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# **Waterways 2000**

## **Rock Creek Natural Area Management Plan**

**December 10, 1996**



**King County  
Department of Natural Resources  
Parks and Recreation Department**

## Acknowledgments

Our sincere thanks goes out to the many committed individuals who participated in the conservation of the Rock Creek Natural Area. Prior to the site acquisition, individual Cedar River Basin residents and Save Rock Creek committee members significantly helped to raise community awareness of the unique qualities of this site. During the planning process basin residents, Tahoma School District students, teachers from the Rock Creek Elementary School, and the site management planning team worked to brainstorm environmental education ideas and information on the site. Thank you for all your help.

In addition, a special thanks to the Waterways 2000 Subcommittee members who have volunteered countless hours toward open space conservation.

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# Waterways 2000 Rock Creek Natural Area Management Plan

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# PREFACE

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## Waterways 2000 Program Overview

Old timers talk of salmon so thick you could walk across the backs of them, but in recent years the numbers have greatly declined, with some species close to being listed as endangered. Salmon have a deep history as a major northwest cultural symbol, are vital to the fishing industry, and are a major keystone species linked through the biological system to a variety of other wildlife species. For these reasons, salmon became the central symbol of the Waterways 2000 program. The challenge was to protect their threatened habitat and to do it without additional government regulation.

The Waterways 2000 program was initiated in 1993 through action of the King County Executive and Council, who asked the King County Open Space Citizens Oversight Committee (COC) to develop the program. The vision for Waterways was to conserve a system of interlocking greenways along King County's extensive network of streams and rivers that would accomplish the following goals:

- Protect salmon runs and river habitat systems through a watershed approach,
- Preserve recreational, scenic, cultural and wildlife resources, or enhance existing protected resources,
- Encourage property owners and residents to participate voluntarily,
- Foster stewardship through citizen and government partnerships and environmental education,
- Create a strong constituency for supporting salmon and waterways protection, and
- Develop pilot projects for urban waterways.

Over the last three years the Waterways 2000 program has demonstrated that the protection of salmon runs and aquatic resources can be achieved in King County with an active, ongoing, working partnership among governmental agencies, local communities and property owners. This preface gives a brief overview of how the program was developed and its major components.

## History of Program Development

In January 1994, a Waterways 2000 subcommittee of the King County Open Space Citizen's Oversight Committee (COC) was formed to evaluate King County's seventy-two basins. The Subcommittee enlisted prominent scientists and resource experts to participate on a Waterways Advisory Panel (WAP) to develop criteria and identify the highest-value resource areas. Concurrently, the Subcommittee developed criteria for evaluating the basins for the other objectives. Public meetings were held in April 1994 to solicit comments on the criteria, and to identify issues and community support. Stakeholders, representing recreational, agricultural, development, urban, and Tribal interests were involved throughout the process.

In June 1994, six basins were selected that would provide the best opportunities for achieving the Waterways goals (see Table I, page iv). Stream reaches within these basins were selected over the summer and basin teams made up of citizens, County staff and stakeholders were formed for each basin. During September to December 1994 the Basin Teams met with citizens at town hall meetings and in the field to develop specific recommendations for property acquisition and stewardship strategies. The Subcommittee reviewed the recommendations and presented a report to the full COC that was then transmitted to the County Executive and County Council. The County Council approved the Waterways 2000 Acquisition and Stewardship Report in February 1995 and implementation began.

The King County Council appropriated over \$14.8 million to Waterways 2000 from several funding sources, including Conservation Futures Tax levy funds, 1989 Open Space Bond Fund reallocations, Real Estate Excise Tax Bond funds and King County general funds. The COC also recommended appropriating \$600,000 of 1989 Open Space Bond interest earnings to the project, for a total of over \$15.4 million.

The Citizen Oversight Committee recommended that King County use most of the \$15.4 million to acquire property interests in six critical resource basins and one urban creek watershed in unincorporated King County. The COC recommended that \$697,000 be allocated to support the first two years of essential basin stewardship and site management, and that King County grant \$800,000 to the City of Seattle and \$800,000 to four suburban cities for urban waterways demonstration projects.

### **Program Implementation**

**Acquisition:** The Waterways 2000 program emphasized cost-effective acquisitions, leveraging of public funds, and other incentives to encourage property owners to participate in resource conservation without King County purchasing their property outright. Property owners participated on a strictly voluntary basis. In addition, potential acquisitions were evaluated for their value to the conservation of the entire system, not as isolated pieces.

By June 30, 1996, King County had acquired 1,173 acres of fee simple or conservation easement property interests. An additional 334 acres were protected through the open space tax benefits program (PBRs).

**Stewardship:** Stewardship by property owners, as well as by agencies and community groups on public lands, is a critical component and a highly cost-effective strategy to help improve habitat and aquatic resource conditions regionally. The basin teams developed stewardship strategies for each basin. During 1995, the basin stewardship program provided over thirty opportunities for citizen involvement and education. These activities included stream restoration, non-native plant removal,

native planting and salvage, park adoptions, watershed festivals, litter clean-up, and workshops on native plants or amphibian monitoring. Over 600 people participated in these events, volunteering over 1700 hours and planting 3500 native trees and shrubs. Partnerships have been built with citizens, community groups, and schools. Similiar events are occuring during 1996.

**Urban Program:** Another important goal of Waterways 2000 was to develop pilot programs that demonstrate how aquatic resources in urban streams and rivers can be better protected and cared for. Building a regional constituency for conservation is important to the success of the program and to do this urban dwellers must also be able to see tangible results. Since urban waterways are typically degraded compared to more rural waterways, the criteria were adapted to reflect this. Incorporated cities were asked to work with their citizens to develop and submit proposals for urban projects to be funded through Waterways grants.

**Site Management:** A site management plan (SMP) guides the short and long-term management of a site or stream reach to achieve desired conditions or outcomes that are consistent with the overall goals of the Waterways 2000 program. The plan recommendations are based on a synthesis of information gathered from resource and human use inventories and from meetings with the community. In addition to conserving the sites resources, the plan recommendations seek to involve the community in the management of a site, provide educational opportunities and instill the value of preserving natural areas within the community.

Implementation of the SMP involves regular maintenance, resource management, public partnerships, and public access tasks. Each site can be expected to initially require differing levels of traditional maintenance. Over time, site needs may vary considerably due to use patterns and the ability to enlist volunteers in the Adopt-a-Park Program and for special projects. Resource management is needed to ensure that the quality and condition of aquatic and other natural resources on Waterways 2000 sites is maintained or improved. Public partnerships include recruiting and supporting volunteer efforts, education, and interpretive programs. Finally, site improvements, such as trails or gates, support and control public access and use.

**Table I. River Basins and Reaches  
Selected for the Waterways 2000 Pilot Program**

<b>Bear Creek Basin:</b>	Upper Bear Creek - Paradise Lake to Woodinville-Duvall Road Reach Upper Bear Creek - Woodinville-Duvall Road to Tolt Pipeline Reach Cottage Lake Creek Headwaters Reach Mid-Bear Creek - Tolt Pipeline to NE 116 <sup>th</sup> Reach Mid-Cottage Lake Creek Reach
<b>Lower Cedar River Basin</b>	Rock Creek Shaw/Landsburg Reach Peterson Creek Reach
<b>Griffin Creek Basin</b>	Middle Zone Reach east of Carnation/Fall City Road  Forest Zone Reach
<b>Patterson Creek Basin</b>	Tributary 0383 Main Stem Reach 3B Main Stem Reach 3A Canyon Creek Reach
<b>Middle Green River Basin</b>	O'Grady Reach Newaukum Creek Confluence Reach Auburn Narrows Reach
<b>Middle Fork Snoqualmie River Basin</b>	Oxbox Reach South of Three Forks Reach

# **Section One**

## **INTRODUCTION**

The Rock Creek Natural Area was purchased under the Waterways 2000 program because it provides opportunities to achieve the broad program goal of conserving high quality aquatic resources. The quality of the resources on the site is unusual for not only the Cedar River Basin but also for King County as a whole. The site is in exceptional condition given its proximity to the developing suburban fringe, and retains a "wild" character that one would expect of lands further removed from a growing city. The creek is potentially one of the most productive in the Cedar River system and benefits greatly from the site's heavily wooded riparian and upland areas. The integrity of the resources on the site also makes it extremely valuable as a reminder of the resource quality which was once common in the county and now is being conserved through the Waterways 2000 program.

### **Location and Context**

The Rock Creek Natural Area comprises 98 acres and is located in east King County, approximately 0.5 mile east of State Route (SR) 169 and 0.75 mile north of SR 516. To the south of and immediately adjacent to the site is a 40 acre parcel purchased as a Cedar River Legacy property. Scattered single-family homes border the site to the north and west; higher density subdivisions of single-family homes border the southwest; undeveloped forest borders the south; and several hundred acres of clear-cut commercial forestlands border the southeast and east. Lake Youngs Pipeline and King County Cedar River Regional Trail traverse the northeastern portion of the site.

### **Planning Process**

The Rock Creek planning team collected and analyzed available data, conducted field trips with citizens and agency staff, and developed proposals for the use of the Rock Creek site. The team visited the site with instructors from Rock Creek Elementary in order to assess the current interest in the site. These groups provided invaluable input into the planning process. Prior to the County's acquisition of the site, the community near the site was very active in expressing its concern for the preservation of the site's resources. Many citizens - some in the informal organization "Save Rock Creek" - voiced their interests during the review of the Draft EIS for the Wilderness Retreat and Wilderness 50 developments. These citizens helped raise the awareness of the valuable resources found in and along Rock Creek.

### **Natural Features**

The Rock Creek Natural Area is the site of the highest quality aquatic habitat in the Cedar River Basin Planning Area and is one of the two best aquatic habitats remaining in the Lake Washington drainage. Rock Creek is potentially the best tributary habitat in the Cedar River watershed for chinook, sockeye and coho salmon, and steelhead and cutthroat trout. The

creek is unique in that it draws its flow primarily from those groundwater springs, and as a result has stable hydrology and high water quality and is not subject to damaging flood flows. However, the potential of the creek to provide high quality in-stream habitat is directly affected by groundwater withdrawal upstream of the Rock Creek Natural Area by the City of Kent. The good physical condition of the Rock Creek watershed, in which minimal urban development has occurred, is an important contributing factor to the quality of the stream habitat.

Rock Creek's riparian zone contains both coniferous- and deciduous-dominated forest areas. Deciduous forest dominates on the west side of the creek while the eastern bank is dominated by either mature conifers or a deciduous/coniferous mix. These forested areas provide several important benefits to the creek, including shade, detrital contributions critical to food web processes, and inputs of large organic debris that contribute to stream channel stability and to the creation of habitat complexity. An example of this contribution to complexity is the numerous high quality pools that have formed behind large organic debris in the high gradient stream reaches. Overall, Rock Creek's low water velocities, high habitat complexity, and clean gravels are key elements in its support of aquatic wildlife.

In addition to the stream and riparian areas that make it so valuable, the site contains upland forest and wetland areas that are critical to the health of the stream and the wildlife that visit the site. There are several distinct forested areas on the site, the differences between which are related primarily to the age or type of the trees in these areas. The oldest forest cover is found on the western portion of the site along the Lake Youngs Pipeline and south of the King County Cedar River Regional Trail. The majority of the site lies within a somewhat younger coniferous forest stand. The trees in this "younger" area are relatively widely spaced, providing an opening for the development of a shrub layer. Finally, there is an area of deciduous forest near Rock Creek and the Lake Youngs Pipeline right-of-way.

Four wetlands, comprising 1.12 acres, occur on the site. These include two palustrine forested wetlands, a palustrine forested/palustrine emergent wetland and a palustrine scrub-shrub wetland. All but the northwestern-most wetland are dominated by deciduous vegetation in the tree canopy and shrub layer. The vegetation of the northwestern wetland is dominated by a coniferous tree layer.

The site is used by a variety of wildlife, including, and of particular note, a herd of wild elk, cougar, bear, black tail deer, bald eagle, red-tailed hawk, pileated woodpecker and Pacific giant salamander.

## **Site Use**

Currently, the Rock Creek Natural Area is the site of a range of human activity, some of which is consistent with the public access goals of the Waterways program and some of which is not. Activities consistent with the program goals include low-impact use by hikers, bird-watchers, and groups of students from neighboring Rock Creek Elementary School taking part in environmental education. These school groups comprise approximately 25 to

30 students at a time and visit the site on an irregular basis, largely in the fall and spring. These low-impact uses take place primarily on the site's several trails and occur year-round. At times the site is also used for higher impact recreation which is not consistent with Waterways 2000 goals. These forms of recreation include All-Terrain-Vehicle (ATV) use and horse-riding. Evidence of past use is also apparent, most notably a footprint of the early phase of development by the previous owner. This takes the form of a rough gravel road running southwest of the creek and faint roads east of the creek.

## **Opportunities**

In the context of the Waterways 2000 program, the Rock Creek Natural Area holds many opportunities for action and education that will contribute to both resource protection and restoration and the development of a sense of ownership and a stewardship ethic among visitors. Particularly promising is the opportunity to strengthen an existing relationship with the elementary school. The school has used the site for environmental education and have expressed an interest in continuing this use, in addition to contributing to the stewardship of the site. Additional opportunities include the following:

- exploring the relationship of salmonid and wildlife populations to the quality of their habitat
- monitoring the process of succession in forest habitats
- re-establishing native vegetation as a way of supporting endemic wildlife and repairing damage from past uses
- studying the role of the site's habitat in relation to the loss of like habitat in the surrounding area
- participating in the collection of biological information to be used in guiding ecological management decisions.

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## **Section Two:**

### **A VISION FOR THE ROCK CREEK NATURAL AREA**

The vision for the Rock Creek Natural Area is one in which the community, with the assistance of County staff, works for the protection of the health of the stream, forest, and wildlife and in conjunction learns about the importance of this site to the health of the watershed. County staff and the community, including students and teachers from the Rock Creek Elementary School, will work to support the key ecological aspects of the site. Visitors will be welcome to use the site for passive recreation, especially for purposes that foster a sense of community ownership and stewardship of the site and that do not have detrimental effects on its resources. Overall, the County and the community will collaborate in an effort to conserve the high quality natural resources that make this site so valuable

The short-term (five to ten year) vision for this site focuses on maintaining or improving the condition of the site's natural resources while gathering information about those resources. Actions taken to maintain or improve conditions may include the eradication of invasive species and the appropriate removal of hazard trees. County staff will assist groups from the Rock Creek Elementary School in finding ideal sites near the creek from which they can observe and learn about the dynamic natural system. These groups will come to play an important role in the ongoing stewardship of the site and will insure that their educational activities respect and protect the natural values of the site. The County will seek out opportunities to engage in partnerships with the community around the site that will support the conservation of the site's resources, and will focus on involving the public and the school system in stewardship decisions and actions. The County may also form partnerships that aid restoration on the site, especially when a restoration opportunity is at hand and the partnership involves the active participation of the community and the donation of time or materials.

Over the long term the Rock Creek site will continue to exist as high quality natural habitat supporting aquatic and terrestrial wildlife, and will be a "classroom" in which citizens can study and understand the natural forces at work in the watershed. The site will gain importance as a buffer between undeveloped commercial forestland to the east and developed areas to the west, and as such will be subject to outside pressures that may influence the quality of its resources. The site will continue to provide habitat types that are disappearing from the eastern edge of the Puget Sound lowlands. Passive use of the site will continue, providing the public with the opportunity to learn about and enjoy an important part of the Cedar River watershed's natural resource system.

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### **Section Three:**

## **MANAGEMENT GOALS, OBJECTIVES AND ACTIONS:**

At the Rock Creek Natural Area we have the opportunity to obtain the stated programmatic goals of Waterways 2000. The following goals, objectives and recommended actions are methods to begin management of the site in accordance with the long-term vision.

As the planning team members developed the following objectives and actions they found that key questions revolved around providing for public access and supporting the environmental education activities of neighboring Rock Creek Elementary School while still meeting the primary objective of protecting the site's natural resources. The team carefully considered the site as a whole and decided that the conservation of resources would be best served by directing public access to the area southwest of Rock Creek. Then the team conducted field trips to better address site-specific issues, such as the number and location of access points to the stream, and conversion of the preliminary plat-road system remaining

from previous development activity to trail use. Throughout this process they sought assistance from other county agencies and the Rock Creek Elementary school.

A section of the plat-road system near 252nd Street was a key issue. Since this section of the plat-road bisects a wetland, a culvert was installed to allow temporary use of the road by maintenance vehicles. The temporary road will allow for flexibility when implementing recommended actions during the initial management of the site. In future years, after monitoring the natural conditions and public use of the site, a decision will be made as to whether the temporary road will remain.

The following recommended actions will be subject to an implementation analysis and department approval before implementation occurs, with the exception of early action items below that have already been implemented. Following implementation, the goals, objectives and recommended actions will be revisited in one-year and then on a five-year basis to determine if they are consistent with the program goals and site vision, and to determine what new actions need to occur in order to continue to achieve these goals.

## **I. MANAGEMENT OF STREAM AND WETLAND ECOSYSTEM**

**GOAL:** Protect the health of the stream, wetland, and riparian ecosystems on the site.

**AQUATIC ECOSYSTEM OBJECTIVE:** Sustain long-term high quality habitat of the stream channel and wetland ecosystem.

- **Recommended Action:** Continue dialogue with the City of Kent regarding their water diversions of the stream in order to ensure a base flow sufficient for fish spawning.

**Justification:** Efforts should be made to obtain a minimum late summer/fall base flow sufficient to allow sockeye and chinook salmon spawning and to reduce the effect of extreme low flow events. These low-flow events are particularly damaging to rearing coho salmon and steelhead and cutthroat trout.

**Who:** Water and Land Resources Division (WLRD) Staff

- **Recommended Action:** Restore wetland bisected by the trail where a culvert has been installed. Restoration should include revegetation of the site with native wetland plant species.

**Justification:** Efforts should be made to restore degraded areas of the site to help maintain diverse habitat areas and to restore the micro-hydrology of the wetland.

**Who:** Parks Maintenance Staff: Restore and maintain.  
Cedar River Basin Steward: coordinate revegetation of site.  
Public/Schools: Expressed an interest in participating in site revegetation.

## **II. MANAGEMENT OF FOREST ECOSYSTEM:**

**GOAL:** Maintain the health of the forest ecosystem and allow progression into a mature coniferous forest.

**FOREST ECOSYSTEM OBJECTIVE:** Promote natural succession of native vegetation through vegetation management. Input of coniferous, large woody debris to the forest floor, riparian areas and aquatic habitats should be encouraged.

- **Recommended Action:** Allow the preliminary plat road network on the north to northeast side of the site to grow over and eventually become naturally vegetated. In some areas revegetation may assist this process. Install a gate (early action) at the pipeline entrance to the northern section of the site to prevent intrusion into the riparian habitat. Two years after the installation of the gate, determine if the gate is still necessary as a deterrent to unwanted access to the riparian area.

**Justification:** Allowing the road network in the north/northeast to grow over will encourage the natural successional process to occur, minimize disturbance of the habitat, and encourage public use on the southwest side.

**Who:** Parks Maintenance Staff: Monitor northern portion of site until preliminary plat road network is grown over (one to one and a half years).  
Cedar River Basin Steward: Help coordinate revegetation.

- **Recommended Action:** Provide training for Parks Maintenance Staff on the management of large woody debris (LWD), snags and hazard trees. If removal of LWD is necessary, the preferred method is to drag debris out of the way rather than to cut it. When cutting is the only alternative, efforts should be made to minimize cuts and leave pieces of LWD as long and as intact as possible. Snags should be left standing whenever possible or shortened to reduce hazards rather than cutting them at the base.

**Justification:** Natural forest processes should be encouraged to continue. However, efforts should be made to allow for the public to safely use the site for passive recreation and environmental education.

**Who:** Cedar River Basin Steward, WLRD Ecologist and Parks Recreation Coordinator: Coordinate training.

Parks Maintenance Staff: Participate in training and continue on-going management of LWD, snags, and hazard trees.

**FOREST ECOSYSTEM OBJECTIVE: Discourage the invasion of non-native plant species into the site.**

- **Action:** Non-native plants should be removed and replanted with native vegetation. Investigate for signs of non-native vegetation and, if present, remove and replace with native species, if necessary.

**Justification:** Invasive, non-native vegetation may successfully compete with native vegetation and diminish species diversity on the site.

**Who:** Parks Maintenance Staff: Identify and assist with revegetation  
WLRD Cedar River basin steward: Organize revegetation work parties  
Public/Schools: Assist in removal and replanting of vegetation

**FOREST ECOSYSTEM OBJECTIVE: Protect the aquatic resources of Rock Creek as well as the homes adjacent to the site in the event of catastrophic fire.**

- **Recommended Action:** Ensure visitors understand that campfires will be prohibited at Rock Creek. Develop a plan with local fire fighters to protect the aquatic resources of Rock Creek in the event of a fire. Discuss types of fire dousing materials with fire fighters that would allow fires to be fought without undue harm to the resources, i.e. water as opposed to foam. Determine from fire fighters if water used to fight fires would come from Rock Creek or another source. Give a detailed map of Rock Creek trails to firefighters.

**Justification:** Some fire fighting methods could harm the ecosystem. Due to the proximity of housing developments near Rock Creek, there can be no "let it burn" policy.

**Who:** WLRD Cedar River Basin Steward and Parks Recreation Coordinator:  
Organize meeting with Parks Maintenance Staff, WLRD ecologist and local fire fighters.

### **III. MONITORING AND ASSESSMENT:**

**GOAL:** Protect high quality habitat by monitoring key ecosystem processes and functions over time.

**MONITORING AND ASSESSMENT OBJECTIVE:** Continue ongoing assessment of the site to determine if there are substantive changes due to public use or other impacts.

- **Recommended Action:** Conduct monitoring using standardized monitoring forms to update baseline data of site. Monitoring should focus on impacts due to public access, changes in plant composition and distribution, fish counts, water quality, forest composition and elements of forest, stream and wetland characteristics.

**Justification:** Monitoring will provide on-going information necessary in determining if the vision for the site is being attained.

**Who:** WLRD Ecologist: Oversee collection of biological data, including monitoring and data collection by the public coordinated with the Cedar River Basin Steward.

Parks Maintenance Staff: Assess human impacts to site, remove garbage, address encroachment issues.

Public/Schools: Expressed an interest in the collection of data

- **Recommended Action:** Conduct additional assessment of public use/access and natural features on northeastern portion of the site.

**Justification:** Public uses of the site are currently encouraged to take place on the southwestern portion of the site. Collection of additional information on northeastern portion of the site is necessary in order to determine if this area can maintain passive recreational uses and if additional vegetation management is necessary.

**Who:** Cedar River Basin Steward: Coordinate data collection if public is involved.

WLRD Ecologist: Oversee collection of biological data.

Public/Schools: Expressed an interest in assisting with the collection of data.

#### **IV. PUBLIC/PRIVATE PARTNERSHIPS:**

**GOAL:** Form lasting public/private partnerships between King County and Rock Creek community for ongoing stewardship of site.

**PARTNERSHIP OBJECTIVE:** Encourage an ongoing process to integrate the community's stewardship ideas and needs into site management.

- **Recommended Action:** Work with the Tahoma School District to develop a site specific environmental education program.

**Justification:** Development of partnerships with area schools helps to promote a sense of ownership of the site by local citizens.

**Who:** Cedar River Basin Steward:  
Parks Recreation Coordinator:  
Tahoma School District Staff: Have expressed an interest in assisting with ongoing site maintenance needs.

- **Early Action:** Develop outreach efforts to identify community interests and needs with regard to the site. Encourage existing or new organizations to enroll in programs such as Adopt-A-Park.

**Justification:** Development of partnerships with local community helps to promote a sense of ownership of the site by local citizens.

**Who:** Parks Volunteer Coordinator:  
WLRD Cedar River Basin Steward:  
Tahoma School District: Has expressed an interest in enrollment in the Adopt-a-Park Program

- **Recommended Action:** Develop a brochure for neighboring home owners near Rock Creek informing them that Rock Creek, a unique natural resource with high quality aquatic and terrestrial wildlife habitat, is their neighbor. This brochure will explain how they can be a good neighbor to Rock Creek and address landscaping with native vegetation, deter people from using harmful chemicals that may drain to the creek, etc.

**Justification:** People who choose to live near Rock Creek may have an aesthetic connection to the area, but may not understand how their actions directly impact the quality of the habitat near their home.

**Who:** Cedar River Basin Steward: Work with school and  
Parks Recreation Coordinator/Interpretive Specialist:  
Tahoma High School: High School students have received a grant to produce.  
Rock Creek Elementary School: Has expressed an interest in providing artwork.

## **V. PUBLIC ACCESS TO THE ROCK CREEK NATURAL AREA:**

**GOAL:** Provide for passive recreational use of the site while protecting the site's outstanding natural features from over-use and disturbance.

**PUBLIC ACCESS OBJECTIVE:** Placement and maintenance of trails should minimally disturb vegetation, aquatic habitats and wildlife of the site while accommodating passive recreational uses and environmental education.

- **Recommended Action:** Maintain trails on the southwest side of the Rock Creek Natural Area (see Appendix A: Map 2) at a maximum width of eighteen inches to two feet, with the exception of an interpretive trail, if developed, which may be wider. Any new trails that require construction will also be built using this guideline. Additional trail guidelines can be found in the USFS trail manual and the King County SAO ordinance.

**Justification:** Limiting trail width and height prevents non-native species from invading the area and resembles a wilderness setting more appropriate to the Rock Creek Natural Area.

**Who:** Parks Maintenance Staff: Conduct routine maintenance of trails.

- **Recommended Action:** Maintain the section of the preliminary plat-road from 252nd Street SE entrance at its current length for temporary use by maintenance vehicles. The road currently extends approximately 1200 feet to the east from this entrance. The road will be maintained at the minimum allowable width to minimize impacts to the surrounding vegetation. When the temporary need for the road no longer exists the road will be removed or converted into a trail.

**Justification:** The temporary road will allow for flexibility when implementing recommended actions during the initial management of the site.

**Who:** Parks Maintenance: Conduct routine maintenance.

WLRD Ecologist: Monitor impact on natural system.

Parks Recreation Coordinator: Monitor public use.

Cedar River Basin Steward: Coordinate revegetation when converted.

- **Early Action:** Reroute public access at 256th Street so that the trail is not encroaching onto neighboring private property. The new access will be relocated to where Parks Maintenance staff have surveyed a new trail. Parks will work with neighbors regarding their preference for vegetative cover for the old trail.

**Justification:** Relocating the trail directs public use away from private property.

**Who:** Parks Maintenance Staff: provide labor and materials for trail rerouting.

Youth at Risk: Have expressed an interest in rerouting trail.

Cedar River Basin Steward: Coordinate revegetation project

Public/Schools: Have expressed an interest in assisting with revegetation of existing trail.

**PUBLIC ACCESS OBJECTIVE:** Ensure that visitors use the site in ways that do not degrade, through over-use and disturbance, the site's natural features.

- **Recommended Action:** Inform visitors through signs and brochures what uses are allowed at Rock Creek. Passive-recreational uses of the site are limited to low-impact, passive recreational opportunities such as hiking, photography, environmental education, walking with a leashed pet, and wildlife viewing.

**Justification:** The primary objective of the Waterways 2000 program is to conserve aquatic habitat. The passive-recreational uses listed above are compatible with maintaining the high-quality natural features of the Rock Creek Natural Area.

**Who:** Parks Maintenance Staff: Install a Parks Department "Please observe the following rules" sign (early action). See also Waterways sign under Section VI - Environmental Education and brochure under Section IV - Public/Private Partnerships.

- **Early Action:** Discourage trail use by bicycles and horses, and support the prohibition of motorized vehicles on the site. Install a gate and place natural debris on either side of the gate to create a barrier for motorized vehicles, bicycles and horses at public entrances.

**Justification:** The goals of Waterways 2000 include protection of water quality, stream and forest habitats, channel stability and vegetation. Motorized vehicles, bicycles and horses would degrade the high quality natural features of the Rock Creek site and would be incompatible with the Waterways goals.

**Who:** Parks Maintenance Staff: Install gate and natural debris.

- **Recommended Action:** At the site entrance by 252<sup>nd</sup> Street, the trail forks: the left arm that extends north will be revegetated from a preliminary plat road to a footpath with a maximum width of two feet. This trail shall be maintained as a pathway for pedestrian use only. Since a new subdivision has been approved for development at the end of this arm of the trail, it will be important to monitor possible encroachment at this location of the site as well as monitor for possible dumping.

**Justification:** Provides public access from the new subdivision while limiting this trail to pedestrian uses, which is more compatible with Waterways goals of protecting the natural resources of the site. The use of the foot path system by motorized vehicles and horses may degrade the site beyond an acceptable level.

**Who:** WLRD Basin Steward: Organize revegetation with public.  
Schools/Public: Interest in revegetating trail to make it narrower.  
Parks Maintenance Staff: Monitor for dumping and encroachment.

## **VI. ENVIRONMENTAL EDUCATION:**

**GOAL:** Encourage use of the Rock Creek site for environmental education by neighbors and the Tahoma School District, particularly Rock Creek Elementary, which is within walking distance to the site. Encourage use of the site in a manner that does not degrade the resources.

**ENVIRONMENTAL EDUCATION OBJECTIVE:** Provide opportunities for approximately four Rock Creek Elementary classes of 25 to 30 students to visit the site once a month in a manner that does not degrade the natural resources.

- **Recommended Action:** Convene a group of teachers, WLRD and Parks staff to determine how to best support environmental educational opportunities while meeting the following parameters: 1) does not significantly degrade the natural resources; 2) provides access to the creek; 3) assure safety for schoolchildren; 4) provide a gathering area for a school class; 5) provide access point close to school; 6) seek protection from illegal and excessive uses by public; and 7) provide rustic character. Examples of illegal uses include gathering of natural materials, motorized vehicles, or horses. Examples of excessive use include party spots or bikes.

**Justification:** Selecting opportunities for a class to conduct field studies and afford protection of the high quality of the riparian ecosystem would be congruent with the Waterways goals. In addition, providing a setting where students can congregate to learn about the site's natural features is also compatible with Waterways goals.

**Who:** WLRD Cedar River Basin Steward, Parks Recreation Coordinator and Maintenance Manager, and Rock Creek Elementary School teachers.

**ENVIRONMENTAL EDUCATION OBJECTIVE:** Provide educational opportunities through entrance design and signage.

- **Recommended Action:** Develop language and graphics for a generic Waterways 2000 sign and install at major access points for each Waterways 2000 site. The signs shall inform the public about the resource protection goals of the Waterways 2000 program.

**Justification:** Signs provide a continual on-site opportunity for public education on the unique natural features of the Rock Creek site, the Waterways program goals to protect salmon and other wildlife habitat, why these sites are sensitive, how people can aid in the site's protection, and the passive recreation uses that are compatible with the Waterways goals.

**Who:** Parks Maintenance Staff: install signs.

WLRD Staff and Parks Recreation Coordinator: design a Waterways 2000 sign.

- **Recommended Action:** Enhance site entrance at 252<sup>nd</sup> Street by replacing non-native plants with native vegetation.

**Justification:** The entrance at 252<sup>nd</sup> Street will be the main access point for visitors. Presently the area is overgrown with weeds, and there is an unattractive surface water detention pond by the entrance. Native plant vegetation will establish an initial impression with the visitor of the natural character of the site. In addition, the plantings will improve the entrance appearance and provide amore welcoming location for environmental education through signage.

**Who:** Cedar River Basin Steward: Coordinate with WLRD staff and Parks to design a more attractive entrance through participation in WLRD's Ugly Pond Project.

Parks Maintenance Staff: Remove weeds, bollards and sawhorses.

- **Recommended Action:** Assess the possibility of interpretive elements at the site depending upon usage.

**Justification:** An increase in the number of visitors to the site may justify providing interpretive elements at the site.

**Who:** Parks Recreation Coordinator, Parks Maintenance Manager, and WLRD Cedar River Basin Steward.

## **VII. SECURE AND PROTECT THE ROCK CREEK SITE:**

**GOAL:** Maintain a clean and refuse-free site.

**SECURE AND PROTECT OBJECTIVE:** Take measures to prevent illegal dumping, prevent access by motor vehicles, horses and bicycles and prevent encroachment.

- **Recommended Action:** For the first year and a half, once a month walk both the north and south sides of the site, inspect the culvert to assure it isn't clogged, inspect for signs of vandalism and encroachment, and remove trash. After the first year and a half, walk only the south side of the site.

**Justification:** Monthly inspection will assist with the healthy continuance of the site's natural systems as well as allow the County the ability to address any problem areas in a timely manner.

**Who:** Parks Maintenance Staff: remove refuse and inspect the site  
Public/Schools: Have expressed an interest in assisting with clean-up

**SECURE AND PROTECT OBJECTIVE:** Define legal boundaries of the site by survey where these boundaries are unclear.

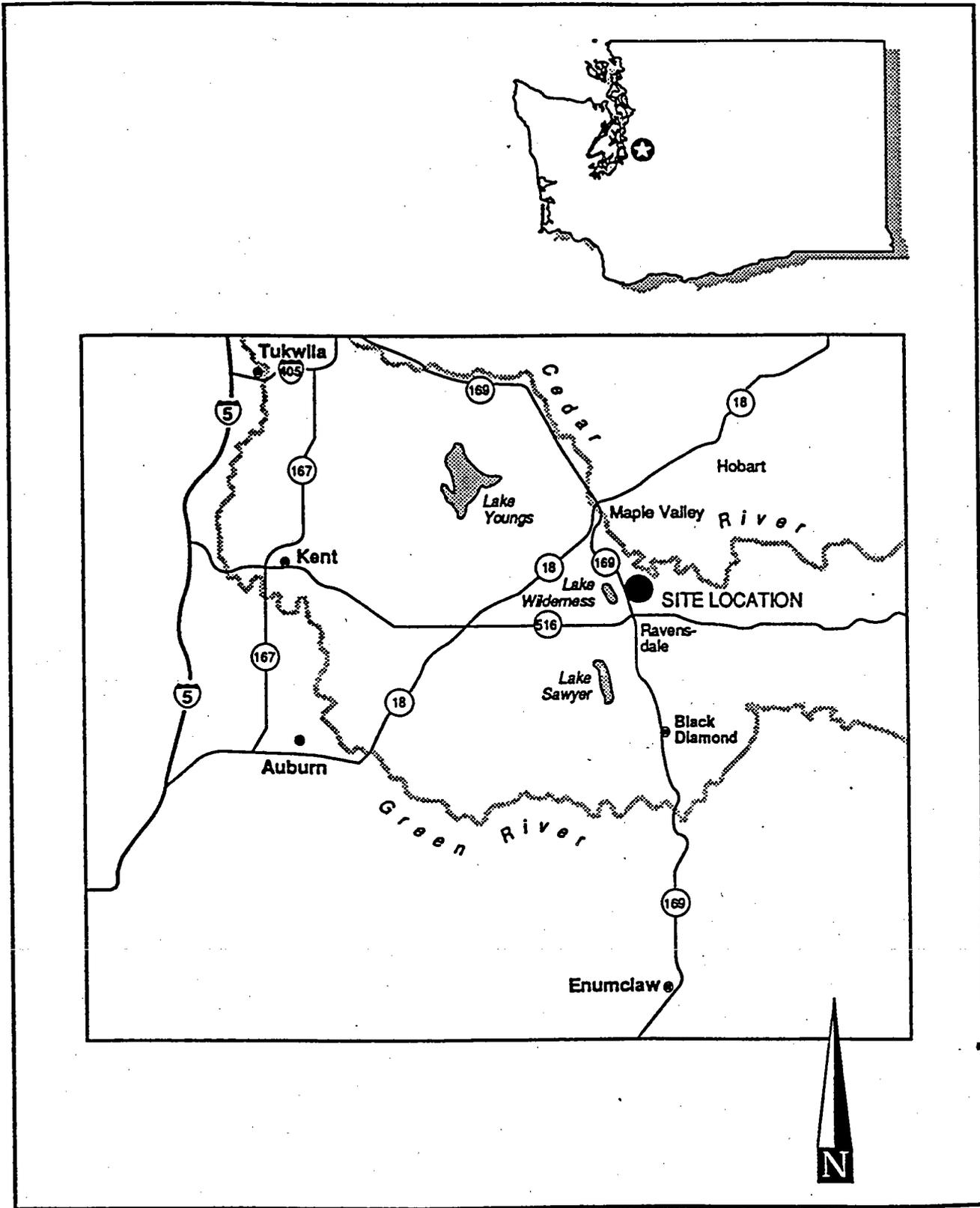
- **Early Action:** Survey the legal boundaries and place boundary markers at appropriate intervals along boundary lines of site.

**Justification:** Accurate boundary delineation will assist the County in determining potential encroachment into the site.

**Who:** King County or Contract Surveyors: Establish and mark boundary lines with permanent markers.

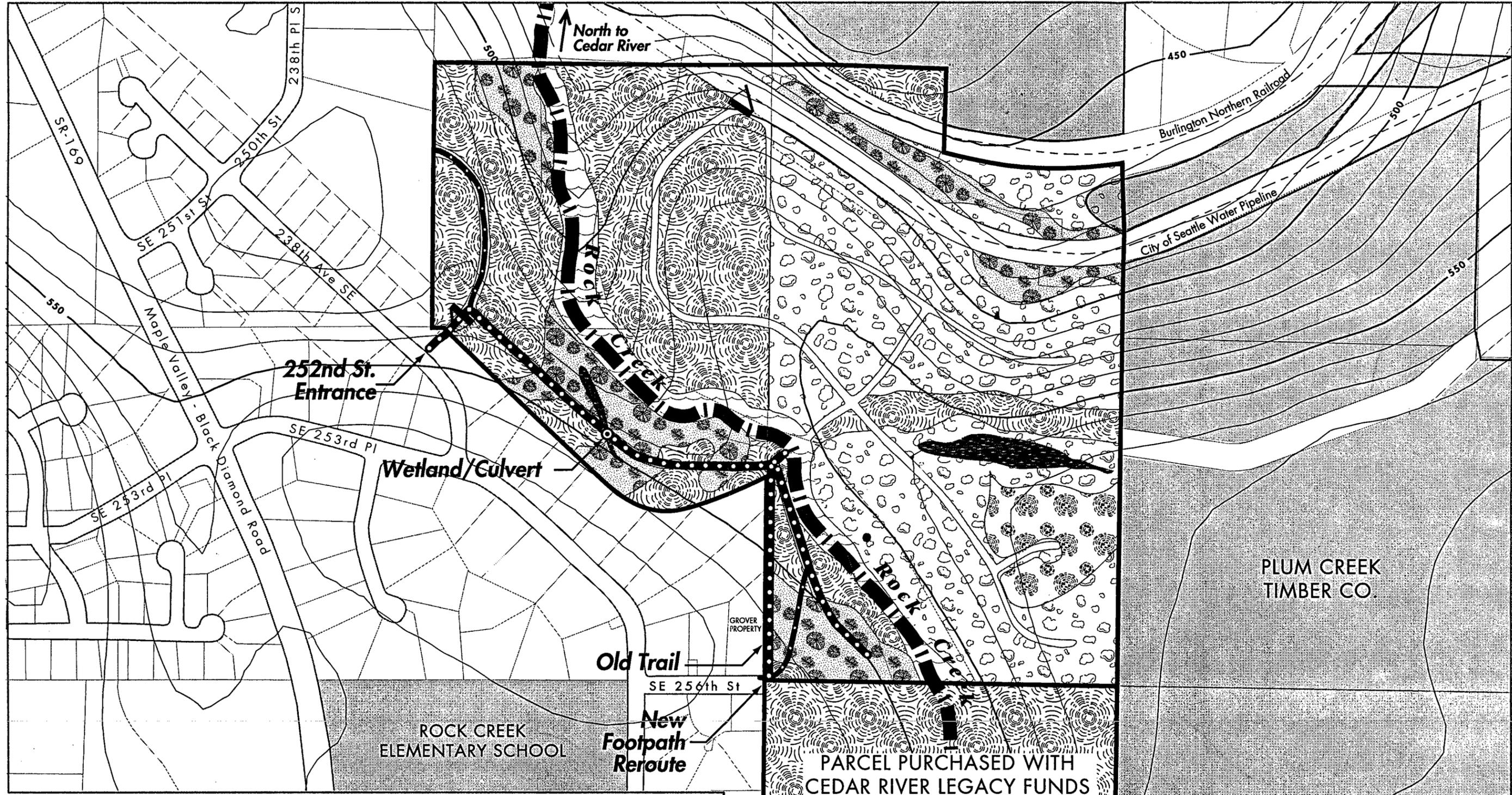
# **APPENDIX A: MAPS**

- 1. Rock Creek Site Location**
- 2. Rock Creek Site Map**



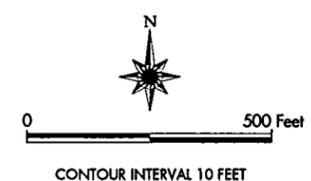
Rock Creek Waterways 2000 Site Location

Map courtesy of Jones & Stokes Associates, Inc. 1993  
 Wilderness Retreat/Wilderness 50 Technical Appendix.



# ROCK CREEK WATERWAYS PROPERTY

- |  |                             |  |                                |
|--|-----------------------------|--|--------------------------------|
|  | Stream                      |  | Pipeline                       |
|  | Topographic Contour         |  | Railroad Easement              |
|  | Trail                       |  | Project Boundary               |
|  | Limited Access              |  | Riparian                       |
|  | Wetland                     |  | Forest-Shrub                   |
|  | Location of Special Feature |  | Deciduous Forest               |
|  | Gate                        |  | Immature Coniferous Forest     |
|  | Parcel Boundary             |  | Mature Coniferous Forest       |
|  | Contour line                |  | Recently Cut & Replanted Stand |



This map was developed by King County SWM GIS/ Cartography for planning purposes only and is representational. It was not designed to be used as a base map for other uses nor as a source for accurate measurements. Map revised 12/4/96.

# APPENDIX B: NATURAL RESOURCES

## Present Conditions at the Rock Creek Natural Area

Summarized from: Technical Appendices: Volume 2 - Proposed Plat of Wilderness Retreat (S89P0140) and Proposed Plat of Wilderness 50 (S90P0072) - April 6, 1993; Jones & Stokes Associates, Inc., in association with Geotech Consultants, Inc. Bellevue, WA. Prepared for King County Department of Development and Environmental Services, Environmental Division, King County, WA.

### Water Quality and Quantity:

Groundwater in the Rock Creek area is of high quality. No obvious problems were detected in tests conducted in 1992. With the exception of silica, all parameters tested were below the levels set by the standards.

Rock Creek originates approximately 3 miles upstream of the Waterways site. Rock Creek flows from a wide, flat-bottom valley underlain by outwash material and dense glacial till. Shallow aquifers perched on the till provide a number of seeps and springs which form the headwaters of the stream. The stream then flows west and north, adding additional flow from seeps and discharge from shallow aquifers.

Extensive information concerning the water quality of the stream is not available. Based on the largely rural nature of the upper watershed, the lack of significant pollutant sources, and the abundance of sensitive fish species and invertebrates within the stream, it is likely that water quality is excellent. The Washington Department of Ecology has rated the Cedar River and its tributaries in the area of Rock Creek Class A, excellent, in terms of water quality. Pollutant sources within the basin consist primarily of dysfunctional septic drain fields, road runoff, and pollutants associated with landscape maintenance. In general, the density of development increases in the lower portion of the watershed. It is likely, therefore, that water quality in the lower portion of the stream is slightly poorer than in the upper portion of the stream. It should be emphasized, however, that the overall water quality of the stream is excellent, especially in comparison to other streams in the developing portions of King County.

Twenty-eight years of historic stream flow record (1945-1973) are available for Rock Creek from measurements collected by the U.S. Geological Survey (USGS) Water Resources Division below the Waterways site. Due to the unique spring-fed water source, streamflows in Rock Creek are not subject to the level of fluctuation observed in many Puget Sound streams. The USGS estimates that the average monthly streamflows in Rock Creek is about 20 cfs, with peak flows typically occurring in February. Flows vary from about 1 cfs during

September to a 1-year stormflow' of about 16 cfs. The 100-year storm would generate a flow of about 245 cfs.

The City of Kent has a water withdrawal system located approximately 2 miles upstream from the southeast edge of the Waterways Site. The city withdraws between 6 and 12 cubic feet per second (cfs).

### **Stream and Riparian Community:**

Forested habitat within the Rock Creek ravine was classified as riparian habitat, totaling 7.1 acres. Riparian zones are terrestrial areas where the vegetation and microclimate are influenced by water and are typically associated with streams, rivers, and floodplains.

The riparian community along Rock Creek contains a patchwork of conifer- and deciduous-dominated forest. Deciduous areas generally occur along the west bank of the creek. These areas are characterized by mature red alders, big-leaf maples, and black cottonwoods to 36 inches dbh, or a deciduous/conifer mix. The remainder of the riparian community is dominated by mature conifers, mainly western hemlock and western red cedars (also ranging to approximately 36 inches dbh) or a deciduous/conifer mix.

Although the understory composition varies throughout this community, vine maple, salmonberry, and salal are the primary shrub species. Red elderberry, devil's club, and Oregon grape are other common shrubs. Sword fern dominates the herbaceous layer, which contains several wetland-associated species such as slough sedge and pig-a-back. Other herbaceous species include licorice-fern and maidenhair fern.

Trees that meet the county's definition of significant trees occur throughout the riparian area. In addition, large snags occur along the creek, and downed logs are abundant in the creek.

Large Organic Debris (LOD) is present in much higher volumes than elsewhere within the surveyed sections of Rock Creek. The large volumes of LOD, combined with the low gradient of the stream and shallow confinement and channel entrenchment, have produced the wide braided channel configuration. The stream has scoured and deposited the easily erodible silt detrital substrates from around the large logs to form the various channels. Many pools have formed behind LOD dams. Pools have also been formed by gravel dams, created at the head of riffle sections by spawning salmon. While salmon redds are flattened by high flows in more confined and higher gradient stream reaches, insufficient energy is developed in this segment and evidence of salmon spawning activity persists year-round.

Less shading occurs in this section of the stream. The channel width is greater than 50 feet along much of this segment, and soils within the OHWMs (Ordinary High Water Marks) are inundated or saturated year-round, which precludes growth by most tree species. Riparian shading within the channel is primarily provided by red alder, salmonberry, and devil's club, which can better tolerate these conditions. In addition to riparian vegetation, a significant amount of shade is provided by the high density of downed trees. Cover and soil binding are

provided by aquatic vegetation, which is found only along this segment. Aquatic plants present include water starwort, water fern, sedges, water smartweed, speedwell, and milfoil. Outside of the OHWM the mix of tree and understory species is similar to other sections of the stream. Western hemlock, Douglas-fir, western red cedar, red alder, and big-leaf maple form the riparian canopy. Overstory and understory species include salmonberry, devil's club, salal, and sword fern.

As mentioned earlier, the stream channel within this segment is relatively unstable. Although low stream gradients and the shallow channel cross section produce very little energy under most flow conditions, channel shifting probably occurs during major storm events. Streambanks appear highly stable and no visual evidence of past erosion was found.

The section provides some of the best coho salmon spawning and rearing habitat in Rock Creek and the Cedar River. Although much of the substrate was overlaid with a silt/detritus layer during this study, indicates this layer is removed by higher flows and the swimming/spawning action of adult salmon on and steelhead. This segment also provides spawning habitat for cutthroat trout.

Velocities in this segment are relatively low. Low velocities and abundant pool habitat and cover are desirable components for coho salmon rearing habitat. This type of habitat is preferred by all species for winter rearing. Large numbers of juvenile salmonids were observed during Level 1 and 3 surveys in this segment.

Riparian areas are recognized as valuable wildlife habitat by the WA Dept. of Fish & Wildlife. Several species of wildlife rely on riparian zones and many others use it to meet all or some of their life requirements. Because of their linear configuration, riparian areas often serve as migrating, dispersal and foraging travel corridors for wildlife species.

#### **Wetlands:**

There were four hydrophytic plant associations on the site. These four wetlands total 1.2 acres. They consist of two palustrine forested wetlands, a palustrine forested/palustrine emergent wetland, and a palustrine scrub-shrub wetland.

The first hydrophytic association was located in the southwestern part of the property. This association was dominated by red alder in the tree canopy layer and by vine maple and salmonberry in the shrub layer. The sparse herb layer includes spreading wood-fern, and sword fern.

The second hydrophytic plant association occurred in the northwestern part of the property at the base of the western slope of the stream channel. Western red cedar dominates the tree canopy layer, and salmonberry dominates a sparse shrub layer. The herb layer is dominated by skunk cabbage, spreading wood-fern, and sword fern.

The third hydrophytic association occurred along the stream bank and side-channels in the wide northern end of the channel. While red alder dominates the tree canopy layer, salmonberry is the dominant shrub layer species.

The fourth hydrophytic plant association occurred in the tributary drainage oriented east to west across the central part of the Waterways site. This association was dominated by thick, monotypic growth of hardhack in the shrub layer. The herb layer was dominated by slough sedge. Tree cover occurred only along the edges of this association, and was dominated by red alder.

The wetlands present at the site are small, isolated, and low in structural diversity. Wetland D on the eastern portion of the site is large enough to be used by some breeding bird species associated with forested and scrub-shrub wetlands. The adjacent shrub and band of mature coniferous forest produce diversity and interspersions among habitat types. Nevertheless, wildlife surveys of this wetland detected few wildlife species. All wetlands on the site provide water, which is important to amphibians during the breeding season and to other wildlife as drinking water throughout the year. However, these areas by themselves are not extremely valuable wildlife habitat because of their small size, isolation, and low structural diversity. Wetlands on the site are forest and/or shrub dominated, relatively small, and contain little open water.

#### **Upland Forest Cover:**

Mature Coniferous Forest Community. The area designated as mature coniferous forest, which is the second most abundant community overall, is dominated by a mix of large Douglas-fir, western hemlock, and western red cedar. Dominant trees range from 10 to 40 inches dbh. Average dbh of these dominant trees is approximately 20 to 25 inches, with heights generally ranging between 90 and 150 feet. Species scattered in the canopy layer include occasional 10- to 24 inch dbh red alder, big leaf maple, and smaller Pacific yew. Dominant shrub species include salal, Oregon grape, sapling western hemlock, and western red cedar. Sword fern dominates the herbaceous layer.

This community occurs on the western portion of the site, along the City of Seattle Aqueduct right-of-way, and north of the Burlington Northern Railroad right-of-way on the Wilderness 50 site. The greatest concentrations of significant trees occur in this community, particularly on the Wilderness Retreat site east and north of Rock Creek. Conifer snags are present throughout including one that measures 4 feet in diameter. Downed logs are abundant although most of the larger logs are in advanced stages of decomposition.

This community contains a high level of structural diversity. Several age classes of trees present a multi-layered canopy; a moderate amount of snags, stumps, and downed woody material in various states of decay is present and the shrub layer is well developed. This structural diversity provides a higher potential in wildlife species diversity. Several species of wildlife are closely associated with mature forest communities.

Forest-Shrub Community. Forest-shrub is the most abundant community on the site. Apparently the result of partial timber harvest, this community is comprised of widely spaced, 5 to 10 inch diameter at breast height (dbh) Douglas-fir, western hemlock, and western red cedar. The openness provides for a well developed shrub layer.

Salal and Oregon grape dominate the shrub layer. Patches of sapling red alder and ocean spray are also common in the shrub layer. Bracken fern, deer-fern, and sword fern dominate the herbaceous layer. Numerous weedy species, such as fireweed, occur in the herbaceous layer of this community, particularly along existing roads. Other common shrub species in this community include vine maple, Himalayan blackberry, red huckleberry, and common snowberry.

No concentrations of significant trees or snags (trees larger than 12 inches in diameter, as defined by King County) were observed in this community; however, coniferous snags measuring between 6 and 10 inches dbh are scattered throughout. Few downed logs are present.

Deciduous Forest Community. Deciduous forest totaling 11.1 acres occurs near Rock Creek and the Lake Youngs Pipeline right-of-way. This community is dominated by red alder and big-leaf maple ranging from 6 to 28 inches dbh. Occasional black cottonwoods to 40 inches dbh also occur in this community, mostly in the Rock Creek vicinity. Douglas-fir, western hemlock, and western red cedar are also present in the canopy layer. Vine maple and salmonberry generally dominate the shrub layer, which also contains scattered hemlock, cedar saplings and occasional patches of devil's club. Sword fern usually dominates the herbaceous layer.

Snags, mostly alder and maple, occur in this community but are not abundant. Concentrations of significant deciduous trees occur within this community in the southwest corner of the Waterways site and in the north portion of the site west of Rock Creek. Large red alders, big-leaf maples, and black cottonwoods occur in these areas, as do concentrations of downed logs.

This community contains a moderate level of structural diversity. Major structural components include large, decadent big-leaf maples interspersed with dense stands of alder. The shrub layer is patchy and is often dominated by a monotypical layer of sword fern. Woody debris is moderate and some large snags and stumps are present. Only a few species of wildlife are closely associated with deciduous forests alone, but because of interspersion with other habitat types many species likely use this vegetative community.

#### **Special-Status Plants:**

According to state sensitive plant lists (Washington Natural Heritage Program (1990) no endangered or threatened plants are known to occur in King County. In addition, no records of endangered, threatened or sensitive plants have been reported in the area. Based on this information, state or federally listed threatened or endangered species are absent from the

site. However, the site contains potential habitat for one state listed sensitive plant species, tall bugbane (Cimicifuga elata) known to occur in King County.

Tall bugbane is associated with moist forests containing scattered big-leaf and vine maples. Similar habitat is present within the riparian community on the northwest corner of the site, although this species was not observed during field surveys of riparian habitat and the status of this plant on the site is undetermined.

Four other sensitive plant species were initially determined to be potentially present, but were assumed absent based on habitat associations. Fringed pinesap (Pleuricospora fimbriolata) is primarily associated with forests more than 80 years old that contain little ground vegetation (Gamon pers. comm.), and such habitat is lacking on the site. The three remaining species, swamp gentian (Gentiana douglasiana), water lobelia (Lobelia dortmanna), and small northern bog-orchid (Platanthera obtusata), occur mostly within sphagnum bogs or lakes, which are lacking on the site.

The WDNR Natural Heritage Information System revealed no records of sensitive plants on the site or in the surrounding area, and no sensitive plants were observed during wetland, vegetation or wildlife surveys. Based on this information and habitat associations of sensitive plant species, tall bugbane is the only sensitive plant that may be present.

#### **Soils:**

Sheet 417 of the King County Area Soil Survey maps the entire site as Everett gravely sandy loam. This mapping unit is described as an excessively drained non-hydric soil. The site contains gravely sandy loam to depths of over 20.

#### **Wildlife Habitat Values:**

Many species of wildlife require a combination of habitats or require a large amount of space. For example, some species breed in forested areas and feed in open areas. Great horned owls commonly nest in habitats similar to the mature coniferous forest on the site and forage in immature open coniferous forest, mixed shrub areas, open areas similar to the pipeline right-of-way, and in clearcuts, which are present east and south of the site. American kestrels may also nest and forage in similar habitats.

The value of a site as wildlife habitat depends on habitat surrounding the site as well as habitat on the site. The site is located in a transitional area between urbanizing areas to the west and rural and commercial forestlands to the east. This results in the presence of species associated with both habitat types.

Extensive forested habitat present on and west of the site provides foraging, resting and breeding habitat for elk and black-tailed deer. Deer and elk sign was observed on each of the two sites and long the pipeline right of way. Deer sign was observed most often in the forest shrub community and elk sign was usually found in mature coniferous forest and along the

pipeline right of way. Signs of both species were commonly observed near wetlands and along Rock Creek. An elk was observed crossing Southeast 244<sup>th</sup> Street, west of the study area, and a small elk herd is known to use the general area.

Deer of the Puget Sound lowlands are typically nonmigratory, and deer likely use the site and adjacent areas year-round. Elk, on the other hand, are more likely to use the site and surrounding area during the winter when they move from higher elevations of the nearby Cedar River Watershed. Mature coniferous forest provides excellent thermal cover for both species, and immature coniferous forest, shrub areas, and hundreds of acres of adjacent clearcuts provide abundant foraging habitat.

In addition to deer and elk, black bear, mountain lion, and bobcat may occasionally use the site. Black bear and mountain lion generally require extensive undeveloped areas, and the increasing presence of roads and development west of the site has reduced habitat quality for these species. Scent stations, conducted on December 17 and 18, 1991, determined the presence of coyote and raccoon. These two species are common in the Puget Sound lowlands.

## CONCLUSIONS

The two most important features contributing to the overall habitat quality in Rock Creek are the mature forested riparian corridor and the LOD that it contributes to the stream. Loss of either of these features would greatly reduce habitat value and lessen fish production.

The forested riparian corridor provides multiple benefits to fish habitat that could be described as primary and secondary. Primary benefits are those that directly affect fish habitat and include stream shading, cover, and nutrient inputs. Stream shading is a necessary component of quality fish habitat. Fish seek out protected areas where they are safe from predation. A large percentage of Rock Creek's cover is provided by overhanging root wads and LOD supplied by adjacent vegetation. The riparian corridor also provides plant materials to the stream, which form an integral nutrient base. These nutrient inputs provide food for aquatic invertebrates which, in turn, are preyed upon by fish.

Secondary benefits focus on ameliorating impacts on the stream from extraneous sources. Impacts from storm events are greatly lessened by the forested riparian zone. Heavy rains are intercepted by the trees, thereby lessening the erosive impact that the streambank soils receive in unprotected areas. The trees also benefit soils by providing organic matter, which creates a thick, loosely packed humus. These highly organic soils provide higher rates of infiltration than do more compacted soils typical of barren hillslopes, thereby lessening overland flow into the stream channel and increasing groundwater storage. Increased groundwater storage helps maintain summertime discharge levels. The overall effect is to moderate the hydrological flow pattern of the stream. Loss of the forested riparian corridor could result in a highly fluctuating hydrologic pattern with higher erosive potential during storm events and lower discharge levels during summer low flows. This type of pattern markedly decreases habitat value for fish.

LOD is the other important component in maintaining fish habitat in Rock Creek. LOD diverts and sometimes obstructs water flow through the stream channel. Changes in the flow pattern often cause beneficial physical changes to salmonid habitats. LOD often constricts the water flow, resulting in localized increases in velocity, which cause scour pools to form. Scour pools are important rearing areas for salmonids, especially during the summer months. As velocity is reduced downstream of the point where scouring occurs, gravel is deposited, providing salmonid spawning habitat. Flow blockages from LOD can result in the creation of pools, which act as settling areas for smaller sized substrates. In low gradient areas, silt is deposited in the pool upstream of the dam. Where higher gradients exist, gravel can deposit, forming large spawning areas. As water spills over the flow blockage, plunge pools are formed downstream. LOD can divert water in two directions causing the formation of side channels. This process has resulted in the myriad of side channels-found in the riparian wetland section of the site.

The overall effect of LOD on salmonid habitats is to increase habitat diversity. Streams devoid of LOD are much less productive and are often characterized as long riffle or shallow glides with few pools and little sinuosity. The overall effect of LOD on the stream is to increase its length and thereby decrease its gradient. Length is increased as the flow is diverted from side to side across the channel. While localized scouring occurs because of channel restrictions, lengthening results in decreasing the overall velocity of the stream, which helps prevent habitat destruction during high flow events.

High densities of LOD appear particularly beneficial to coho salmon in Rock Creek. The areas with the highest densities of LOD provide the best spawning and rearing habitat for coho salmon in the stream. Areas with moderate amounts of LOD (the middle and lower two-thirds of the site, appear best suited for steelhead rearing. Studies have shown steelhead prefer riffle habitats. This area has a higher percentage of riffle habitats than do areas with high levels of LOD. Stream sections with low LOD levels (downstream of the site), also have higher riffle ratios; however, habitat quality is diminished because less in-stream cover and habitats providing protection during high flows are available.

Besides influencing stream velocity and channel morphology, LOD also provides benefits to the stream from a bioenergetics standpoint. LOD traps and retains smaller vegetative matter (leaves, twigs, etc.) which, in turn, provides food for aquatic macroinvertebrates and for the microbial organisms on which they feed.

Future land use actions should focus on maintaining the mature riparian corridor. Its preservation would provide Rock Creek with continued shading, contributions of LOD and detrital matter, surface runoff filtration, bank stability, and overall habitat quality.

# APPENDIX C: LIST OF PLANT SPECIES

<i>Species</i>	<i>Common Name</i>
<u>Acer circinatum</u>	Vine Maple
<u>Acer macrophyllum</u>	Big-leaf maple
<u>Alnus rubra</u>	Red alder
<u>Athyrium filix-femina</u>	Lady fern
<u>Berberis nervosa</u>	Dull Oregon grape
<u>Blechnum spicant</u>	Deer Fern
<u>Cardamine occidentalis</u>	Bittercress
<u>Carex obnupta</u>	Slough sedge
<u>Cornus stolonifera</u>	Red-osier dogwood
<u>Corylus Cornuta</u>	California hazelnut
<u>Dicentra formosa</u>	Bleeding heart
<u>Dryopteris dilitata</u>	Spreading wood-fern
<u>Epilobium angustifolium</u>	Fireweed
<u>Epilobium watsonii</u>	Watson's willow-herb
<u>Equisetum arvense</u>	Common horsetail
<u>Equisetum telmateia</u>	Giant horsetail
<u>Galium aparine</u>	Catchweed bedstraw
<u>Gaultheria Shallon</u>	Salal
<u>Geum macrophyllum</u>	Large-leaved avens
<u>Holodiscus discolor</u>	Ocean spray
<u>Hydrophyllum tenuipes</u>	Pacific waterleaf
<u>Lonicera involucrata</u>	Black twinberry
<u>Lysichitum americanum</u>	Skunk cabbage
<u>Oplopanax horridum</u>	Devil's club
<u>Polystichum munitum</u>	Sword fern
<u>Populus balsamifera</u>	Black cottonwood
<u>Pseudotsuga menziesii</u>	Douglas fir
<u>Pteridium aquilinum</u>	Bracken fern
<u>Rhamnus purshiana</u>	Cascara
<u>Rosa nutkana</u>	Nootka rose
<u>Rubus discolor</u>	Himalayan blackberry
<u>Rubus spectabilis</u>	Salmonberry
<u>Rubus vitifolius</u>	Pacific Blackberry
<u>Sambucus racemosa</u>	Red Elderberry
<u>Spiraea douglasii</u>	Hardhack
<u>Symphoricarpos albus</u>	Snowberry
<u>Taxus brevifolia</u>	Pacific Yew
<u>Tellima grandiflora</u>	Fringecup
<u>Thuja plicata</u>	Western red cedar
<u>Tsuga heterophylla</u>	Western Hemlock
<u>Urtica dioica</u>	Stinging nettle
<u>Vaccinium parvifolium</u>	Red huckleberry