REDMOND WATERSHED

MASTER PLAN

NAKANO · DENNIS
LANDSCAPE ARCHITECTS

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Appendices

The paramount goal of the Master Plan for the Redmond Watershed is to preserve and enhance the diverse habitats of the site while providing recreational and educational opportunities. The proposed improvements and renovations are sited to produce minimum impact to the site. The goal of educating users supports the goal of habitat preservation. Education about habitat, habitat preservation, wildlife, resource conservation, and hydrology will directly enrich the visitors' experience of the site and provides indirectly for the preservation of the site itself.

The Redmond Watershed is an 800 acre second growth forested site located east of the Redmond central business district, north of Novelty Hill Road. Although it has never served its originally intended purpose as a true watershed, the site has become a valuable natural and recreational resource for the region. In 1989, the citizens of King County passed an Open Space Bond which is the source of funding for the preservation and improvements of the Watershed.

An Interlocal Agreement between the City of Redmond and King County outlines the program for the site. The Redmond Watershed is to remain in passive recreational use for the public in perpetuity, except for the 80 acre parcel south of the Puget Power right-of-way which can include active recreation, buildings, and parking. Other provisions of that agreement include the banning of all motor vehicles except for emergency and service vehicles, provision for connection of Watershed trails to a future regional trail network, construction of support facilities for the regional trails, and future paving of the East/West regional trail through the Watershed.

The City of Redmond hired a team of consultants headed by Nakano• Dennis to prepare a plan for the site. The Redmond City Council and Redmond Parks Department authorized and appointed a Steering Committee to work with the consultants in reviewing concepts and making recommendations for the Master Plan.

The design team conducted a site inventory of the Redmond Watershed using both available mapped information and on site investigations. The site itself yields the most important information both of a quantitative and qualitative nature. An inventory of wetlands and wildlife was compiled for the 80 acre parcel and for areas along the existing trail corridors in the upper 720 acre area. A thorough inventory of the existing trails yielded information about the evolution of the trail system and the physical condition of the trails.

Out of the information and impressions gathered, an ecological approach to planning for the Redmond Watershed has been developed. An Opportunities and Constraints Plan identifies ecologically sensitive areas, areas of interpretive interest, and areas where new trails could offer access not available in the existing trail system. A Development Rating Plan rates the site in five categories from most to least restrictive for development based on value of habitat for wildlife, sensitivity to disturbance, presence of priority wildlife species, degree of habitat

disturbance, and adjacent land use. Implicit in the rating system are the values of preserving and enhancing habitat diversity, providing education, and offering recreation.

A variety of plans have been developed and considered in a process which has included input from the public, Redmond City staff, the Steering Committee, the Parks Board, the Redmond City Council, the Audubon Society, and the team of consultants. In order to evaluate the Master Plan, the Steering Committee and the consultants developed guidelines and recommendations which balance the goals of site preservation, user safety, and fairness to existing and potential users. This provides a means of evaluating the merits of the alternative plans relative to project goals.

Siting is an important means of preserving the site while providing educational and recreational opportunities.

The proposed Master Plan:

- Preserves sensitive wetland habitats by restricting trail access to the perimeter of the largest wetland areas.
- Allows only lowest impact foot trails and boardwalks in or adjacent to sensitive areas.
- Includes an equestrian loop trail which allows that user group to segregate itself from bicyclists at the trailhead. This segregation is desirable for safety reasons.
- Locates bicycle trails on a flat area in a relatively tolerant forest habitat.
- Locates maintenance, emergency, and police vehicle access in the already impacted utility corridors.
- Eliminates existing trails in an area at the north end of the site which has steep slopes and stream corridors.

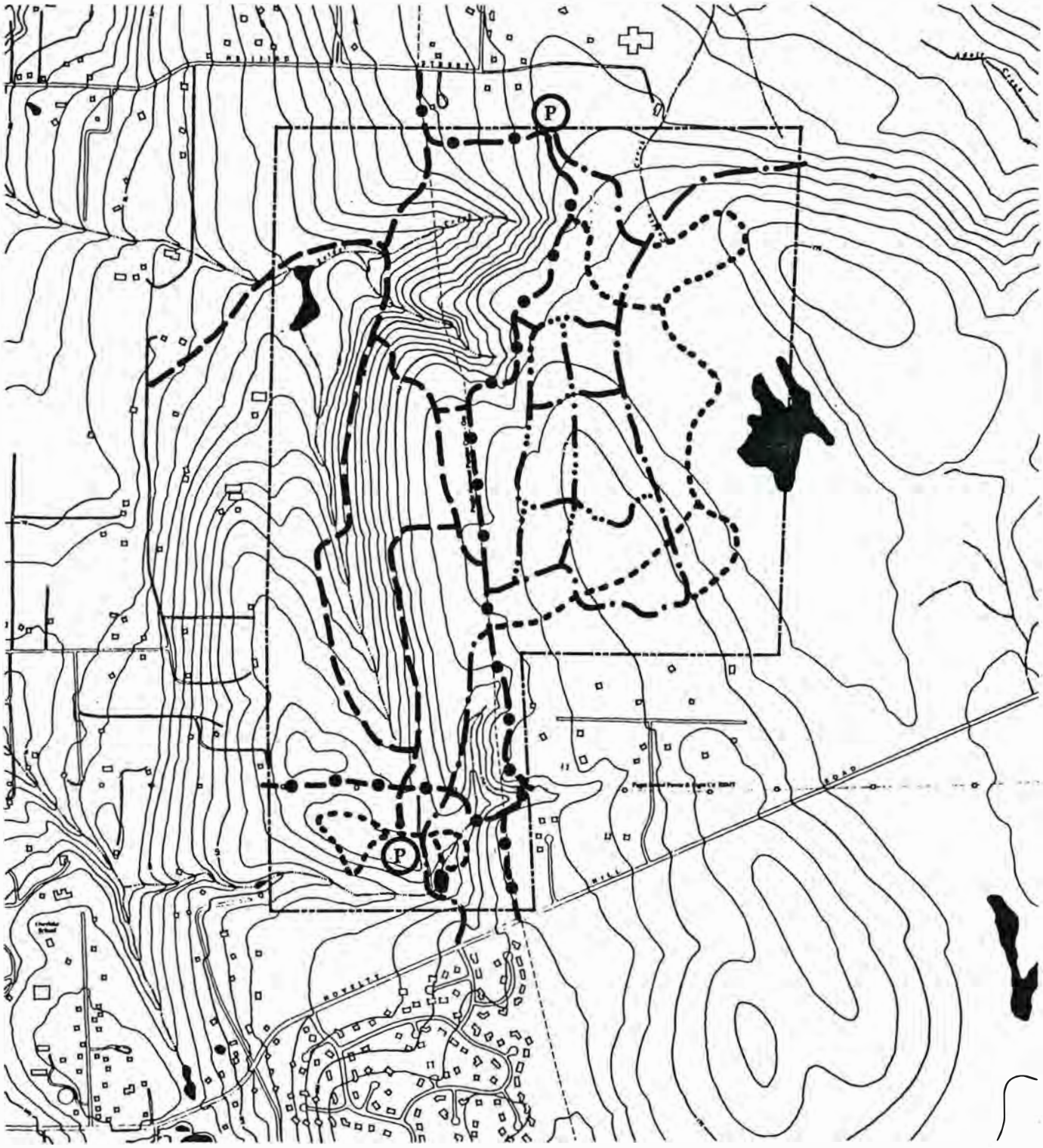
The proposed improvements to existing trails will minimize future impacts to natural systems. Erosion of poorly sited trails, widening trail treads on poorly constructed trails, siltation of streams at trail fords, and invasion of non-native plants will be minimized by implementing the proposed plans. The proposed designation of trails for specific use groups based on ecological criteria will further reduce impacts relative to the existing situation.

The Master Plan and the construction phase which will follow are one step in the evolution of the Redmond Watershed. Opportunities to understand and experience the Redmond Watershed's diverse habitat via educational tours, interpretive signage, and community school sponsored improvement or volunteer maintenance projects will provide the visitor with a deepened understanding and appreciation of the site and the natural world in general. Over time it is the involvement of the immediate and wider community which will preserve this valuable resource for future generations.

INTRODUCTION

REDMOND WATERSHED

MASTER PLAN



Redmond Watershed Preserve

City of Redmond Department of Parks and Recreation

NORTH

NAKANO ◆ DENNIS
LANDSCAPE ARCHITECTS

KEY

P Parking

Regional Trail

Multi-use Trail

Equestrian Trail

Bicycle Trail

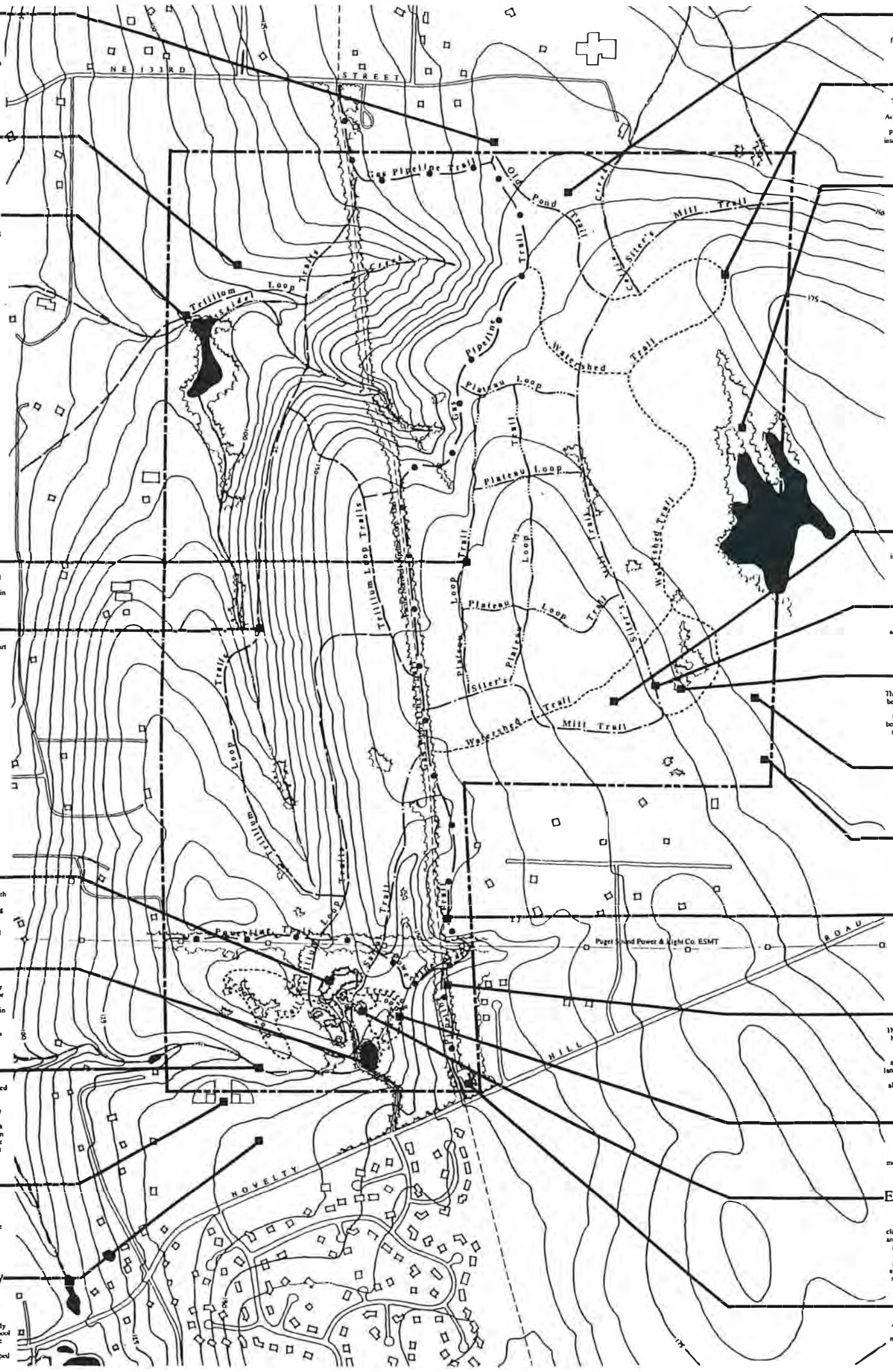
Foot Trail

SCALE 1" = 400'-0"

FEET MILES

10
5
1
ACRES

TRAIL USE PLAN
OPTION 1A



Potential Trailhead

Negotiations are now underway to acquire property for trailhead services at the north end of the Watershed. The ultimate location of this facility will depend on what property is acquired. Services will include paved parking for autos with a bicycle washdown area and bicycle racks and gravel parking for horse trailer rigs with watering troughs and hitching rails. Both will be near the restroom, picnic area, information board and trailheads. These services will facilitate safe and convenient access to the site.

Cottonwood Forest

Environmental education could be furthered by offering interpretive information about the cottonwood forest and about the variety of other plant associations found in the Watershed. Cottonwood is associated with wet locations.

Beaver Pond Viewpoint

Both man and beaver have had a role in damming this pond. Remnants of the City's watershed improvements and active and abandoned beaver dams are all visible at this pond. A viewing area raised to protect water quality could be built as a blind to allow visitors an opportunity to view the wildlife.

Plateau Loop Trail

This loop which includes some re-built trails and some new trails offers an easy trail for mountain bicyclists in a forest habitat which can best sustain this trail use.

Trillium Loop Trails

These trails, some re-built, some new, will be part of an equestrian loop trail. For safety and aesthetic reasons, many horseback riders prefer not to share the trail with bicycles.

Trailhead Services

Services will include paved parking for autos with a bicycle washdown area and bicycle racks and gravel parking for horse trailer rigs with watering troughs and hitching rails. Both will be near the restroom, picnic area, information board, and trailheads. These services will facilitate safe and convenient access to the site.

Open Water Wetland

Four open water wetlands in the Watershed offer a rich source of food, cover, and nesting sites for wildlife and varied habitat for a range of native plants. Additionally, wetlands functions contain and slow runoff and to recharge ground water. Two priority species, pileated woodpecker and cutthroat trout, were sited in Watershed wetlands and streams.

Trout Stream

Wildlife biologists studying the Watershed spotted fingerling cutthroat trout in this Mackey Creek tributary. The Washington Department of Wildlife identifies the cutthroat trout as a priority species. Access to this area would be available only to hikers. Trail construction methods, such as raised boardwalks will protect the stream from adverse impacts. An interpretive program of site tours and signage will include information about cutthroat trout.

Future Ballfields

A portion of the Watershed south of the Puget Power right-of-way can be used for active recreation under the guidelines of the Interlocal Agreement. Because of environmental and code constraints and circulation requirements only a small area at the southwest corner of the Watershed is suitable for ballfield development.

School District Property

The Lake Washington School District does not intend to develop this property as a school for at least the next 15 years. If the property is developed as a school, the Watershed would provide excellent opportunities for scientific study by the students. In an arrangement with the School District, future school parking lots could provide overflow parking for Watershed users and in exchange part of the Watershed could be developed as a ballfield site for the school.

Conifer Successional Forest

This habitat represents a phase in forest succession which can follow ecological disturbance such as logging. An interpretive tour or display in this area could illustrate forest succession, habitat diversity, and native plant associations.

Watershed Trail

This primitive trail and boardwalk would provide access to the edge of a large open water wetland and a forested wetland. Access to this area would be available only to hikers. A wetland viewpoint will offer opportunities for nature study, wildlife photography, and sketching or painting. Interpretive tours and interpretive signage at this site could educate the visitor about the important role of wetlands in storm water management and as wildlife feeding and breeding areas.

Wetland Preserve

This large wetland which includes an area of open water straddles the east property line. Trail development in this area will be hiker only trails and boardwalks and the alignment will be restricted to the edges of the wetland leaving a large area undisturbed.

Hemlock Forest

Environmental education could be furthered by offering interpretive information about the hemlock forest and about the variety of other plant associations found in the Watershed. Hemlock is the dominant species of the Northwest's climax forest.

Siler's Mill Trail

This multi-use trail follows an old railroad grade and provides access to the site from the east. This is part of a nine and a half mile existing trail system which will be rebuilt during the construction phase.

Windfall Area

The timbers downed in this part of the site by wind storms could be left to decay and provide habitat for small mammals, reptiles, and insects or some could be milled to provide surfacing for boardwalks. The use of this timber would conserve resources because off site timber harvest would be reduced. Replanting of these cleared areas with native vegetation could be a study area for forest regeneration.

Buffer Area

Trails and facilities will avoid the perimeter of the site adjacent to private properties. Desire trails which connect the site to private property will be blocked and perhaps signed to preserve the privacy of adjacent land owners.

Potential Site Entry Trail

A multi-use entry trail could connect the site to the adjacent neighborhood as future development occurs.

Regional Trails

These multi-use trails will become part of a regional system of trails at some time in the future. The tread on these trails will be 8 feet wide minimum in first phase construction to allow pick-up trucks access for emergency and service purposes. The east/west regional trail will ultimately be a 12 foot paved trail with a parallel soft surface horse trail, north/south will be an 8 foot soft surface trail with a parallel soft surface horse trail.

Native Shrub Plantings

The gasline corridor is now primarily vegetated with grasses and herbaceous weeds. The addition of low growing native shrubs will meet the visibility and access requirements of the Pacific Northwest Gas Company while providing better cover and a more varied food source for wildlife. It could also illustrate the landscape value of native plants and improve the visual interest of the corridor. Budget available under the Interlocal Agreement allows partial implementation of a shrub planting scheme for the corridor.

Treefrog Loop Trail

This barrier-free accessible trail with a hardened, paved, or boardwalk surface takes the visitor through forested and open water wetlands and upland forests. The interpretive panels mounted along this loop illustrate the link of habitat diversity and habitat values to wildlife.

Environmental Learning Center

Education is a primary goal of the Master Plan. This facility, proposed for a future phase, includes a small building with classroom and office space, an outdoor classroom, staff parking, and direct access to the interpretive loop trail. The built facility is not within the scope of the budget available under the Interlocal Agreement, but the Redmond Recreation Department is already planning interpretive tours of the site. Education engenders the appreciation and respect for habitat which is an essential element in the preservation of this site and natural ecosystems generally.

Maintenance Facility

A shop building with a service yard will provide equipment and material storage, a small office space, and workshop space for maintenance crews. The building may also house an emergency access vehicle available to Police and Fire Departments. In the future a city composting and nursery site may be added in the vicinity of the Maintenance Facility.

Redmond Watershed Preserve

City of Redmond Department of Parks and Recreation

NORTH

NAKANO ◆ DENNIS
LANDSCAPE ARCHITECTS

10
5
1
ACRES

KEY

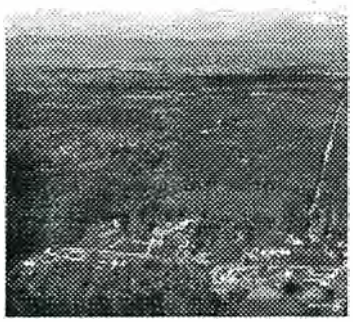
- Regional Connector Trail
- Multi-use Trail
- Equestrian and Hiker Trail
- Bicycle and Hiker Trail
- Hiker Only Trail

SCALE 1" = 400'-0"

400 100 0 1/8 1/4 1/2
FEET MILES

MASTER PLAN

Primarily a forested area, the Redmond Watershed is an 800-acre parcel of land containing several wetlands and streams populated by a variety of birds and animals. Located adjacent to Novelty Hill Road in Redmond, Washington, it is also used by the local community for hiking, jogging, horseback riding, and mountain biking.



It is the existing trail system on the site which serves as the basis for the community uses. This system has been established not only by users clearing vegetation, but also by the utilization of existing dormant railroad grades and skid roads. Prior to 1926, the Redmond Watershed had been a source of timber, and these now dormant rail lines traversed the site to serve the logging industry.

Due to population growth in the region, recreational activity has increased in the watershed. Recreationalists travel from all over the King County area to use the site. The Redmond Watershed's popularity will continue to grow as development of surrounding areas increases. Future connections to the regional trail network will further increase the number of users.

Creating A Watershed

In 1926, in order to create a watershed and supply water to the city, the City of Redmond purchased 160 acres from the Weyerhaeuser Timber Company for $1000. Following that purchase, two dams were built across Seidel Creek and a pipeline was built to carry water to the city.

Subsequent purchases to protect the water quality were made. In 1942, 320 acres was purchased from Weyerhaeuser for $1500; 160 acres from Silver Logging Company in 1943 for $3200; and another 160 acres from Silver Logging Company in 1944 for $2800. Additional dams were soon built, but when the water failed to meet Washington State Health Department standards, the watershed was abandoned as a city water source. Remnants of these dams remain on the site, and beavers have built additional dams adjacent to the man made structures.

Subsequent developments include construction of major utility corridors through the site. In 1956, Pacific Northwest Pipeline Corporation built two gaslines which run north to south in a 200 foot wide easement. In 1965, an overhead power line was built by Puget Sound Power and Light Company in a 200 foot easement which runs east to west across the Redmond Watershed.

In 1970, the Redmond City Council planned to construct an airport and an industrial park in the Redmond Watershed. This plan was abandoned after a study by the Redmond Planning Department and a subsequent public hearing.

A study by McConnell/Burke completed in 1985, identified several potential uses for the site including a city nursery, golf course, firing range and urban development. That study offered a series of plans from

low intensity use to high intensity use with each of the plans setting aside an area around Seidel Creek as a natural area. None of these plans were ever implemented.

Adjacent land uses, current and future, are a significant factor to be considered in planning for the Redmond Watershed. Subdivision developments have been built to the north and south of the site. Privately owned land to the east and southeast of the site is currently under consideration for Master Planned Development. While these may not be approved, some type of development will eventually occur on that land. As regional population grows, the trails in the Redmond Watershed will need to accommodate increasing use.

The Interlocal Agreement

In 1989, the citizens of King County passed the Open Space Bond aimed at reserving park lands to serve the growing population of this region. Some of that money was allocated for the Redmond Watershed. To execute the planned improvements, King County and the City of Redmond entered into an "Interlocal Cooperation Agreement for the Development of Redmond Watershed Trails". That agreement sets some parameters and requirements for the programming of the site.

The Interlocal Agreement states in part "as a condition of the use of bond proceeds for the trail system project, the Redmond Watershed Property must be preserved and remain in passive recreational use by the general public in perpetuity, except for up to eighty (80) acres, which may be devoted by Redmond to future active recreational use".

Further provisions of the Interlocal Agreement include:

- the banning of motor vehicles (except for emergency, maintenance, and motorized wheelchairs)
- provision for connection of the Redmond Watershed trails to the planned regional trail network
- construction of support facilities for the regional trail network
- confinement of active recreation and parking to the 80 acre area south of the Puget Power right of way
- future paving of the East/West connector trail.

Planning Process

The City of Redmond selected Nakano • Dennis and a team of sub-consultants to prepare planning and construction documents for the implementation of the Redmond Watershed improvements outlined in the Interlocal Agreement. The Redmond City Council and Redmond Parks Department authorized and appointed a Steering Committee to work with the consultants in reviewing concepts and making recommendations for the Master Plan.

Members of the Steering Committee include representatives of the

Redmond City Council, the Redmond Parks Board, the Trails Committee, King County Parks Department, the Redmond Parks Department, and community members representing the primary user groups. Nakano • Dennis assembled an interdisciplinary team to look at all aspects of the Redmond Watershed site in developing a Master Plan.

The delicate balance of preserving the site, accommodating user demands, and ensuring trail safety is the major task which faces the consultants and the Steering Committee in preparing a Master Plan. That balance has been achieved by soliciting and evaluating the concerns of all interested parties:

- Members of equestrian and bicycle organizations have made their desires and concerns known both via public comment and through their representatives on the Steering Committee.
- Representatives of the Trails Committee on the Steering Committee have provided historic knowledge about how the site has been used and physical knowledge of the land and the existing trails.
- Various public entities have conveyed their comments and concerns through their representatives on the Steering Committee.
- Input from the general public was obtained in a forum sponsored by the City of Redmond.

This process generated a broad range of opinions and concerns, particularly in the area of trails planning. Input from these sources exposed some conflicting concerns. The Parks Board suggested that the Steering Committee establish guidelines for evaluating alternative plans to justify their decision making process. These guidelines are included in the Master Plan section of this report.

SITE INVENTORY

REDMOND WATERSHED

MASTER PLAN

Published sources and site reconnaissance provide data about the Redmond Watershed. These published sources, such as topographic maps from the United States Geological Survey (USGS) and soil classification maps from the United States Department of Agriculture (USDA), have provided valuable information about the site. However, it is the site itself which has provided the most valuable data. The Redmond Watershed is best appreciated by actually experiencing the beauty of its forests, streams, and wetlands. The analysis of the collected data and the considerations borne out of impressions of the site both contribute to development decisions.

Soils

Based on the maps obtained from the USDA and USGS, the soils map indicates that most of the Redmond Watershed soils are in the Alderwood series. There are two categories of Alderwood-gravely, sandy loam which can be found on this site (one in areas over 15% slope and the other in those under 15%). These soils, formed over glacial till, are moderately well drained, have moderate to severe erosion potential, and produce slow to medium runoff. Severe erosion potential occurs on steep slopes without vegetative cover.

What this means is that once organic matter has been removed from the surface, these mineral soils are sufficiently stable and well drained for the construction and maintenance of properly engineered soft surface trails.

The other soil type to be found in the Redmond Watershed is Seattle Muck, an organic soil derived primarily from sedges which forms in poorly drained depressions and in stream valleys. These soils are poorly drained, have little or no erosion potential, and runoff is ponded. The *Soils* drawing illustrates the extent of those soils. Seattle Muck is not suitable for trail construction under most circumstances.

USGS maps indicate that some of the site's soils are formed over glacial outwash. Soils formed over outwash generally have better drainage and less runoff than soils formed over glacial till which is more compacted. Mapped soil information is confirmed through on site investigations by the geotechnical engineer. Test pits have been dug in areas proposed for development of parking areas, buildings, and drain fields. Local soil conditions will be more thoroughly investigated by the geotechnical engineer during the next design phase (the results of the preliminary survey are found in Appendix 1). This will be particularly important in the area which has been used as a city refuse site.

Slopes

The slope map illustrates not only the steepness of the site, but also the major landforms and features in the Redmond Watershed which include:

- a large plateau area which makes up the east half of the site
- the Seidel Creek valley which is flanked by very steep slopes east of the creek, and more gentle slopes west of the creek
- another smaller plateau located at the south end of the site which forms the high ground of a ridge which runs north to south along the west boundary of the Redmond Watershed.
- topographic depressions in relatively flat parts of the site at the east boundary, the northwest corner, and the southwest which collect precipitation and runoff to form wetlands.

The City of Redmond Sensitive Areas Ordinance Section 20C.40 classifies areas exceeding 15% slope as sensitive areas. Restricted activities include filling, dumping, excavation, clearing, grading, and construction. However, the following activities are exempted from these restrictions:

- educational activities
- scientific research
- "outdoor recreational activities including but not limited to interpretive field trips, bird watching and hiking, that will not have significant effect on the sensitive area."
- trails under 8 feet in width

Hydrology

The Redmond Watershed includes a number of streams in the Lake Sammamish Basin: Colin Creek, Seidel Creek, and a tributary of Mackey Creek. Within the site these creeks form three sub-basins of which the Seidel Creek Sub-basin is the largest. A small area at the northeast corner of the site is in the Snoqualmie River Basin.

Wetlands, because of their special role as wildlife habitat, aquifer recharge, and storm water retention, are important natural resources. Open water areas, in association with other wetland types and upland habitats, provide particularly rich wildlife habitat. A number of open water wetlands are located in the site:

- one straddles the east property boundary line
- one occurs at the confluence of the Seidel tributaries in the northwest corner of the site
- one is near the south border of the site
- a small one is in the northwest corner of the 80 acre parcel located south of the powerline
- some smaller wetlands in the 80 acre parcel have an open water component

A total of twelve wetlands have been delineated and surveyed in the 80 acre parcel. In addition, wetlands located near the existing trail system have been delineated and surveyed (see Appendix 3). The location of the two major wetlands at the east and west boundaries of the site have been determined by USGS Maps, USDA Maps, and aerial

photos.

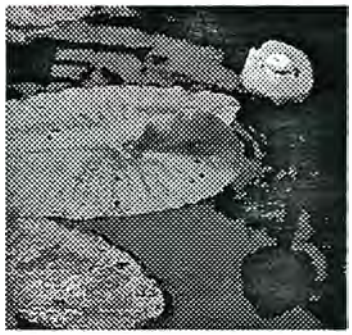
There are wetlands on the Redmond Watershed site not shown in the Hydrology map, because the cost of delineating all the wetlands throughout the site is prohibitive. However, wetlands will be delineated near the location of proposed new trails.

Vegetation

The Redmond Watershed is primarily second growth forest with canopy cover over most of the site. A broad range of typical Northwest plant associations are represented including conifer forests, broadleaf forests, and mixed forests. The Vegetation map delineates the configuration of the major vegetation categories in the site. Appendix 4 includes an inventory of the plant species found in each of those major vegetation types. Within those broad categories, moisture and age are the primary determinants of the vegetation community.

A number of plant associations of interpretive interest have been identified:

- open water wetlands
- forested wetlands
- hemlock forest
- coniferous successional forest
- cottonwood forest



A small percentage of the site is without forest cover.

- The utility corridors: where trees are regularly removed to allow aerial monitoring, access for repairs, and to prevent foliage from growing into the overhead wires.
- The larger open water wetlands
- An area of windfalls located near the southeast property corner at the east end of the notched boundary
- The city's refuse site in the lower 80 acres

While most of the site supports native plants, some exotic plants such as Scotch broom and Himalayan blackberry have invaded disturbed habitats, notably the utility corridors and refuse site. The diversity of native vegetation types is a significant factor influencing the presence of wildlife.

Wildlife

The forested areas of the Redmond Watershed are contiguous with larger forested areas extending east to the Snoqualmie River. The diversity of habitats offers food, water, and shelter for birds and other wildlife. The extent of the habitat provides sufficient range to support large mammals such as black bear, black-tailed deer, and coyotes. These mammals may disappear from the site in time, as development to the

east reduces their range and interrupts forest corridors.

Many songbird species, and some raptor and water bird species have been sighted in the Redmond Watershed by the team's biologists. The site's wildlife has been surveyed throughout the 80 acre site and in the vicinity of the existing trails in the upper 720 acre site. A wildlife report and list is included in the Wetland and Wildlife Report in Appendix 2. The bird list is not a complete list of species living on the site, however it does illustrate the broad range of bird life present. Among the species observed is the pileated woodpecker, which has been designated a priority species by the Washington Department of Wildlife.

A number of small mammals, reptiles, fish, and amphibians were also observed, including another Washington Department of Wildlife priority species: cutthroat trout. Fingerlings of this species were seen in the Mackey Creek tributary at the south boundary of the site.

These observations of numerous species clearly indicate the value of the site as wildlife habitat. They also suggest a direction for the interpretive planning for the Redmond Watershed. More habitat and wildlife study will be conducted along corridors for proposed new trail alignments during the design phase to evaluate the appropriateness of the proposed locations.

Utilities

Although there are major utility corridors passing through the Redmond Watershed, there are currently no utility services connected to the site. However, water and electrical service are reasonably close to the site for connection. The Redmond Watershed is bounded by three water districts which have main lines in proximity to the site. The area is currently in a disputed water service area with both the City of Redmond and Union Hill Water Association laying claim to the area. No sanitary service lines are located near the site, and the existing developments in the project area are on septic field systems.

Preliminary investigations by the team's geotechnical engineer indicate that the site soils will support a drainfield. Preliminary calculations by the civil engineer indicate that storm water detention will be necessary to process runoff from the buildings and paved areas proposed. A Utility Inventory prepared by the team's civil engineer gives more details about utilities in Appendix 5.

Existing Trails

A thorough inventory of 9-1/2 miles of existing trails in the Redmond Watershed by Conservation Resources Inc., the team's trail consultant, provides pertinent information about trail mileage, trail tread material, clearing and tread width, side slope, steepness, and overall condition. This data was averaged over each segment of trail and again over the

entire site. The Trail Survey Summary is included in Appendix 6.

Trail surface conditions in the Redmond Watershed clearly need improvement. Current trail conditions in the Redmond Watershed reflect the fact that trails were never deliberately located, but were user developed. Trail treads are not properly drained and are highly subject to erosion. Mud, pooling of water, and exposed tree roots and rocks are common throughout the trail system. When a puddle forms on a trail users tend to bypass it and widen the area around the puddle. Trail tread materials do vary over the site, but two types of surfaces are most common:

- The old railroad grades are usually raised above the surrounding area and are formed of compacted mineral materials which have stood up well to use.
- Those trails established by informal human use have a layer of organic soil over mineral subgrade. They tend to be muddy and puddled not only because of poor drainage, but also because they are often recessed into the surrounding grades.

The average tread width over the system is 4-1/2 feet, which is relatively wide. Clearing width or travelway varies over the Redmond Watershed, with the average being 7 feet. The utility corridor has a relatively narrow travelway of 4-1/2 feet because of the high brush encroaching on the trail. On the other hand, trails in the conifer forested area are generally wider because the understory is very open and the trees are more widely spaced. For example, Trail 14-15 has a travelway of 7.5 feet. This is a useful point of comparison for evaluating the impact of future trail development.

Side slope is the percent of rise over run measured perpendicular to the trail. Side slope provides drainage for the trail tread. Most of the trails in the Redmond Watershed have zero side slope which is typical of trails which are established by users in relatively flat, easily accessible areas. The lack of side slope contributes to puddled, muddy trail conditions. The average side slope of the existing trail system is 1.5%. New trails will have 2% side slope where possible.

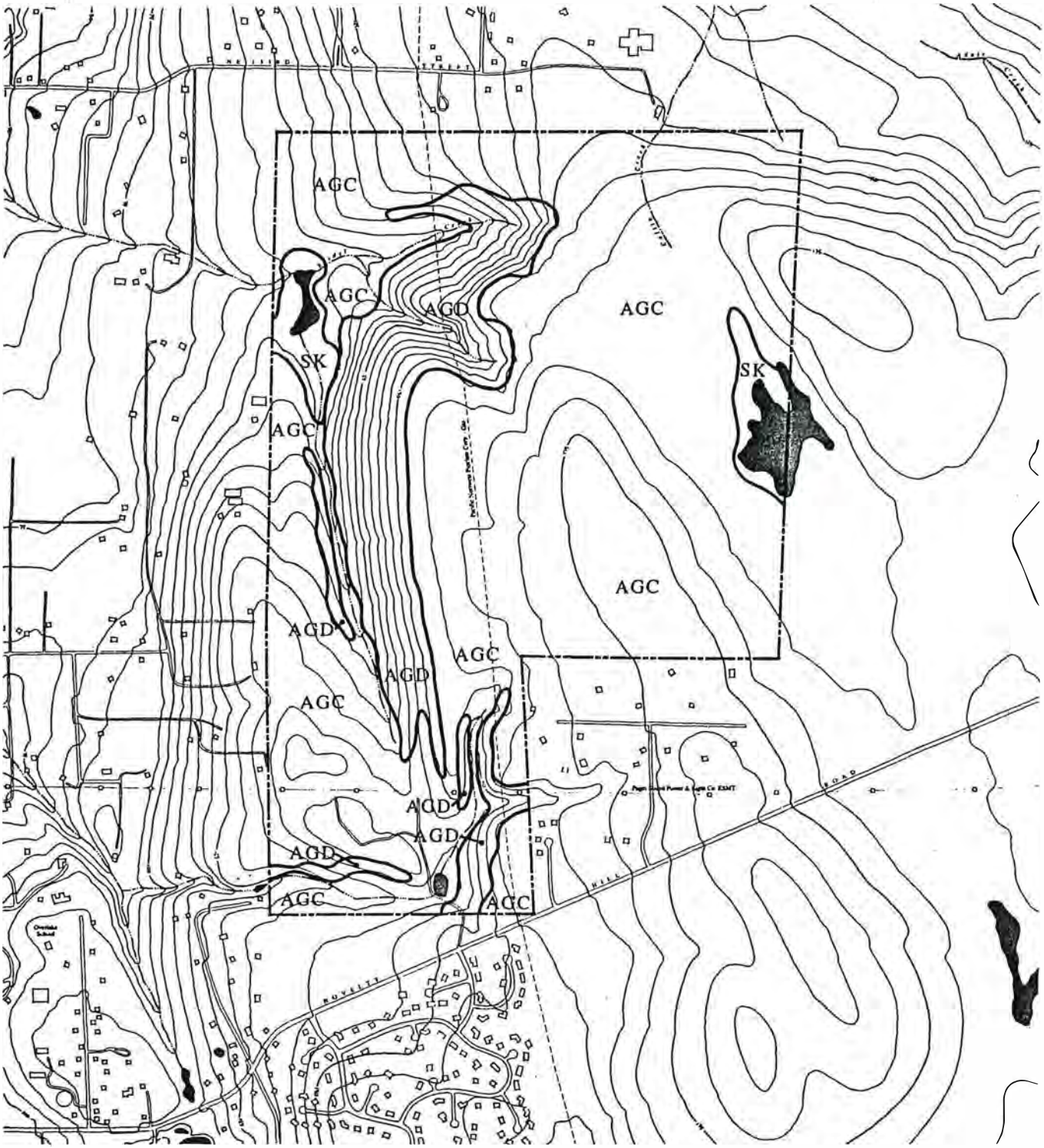
The trail inventory also includes graphic profiles of the existing trails. Because much of the trail development is concentrated in the flat plateau area the average steepness or grade is low. However, there are some very steep grades of up to 40%, specifically in the utility corridors. These steep trails will need to be relocated to reduce difficulty and erosion potential.

Trail steepness, or grade, is calculated by dividing the rise by the run along the trail. The trail inventory supplied two different types of information regarding grade: absolute grade and average grade. Both indicators of trial steepness are expressed as a percentage. Absolute grade reflects the degree to which the trail is steep, while average grade indicated the gain or loss of elevation over the entire length of the trail.

Analysis of both average and absolute grades for the existing trail system is an essential component of the trails planning process. To minimize recreational impacts of natural systems and to ensure use safety, overly steep portions of a trail must be relocated. The trail survey identifies about 2 miles of trails needing relocation.

The popularity of Trillium Trail may be related to its varied topography, its meandering alignments, and its enclosing forest canopy. This suggests that new trail development should include these characteristics typical of forest trails.

The proposed trail system will better withstand impact not only because of improvements in drainage, surfacing, and grade, but also due to improved trail maintenance. Maintenance of the existing trails cannot be readily undertaken now due to the extensive drainage problems which can only be addressed by reconstruction.



Redmond Watershed Preserve

City of Redmond Department of Parks and Recreation

NORTH

NAKANO ◆ DENNIS
LANDSCAPE ARCHITECTS

KEY

AGC	ALDERWOOD SANDY, GRAVELLY LOAM UP TO 15% SLOPES
AGD	ALDERWOOD SANDY, GRAVELLY LOAM 15% TO 30% SLOPES
SK	SEATTLE MUCK

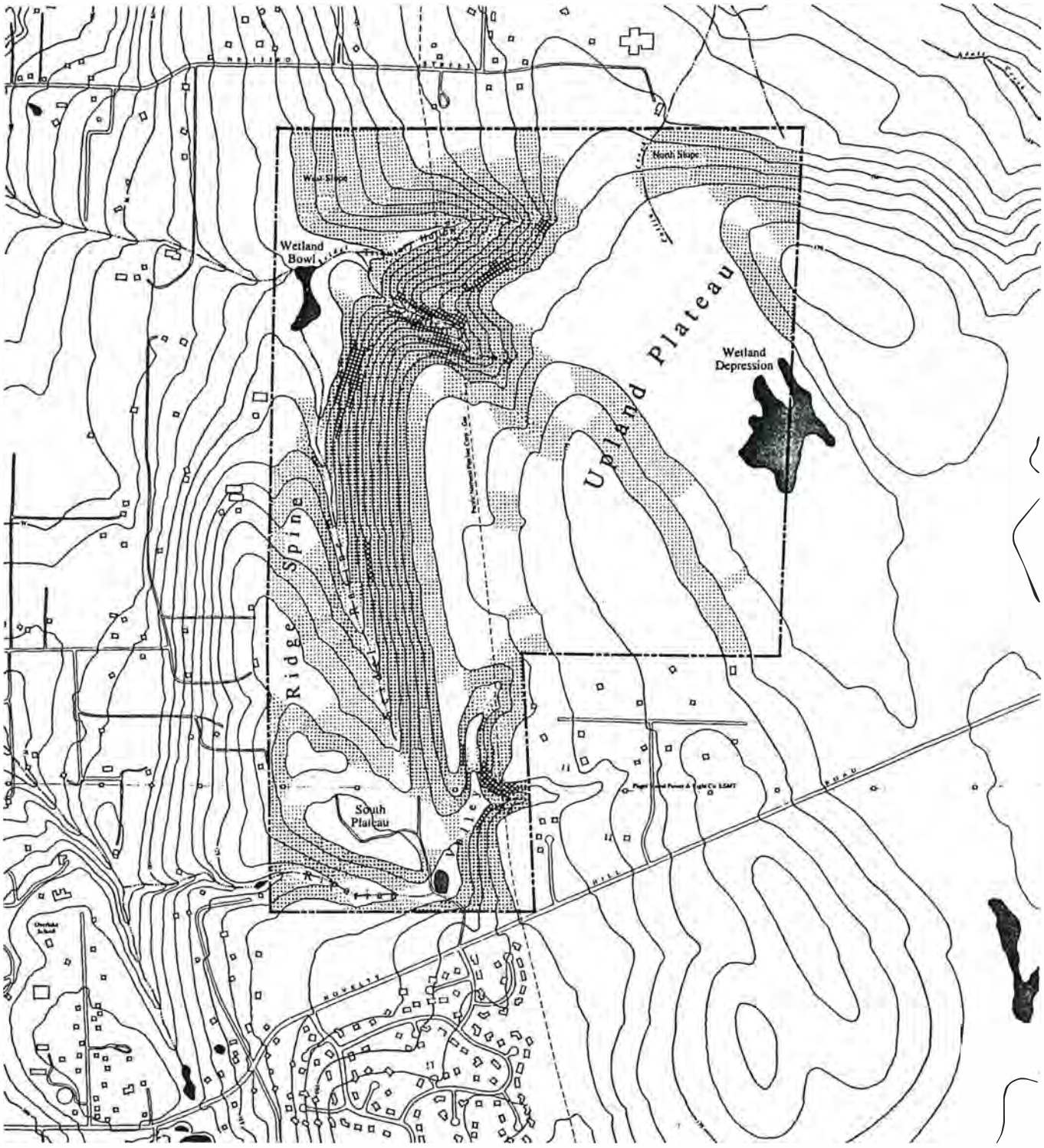
NOTE:
The information shown is based on USGS Topographic Maps and USDA Soils Maps.

10
5
1
ACRES

SCALE 1" = 400'-0"

400 100 0 1/8 1/4 1/2
FEET MILES

SOILS



Redmond Watershed Preserve

City of Redmond Department of Parks and Recreation

NORTH

NAKANO • DENNIS
LANDSCAPE ARCHITECTS

KEY

- < 5% SLOPE
- 5% to 8% SLOPE
- 8% to 15% SLOPE
- 15% to 30% SLOPE
- > 30% SLOPE

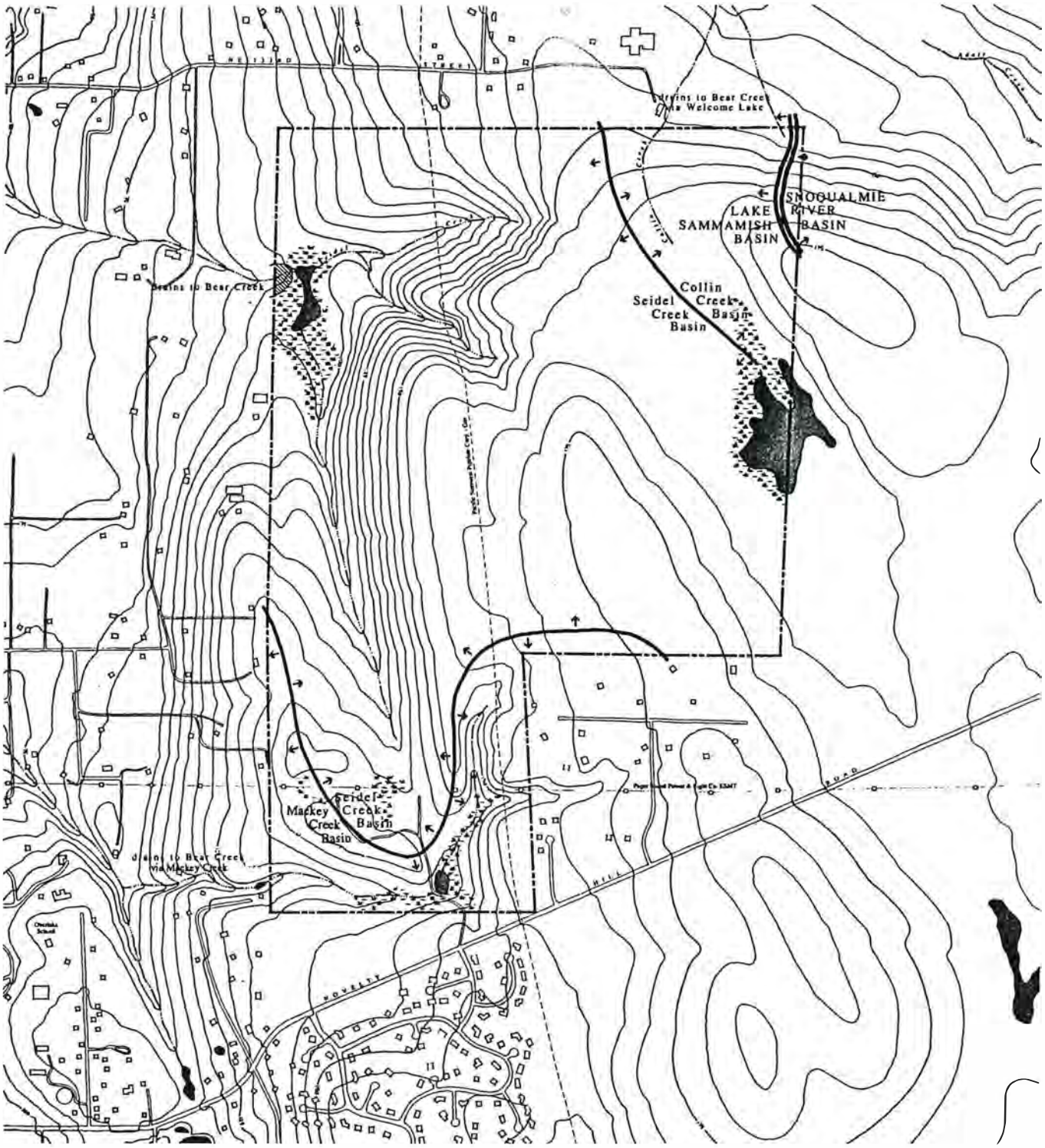
NOTE: CONTOUR INTERVAL 5 METERS

10
5
1
ACRES

SCALE 1" = 400'-0"

400 100 0
FEET MILES

SLOPES & LANDFORMS



Redmond Watershed Preserve

City of Redmond Department of Parks and Recreation

NORTH

NAKANO • DENNIS
LANDSCAPE ARCHITECTS

HYDROLOGY

KEY

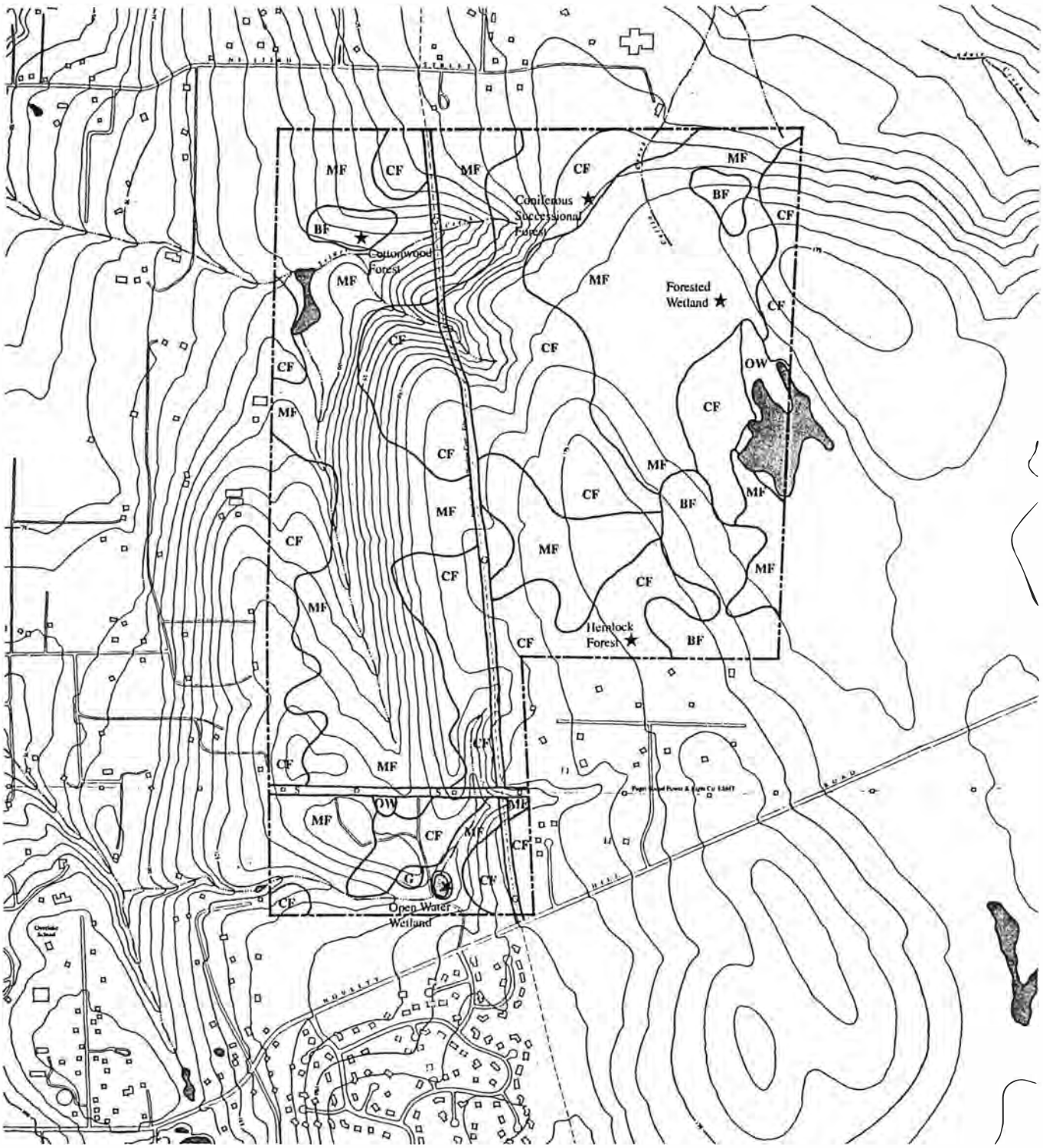
- OPEN WATER
- WETLAND
- PERENNIAL STREAM
- FLOOD HAZARD AREA
- MAJOR DRAINAGE BASIN BOUNDARY
- MINOR DRAINAGE BASIN BOUNDARY

NOTE:
The map shows approximate locations of hydrologic features based on USGS Maps, USDA Maps, King County Associate Section Maps, and aerial photos. Wetlands south of the Puget Power Transmission Line are located by survey.

SCALE 1" = 400'-0"

FEET MILES

ACRES



Redmond Watershed Preserve

City of Redmond Department of Parks and Recreation

NORTH

NAKANO ◆ DENNIS
LANDSCAPE ARCHITECTS

KEY

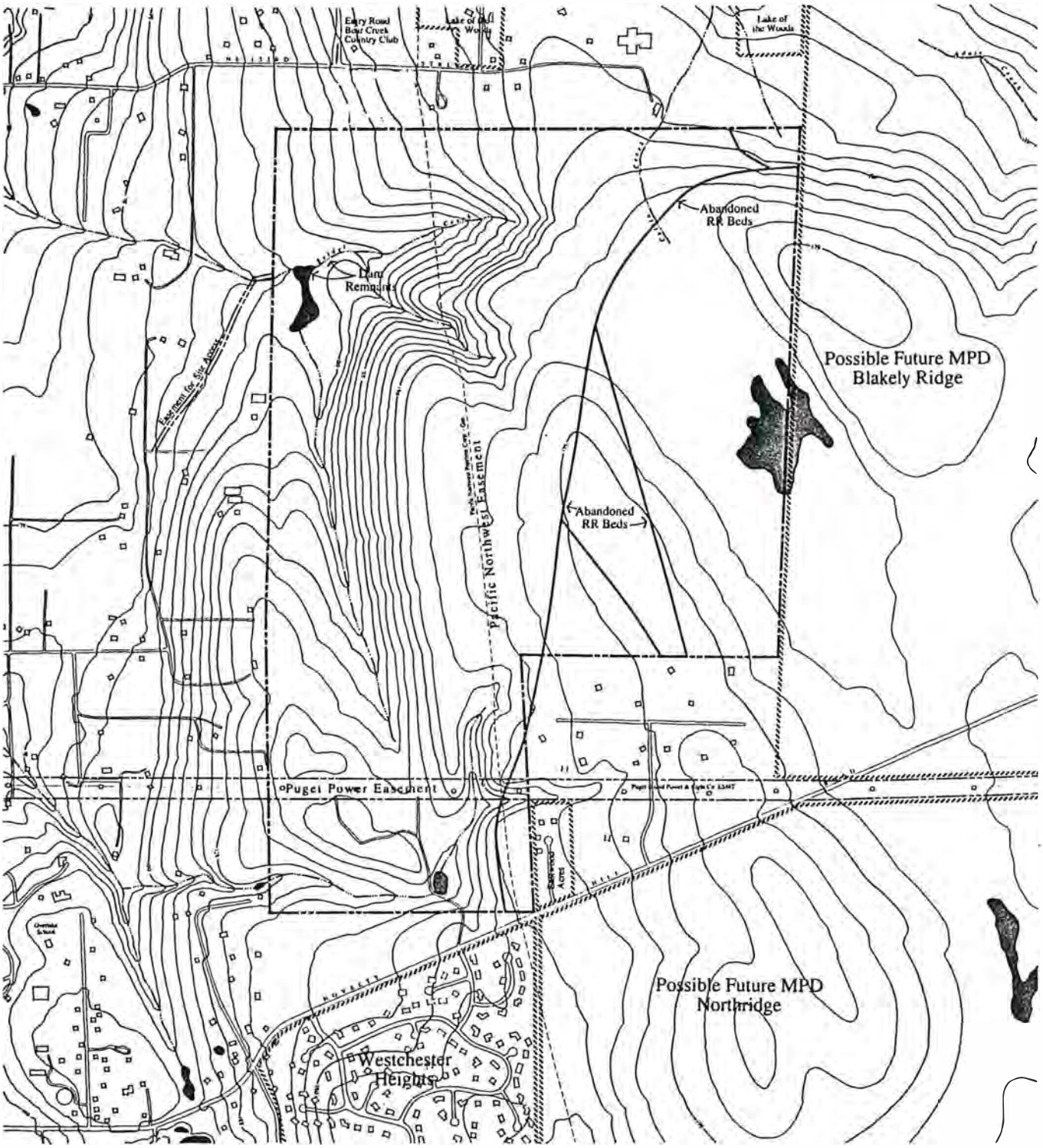
CF	CONIFEROUS FOREST
BF	BROADLEAF FOREST
MF	MIXED FOREST
S	SCRUB/SHRUB
OW	OPEN WATER WETLAND
G	GRASSLAND
★	PLANT COMMUNITY OF INTERPRETIVE INTEREST

10
5
1
ACRES

SCALE 1" = 400'-0"

FEET MILES

VEGETATION



Redmond Watershed Preserve

City of Redmond Department of Parks and Recreation

NORTH

NAKANO ♦ DENNIS
LANDSCAPE ARCHITECTS

UTILITIES HISTORICAL & CURRENT LAND USE

KEY

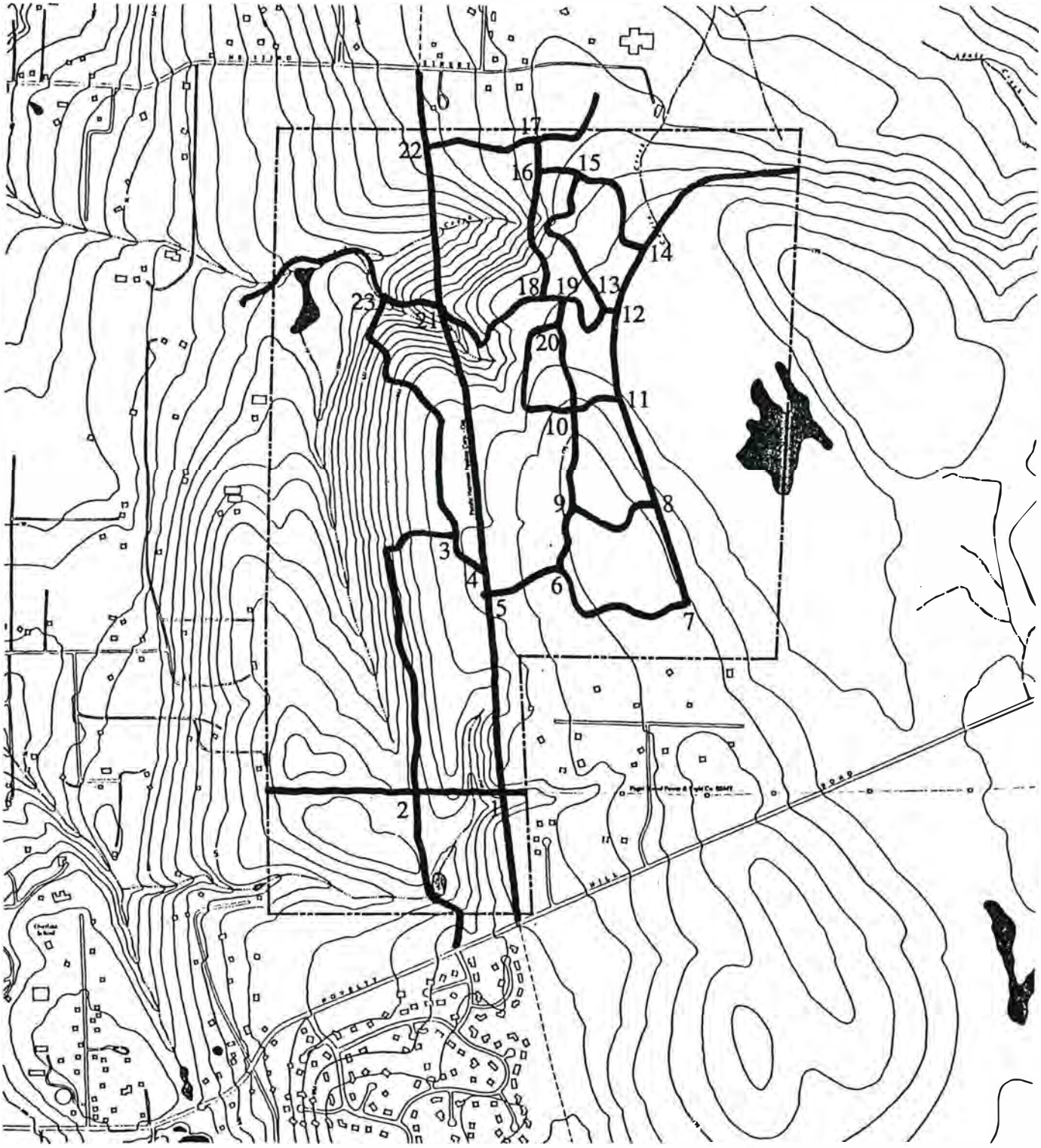
MPD BOUNDARIES

EASEMENT BOUNDARIES

SCALE 1" = 400'-0"

FEET MILES

ACRES



Redmond Watershed Preserve

City of Redmond Department of Parks and Recreation

NORTH

NAKANO • DENNIS
LANDSCAPE ARCHITECTS

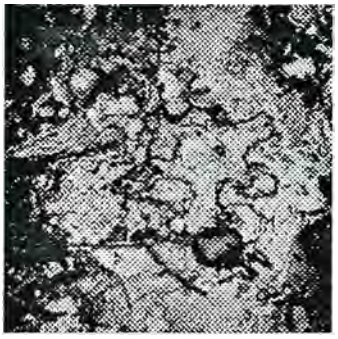
10
5
1
ACRES

SCALE 1" = 400'-0"

FEET MILES

EXISTING TRAILS

SITE ANALYSIS



REDMOND WATERSHED

MASTER PLAN

Two analysis plans summarize, synthesize, and evaluate the information and impressions gathered by the site inventory process and form an important link with the Master Plan.

The Opportunities and Constraints Plan

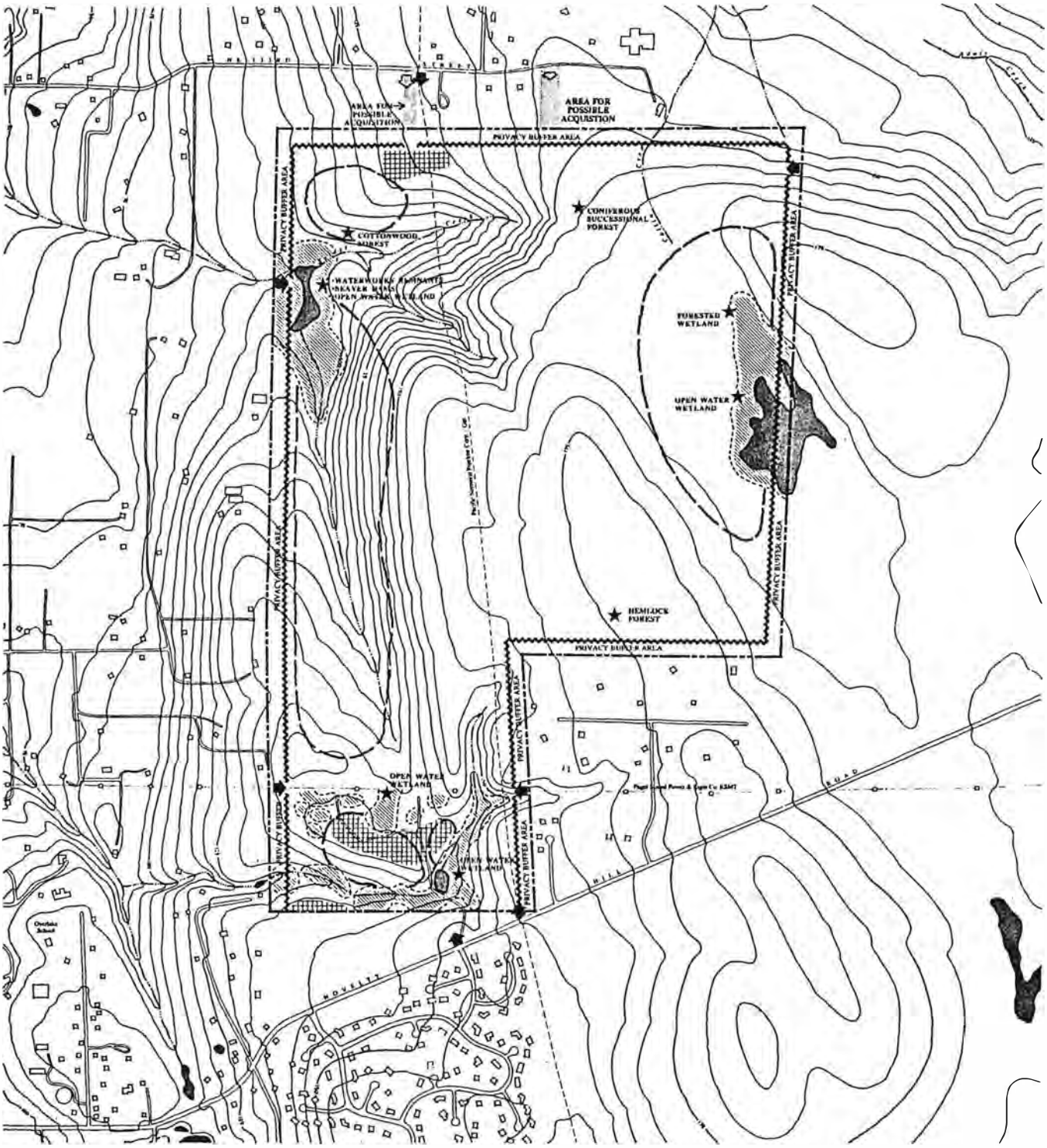
- Constraints: Sensitive wetland habitats and wetland buffers where development will be limited to foot trails and a privacy buffer at the perimeter of the site which will should remain undeveloped to protect neighbors.
- Opportunities: Habitat zones and cultural remnants of interpretive interest, areas appropriate for the development of trailhead service areas, and areas where new trails could offer access not available in the existing trail system.

The Development Rating Plan

The Development Rating Plan guides the development of the site based on the information in the Site Inventory Plans and the Opportunities and Constraints Plan. The Development Rating Plan rates areas along a continuum of most to least restrictive for development. The rating system is based on the value of the area as wildlife habitat, on an area's sensitivity to disturbance, on the presence of priority wildlife species, on the degree of existing or ongoing habitat disturbance, and on adjacent land use.

- The most sensitive habitat areas are rated most restrictive for development. No through access, only access to the perimeter of these areas is appropriate. The wetland at the east boundary of the site is particularly valuable habitat as it is contiguous with large wetlands and wetland buffers on adjacent property which will not be developed. The sighting of two priority species, pileated woodpecker and cutthroat trout lends the wetlands and streams in the south 80 acre parcel special habitat importance. Both these areas are rated most restrictive for development.
- The least restrictive areas for development include those areas in a disturbed state: the utility corridors and the city refuse site. These disturbed habitats are the most appropriate for more intensive development.
- Three other categories of appropriate development levels make up the middle of the range: areas for multi-use trails, low impact passive use trails, and lowest impact foot traffic only trails.

Implicit in the rating system are the values of preserving and enhancing habitat diversity, providing education, and offering recreation. These goals will be the guiding principles as planning progresses through the construction phase. Further information about wetland location, soil properties, and slope will be gathered in the next phase which may alter the plan boundaries of development rating areas, but the goals will guide the process to a conclusion appropriate to the site.



Redmond Watershed Preserve

City of Redmond Department of Parks and Recreation

NORTH

NAKANO • DENNIS
LANDSCAPE ARCHITECTS

KEY

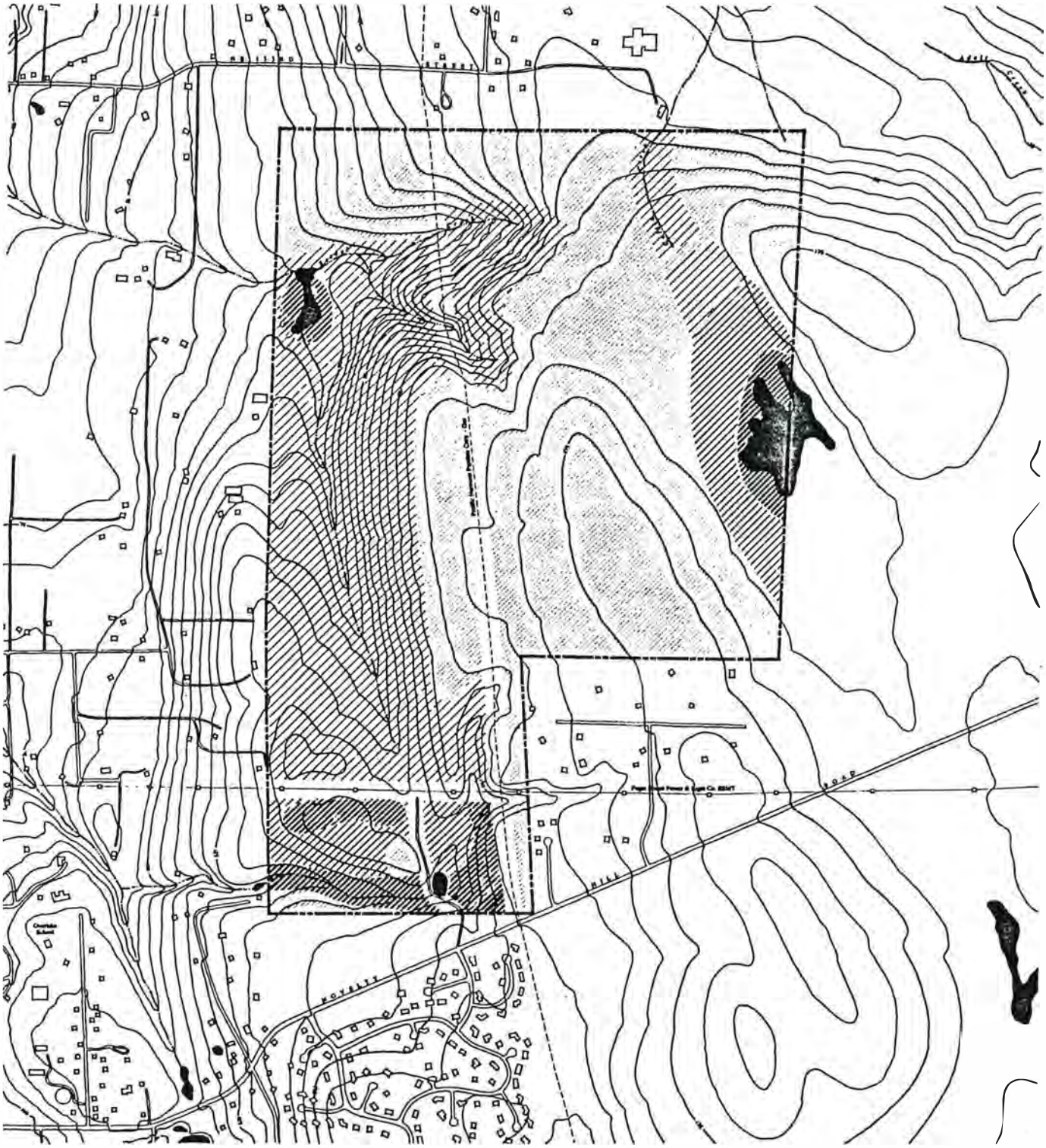
- ★ INTERPRETIVE OPPORTUNITY
- WETLANDS AND BUFFERS
- AREA FOR POSSIBLE NEW TRAIL DEVELOPMENT
- AREAS WITH DEVELOPMENT POTENTIAL
- EXISTING ENTRY
- POSSIBLE NEW ENTRY

SCALE 1" = 400'-0"

FEET MILES

10 5 1 ACRES

OPPORTUNITIES AND CONSTRAINTS



Redmond Watershed Preserve

City of Redmond Department of Parks and Recreation

NORTH

NAKANO ♦ DENNIS
LANDSCAPE ARCHITECTS

Key

Most Restrictive	1	Restrict access to edge viewing of habitat.
	2	Lowest impact, foot traffic only trails only.
	3	Low impact passive use trails only.
	4	Trails for multi-use and cycle traffic. Services like parking, maintenance, restrooms. Active uses in lower 80 acres, e.g., ballfields.
Least Restrictive	5	Vehicular routes for parking, service, and emergency.

10
5
1
ACRES

SCALE 1" = 400'-0"

400 200 0 400 800
FEET MILES

DEVELOPMENT POTENTIAL AND CONSTRAINTS

MASTER PLAN

REDMOND WATERSHED

MASTER PLAN

The Master Plan program for the Redmond Watershed includes wildlife viewpoints, interpretive programs, habitat preserves, trailhead service areas, soft surface and paved regional trails, soft surface and boardwalk ancillary trails, hard surface trails accessible to the physically challenged, a maintenance building and yard, future city compost and nursery site, future ballfields for the adjacent school property, and a future environmental education building. The program reflects: the Interlocal Agreement between the City of Redmond and King County, Redmond City Council's objective to preserve the Redmond Watershed's character and its natural systems, public input both directly and through representatives of user groups on the Steering Committee, and the *genius loci*, the spirit of the place.

The three primary goals which emerge from the planning process are preserving the site, offering recreational opportunities, and educating the visitor about the natural world. These goals are reflected in the decisions about how to fit the program to the site. The ecological criteria for development allow the achievement of the best possible balance between sometimes conflicting goals. The guidelines developed by the consultants, the Steering Committee, and the Park Board specify how to achieve those goals.

Master Plan Guidelines

Preservation and Protection of the Site

- Preserve the natural flora and fauna of the Redmond Watershed.
- Protect sensitive and ecologically fragile areas.
- Locate new trails and determine future trail uses based on ecological criteria.
- Minimize the impact of trails.
- Discourage informal, unauthorized trail making.
- Provide restrooms at both the southern and northern access near parking areas. . .
- Provide a maintenance facility along the Gas Line Trail.
- Prevent siltation of streams with appropriate trail location and construction practices.
- Manage for wildlife not for "urban park" use, e.g. do not "clean up" downed logs, dead snags, etc. that provide habitat and nutrients.
- Enhance habitat diversity with appropriate and varied replanting, e.g. plant food sources for known bird and animal population.
- Re-vegetate disturbed areas and trails with native plants.
- Remove non-native plants as part of initial construction and on-going maintenance.
- Manage disturbed regional trail corridors for maximum vegetative cover to enhance their value as wildlife corridors.
- Dogs should be excluded from hiker only nature trails and should be leashed on other Redmond Watershed Trails.
- Do not use pesticides or herbicides on the site.

Education

- Create a committee, e.g. Friends of the Watershed, to oversee educational opportunities and materials regarding trail etiquette and site preservation, and to coordinate maintenance sessions, provide patrols, and sponsor joint classes for equestrians and bicyclists.
- Use interpretive signage to convey important ecological information about the site.
- Post colorful, graphic warning signs to assure safety, e.g. pictures such as used on ski slopes to indicate short sight distances.
- Provide ecologically appropriate access to the range of diverse habitats.
- Create educational and interpretive opportunities, e.g. guided tours, educational brochures.
- Establish a City of Redmond authorized policing and enforcement program of rules and regulations.

Recreation

- Provide passive recreational opportunities for hikers, slow riding equestrians, and slow, family-type bicyclists.
- Develop trail standards which provide safe and pleasurable trail experiences for all users.
- Utilize as much as possible of the existing trail system.
- Develop trails that incorporate safety features and cause users to maintain slow speeds, e.g. bends.
- Develop additional trail mileage to create a satisfactory trail system which provides logical and convenient circulation, e.g. loops. Additional trails will provide access for equestrians west of the Trillium Trail and access for only hikers east of the Siler Trail.
- Utilize graphic signage to clearly identify trail use.
- Allow hikers to utilize any trail.
- Provide trail access for physically challenged persons within the lower 80 acres.
- Parking areas should provide safe non-paved areas for unloading horses from trailers.
- Provide multi-use trails as regional connectors and as needed for circulation. Provide some segregated use trails for each user group for reasons of maintenance, capital costs, safety, aesthetics, and environmental appropriateness.

Budget

- Ensure that if phasing is necessary an equestrian trail loop should be in Phase 1.
- Consider maintenance costs for the developed system.
- Plan for immediate and future use when designing support facilities.
- Develop a plan which fits the available funds for capital improvements and maintenance. Also, identify possible future improvements which will not be funded in this construction phase.

Trail Alternative Plans

The development of trail alternatives has been a major task of Master Planning. The process of developing trail plan alternatives is a balancing act which must take into account

- Preservation of natural habitat
- Desires of the public
- Safety of the user
- Accessibility for the physically challenged
- Need for logical circulation
- Sensitive area ordinances
- Educational opportunities
- Requirements of the Interlocal Agreement
- Ease of maintenance
- Available capital and maintenance budget
- Emergency access requirements

To accommodate hikers, equestrians, and bicyclists, the Redmond Watershed trail plan has to reflect either a multi-use or segregated use philosophy. Trail safety, equity, and site access must all be weighed in the decisions about trail use. Hikers, equestrians, and cyclists all have to be safely accommodated. Four generations of trail alternative plans have been produced. Plans and descriptions of these are included in Appendix 7.

The Recommended Trail Plan

The Park Board recommends to the City Council Trail Plan Option 1A which is a modification of Option 1 developed by the consultants with the Steering Committee. The modifications were based on a desire to increase opportunities for hikers, to avoid development of regional trails in steep areas and stream corridors, and to match development standard of regional trails in the Redmond Watershed to King County's regional trails. The recommended plan:

- Locates the most active and heaviest uses in the already impacted utility corridor and in the least sensitive habitats identified in the Development Opportunities and Constraint Plan.
- Uses the utility corridors where grades allow as the major north/south and east/west regional connector trails and as emergency access routes. It is appropriate to locate the most substantial development in these corridors which will remain disturbed. The regional trails avoid steep slope areas and stream corridors.
- Includes a foot path and boardwalk to the edge of the site's largest wetland habitat with cut off trails offering short or long loop routes for hikers. While access to this part of the site has educational and aesthetic value, the protection of habitat is paramount. The most sensitive areas at the east site boundary will not be penetrated with trails and only the lowest impact foot traffic use is allowed adjacent to this area.
- Includes a hikers only interpretive trail, part of which is accessible to the physically challenged, to the wetlands and riparian habitats

in the lower 80 acres. These offer educational opportunities for young, less vigorous, or physically challenged users. Again access to these sensitive areas is restricted to the edge of the wetland. It is recommended that dogs be restricted from these trails.

- Includes a 2-1/2 mile equestrian loop which includes the Trillium Trail and some new trails located west of the Gasline Trail. Many horse riders object to sharing the trail with cycles for safety reasons so a segregated trail is necessary to accommodate this user group. Any segregated trail will necessarily have lower impact than a multi-use trail because the trail design specifications can be reduced from multi-use standards and the user impact will be correspondingly less due to fewer visitors. This gives ecological logic to the location of the equestrian loop in this area.
- Designates the entry at 209th as an equestrian and hiker entry at the request of neighbors whose private road is used to access this entry. All other site entries will be multi-use. The plan allows equestrian users to access segregated use trails at trailheads adjacent to the parking areas for safety reasons.
- Includes a bicycle loop trail in a relatively flat area which can withstand this use. The low slopes on this loop will encourage sedate, family-oriented cycling.

Trail Development Standards

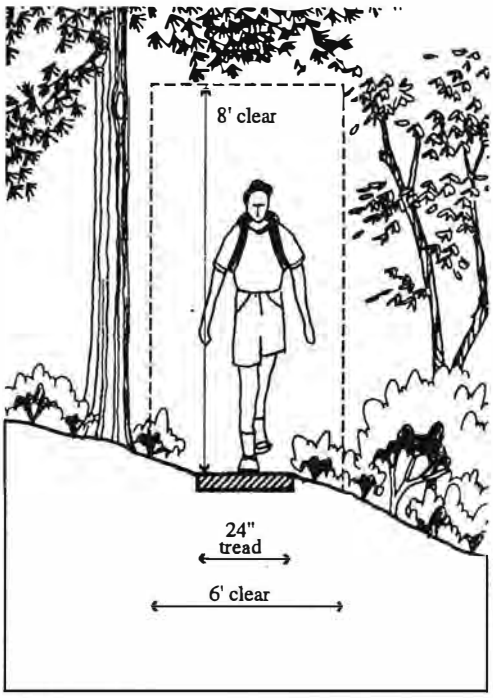
The character of the Redmond Watershed site is consistent with a primitive level of trail development. United States Forest Service (USFS) trail standards are the basis of proposed standards for new and renovated ancillary trails.

- Proposed tread widths range from 24 inches for foot trails, and up to 48 inches for multi-use trails.
- Proposed clearing widths range from 6 feet for hiker only trails and up to 8 feet for multi-use trails.

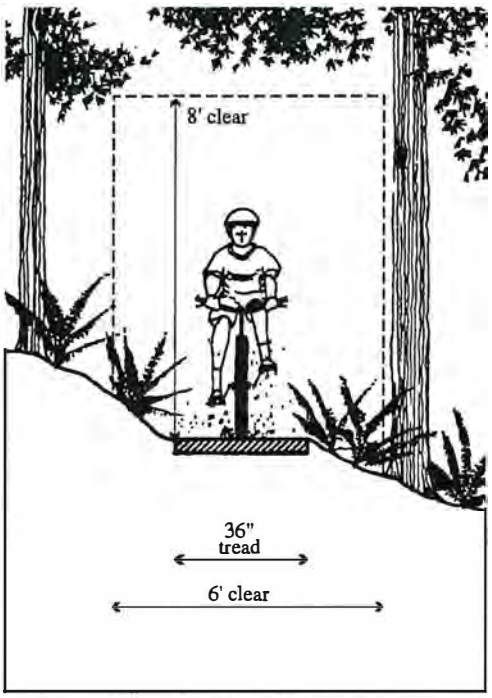
USFS trail standards also include clearing heights, steepness factors, and site distance for each type of trail. These standards allow for safe and comfortable use of the system for the designated users.

The main connector trails, which will run in or near the utility corridors, will be developed to a higher standard. In the future, these trails will connect to King County's Regional Trail System. Additionally, they allow emergency and maintenance vehicles ready access to the site. The north/south regional trail will have an 8 soft surface foot tread and a 12 foot clearing width. The east/west regional trail will have a 12 foot paved tread with 2 foot shoulders. A separated soft surface equestrian trail will run parallel to the regional trails. Grade or steepness of these trails will meet the regional standards of 5-7% maximum. The east/west trail will not be paved until it is connected to the regional trail system.

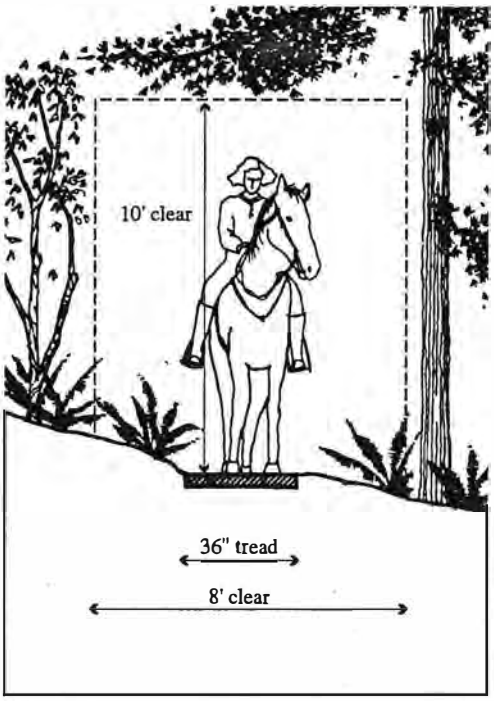
It is valuable to compare these standards with the existing trail



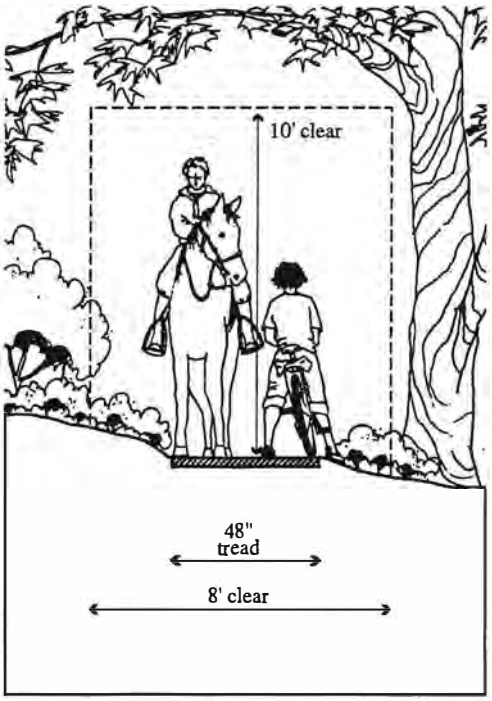
Hiking



Mountain Bike



Equestrian



Multi-use

dimensions to evaluate the change to the site which these trail standards would entail. Proposed trail tread width standards for all ancillary trails are the same or narrower than the existing average tread width of four feet. The average travelway of the proposed ancillary trails is 7.1 feet. This is close to the average travelway of 7.0 feet over the existing trail system.

Recreational trails always cause some degree of impact to the natural environments in which they are placed. The challenge of the trail planning and design process is to satisfy the public's desire for recreational experiences, without unduly disrupting natural processes and environments. Well-sited and engineered trails do initially cause a direct impact to the region's wildlife and natural systems. The impacts associated with the placement of such a trail tend to stabilize over time. Recreational impacts resulting from the poorly located, insufficiently drained, and badly surfaced existing trails do not stabilize over time. The displacement of some wildlife will occur during construction or reconstruction, but most species are capable of adapting to the physical alteration of their environment.

Trailhead Services

The services at the trailheads located at the north and south ends of the Redmond Watershed will include:

- Restrooms
- Parking for cars and horse trailers
- Access roads
- Informational signage
- Picnic areas

Site furnishing and amenities at the trailheads will include:

- Drinking fountains, picnic tables, and benches
- Bicycle racks and bicycle wash down area
- Hitching rails and water source for horses

At the south end a plan for these services has grown out of both the ecological goals of the Development Rating Plan and the circulation and security requirements. The proposed access road at the south end follows the existing service road not only because that route avoids the wetlands and riparian habitats but also because it follows an existing cleared route that minimizes additional clearing. The existing route also provides an aesthetically pleasing and logical connection to the site selected for the service area.

The parking lot, restroom, and picnic area are located to make use of the existing cleared area at the city refuse site. This location functions for the circulation system and minimizes further clearing. More extensive soil and topographic surveys in the next phase will confirm the feasibility of this location.

Development at the north end will occur on property yet to be acquired, so the configuration of that development is not yet determined. The maintenance building will be located adjacent to and west of the gasline corridor near Novelty Hill Road. Existing habitat disturbance in the corridor makes this a reasonable location from an ecological point of view. Furthermore, its location near Novelty Hill Road preserves the interior of the site from service traffic and provides visibility and security.

Unique Places

Special places throughout the Redmond Watershed can enhance the visitor's experience of the site and understanding of the natural world and increase the value of the site as wildlife habitat:

- Simple rustic benches built at intervals along the trail where one may rest and listen for bird life.
- Viewing platforms at the edge of wetland or streams will provide habitat sensitive development which allows the visitor to appreciate the beauty of nature and observe wildlife.
- A viewing blind at the pond near the northwest corner of the site might allow the visitor to see beavers at work.
- Re-vegetation of disturbed landscapes could distinguish special places and diversify habitats. For example, the gas line corridor could be replanted in swaths of low growing native shrubs which could benefit wildlife and educate visitors about landscaping with native plants. An area of windfalls could be re-planted in test plots with different native species to study regeneration.
- An environmental learning center could sponsor events such as interpretive ranger programs, bird watching classes, and equestrian trail rides.
- Nature tours, art and photography classes, trail clean-up groups, or trail sharing seminars could meet at an outdoor 'classroom' before venturing onto the trails.
- Habitat enhancements such as bird or bat houses could be hung in the trees, some in remote locations, some in site of viewing areas.
- Fish runs might be re-established by stocking Redmond Watershed streams with native species.
- Bike racks at junctions of multi-use and hiker only trails.

Not all of these possibilities are within the scope of the construction phase which follows this Master Plan, but could be added over time.

The Interpretive Program

Education about the environment will add to the visitor's understanding of the Redmond Watershed site, which in turn will foster a respect for the value of the Redmond Watershed and for the natural world in general. The relationship of wildlife to habitat is an important connection. The information gathered about vegetation and wildlife is the basis of an interpretive display which is proposed in the first construction phase

along a trail accessible to the physically challenged near the south entry. That plan includes four baked enamel on steel panels which illustrate and describe habitat diversity, wildlife shelter, food sources, and wildlife observation opportunities. Appendix 8 more thoroughly describes the content and educational goals of those four panels. The natural diversity of the Redmond Watershed offers many opportunities for interpretation in addition to those planned as part of the first construction phase. Some additional interpretive themes are identified in the Opportunities and Constraints Plans and in the Master Plan.

Redmond's Recreation Division will offer classes on the site beginning in the Fall of 1994. Future plans include a small building with classroom and office space to facilitate that program. Plans are already underway to affiliate with the school district's science and environmental education departments and local colleges. The understanding and respect which can arise out of an educational program is an important element in the preservation of the site.

Informational Signage

Graphic signage will be used to quickly and directly convey information to park users. Signage standards such as those developed by the Army Corps of Engineers, which include graphic images and minimal text, will be used in the Redmond Watershed. Graphic signage will describe park rules, indicate location of services, illustrate trail yielding etiquette, and designate user groups for each trail. Text signage will be used to name trails, to supplement graphic images, and in other instances where graphic images will not fully inform park users. Simple wood posts will be used for mounting signage. Trail name markers and trail user designations will mark trail intersections. At service areas graphic images with arrows will direct visitors to restrooms, picnic areas, trails, parking areas, and other services.

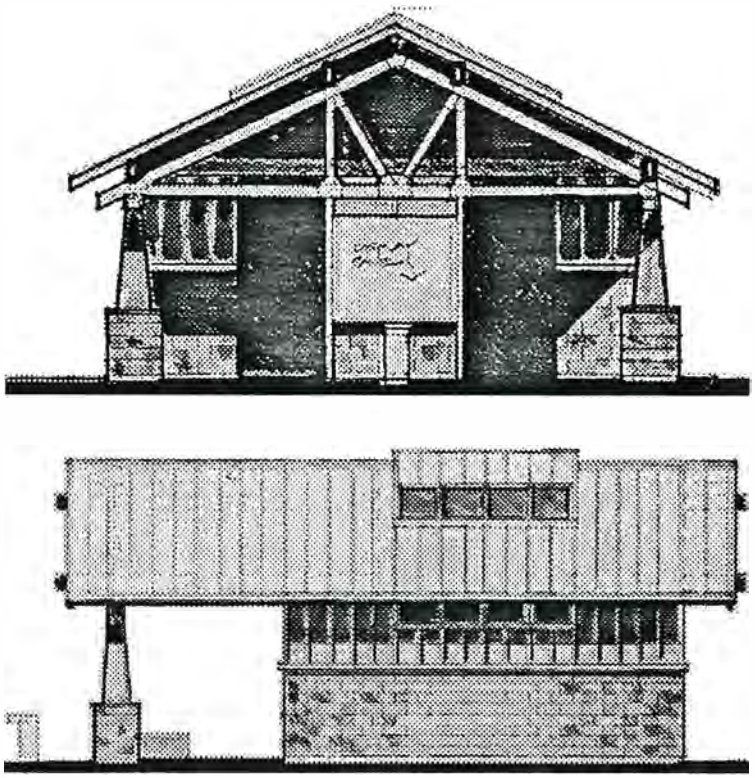
Other types of informational signage will be needed to guide park users. Trail maps will be displayed in permanent signage as well as being available in printed brochure form. Standard road signage will be used for stop signs, one way indicators, yield signs, and speed limit signs. Some signage might combine park rules and educational material about wildlife. For instance, studies indicate that signage which instructs users to remain on the trail has been most effective when it includes information about the impact of this activity on wildlife and habitat.

Informational signage is one element of the educational program which will be undertaken in the Redmond Watershed to insure safe and logical use of the park and to preserve the site from possible environmental damage. In combination with environmental education programs, informational signage is an important element in fostering an attitude of stewardship.

Architecture

The restroom buildings and the maintenance building are designed to reflect the natural character of rustic architecture that has been historically developed in our national wildland parks. However, the construction materials and methods of these new buildings differ from those traditional structures of wood, timber and stone for reasons of economy, durability, and maintenance. These building will have a rough hewn masonry wainscot in place of the stone base. The texture and appearance of traditional board and batten siding is recalled in metal battens over smooth concrete masonry walls. Open trusses with exposed wood decking under a metal roof complete the exterior envelope of the structures. The restroom buildings will have a large covered outdoor area where visitors can wait for companions, seek shelter from the weather, or read informational signage built into the support structure.

The restroom waste lines will be connected to a drainfield unless further soil investigation shows this is not feasible. Alternative waste handling options, composting toilets and pump tank systems, have been investigated and were found to be more costly in terms of initial construction or maintenance than the conventional drainfield system. When sewer lines become available adjacent to the site, the restroom waste lines can be connected without any alteration to the fixtures or building.



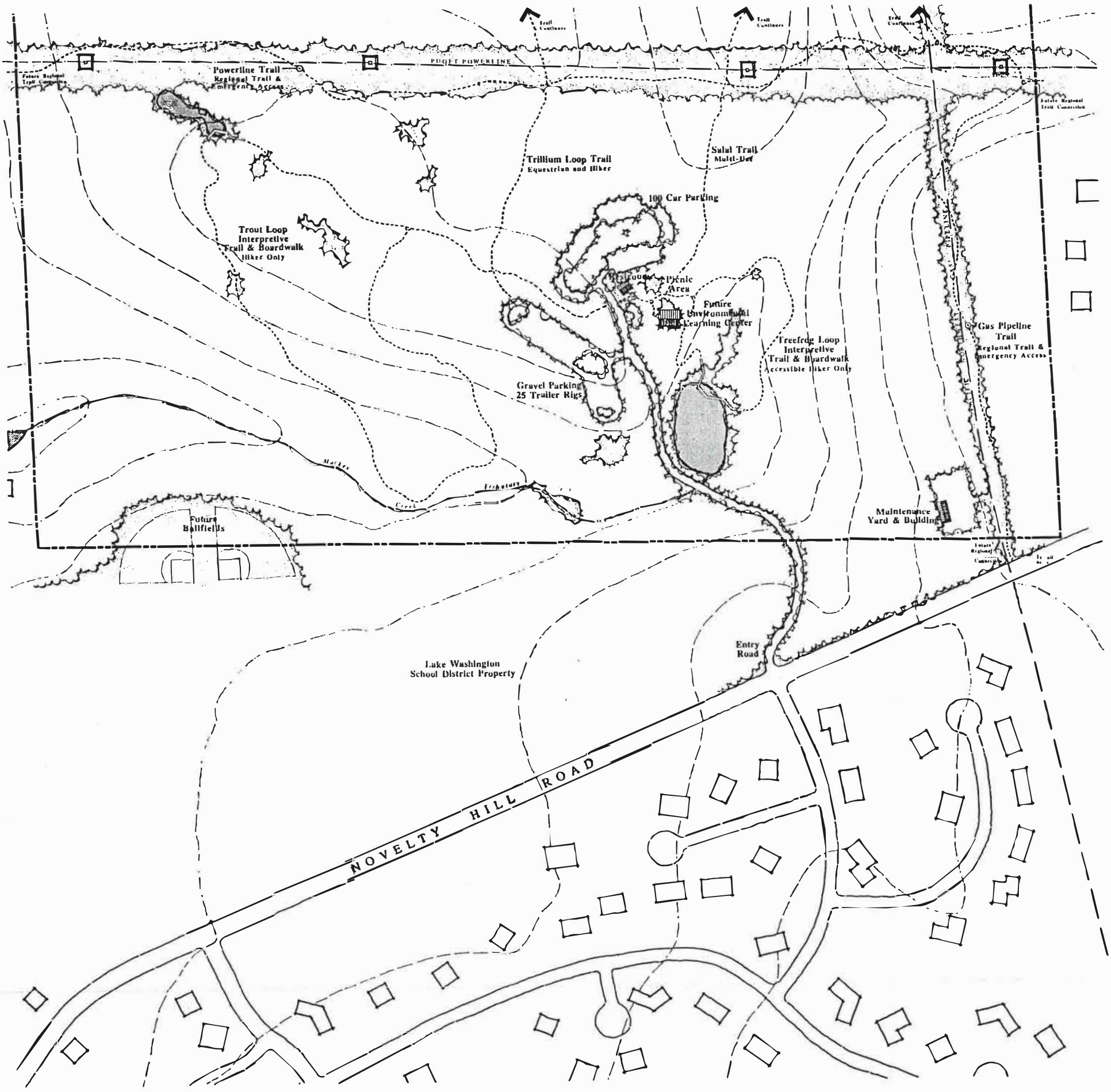
Construction Cost Estimate Summary

Trail System	
Trail Improvements, Relocation, and New Trails	$ 639,760
Signage	$ 12,000
Site Improvements	
Restrooms (2)	$ 120,000
Maintenance Building	$ 95,000
Picnic Area	$ 10,000
Access Road (1000 lf, 2 catch basins)	$ 32,000
Parking Lots (2)	$ 90,000
Planting	$ 15,000
Novelty Hill Road Improvements	$ 50,000
Utilities	
Detention and Storm Drainage (2)	$ 109,500
Septic and Drainfield (2)	$ 45,000
Water Service and Hydrants (2)	$ 61,000
Electrical Service (2)	$ 30,000
SUBTOTAL	$ 1,309,260
15% SCHEMATIC CONTINGENCY	$ 196,389
TOTAL	**$ 1,505,649**

Annual Trail Maintenance Costs

Maintenance for a reconstructed trail system can be accomplished with a combination of paid and volunteer labor:

	Rate	Hours /Week	Hours /Year	Annual Cost
Volunteer Coordinator	$10	16	800	$8000
Skilled Labor	$14	16	800	$11,200
Volunteers		40	2000	0
Tools and Materials				$6800
TOTAL				**$26,000**



Redmond Watershed Preserve

City of Redmond Department of Parks and Recreation

NORTH

NAKANO • DENNIS
LANDSCAPE ARCHITECTS

SCALE 1" = 100'-0" 1 ACRE

100 50 0 200 400 600
FEET

80 ACRE DETAIL SITE PLAN

CONCLUSION

REDMOND WATERSHED

MASTER PLAN

APPENDIX 1

GEOTECHNICAL PRELIMINARY SITE EVALUATION

REDMOND WATERSHED

MASTER PLAN

Report

Geotechnical Engineering Services

Preliminary Site Evaluation

Redmond Watershed Preserve,

South Access

King County, Washington

For City of Redmond

October 8, 1993

For

Nakano ♦ Dennis Landscape Architects

GeoEngineers

October 8, 1993

Geotechnical, Geoenvironmental and Geologic Services

Nakano ♦ Dennis Landscape Architects
300 East Pike
Seattle, Washington 98122

Attention: Mr. Kenichi Nakano

Report
Geotechnical Engineering Services
Preliminary Site Evaluation
Redmond Watershed Preserve, South Access
King County, Washington
for City of Redmond
File No. 0500-061-R02

INTRODUCTION

This report presents the results of our preliminary evaluation of geotechnical conditions at the site of proposed parking and restroom facilities at the Redmond Watershed Preserve in King County, Washington. The preserve is located on Novelty Hill, approximately 3 miles northeast of downtown Redmond. The locations of the site and surrounding features are shown on the Vicinity Map, Figure 1. The south access and related existing features are shown on Figure 2.

Our services were requested by you on April 7, 1993 and were authorized in the signed Subconsultant Agreement for Services dated June 8, 1993. We discussed our preliminary conclusions and recommendations with Ms. Dodi Fredericks of Nakano ♦ Dennis on September 8, 1993.

PROJECT UNDERSTANDING

Our present understanding of the project is based on information provided to us by Ms. Fredericks. The project consists of the development of a system of trails for pedestrian, equestrian and bicycle use. The trail system will be developed around a network of existing trails and utility easements that cross the preserve. Access to the trail system will be from the north via Northeast 133rd Street and from the south, off of Novelty Hill Road. Parking areas and

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restroom facilities are planned at these access locations. We understand that the City of Redmond is presently attempting to acquire an easement across private property to gain access to the northern portion of the trail system, and that the location of parking and restroom facilities associated with that access has yet to be determined. Therefore, this study addresses the parking and restroom facilities associated with the southern access only.

The site of the proposed parking and restroom facilities on the southern portion of the preserve is located approximately 900 feet north of Novelty Hill Road, and encompasses approximately 3 acres. The proposed facilities to be constructed at the site include a parking lot designed to accommodate approximately 100 cars, a restroom building and associated on-site drainfield, and possibly a picnic structure with a slab-on-grade concrete floor.

We understand that a portion of the site is presently used by the City of Redmond as a composting area and that fill had previously been dumped at the site over a period of many years. The nature and extent of this fill is uncertain, but likely includes organic material, rubble and debris.

PURPOSE AND SCOPE

The purpose of our services is to evaluate the geotechnical feasibility of parking lot, restroom and septic drainfield construction at the proposed site as part of the master planning phase of the Redmond Watershed Preserve project. Site-specific design criteria related to earthwork, building foundation support and drainfields are to be developed during a subsequent phase of the project.

The specific scope of our services includes the following items:

1. Review available geologic and geotechnical information pertaining to the site, including published and unpublished maps, folios, surveys, and geotechnical reports.
2. Conduct a geologic reconnaissance of the site of the proposed parking area and restroom facilities to preliminarily evaluate geotechnical site characteristics including foundation support, slope stability and erosion, relative soil permeability and natural drainage.
3. Meet with personnel from Nakano ♦ Dennis to discuss preliminary findings and consideration of alternative sites, as necessary.
4. Summarize our conclusions and recommendations in a brief letter report.

SITE CONDITIONS

GENERAL

We performed a geologic reconnaissance of the site and surrounding area on August 23, 1993. Our reconnaissance included probing and excavation of near-surface soils with hand tools to depths ranging from about 1.5 to 3 feet, and characterizing and mapping surface features by

pacing distances and obtaining measurements with a clinometer and compass. Field notes and photographic documentation obtained during our reconnaissance are retained in our files and are available upon request.

SURFACE CONDITIONS

The site is situated near the top of a broad, northwest-southeast trending hilltop. An existing unsurfaced road provides access to the site from Novelty Hill Road as shown in Figure 2. The eastern portion of the site is relatively flat and unvegetated. This area, which is highlighted in Figure 2, is presently used by the City of Redmond for a composting area. This portion of the site is elevated approximately 20 to 30 feet above the western portion of the site. The western area is vegetated with scattered brush and second-growth mixed conifers having 8- to 20-inch trunk diameters. The ground surface slopes steeply downward from the eastern portion of the site to the western portion of the site at an inclination of about 75 percent. The ground surface on the western portion of the site slopes gently downward to the southwest, west and northwest at an average inclination of about 15 percent.

We observed evidence of minor erosion on the unsurfaced access road in the vicinity of the site. However, we observed no other evidence of erosion or slope instability elsewhere on the site during our reconnaissance. The site slopes are typically well vegetated and, with the exception of the steep slope near the middle of the site, are gently inclined.

The site appears to be generally well drained. We observed no surface water on the site at the time of our reconnaissance. Local areas surrounding the site appear to be poorly to moderately well drained. A pond is located near the southeast portion of the site, and several wetlands have been mapped by others in the area north of the site and along an intermittent stream that flows east and south of the site, as shown in Figure 2.

SUBSURFACE CONDITIONS

The shallow subsurface soils, as encountered in our explorations, are variable across the site. In general, we encountered fill overlying glacial till on the eastern portion of the site and native glacial drift deposits on the western portion of the site.

The fill encountered on the eastern portion of the site includes soft organic debris (compost material) generally about 2 to 4 feet thick. This material, which includes grass clippings, wood chips and cut brush, is underlain at the extreme eastern portion of the site by very dense, glacially consolidated till consisting of a mixture of silt, sand, gravel, cobbles, and boulders. Permeability of the till is very low due to the soil gradation and consolidation.

Near the middle of the site, the organic fill is underlain by loose to medium dense rubble fill that includes sand, gravel, cobbles and concrete rubble. The rubble fill underlies the steep slope that separates the compost area from the wooded western portion of the site. Based on the

height of this fill slope, the rubble fill appears to be as much as approximately 20 feet thick. Permeability of the fill is variable with fill composition and consolidation, but in general is at least moderate.

The ground surface on the western portion of the site is generally mantled with a 6-inch thick layer of forest duff. The duff is underlain by glacial drift deposits including weathered ablation till on the northwestern portion of the site, and granular outwash on the southwestern portion of the site. Ablation till generally consists of the same mixture of material as described above for glacially consolidated till, but has not been overridden (and overconsolidated) by glacial ice. The weathered ablation till encountered on the site is loose and is moderately permeable. The outwash encountered on the site generally consists of sand with silt, gravel and occasional cobbles, and is loose to medium dense. Permeability of the outwash is at least moderate; it will typically be more permeable than the ablation till and substantially more permeable than the dense underlying consolidated till.

According to the U.S. Department of Agriculture Soil Survey of King County, Washington, the site is underlain by Alderwood sandy, gravelly loam. This soil is described as being derived from glacial till. The geologic units underlying the site as mapped by the U.S. Geological Survey include glacial till and outwash. Field data for both of these published references is typically obtained from widely scattered locations and then compiled using topographic base maps and aerial photographs. The results of our site reconnaissance indicate that at least a portion of the site is underlain by granular outwash soils. The vertical and areal extent of these soils should be characterized in more detail prior to commencing design work as described below.

Ground water seepage was not observed in any of our shallow explorations at the time of our reconnaissance. We also observed no evidence of ground water seepage emerging from slope faces on the site. It is our opinion that seasonal shallow "perched" zones of ground water are likely to occur intermittently in areas of the site underlain by till. In general, ground water conditions at the site should be expected to fluctuate as a function of season, precipitation and other factors.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

Based on our review of available information, our site reconnaissance, and our experience in the general area, it is our opinion that geotechnical conditions at the site are generally suitable for development of the site as proposed. A more detailed exploration program will be necessary to determine the vertical and areal extent and character of the subsurface materials underlying the site and to develop site-specific design criteria for the various planned elements of the project. Discussions of specific geotechnical considerations are presented in the following paragraphs.

FOUNDATION, FLOOR SLAB AND PAVEMENT SUPPORT

In general, it appears that the native soils underlying the site are adequately consolidated, or will respond to compactive effort, to provide sufficient support for structures and pavements. We did not observe conditions during our reconnaissance suggesting that deep foundations (e.g., piles) will be necessary for building support. However, it will be necessary to strip the organic fill and forest duff layers from proposed building and parking areas. These materials should be placed in nonsettlement-sensitive areas (e.g. areas to be landscaped) or removed from the site. The character and extent of the rubble fill should be further evaluated to determine if the fill will provide adequate support, in either its present or reconditioned state, for any structures or pavement that might be situated on that material if such uses are contemplated.

SLOPE STABILITY CONSIDERATIONS

The results of our preliminary reconnaissance indicate that the site slopes are generally stable. Stability of the steep rubble fill slope should be further evaluated to determine if regrading or other measures to improve the slope stability should be accomplished if those issues are important to design of the project. Also, we recommend that subsurface explorations be accomplished to characterize the soil and ground water conditions at the contact between the rubble fill and underlying native soils.

SEPTIC DRAINFIELD CONSIDERATIONS

There are two general considerations for determining the feasibility of on-site sewage treatment. One is the relative permeability of the soil in the proposed drainfield areas. The permeability is controlled by the gradation, or particle size distribution, as well as the degree of consolidation of the soil. The other consideration is the vertical and areal extent of suitable soil for both primary and back-up drainfield areas. Depth to ground water and proximity to surface water are related considerations.

Based on our preliminary observations at the site, it is our opinion that on-site sewage treatment associated with the proposed restroom facilities is feasible. It appears that relatively permeable ablation till and outwash deposits underlie much of the site to at least shallow depths. With the exception of the pond located near the southeast corner of the site, it appears that mapped wetlands and streams are separated laterally from the proposed boundary of the site by at least 150 feet. We recommend that the drainfields be planned for the western portion of the site if at all possible to maximize the distance between the drainfields and pond.

Subsurface explorations should be accomplished at the site to better determine the vertical and aerial extent of suitable drainfield soils and depth to ground water, and to obtain samples for laboratory particle size analysis and/or accomplish field percolation tests for drainfield design. Depending on the results of these explorations and tests, it may be necessary to consider the design of modified septic systems such as mound or pre-filter systems.

LIMITATIONS

We have prepared this report for use by Nakano ♦ Dennis and members of the design team in design of a portion of this project. The information contained herein is specific to this site and is not applicable to other sites. Site development plans and design details were not known at the time of this writing. Our report, conclusions and recommendations should not be construed as recommendations for detailed final design nor as a warranty of the subsurface conditions.

If there are changes in the configuration of the proposed development, the conclusions and recommendations presented may not be applicable. If design changes are made, we request that we be given the opportunity to review our conclusions and recommendations and provide a written modification or verification.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in this area at the time this report was prepared. No other conditions, express or implied, should be understood.

We appreciate the opportunity to be of service to you on this project, and we look forward to working with you during the design phase. Please call if you have any questions concerning this report or if you require additional information.

Yours very truly,

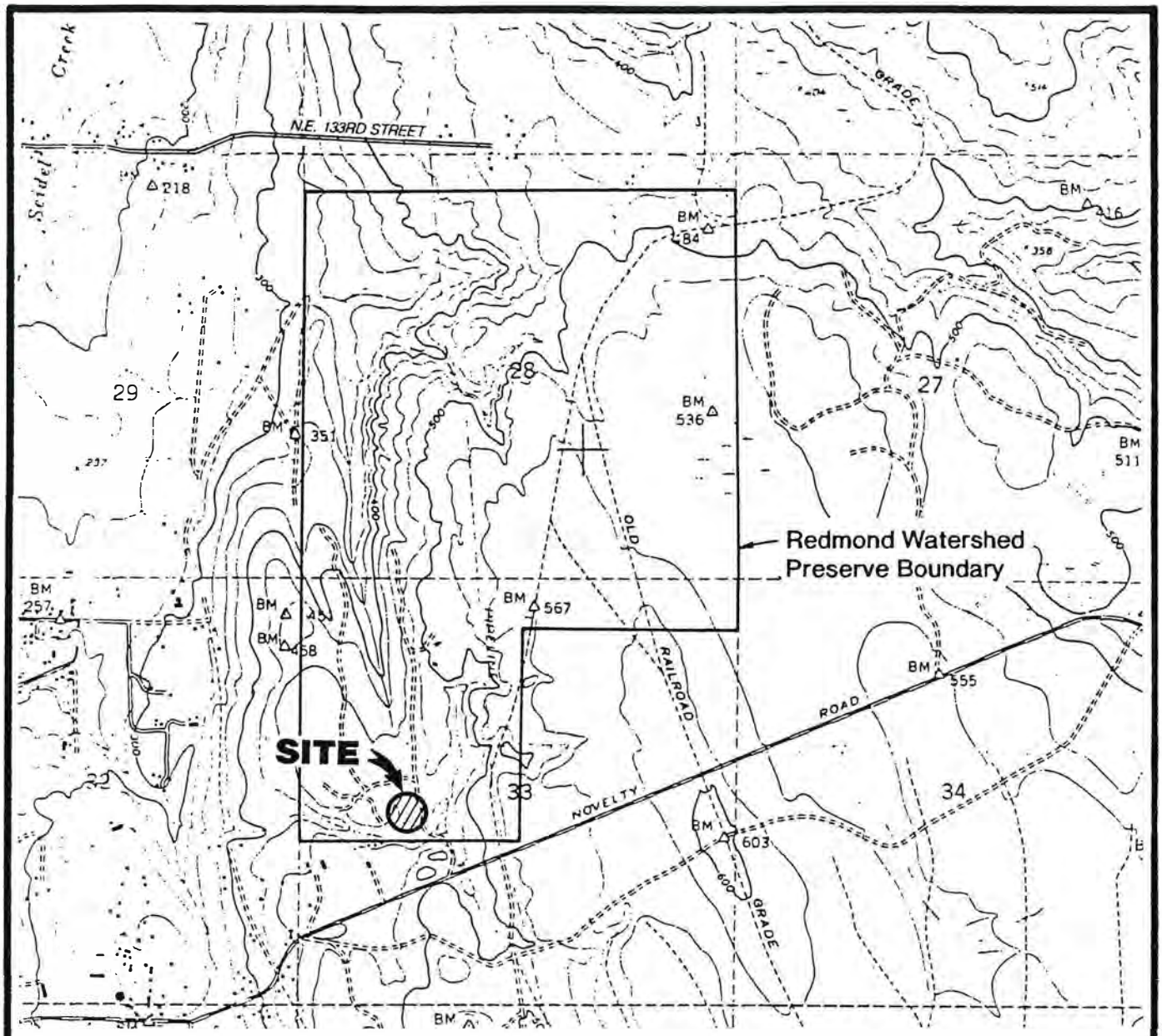
GeoEngineers, Inc.

Michael D. Hylland
Senior Staff Geologist

Jon W. Koloski
Principal

MDH:JWK:nlm
Document ID: 0500061.R

Two copies submitted



Reference: USGS 7.5' topographic quadrangle map "Redmond, Wash.," photorevised 1973.

GeoEngineers	**VICINITY MAP** .
	FIGURE 1

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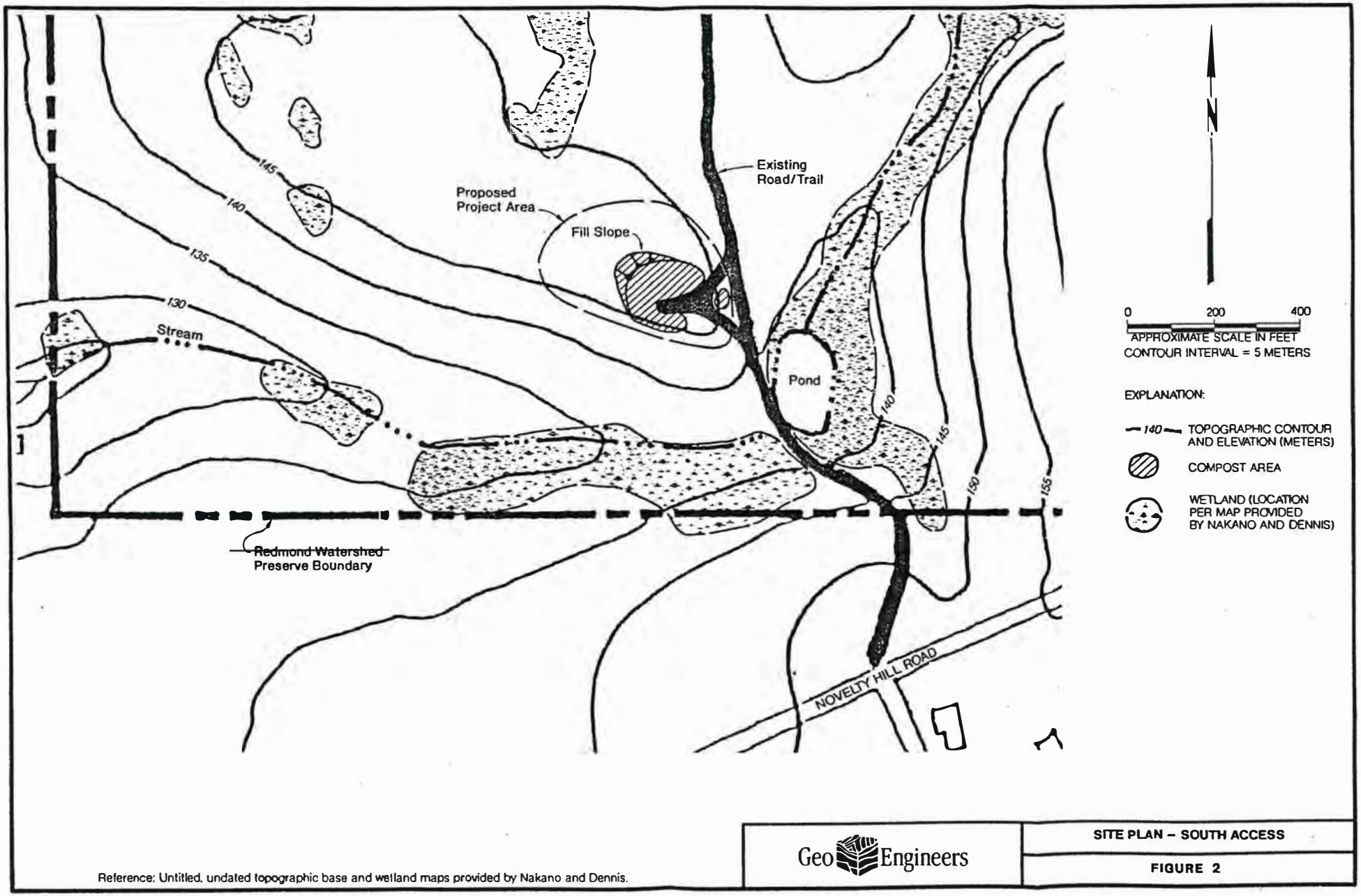

Reference: Untitled, undated topographic base and wetland maps provided by Nakano and Dennis.

Geo Engineers

SITE PLAN – SOUTH ACCESS

FIGURE 2

APPENDIX 2

WETLAND AND WILDLIFE REPORT

REDMOND WATERSHED

MASTER PLAN

THE REDMOND WATERSHED PRESERVE WETLANDS STUDY

Prepared for:

NAKANO•DENNIS
2808 II E. Madison St.
Suite 206
Seattle, WA 98112

Prepared by:

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September 1993

THE REDMOND WATERSHED PRESERVE WETLANDS STUDY

INTRODUCTION

The Redmond Watershed Preserve is a forested tract of land located in the Sammamish River basin and encompassing over 800 acres. This property was originally acquired by the City of Redmond for use as a water supply source, but has been used as open space since these plans were abandoned.

For this study, wetlands were identified and delineated on the southernmost 80 acres, which comprise the south half of the northwest quarter of Section 33, T 26N, R 6E. This 80-acre parcel is north of the Lake Washington School District property adjacent to Novelty Hill Road. A Puget Power line easement runs east/west along the northern boundary and, just within the eastern boundary of the parcel, a natural gas pipeline easement runs north/south. Along with the delineation, vegetation types and observations of wildlife were recorded.

METHODS

Wetlands were identified according to the methodology outlined in the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (USFWS 1989). Vegetation, soils, and hydrology were examined, and areas meeting the criteria for all three parameters were designated as wetland.

The presence of hydrophytic vegetation was determined using the wetland indicator status assigned to each species by Reed 1988 (see Table I). This criterion is met in plant communities with more than 50% of the dominant species having a wetland indicator status of facultative (FAC), facultative wetland (FACW), or obligate (OBL).

Soil color in hand-dug test pits was determined using the Munsell Soil Color Chart (1992). Unmottled soils with a chroma of 1 or less, and mottled soils with a chroma of 2 or less are considered indicative of hydric soil. Wetland hydrology is present when soil is saturated to the surface for at least one week during the growing season. Field indicators of wetland hydrology were observed and recorded to meet this parameter.

Plant communities also were grouped into habitat types, using aerial photographs and groundtruthing on site. Significant habitat features were noted and observations of vertebrate wildlife species were recorded in each habitat type. Field studies were conducted during May, June and July, 1993. See the attached map for the locations of wetland boundaries.

RESULTS

Wetlands *

Twelve wetland areas were delineated on this 80-acre parcel. All of the wetlands delineated are Palustrine according to the Cowardin system of wetland classification (Cowardin et. al., 1979). Two of the wetlands have relatively large open water components and four others are small ponded areas within the forest. Table IV lists the vegetation classes present within each wetland as well as the City of Redmond classification for each wetland.

Though the majority of the property is vegetated with mature second growth forest, a variety of habitat types are present. Most of the eastern portions are dominated by coniferous trees while the western portions are mixed with deciduous and coniferous species both represented in the canopy.

A Puget Power line easement runs east/west along the northern portion of the property addressed in this study. The plant communities within this easement are maintained by Puget Power and consist of shrubs such as vine maple and red huckleberry, Himalayan blackberry, salmonberry and herbaceous species. Just within the eastern boundary of the parcel, a natural gas pipeline easement runs north/south. This area, like the Puget Power easement, is maintained and supports mostly grasses, herbs, and small shrubs, although many small areas are unvegetated. An old borrow pit is located in the south-central portion of the property and is likewise a disturbed community composed mainly of grass and shrub species. Invasive and exotic plants were observed mostly in these areas and along the entry road and numerous trails.

According to the King County Soil Survey (1973), soil on this site has been mapped as Alderwood gravelly sandy loam which is not considered a hydric soil, though it may have hydric inclusions. Seventy-eight test pits were examined on the property. Using a Munsell Soil Color Chart, soil color was determined and recorded along with other soil characteristics.

With field studies performed during a very wet spring and summer, wetland hydrology was clearly evident in wetlands throughout the parcel. Many areas of ponded surface water were present at the time of observation and boundaries followed distinct changes in vegetation, soils, hydrology and topography. Tables II and III detail our determination of soil colors and hydrology within the test pits.

Wetlands One, Four, Nine, and Ten

The largest wetland system on this eighty acre site is associated with a drainage which flows northeast to southwest through the parcel. An entry road which crosses the drainage has impounded water and created a pond to the east of the road.

*Note: Refer to Appendix 3 for map of wetlands.

Wetland One extends beyond the northern boundary of this parcel and is associated with the portion of the drainage which is east of the road and is contiguous with the pond. Another small drainage enters the pond at its southwest end and extends beyond the southern boundary of the parcel. Both drainages are forested with species including western red cedar, hemlock, red alder and cottonwood comprising the canopy. Dominant understory species include cascara, salmonberry, devil's club, lady fern, skunk cabbage and buttercup.

As the eastern drainage reaches the ponded area, willow, hardhack and crabapple become dominant leading to a lush emergent community including bulrushes, cattail, and soft rush. A healthy community of floating-leaved plants including pond lily and starwort dominate the eastern side of the pond, and floating logs throughout the pond support plants such as Labrador tea, sedges and moss. The transition from wetland to upland throughout Wetland One is correlated with an abrupt change in topography. Communities outside the wetland boundary along the drainages are dominated by Douglas fir and hemlock with a fairly sparse understory including sword fern and bedstraw. Closer to the pond margins, the understory is thicker with additional shrub species including vine maple, hazelnut, Oregon grape and red huckleberry.

Soil colors most frequently observed within the wetland were black (10 YR 2/1) and very dark grayish brown (2.5 Y 4/2) with many mottles; those outside the boundary were most often dark brown (7.5 YR 3/4) and dark yellowish brown (10 YR 3/4), both with few mottles. Hydrology was evidenced by water flowing through the system and saturated soils within the wetland as well as extensive ponding. Soils outside the wetland boundary were well-drained and only slightly damp.

Water from the pond and the portion of the drainage east of the road is carried by a culvert located beneath the road. Downstream of this point, a defined stream channel is present. Wetlands Four, Nine and Ten are adjacent to this stream in the western portion of the property. These are all forested wetlands with an overstory comprised of western red cedar, red alder and Sitka willow with a diverse understory including salmonberry, devil's club, stink currant, wild rose, skunk cabbage and foam flower. Soil colors commonly seen within the wetlands were black (10 YR 2/1) and very dark brown (10 YR 3/2) with mottles. Soil color changed abruptly to dark yellowish brown (10 YR 3/4) with a corresponding rise in elevation outside of the delineated boundary. Soils were saturated throughout these wetlands and scattered areas were ponded.

Wetlands Six, Seven, and Eight

These are all relatively small ponded depressions with open water and are located in the west-central portion of the property. All are enclosed by the canopy of the surrounding mixed forest composed of species including Douglas fir, western red cedar, hemlock, big leaf maple and red alder. Shrub species on the margins of these wetlands include crabapple, hardhack, willow and salmonberry. Herbaceous dominants include lady fern, skunk cabbage, and water parsley. Soils within the

wetlands were ponded or saturated and black (10 YR 2/1) or very dark brown (10 YR 3/2) and mottled. Though all of these wetlands contain fallen logs and snags, Wetland Eight has a particularly high number of valuable habitat features.

Wetland Five

This is a small forested wetland depression located just west of the entry trail and south of the powerline easement. The overstory is comprised of red alder, western red cedar and black cottonwood. A thick tangle of woody debris and vine maple arching over from higher spots encompasses understory species including devil's club, skunk cabbage, swamp gooseberry and lady fern. Outside the wetland boundary dominant species include false lily-of-the-valley, sword fern and wild geranium. Soil colors within the wetland were black (2.5 YR 2.5/1) and very dark grayish brown (2.5 Y 4/2) while those outside the boundary were dark yellowish brown (10 YR 3/4 and 10 YR 4/4). Much of this wetland was ponded and several snags showed recent woodpecker foraging signs. Probably because of its proximity to the trail, litter was present in this wetland.

Wetlands Two, Three, Eleven, and Twelve

All of these wetlands have portions located in the powerline easement and Wetlands Two, Three and Eleven extend north of this parcel.

Wetland Two is located at the headwaters of Seidel Creek. Within the powerline easement, dominant plants include salmonberry, spirea and reed canarygrass. A large open water component of the wetland lies just south of the powerline easement. Water appears to be impounded by a trail running along the easement, although scattered ponding and flow were observed within the easement, particularly following storm events. South of the easement, floating logs and stumps within the ponded area support Labrador tea, sedges, grasses and mosses with emergents including small fruited bulrush, cattail and soft rush scattered throughout the pond. An overstory of willow, black cottonwood, red alder and western hemlock encloses the large wetland area south of the powerlines including the pond. A diverse shrub layer is composed of vine maple, salmonberry, crabapple, spirea and twinberry, with herbaceous species including skunk cabbage, slough sedge, water parsley and lady fern.

As with other wetlands in this parcel, the transition to upland is fairly abrupt. Soil color within the wetland was characteristically black (10 YR 2/1) or very dark grayish brown (10 YR 3/2) with mottles, and saturated or ponded while adjacent upland soils were dark brown or dark yellowish brown (10 YR 3/3 and 10 YR 3/4) and damp. This wetland is rich with snags, logs, stumps and other valuable wildlife habitat features.

Wetland Three also extends north of the 80-acre parcel. Within the powerline easement, dominant plants include salmonberry, evergreen blackberry and reed canarygrass. The portion of the wetland south of the powerline is forested and has ponded portions, although it lacks the large open water element found in Wetland

Two. Dominant plant species in this segment include western red cedar, red alder, salmonberry, vine maple, lady fern, skunk cabbage, slough sedge, and water parsley. Soil observed within this wetland was black (10 YR 2/1) and ponded or saturated. This wetland contains numerous snags, one of which contained a chickadee nest, and a female pileated woodpecker was seen foraging in the wetland.

Wetland Eleven is a depression extending north of the powerline easement. Dominant vegetation observed within the easement includes salmonberry, small fruited bulrush, evergreen blackberry, reed canarygrass, and twinberry. Beyond the powerline easement the wetland is forested with dominant plants including western red cedar, willow, salmonberry, skunk cabbage and slough sedge. Soils were black (10 YR 2/1) or very dark grayish brown (10 YR 3/2) with mottles, and saturated or ponded while adjacent upland soils were dark brown or dark yellowish brown (10 YR 3/3 and 10 YR 3/4) and damp.

Wetland Twelve is a depression located on a west-facing slope just east of the entry trail. Dominant plants within the wetland include spirea, salmonberry, reed canarygrass, and small fruited bulrush. The soil was very dark brown (10 YR 3/2) with many mottles and rhizospheres and was saturated at the time of observation.

Wildlife and Significant Habitat Features

The high quality of wildlife habitat found on the property was evidenced by the many songbird species observed during our visits. Those commonly noted include Swainson's thrush, American robin, western tanager, cedar waxwing, black-capped and chestnut-backed chickadee, song sparrow and bushtit. Nests and fledglings of hairy and downy woodpeckers, black-capped chickadees and chestnut-backed chickadees, black-headed grosbeaks, Hammond's flycatchers, and solitary vireos were observed. A female pileated woodpecker, considered a Priority Species by the Washington Department of Wildlife, was seen foraging in Wetland Three. Additionally, a hooded merganser with two young were frequently seen feeding in the ponded area within Wetland One, as were mallards with young.

Mammals and/or their signs commonly noted included those of black bear, black-tail deer, coyote, Douglas' squirrel and mice. Numerous burrows were seen, especially in the coniferous forest near Wetland One. Garter snakes were observed in the powerline easement and within the ponds. Amphibians seen were limited to frogs and tadpoles. Because many mammals, reptiles and amphibians are secretive in their habitats and difficult to detect with the methods employed within our scope of work, this list should not be viewed as complete. This property offers superior habitat contiguous with a larger expanse of forested land and with plentiful food, cover and water available, a number of other species can be expected to use these resources.

The drainage and stream (WRIA 08-0117) described in the discussion of Wetlands One, Four, Nine and Ten is a tributary of Mackey Creek (WRIA 08-0115). Several fry, which were believed to be cutthroat, were seen in the lower part of the stream in the vicinity of Wetlands Nine and Ten. No other fish were observed, though sculpins or coho could possibly make use of this habitat. According to the *King County Sensitive Areas Map Folio* dated December 1990, this is shown as a Class 2 stream with salmonid use up to the pond. The culvert separating Wetland Four and the pond in Wetland One is a barrier to migrating fish, though the pond may offer suitable habitat to cutthroat that could have colonized the pond/wetland in the past. In a study completed previously (The Watershed Company, 1991), no fish were detected through electroshocking in the drainage that flows into the pond's southwest edge (WRIA 08-0117A). Other than casual observation in the course of our wetland delineations, no study of fish use in either the pond or the drainage which flows into the pond's eastern edge has been completed. No other fish were detected in the course of our work.

Special habitat features found throughout the property include plentiful snags, downed logs, and large stumps. Many of the mature trees have hollowed cavities or broken hollow tops. All of these provide important shelter and locations for use by cavity nesting birds and animals, many of which were observed during our visits. Snails observed in several of the wetlands provide food for wildlife, as well as many kinds of nuts, berries and fungus which are abundant throughout the property.

Crows, which are known to prey on songbird nestlings, were seen most commonly in the powerline easement. Because crows rarely penetrate large tracts of intact forest, the large expanses of intact forest to the east and west of the entry road are the most valuable habitat for reproductive success of songbirds found on the property. In addition to native animals, signs of domestic animals such as dogs, cats and horses were abundant. As with invasive plants, these were mostly restricted to the disturbed areas such as pathways and easements. Bullfrogs noted in Wetlands One and Two are of concern because they are exotic species which prey on many of our native fish, amphibians and reptiles. See Table V for a list of wildlife observations.

SUMMARY

The property was screened in terms of vegetation, soils, and hydrology, and twelve wetland areas were identified and delineated. No threatened or endangered species were detected on the property; however, a full wildlife study of the parcel was not completed. Two Priority Species (per the Washington Department of Wildlife) were detected during the course of our delineations; these include the pileated woodpecker foraging within Wetland Three, and cutthroat trout observed in the Mackey Creek tributary on-site. Priority Species have been defined as "wildlife species of concern due to their population status, recreational importance and their sensitivity to habitat alterations."

Activities in and around these wetlands are regulated by the City of Redmond Sensitive Areas Ordinance. Wetland buffers under this ordinance vary from zero to 140 feet, depending on wetland type and adjacent land use; on-site wetland types vary from Type I to Type IV. Within the buffer areas, low impact uses consistent with the purpose of the buffer are permitted; such uses could include trails constructed of pervious materials, educational facilities, and stormwater management facilities. Buffer width averaging is allowed, when the wetland contains variations in sensitivity; also, buffers may be reduced by up to 25% for enhancement work within the buffer.

Similarly, the stream that runs east-west near the southern property boundary is regulated by the Redmond Sensitive Areas Ordinance. This stream is classified as a Class II stream due to its use by salmonid fish, and carries a buffer of 115 feet. Buffer width averaging along the length of a stream is not permitted. Allowed uses within the stream buffer include footbridges, educational facilities, and trails constructed of pervious materials. Trails must have a width of eight feet or less and be located in the outer half of the stream buffer. Stream buffers are measured from the ordinary high water mark.

Wetland functions and values are diverse and numerous. As areas for flood mitigation and aquifer recharge, wetlands are particularly important in developed regions. The property provides food, cover, water, movement corridors and breeding habitat for wildlife as well as a site for recreation and education for nearby communities.

TABLE I: VEGETATION

Common name	Scientific name	Indicator status
Overstory/Trees:		
red alder	*Alnus rubra*	FAC
big leaf maple	*Acer macrophyllum*	FACU
Pacific dogwood	*Cornus nuttallii*	NL
English holly	*Ilex aquifolium*	NL
Sitka spruce	*Picea sitchensis*	FAC
black cottonwood	*Populus trichocarpa*	FAC
bitter cherry	*Prunus emarginata*	NL
Douglas fir	*Pseudotsuga menziesii*	NL
western crabapple	*Pyrus fusca*	FAC+
cascara	*Rhamnus purshiana*	NI
willow	*Salix* spp.	OBL-FACU, NI
Pacific willow	*Salix lasiandra*	FACW+
Sitka willow	*Salix sitchensis*	FACW
Pacific yew	*Taxus brevifolia*	FACU-
western red cedar	*Thuja plicata*	FAC
western hemlock	*Tsuga heterophylla*	FACU
Shrubs/Vines:		
vine maple	*Acer circinatum*	FACU+
Oregon grape	*Berberis nervosa*	NL
hazelnut	*Corylus cornuta*	NI
salal	*Gaultheria shallon*	NL
Labrador tea	*Ledum groenlandicum*	OBL
trumpet honeysuckle	*Lonicera ciliosa*	NL
twinberry	*Lonicera involucrata*	FAC
devil's club	*Oplopanax horridum*	FAC
swamp gooseberry	*Ribes lacustre*	FAC+
Himalayan blackberry	*Rubus discolor*	FACU-
evergreen blackberry	*Rubus lacinatus*	FACU+
thimbleberry	*Rubus parviflorus*	FACU+
salmonberry	*Rubus spectabilis*	FAC
trailing blackberry	*Rubus ursinus*	NL
red elderberry	*Sambucus racemosa*	FACU
mountain ash	*Sorbus aucuparia*	NL
Douglas' spiraea	*Spiraea douglasii*	FACW
snowberry	*Symphoricarpos albus*	FACU
red huckleberry	*Vaccinium parviflorum*	NL

TABLE I: VEGETATION (cont.)

Common name	Scientific name	Indicator status
Groundcover/Aquatics		
quackgrass	*Agropyron repens*	FACU
lady fern	*Athyrium filix-femina*	FAC
bentgrass	*Agrostis* spp.	FACW-FACU, NI
deerfern	*Blechnum spicant*	FAC+
starwort	*Callitriche* spp.	OBL
Henderson's sedge	*Carex hendersonii*	NI
slough sedge	*Carex obnupta*	OBL
sedge	*Carex stipata*	NL
sedges	*Carex* spp.	OBL-FACW
western coralroot	*Corallorhiza mertensiana*	NL
orchard grass	*Dactylis glomerata*	FACU
wood fern	*Dryopteris dilatata*	FACW
marsh willow herb	*Epilobium watsonii*	OBL
field horsetail	*Equisetum arvense*	FACW
giant horsetail	*Equisetum telmateia*	FACW
fireweed	*Epilobium angustifolium*	FACU+
tall fescue	*Festuca arundinacea*	FACU
cleavers	*Galium aparine*	FACU
Pacific bedstraw	*Galium cymosum*	FACW
small bedstraw	*Galium trifidum*	FACW+
crane's bill	*Geranium richardsonii*	FACU+
largeleaved avens	*Geum macrophyllum*	FACW+
common hawkweed	*Hieracium vulgatum*	NL
velvet grass	*Holcus lanatus*	FAC
pinesap	*Hypopitys* spp.	NL
duckweed	*Lemna minor*	OBL
twinflower	*Linnaea borealis*	FACU-
taper-tip rush	*Juncus acuminatus*	OBL
toad rush	*Juncus bufonius*	FACW+
soft rush	*Juncus effusus*	FACW
dagger leaf rush	*Juncus ensifolius*	FACW
skunk cabbage	*Lysichitum americanum*	OBL
false lily-of-the-valley	*Maianthemum dilatatum*	FACU-
miner's lettuce	*Montia perfoliata*	FAC
forget-me-not	*Myosotis* spp.	OBL-FAC-
water milfoil	*Myriophyllum* sp.	OBL
yellow water lily	*Nuphar polysepalum*	OBL
water parsley	*Oenanthe sarmentosa*	OBL
reed canary grass	*Phalaris arundinacea*	FACW
common plantain	*Plantago major*	FAC+
licorice fern	*Polypody* spp.	NL

TABLE I: VEGETATION (cont.)

Common name	Scientific name	Indicator status
Groundcover/Aquatics		
sword fern	*Polystichym munitum*	NL
creeping buttercup	*Ranunculus repens*	FACW
curly dock	*Rumex crispus*	FACW
small fruited bulrush	*Scirpus microcarpus*	OBL
bittersweet nightshade	*Solanum dulcamara*	FAC
hedge nettle	*Stachys cooleyae*	FACW
common chickweed	*Stellaria media*	NL
foamflower	*Tiarella trifoliata*	FAC
piggyback plant	*Tolmiea menziesii*	FAC
starflower	*Trientalis latifolia*	FAC-
white clover	*Trifolium repens*	FACU
western white trillium	*Trillium ovatum*	NL
cattail	*Typha latifolia*	OBL
stinging nettle	*Urtica dioica*	FAC+
American brooklime	*Veronica americana*	OBL

OBL	Obligate wetland plants-occur almost always (>99%) in wetlands under normal conditions
FACW	Facultative wetland plants-ususlly occur in wetlands (67-99%), but occasionally in nonwetlands(1-33%)
FAC	Facultative plants-are equally likely to occur in wetlands or nonwetlands (34-66%)
FACU	Facultative upland plants-usually occur in nonwetlands (67-99%), but occasionally in wetlands (1-33%)
NI	No information is listed for the indicator statua of these species in Reed (1988)
NL	These species have not been listed in Reed (1988)

TABLE II: SOIL TEST PIT DATA

Soil pit#	Matrix Color	Mottles	Hydrology	Wetland
1	7.5 YR 3/3	YES	DAMP	NO
2	10 YR 4/4	YES	DAMP	NO
3	2.5 Y 4/3	YES	VERY DAMP	TRANSITION
4	2.5 Y 4/2	YES	SATURATED	YES
5	10 YR 4/2	7.5 Y 4/4	SATURATED	YES
6	7.5 YR 3/4	YES	DAMP	NO
7	10 YR 3/2	YES	SATURATED	YES
8	10 YR 3/2	YES	VERY DAMP	YES
9	10 YR 3/3	YES	VERY DAMP	TRANSITION
10	2.5 Y 4/2	YES	VERY DAMP	YES
11	7.5 YR 3/4	NO	DAMP	NO
12	10 YR 2/1	NO	SATURATED	YES
13	10 YR 3/2	YES	SATURATED	YES
14	10 YR 3/4	NO	DAMP	NO
15	2.5 Y 4/1	NO	WATER TABLE-8 in	YES
16	10 YR 3/4	YES	DAMP	NO
17	2.5 Y 2/1	NO	SATURATED	YES
18	7.5 Y 2.5/3	NO	DAMP	NO
19	2.5 Y 3/2	NO	SATURATED	TRANSITION
20	7.5 Y 3/4	YES	DAMP	NO

TABLE II: SOIL TEST PIT DATA (cont.)

Soil pit#	Matrix	Mottles	Hydrology	Wetland
21	10 YR 4/4	YES	SATURATED	YES*
22	10 YR 4/3	YES	SATURATED	YES*
23	10 YR 4/2	YES	SATURATED	NO
24	10 YR 3/4	YES	DAMP	NO
25	10 YR 3/3	YES	DAMP	NO
26	10 YR 3/1	NO	VERY DAMP	YES
27	10 YR 3/2	YES	DAMP	BOUNDARY
28	10 YR 3/4	NO	DAMP	NO
29	10 YR 3/4	NO	DAMP	NO
30	10 YR 3/4	NO	DAMP	NO
31	10 YR 3/4	NO	DAMP	NO
32	10 YR 2/1	NO	SATURATED	YES
33	10 YR 3/2	NO-SANDY	SATURATED	YES
34	10 YR 4/3	YES	SATURATED	YES
35	10 YR 3/4	NO	DAMP	NO
36	2.5 Y 4/1	YES	SATURATED	YES
37	10 YR 3/2	10 YR 3/6	SATURATED	YES
38	10 YR 3/2	NO	SATURATED	YES
39	10 YR 3/3	NO	DAMP	NO

*These soil pits were located in the Puget Powerline easement. Soils in this area are disturbed and still developing hydric colors. Other evidence of hydric conditions were observed.

TABLE II: SOIL TEST PIT DATA (cont.)

Soil pit#	Matrix	Mottles	Hydrology	Wetland
40	10 YR 4/4	YES	DAMP	NO
41	2.5 Y 2/1@>10"	YES	SATURATED	YES
	2.5 Y 3/2@ 1-10"	YES	SATURATED	YES
42	2.5 Y 3/2	YES	VERY DAMP	TRANSITION
43	2.5 Y 4/2	YES	SATURATED	YES
44	10 YR 3/4	YES	DAMP	NO
45	10 YR 3/4	NO	DAMP	NO
46	10 YR 3/4	YES	DAMP	NO
47	10 YR 3/3	YES	DAMP	NO
48	10 YR 3/6	NO	DAMP	NO
49	10 YR 3/3	YES	WATER TABLE	YES
50	10 YR 3/2	YES	SATURATED	YES
51	10 YR 3/2	YES	SATURATED	YES
52	10 YR 3/3	NO	DAMP	NO
53	10 YR 4/4	YES	SATURATED	TRANSITION
54	10 YR 3/3	NO	DAMP	NO
55	10 YR 4/4	NO	DAMP	NO
56	10 YR 2/1	NO	SATURATED	YES
57	10 YR 3/2	NO	SATURATED	TRANSITION
58	10 YR 3/3	NO	DAMP	NO
59	10 YR 2/1	NO	SATURATED	YES
60	10 YR 4/4	NO	DAMP	NO

TABLE II: SOIL TEST PIT DATA (cont.)

61	10 YR 3/2	YES	DAMP	YES
62	10 YR 3/4	NO	DAMP	NO
63	10 YR 3/4	NO	DAMP	NO
64	10 YR 3/1	NO	SATURATED	YES
65	10 YR 3/3	NO	DRY	NO
66	10 YR 4/3	YES	SATURATED	YES
67	10 YR 3/3	NO	DRY	YES
68	10 YR 3/4	YES	DAMP	NO
69	7.5 Y 3/4	NO	DAMP	NO
70	10 YR 3/3	YES	DAMP	NO
71	5 Y 4/1	YES	PONDED	YES
72	10 YR 4/4	YES	DAMP	NO
73	10 YR 3/3	NO	DAMP	NO
74	10 YR 3/3	NO	DAMP	NO
75	10 YR 3/4	NO	DAMP	NO
76	7.5 YR 3/4	NO	DAMP	NO
77	10 YR 5/2	YES	SATURATED	YES
78	10 YR 3/3	YES	DAMP	NO

TABLE III: SOIL COLOR NAMES

Soil Color	Name
7.5 YR 2.5/2	very dark brown
7.5 YR 2.5/3	very dark brown
7.5 YR 3/3	dark brown
7.5 YR 3/4	dark brown
10 YR 2/1	black
10 YR 2/2	very dark brown
10 YR 3/1	very dark gray
10 YR 3/2	very dark grayish brown
10 YR 3/3	dark brown
10 YR 3/4	dark yellowish brown
10 YR 3/6	dark yellowish brown
10 YR 4/2	dark grayish brown
10 YR 4/3	brown
10 YR 4/4	dark yellowish brown
2.5 Y 2/1	black
2.5 Y 2.5/1	black
2.5 Y 5/2	grayish brown
2.5 Y 3/2	very dark grayish brown
2.5 Y 4/1	dark gray
2.5 Y 4/2	dark grayish brown
2.5 Y 4/3	olive brown
5 Y 4/2	olive gray
5 Y 3/3	dark olive

TABLE IV: LIST OF WETLAND CLASSES
COWARDIN AND CITY OF REDMOND WETLAND CLASSIFICATIONS

Wetland	Vegetation Classes	Redmond Classification *
One	Aquatic bed Unconsolidated shore Emergent Scrub shrub Forested	Type II (probable) 50-100 foot buffer
Two	Aquatic bed Emergent Scrub shrub Forested	Type I (probable) 100-150 foot buffer
Three	Aquatic bed Emergent Scrub shrub Forested	Type II (probable) 50-100 foot buffer
Four	Emergent Scrub shrub Forested	Type II 50-100 foot buffer
Five	Scrub shrub Forested	Type III 25-50 foot buffer
Six	Emergent Scrub shrub Forested	Type III 25-50 foot buffer
Seven	Emergent Scrub shrub Forested	Type III 25-50 foot buffer

* Wetland classification based on available information on off-site portions of wetlands.

TABLE IV: LIST OF WETLAND CLASSES (cont.)

Wetland	Vegetation Classes	Redmond Classification *
Eight	Emergent Scrub shrub Forested	Type III 25-50 foot buffer
Nine	Scrub shrub Forested	Type III 25-50 foot buffer
Ten	Scrub shrub Forested	Type II 50-100 foot buffer
Eleven	Emergent Scrub shrub Forested	Type II (probable) 50-100 foot buffer
Twelve	Scrub shrub	Type IV no buffer

* Wetland classification based on available information on off-site portions of wetlands.

TABLE V: WILDLIFE OBSERVATIONS

Common Name	Scientific Name	Observation	Habitat Type
Birds:			
mallard*	*Anas platyrhynchos*	visual	W
cedar waxwing	*Bombycilla cedrorum*	visual	M, D
Canada goose	*Branta canadensis*	visual	(flying over)
red-tailed hawk	*Buteo jamaicensis*	visual	D
purple finch*	*Carpodacus purpureus*	visual	M
Swainson's thrush	*Catharus ustulatus*	visual	M, C, W
brown creeper	*Certhia americana*	visual	C
evening grosbeak	*Coccothraustes vespertinus*	visual	M, D
olive-sided flycatcher	*Contopus borealis*	vocal	M, C
American crow	*Corvus brachyrhynchos*	visual	D
Steller's jay	*Cyanocitta stelleri*	visual	D, M
black-throated gray warbler	*Dendroica nigrescens*	vocal	M
yellow warbler	*Dendroica petechia*	visual	M
pileated woodpecker	*Drycopus pileatus*	visual	M, C, W
western flycatcher	*Empidonax difficilis*	vocal	M, C, W
Hammond's flycatcher*	*Empidonax hammondii*	visual	C
willow flycatcher	*Empidonax traillii*	visual	M
varied thrush	*Ixoreus naevius*	visual	M
dark-eyed junco	*Junco hyemalis*	visual	M, D
hooded merganser	*Lophodytes cucullatus*	visual	W
song sparrow*	*Melospiza melodia*	visual	M, C, W, D
black-capped chickadee*	*Parus atricapillus*	visual	M, C, W, D
chestnut-backed chickadee*	*Parus rufescens*	visual	M, C, W, D
fox sparrow	*Passerella iliaca*	visual	M, W, D
black-headed grosbeak*	*Pheucticus melanocephalus*	visual	M
downy woodpecker*	*Picoides pubescens*	visual	M, W
hairy woodpecker*	*Picoides villosus*	visual	M, C, W
rufous-sided towhee	*Pipilo erythrophthalmus*	visual	M, W, D
western tanager	*Piranga ludoviciana*	visual	M, D
common bushtit	*Psaltriparus minimus*	visual	M, C, W, D
rufous humingbird	*Selasphorus rufus*	visual	W, D
white-breasted nuthatch	*Sitta carolinensis*	visual	M, C
violet-green swallow	*Tachycineta thalassina*	visual	W, D
Bewick's wren	*Thryomanes bewickii*	visual	M, C, W, D
winter wren	*Troglodytes troglodytes*	visual	C, D
American robin*	*Turdus migratorius*	visual	M, C, W, D
solitary vireo	*Vireo solitarius*	vocal	C, W, D
Wilson's warbler	*Wilsonia pusilla*	visual	M, W, D

Habitat Type Codes
M=Mixed forest
C= Conifer forest
W=Wetland
D= Disturbed-includes entry road, powerline, borrow pit and gas line
* indicates nesting activities were observed

TABLE V: WILDLIFE OBSERVATIONS (cont.)

Common Name	Scientific Name	Observation	Habitat Type
Mammals and other wildlife:			
coyote	*Canis latrans*	visual, droppings	M
porcupine	*Erethizon dorsatum*	scratchings	M
Pacific treefrog	*Hyla regilla*	visual	M, C,W
blacktail deer	*Odocoileus hemionus*	visual, tracks, droppings	M, C,W,D
cutthroat trout	*Oncorhynchus clarki*	visual	W
raccoon	*Procyon lotor*	tracks	W, D
bullfrog	*Rana catesbeiana*	visual	W
douglas squirrel	*Tamiasciurus douglasii*	visual	M, C
northwestern garter snake	*Thamnophis ordinoides*	visual	D,W
tadpoles	unidentified	visual	W
mouse	unidentified	visual	M
black bear	*Ursus americanus*	droppings, scratchings	M

Habitat Type Codes
M=Mixed forest
C= Conifer forest
W=Wetland
D= Disturbed-includes entry road, powerline, borrow pit and gas line

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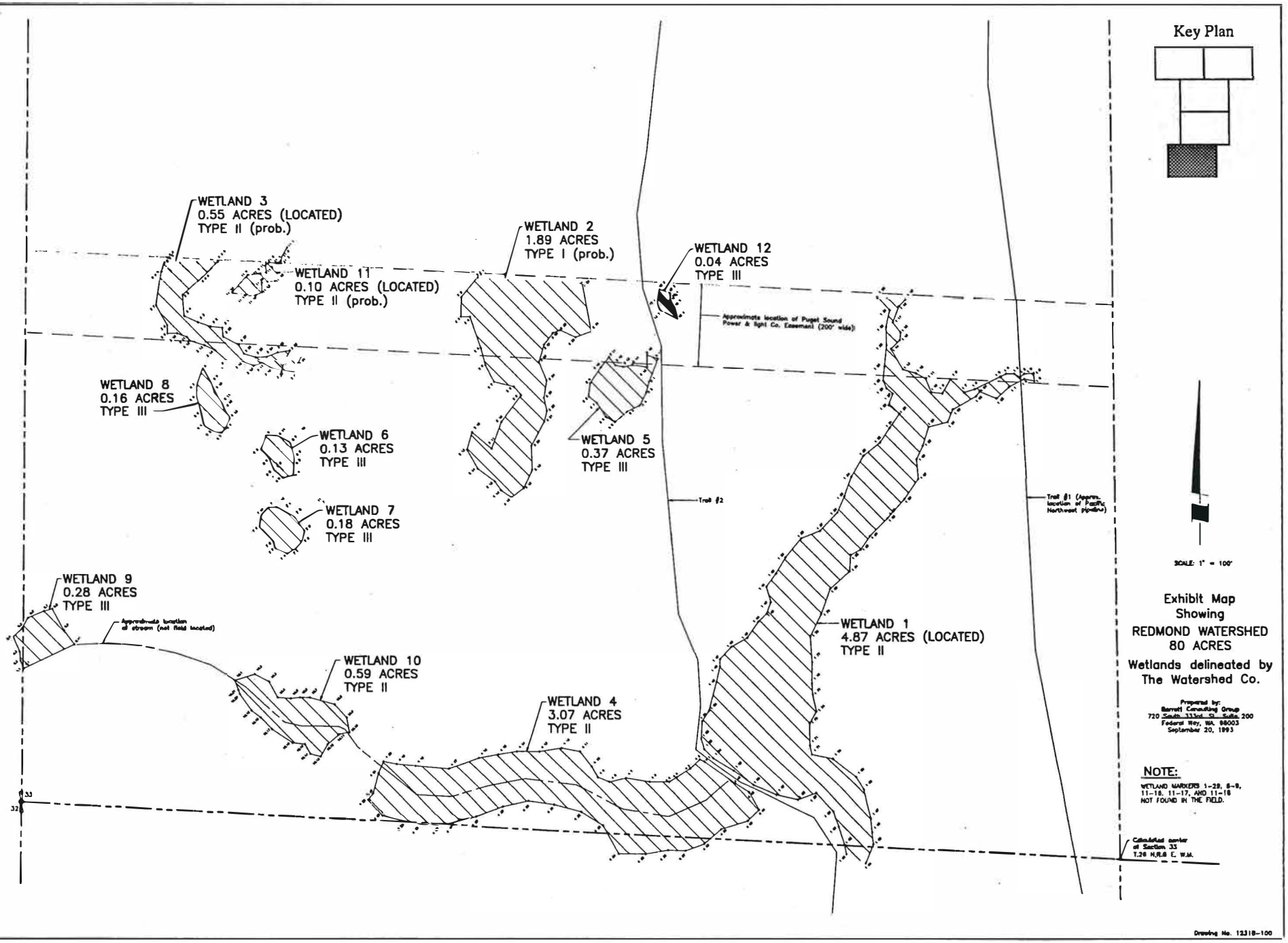
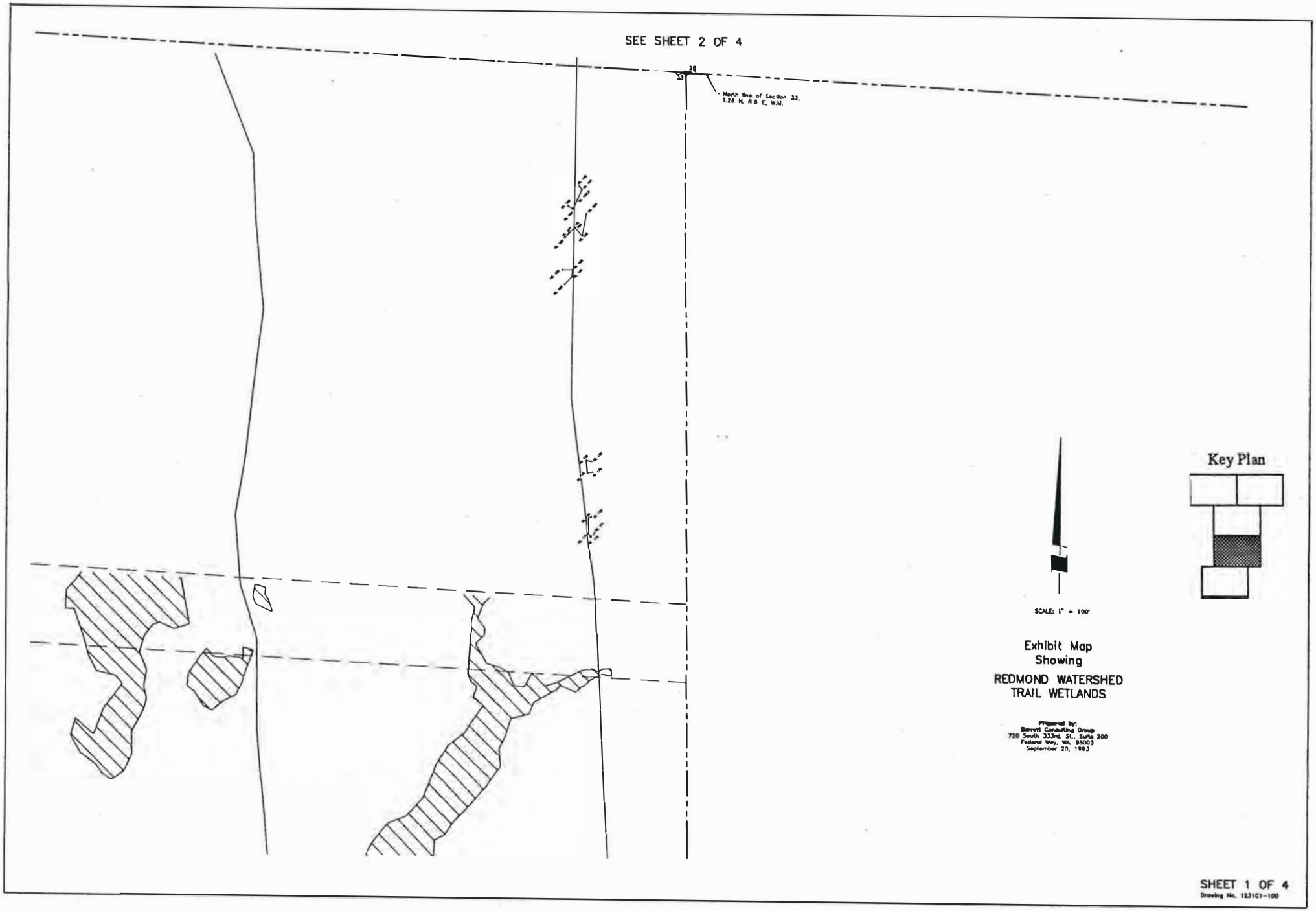
APPENDIX 3

SURVEYS OF WETLANDS AND TRAILS

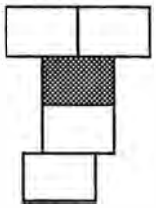
REDMOND WATERSHED

MASTER PLAN


WETLAND 3
0.55 ACRES (LOCATED)
TYPE II (prob.)
WETLAND 11
0.10 ACRES (LOCATED)
TYPE II (prob.)
WETLAND 2
1.89 ACRES
TYPE I (prob.)
WETLAND 12
0.04 ACRES
TYPE III
Approximate location of Puget Sound Power & light Co. Easement (200' wide)
WETLAND 8
0.16 ACRES
TYPE III
WETLAND 6
0.13 ACRES
TYPE III
WETLAND 5
0.37 ACRES
TYPE III
WETLAND 7
0.18 ACRES
TYPE III
Trail #2
Trail #1 (Approx. location of Pacific Northwest pipeline)
WETLAND 9
0.28 ACRES
TYPE III
Approximate location of stream (not field located)
WETLAND 10
0.59 ACRES
TYPE II
WETLAND 4
3.07 ACRES
TYPE II
WETLAND 1
4.87 ACRES (LOCATED)
TYPE II
33
32
Key Plan
SCALE: 1" = 100'
Exhibit Map
Showing
REDMOND WATERSHED
80 ACRES
Wetlands delineated by
The Watershed Co.
Prepared by:
Barnett Consulting Group
720 South 333rd St. Suite 200
Federal Way, WA 98003
September 20, 1993
NOTE:
WETLAND MARKERS 1-28, 8-9, 11-18, 11-17, AND 11-18 NOT FOUND IN THE FIELD.
Calculated center of Section 33 T.26 N,R.8 E. W.M.
Drawing No. 1231B-100


SEE SHEET 2 OF 4
North line of Section 33, T.28 N, R.5 E, W.M.
SCALE: 1" = 100'
Key Plan
Exhibit Map
Showing
REDMOND WATERSHED
TRAIL WETLANDS
Prepared by:
Barrett Consulting Group
720 South 333rd. St. Suite 200
Federal Way, WA. 98003
September 20, 1993
SHEET 1 OF 4
Drawing No. 1231C1-100

Key Plan



SEE SHEET 3 OF 4

SEE SHEET 3 OF 4

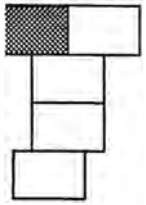
SCALE: 1" = 100'

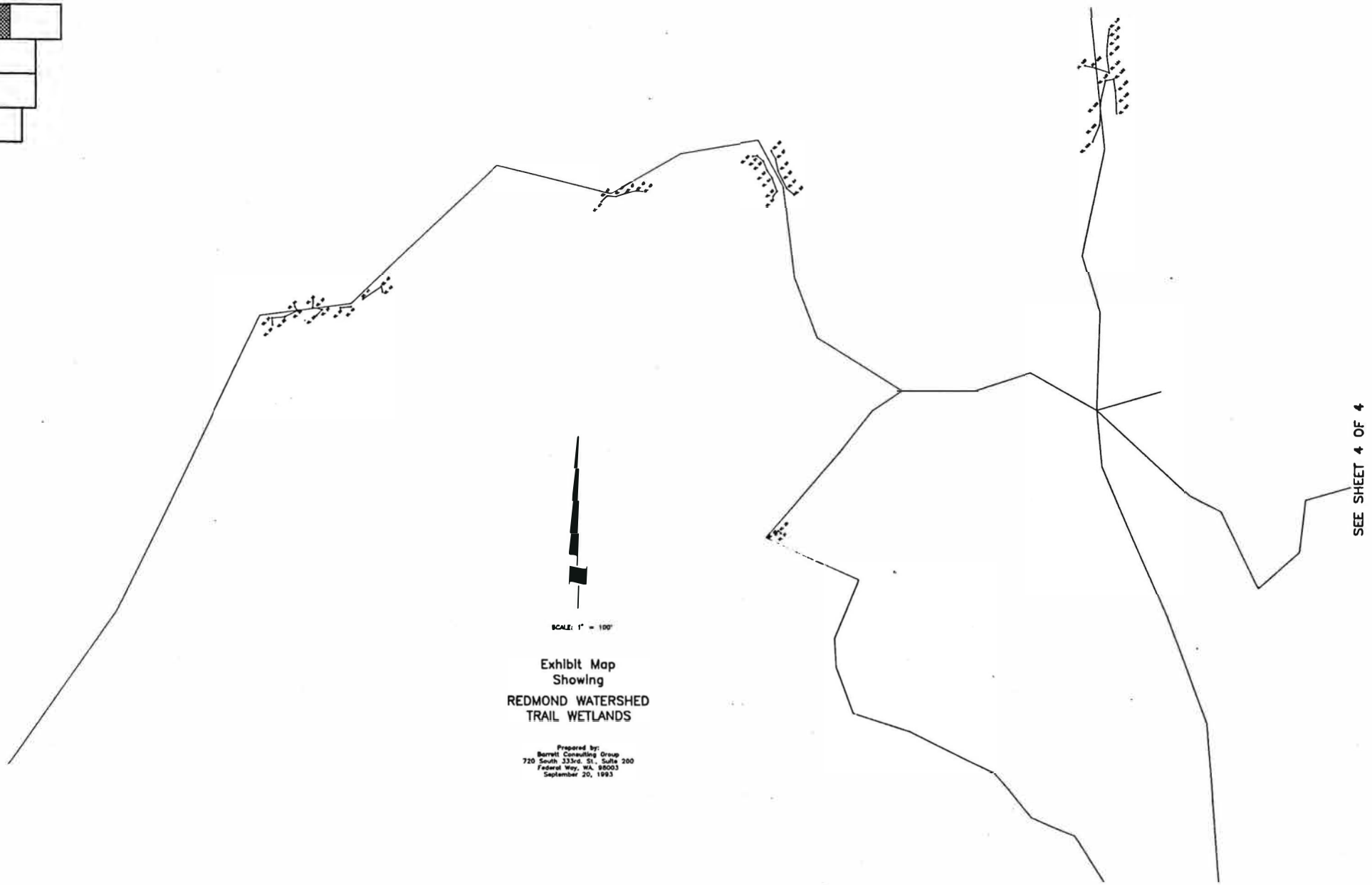
Exhibit Map
Showing
REDMOND WATERSHED
TRAIL WETLANDS

Prepared by:
Barnett Consulting Group
720 South 333rd. St., Suite 200
Federal Way, WA. 98003
September 20, 1993

SEE SHEET 1 OF 4

Key Plan





SCALE: 1" = 100'

Exhibit Map
Showing
REDMOND WATERSHED
TRAIL WETLANDS

Prepared by:
Barrett Consulting Group
720 South 333rd. St., Suite 200
Federal Way, WA. 98003
September 20, 1993

SEE SHEET 4 OF 4

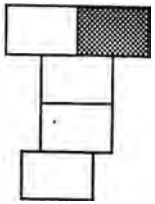
SEE SHEET 2 OF 4

Drawing No. 1231C3-100

SEE SHEET 3 OF 4

SEE SHEET 2 OF 4

Key Plan



SCALE: 1" = 100'

Exhibit Map
Showing
REDMOND WATERSHED
TRAIL WETLANDS

Prepared by:
Barratt Consulting Group
720 South 333rd St., Suite 200
Federal Way, WA 98003
September 20, 1993

APPENDIX 4

PLANT LIST OF MAJOR VEGETATIVE AREAS

REDMOND WATERSHED

MASTER PLAN

CONIFEROUS FOREST

Douglas fir
Western hemlock
Western red cedar
Bitter cherry
Vine maple
Red huckleberry
Hazelnut
Salal
Oregon grape
Sword fern
Foam flower
Cascara
Red elderberry

BROADLEAF FOREST

Red alder
Black cottonwood
Big-leaf maple
Cascara
Vine maple
Red-osier dogwood
Salmonberry
Osoberry
Hazelnut
Sword fern
Lady fern
Piggy back
Skunk cabbage
False lily-of-the-valley

SCRUB/SHRUB

Salmonberry
Thimbleberry
Bracken fern
Red elderberry
Evergreen blackberry
Himalayan blackberry
Spirea
Twinberry
Willow

MIXED FOREST - UPLAND

Douglas fir
Western hemlock
Western red cedar
Red alder
Big-leaf maple
Cascara
Vine maple
Salmonberry
Hazelnut
Sword fern
Bracken fern
Deer fern
Dewberry
Salal
Oregon grape
Red huckleberry
Red elderberry
Osoberry

MIXED FOREST - RIPARIAN/WETLAND

Western red cedar
Red alder
Black cottonwood
Western crabapple
Vine maple
Salmonberry
Spirea
Willow
Hazelnut
Red huckleberry
Red elderberry
Devil's club
Twinberry
Lady fern
Sword fern
Skunk cabbage
Water parsley
Sedges
Piggy back
Buttercup
False lily-of-the-valley

SCRUB/SHRUB (CONT.)

Reed canarygrass
Small-fruited bulrush
Horsetail
Fireweed
Self-heal
Fescue

GRASSLAND - PIPELINE

Red alder
Bracken fern
Sword fern
Lady fern
Creeping buttercup
Common plantain
English plantain
Large-leaf avens
Watson's willow-herb
Fescue
Bentgrass
Orchard-grass
Reed canarygrass
Small-fruited bulrush
Spike rush
Horsetail
Soft rush

APPENDIX 5

UTILITY INVENTORY

REDMOND WATERSHED

MASTER PLAN

S V R

D E S I G N C O M P A N Y

REDMOND WATERSHED CITY PARK

August 10, 1993

UTILITY INVENTORY

Domestic Water and Fire Protection:

The Redmond Watershed property is bounded by three water districts. To the west is the City of Redmond Water District. They have an existing 6-inch line that extends northeast along Redmond Road to approximately 116th Street. From here the 6-inch line extends diagonally to the northeast to 209th Ave N.E., then runs north along 209th Avenue until approximately 126th Street. There is a moratorium on connections to this line due to existing capacity problems. Depending upon the master plan review for developments in the area east of the Watershed, the City of Redmond may consider this area within their service area in the future.

The Union Hill Water Association currently serves the existing single family development to the south, and also the small development directly to the east of the Redmond Watershed. Their service area northern boundary is the southernmost Watershed boundary. The Association has a 10-inch diameter line located in Novelty Hill Road adjacent to the southeast corner of project site and an 8-inch line directly across Novelty Hill Road from the existing access road. This line could serve the southern portion of the site.

It should be noted that the Redmond Watershed is currently within a disputed water service area. Both the City of Redmond Water District and the Union Hill Water Association lay claim to the area.

The Woodinville Water District serves the area just to the north of the Redmond Watershed. There is an existing 8-inch line extending along N.E. 133rd Street to approximately Colin Creek. The property which the City of Redmond is trying to purchase for the northern portion of the project is considered within the Woodinville Service area, and could easily be served by this line.

The City of Redmond Fire Department has jurisdiction over the site. The assistant fire marshall indicated a probable maximum fire flow requirement to each parking area is 1,000 gpm. This flow will require construction of an 8-inch line. For estimating purposes it is assumed a watermain extension can be made from the existing lines in Novelty Hill Road and N.E. 133rd Street. The estimate assumes existing pressure and supply in these lines is adequate to support the additional service.

Sanitary Sewer:

The existing developments around the Redmond Watershed Project are currently on septic field systems. The closest southern sanitary sewer service line is a line from the City of Redmond extending to the intersection of Novelty Hill and Avondale Roads. The City of Redmond has indicated they may be extending the service line along Novelty Hill Road if the Quadrant and Port Blakely developments are approved. These two developments are in the master planning phase. At this time it is assumed that the restrooms will be on a gravity septic drainfield system.

The closest northern sanitary service is from the City of Woodinville service district. Their closest line is approximately at the intersection of 172nd Avenue N.E. and N.E. 124th Place. There is no plan to extend these lines in the near future. It is assumed that the restrooms in the northern portion will also be on a septic drainfield system.

According to the USGS Soils mapping for the site area there are two types of soils on-site - Alderwood gravelly sandy loam and Seattle muck. The proposed drainfields would be located within Alderwood type soils. Field investigation of local soil characteristics is required to determine whether suitable sites are available for drainfields.

Storm Drainage:

The topography for the northern development site is sloping east to west and is within the Siedel Creek drainage sub-basin. The southern development site generally slopes to the southwest and drains to a creek exiting the site at the southwest corner. The southern development area includes a number of wetlands scattered throughout this portion of the site. The storm water system will be designed to conform with the DOE and King County Surface Water Design Manuals.

Based on preliminary calculations detention will be required for both areas of development. An open detention and water quality pond is proposed for the southern developed area. A detention tank or pond is proposed for the northern site. Water quality facilities in the form of biofiltration swales are proposed for both areas.

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Redmond Watershed Park
Master Plan Estimate of Probable Utility and Parking Lot Construction Costs
by: SvR Design Company, August 10, 1993 SvR No. 93007

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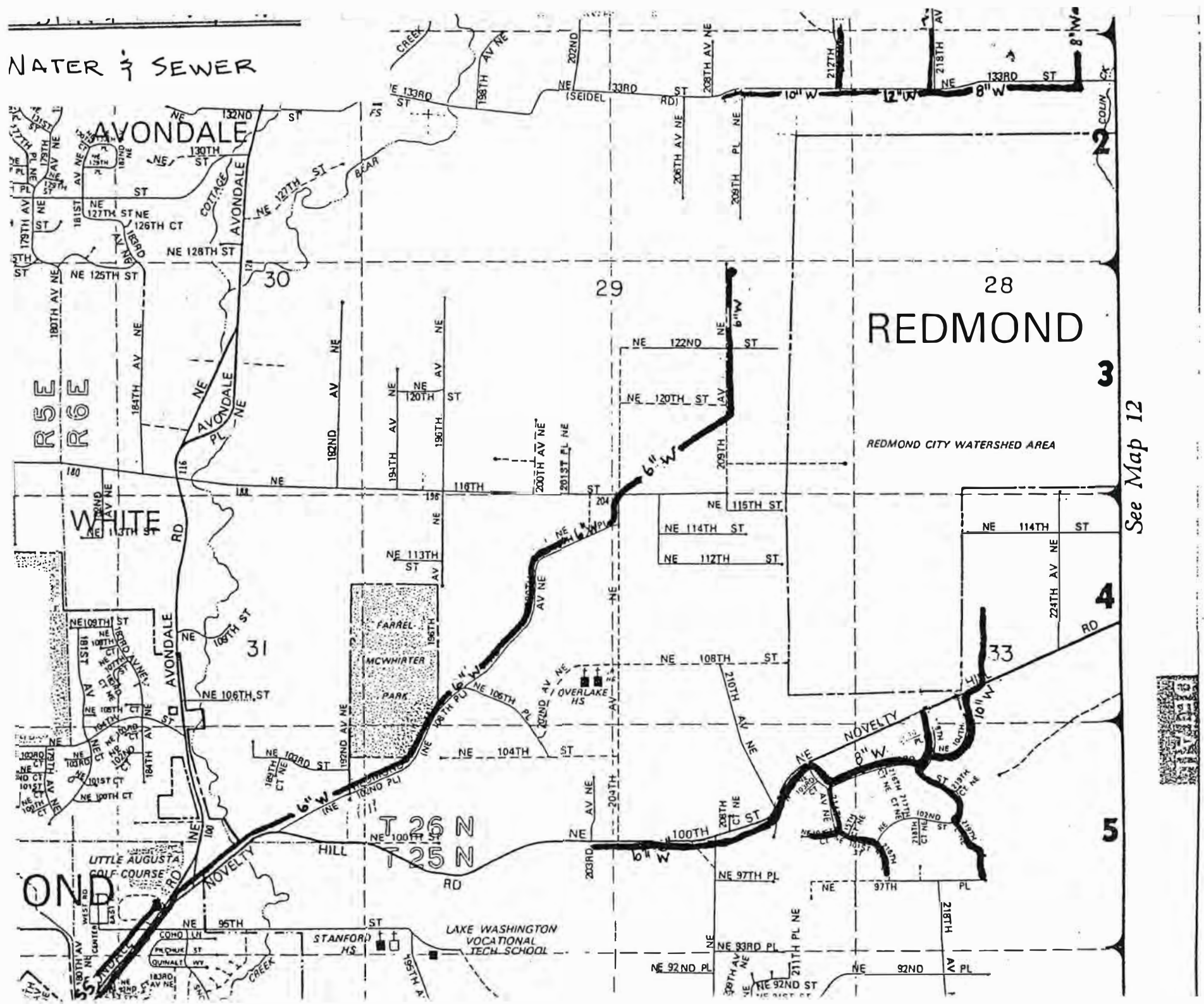
Item	Unit Price	Unit	South Parking Area Quantity	South Parking Area Subtotal	North Parking Area Quantity	North Parking Area Subtotal	Total Cost
Pavement							
Asphalt Concrete Pavement	$40	TON	830	$33,200	245	$9,800	$43,000
Crushed Rock Base Course	$15	TON	2230	$33,450	655	$9,825	$43,275
Curb Stop	$25	EA	100	$2,500	50	$1,250	$3,750
Storm Drainage							
Catch basin	$1,000	EA	3	$3,000	2	$2,000	$5,000
Storm pipe	$25	LF	300	$7,500	200	$5,000	$12,500
Biofiltration swale	$30	LF	200	$6,000	200	$6,000	$12,000
Detention Pond System	$45,000	LS	1	$45,000		$0	$45,000
Detention Tank System	$35,000	LS		$0	1	$35,000	$35,000
Sanitary Sewer							
Septic Drainfield System, 2000 gpd	$27,000	LS	1	$27,000		$0	$27,000
Septic Drainfield System, 1000 gpd	$18,000	LS		$0	1	$18,000	$18,000
Water							
Domestic Water/Fire Service	$35	LF	1400	$49,000	200	$7,000	$56,000
Fire hydrant	$2,500	EA	1	$2,500	1	$2,500	$5,000
SUBTOTAL				$209,150		$96,375	$305,525
Contingency (20%)				$41,830		$19,275	$61,105
TOTAL				**$250,980**		**$115,650**	**$366,630**

Note: Estimate is based on 100–stall south parking lot and 50–stall north parking lot. Pavement section assumes 2" A.C. on 6" base. Stormwater detention system provides detention for 10–year storm per Dept. of Ecology/King County requirements. Onsite wastewater disposal system consists of septic tank and gravity drainfield. Estimate assumes suitable soil types and sufficient area for drainfield is available within site. Assumes fireflow requirement of 1000 gpm with 8" service line to site. Utility fees, and permitting and hookup charges not included.


WATER & SEWER
AVONDALE
REDMOND
WHITE
FARREL MCWHIRTER PARK
OVERLAKE HS
LITTLE AUGUSTA GOLF COURSE
STANFORD HS
LAKE WASHINGTON VOCATIONAL TECH SCHOOL
HILL
NOVELTY
REDMOND CITY WATERSHED AREA
See Map 12
T 26 N
T 25 N
R 5 E
R 6 E
NE 132ND ST
NE 130TH ST
NE 128TH ST
NE 125TH ST
NE 122ND ST
NE 120TH ST
NE 116TH ST
NE 115TH ST
NE 114TH ST
NE 112TH ST
NE 113TH ST
NE 109TH ST
NE 108TH ST
NE 106TH ST
NE 104TH ST
NE 103RD ST
NE 100TH ST
NE 97TH PL
NE 95TH ST
NE 93RD PL
NE 92ND PL
NE 92ND ST
NE 133RD ST
SEIDEL RD
COTTAGE LAKE CREEK
BEAR CREEK
AVONDALE RD NE
NOVELTY HILL RD
180TH AV NE
184TH AV NE
188TH AV NE
192ND AV NE
196TH AV NE
198TH AV NE
200TH AV NE
202ND AV NE
204TH AV NE
206TH AV NE
208TH AV NE
210TH AV NE
212TH AV NE
218TH AV NE
224TH AV NE
6" W
8" W
10" W
12" W

APPENDIX 6

TRAIL SURVEY EXAMPLE

REDMOND WATERSHED

MASTER PLAN

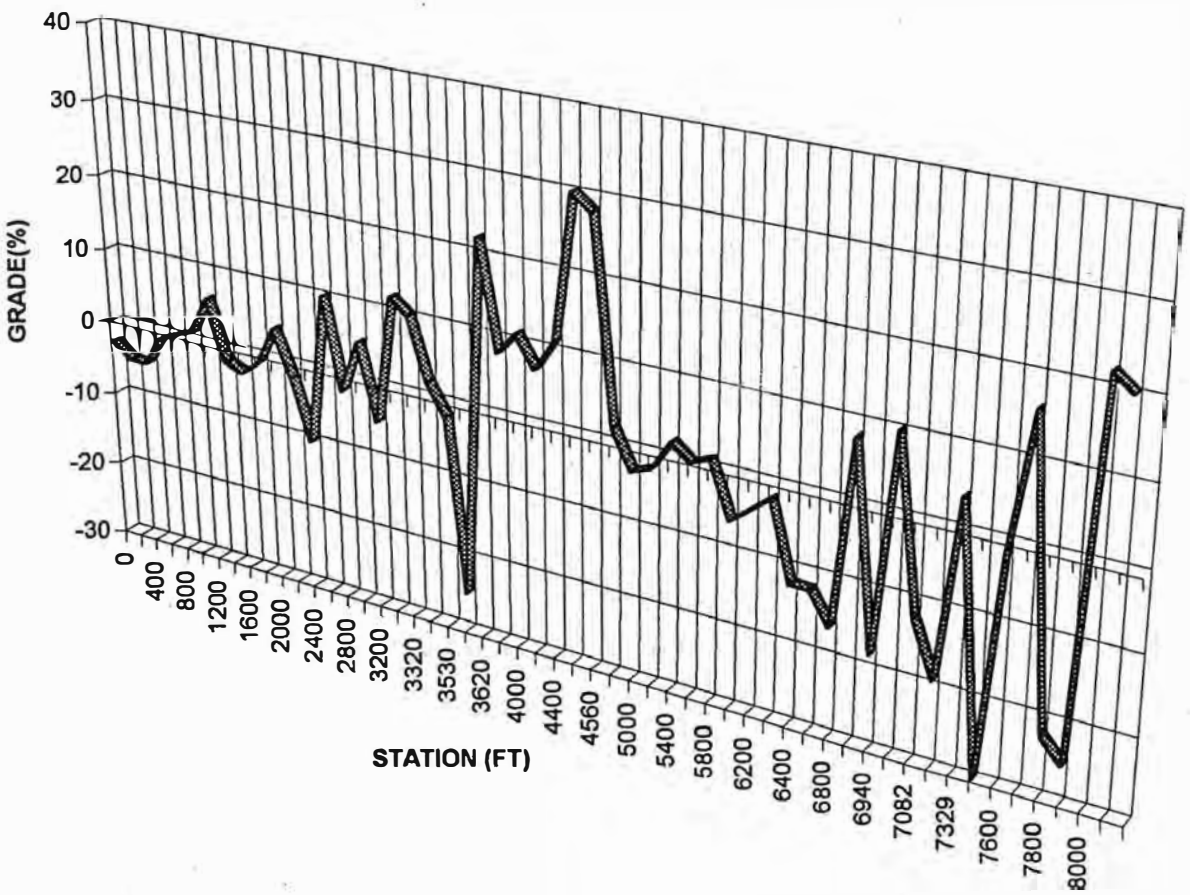
REDMOND TRAIL SURVEY SUMMARY

TRAIL	TOTAL LINEAR FEET	AVERAGE SIDESLOPE	AVERAGE TREADWIDTH	AVERAGE ABSOLUTE GRADE	AVERAGE GRADE	TOTAL RELOCATION
WEST BOUNDARY>23>21	3815	0.87	6.35	3.96	3.45	1015
TRILLIUM TRAIL	8050	7.94	4.74	9.30	0.04	1308
PUGET POWERLINE TRAIL	5500	0.00	3.48	7.71	4.52	5500
N/S CORRIDOR	8500	0.06	6.71	7.71	-0.29	170
EAST BOUNDARY > 14	1642	0.00	6.71	7.71	-0.29	170
9>10	1330	0.00	2.75	1.38	-1.13	0
8>9	1110	0.00	2.64	2.14	1.86	0
8>7	1140	0.00	4.40	2.20	2.20	0
7>6	2000	0.00	3.45	1.09	-0.36	0
6>9	700	0.00	5.00	0.20	-0.20	0
5>6	965	0.00	4.17	2.17	1.17	0
4>3	440	0.00	4.00	2.25	-2.25	0
21>18	1470	4.20	4.10	8.56	3.70	600
21'>18'	600	0.00	4.80	1.80	1.80	0
20>10 W	1575	4.36	4.36	1.82	1.82	0
19>20	275	0.00	4.50	10.75	1.75	2015
19>13	970	5.33	3.50	2.17	1.83	0
18>19	267	5.75	5.50	8.25	1.75	0
18'>17	630	0.00	3.20	4.00	4.00	0
17>16	370	4.00	7.33	2.00	-2.00	0
16>18'	1390	2.50	4.13	7.67	-1.00	0
16>15	460	1.00	3.33	3.67	3.67	0
15>14	1570	0.78	4.33	1.56	1.33	0
14>12	785	0.00	4.33	1.33	1.33	0
13>15	1890	3.92	4.08	6.33	-0.67	0
12>13	115	0.00	3.50	4.00	2.00	0
12>11	870	0.00	3.80	0.00	0.00	0
11>8	1240	0.00	3.40	1.40	1.40	0
11>10	550	0.00	5.42	6.50	1.83	58
10>20 E	930	5.00	3.00	2.00	-1.67	0

TOTAL LINEAR FEET=	51149
AVERAGE SIDESLOPE=	1.52
AVERAGE TREADWIDTH=	4.37
AVERAGE ABS. GRADE=	4.05
AVERAGE GRADE=	1.05
TOTAL RELOCATED FT.=	10836

TRILLIUM TRAIL PROFILE

TOTAL LINEAL FEET=	8050
AVERAGE SIDESLOPE=	8
AVERAGE TREAD WIDTH=	5
AVERAGE ABSOLUTE GRADE=	9
AVERAGE GRADE=	0
TOTAL RELOCATION=	1308



TRAIL: TRILLIUM TRAIL

STATION #	STATION (FT)	DISTANCE (FT)	RE-LOCATION	SIDE-SLOPE	GRADE (+/-)	GRADE (ABS)	GRADE (%)	TREAD WIDTH (FT)	TREAD MATERIAL	TRAVEL-WAY (FT)	TRAVEL-WAY (CLASS)	REMARKS
0+00	0	0	n	0	-1	3	-3	4	mineral	8	1	trail begins on RR grade
2+00	200	200	n	0	-1	5	-5	6	mineral	8	0	between 200-400' needs brushing
4+00	400	200	n	0	-1	5	-5	6	mineral	10	1	
6+00	600	200	n	0	-1	1	-1	6	mineral	8	1	~400-600' a 6'x3'x2" deep puddle; roots in tread
8+00	800	200	n	0	1	0	0	4	mineral	8	1	large puddle at intersection with E/W trail
10+00	1000	200	n	0	1	1	1	4	mineral	6	2: 4" diam. alder branch at eye height	between 800-1000': 75% trail is puddles average depth 3-4"; class 4 brushing
12+00	1200	200	n	20	1	6	6	6	min/duff	6	1: 3' on one side due to 3" diam alder, unlimited on other	1000-1200': roots in tread; large puddles; 2-3" alders in travelway
14+00	1400	200	n	20	-1	2	-2	4	min/duff ber	8	1	1200-1400': 3-4" roots in tread; significant puddling
16+00	1600	200	n	15	-1	3	-3	4	org	7	0	1400-1600': 2-3" roots in tread and travelway brushing
18+00	1800	200	n	20	-1	1	-1	4	organic	8	0	1600-1800': 80% trail is 4-5" deep puddles

STATION #	STATION (FT)	DISTANCE (FT)	RE-LOCATION	SIDE-SLOPE	GRADE (+/-)	GRADE (ABS)	GRADE (%)	TREAD WIDTH (FT)	TREAD MATERIAL	TRAVEL-WAY (FT)	TRAVEL-WAY (CLASS)	REMARKS
20+00	2000	200	n	10	1	4	4	5	organic	8	0	1800-2000': puddling of organic soils- 50% of trail
22+00	2200	200	n	5	-1	2	-2	5	mineral	7	2	2000-2200': puddling of org soils
24+00	2400	200	n	0	-1	10	-10	2	min	5	1';4': class 4 one side of trail and class 0 on other	2000-2400': ~8, 10" alders in travelway
26+00	2600	200	n	28	1	10	10	3	org	7	4';3': class 1	2400-2600': ~50' of 2" roots in tread and erroded soils
28+00	2800	200	n	0	-1	2	-2	3	min	6	1	2600-2800': HUGE 12'x5'x8" deep puddle
30+00	3000	200	n	0	1	5	5	4	org	6	1	3000: 20' long x 3" deep puddle 2800-3000: minor brushing and 10" alder in travelway
32+00	3200	200	n	0	-1	5	-5	4	org	6	1	3000-3200': 30' x 6' x 6" deep puddle; trail goes off course for ~15' to skirt downed and living alders--trail may easily be re-established
32+40	3240	40	n	22	1	12	12	4	min/duff	5	2	begin hill...a 7' x 4' x 3" deep puddle on organic soils
33+20	3320	80	n	0	1	10	10	4	mienral	5	1	end of short incline; 8" snag alder in travelway

STATION #	STATION (FT)	DISTANCE (FT)	RE-LOCATION	SIDE-SLOPE	GRADE (+/-)	GRADE (ABS)	GRADE (%)	TREAD WIDTH (FT)	TREAD MATERIAL	TRAVEL-WAY (FT)	TRAVEL-WAY (CLASS)	REMARKS
34+00	3400	80	n	0	1	2	2	3	mineral /duff	4	3	puddles
35+30	3530	130	n	0	-1	2	-2	4	mineral	7	1	begin downgrade on trail; 20' x 4" deep puddle on org soils; alders and snag in travelway
36+00	3600	70	y	30	-1	25	-25	5	mineral	8	0	Trail goes straight downgrade: ~1 ft soil erosion; roots exposed ALSO: (1)~20' mtn. bike offshoot around an island containing 14" alder snag (2) ~ 36+15 a 8'x4'x8" deep puddle
36+20	3620	20	y	10	1	22	22	5	organic sludge	8	0	
37+85	3785	165	y	33	1	8	8	9	mineral	8	0: 3, 6" hemlocks	
40+00	4000	215	n	8	1	11	11	3	mineral	5	0: 3" and 10" hemlocks in travelway	puddling of org soils
42+00	4200	200	n	0	1	7	7	4	organic	8	0	(1) 30' alternate trail needs more complete obliteration (2) 6' wide hemlock in tread (3) 2, ~ 11' long puddles

STATION #	STATION (FT)	DISTANCE (FT)	RE-LOCATION	SIDE-SLOPE	GRADE (+/-)	GRADE (ABS)	GRADE (%)	TREAD WIDTH (FT)	TREAD MATERIAL	TRAVEL-WAY (FT)	TRAVEL-WAY (CLASS)	REMARKS
44+00	4400	200	y: begin	5	1	11	11	8	mineral /duff	8	0	intersection #3.. a bench at the top of a steep downgrade stretch of trail(1) 8" snag in tread (2) puddling and rutting of org soils
45+04	4504	104	y: cont	0	1	30	30	5	silt/ organic	8	0	bottom of intensively gullied(3-4' deep) downgrade stretch: a small 2 ft. wide stream crosses this point
45+60	4560	56	y: end	20	1	28	28	6	mineral	8	0	
48+00	4800	240	n	0	1	2	2	4	mineral	8	0	several 10-15' long, sludgy puddles (~4" deep)
50+00	5000	200	n	0	-1	3	-3	8	organic	8	0	4800'-5000': 14" downed tree across tread and lots of puddling of org soils
52+00	5200	200	n	8	-1	2	-2	9	organic	9	0	5000-5200': (1)25' stretch of significant roots in tread causing trail migration (2) ~51+50 puddling
54+00	5400	200	n	5	1	2	2	4	organic	6	0: 12" diam. snag in travelway	5200-5400': (1)severe root exposure in tread (2) 3-4" rutting and erosion of tread
56+00	5600	200	n	0	1	0	0	5	organic	5	2	5400-5600': many puddles, some >15' long and 5" deep
58+00	5800	200	n	10	1	1	1	3	organic	8	0	heavy organic soils

STATION #	STATION (FT)	DISTANCE (FT)	RE-LOCATION	SIDE-SLOPE	GRADE (+/-)	GRADE (ABS)	GRADE (%)	TREAD WIDTH (FT)	TREAD MATERIAL	TRAVEL-WAY (FT)	TRAVEL-WAY (CLASS)	REMARKS
60+00	6000	200	n	3	-1	6	-6	5	mineral w/duff	8	0	
62+00	6200	200	n	0	-1	4	-4	4	organic	8	0: 8" alder in travelway	6200': ~25 of puddles 6000-6200': (1) large 3' stump in tread, corridor is ~20' due to trail on either side (2) ~80' of unneccesary trail meanders
63+00	6300	100	n	0	-1	2	-2	4	mineral	8	0	
64+00	6400	100	n	0	-1	12	-12	5	mineral	8	0	6300-6400': (1) a 2.5' diam. hemlock in tread, trail goes around both sides and corridor widens to ~15'
66+00	6600	200	n	2	-1	12	-12	4	organic	8	0	6400-6600': puddling
68+00	6800	200	n	2	-1	16	-16	3	mineral	8	0	
68+51	6851	51	y: begin	10	1	8	8	3	mineral	8	1	begin downgrade section
69+40	6940	89	y: cont	0	-1	18	-18	5	organic	8	0	base of gully: large 15' long, 4" deep puddle
70+00	7000	60	y	10	1	10	10	5	mineral	8	0	
70+82	7082	82	y	20	-1	12	-12	4	mineral	8	0	
71+84	7184	102	y	18	-1	19	-19	4	organic	8	0	end trail relocation: sludgy puddle here with 4" H2O
73+29	7329	145	y	20	1	4	4	5	mineral	8	0: 12" hemlocks in travelway	good trail and tread
75+24	7524	195	y		-1	30	-30	6	mineral	8	0	end relocation: good trail and tread

STATION #	STATION (FT)	DISTANCE (FT)	RE-LOCATION	SIDE-SLOPE	GRADE (+/-)	GRADE (ABS)	GRADE (%)	TREAD WIDTH (FT)	TREAD MATERIAL	TRAVEL-WAY (FT)	TRAVEL-WAY (CLASS)	REMARKS
76+00	7600	76	n	20	-1	1	-1	3	organic	8	1	1: minor brushing and a few 3" diam. hemlocks since 7524
77+60	7760	160	y: begin	22	1	16	16	7	mineral	8	0	begin trail relocation at top of downgrade stretch
78+00	7800	40	y: cont	20	-1	22	-22	3	mineral	5	1: alder branches	continue reloc.
79+55	7955	155	y	5	-1	25	-25	6	organic	8	0	bottom of downgrade stretch: trail crosses 3' wide, 4" deep running creek
80+00	8000	45	y	0	1	22	22	3	mineral	8	0	gullied, severe root exposure
80+50	8050	50	y	0	1	20	20	10	mineral	8	0	trail end: top of severely gullied section of trail..end relocation

TRILLIUM TRAIL SUMMARY

The Trillium Trail passes through dense forest. A portion of the trail follows an old railroad grade, offering users a gentle grade and wide travelway. Significant sections of the trail have organic soils, resulting in muddy conditions and puddling. Several portions of the trail possess a steep grade which is discontinuous with the remainder of the trail. Approximately 1300 feet of trail relocation will result in a more consistent trail experience.

APPENDIX 7

TRAIL PLAN
ALTERNATIVES A, B, C
OPTIONS 1,2

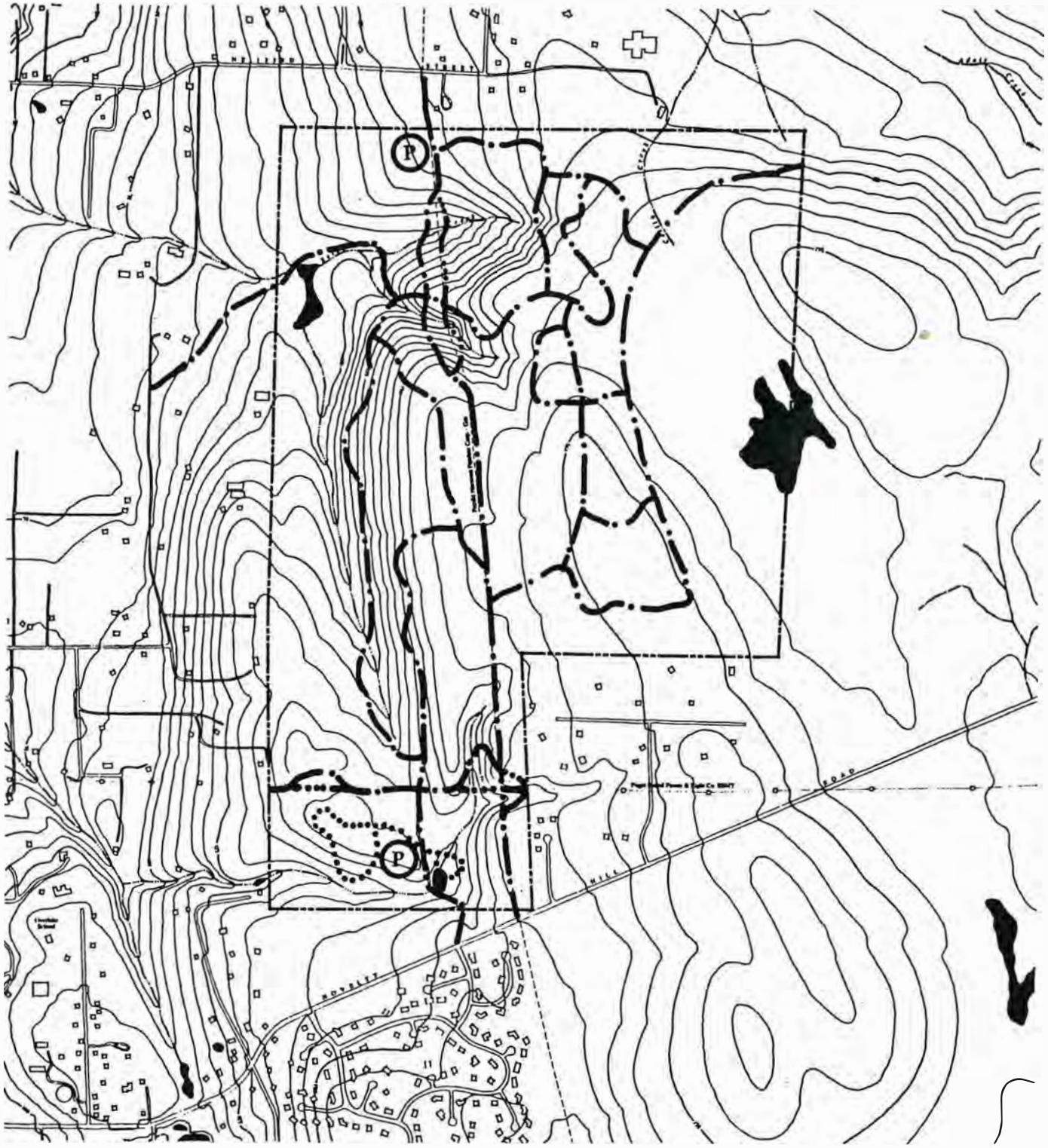
REDMOND WATERSHED

MASTER PLAN

Three generations of alternative plans ultimately yielded two options which the Steering Committee could support. The first generation of three trail alternative plans included a multi-use system ranging from easy to difficult trails, a multi-use system with all trails developed to an easy standard, and a combined multi and segregated use system with each user group having about a mile of segregated use trail. Each of these alternatives also included a hikers only interpretive loop trail.

The next generation of three trail alternative plans, Alternatives A, B, and C (see Appendix 7), included refinements of the latter two alternatives and a third combined multi and segregated use system with longer segregated loop trails of about two miles each.

Members of the public, Steering Committee members, City Council members, Parks Board members, the Redmond Parks Department, and the consultants raised numerous concerns about the trail plans. Options 1 and 2 are the result of a process of weighing and addressing all those concerns. Both of these options include multi-use regional trails, multi-use trails required for logical circulation, hikers only interpretive loop trails in the 80 acre parcel, a hikers only loop trail to the perimeter of the large wetland on the site's east boundary, and an equestrian loop trail which includes the existing Trillium Trail and new trails to the west. Option 1 includes a bicycle loop trail whereas Option 2 designates those same trails multi-use.



Redmond Watershed Preserve

City of Redmond Department of Parks and Recreation

NORTH

NAKANO ♦ DENNIS
LANDSCAPE ARCHITECTS

KEY

P Parking

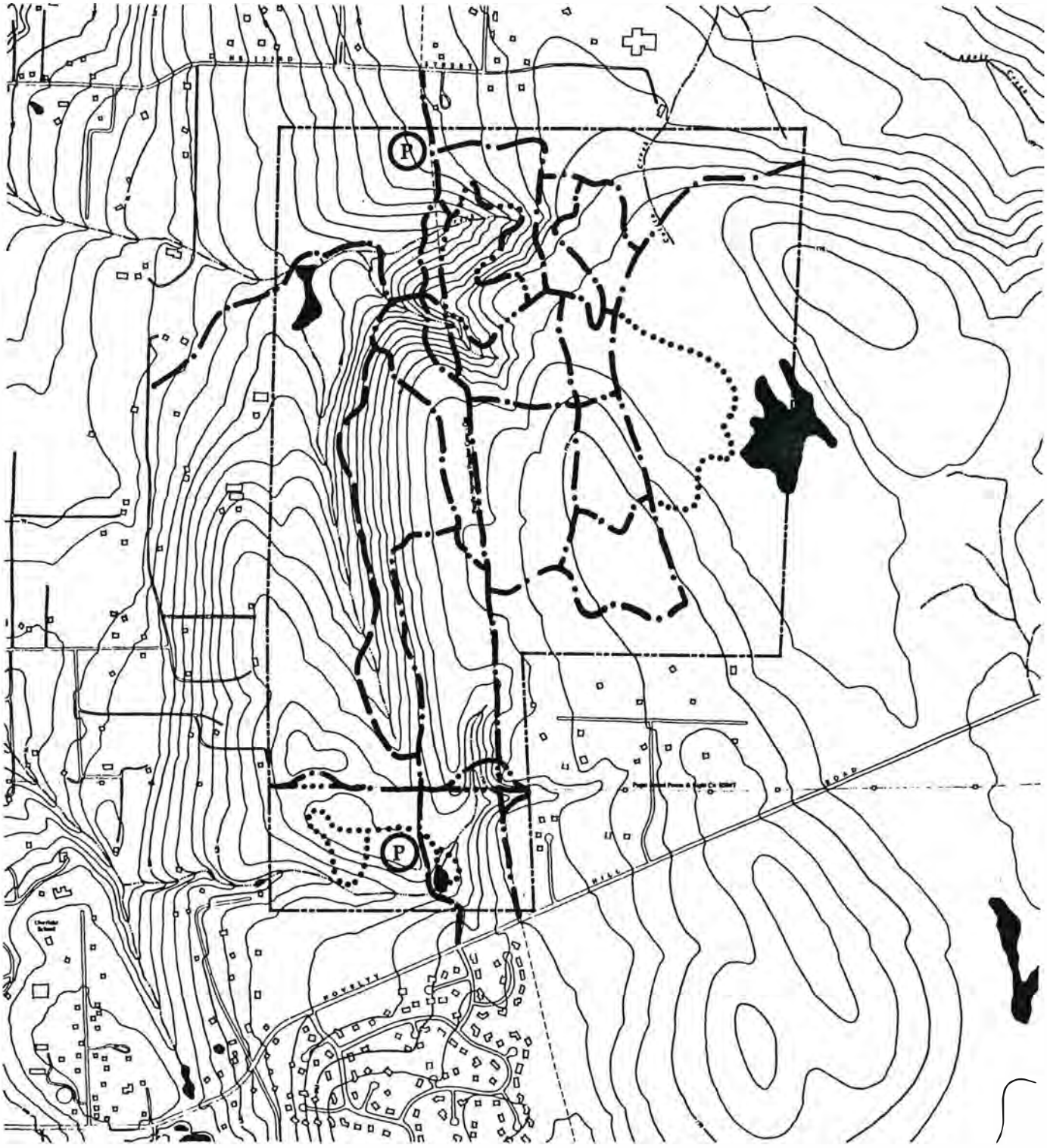
Multi-use Trail

Bicycle Trail

SCALE 1" = 400'-0"

10 5 1 ACRES

TRAIL USE PLAN - ALTERNATIVE A



Redmond Watershed Preserve

City of Redmond Department of Parks and Recreation

NORTH

NAKANO • DENNIS
LANDSCAPE ARCHITECTS

TRAIL USE PLAN
ALTERNATIVE B
Multi-use Trails with
Specialty Use Bypasses

KEY

P Parking

Multi-use Trail

Equestrian Trail

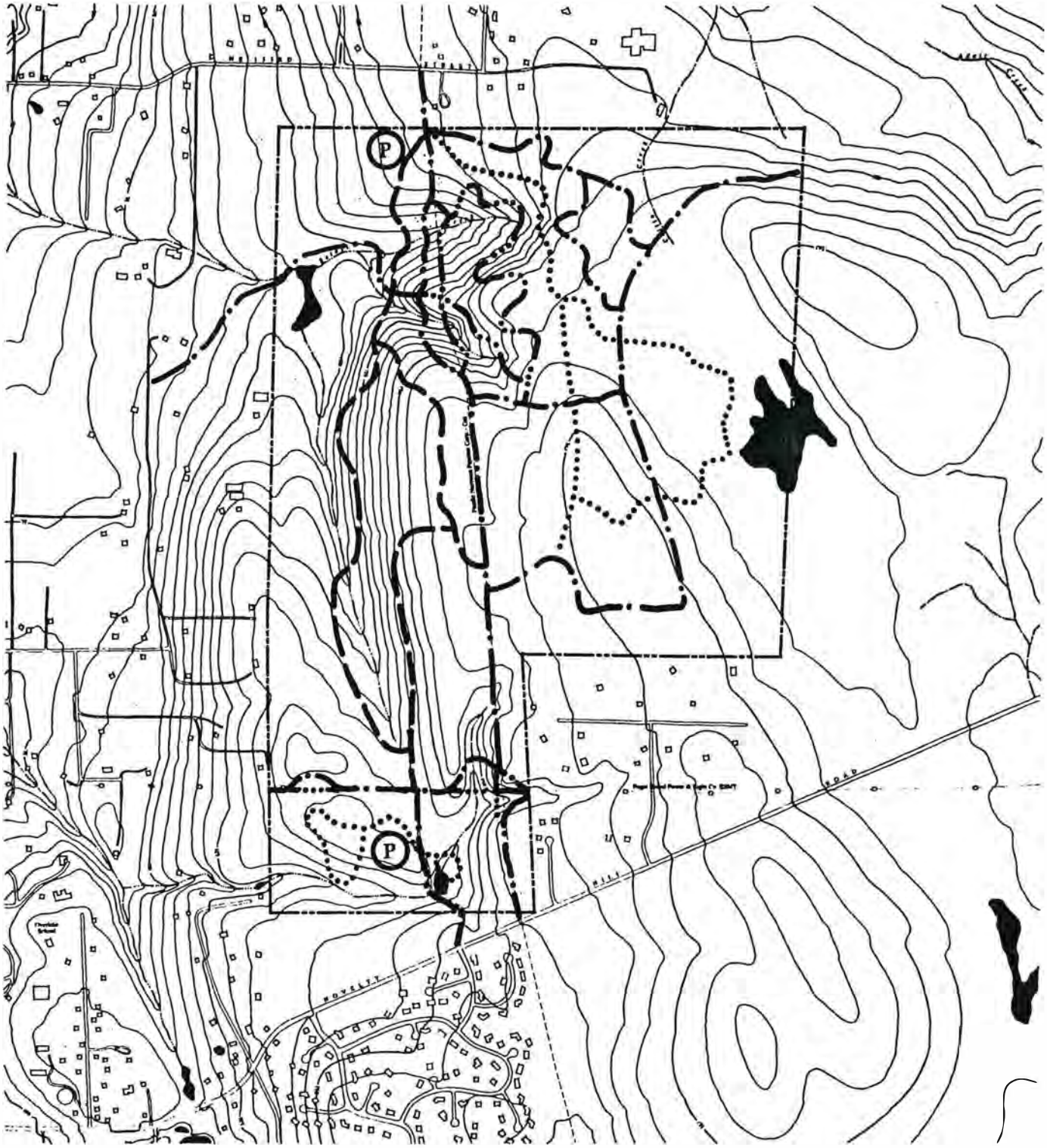
Bicycle Trail

Foot Trail

SCALE 1" = 400'-0"

400 100 0 1/8 1/4 1/2
FEET MILES

10 5 1
ACRES



Redmond Watershed Preserve

City of Redmond Department of Parks and Recreation

NAKANO • DENNIS
LANDSCAPE ARCHITECTS

TRAIL USE PLAN
ALTERNATIVE C
Multi-use Trails with
Specialty Use Loops

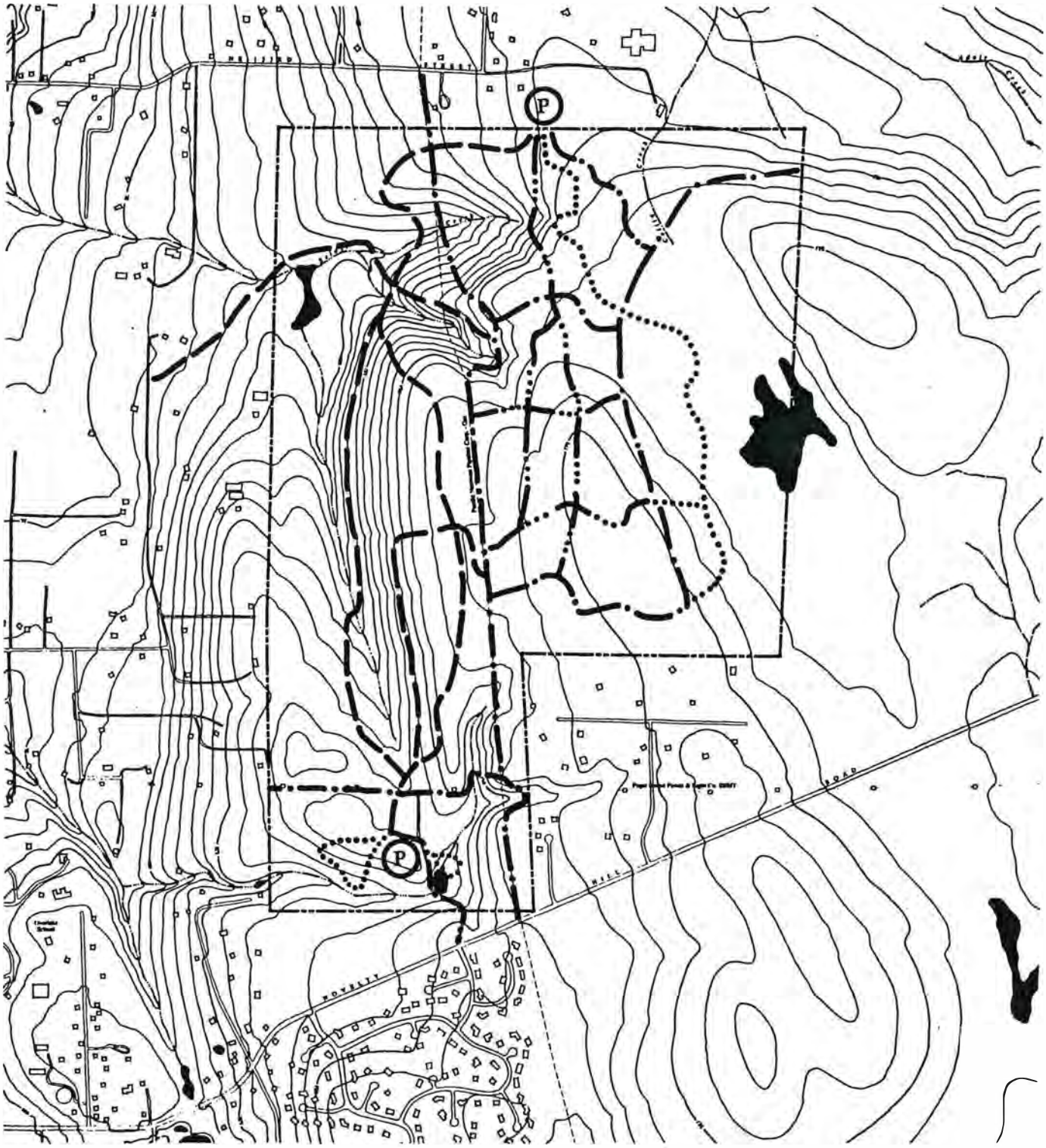
KEY

- (P) Parking
- Multi-use Trail
- Equestrian Trail
- Bicycle Trail
- Foot Trail

SCALE 1" = 400'-0"

FEET MILES

10
5
1
ACRES



Redmond Watershed Preserve

City of Redmond Department of Parks and Recreation

NORTH

NAKANO • DENNIS
LANDSCAPE ARCHITECTS

KEY

P Parking

Multi-use Trail

Equestrian Trail

Bicycle Trail

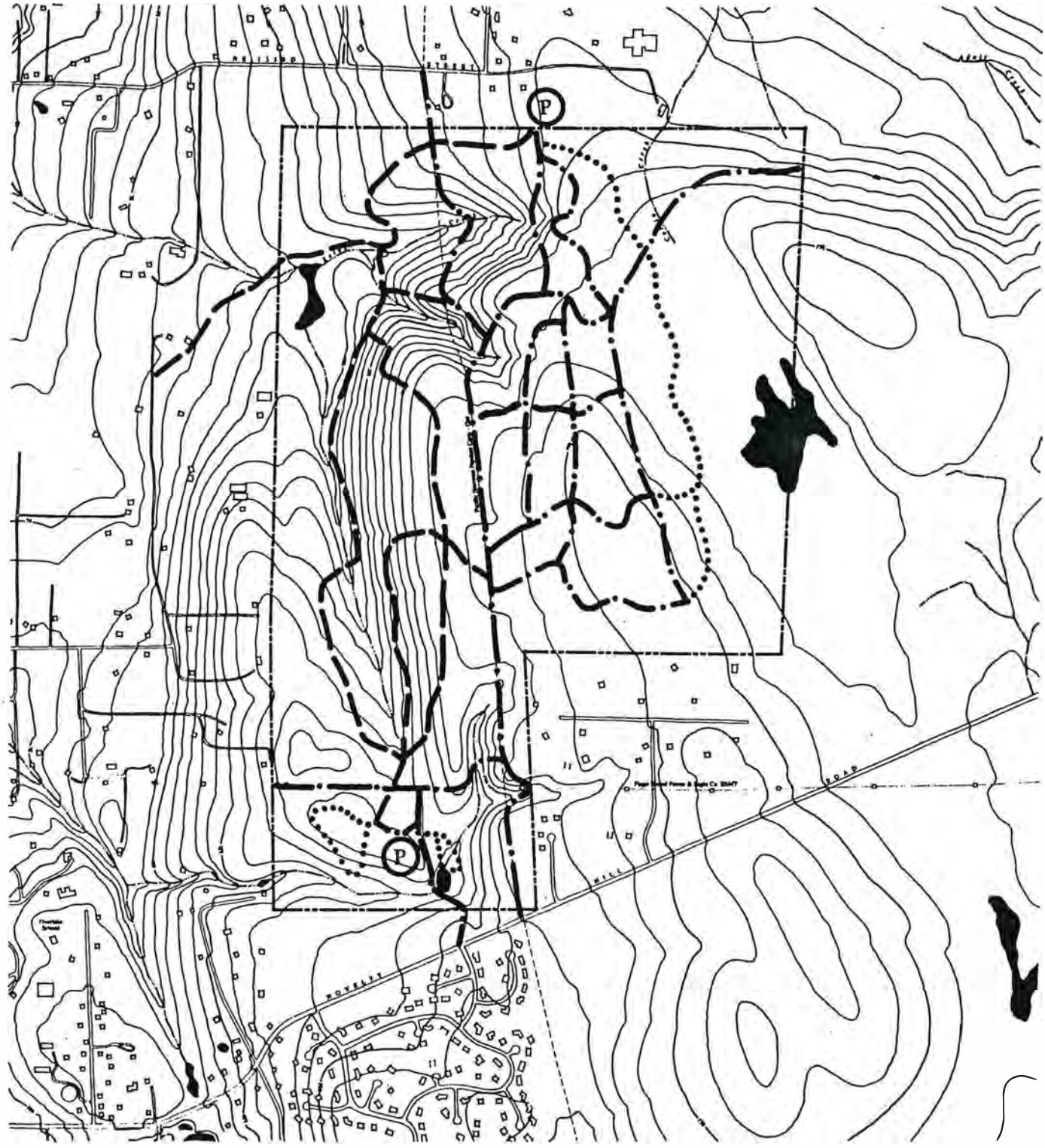
Foot Trail

SCALE 1" = 400'-0"

FEET MILES

10
5
1
ACRES

TRAIL USE PLAN - OPTION 1



Redmond Watershed Preserve

City of Redmond Department of Parks and Recreation

NORTH

NAKANO • DENNIS
LANDSCAPE ARCHITECTS

KEY

P Parking

Multi-use Trail

Equestrian Trail

Foot Trail

SCALE 1" = 400'-0"

10
5
1
ACRES

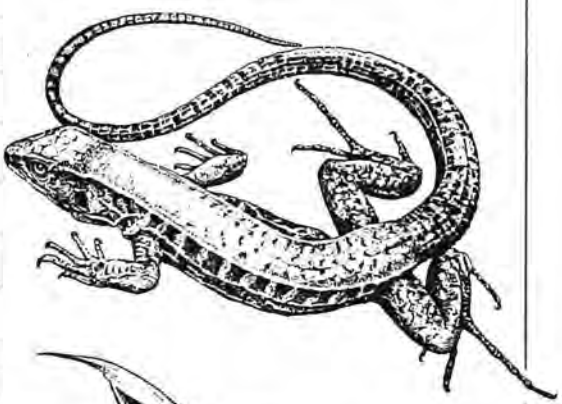
TRAIL USE PLAN - OPTION 2

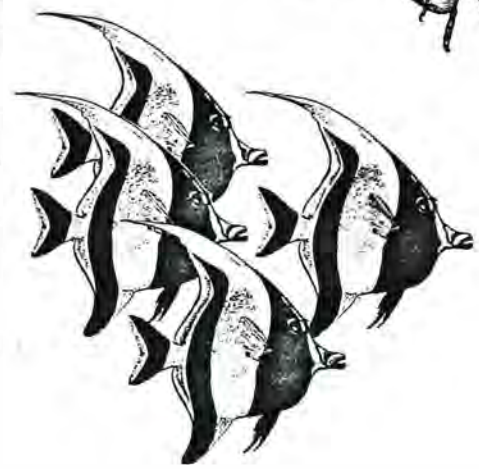
APPENDIX 8

INTERPRETIVE GRAPHICS

REDMOND WATERSHED

MASTER PLAN





LINDA M. FELTNER

Interpretive Graphics for Redmond Watershed

Four interpretive panels are to be created for the barrier-free interpretive trail surrounding one of the large ponds in the Redmond Watershed.

This area is an ideal location to present interpretive messages which explore the importance of wetlands and woodlands, and their benefit to wildlife. This nature preserve provides homes and food for a diverse number of plants and animals. The access around the pond provides an excellent opportunity for closer observation of both aquatic and terrestrial life.

Porcelain enamel is recommended for the outdoor panels. Four panels, 20x24", will be printed and fired with one background color and two print colors. The colors will harmonize with the surrounding landscape.

Objectives:
That the visitor will be able to...

- ...understand that this area was set aside for open space as a nature preserve for wildlife.
- ...understand that a wetland hosts extraordinary biological diversity.
- ...heighten their awareness of the wildlife activity around the area (bird song, traces of life, look closer, listen, smell)
- ...learn about the relationship of wildlife to habitat.
- ...establish a positive relationship between visitors and wildlife, leading to visitor interest, empathy, and support.

Topics:
In general, we want to tell visitors about...

Panel 1. ...the space provided for wildlife and people.
Panel 2. ...the abundance of food available for wildlife.
Panel 3. ...the shelter that the forest furnishes for wildlife.
Panel 4. ...the signs of life to be found by looking & listening.

Wildlife Artist ■ Graphic Designer
P.O.Box 4251, Seattle, WA 98104 (206) 767-9937

Interpretive Graphics for Redmond Watershed

Panel #1: (A place for wildlife)

Wildlife benefits from open space areas. This is a place, close to an urban area, where wildlife can be observed relatively undisturbed. The initial panel would introduce the value of wetlands, including lessening the impact of flood waters upon the downstream areas. This ecosystem provides food, shelter, water, & breeding habitat for animal and plant life. Wetlands house a myriad of life forms (biodiversity). Look closer, look quietly, animals hear & see the visitor before the visitor will hear or see them. The relationship of water to the abundance and diversity of wildlife depends upon the quantity and quality of water.

Panel #2. (Food)

A food web develops within pools of water which supports fish (cutthroat trout to be illustrated), and other life. A healthy and balanced ecosystem, provides nourishment for many different kinds of plants and animals. Slow-moving streams and pooling water will allow a variety of plankton, insects, tadpoles, and small fish to flourish. Snails, clams, bullfrogs, amphibians, garter snake, raccoon, Pacific treefrog, tadpoles, and ducks, could be some of the illustrated subjects.

An above-and below-water scene could be created, showing a log with plants growing on it. Different types of vegetation,and animals could be shown *in situ*, including a cut-away view through the layers of soil.

The deciduous and conifer trees surrounding the pond provide provide berries, nuts and fungus for food for terrestial and arboreal wildlife. Coyote, bear, mouse, Douglas squirrel, deer, and birds are possible animals to illustrate.

Panel #3. (Shelter)

The surrounding woodland provides numerous places for vertebrates and invertebrates to feed, nest, and roost.

There is an abundance of remnant standing trees (snags), downed logs, and hollows in living trees. These provide cavities important to wildlife. Plants and animals use many parts of the snags for food and shelter. The old and decaying wood is rich with life. Discover the paths of beetles and termites in the down and dead wood. These open up ways for other insects and fungi to enter the tree. Each stage of decay supports a unique accumulation of insects and fungi to break down and decompose the wood.

Foraging birds such as woodpeckers and chickadees, along with salamanders and spiders, search for insects. The pileated woodpecker excavates cavities in which to nest. Listen for the drumming or loud call. The abandoned cavitity could become shelter for Douglas squirrels, raccoons, or small owls.

The illustration could depict the pileated woodpecker and its distinctive chisled holes.

Panel #4 (Signs of Life)

By looking and listening, an extraordinary world awaits discovery. Quietly observe. Listen for sounds of birds in the early morning or late evening. The singing frogs and toads proffer an unusual chorus. Signs of life that the visitor may find could be a dropped feather, partially eaten nuts, shreaded fir cones, woodpecker holes, bird calls, deer tracks, scat droppings, scratched trunks. Smell the fragrance of conifers, ripening berries, or the musty aroma of the bog and forest compost.

A group of images could illustrate items which may be found along the trail, such as nibbled nuts, tracks, or varieties of woodpecker holes.

APPENDIX 9

DETAIL COST ESTIMATE FOR OPTION 1A TRAIL PLAN

REDMOND WATERSHED

MASTER PLAN

Trail Type	Width	Linear Feet	Mileage	Cost/Foot	Total Cost
Equestrian					
Reconstruction	3	16896	3.20	$ 3.50	$ 59,136.00
New / Rerouted	3	5280	1.00	$ 3.50	$ 18,480.00
Total		**22176**	**4.20**		**$ 77,616.00**
Hiking Trails					
East Interpretive					
Reconstruction	2	0	0.00	$ 3.50	$ 0.00
New / Rerouted	2	10309	1.95	$ 4.20	$ 43,297.80
Boardwalk	2	1000	0.19	$ 65.00	$ 65,000.00
Total		**11309**	**2.14**		**$ 108,297.80**
South Interpretive					
Reconstruction	0	0	0.00	$ 0.00	$ 0.00
New / Rerouted	6	2500	0.47	$ 8.40	$ 21,000.00
Boardwalk	6	500	0.90	$ 100.00	$ 50,000.00
Total		**3000**	**0.57**		**$ 71,000.00**
Bicycling					
Reconstruction	3	0	0.00	$ 3.50	$ 0.00
New / Rerouted	3	8448	1.60	$ 3.50	$ 29,568.00
Total		**8448**	**1.60**		**$ 29,568.00**
Multi-use					
Non-regional					
Reconstruction	4	3200	0.61	$ 3.50	$ 11,200.00
New / Rerouted	4	0	0.00	$ 5.00	$ 0.00
Total		**3200**	**0.61**		**$ 11,200.00**
Regional					
North/South (Gas Line)					
Reconstruction	8	9504	1.80	$ 16.00	$ 152,064.00
New / Rerouted	8	0	0.00	$ 16.00	$ 0.00
Parallel Equestrian	3	9504	1.80	$ 3.50	$ 33,264.00
Total		**9504**	**1.80**		**$ 185,328.00**
East/West (Puget Power)					
Reconstruction	12	0	0.00	$ 0.00	$ 0.00
New / Rerouted	12	5500	1.04	$ 25.00	$ 137,500.00
Parallel Equestrian	3	5500	1.04	$ 3.50	$ 19,250.00
Total		**5500**	**1.04**		**$ 156,750.00**
GRAND TOTAL		**63137**	**11.96**		**$ 639,759.80**

APPENDIX 10

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REDMOND WATERSHED

MASTER PLAN

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