 12: ENVIRONMENTAL

A-12.1 The Natural Environment

This appendix provides a general overview of the key natural environment components found within the Woodinville Area as a basis for land use planning and for regulation of critical areas. This section discusses the natural environment in terms of sensitive hydrologic (water) and geologic (soil) areas. Hydrologic resources encompass five of the critical areas defined by the Growth Management Act: fish and wildlife habitat, water quality, frequently flooded areas, wetlands, and aquifers. The hydrologic resources portion also includes a description of current surface water management practices in the City of Woodinville and a summary of surrounding drainage, flooding, and stormwater runoff. Geologic resources encompass two types of critical areas: geologic hazard areas and aquifer recharge areas.

This appendix includes maps of sensitive areas obtained from Woodinville Sensitive Areas Inventory (2002) and Snohomish County (see Figure A12-1).

The City of Woodinville has adopted Sensitive Areas Regulations in compliance with the Growth Management Act as part of the Zoning Code (WMC 21.24 March 1993). With the March 24, 1999 Endangered Species Act (ESA) listing of Chinook Salmon, it is anticipated that these regulations will be revised based on the findings and conclusions of the Tri-County Model 4(d) Rule Response Proposal (draft) and other studies based on Best Available Science.

Woodinville's natural environment includes sensitive hydrologic areas and sensitive geologic areas, as discussed below. Table A12-1 provides an overview of these areas for both the City of Woodinville as well as Grace (Snohomish County).

A-12.2 Sensitive Hydrologic Areas

Hydrologic areas include rivers, streams, lakes, ponds, wetlands, and floodplains. Within the Woodinville Area, sensitive hydrologic areas include three hydrologic systems:

1. The Sammamish River and associated floodplain and tributaries located in the valley south of downtown Woodinville,
2. Bear Creek and its associated lakes and tributaries, located mostly to the east of the City limits, and

Table A 12-1 Sensitive Areas in the Woodinville

Woodinville Survey Area			
Sensitive Environmental Feature	City of Woodinville	Grace Neighborhood	Total
<u>Hydrologic</u>			
Streams ¹			
Class 1	2 miles	0 miles	2 miles
Class 2	5 miles	16 miles	21 miles
Unclassified	6 miles	N/A	6.0 miles
Streams Total	13 miles	16 miles	31.0 miles
Wetlands ²	100 acres	16 acres	116 acres
Floodplains	433 acres	N/A	433 acres
<u>Geologic</u>			
Erosion ²	347 acres	N/A	347
Landslide Hazard ²	314 acres	27 acres ³	341
Seismic ²	664 acres	N/A	664

Notes:

¹ Distances were calculated from Geographic Information System coverage's and rounded to the nearest half mile.

² Acreages were calculated from Geographic Information System coverage's and rounded to the nearest whole number.

³ Slope greater than 25 percent.

Source: EDAW, Inc., King County, and Snohomish County 1995

A-12.2.1 Watershed Basins

Within the Woodinville Area, there are three watershed basins - the Sammamish River Basin, the Bear Creek Basin, and Little Bear Creek Basin. Little Bear Creek and Bear Creek extend into Snohomish County.

Sammamish River Basin

The Sammamish River has played a significant role in shaping the natural environment in and around the Woodinville Area. The river connects two major water bodies on the Eastside - Lake Sammamish and Lake Washington. Within the Woodinville Planning Area, the river flows north from Redmond to the southwestern edge of downtown Woodinville before turning west toward the City of Bothell.

A number of tributaries feed into the Sammamish River from the hillsides east and west of the Sammamish River Valley. Farther north, in Snohomish County, there are several tributaries flowing west and south into the main channel of Little Bear Creek. This creek parallels SR 9 and SR 522, and flows through the North Industrial and Downtown Area neighborhood before entering the Sammamish River.

To reduce agricultural damage along the Sammamish River and to regulate the level of Lake Sammamish, the U.S. Army Corps of Engineers dredged a channel for the river, filling in the former meanders. The new channel, completed in 1966, was designed to contain a 40-year springtime flood event. The U.S. Army Corps of Engineers construction and subsequent maintenance program for the Sammamish River was a "single-objective" program intended to maximize the area protected and conserve usable agricultural land. Maintenance requirements have kept the stream bank devoid of significant vegetation and the banks have been regularly lined with riprap to prevent erosion and natural channel migration.

The Water Resource Development Act of 1986, authorized the U.S. Army Corps of Engineers to review existing federally authorized projects for opportunities to improve the quality of the environment in the public interest. The Corps currently is working on the General Investigation study for the Sammamish River Corridor Action Plan (Tetra Tec, Inc., October 31, 2001, draft). This plan in its entirety, is a study of the Sammamish River corridor.

Wetlands located within the basin occur in isolated areas, primarily along tributaries to the Sammamish River. Within the city limits, there are approximately 100 acres of wetlands. The most significant of these is a 24-acre wetland associated with Little Bear Creek in the Wedge neighborhood.

Within the basin, the 100-year floodplain extends along the entire Sammamish River and comprises 433 acres of land within the City.

Bear Creek Basin

The Bear Creek Basin is located east of the Sammamish River Basin and extends from Redmond north into Snohomish County (see Figure A13-2). This basin is the most productive spawning salmonid basin for its size in the Puget Sound area, often with over 30,000 fish returning annually. Significant water systems within the basin include Bear Creek, Daniel's Creek, Cottage Lake Creek, and Evans Creek. All of these water systems flow south and drain either directly into the Sammamish River or into Lake Sammamish, which flows into the Sammamish River.

The Bear Creek Basin is divided into four major sub-basins:

1. Cottage Lake Creek,
2. Upper Bear Creek,
3. Lower Bear Creek, and
4. Evans Creek.

The Cottage Lake Creek sub-basin has a very high fish population, particularly downstream of Cottage Lake. The upper part of the sub-basin is rural, but development is proceeding rapidly downstream of Cottage Lake. Cottage Lake Creek is noted for its rare run of naturally spawning Chinook salmon.

The Upper Bear Creek sub-basin contains rural development upstream of its confluence with Cottage Lake Creek. This area is conducive to a large fish population, particularly along the main stem of the creek, as well as its numerous tributaries draining the eastern uplands. The Upper Bear Creek sub-basin contains excellent spawning and rearing areas in diverse stream habitat and extensive wetland systems as well as an abundant freshwater mussels population, indicating very good water quality.

Farther east and within the Woodinville Planning Area in Snohomish County, there are also a number of streams that form the headwaters of Bear Creek. These streams flow generally south and are outlets for both Crystal and Echo lakes. Bear Creek flows into the Sammamish River south of downtown Redmond.

Present problems in the basin reflect the nature and intensity of urban development. Generally sparse urbanization in the northern and eastern parts of the basin have allowed upper Bear Creek and Cottage Lake Creek to maintain high quality fish habitat and to avoid most drainage-related problems. Recommendations of the Bear Creek Basin Plan seek to protect aquatic resources in the face of expanding urbanization and to enhance these resources wherever feasible.

Wetlands within the basin and Woodinville Planning Area are scattered throughout the basin and constitute an important natural feature for plant and wildlife habitat. The most significant of these wetlands for this basin is a large U-shaped wetland located west of Cottage Lake.

Floodplains within the basin and Woodinville Planning Area are located along the southern end of Cottage Lake Creek and Bear Creek.

Little Bear Creek Basin

Little Bear Creek is approximately 9 miles in length and its watershed covers approximately 15 square miles in south Snohomish County and north King County, including Woodinville. Little Bear Creek flows into the Sammamish River about 5 miles upstream from Lake Washington. Six tributaries flow into Little Bear Creek, and the watershed contains 71 wetlands. The lower 2.9 miles of Little Bear Creek have been straightened and altered for agriculture and subsequent industrial purposes.

The Little Bear Creek watershed is rapidly urbanizing with residential development and hobby farms located in the upper watershed. Most of the Little Bear Creek watershed within Snohomish County is medium density rural residential. The SR 9 and SR 522 corridors support light and heavy industry.

Little Bear Creek, like North and Swamp Creeks, flows into Lake Washington. The Washington Department of Ecology (1995) assessed Little Bear Creek as not supporting the designated uses of primary and secondary contact recreation because of pollutants. The major pollutant identified by the Department of Ecology was a bacterium. Sources of bacteria include runoff from pastureland, animal holding, and failing septic systems. Runoff from roads and the industrial areas in the lower watershed also contributes petroleum products, metals, and sediment to the creek.

Little Bear Creek watershed supports a variety of fish species, including Coho salmon, sea-run cutthroat trout, steelhead, Chinook salmon, sockeye and kokanee salmon, resident cutthroat trout, rainbow trout, sculpins, lampreys, and stickleback. However, the abundance of fish such as Coho salmon has noticeably decreased in recent years, and is consistent with other watersheds in the Sammamish River and Lake Washington Basin.

A-12.2.2 Summary of Surrounding Drainage, Flooding, and Stormwater Runoff

The following summary provides a review of drainage, flooding, and stormwater runoff in the area and nearby jurisdictions. The plans and studies listed below provide guidance to the City of Woodinville for corrective actions to mitigate or cleanse those discharges that pollute waters of the state including Puget Sound. The City supports the mitigation measures and corrective actions outlined by the surrounding jurisdiction's plans and policies. The review also recognizes the fact that drainage, flooding, and storm-water runoff are watershed basin concerns that are not confined by the political or planning boundaries of the City of Woodinville.

City of Woodinville

Upon incorporation, the City established a stormwater utility to manage flooding, erosion, sedimentation, aquatic habitat, and water quality. The King County Surface Water Management Division of King County Public Works has been retained under contract to provide technical and administrative services related to this utility. Duties include facilities maintenance, drainage investigation, public education and involvement, billing and revenue collection, and planning. The City uses the *King County Surface Water Design Manual* to regulate runoff within its boundaries. This document contains provisions for Best Management Practices (BMPs), such as oil/water separators and erosion control practices consistent with the State Department of Ecology's requirements.

The City is planning to develop and adopt its own stormwater management plan. When this document is being prepared, the City will consider and include appropriate corrective measures defined in the plans that follow.

City of Redmond

The *City of Redmond Comprehensive Stormwater Plan* (City of Redmond, 1997) is Redmond's first effort to produce a stormwater plan incorporating recent stormwater regulation and issues of concern. Four water bodies directly receive the majority of Redmond's stormwater runoff; Lake Sammamish, the Sammamish River, Bear Creek, and Evans Creek. The City of Woodinville, which lies downstream from the City of Redmond, shares a portion of the Sammamish River Basin.

The Plan outlines a number of corrective actions to protect water quality and reduce runoff in the City of Redmond. The Plan establishes that all projects which create more than 5,000 square feet of impervious area shall provide treatment of runoff from the added impervious area and control runoff from the development. The maximum discharge rates allowed for these projects depend on the environmental sensitivity of the downstream conveyance system.

The Plan also outlines a number of management practices to control pollutants associated with rapid growth, such as sediments, nutrients, bacteria, and petroleum hydrocarbons. Some of the management practices to control these elements include limiting the size and timing of clearing and grading projects, creating artificial wetlands and detention basins, converting failing septic systems to sewer, educating the public on fertilizer use, utilizing proper operations and maintenance practices for all stormwater systems, and enforcing spill control and response measures. The Plan also includes recommended basin planning efforts to determine how the 11 major basins in the City of Redmond should develop to best protect associated natural resources.

City of Bothell

The City of Bothell adopted the King County Surface Water Design Manual in 2000.

The majority of the stormwater runoff in the Bothell area discharges to North Creek, Horse Creek, Swamp Creek, and the Sammamish River. The City of Woodinville lies upstream from Bothell along the Sammamish River.

King and Snohomish Counties

King County uses the *King County Surface Water Design Manual* (see discussion under City of Woodinville above). King County is also largely responsible for the basin planning that has taken place (see below). Snohomish County has a *Snohomish County Drainage Ordinance and Procedures Manual* (1979). However, because this manual is outdated, Snohomish County uses the *Snohomish County Drainage Manual, Title 24*, adopted in 1999.

Bear Creek Basin

The *Bear Creek Basin Plan* (King County Surface Water Division, 1990) is the surface water management plan for the Bear Creek Basin, a portion of which lies within the City of Woodinville. The document was a result of an interlocal effort involving King County, Snohomish County, and the City of Redmond from 1987 to 1990, prior to the City of Woodinville's incorporation. In order to prevent flooding and erosion, and preserve salmon spawning habitat in the 50-square mile Bear Creek Basin, the Plan contains a number of basin management recommendations. It offers a broad range of management approaches, including land use controls, stream buffers, floodplain development limits, and the hiring of a "stream steward". The stream steward conducts education and citizen participation programs. The document seeks to balance choices between resource protection and regional growth by focusing efforts where the resource is most valuable and the present impacts of urbanization are least damaging. The Plan also seeks to identify which of the basin's components are most critical, how protection of these components is best achieved, and what minimum level of protection is necessary for the remainder of the system.

Some of the specific recommendations outlined in the Basin Plan include low density zoning ¼ mile in either direction from the stream banks, a minimum buffer of 150 feet from the ordinary high water mark on each side of the stream for Class 1 streams, on-site detention/retention facilities to control downstream or down slope impacts of new development, limit clearing to 25% of sites smaller than 2.5 acres to reduce erosion, revegetation of cleared areas, maintenance of road ditches, and water quality and sediment transport monitoring.

The *Redmond-Bear Creek Valley Ground Water Management Plan* (Washington State Department of Ecology, 1994) is the ground water management plan for the Redmond-Bear Creek Valley, within which a portion of the City of Woodinville is located. Although not a drainage, flooding or stormwater runoff plan itself, this Plan illustrates the effect that rain, stormwater runoff and surface water have on the quality of ground water in the Redmond-Bear Creek Valley. The Plan is intended to inform and guide ground water protection efforts and safeguard the quality and availability of groundwater within the management area. The Plan also provides a characterization of the Redmond-Bear Creek Valley Ground Water Management Area (RBC-GWMA), including land use impacts on ground water, general hydrology of the area, and water balance (ground water discharge and recharge).

Some of the specific recommendations outlined in the Plan include the augmentation of the state's Underground Storage Tanks Program to reduce the possibility of leakage from home heating oil tanks into groundwater supplies, the development of an improved Local Emergency Management plan for hazardous material spills, development of a Wellhead Protection Program for sewer systems serving over 1,000 connections to reduce nitrate contamination of ground water, and the development of a public education program to increase the awareness of on-site sewage system operation and maintenance.

Sammamish River Basin

The Army Corps of Engineers is currently working on the General Investigation study for the Sammamish River Corridor Action Plan (Tetra Tech, Inc, Oct. 31. 2001). This plan in its entirety is a study of the Sammamish River corridor. The plan will supercede the Sammamish River Multi-Objective Greenway Plan (King County Surface Water Management, 1992) and the Sammamish River Corridor Conditions and Enhancement Opportunity Report (King County, 1993) that was utilized as an interim guide for mitigation and enhancement projects.

The goal of the Sammamish River Corridor Action Plan is to guide the conservation and enhancement of natural resources in the River corridor for at least the next five to ten years, with a particular focus on enhancing habitat and habitat-forming processes that would contribute to salmon recovery in the Greater Lake Washington Watershed.

The Action Plan will include a review of historic (pre settlement) and existing conditions in the corridor and a strategic plan for identifying and developing restoration plans. The plan also includes a preliminary list of recommended actions that include programmatic and site-specific recommendations and further studies that could lead to future restoration actions, scoring and ranking of recommended actions, a final recommended action plan with high priority and lower priority actions. A preliminary monitoring and adaptive management plan, and an implementation strategy for the plan are also included.

The plan will address the limiting factors to salmon production and survival such as: elevated water temperatures, degraded riparian zone, lack of habitat complexity, fish passage barriers, low flows, and other water quality problems. Limiting factors for wildlife include the lack of riparian, wetland and terrestrial habitats, lack of migratory corridors, and disturbance and mortality from adjacent urban and rural development.

Overall, the recommended action agenda will significantly transform the Sammamish Corridor. Although it will not restore the corridor to historic conditions, it will partially restore natural processes,

significantly address the key limiting factors for fish and wildlife, and provide a greatly enhanced corridor for human use and enjoyment.

Little Bear Creek Basin

A complete basin plan has not been prepared for Little Bear Creek Basin. However, Snohomish County is currently preparing a restoration and monitoring project plan for the basin. The study will focus on small farm plans, streamside restoration and fish passage barriers.

The *Snohomish County Ambient Water Quality Monitoring Summary Report 1992-1995* (Snohomish County, 1996) which was conducted to monitor water quality throughout Snohomish County is part of the county's Ambient Water Quality Monitoring Program. The program was designed to establish baseline conditions for Snohomish County surface waters, to identify problem areas for non-point pollutants, and to correlate non-point pollution with land use. The Surface Water Management Department (SWM) uses the results of the program to determine which educational programs and best management practices will most effectively reduce non-point pollution to surface waters.

The City of Woodinville conducted a Corridor Habitat Assessment for Little Bear Creek. The assessment was carried out by accomplishing several tasks including existing data collection, habitat and presence surveys for fish and wildlife, and documentation of findings.

The project goals were to document existing fish and wildlife, habitat conditions, fish and wildlife utilization, and identify potential restoration opportunities along Little Bear Creek within the City limits.

Because Endangered Species Act (ESA) considerations are an important facet of current stream related surveys, the focus was on collecting data that would assist in the determination of limiting factors as they relate to ESA listed salmonids. This included data required to address the Matrix of Pathways and Indicators developed by the National Marine Fisheries Service (NMFS). The Matrix of Pathways and Indicators addresses baseline conditions by examining a total of 6 pathways and 17 associated indicators. The result is either a determination of properly functioning, at risk, or not properly functioning rating based on specific criteria.

Puget Sound Region

The *Stormwater Management Manual for Western Washington* (Washington State Department of Ecology, 2001) is essentially a Best Management Practices (BMP) manual, which addresses erosion and sediment control, runoff and pollution control from urban land use, and provides implementation guidance for local governments including model ordinances. This manual is included in this review of drainage, flooding, and stormwater runoff plans, because most surface water runoff from the City of Woodinville ultimately enters the Puget Sound.

The manual contains five volumes that address minimum requirements for all new development and redevelopment, including preparation of storm water site plans, and a BMP selection process for permanent storm water quality control plans, erosion and sedimentation control, guidelines for controlling pollutants other than sediment, NPDES stormwater permit requirements, infiltration, and detention BMPs, natural wetlands and storm water management, biofilter and vegetated BMPs, streamside stabilization methods, and source control BMPs for many types of urban land uses.

The *Puget Sound Water Quality Management Plan* (Washington State Department of Ecology, 1994) was developed to fulfill the requirements of the Puget Sound Water Quality Act and the federal Clean Water Act. The goal of the plan is to restore and protect the biological health and diversity of Puget Sound. The strategy for achieving this purpose is to protect and enhance Puget Sound's water and sediment quality, its fish and shellfish, and its wetlands and other habitats. This plan is included in this review, because most surface water runoff from the City of Woodinville ultimately enters the Puget Sound.

The regulatory heart of the plan is the “Action Plan,” which contains a number of programs to restore and protect the biological health and diversity of Puget Sound. It preserves and restores wetlands and aquatic habitats, preventing increases in pollutants entering the sound and its watersheds and ultimately eliminating harm from the entry of pollutants to the waters, sediments, and shorelines of Puget Sound. These programs include an Estuary Management and Plan Implementation Program, a Fish and Wildlife Habitat Protection Program, Spill Prevention and Response Program, an Education and Public Involvement Program, and a Non-point source Pollution Program. Some of the specific recommendations outlined in this last program include the creation of local on-site sewage operation, maintenance, inspection, and operation programs to reduce surface water contamination from septic systems, an animal waste management program through the Department of Ecology to protect surface water from animal wastes, the implementation of new forest practices to reduce erosion, the enforcement of boating-related activities which affect water quality (such as sewage, petroleum, and other pollutants), and a household waste management plan to reduce household hazardous wastes affecting water quality.

A-12.3 Sensitive Geologic Areas

Sensitive geologic areas include erosion problem areas, landslide hazard areas, and seismic hazard areas. Each of these sensitive areas is described below and shown in Figure A13-3.

Erosion Problem Areas

There are approximately 347 acres of erosion problem areas in the City of Woodinville (see Table A13-1). Most of these areas can be found on the hillsides to the east and west of the Sammamish Valley, in or adjacent to the neighborhoods of West Ridge and East Valley, as well as in the south-southeast portion of the Woodinville Area. There are also erosion problem areas east of State Route 522 in the North Industrial and Grace neighborhoods. Many of these areas contain glacial deposits of loose, gravelly or sandy soils that compact poorly and erode quickly when in contact with surface water runoff. The most erosive soils require special construction techniques to avoid dangerous landslides and the rapid formation of gullies.

Landslide Hazard Areas

Within the Woodinville Planning Area and within King County, approximately 417 acres of landslide hazard areas are located along the east and west ridgelines of the Sammamish River Valley (see Table A13-1). The area on the west side of the valley is located just west of the Burlington-Northern railroad tracks in the West Ridge neighborhood. The area on the east begins just east of Woodinville-Redmond Road. These areas contain steeply sloping unconsolidated glacial deposits that are highly susceptible to landslides and are a major hazard to people and structures.

Seismic Areas

More than three earthquakes a day, on average, are documented in the State of Washington, the majority occurring in the western half of the state. Most of these are too small to be felt, but large earthquakes have occurred in the Puget Sound during historic times that demonstrate the potential for earthquake-caused damage and loss of life. Seismic areas are identified on Figure A13-3 according to the King County Sensitive Areas Ordinance. Seismic areas are those areas subject to severe risk of earthquake damage as a result of seismically induced settlement or soil liquefaction. These conditions occur in areas underlain by cohesionless soils of low density, usually in association with a shallow groundwater table.

Within the King County portion of the Woodinville Planning Area, there are approximately 939 acres of seismic hazard areas which include almost all of the Sammamish River Valley.

A-12.4 Environmental Resources and References

The following reports and documents support the continued effort by the City of Woodinville in protecting and restoring critical areas. Some are in draft form and will be revised and updated when finalized. The list is not conclusive in that the science, technology and adaptive management practices will increase our future knowledge of environmental practices. The following documents are retained at City Hall for public availability and review:

1. City of Woodinville Shoreline Master Program, July 1997,
2. Draft Little Bear Creek Corridor Habitat Assessment, David Evans & Associates, December 2001,
3. National Oceanic and Atmospheric Administration (NOAA) & National Marine Fisheries Services (NMFS), Endangered and Threatened Species; Final Rule, Section 4(d), March 24, 1999 listing of Puget Sound Chinook Salmon,
4. Draft Tri-County Model 4(d) Rule Response Proposal A Salmon Conservation Program, Biological Review Draft, May 18, 2001,
5. Draft Report Citations of The Best Available Science For Designating and Protecting Critical Areas, Washington State Office of Community Development, July 2001,
6. Draft WRIA 8 Greater Lake Washington Watershed Near Action Agenda, November 21, 2001,
7. King County Surface Water Manual,
8. Draft Sammamish River Corridor Action Plan, Tetra Tech, Inc. October 31, 2001
9. Wetland Functions Assessment Sammamish River Sub-Basin,
10. 1999/2000 Volunteer Salmon Watcher Program Report, King County Department of Natural Resources, May 2000, May 2001.
11. Draft Best Available Science for Wetlands Volume 1 & 2, Department of Ecology, March 2002.
12. Little Bear Creek Corridor Habitat Assessment, July 2002.
13. City of Woodinville Sustainable Development Study – R-1 Zone Phase 2a, October 2007.
14. Woodin Creek Basin Habitat Assessment, September 2004.
15. WRIA 8 Salmon Conservation Plan, 2005, Volumes 1, 2, and 3