Upper Cispus Watershed Analysis

Mt. Adams from Takhlakh Lake

Gifford Pinchot National Forest
Cowlitz Valley Ranger District
December 2001

Upper Cispus Watershed Analysis Team Members

Team Leader	Buddy Rose
Archeologist	Rick McClure
Botanist	Andrea Ruchty
Fire Planner	Dave McCullough
Fisheries Biologist	Ken Meyer
Geologist	Jim Chamberlin
Hydrologist	Steve Markman
Lands, Minerals and Special Uses	Dick Dinkelman
Recreation/Wilderness Planner	Jack Thorne
Silviculturist	Gary Wright
Special Forest Products	Julie Ashe
Wildlife Biologist	Tom Kogut
Fish and Wildlife Service Representative	Joe Hiss
Writer/Editor	Buddy Rose

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Chapter 1 - Overview

Introduction

Watershed analysis is an analytical tool designed to describe the biophysical processes and interactions that operate on a landscape at the watershed scale. The purpose of the analysis is to provide a scientific understanding of ecological processes that can be used to guide future management activities within the watershed. Management direction pertinent to conducting watershed analysis is found within the *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl* (USDA, USDI 1994).

A. ANALYSIS PROCESS

The Upper Cispus Watershed Analysis updates and replaces the Middle and Upper Cispus Pilot Watershed Analysis (June 1995). The process used to conduct the Upper Cispus Watershed Analysis is a synthesis of previous efforts that have been utilized on the Cowlitz Valley Ranger District. The key tasks involve, 1) identifying issues and questions that are relevant to key management objectives, 2) characterizing the historic and current condition of the watershed's physical, biological, and human elements, 3) determining trends based upon historic and current conditions, and 4) interpreting the results in the form of recommendations that are responsive to the key watershed processes identified.

Based upon funding limitations for the analysis, limited field data collection was gathered during the process. Data used in the analysis was from the previous watershed analysis plus that collected during the limited field visits or extracted from existing sources. Data sources, data gaps, and any associated assumptions are noted at the beginning of each respective resource section in Chapter 3.

The information presented in this document may need periodic updating to reflect changing conditions and newly discovered information. An analysis file to track document edits will be on file in the planning department at the Cowlitz Valley Ranger District. A process for tracking and disseminating edits of these documents needs to be developed.

B. WATERSHED OVERVIEW

The Upper Cispus watershed, a fifth-field watershed, encompasses about 155,000 acres in the Cispus River drainage of the Gifford Pinchot National Forest. All of the watershed is National forest land. The northern portion of the watershed is bounded by the ridges forming the boundary between the Cispus and Cowlitz River Watersheds while the southern boundary is defined by the boundary between the Cispus and Lewis River Watersheds (Maps1,2 and 3, Regional and Local Vicinity and Watershed Boundary and Topography). To the east is the boundary between the Gifford Pinchot National Forest and the Yakama Indian Reservation.

The nine sixth-field watersheds in the analysis area were named according to the primary aquatic feature they encompass and/or general location. Table 1-1 lists the nine sixth-fields and associated aquatic features within the Upper Cispus watershed. See Map 4, Sixth-field Watershed Boundaries, for a display of their locations.

Table 1-1 : General Location of Sixth-field Watersheds

Sixth-field	Acres	Name	Other Aquatic Features
170800040401	12,944	Cispus River Headwaters	Cispus River, Goat Creek
170800040402	9,742	Walupt Creek	Walupt Lake
170800040403	18,410	Cispus River - Chambers Creek	Chambers Lake, Wesley Creek
170800040404	17,732	Cispus Muddy Fork	Spring Creek, Horseshoe Lake
170800040405	18,777	Cispus River - Cat Creek	Orr Creek, Mouse Creek
170800040406	15,686	Adams Fork	Ollallie Lake, Killen Creek
170800040407	18,307	East Canyon Creek	Council Lake, Takhlakh Lake
170800040408	15,637	Cispus River - Blue Lake	Prospect Creek, Juniper Creek
170800040409	27,908	North Fork Cispus River	Timonium Creek, Wobbly Lake

The major road through the watershed is Forest Road 23 (see Chapter 3, Transportation System for other roads within the Upper Cispus Watershed). Road 23 is a major forest arterial connecting the towns of Randle and Trout Lake. Other major roads within the watershed are Forest Road 22 that traverses the North Fork Cispus drainage, and Forest Road 21, that connects the Cispus River area to U.S. Highway 12 near the town of Packwood, via the Johnson Creek drainage.

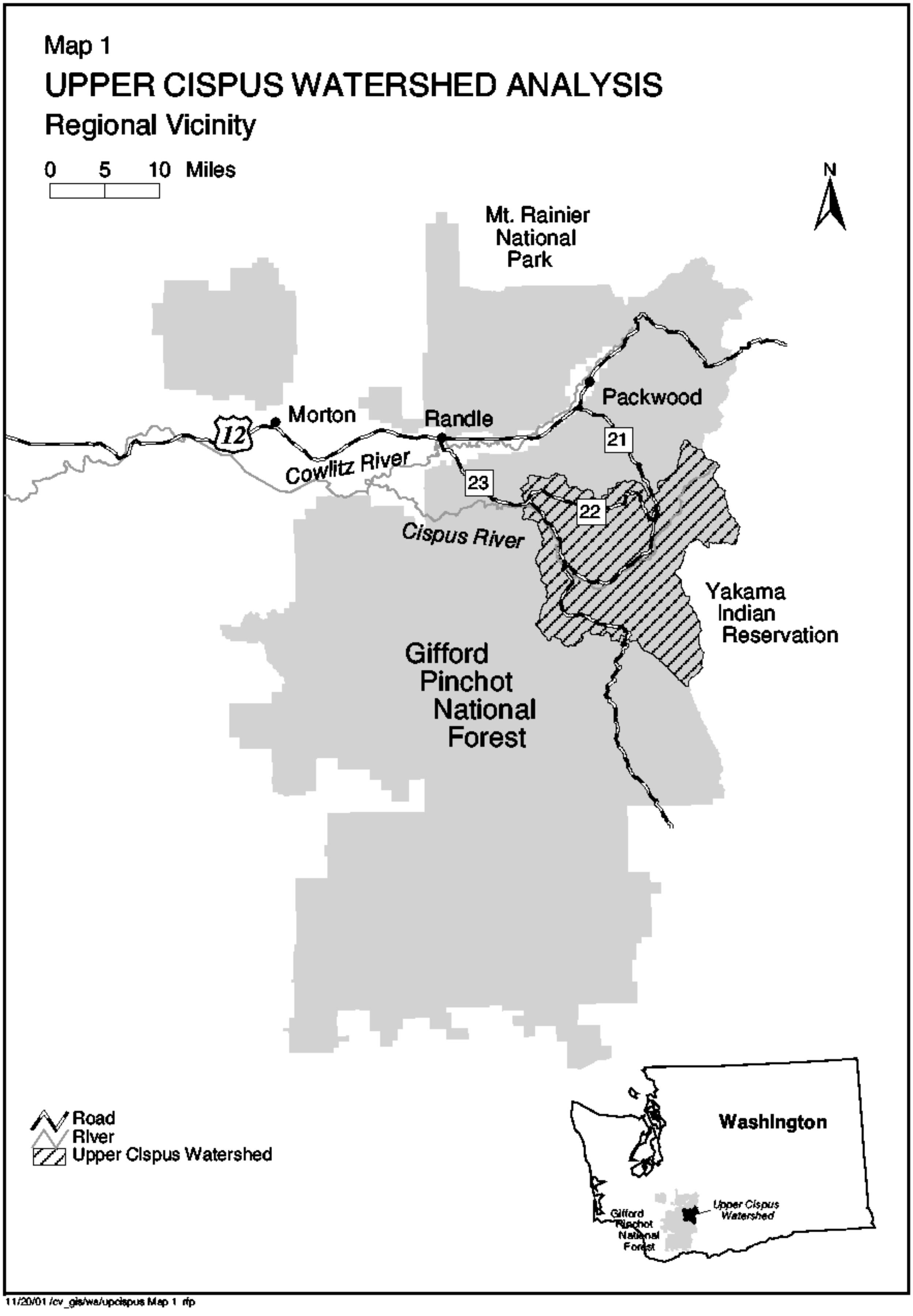
1. Management Direction

Lands within the Upper Cispus watershed are managed according to direction provided by *Gifford Pinchot National Forest, Land and Resource Management Plan, Amendment 11* herein referred to as Amendment 11. This document combines direction from the *Gifford Pinchot National Forest Land and Resource Management Plan* (USDA 1990) and the *Record of Decision (*ROD*) for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Spotted Owl* (USDA, USDI 1994), herein referred to as the Northwest Forest Plan.

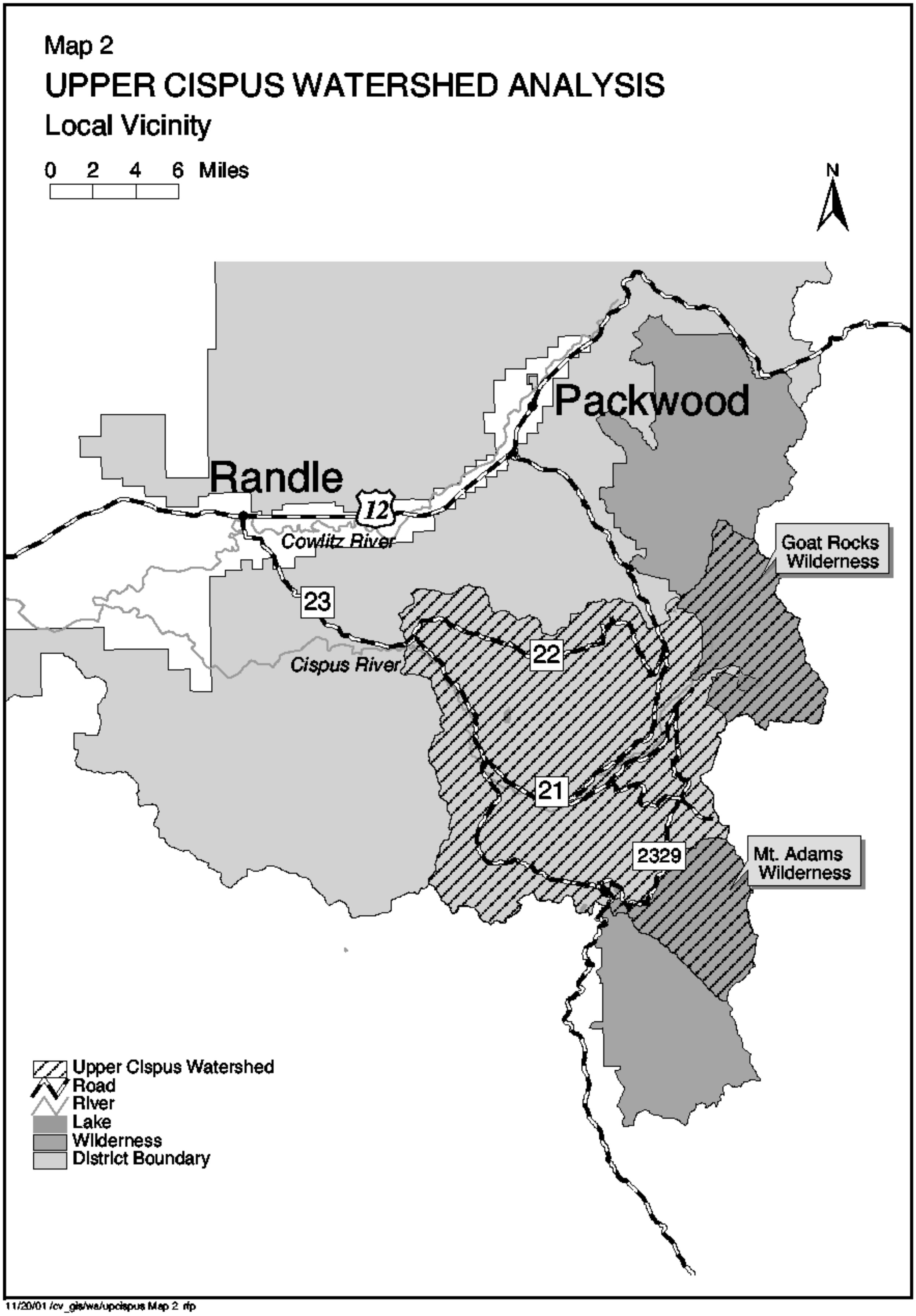
Management direction is applied to specific lands using the overlying direction from the 1994 Northwest Forest Plan and the underlying Management Area Category (MAC) direction of the 1990 GP Forest Plan. Amendment 11 documents the combination of these two levels of management direction.

a. Northwest Forest Plan

The following Northwest Forest Plan land management designations are within the Upper Cispus watershed. See Map 5, Land Management Allocations - NW Forest Plan, GP Forest Plan.



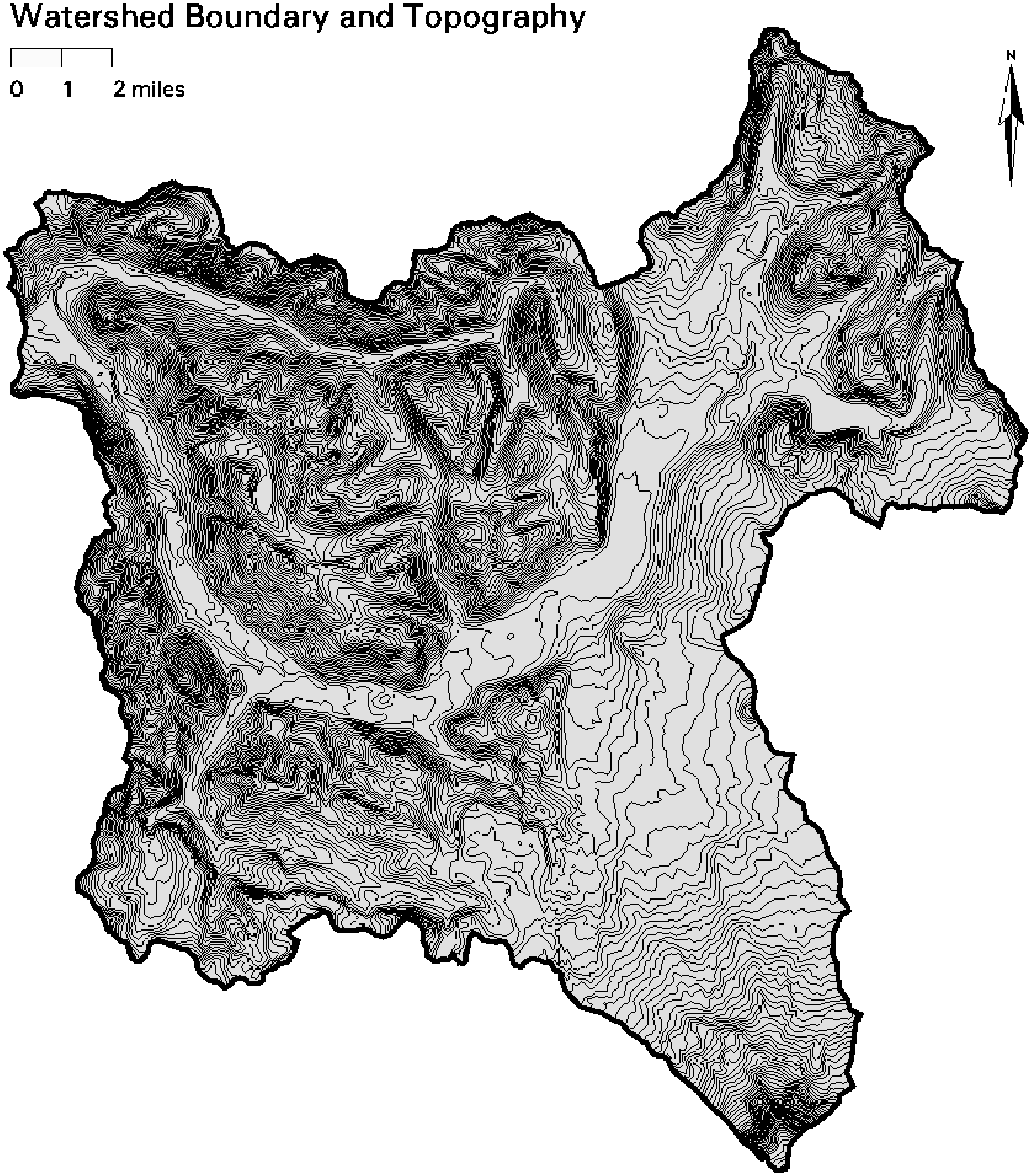
Map 1
UPPER CISPUS WATERSHED ANALYSIS
Regional Vicinity
0 5 10 Miles
N
Mt. Rainier National Park
Packwood
Morton
Randle
12
21
23
22
Cowlitz River
Cispus River
Yakama Indian Reservation
Gifford Pinchot National Forest
Road
River
Upper Cispus Watershed
Washington
Upper Cispus Watershed
Gifford Pinchot National Forest
11/20/01 /cv_gis/wa/upcispus Map 1 rfp


Map 2
UPPER CISPUS WATERSHED ANALYSIS
Local Vicinity
0 2 4 6 Miles
N
Packwood
Randle
12
Cowlitz River
23
Cispus River
22
21
2329
Goat Rocks Wilderness
Mt. Adams Wilderness
Upper Cispus Watershed
Road
River
Lake
Wilderness
District Boundary
11/20/01 /cv_gis/wa/upcispus Map 2 rfp

Map 3

UPPER CISPUS WATERSHED ANALYSIS
Watershed Boundary and Topography

0 1 2 miles



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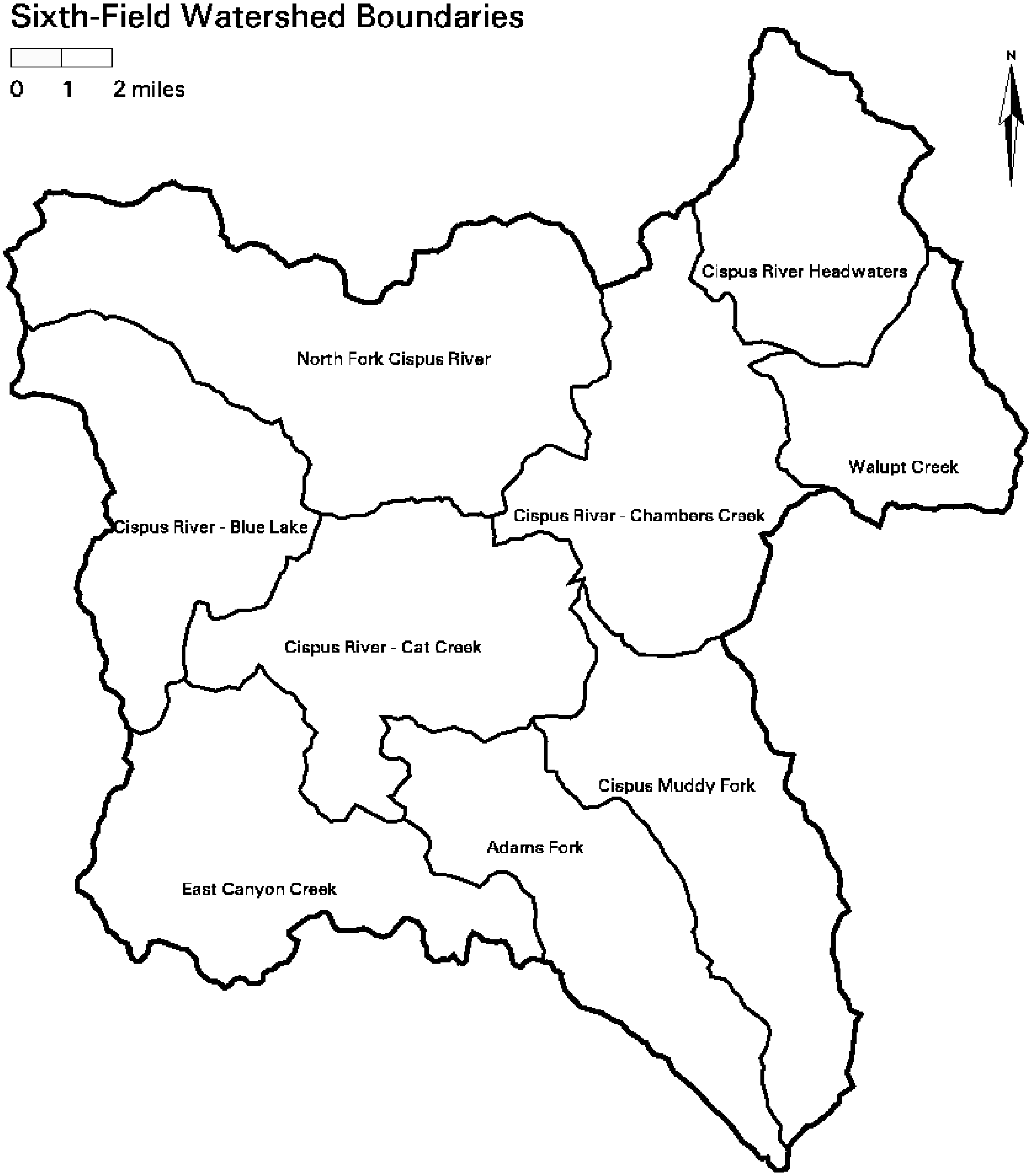
Map 4

UPPER CISPUS WATERSHED ANALYSIS
Sixth-Field Watershed Boundaries



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<u>Cispus Adaptive Management Area</u> - lands where the development and testing of technical and social approaches to achieving desired ecological, economic and social objectives is emphasized with the overall of objective of managing on a ecosystem basis. Management recommendations for the Cispus Adaptive Management Area have been developed as part of the Cispus AMA Guide [March 1998]. See Chapter 6 for more information regarding these management recommendations.

<u>Administratively Withdrawn Areas</u> - includes wildlife, recreation, visual and other areas not managed to provide timber outputs.

<u>Congressionally Withdrawn Areas</u> - includes lands within congressional designations that normally preclude timber harvest.

<u>Late Successional Reserves</u> - lands where the objective is to protect and enhance conditions of the late-successional and old-growth forest systems.

<u>Matrix</u> - lands where most scheduled timber harvest is expected to take place.

Table 1-2 lists the acreage and percent of each sixth-field that is occupied by each land management allocation.

Table 1-2: Acreage and Percent of Each NW Forest Plan Land Management Allocation within Each Sixth-field Watershed

Sixth-Field Waterhsed	Adpative Management Area		Administratively Withdrawn Areas		Congressionally Reserved Areas		Late-Successional Reserves		Matrix	
	Acres	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
Cispus Headwaters	272	0%	2	0%	12,697	30%	0	0%	10	2%
Walupt Creek	0	0%	439	54%	9,283	22%	0	0%	0	0%
Chambers Creek	15,643	14%	271	33%	1,964	5%	0	0%	524	90%
Muddy Fork	7,605	7%	5	1%	10,084	24%	0	0%	0	0%
Cat Creek	18,777	17%	0	0%	0	0%	0	0%	0	0%
Adams Fork	8,246	8%	0	0%	7,440	18%	0	0%	0	0%
E. Canyon Creek	15,848	14%	64	8%	261	1%	2,125	100%	9	2%
Blue Lake	15,594	14%	35	4%	0	0%	0	0%	8	1%
North Fork Cispus	27,879	25%	1	0%	0	0%	0	0%	27	5%
Total	**109,863**	**100%**	**816**	**100%**	**41,730**	**100%**	**2,125**	**100%**	**579**	**100%**

b. Management Allocation Categories (MACs)

The following table summarizes the MAC designations found on Map 5, Land Management Allocations - NW Forest Plan, GP Forest Plan, and gives the reference information where specific management direction can be found.

Table 1-3: Management Area Categories, GP Forest Plan

MAC Designation	Acres	Description	Amendment 11 Pages
LS	385	General Late Successional Reserves	Pages 5-31 to 5-32
ES	2,624	Deer and Elk Winter Range	Pages 6-21 to 6-27
QX	5,165	Mountain Goat Winter Range	Pages 5-33 to 5-36 and 6-28 to 6-32
WW	41,730	Wilderness	Pages 3-7 to 3-14
MX	1,767	Mountain Goat Summer Range	Pages 5-33 to 5-36 and 6-28 to 6-32
RL, RM, DM	19,596	Roaded Recreation without (DM – with) Timber Harvest	Pages 4-14 to 4-16
UD, UH, UL	11,161	Unroaded Recreation without Timber Harvest	Pages 4-22 to 4-24
VL, VM	5,313	Visual Emphasis	Pages 5-49 to 5-51 and 6-41 to 6-44
9L	18	Special Interest	Pages 4-17 to 4-21
2L	910	Developed Recreation	Pages 4-6 to 4-9
NA, NL	7,588	Scenic River	Pages 5-52 to 5-56
TS	58,855	General Forest	Pages 6-25 to 6-27

c. Other Northwest Forest Plan Designations

Key Watersheds - This allocation overlays the land allocation of designated areas. Tier 1 Key Watersheds serve as refugia crucial for maintaining and recovering habitat for at-risk stocks of anadromous salmonids, bull trout and resident fish species. Tier 2 Key Watersheds may not contain at-risk fish stocks, but are an important source of high quality water. Lands included within Inventoried Roadless areas that fall within Key Watersheds have special direction that precludes new road construction (Amendment 11, pages 2-10 to 2-11). See Map 6, Key Watersheds and Roadless Areas.

Riparian Reserves - This allocation includes areas along streams, wetlands, ponds, lakes, and unstable or potentially unstable areas. Riparian Reserves overlay all other management allocations. Riparian dependent resources receive primary emphasis and special standards and guidelines apply (see Amendment 11, pages 2-4 to 2-10). See Map 7, Riparian Reserves.

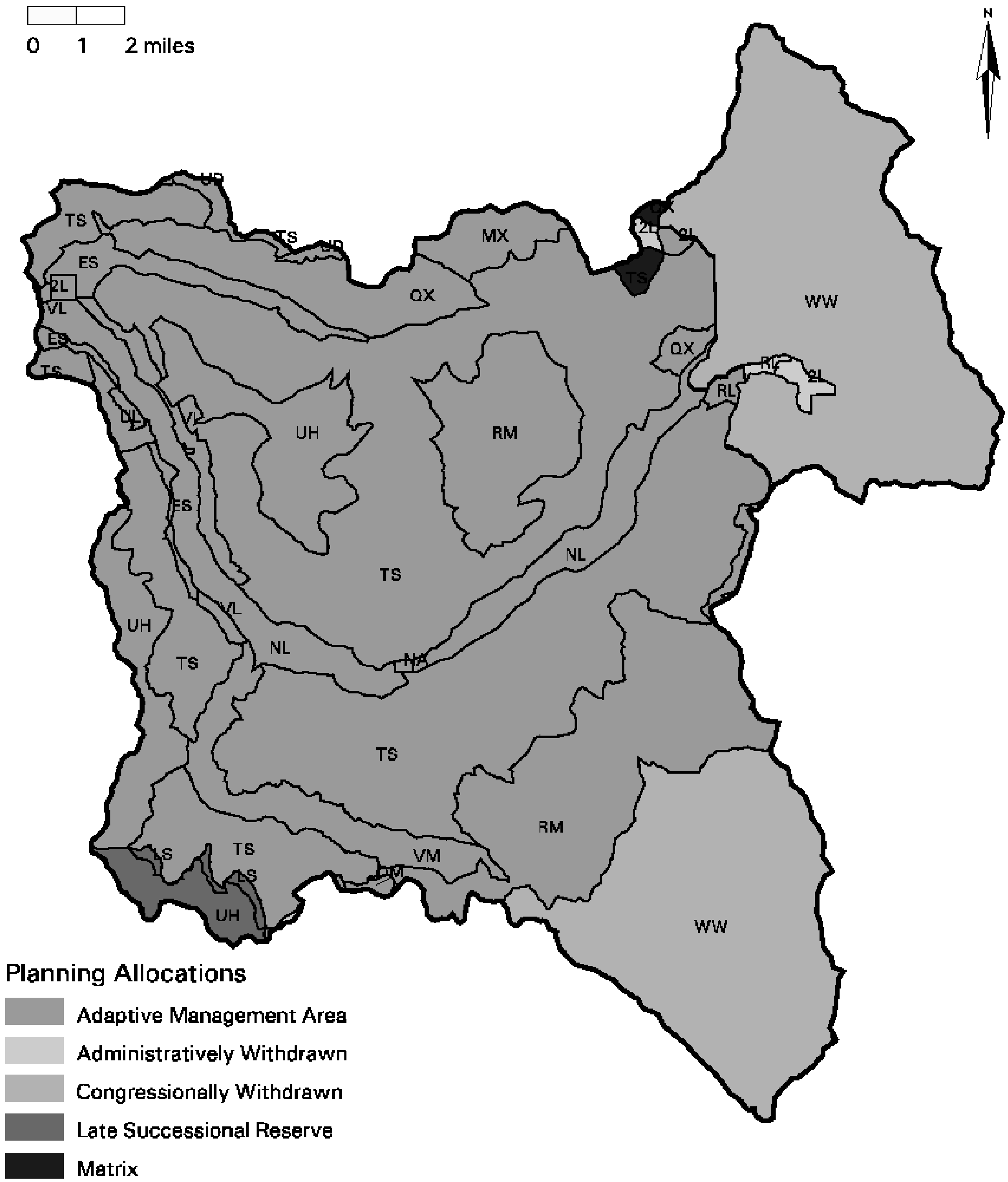
d. Other Areas of Interest

Inventoried Roadless Areas – Inventoried Roadless Areas are areas without roads that have been identified as having the potential for designation as Wilderness. The Northwest Forest Plan included references to these areas in regard to their value as high quality habitats in Key Watersheds. No new roads will be constructed in roadless areas in Key Watersheds. See Map 6 for their locations.

Map 5

UPPER CISPUS WATERSHED ANALYSIS

Land Management Allocations - NW Forest Plan, GP Forest Plan



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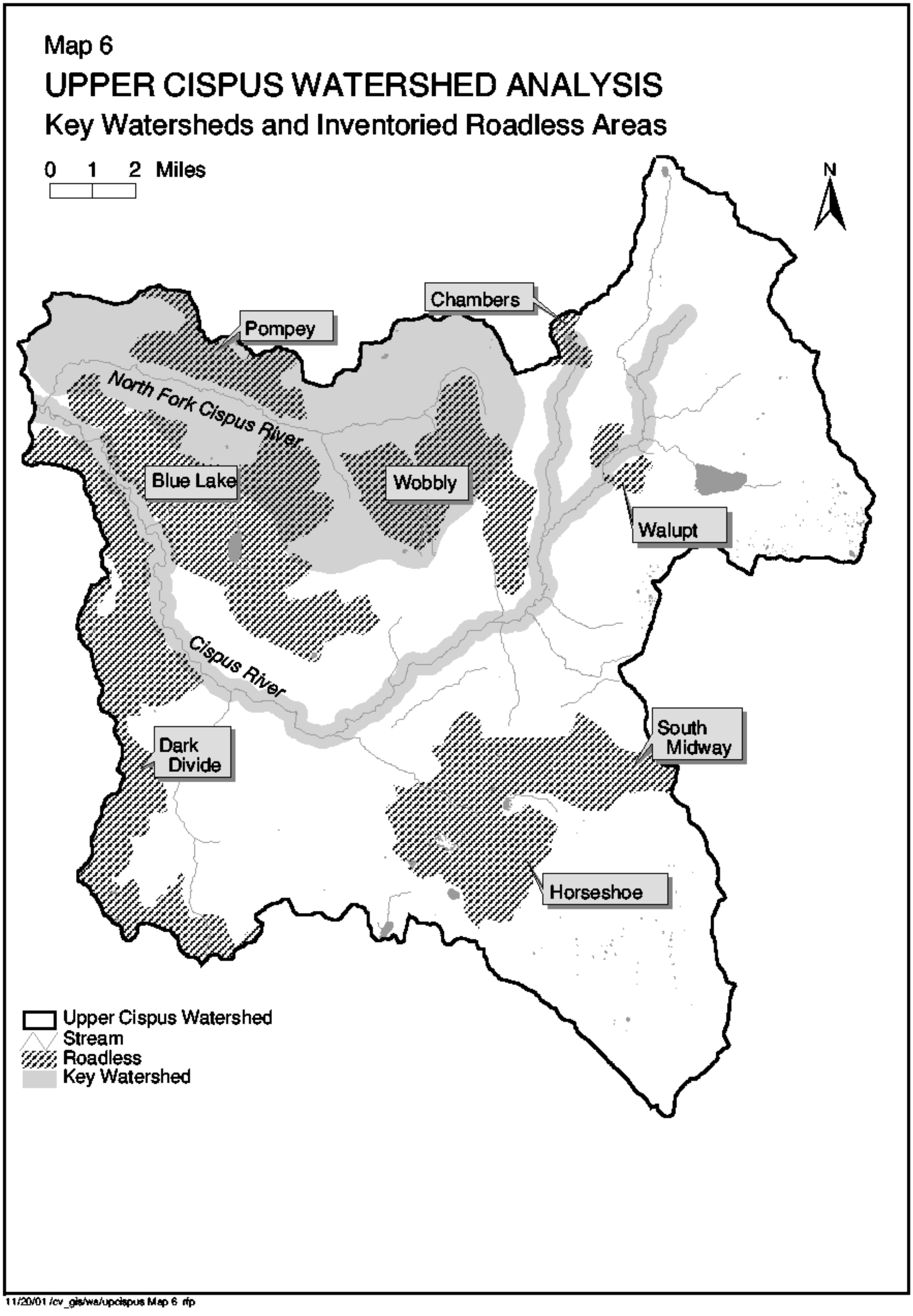
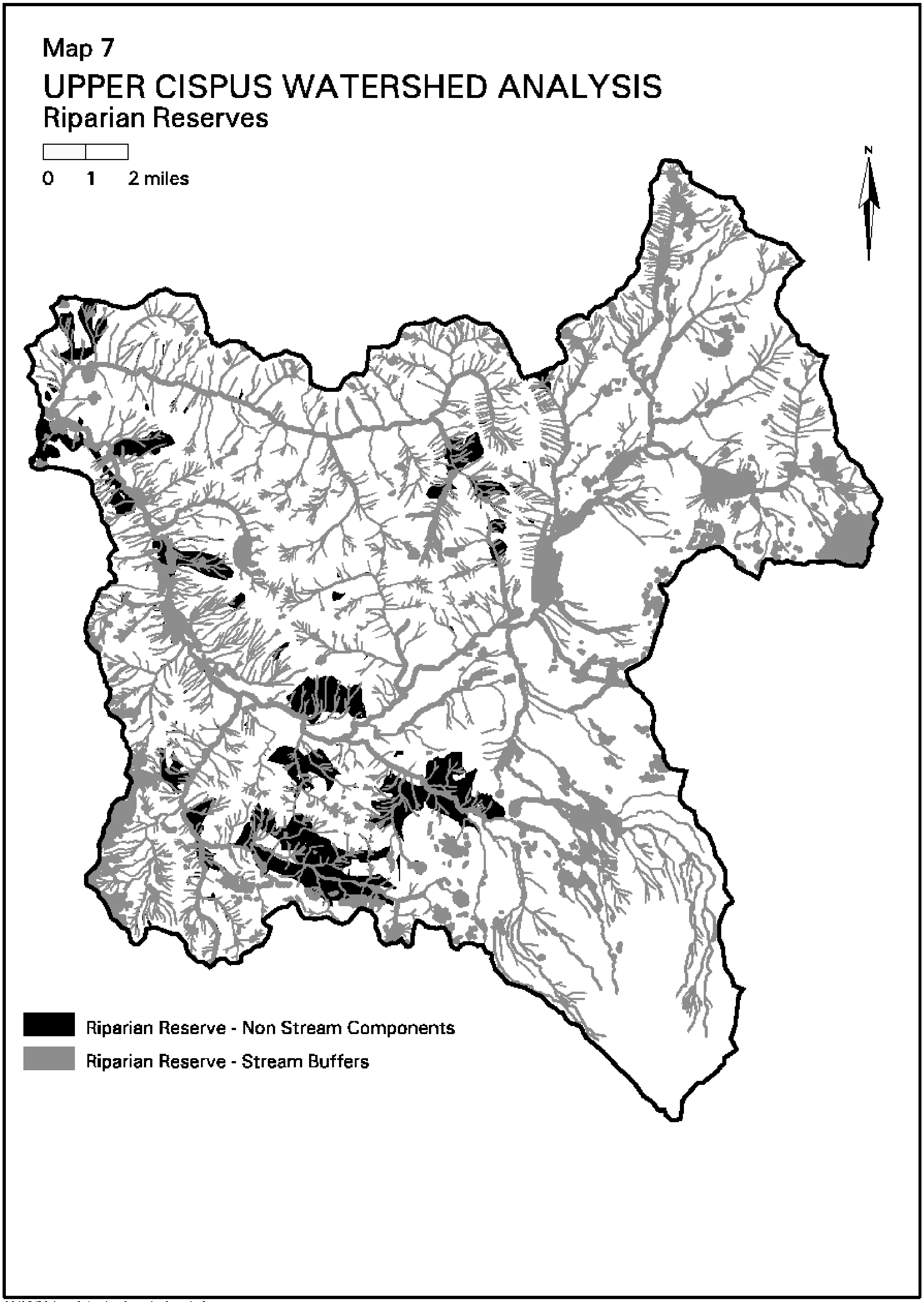

Map 6
UPPER CISPUS WATERSHED ANALYSIS
Key Watersheds and Inventoried Roadless Areas
0 1 2 Miles
N
Chambers
Pompey
North Fork Cispus River
Blue Lake
Wobbly
Walupt
Cispus River
Dark Divide
South Midway
Horseshoe
Upper Cispus Watershed
Stream
Roadless
Key Watershed
11/20/01 /cv_gis/wa/upcispus Map 6 rfp



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Chapter 2 - Issues and Key Questions

Within any given area there are many issues that must be considered prior to the implementation of management activities. The following list of issues and associated questions focuses this analysis on issues that were deemed most pertinent to management within the Upper Cispus watershed. They are grouped by topical categories to assist the reader in finding particular areas of interest. The issues and key management questions were developed by the interdisciplinary team in association with the line officer on the Cowlitz Valley Ranger District. The analysis questions represent the fundamental information necessary to answer the key management questions. Following each question is a reference to where information about the question can be found within the subsequent chapters of this document.

A. WATER RESOURCES ISSUES

The water quality/quantity issue being addressed is whether changes to vegetation, soils, and aquatic features in the Upper Cispus watershed are having notable or cumulative effects on water quality and quantity. Resources and processes relevant to evaluating these conditions include channel migration and widening, presence of amphibians, condition of fish habitat, amount and frequency of soil disturbance, rates of human-caused sediment input as compared to natural rates, and continuity of late-structural forest in riparian areas.

Key Management Questions

1. For the entire watershed and each 6th field watershed, what is the current rating for each of the 19 fish habitat indicators described by the USFWS? (pages 3-123 to 3-152)

2. For the entire watershed and each 6th field watershed, do existing conditions meet Aquatic Conservation Strategy Objectives? (pages 5-1 to 5-17)

3. Which areas - streams, stream segments, roads, stream crossings, trails, riparian areas, and sideslopes - are in need of restoration in order to improve aquatic habitat? (pages 4-1 to 4-5 and 4-16 to 4-25)

4. What monitoring and other activities are required and recommended according to the Memorandum of Understanding (MOU) with the Washington Department of Ecology? (page 4-6)

Analysis Questions at the 6th field watershed level

1. What is the current and historical[1] occurrence and distribution of fish? (pages 3-80 to 3-92 and 3-104 to 3-111)

2. What is the current and historical condition of water temperatures of perennial streams? (pages 3-5 to 3-21)

3. How does the current water temperatures of perennial streams affect the health and distribution of fish? (pages 4-16 to 4-19)

4. Are there any known water quality problems in addition to stream temperatures? If so, how do these water quality problems affect the health and distribution of fish? (pages 4-19 to 4-25)

5. What is the number, size, and location of Large Woody Debris (LWD) and pools in fish-bearing streams? (pages 3-134 to 3-138)

6. What is the quantity, location, and quality of off-channel fish habitat in fish-bearing streams? (pages 3-138)

7. Where do refugia for aquatic organisms exist in the watershed? (pages 3-138)

8. How and in what streams or stream segments has the morphology, composition, and stability of stream channels changed from historic conditions? How has this affected fish health and habitat? (pages 3-25 to 3-31 and 4-21 to 4-22)

9. Are changes in the peak flows and/or baseflows of streams occurring as a result of past and current land uses?[1] If so, in what streams or stream segments is this occurring? (pages 3-21 to 3-25)

10. What is the current number, density, and location of roads and stream crossings in Riparian Reserves? (pages 3-139 to 3-140)

11. What is the current road density outside of Riparian Reserves? (pages 3-140)

12. What is the current Hydrologic Recovery (in percent) of each sub-watershed? (pages 3-140 to 3-142)

13. What is the condition of Riparian Reserves in terms of providing the desired amounts of shade and LWD to perennial streams? (pages 3-16 to 3-21 and 4-1 to 4-3)

14. Where have land use activities caused or contributed to mass wasting or surface erosion? (pages 3-152 to 3-156)

15. How does sediment delivery to streams compare between historic times and today? (pages 3-39 to 3-41)

16. What monitoring of streams and lakes has been done since the implementation of the Northwest Forest Plan in 1994? What monitoring was done prior to 1994 but is still valuable? (pages 3-5 to 3-39)

17. When and of what magnitude did large scale natural disturbances (fires, floods, earthquakes) occur in the watershed? (pages 3-40 to 3-54)

B. BIOLOGICAL RESOURCES ISSUES

1. What is the current distribution and amount of forest vegetation structural stages? (pages 3-64 to 3-71)

2. How has the distribution and amount of forest structural stages changed over time? (pages 3-60 to 3-64)

[1] Historical is defined as before 1950 in the Upper Cispus Watershed. Timber harvest activities in the watershed began in the early 1950's.

3. What is the current status and distribution of Proposed, Endangered, Threatened, and Sensitive (PETS) plant, animal, and fish species and their habitats in the watershed, and are there opportunities present to maintain or improve habitat conditions for these species? (pages 3-72 to 3-92)

   - List of documented and suspected PETS species in the watershed
   - Synopsis of recent survey results

   - Habitat analysis: Northern spotted owl, listed fish

4. What is the status and distribution of survey and manage plant and animal species and their habitats in the watershed, and are there opportunities to maintain or improve habitat conditions for these species? (pages 3-92 to 3-100)

   - List of documented and suspected survey and manage species
   - Synopsis of survey results and known distribution in the watershed

5. What is the status and distribution of selected plant and animal species or groups such as big game species (deer, elk, mountain goats), cavity excavators, exotic plant and animal species, and others within the watershed? Do opportunities exist to enhance habitat conditions for these species, or control numbers and colonization of invasive species? (pages 3-100 to 3-119)

   - Big game winter range habitat analysis
   - Mountain goat distribution
   - List of exotic and invasive plants and animals and distribution in the watershed

6. What is the overall condition of wildlife habitat in the watershed considering forest fragmentation, connectivity of late-successional habitats, special and unique habitats, etc.? (pages 3-199 to 3-123)

   - Fragmentation/interior forest analysis
   - Connectivity analysis (riparian and non-riparian)
   - Listing of special/unique habitats

C. PHYSICAL RESOURCES ISSUES

1. For the watershed and each sub-watershed, what are the potential areas of concern from mass wasting or surface erosion based on natural occurrence and management activities? (pages 3-152 to 3-156)

   - Current information and spatial location of mass wasting events
   - Areas of potentially unstable soils in the watershed and tables by sub-basin of unstable soils.
   - Historical sequence of debris flows and landslides.
   - Transport of material to streams from upland sites.

- Land use activities that may have increased potential for mass wasting or surface erosion.

2. Is sediment from roads reaching streams and what roads are of most concern? (pages 3-155 to 3-156 and 4-4 to 4-5)

    - Miles of road in each sub-basin
    - Proximity of roads to streams.
    - Number of roads crossing streams using bridge or culvert.
    - Known problem roads for maintenance.
    - Current use of roads.
    - Road surfacing type.

3. Are natural disturbances (landslides, volcanic activity, etc.) a potential source for transporting sediment or adding sediment to the natural regime? (pages 3-152 to 3-155)

    - Review tephra deposits in the area from Mount St. Helens.
    - Review literature for other natural activities that may have occurred in the watershed.

D. SOCIAL AND ECONOMIC RESOURCES ISSUES

1. What are the number, distribution, and resource conditions of Concentrated Use Areas (CUA's) within the watershed? (pages4-26)

    - MM/INFRA inventory of CUA's in progress.

2. What recreation uses occur within the watershed and how do they affect resources, especially water resources? (pages 3-156 to 3-159 and 4-3)

    - Recreation user survey, NRUM survey currently in progress; number of users, kinds of use, locations of concentrated recreation use.

3. What are the number, location, and condition of developed recreation sites and trails? (pages 3-159 and 3-161)

    - Trail condition surveys in progress.

4. What are the trends in recreation use and site conditions? (pages 4-25 to 4-28)

    - NRUM study, SCORP and other regional or programmatic studies.
    - Trail and CUA inventories in progress.

5. What are the opportunities for expansion of recreation activities, expansion of existing facilities and trails, opportunities for new facilities? (pages 6-9 to 6-12)

Chapter 3 - Historic and Current Conditions

Introduction

The purpose of this chapter is to describe what is currently known about the historic and current conditions of the various physical, biological, and social components of the watershed. In previous watershed analyses, the difference between historic and current conditions has been used synonymously with the concept of a "range of natural variability." In most cases, we do not have sufficient data to accurately describe a "historic" condition for the entire watershed. Thus, it would be erroneous to conclude that these differences constitute the "range of natural variability." Landres, et al. (1997) states that "natural variability is a complex temporal and spatial property of all ecosystems that is best described with several metrics, not just range."

What we do have, and present in this document, are scattered historic data for small areas, small pieces of the puzzle or discreet snapshots in time, that are better described as "reference" conditions. The historic or reference data are compared to the current condition to determine trends within the watershed. Understanding these trends allows appropriate management activities to be prescribed within the watershed that are designed to lead toward desired future conditions.

Reference (historic) and current conditions are presented for the major terrestrial, aquatic, and social elements of the Little Nisqually watershed in the following narratives. Each topic begins with a statement of the data sources used, data gaps, and any major assumptions that are important to the interpretation of the data.

A. WATER RESOURCES

This section consists primarily of hydrologic information that is not described in the 1995 Watershed Analysis, and most of the hydrologic information in the 1995 Watershed Analysis is not included in this section.

Several of the names of the 6^{th} field sub-watersheds in this section are slightly longer than the names used in the rest of the document, but should be easily recognizable. For example, sub-watershed “Headwaters” is referred to as “Cispus River – Headwaters,” sub-watershed “Chambers” is referred to as “Cispus River – Chambers Creek,” and sub-watershed “Blue” is referred to as “Cispus River – Blue Lake.” The names of the sub-watersheds used in this section are the same as those chosen in the Watershed Delineation of 2000 for the Cowlitz Valley Ranger District.

1. Description of the Watershed

Entire watershed - The watershed is mountainous and forested, and the basin-wide annual average precipitation of 84 inches has given rise to approximately 72 perennial streams. See Map 8 – Stream Classes. The largest perennial stream is the Cispus River, which flows southwest and northwest before entering the Cowlitz River; the Cowlitz River flows west and drains into the Columbia River. Physical characteristics of the Cispus River watershed are listed in Table 3-1.

TABLE 3-1: Physical characteristics of the Upper Cispus River watershed.

Drainage area	234.87 square miles. 5th field Hydrologic Unit Code of 1708000404.
Elevation range	▪ Minimum elevation of 1,350 feet at the confluence of the Cispus River and the North Fork of the Cispus River, located at the western edge of the watershed. ▪ Maximum elevation of 12,276 feet at the summit of Mount Adams in the southeastern corner of the watershed. Several peaks are greater than 7,400 feet in the Goat Rocks wilderness, located in the northeastern edge of the watershed.
Climate	▪ Warm, dry summers and cool, wet winters. ▪ 84 inches of annual precipitation over the entire watershed.
Land cover and vegetation	▪ 83% of the watershed is forested. Forests are dominated by conifers: Douglas-fir, Pacific silver fir, western hemlock, mountain hemlock, western red cedar, Alaska yellow cedar, western white pine, and lodgepole pine. Hardwood trees include: big leaf maple, red alder, and vine maple. ▪ 17% of the watershed consists of lakes, rivers, meadows, rock outcrops, and glaciers.
Largest river	▪ Cispus River. ▪ 55.4 kilometers (34.4 miles) in length in the Upper Cispus River watershed. ▪ Flow of approximately 700 to 300 cubic feet per second (cfs.) from August to early October. ▪ Source areas: Goat Rocks (peaks over 7,000 feet) and Mount Adams (12,276 feet).
All rivers and streams	▪ Approximately 72 perennial streams, totaling 396.9 kilometers (246.5 miles) in length. ▪ Other major perennial streams: Muddy Fork, Adams Creek, North Fork Cispus River, Chambers Creek, Cat Creek, East Canyon Cr., Blue Lake Creek.
Lakes	▪ 19 lakes and ponds, ranging in size from 3.5 to 384 acres. All lakes are above 2,500 feet in elevation. ▪ Walupt Lake, 384 acres in size with a maximum depth of 295 feet. ▪ Blue Lake, 128 acres in size with a maximum depth of 192 feet.
Streams on the 303(d) list for temperature	▪ *East Canyon Creek.* Temperature is above the Washington standard of 16.0^{o}C for a number of days during July and August of every year. ▪ *Cispus River.* Temperature near the confluence with the North Fork of the Cispus River approaches and/or slightly exceeds 16.0^{o}C during a few days in July and/or August of most years. ▪ *North Fork Cispus River.* Temperature is above 16.0^{o} C for 1-3 days during July and/or August of some years.
Geology	▪ Dominated by lava flows less than 40 million years old. ▪ Landscape has been modified by episodes of glaciation in the past 2 million years.
Wildlife	264 vertebrate wildlife species (mammals, birds, reptiles, and amphibians).
Fish	▪ Approximately 127 miles of fish-bearing streams; 25 miles accessible to anadromous species. ▪ Anadromous fish: Chinook salmon, coho salmon, steelhead, sea-run cutthroat. ▪ Resident fish: cutthroat trout, rainbow trout, brook trout (char), bull trout.
Land uses	▪ 31.29 square miles of timber harvest from 1950 to 1993. 27.44 square miles were clear-cut, which is 11.7 percent of the watershed. ▪ 315.37 miles of roads were constructed from 1926 to 1990. This is 1.34 miles of road per square mile of land.

<u>Sub-watersheds.</u> The Upper Cispus River 5th field watershed contains nine 6th field sub-watersheds The sub-watersheds range in size between 15.22 and 43.61 square miles. All of the sub-watersheds contain perennial streams. Physical characteristics of the sub-watersheds are described in Table 3-2. See Map 3, 6th Field Watersheds in Chapter 1.

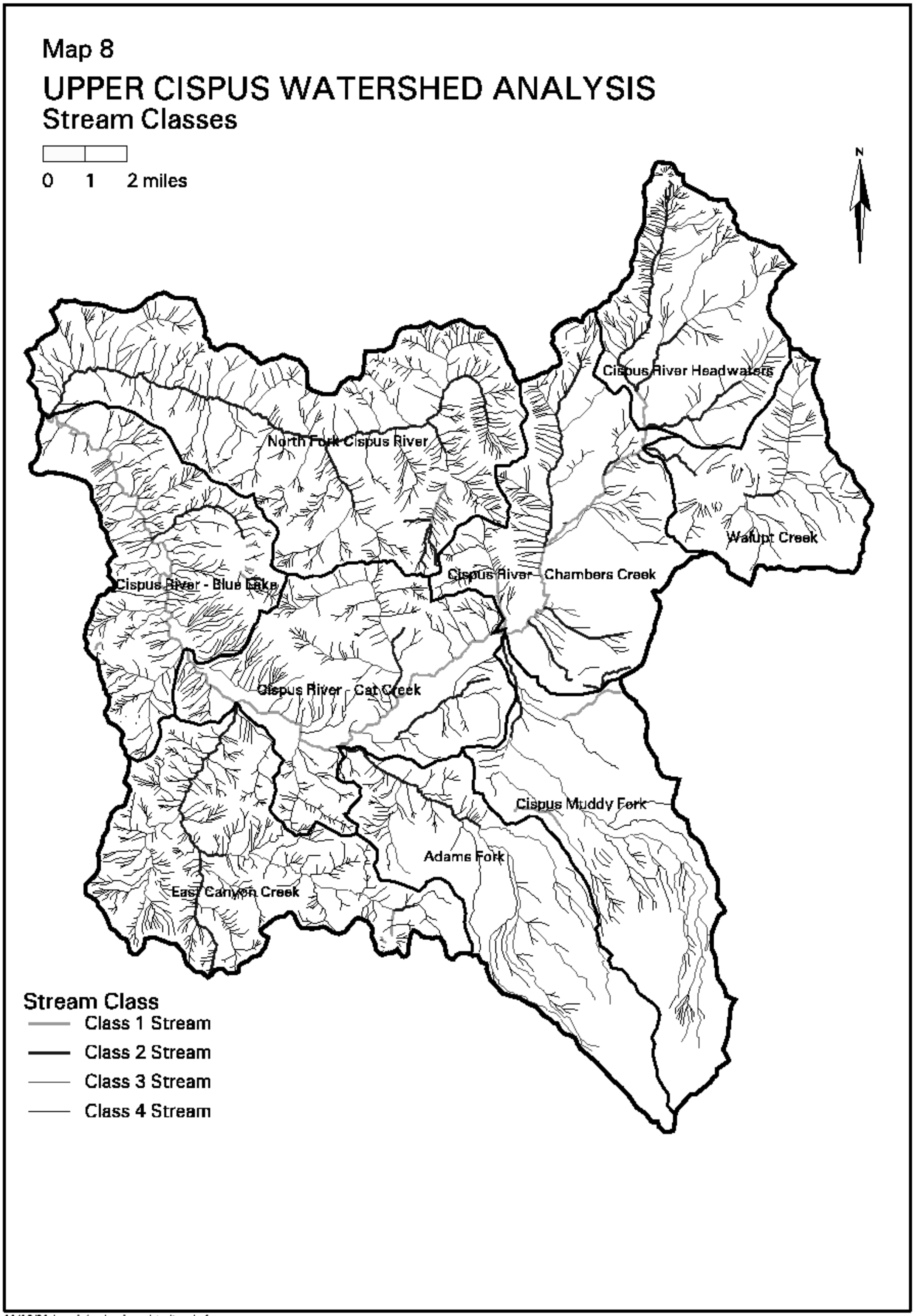

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TABLE 3-2: Physical characteristics of the 6th field sub-watersheds of the Upper Cispus River watershed.

6th field sub-watershed number (HUC1708000404_ _) and name	Size (acres and square miles)	Total perennial stream distance	Number of perennial streams[1]	Names of perennial streams[1]
01 Cispus River Headwaters	12,994.18 acres 20.30 sq. mi.	35.2 kilometers 21.9 miles	7	Cispus River, Goat Creek, and 5 unnamed streams.
02 Walupt Creek	9,741.96 acres 15.22 sq. mi.	16.8 kilometers 10.4 miles	3	Walupt Creek and 2 unnamed streams.
03 Cispus River – Chambers Creek	18,409.53 acres 28.76 sq. mi.	38.1 kilometers 23.7 miles	10	Cispus River, Chambers Creek, Elk Creek, Wesley Creek, Midway Creek, Pimlico Creek, and 4 unnamed streams.
04 Cispus Muddy Fork	17,731.88 acres 27.71 sq. mi.	50.8 kilometers 31.6miles	10	Muddy Fork, Spring Creek, North Fork Spring Creek, South Fork Spring Creek, and 6 unnamed streams.
05 Cispus River - Cat Creek	18,776.71 acres 29.34 sq. mi.	46.1 kilometers 28.6 miles	6	Cispus River, Cat Creek, Orr Creek, Squaw Creek, Mouse Creek, and 1 unnamed stream.
06 Adams Fork	15,685.95 acres 24.51 sq. mi.	52.4 kilometers 32.6 miles	6	Adams Creek, Killen Creek, East Fork Adams Creek, West Fork Adams Creek, and Sheep Creek.
07 East Canyon Creek	18,307.07 acres 28.60 sq. mi.	43.8 kilometers 27.2 miles	7	East Canyon Creek, Dark Creek, Summit Prairie Creek, Table Creek, and 3 unnamed tributaries.
08 Cispus River – Blue Lake	15,637.30 acres 24.43 sq. mi.	37.5 kilometers 23.3 miles	7	Cispus River, Prospect Creek, Juniper Creek, Blue Lake Creek, Slickrock Creek, Horse Creek, and 1 unnamed stream.
09 North Fork Cispus River	27,907.88 acres 43.61 sq. mi.	75.9 kilometers 47.2 miles	16	North Fork Cispus River, St. John Creek, St. Michael Creek, Wobbly Creek, Timonium Creek, Yozoo Creek, Preacher Creek, Siwash Creek, Jackpot Creek, Swede Creek, Irish Creek, and 5 unnamed streams.
TOTALS		**396.9 km 246.5 miles**	**72**	

[1] Perennial streams on August 1, 2000.

2. Stream Temperature Monitoring

Summary

- The natural range of summer stream temperatures in the Upper Cispus watershed has been estimated to be between 11.0 and 19.0 degrees celsius (Middle and Upper Cispus Pilot Watershed Analysis 1995). The temperatures of all streams monitored to date have fallen within this range.
- Three streams – East Canyon Creek, North Fork of the Cispus River, and the Cispus River – are currently on the 303(d) list for elevated temperature because they have exceeded the Washington standard of 16.0 degrees Celsius.
- Stream temperatures have been static from 1991 to 2000. There has not been an overall increase or decrease in summer peak stream temperatures during that time period.
- The temperatures of some streams may decrease in the future. Restrictions on timber harvest

next to streams since the implementation of the 1994 Forest Plan should in time result in an increase in the amount of shade covering some sections of streams.

- Chambers Creek has approached or slightly exceeded the Washington standard of 16.0 degrees Celsius in some years.

Stream temperature analysis in the Upper Cispus River watershed is divided into three time periods.

- Summer of 2000 - Twenty-four sites were monitored on ten streams from July 5 through September 15. Stream temperatures were recorded 24-hours a day every 20 or 40 minutes. Recorded stream temperatures were within approximately 0.3 degrees Celsius of actual stream temperatures – equipment and methods are documented in the Upper Cispus River Water Quality Restoration Plan of 2001.

- 1991 through 1999 - For each year, up to six streams were monitored from July through September. In many cases, the stream temperature equipment and methods were poorly documented or not documented at all. As a result, some of this data is of questionable accuracy and will only be briefly discussed.

- Before 1950 - Although no stream temperature monitoring was recorded before 1950, the likely condition of stream temperatures will be briefly discussed for this pre-timber harvest time period.

a. Summer of 2000

Temperatures of individual streams are listed in Table 3-3. Map 9, Stream Temperature Monitoring Locations, shows where stream temperatures were monitored and what the maximum termperatures were. Figures 3-1 and 3-2 illustrate the stream temperature data. Conclusions are described below.

1 - The annual maximum temperature of the Cispus River is generally between 10.5 and 15.5 degrees celsius (^{o}C). Maximum temperatures generally occur in July and August, and temperatures begin to decrease in early September.

2 - In the summer on a given day, the Cispus River contains three distinct temperature segments.
  - The upper part of the Cispus River - which is contained in sub-watersheds 01, 02, and 03 – is a moderately warm segment. In July and August of 2000, maximum temperatures were generally between 13.0 and 15.0^{o}C.
  - The middle part of the Cispus River – which is contained in sub-watershed 05 – is the coolest of the three segments. In July and August of 2000, maximum temperatures were generally between 11.0 and 14.0^{o}C. The primary reason for this is the inflow of approximately 136 cubic feet per second (cfs.) of cold water from the Muddy Fork – this stream is fed by melt from glaciers on Mount Adams and did not exceed 10.3^{o} C in 2000. Adams Creek also contributes a baseflow of approximately 75 cfs. of cool water to the Cispus River. Stream discharges were measured or estimated on August 1, 2000.
  - The lower part of the Cispus River – which is contained in sub-watershed 08 – is the warmest of the three segments. There are two reasons for this: a) East Canyon Creek contributes approximately 10 cfs. of water that frequently exceeded 16.0^{o} C in July and August of 2000, and b) below Blue Lake Creek, the Cispus River leaves its canyon setting

and the stream channel widens – this results in a dramatic increase in the amount of direct sunlight that hits the stream surface. In August of 2000, the maximum temperature of the Cispus River near its confluence with the North Fork of the Cispus River was generally between 15.0 and 16.0^{o}C.

3 - Three streams exceeded the Washington temperature standard of 16.0^{o}C in the summer of 2000. These three streams are currently on the 303(d) list for elevated temperature (Figure 3-2).

- East Canyon Creek exceeded 16.0^{o}C during 12 days. The maximum temperature was 16.8^{o}C.
- The Cispus River just above the North Fork of the Cispus River reached 16.0^{o}C during one day.
- The North Fork of the Cispus River exceeded 16.0^{o}C during one day. The maximum temperature was 16.2^{o}C.

4 - The outflow streams from Blue Lake and Walupt Lake do not have the same effect on the temperature of the Cispus River.

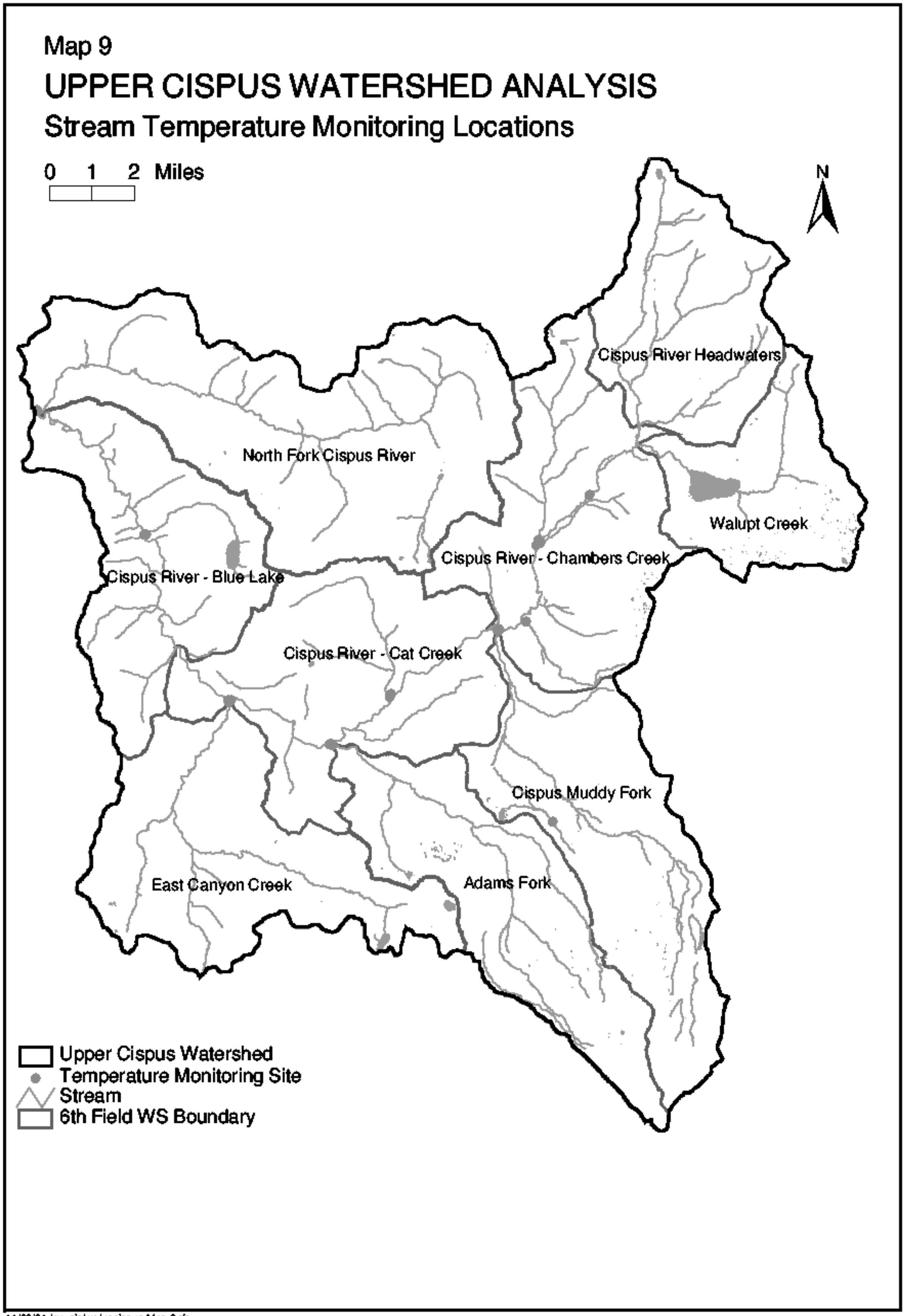
- Blue Lake Creek does not increase the temperature of the Cispus River. Although the surface of Blue Lake warms to nearly 20^{o}C in August, the stream draining from the lake cools substantially as it flows through a shaded canyon before draining into the Cispus River. The maximum 7-day average temperature of Blue Lake Creek in the summer of 2000 was 12.9^{o} C near the confluence with the Cispus River, and the maximum 7-day average temperature of the Cispus River below Blue Lake Creek was 12.7^{o}C.
- Walupt Creek contributes warm water to the Cispus River. The temperature of Walupt Creek at the confluence with the Cispus River was between 16.0 and 20.8^{o}C on most days in July and August of 2001. These temperatures likely mirror the surface temperature of Walupt Lake.

TABLE 3-3: Stream temperature summary for the Upper Cispus River watershed, July 5 - Sept. 15, 2000. Temperatures are in degrees Celsius (^{o}C). Temperatures above the 16.0 ^{o}C standard are in bold.

Sixth field sub-watershed[1] Hydrologic Unit Code 1708000404_ _	**Stream name** (Downstream order)	**Description of monitoring location**	**Maximum temperature (^{o}C)**	**Number of days above 16.0 ^{o}C**	**Maximum 7-day average temp. (^{o}C)**
03 Cispus R. – Chambers Cr.	Cispus R.	Above Road 2160	14.6	0	14.2
	Cispus R	Above Chambers Cr.	15.2	0	15.0
	Chambers Creek	Near confluence with Cispus R.	14.9	0	14.1
	Cispus River	Just below Chambers Cr.	14.9	0	14.3
	Cispus River	Just above Muddy Fork	13.7	0	13.1
	Midway Creek[1]	Near confl. with Cispus R. @ Road 56	13.2	0	12.4
04 Muddy fork	Spring Creek	Above Road 2329	8.1	0	7.8
	Muddy Fork	Near confluence with Cispus R.	10.3	0	9.7
05 Cispus R. – Cat Cr.	Cispus River	Just below Muddy Fork	11.1	0	10.6
	Cispus R.	Just above Cat Creek	12.3	0	11.7
	Cat Cr.	Near confluence with Cispus R.	13.2	0	12.7

	Cispus River	Just below Cat Creek	12.3	0	11.7
	Cispus River	Just above Adams Fork	12.1	0	11.6
	Cispus River	Just below Adams Fork	11.3	0	10.9
	Cispus River	Above East Canyon Cr.	11.4	0	11.0
	Cispus River	Just below East Canyon Cr.	14.2	0	13.8
06 Adams Fork	Adams Fork	Near confluence with Cispus R.	8.6	0	8.2
07 East Canyon Cr.	East Canyon Creek	Near confluence with Cispus R.	16.8	**12**	**16.4**
08 Cispus River – Blue Lake	Blue Lake Creek	Near confluence with Cispus R.	14.0	0	12.9
	Cispus River	Just below Blue Lake Creek	13.1	0	12.5
	Cispus River	Just above North Fork Cispus R.	**16.0**	0	15.2
09 North Fork Cispus River	North Fork Cispus River	Near confluence with Cispus R.	**16.2**	**1**	15.6

[1]There is no stream temperature data for sub-watersheds 01 and 02: Cispus River Headwaters and Walupt Creek.



11/20/01 /cv_gis/wa/upcispus Map 9 rip

FIGURE 3-1: Maximum temperatures of the Cispus River at 12 locations from July 5 - September 15, 2000.

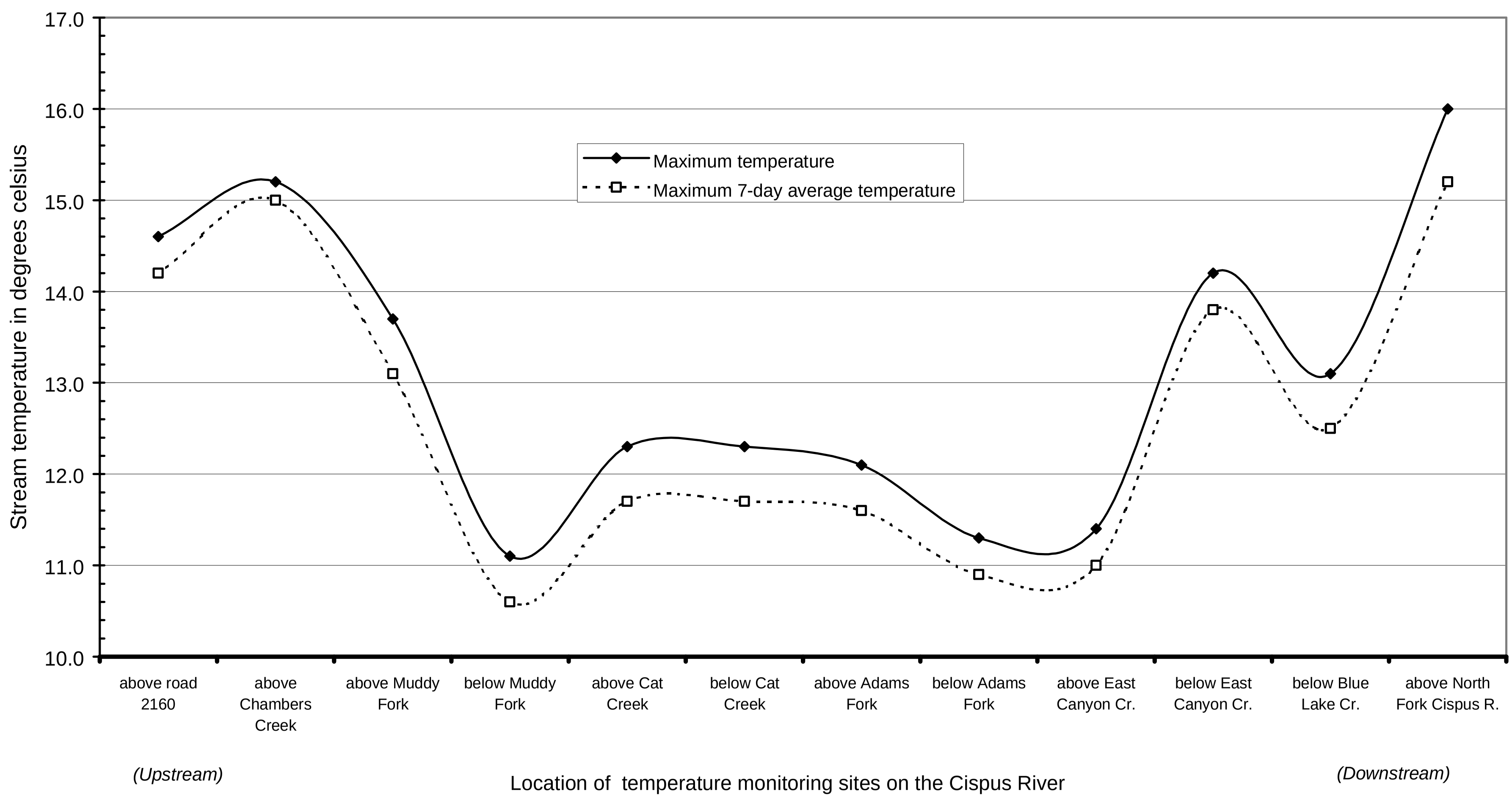
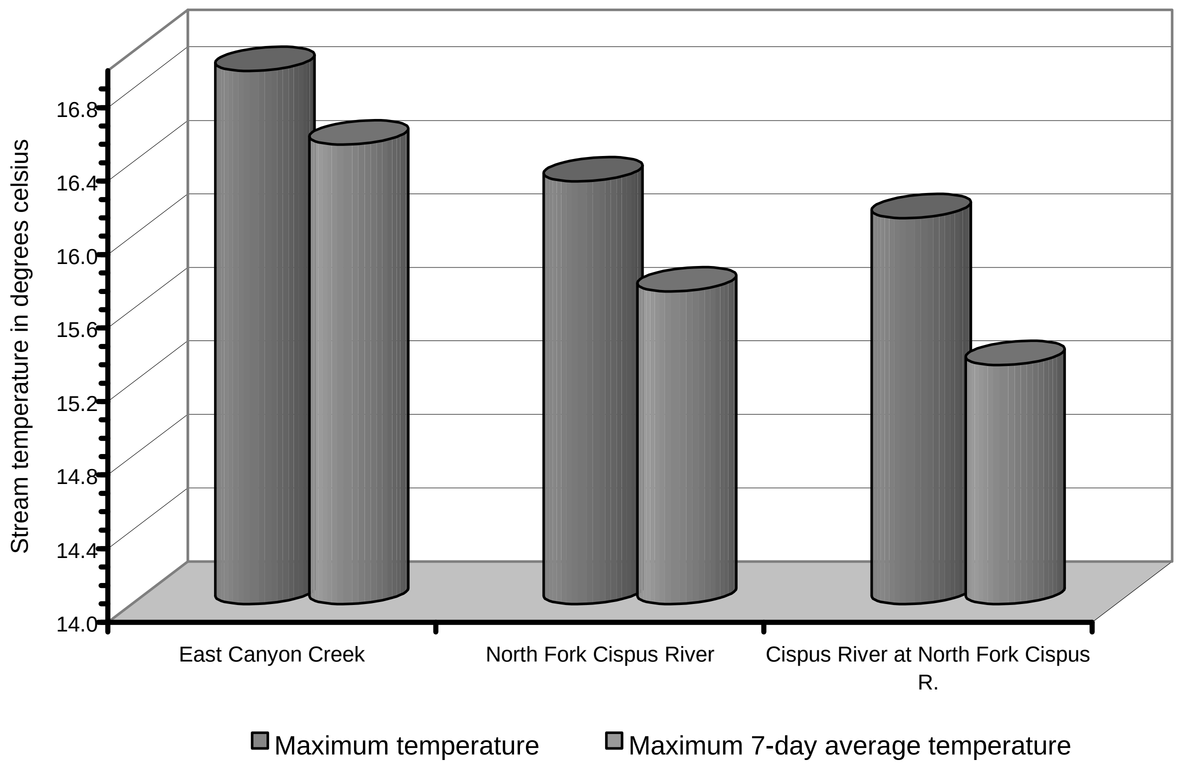


FIGURE 3-2: Maximum temperatures of 303(d) listed streams from July 5 - September 15, 2000.



b. 1991 through 1999

The stream temperature data collected from 1991 through 1999 supports the conclusions previously described for the 2000 data. A few additional conclusions are listed below.

- Streams that exceed the Washington standard of 16.0°C do so only in July and/or August
- East Canyon Creek exceeds the Washington standard of 16.0°C every year during a number of days. As a result, East Canyon Creek should not be considered for removal from the 303(d) list. East Canyon Creek is the warmest stream in the Upper Cispus River watershed of those streams where temperature has been measured.
- The entire North Fork of the Cispus River approaches the Washington standard of 16.0°C every year, but only slightly exceeds the standard for 1-3 days of some years. As a result, the North Fork of the Cispus River may be a candidate for removal from the 303(d) list.
- The Cispus River near its confluence with the North Fork of the Cispus River approaches or slightly exceeds the Washington standard of 16.0°C for a few days every year.
- Chambers Creek slightly exceeds the Washington standard of 16.0°C for a few days during some years.

TABLE 3-4: Stream temperature summary for the Upper Cispus Watershed, 1991 – 1999. Temperatures are in degrees celsius (^{o}C). Temperatures above the 16.0 ^{o}C standard are in bold.

5th field water-shed	Stream name	Monitoring location	Years moni-tored	Total number of days exceeding 16^{o}C	Number of years the temperature exceeded 16^{o}C	Max. temp. during monitoring period	Max. 7-day avg. for all years monitored, ^{o}C, (year)
03	Cispus River	At Road 2160	1994	0	0		14.3 (1994)
03	Chambers Creek	½ mi abv Cispus R. confluence	1994, 2000	**4**	1	**16.4 (1994)**	**16.0** (1994)
03	Pimlico Creek	Near Road 21	1994	0	0		14.0 (1994)
04	Muddy Fork	Near confluence with Cispus R.	1994	0	0		12.3 (1994)
05	Cat Creek (Cispus River)	At Road 78	1997	0	0		10.9 (1997)
05	Cat Creek	Near confluence with Cispus	1997	0	0		
06	Adams Fork	½ mi abv Cispus R. confluence	1994	0	0		10.4 (1994)
07	Dark Creek	East Canyon Cr/	1994	0	0		14.0 (1994)
07	East Canyon Creek	Above Dark Creek	1994, 1995	**51**	2	**18.1 (1995)**	18.3 (1994)
07	East Canyon Creek[2]	Below Dark Creek	1994	**12**	1		**16.6** (1994)
07	East Canyon Creek	Near Cispus R.	1994-1997 1999	**60** (36 days in 1994)		**18.1 (1995)**	**17.9** (1994)
08	Cispus River	Above N. Fork Cispus River	1994	**5**	1	**16.0 (2000)**	15.8 (1994)
09	North Fork Cispus R.	Below St. Michaels Cr.	1994	0	0		15.0 (1994)
09	Timonium Creek	At Road 7800060	1994	0	0		14.1 (1994)
09	North Fork Cispus	At jct. of Roads 22 and 2208	1994	0	0		14.5 (1994)
09	North Fork Cispus	At junction of Roads 22 and 2200043	1994	0	0		14.8 (1994)
09	North Fork Cispus	Near confluence w/Cispus River	1991-1995 1997-1999	**5**	2	**16.2 (1998)**	15.7 (1992)

c. Before 1950

There is no stream temperature monitoring data before the start of timber harvesting activities in the 1950's. Timber harvest activities from the 1950's through the early 1990's may have increased the temperatures of some streams (when compared to stream temperatures before timber harvest activities) primarily for the following reason:

- Buffer strips of trees left next to all streams were not a standard practice until the implementation of the Northwest Forest Plan in 1994. Prior to then, removal of trees up to the edge of some stream channels was fairly common. This greatly reduced the amount of shade covering streams, which in turn increased the amount of direct solar radiation reaching the stream surface.

d. Shade on streams

The amount of shade on perennial streams in the Upper Cispus River watershed was analyzed in detail in the Water Quality Restoration Plan (WQRP) for that watershed in September 2001. Brief extracts of that WQRP are contained below. Shade on streams is provided both by topography and by vegetation. Topographic shade remains constant, however, vegetation shade increases as trees near the stream grow or decreases as human uses or natural processes remove them. Shade on streams is expressed as a percent of stream surface covered by shade on August 1 (when maximum solar radiation typically occurs). Shade classes represent ranges of shade that have different cooling effects to streams. For this analysis shade was divided into four classes:

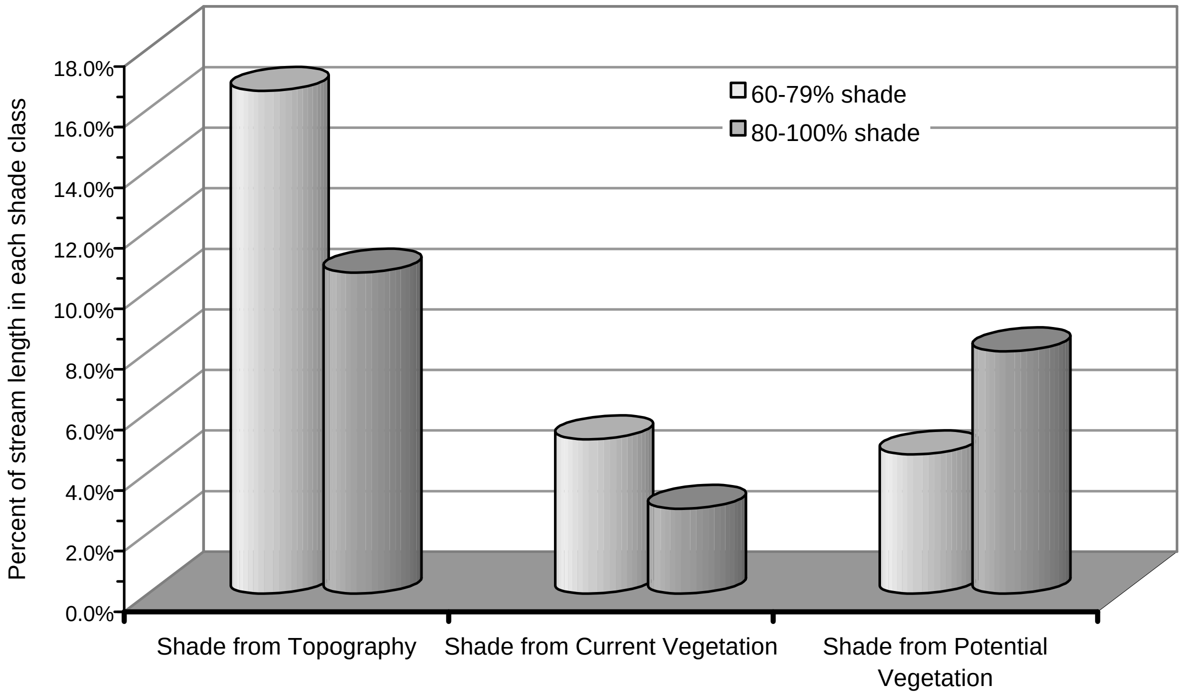
1. 80 to 100 percent shading – which provides maximum stream temperature cooling
2. 60 to 79 percent shading – which provides some cooling effect on stream temperature
3. 30 to 59 percent shading – which provides little cooling effect on stream temperature
4. 0 to 29 percent – which provides minimal or no cooling effect on stream temperature

For parts of the analysis the first two (i.e. 60 to 100 percent) and last two (i.e. 0 to 59 percent) were combined to represent simplified groupings of high and low cooling effects on stream temperatures. For further information, see the Water Quality Restoration Plan for the Upper Cispus River Watershed, September 2001.

Entire fifth field watershed

- Shade from topography on perennial streams exceeds current shade from vegetation for shade classes above 59 percent (Figure 3-3).
- Shade from topography on perennial streams exceeds potential shade from vegetation for shade classes above 59 percent. The difference is far more pronounced for the 80-100% shade class than the 60-79 percent shade class (Figure 3-3). Potential shade is defined as when trees grow to a height of 160 feet.
- Shade from potential vegetation on perennial streams exceeds shade from current vegetation for shade classes above 59 percent (Figure 3-3).

FIGURE 3-3: Comparison of shade from topography to shade from vegetation (current and potential) in the Upper Cispus River watershed on August 1.



Sixth field sub-watersheds

- For the shade class of 80-100 percent, shade from topography on perennial streams exceeds shade from vegetation in four of the nine sub-watersheds (Figure 3-4).
- For the shade class of 60-79 percent, shade from topography on perennial streams exceeds shade from vegetation in seven of the nine sub-watersheds (Figure 3-5).

FIGURE 3-4: Shade from topography and vegetation on perennial streams in 6th field sub-watersheds on August 1, 80-100 percent shade class.

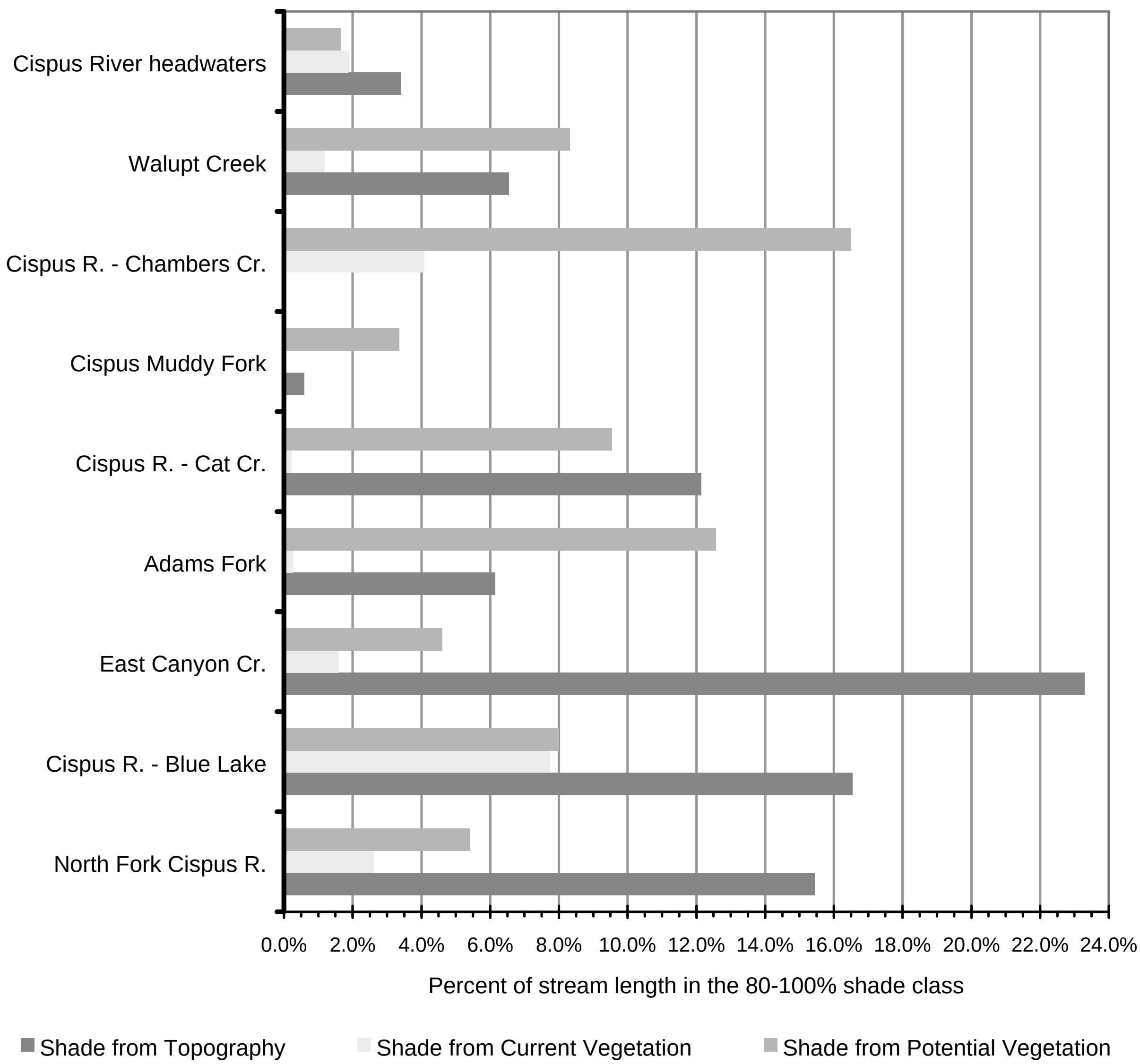
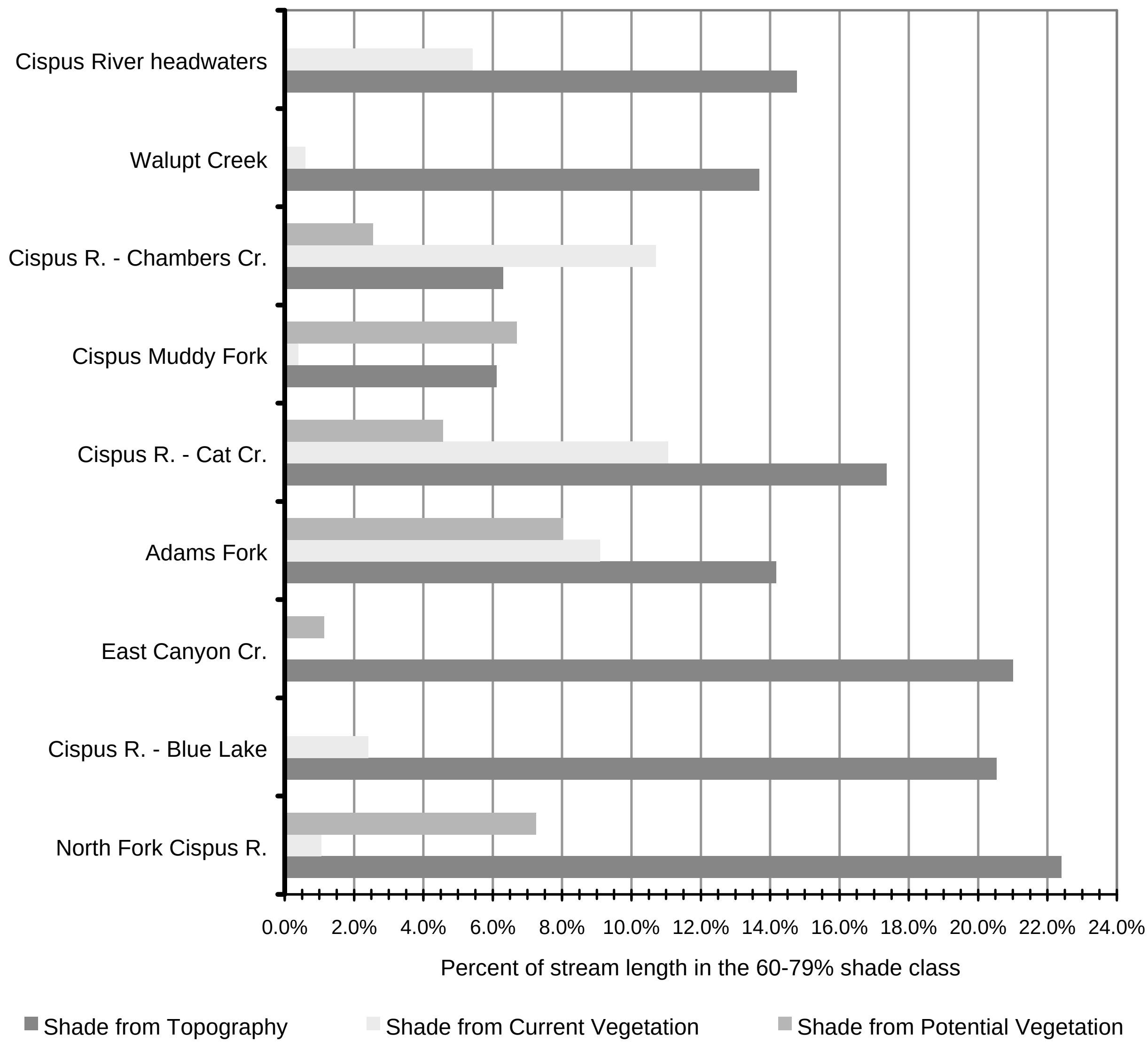


FIGURE 3-5: Shade from topography and vegetation on perennial streams in 6th field sub-watersheds on August 1, 60-79 percent shade class.



3. Streamflow Monitoring

USGS gaging sites

There are no streamflow gaging sites in the Upper Cispus River watershed operated by the United States Geological Survey (USGS). However, there are two gaging sites on the Cispus River less than 4.5 miles downstream of the North Fork of the Cispus River (Table 3-5). The gaging site below Yellowjacket Creek (1432500) is not a good indicator of the streamflow of the Cispus River in the Upper Cispus River watershed. This gaging site includes the flow of Yellowjacket Creek,

which is a major tributary of the Cispus River. The gaging site upstream of Yellowjacket Creek (14231900) *is* a good indicator of the flow of the Cispus River exiting the Upper Cispus River watershed for two reasons.

- There is a 95% percent overlap between the drainage area upstream of the gaging station and that of the Upper Cispus River watershed. The drainage area upstream of the gage is 250 square miles, and the drainage area of the Upper Cispus River watershed is 234.87 square miles.
- The flow of Yellowjacket Creek is not included in the streamflow record of the gage.

The streamflow record (1996 through 2001) from the gaging site upstream of Yellowjacket Creek (14231900) shows the following:

- The flow of the stream was between 300 and 2000 cubic feet per second (cfs.) approximately 90 percent of the time (Figures 3-6).
- High streamflow occurs each year from May through early June as a result of runoff from snowmelt. The peak occurred in May and ranged from 1960 to 5160 cfs.
- The period of low streamflow is from August through early October. Streamflow generally decreases steadily during this time period, with the lowest flow occurring in late September or early October. In the six year time period from 1996 through 2001, the discharge in August through October was in the range of 700 to 300 cfs.
- High streamflow can occur at any time from October through April as a result of rain or rain-on-snow events.

A flow duration curve of the Cispus River is contained in Figures 3-6.

TABLE 3-5: Summary of USGS gages on the Cispus River.

Gage number	Location	Distance downstream of North Fork Cispus River	Drainage area	Period of record	Flow in August through early October	Highest recorded flow
14231900	Cispus R. above Yellowjacket Cr.	2.7 miles	250 sq. mi.	8/27/1996 – 9/10/2000	Flow ranges between 700 cfs. in August to 300 cfs. in October	7,560cfs. on1/1/97
14232500	Cispus R. below Yellowjacket Cr.	4.1 miles	321 sq. mi.	1911 - 1996		31,600 cfs. on 2/8/96

[1] Flow from 10/1/2000 through 9/10/2001 is "provisional', which means that it is subject to revision by the USGS.

Forest Service monitoring

The surface flow (discharge) of streams in the Upper Cispus River watershed was estimated for August 1. The flow of all perennial streams in the watershed on August 1, 2000 was estimated from instantaneous discharge measurements that were taken during the month of August from a number of years. These August 1 estimated discharges were used to calculate the total surface flow contributed by each 6th field watershed to the Cispus River (Table 3-6).

Water withdrawals

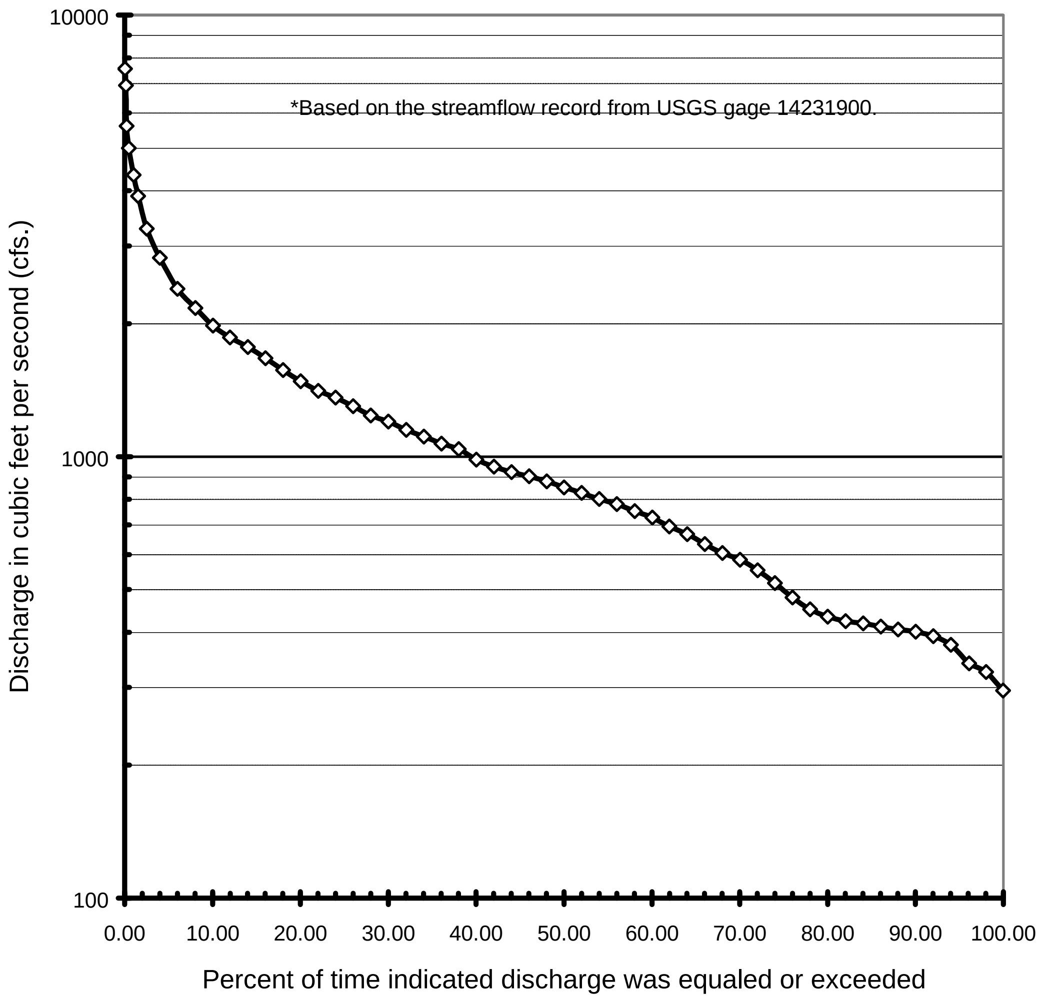
There are currently no water withdrawals from streams in the Upper Cispus River watershed.

TABLE 3-6: Summary of discharges of the Upper Cispus River watershed (5th field) by sub-watershed (6th field) on August 1, 2000.

Name and number of sub-watershed (1708000404_ _)	[1]Surface flow contributed to the Cispus R.	Percent of surface flow of Cispus R.	Perennial streams in addition to the Cispus River	Max. 7-day ave. temp. of a major stream in 2000
Cispus River headwaters (01)	30 cfs.	5.0	Goat Cr., Nannie Cr., 5 unnamed streams	No data
Walupt Creek (02)	12.0 cfs.	2.0	Walupt Cr., 2 unnamed streams.	No data
Cispus River – Chambers Creek (03)	40 cfs.	6.7	Chambers Cr., Wesley Cr., Pimlico Cr., 5 unnamed streams.	14.3^{o}C – Chambers Cr.
Cispus Muddy Fork (04)	136 cfs.	22.9	Muddy Fork, Spring Cr., 6 unnamed streams.	9.7^{o}C – Muddy Fork
Cispus R. – Cat Cr. (05)	83 cfs.	13.9	Cat Cr., Orr Cr., Mouse Cr., Squaw Cr., 2 unnamed streams.	12.7^{o}C – Cat Cr.
Adams Fork (06)	75 cfs.	12.6	Adams Cr., West Fork Adams Cr., East Fork Adams Cr., Killen Cr., Sheep Cr.	8.2^{o}C – Adams Cr.
East Canyon Cr. (07)	15.0 cfs	2.5	East Canyon Cr., Dark Cr., Summit Prairie Cr., 4 unnamed streams	16.4^{o}C – East Canyon Cr.
Ciispus R. – Blue Lake (08)	6.0 cfs.	1.0	Blue Lake Cr., Prospector Cr., Juniper Cr., Slickrock Cr.	12.9^{o}C – Blue Lake Cr.
North Fork Cispus R. (09)	40 cfs.	6.7	St. Johns Cr., Wobbly Cr., Timonium Cr., Yozoo Cr., Preachers Cr., Siwash Cr., Jackpot Cr., Swede Cr., Irish Cr.	15.6^{o}C – North Fork Cispus R.
Upper Cispus River 5th field watershed	**595 cfs.[2]**	**66.6**		

[1]Surface flow, in cubic feet per second (cfs.), was estimated for August 1 based on discharge measurements taken throughout August of 2000.
[2]Surface flow was estimated from the reported discharge at USGS gage 14231900 on August 1, 2000. USGS gage is located 1.5 miles downstream of the confluence of the Cispus River and the North Fork of the Cispus River.

FIGURE 3-6. Flow Duration Curve for the Cispus River above Yellowjacket Creek, 9/27/1996 - 9/10/2001.*



4. Channel Width Monitoring

Channel widths of three streams in the Upper Cispus River watershed were measured from aerial photographs from 1939 through 1998. The channel widths of the Cispus River, the North Fork of the Cispus River, and East Canyon Creek were measured for three reasons:

- Aerial photographs were available for these streams from 1939 through 1998. The 1939 photographs are before widespread timber harvest began in the watershed.
- The widths of the channels of these streams are large enough to be measured at the scales of the aerial photographs. Most of the other streams in the watershed are too narrow for accurate channel measurements at the scales of the aerial photographs.
- These streams contain response reaches that are prone to changes in channel width. Many of the other streams in the watershed are dominated by source reaches and transport reaches, which means these streams are less likely to experience changes in channel widths.

Stream channel widths as measured from the aerial photographs may contain up to 20% error for several reasons:

- The edge of the channel is often obscured by vegetation.
- The edge of the channel is often obscured by shadows.
- The scale of the photographs is different for each year.
- Some of the photographs are not of high resolution.

Stream channel widths of the Cispus River, the North Fork of the Cispus River, and East Canyon Creek – listed in Table 3-7 and graphed in Figures 3-7 through 3-9 - show the following:

- Channel widths increased and decreased several times between 1939 and 1998.
- The channel widths increased after major flood events, then narrowed during the years following the flood events. Channel widths increased between 1973 and 1979 – several flood events occurred during this time period. Channel widths also increased in 1998 – the flood of record occurred in February of that year.
- The greatest changes in channel widths of the Cispus River – over 200 feet between 1993 and 1998 - occurred in the 0.5-mile reach of the stream above its confluence with the North Fork of the Cispus River. Changes in channel widths above the lower 0.5 miles of the Cispus River were less than 70 feet between aerial photograph years.
- The lower 0.25 miles of the North Fork of the Cispus River experienced channel changes – both widening and narrowing – of up to 141 feet between aerial photograph years.

The above information leads to the following conclusion: Flood events have been the primary cause of stream channel widening in the Upper Cispus River watershed. However, timber harvest and road building may be a contributing factor in stream channel widening – the increase in sediment delivery to streams as a result of those activities may have resulted in more channel widening than would have occurred from flood events alone.

TABLE 3-7: Channel widths of three streams in the Upper Cispus River watershed.

		Channel width in feet for the indicated year[1,2]					
Stream	**Location on stream**	**1939**	**1973**	**1979**	**1993**	**1998**	**Comments**
Cispus River	0.5 mile reach above conf. with North Fork Cispus River[1]	296	205	372	199	455	Average width over 0.5 mile stream reach
	0.05 miles above Blue Lake Cr.	111	82	100	97	140	
	miles above Blue Lake Cr.	95	85	112	82	86	
	0.25 miles below Juniper Cr.	137	95	96	98	101	
	0.5 mile reach from Juniper Cr. to road 23 bridge	158	144	133	119	149	Average of two stream width measurements
	Midway between Juniper Cr. and Prospector Cr.		184	185	175	176	
	0.02 miles above Midway Creek		77	81	79	53	
	0.3 miles above Wesley Creek		65	81	37	43	
	0.4 miles below Chambers Cr.		43	55	67	75	
	1.1 miles above Chambers Cr.		42	56	56	95	
	1.7 miles above Chambers Cr.		69	83	72	66	
North Fork Cispus R.	Within 0.25 miles of confluence with Cispus River	41	182	142	83	92	Average width over 0.25 mile stream reach
East Canyon Creek	River mile 1.0		63	140	114	129	
	River mile 2.0		166	168	114	114	
	River mile 3.0		52	49	100	143	

[1] Stream widths were measured from aerial photographs. Measurement error is approximately 20%.
[2] Several major floods occurred between 1973 and 1979. A major flood occurred in 1996.

FIGURE 3-7. Channel widths of the Cispus River at six locations.

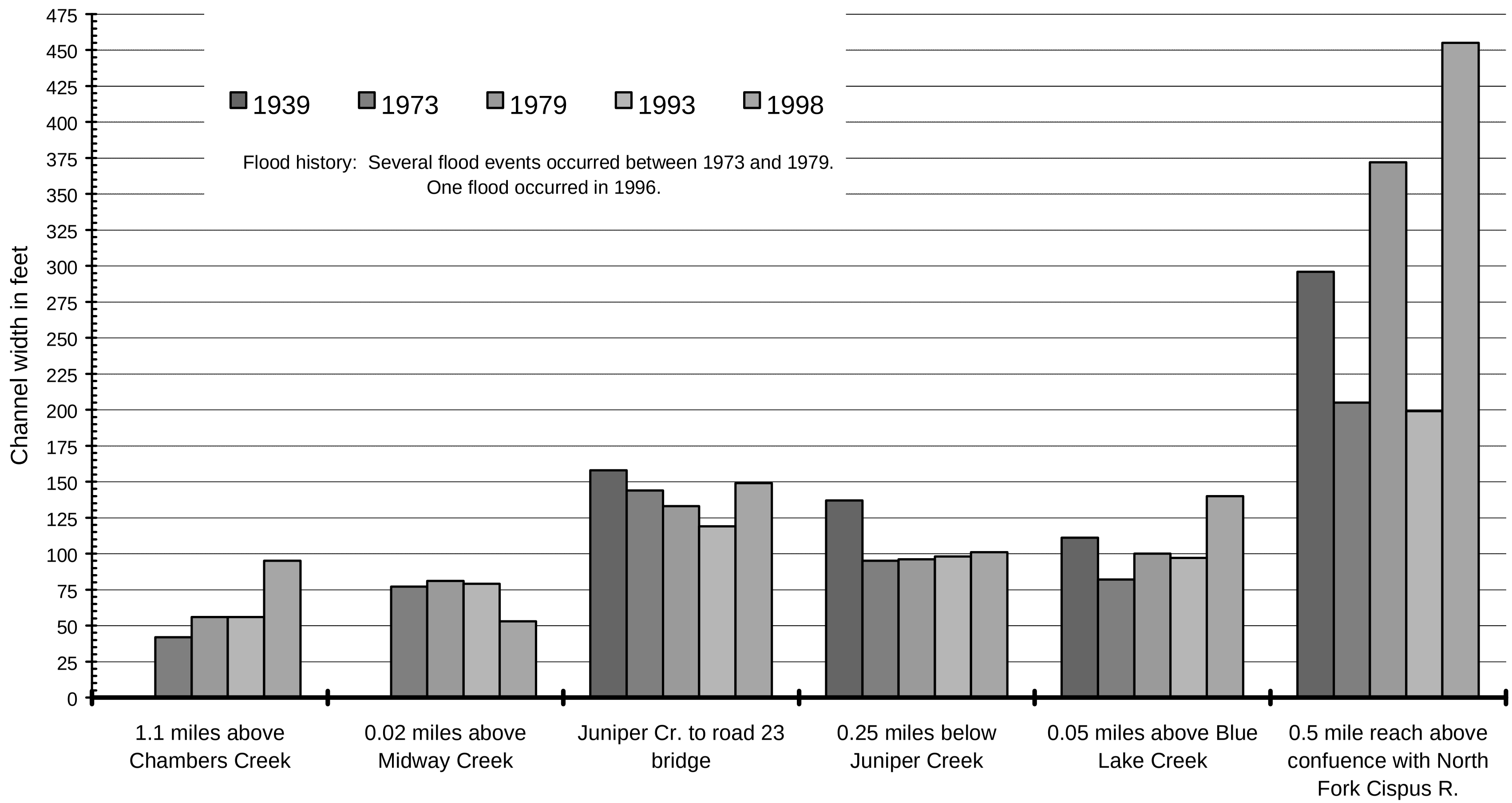


FIGURE 3-8: Channel widths of the Cispus River and the North Fork Cispus River near their confluence.

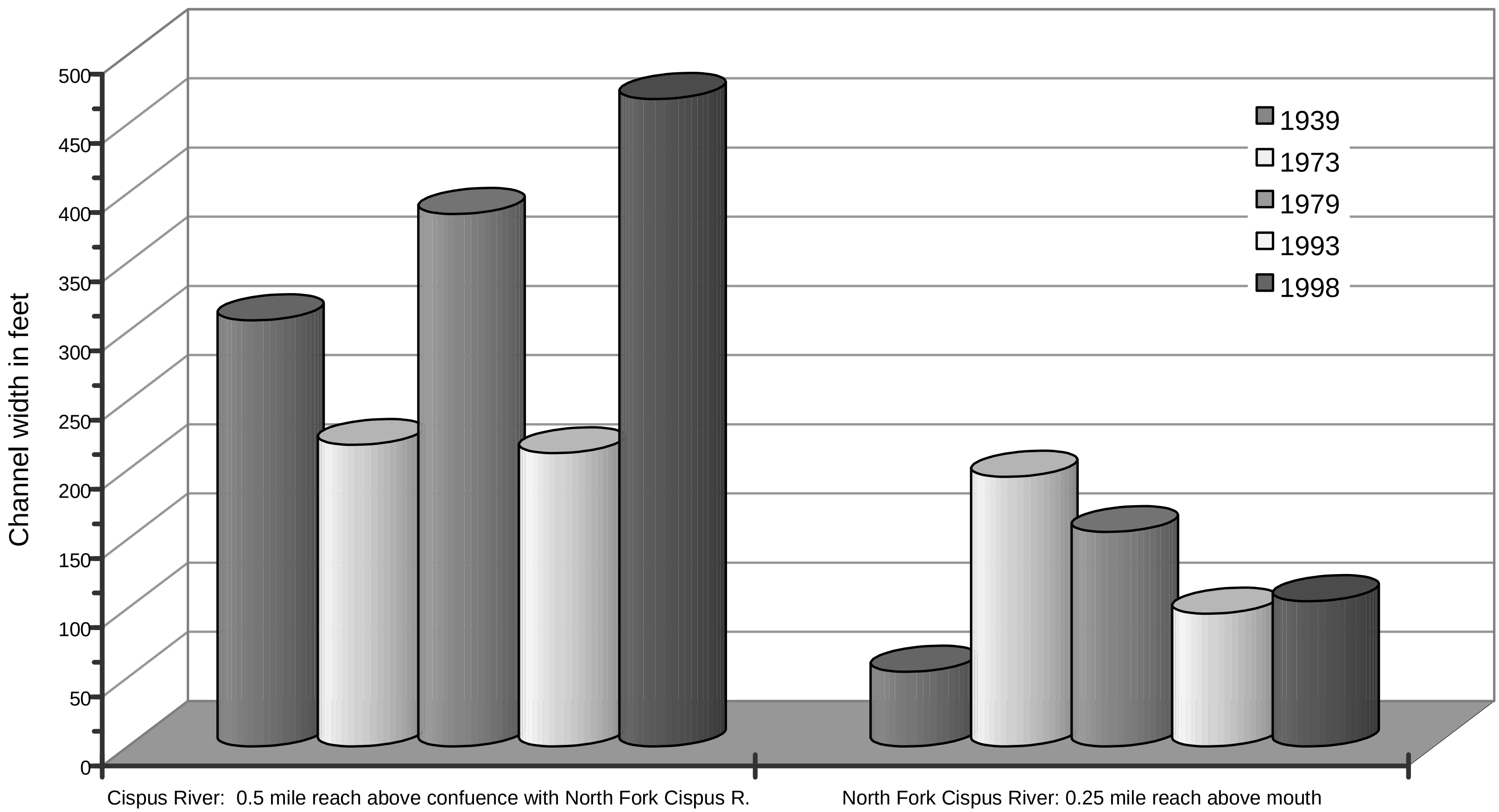
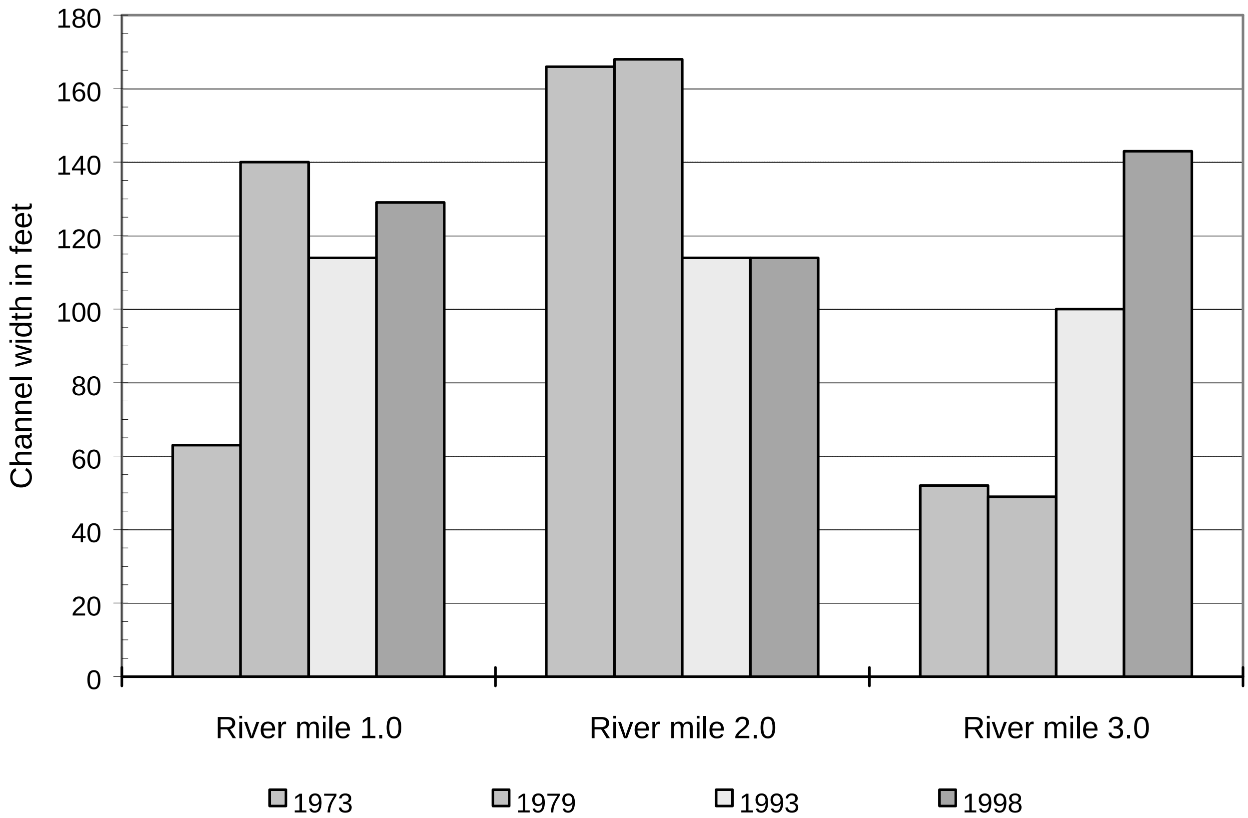


Figure 3-9: Channel widths of East Canyon Creek

Flood history: Several flood events occurred between 1973 and 1979. One flood occurred in 1996.



5. Lake Characteristics

Several lakes in the Upper Cispus watershed have been surveyed since 1999 – Takhlakh Lake, Blue Lake, Olallie Lake, and Chain-of-Lakes. With the exception of Takhlakh Lake, the following text and tables are extracts from the completed lake survey report of each lake – these reports contain detailed descriptions of the physical, chemical, and biological characteristics of each lake.

Blue Lake

Blue Lake is contained in a 1.87 square mile, densely forested basin that sits between 4058 and 5463 feet in elevation. The lake was formed when a lava flow dammed the north end of a glaciated valley. Snowmelt and rainfall have collected behind the lava flow to form a lake with a surface area of 0.20 square miles (128 acres) and a maximum depth of 192 feet.

Blue Lake has the following characteristics of a classic oligotrophic lake.

- Exceptional water clarity. It is possible to see 40 feet vertically down into the lake.

- High water quality. Measured parameters have values in the range seen for unpolluted melted snow.
- Low concentrations of nutrients, phytoplankton, and zooplankton.
- Narrow littoral zone with little vegetation.
- Lake bottom composed of coarse materials (sand, gravel, cobble) and bedrock.

Several interrelated factors are responsible for the oligotrophic nature of the lake.

- Blue Lake is a relatively large, deep lake in a small drainage basin. This means that the volume of water in the lake dilutes the small amount of dissolved and suspended material flowing into it.
- The climate of the basin, as well as the surface of the lake, is warm for only two to three months in the summer. As a result, high rates of biological activity are restricted to the surface of the lake for only that short time period.
- The geology of the drainage basin is less than 30 million years old. In terms of geologic time, there has been little time for the rock units to decompose physically and chemically, which in turn limits the amount of material that erodes into the lake.
- The watershed is relatively pristine. There are a few trails, but no roads or buildings. The watershed has never been logged. Land use is limited to a minor amount of recreation in the summer and fall.

Blue Lake probably did not have fish before the lake was stocked with Eastern brook trout in the 1920's. The brook trout present today are small in size and low in fat content. Several factors, all tied to the oligotrophic nature of the lake, are responsible for this.

- The density of edible zooplankton is extremely low.
- The littoral habitat extends only 5 to 50 feet from the shoreline; this is only eight percent of the lake's surface area.
- The lake contains low concentrations of nutrients such as nitrogen and phosphorous.

Although Blue Lake is accessible only by several trails, recreation at the lake in the summer includes a number of activities – hiking, camping, fishing, floating in small rafts, and horseback riding. A few campsites exist on northeastern corner and eastern side of the lake.

TABLE 3-8: Summary of the characteristics of Blue Lake.

<u>Location</u>
USPLSS: T.11 N., R.9 E., Section 33.
USGS quadrangle: Blue Lake.
Aerial photograph #: 1993 393-27.
Present land use: Unroaded Recreation MAC, Cispus Adaptive Management Area (AMA) [NW Forest Plan].

<u>Drainage basin</u>
Name of drainage basin: Blue Lake Creek.
Basin area: 1.87 square miles.
Drainage basin area, excluding lake: 1.67 square miles.
Relief: maximum elevation of 5463 feet, minimum elevation of 4058 feet.

Drainage basin/lake area ratio: 9.35
Basin relief: 3.19%
Geology: Dominated by volcanic lava flows composed of andesite and basalt.
Geomorphic lake type: Volcanic activity (lava flow dam).
Aspect: North
Chained lake: No

Lake
Origin: Damming of glaciated valley by a lava flow.
Elevation: 4058 feet, with a one foot fluctuation.
Surface area: 0.20 square miles (128 acres).
Maximum depth: 192 feet, at north end of lake.
Average depth: 84 feet.
Maximum length: 4,200 feet, measured northeast to southwest.
Maximum width: 1620 feet, measured perpendicular to maximum length.
Length of shoreline: 10,400 feet.
Volume of water: 11,015 ac-ft.
Ice free months: mid May through late November.
Retention time: 366-730 days (estimated).

Water quality data
Turbidity : 0.42 Nephelometric Turbidity Units (NTU)
Secchi disk depth: 41 feet.
Trophic state: oligotrophic.
pH : 7.9 to 8.0
Alkalinity: 5.63 milligrams per liter (mg/L).
Conductivity : 27.8 to 32.5 micomhos per centimeter (umho/cm).
Total dissolved solids: 15 to 24 mg/L (estimated from conductivity).
Nutrients: similar to that of melted snow in unpolluted areas of the Western United States.

TABLE 3-9: Summary of water quality parameters of Blue Lake.[1]

Parameter	< 2 feet deep	5 feet deep	10 ft. deep	Comparison to criteria or reference conditions
Clarity as Turbidity, NTU	0.42			Considered extremely clear with low suspended sediment.
Clarity as Secchi disc depth, feet			41	Value greater than 32 feet is considered excellent.
pH	7.9			EPA criteria of 6.5 to 9.0 to protect aquatic life.
Alkalinity (HCO_3^-), mg/L[2]	5.63	5.58	5.73	Values indicate a "Moderate" sensitivity to acid rain.
Conductivity, umhos/cm	27.8			Melted snow in western U.S.: 2 to 42 umhos/cm.
Total Dissolved Solids (TDS), mg/L	15 -21			Less than 1,000 mg/L is "fresh" water.
Total Phosphorous (TP), mg/L	0.009	0.007	0.007	Should be less than 0.025 mg/L to prevent eutrophication.
Nitrogen (NO_2^- + NO_3^-), mg/L	0.001	0.001	0.001	Melted snow in the western U.S: 0.02 to 0.62 mg/L.
Chloride (Cl^-), mg/L	0.70	0.79	0.72	Melted snow in Lake Tahoe, Nevada: 1.6 mg/L.
Sulfate (SO_4^{--}), mg/L	0.95	0.96	0.96	Rainwater and melted snow in western U.S.: 0.7 to 7.6 mg/L.
Sodium (Na^+), mg/L	1.53	1.53	1.54	Rainwater and melted snow in western U.S.: 0.0 to 9.4 mg/L.
Potassium (K^+), mg/L	0.16	0.14	0.15	Rainwater and melted snow in western U.S.: 0.0 to 0.6 mg/L.

[1] Nutrients were analyzed by the Forestry Sciences Laboratory, Oregon State University, 3200 Jefferson Way, Corvallis, Oregon 97331. This is in accordance with Memorandum Understanding no. PNW-82-187 between the USDA Forest Service and the Forestry Sciences Laboratory of Oregon State University.
[2] Milligrams per liter. 1.0 milligrams per liter (mg/L) = 1000 micrograms per liter (ug/L).

Olallie Lake

Olallie Lake is contained in a 0.364 square mile, densely forested basin that sits between 4238 and 4500 feet. This lake was formed when an alpine glacier carved a depression in the underlying bedrock. Snowmelt and rainfall have collected in the depression to form a lake with a surface area of 0.024 square miles (15.6 acres) and a maximum depth of 30 feet. Olallie Lake has most of the characteristics of an oligotrophic lake.

- High water clarity. It is possible to see 24 feet vertically down into the lake.
- High water quality. Measured parameters have values in the range seen for unpolluted melted snow.
- Low concentrations of nutrients, and fairly low concentrations of plankton.

There are, however, several characteristics of Olallie Lake that do not match the classic oligotrophic lake. The littoral zone occupies much of the lake, and the substrate of this littoral zone is composed mostly of silt and fine sand.

Several factors are responsible for the oligotrophic nature of Olallie Lake.

- The drainage basin is relatively small compared to the size of the lake. This means that the volume of water in the lake dilutes the small amount of dissolved and suspended material flowing into it.
- The climate of the area, as well as the water in the lake, is warm for three months in the summer. As a result, high rates of biological activity take place during this short time.
- The geology of the drainage basin is less than 0.02 million years old. In terms of geologic time, there has been little time for the rock units to decompose physically and chemically, which in turn limits the amount of material that erodes into the lake.
- The watershed contains limited human disturbance. There is one road, a campground, and a few trails near the lake. Land use is limited to recreation activity in the summer and fall. The watershed has never been logged.

Olallie Lake probably did not have fish before the lake was stocked with Eastern brook trout in 1933. The natural migration of fish into the lake from Sheep Creek is blocked by a number of waterfalls.

The lake is accessible by Forest Service Road 5601, which has resulted in fairly high recreation use in the summer and early fall. Activities include camping, fishing, boating, horseback riding, and hiking. There is a campground with five campsites at the lake, as well as one dispersed campsite outside the designated campground.

TABLE 3-10: Summary of the characteristics of Olallie Lake.

Location
USPLSS: T.9 N., R.10 E., Section 6.
USGS quadrangle: Green Mountain.
Aerial photograph #: 1993 393-108.
Present land use: Roaded Recreation MAC, Cispus AMA [NW Forest Plan]

Drainage basin
Name of drainage basin: Sheep Creek.
Basin area: 0.364 square miles.
Basin relief: 2.5%
Geology: volcanic lava flows composed of andesite, basalt, breccia.
Geomorphic lake type: Glacial Tarns.
Aspect: Southwest

Lake
Elevation: 4238 feet, with a 1 foot fluctuation.
Surface area: 15.6 acres (0.024 square miles).
Maximum depth: 30 feet.
Average depth: 9.6
Maximum length: 1056 feet, measured northeast to southwest.
Maximum width: 845 feet, measured perpendicular to maximum length.
Length of shoreline: 3537.6 feet.
Shoreline development: 2.2%
Volume of water: 83.4 ac-ft.
Ice free months: mid May through late November.

Water quality data
Turbidity : No data.
Secchi disk depth: 24 feet.
Trophic state: oligotrophic.
pH : 7.9
Alkalinity: 1.97 milligrams per liter (mg/L).
Conductivity : 6.6 to 7.4 micomhos per centimeter (umho/cm).
Total dissolved solids: 3.6 to 5.5 mg/L (estimated from conductivity).
Phosphorous, chloride, sulfate, sodium, and potassium: similar to that of melted snow.

TABLE 3-11: Summary of water quality data of Olallie Lake.[1]

Parameter	15 feet deep	Comparison to criteria or reference conditions
Clarity as Secchi disc depth, feet	24	Considered "very good" in the Water Clarity Index.
PH	7.9	EPA criteria of 6.5 to 9.0 to protect aquatic life.
Alkalinity (HCO_3^-), mg/L[2]	1.97	On border of “High” and “Moderate” of sensitivity to acid rain.
Conductivity, umhos/cm	6.6 – 7.4	Melted snow in western U.S.: 2 to 42 umhos/cm.
Total Dissolved Solids (TDS), mg./L	3.6 –5.5	Less than 1,000 mg/L is “fresh” water.
Total Phosphorous (TP), mg/L	0.009	Should be less than 0.025 mg/L to prevent eutrophication.
Nitrogen (NO_2^- + NO_3^-), mg/L	0.000	Melted snow in the western U.S: 0.02 to 0.62 mg/L.

Chloride (Cl^-), mg/L	0.56	Melted snow in Lake Tahoe, Nevada: 1.6 mg/L.
Sulfate (SO_4^{--}), mg/L	0.56	Rainwater and melted snow in western U.S.: 0.7 to 7.6 mg/L.
Sodium (Na^+), mg/L	1.17	Rainwater and melted snow in western U.S.: 0.0 to 9.4 mg/L.
Potassium (K^+), mg/L	0.37	Rainwater and melted snow in western U.S.: 0.0 to 0.6 mg/L.

[1] Nutrients were analyzed by the Forestry Sciences Laboratory, Oregon State University, 3200 Jefferson Way, Corvallis, Oregon 97331. This is in accordance with Memorandum Understanding no. PNW-82-187 between the USDA Forest Service and the Forestry Sciences Laboratory of Oregon State University.
[2] Milligrams per liter. 1.0 milligrams per liter (mg/L) = 1000 micrograms per liter (ug/L).

Chain-of-Lakes

Chain-of-Lakes are contained in a 0.56 square mile, densely forested basin that sits between 4520 and 4347 feet. This lake was formed when an alpine glacier carved a depression in the underlying bedrock. Snowmelt and rainfall have collected in the depression to form seven separate lakes with a total surface area 25.4 acres (0.04 square miles) and a maximum depth of 16.5 feet. Chain-of-Lakes has most of the characteristics of an oligotrophic lake.

- High water clarity. It is possible to see vertically down to the bottom of the lake.
- High water quality. Most measured parameters have values in the range seen for unpolluted melted snow.
- Low concentrations of nutrients, and fairly low concentrations of plankton.
- Fish populations that are naturally sparse or absent.

There are, however, several characteristics of Chain-of-Lakes that do not match the classic oligotrophic lake. The littoral zone occupies much of the lake, and the substrate of this littoral zone is composed mostly of silt.

Several factors are responsible for the oligotrophic nature of Chain-of-Lakes.

- The drainage basin is relatively small compared to the size of the lake. This means that the volume of water in the lake dilutes the small amount of dissolved and suspended material flowing into it.
- The climate of the area, as well as the water in the lake, is warm for three months in the summer. As a result, high rates of biological activity take place during this short time.
- The geology of the drainage basin is less than 0.02 million years old. In terms of geologic time, there has been little time for the rock units to decompose physically and chemically, which in turn limits the amount of material that erodes into the lake.
- The watershed contains limited human disturbance. There is one road, a campground, and a few trails near the lake. Land use is limited to recreation activity in the summer and fall. The watershed has never been logged.

The lake is accessible by Forest Service Road 2329022, which has resulted in fairly high recreation use in the summer and early fall. Activities include camping, fishing, boating, horseback riding, and hiking. There is a campground with three campsites at the lake, as well as one dispersed campsite outside the designated campground.

TABLE 3-12: Summary of the characteristics of Chain-of-Lakes.

Location
USPLSS: T.9 N., R.10 E., Sections 5 and 6.
Aerial Photograph #: 1993 393-109.
Present land use: Roaded Recreation MAC, Cispus AMA [NW Forest Plan].

Drainage basin
Name of drainage basin: Green Mountain.
Basin area: 0.56 square miles.
Maximum elevation: 4520 feet.
Minimum elevation: 4347 feet.
Drainage basin/lake area: 18:6
Basin relief: 4.9 square miles.
Geology: Dominated by volcanic lava flows composed of dacite.
Geomorphic lake type: Glacial Tarn (N).
Aspect: North/northeast.
Chained lake: Chain-of-Lakes #1 is a chained lake, Chain-of-Lakes #2, #3, #4, #5, #6 and #7 are not chained.
Origin of lakes: Depressions in underlying bedrock formed by alpine glacier and filled in with snowmelt and rainfall.
Ice free months: mid May through late November.

TABLE 3-13: Summary of water quality parameters of Chain-of-Lakes in July 2000.[1]

Parameter	Lake #1	Lake #4	Lake #6	Lake #7	Comparison to criteria or reference conditions
Clarity as Turbidity, NTU	0.58	0.74	0.83	-	Considered extremely clear with low suspended sediment
Clarity as Secchi disc depth, feet	16.5*	7.2*	9.9*	4.4*	Values greater than 32 feet is considered excellent
PH – laboratory / field	6.9 6.75	6.8 6.48	6.6 6.76	6.8	EPA criteria of 6.5 to 9.0 to protect aquatic life.
Alkalinity (HCO_3^-), mg/L[2]	.95	1.05	.93	1.10	Values indicate a “Moderate” sensitivity to acid rain.
Conductivity, umhos/cm	7.4	9.5	7.8	9.4	Melted snow in western U.S.: 2 to 42 umhos/cm.
Total Dissolved Solids (TDS), mg./L	4.8	6.2	5.1	6.1	Less than 1,000 mg/L is “fresh” water.
Total Phosphorous (TP), mg/L	0.003	0.012	0.004	0.003	Should be less than 0.025 mg/L to prevent eutrophication.
Nitrogen (NO_2^- + NO_3^-), mg/L	0.000	0.001	0.001	0.001	Melted snow in the western U.S: 0.02 to 0.62 mg/L.
Chloride (Cl^-), mg/L	0.14	0.19	0.17	0.58	Melted snow in Lake Tahoe, Nevada: 1.6 mg/L.
Sulfate (SO_4^{--}), mg/L	0.07	0.08	0.08	0.05	Rainwater and melted snow in western U.S.: 0.7 to 7.6 mg/L.
Sodium (Na^+), mg/L	0.76	0.93	0.73	0.93	Rainwater and melted snow in western U.S.: 0.0 to 9.4 mg/L.
Potassium (K^+), mg/L	0.11	0.33	0.19	0.31	Rainwater and melted snow in western U.S.: 0.0 to 0.6 mg/L.

[1] Nutrients were analyzed by the Forestry Sciences Laboratory, Oregon State University, 3200 Jefferson Way, Corvallis, Oregon 97331. This is in accordance with Memorandum Understanding no. PNW-82-187 between the USDA Forest Service and the Forestry Sciences Laboratory of Oregon State University.
[2] Milligrams per liter. 1.0 milligrams per liter (mg/L) = 1000 micrograms per liter (ug/L)
*These are the maximum depths of the lakes. The Secchi disc is visible at the bottom of each lake.

Takhlakh Lake

Takhlakh Lake sits an elevation of 4385 feet, and is nearly circular in shape with a surface area of 35 acres. A survey of Takhlakh Lake was conducted on September 11-14 of 2001. Although the information collected in that survey has not been analyzed at the time of completion of this Watershed Analysis, the following is known.

- The maximum depth of the lake is 33 feet, and approximately one-third of the lake is between 30 and 33 feet deep.
- The lake shows no temperature stratification in the summer. On September 12, the surface of the lake was 18.0^{o}C and the bottom of the lake was 17.5^{o}C.
- The clarity of the lake is very good - the secchi disc depth is 25 feet.
- The pH of the surface of the lake is 7.6, which is only slightly above the neutral value of 7.0.
- The electrical conductivity of the surface of the lake is 9.0 uS, which indicates low dissolved solids.
- The lake is accessible by Forest Service Road 2329026, and a campground borders the northeastern part of the lake. This has resulted in high recreation use in the summer and early fall. Activities include camping, fishing, boating, and hiking.

6. Sediment Delivery to Streams

The amount of sediment currently being delivered to streams probably exceeds the natural background rate (that which would exist without human activities and barring large-scale landscape disturbances such as fires) for two reasons.

- Approximately 11.7 percent of the watershed (27.44 of 234.9 square miles) was clear-cut between the 1950 and 1993, and leaving buffer strips of trees next to streams was not a common practice in the watershed until the 1990's. The increase in sediment delivery to streams from clear-cutting, particularly when small or no buffer strips are left next to streams, has been documented extensively in the literature (Dissmeyer 2000).
- A number of roads exist in the watershed, some of which are close to streams. Five of the nine sub-watersheds contain more than 14 miles of road per square mile of riparian area, and more than one road crossing per linear mile of stream. Erosion of soils from road surfaces and exposed or disturbed soils in the road prism adjacent to these roads that are in close proximity to streams is much more likely to be delivered to the streams and form sediment.

Erosion from mass wasting, roads, and the land surface was estimated in Appendices L through O of the 1995 Watershed Analysis. The actual amount of sediment delivered to streams was not estimated, although research has shown that the actual amount of eroded soil reaching surface water is usually only 2 to 10 percent of the erosion occurring in the watershed (Dissmeyer 2000).

Geologic and Hydrologic Characterization

The Cispus river watershed is extremely variable geologically. The relatively gentle valley bottom between Chambers Lake and Orr Creek suddenly changes to a steep, bedrock gorge above Buck Creek, then broadens to a wide, low-gradient zone of sediment accumulation below Blue Lake Creek. The valley walls consist of long steep slopes dissected by intermittent and occasional perennial streams and frequent rock outcrops and volcanic intrusions. The ancient landforms and glacial action resulted in shallow residual and colluvial soils which have been covered by layers of volcanic ash from eruptions of Mount St. Helens.

The primary disturbance factors that produce sediment are floods and fires. Upland areas have been impacted by a fire interval of less than 200 years which has periodically resulted in severe erosion and sedimentation in the river system during flood events. For example, the riverine sediment depth at the Tom Music bridge exceeds 60 feet.

The last significant fire was in 1918 and burned approximately 50% of the watershed. A similar fire occurred in 1902 on approximately the same area. Since then, the watershed has been recovering from those disturbances. At the same time, that recovery has been affected by timber harvest and road construction since about 1950 as the area was developed for human use.

Then in 1980, the eruption of Mount St. Helens covered much of the area with several inches of volcanic ash which largely settled into the vegetation, but some of which moved through the aquatic system with unknown effect.

A series of floods from 1933, 1975, 1991, and most significantly, in 1996 have periodically moved large quantities of riverine sediment from the hillslopes into the valley bottom below Blue Lake Creek. Much of this sediment had accumulated in side drainages after the 1902 and 1918 fires and was flushed into the main river channel in these floods. Also during these flood events, many hundreds of thousands of cubic yards of this accumulated sediment was rearranged by channel changes resulting from high flows that can produce a 50 to 100-fold increase in flow for a few days. In 1933, 1975 and 1996 the mainstem Cispus between Blue Lake Creek and Stump Creek migrated during each event by filling the active channels with transported sediment and eroding new channels in previously occupied locations across the floodplain.

While sediment input from harvest areas and road failures during these events is unfortunate, the magnitude of effect of management related sources is largely masked by the background movement of natural sediment from the flushing of channels in the roadless and Wilderness areas, from hillside failures and from rearrangement of sediments that form the existing river channels and floodplains.

Water clarity is also heavily impacted by the input of glacial flour from the glacier-fed Muddy Fork that keeps the river heavily discolored during the warm summer months. During low flows in cooler months, the water is quite clear by contrast. The relatively fine sediments from the glacial flour and flood input is largely washed out of the system during flood events leaving the streambeds lined with cobble and boulders with small areas of sand and gravel.

The combination of unstable sediments in stream channels and periodic flooding results in a high level of instability in the main river channel. The river channel is largely unaffected by the relatively small amounts of management related sediment that move through the system during normal flow and occasional high flows.

The overall effect of this variability is a very diverse aquatic system with periodic input of new spawning gravel and large woody debris, periodically rearranged and cleaned by floods, intermittent segments of cascading white water, pools and riffles, and a large wetland complex above Adams Fork. After each periodic flood there is a corresponding recovery period of channel deepening and vegetative recovery along the new streambanks that eventually provides increasing shade until the next channel migration event.

B. BIOLOGICAL RESOURCES

1. Disturbance Regimes

a. Fire and Windthrow

Fire

Fire is and always has been a part of forest ecosystems, functioning as an important disturbance agent in the analysis area. Native peoples everywhere in North America intentionally set fires to improve game habitat, facilitate travel, reduce insect pests, remove cover for potential enemies, enhance conditions for berries, drive game, and for other purposes. In some cases, carelessness also contributed to wildfires. They also took advantage of the resources made available through natural forest fire events when they occurred.

Historically and prehistorically, American Indians managed huckleberry patches through burning. The following is an excerpt from a recent paper titled <u>A Burning Issue-Native Use of Fire in the Mount Rainier Forest Reserve</u> by Cheryl Mack presented at the 24th Annual Conference of the Society of Ethno biology, March 7-10, 2001:

> The issue of if and how native people burned has long been a topic of discussion. Where I work on the Gifford Pinchot National Forest in southwestern Washington State, it has been suggested, based on various sources, that Indians used fire as a tool to manage huckleberry patches. Huckleberries are an early seral species that grow best in areas that have been recently burned. Indian people today claim their ancestors purposefully set fires under very specific conditions in order to manage the huckleberry resource over time and space. But since theses practices were generally curtailed by the Forest Service in the early 1900's, most of this information dates back several generations, and what those specific conditions were has in most cases been lost.
>
> Here's an example from the ethno historic record. Mary Kiona, a Taidnapam woman born in 1868 in the northern part of the Forest, provided this description of huckleberry management:
>
> "…they used to burn, and then after a while the Indians would grow berries, blackberries, and in higher places, huckleberries…every now and then they would burn such a small area in there so that the huckleberries would grow…

> And until some time ago when the white man came, why, they couldn't make any more of them berry patches by starting fires on account of…forest fire hazard and stuff like that. So since then the huckleberry patches have disappeared almost completely from the Cowlitz land today."
>
> Outside of oral tradition, finding evidence for intentional burning is difficult. In many instances, particularly in Forest Service fire reports from the teens, fires were often attributed to carelessness by Indians, assuming they inadvertently left the log burning that was used to dry their berries (Stabler 1910; Wilcox 1911).

In response to public concern generated by the large fires of 1902 and 1918, the Forest Service adopted a policy of suppressing fire, both natural and man-made. A prospector reportedly set the 1902 Cispus Fire "wishing to make traveling easier", while the 1918 Greenhorn Fire was lightning-caused, reburning much of the same area (Leve 1922). For a more complete discussion of past human uses, see the Middle and Upper Cispus River Pilot Watershed Analysis [Pilot] (1995) Appendix D, pages D-1 through D-12.

The following discussion summarizes some of the findings in the Pilot, pages 4-4 through 4-9, as well as some additional information. For a more complete discussion, refer tp the Pilot and Appendix P, Fire Disturbance Module (Pilot Appendices, pages P-1 through P-20).

Fire is an important natural disturbance agent in the planning area. The short term and long term effects of fire are more important than the actual fire event itself. Significant modification of the seral stages of the vegetation and associated fauna has occurred in the past. Fire acts as a disturbance agent by moving vegetative seral stages back to earlier versions. How far back depends on the severity of the fire. Fire severity can vary from a light to severe under burn, a stand-replacing event, or something in between. Direct impacts are the death of the organism through fire intolerance, while the indirect effects are the loss of viable habitat for the organism leading to its displacement from the site or eventual death if mobility to an acceptable habitat is not possible. The inverse is also true. Fire creates new habitat for early seral species, and without early seral habitat these species would disappear. Fire releases stored nutrients for on-site and off-site uses, which may enhance or inhibit growth on those sites. Fire can be an agent for in-stream recruitment of large woody debris for a short time and may cause a long term deficiency due to lack of large trees in the new stand for a period of time. Fires that burn through riparian areas increase siltation to streams. There have been significant areas of the slopes and larger valley bottoms in the analysis area that have experienced stand replacing fire. Riparian areas have moist microclimates that may somewhat protect them from some wildfire events, but certainly don't exclude them from stand replacing fire as can be seen in photos of past fire events such as the Cispus Burn. Reduction of vegetation along streams would decrease shading and elevate stream temperatures, especially in large burned over areas.

From 1710 to 1950, 86 percent of the analysis area that is capable of growing forest shows the effects of fire due to human and natural fire events with some areas reburning during this same period. Parts of the Cispus burned two times (1902,1918), Mount Adams two to three times (1892, 1918, 1919), Spring Creek three to four times (1870, 1892, 1902, 1919), Lakeview two to three times (1750, 1920, 1930), and Pimlico Creek two times (1902, 1918). Stand origin analyses show an average of 200 acres per year (2000 acres per decade) recovering from stand replacement fire in the analysis area, not including the very large fire effects events averaging 18,800 acres per decade represented by the 1720, 1920, and 1930 decades (Pilot, Figure P-5, Appendix P, page P-15).

The range of natural variability for fire is dependent on the fire ecology group being represented. A range of expected acres burned by fire frequency is displayed for each of the five fire ecology groups represented in the planning area (Pilot, Figure IV-2, page 4-6). Theoretical acres burned range from 514 acres per year assuming a low fire frequency to 2,699 acres per year assuming a high fire frequency for the fire ecology groups.

The fire rotation for the planning area is approximately 260 years. This means that we should see the effects of fire on an average of 386 acres per year; this includes the very large fire events (Pilot, page 4-6). This covers the analysis period from 1710 through 1950. This would appear to indicate that the analysis area is probably represented by a low fire frequency. These numbers should be considered with caution due to the relatively short analysis period and small analysis area. The natural fire rotation for an area is defined as the time necessary for fire to burn over and reproduce a given area. Some areas may burn more than once while others may not burn at all. Natural Fire Rotation = (A/F)T where A = area considered in acres, F = number of acres burned in time T, and T = period considered in years. For example, calculations indicate a fire rotation of about 19,000 years looking at 31 years of fire suppression from 1970 through 2001. Fire history must be placed in a 500+ year context over a large area and the analysis, by necessity, is highly extrapolative. No assumptions, interpretations, or recommendations can or should be made at the sixth-field watershed scale. Only high severity stand replacement fires can be mapped using stand origin analysis. It is difficult to map past fire events using this method accurately due to areas reburning masking previous events, the amount of time it can take for stands to reestablish following a fire event can be from 50-75+ years at higher elevations and in harsher environments, small events not being large enough to identify as stands, and low severity fire events not resulting in stand replacement. See Map 10 - Fire History as Determined by Stand Year of Origin.

Table 3-17 (Regeneration Harvest Acres by Decade and 6th Field, page 3-71) indicates 18,618 acres were regeneration harvested in the analysis area over the last 50 years for an average of 372 acres per year. This is close to the calculated average of 386 acres per year of stand replacing fire effects expected in the analysis area mentioned in the preceding paragraph, including wildfire effects during the period. Approximately 70 percent of the past clearcuts were treated with broadcast burning, but the burned clearcuts contained very few of the remnant structural components of unsalvaged wildfire burned areas such as snags and downed logs. Clearcuts also do not appear to mimic the size and distribution of wildfire events over time on the landscape. This is discussed in Current Vegetation: Amount, Distribution, and Location, page 3-45. Therefore, the management created openings do not function in the same fashion as the wildfire created openings for some plants and animals. More recent harvest units are designed to leave more remnant structural components.

Fire reports during last 31 years indicate wildfires have averaged slightly more than 1 acre per event, and about seven acres per year in the analysis area. There were 197 fires that burned about 207 acres since 1970. This includes fifteen small fires that occurred since the Pilot was written and burned about three acres in the analysis area from 1995 through 2001. Fire suppression will not always be this effective, and larger fires will occur. A new Fire Management Plan for the Gifford Pinchot

Forest providing fire suppression guidelines is being written at this time.

Windthrow

Data Sources/Data Gaps

The primary data source for information on windthrow is aerial photo sets from 1959, 1973, 1979, 1985, 1990, and 1998. Those photos, covering discrete points-in-time, do not easily allow the discovery of windthrow that occurred between those points-in-time.

The 1959 aerial photos are the earliest data available for this watershed. There is no reliable information (photographic or otherwise) concerning windthrow in the watershed prior to 1959.

Assumptions

A quick review of past and current aerial photos is sufficient to draw some conclusions about windthrow activity in the watershed.

Reference (Historic) and Current Conditions

We have no knowledge or data about historic windthrow events in this watershed prior to the early-1950's. The only thing we can say is that windthrow events have very likely occurred in this watershed for as long as it has been forested.

Wind is a natural, but elusive, part of the forest ecosystem. It serves as an agent of disturbance across the landscape when it becomes strong enough to topple trees. In this manner, wind becomes a part of the natural recycling of forest stands; playing an important role in maintaining and renewing the forest ecosystem. Wind is always present in the ecosystem, usually at levels low enough not to cause the windthrow of trees. The amount of windthrow caused by the wind can vary greatly from a few, scattered individual trees to large, contiguous patches of several hundred acres.

The actions of the wind, manifested as windthrow, affect and participate in a wide array of ecosystem relationships. Windthrow fosters diversity in the ecosystem by altering stand structure. Windthrow can affect forest succession, soil, wildlife, fish, and the safety of people and structures.

Windthrow Events (location and size)

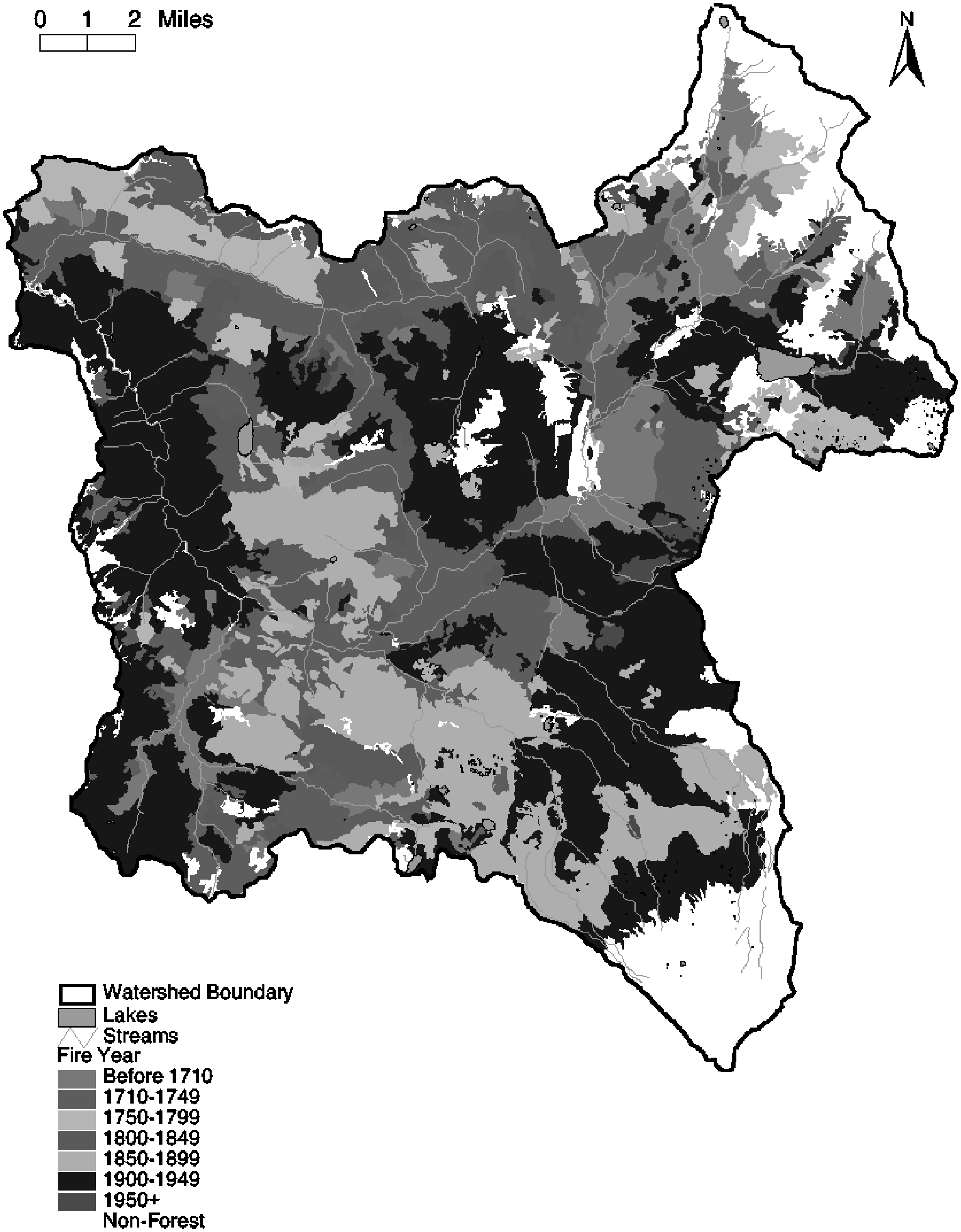
The Middle and Upper Cispus River Pilot Watershed Analysis (1995) identified a total of 116 separate blowdown patches primarily from photo interpretation using aerial photos from 1959 to 1990, but also from other sources to capture events taking place from 1990 to 1994. Based on discussions with District personnel and general knowledge of the watershed no other events involving windthrow have occurred to date (Sept. 2001) except for single tree and small groups (<.2 ac.),events not usually identifiable on the photos.

Windthrow Events (weather and timing)

Map 10

UPPER CISPUS WATERSHED ANALYSIS

Fire History as Determined by Stand Year of Origin



11/20/01 /cv_gis/wa/upcispus Map 10 rfp

Storms associated with windthrow events in this watershed probably involved gale-force and storm-force winds during the fall and winter months (November through February), very often associated with heavy rainfall. There are several categories of gale-force winds and one category of storm winds. The wind speed associated with these categories range from 32 miles per hour to 72 miles per hour.

Information from Harris (1989) and Savill (1983) indicates that windthrow events generally begin to occur when wind speeds reach gale-force or higher. In addition to windspeed, wet, saturated soils from heavy or prolonged rainfall (preceding and during a storm) can be an important contributing factor to windthrow. Rain saturated soils can contribute to windthrow occurring at the lower windspeeds, which under drier conditions probably wouldn't produce windthrow.

The occurrence of windthrow events is tied directly to storm events in the watershed. Determining the exact timing, intensity, and scope of storm events in the watershed is difficult at best because no local records have been kept documenting them, especially in relation to any windthrow that might have been associated with them. While many windthrow events west of the Cascade Range are usually linked to strong storms that blow in from the south or southwest, it is very possible that many of the windthrow events that have occurred in this watershed were a result of strong east winds, especially due to this area's proximity to the crest of the Cascade Range.

Windthrow and Management Activities

The principal management activities that have occurred in the watershed are timber harvest (mostly regeneration harvest by clearcutting, some partial cut salvage, some regeneration by shelterwood, and commercial thinning), road construction, precommercial thinning, and hiking trail construction. No windthrow was identified as being associated with precommercial thinning or hiking trails.

Based on local experience, a substantial amount of individual-tree and small-group-tree windthrow is probably associated with road edges. It is not known exactly how much of this type of road-related windthrow occurs due to the lack of data.

The majority of the windthrow observed on the aerial photos (approximately 85%) was directly related to the edges of clearcuts. Only about 15% of the windthrow events occurred away from clearcut edges. There was no obvious windthrow identified (via aerial photo interpretation) as being associated with shelterwoods or commercial thinnings, although it is known to have occurred to some degree in the watershed.

Risk Analysis

A model is needed to help determine areas of high fire risk at the landscape level, how fire risk will change over time, and whether desired future conditions are attainable or not under current management guidelines due to fire or other disturbance agents.

A combined fire and windthrow risk analysis was done by Pilsun Park as a PhD thesis project for the AMA (Adaptive Management Area). The AMA covers approximately 71 percent of the watershed so there is a data gap or missing data on about 30 percent of the watershed, primarily within the Goat Rocks and Mt. Adams Wilderness areas.

Hazard ratings - Forests in different topographic and soil conditions have different growth rates, susceptibilities to natural hazards, and species compositions; as a result, each area has experienced different disturbance regimes. Fire and windthrow are major disturbance agents in forests affecting the structure of forest communities (Oliver 1981, Marsden 1983, Grimm 1984, Brown 1985, Franklin and Forman 1987, Deal et al. 1991, Price and Bowman 1994, Oliver and Larson 1996). The fire and windthrow hazards are, in many situations, integrated with each other and with stand conditions. Ratings are commonly used to predict risk to stands (Deeming et al. 1977, Lorio et al. 1982, Burgan 1988, Quine 1995, Wilson 1998, Wilson and Baker 1998).

In this study, hazard rating is calculated based on combination of topographic information and vegetation information using Arc/Info, Arc/View and LMS programs.

Fire - Fire type, intensity, size and return interval are fundamental to species distributions, ecological succession, community composition and structure, and landscape patterns and processes (Stewart 1986, Keane *et al*. 1990, Huff 1995), and they are controlled by combination of geoecoclimatic factors. Weather, topography, and fuels are three important factors controlling fire behavior (Agee 1993, Marsden 1983). Fires spread rapidly and evenly over level topography but more slowly and erratically over rough topography.

Several models have been developed to predict fire behavior or rate fire danger using topography, weather and vegetation information (Deeming *et al*. 1977, Rothermel and Rinehart 1983, Burgan 1988, Keane *et al*. 1990, Wilson and Baker 1998).

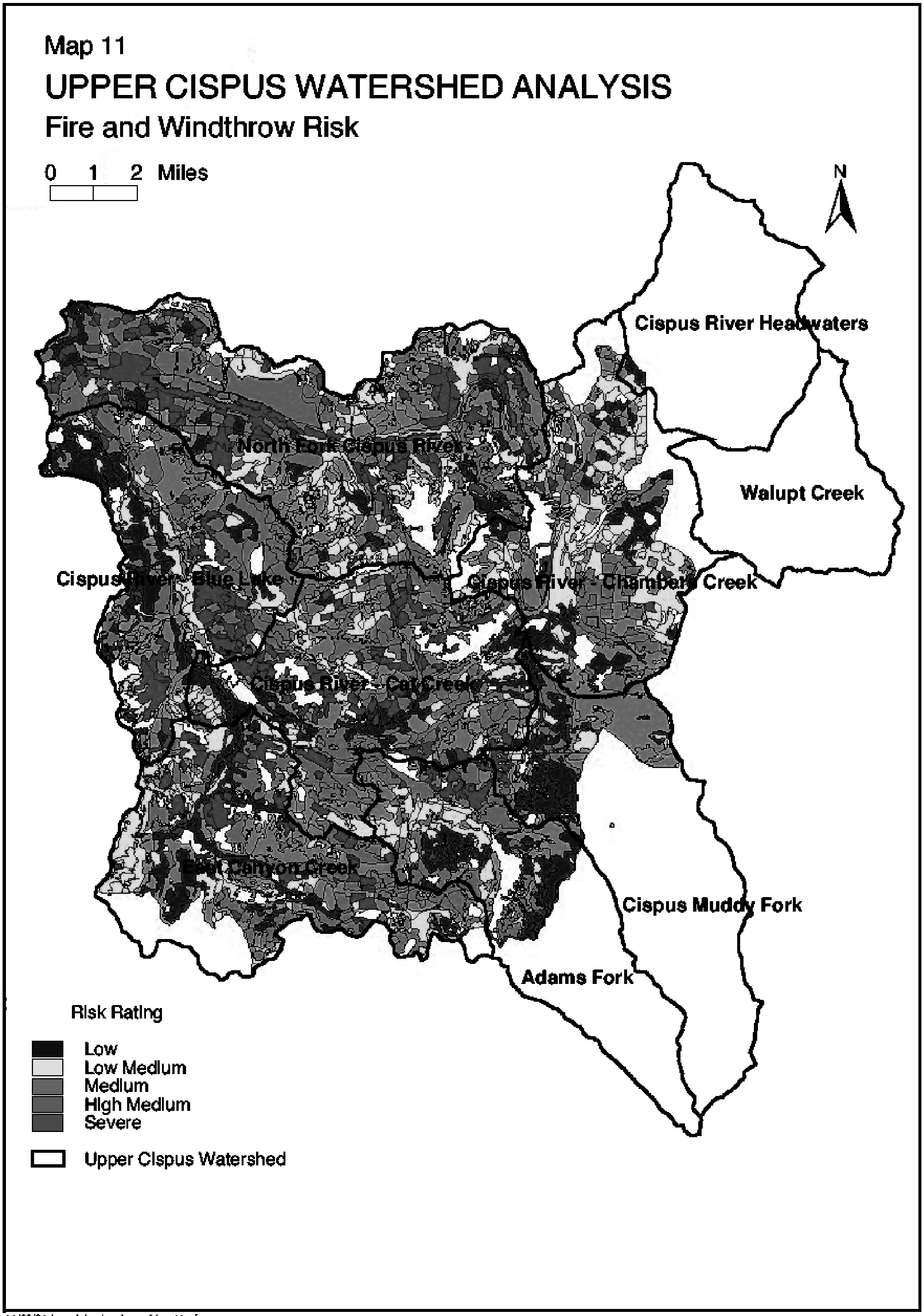
In this study, topographic factors such as aspect, slope, landform and vegetation factors such as stand density and height to the crown base were considered for fire hazard rating. Vegetation change such as height and density through time was predicted by using LMS.

Wind - Windthrow hazard depends upon the interaction of numerous factors pertaining to climate, topography, soil and stand characteristics (Ruel 1995, Mitchell 1995). The variations in soil, topography and forest structure as well as weather increase the difficulty of windthrow prediction (Miller 1985).

Wind hazard areas related to topography are very variable (Neustein 1971, Miller 1985, Ruel 1995). Wind damage is also variable depending on stand structure and tree size of the stands (Wilson 1998). Thinning can reduce or increase the stability of a stand by changing endogenous risk potentials (Busby 1965). In this study, Wilson’s (1998) windthrow hazard model, which uses GIS information for topography (aspect, slope, stand edges), inventory information based on LMS, and soil information, and expresses the results in total hazard classes, is used to rate windthrow hazard.

Fire and windthrow hazard ratings were combined into a single overall hazard rating for each stand.

See Map 11, Fire and Windthrow Risk.



11/20/01 /cv_gis/wa/upcispus Map 11 rfp

b. Insects and Disease

Data Sources/Data Gaps

The primary data sources for information on insects and disease were U.S. Forest Service Region 6 Forest Pest Management (FPM) aerial insect survey maps, the Gifford Pinchot National Forest Total Resource Inventory (TRI) Pest Management Subsystem, and Forest Pest Evaluations by Region 6 Forest Pest Management.

The earliest data available from the aerial insect surveys for this watershed is 1974 data, the latest is 2000. Survey maps are not available for every year from 1974 to 2000.

Only a small portion of the watershed has been surveyed and mapped for disease occurrence. Funding and priority to gather information concerning insects and disease has been low; consequently the amount of data available is limited and incomplete.

Assumptions

A quick review of available data on disease and insect occurrences is sufficient to draw some conclusions about insect and disease activity in this watershed.

Reference (Historic) and Current Conditions

We have no knowledge or data about historic insect and disease occurrence in this watershed prior to 1974. The only thing we can say with any certainty is that most of the insects and disease present today were very probably here hundreds, if not thousands, of years ago. The only exceptions are the balsam woolley adelgid (an insect) and white pine blister rust (a disease). Both are introduced pests not present in the Pacific Northwest until the early part of this century.

Insects and disease are a natural part of the ecosystem and serve as agents of disturbance across the landscape. For the most part, native insects and diseases occur at endemic, or normal, levels and only occasionally appear as spectacular or seriously damaging epidemic outbreaks. However, even at endemic levels, damage to forests from some insects and diseases can, over time, be quite serious. The amount of disturbance caused by them can vary greatly from large conspicuous outbreaks to small, almost imperceptible outbreaks, with damage to trees being anywhere from light to severe. These agents of disturbance are essentially always present in the ecosystem at some level, their presence waxing and waning as the ecological conditions that affect them change over time.

Disease infections and insect infestations are an integral part of this forested ecosystem. Through their presence and actions they affect and participate in a wide range of ecosystem components and relationships. They foster diversity in the ecosystem by altering stand structure, and they can change the species composition of a stand over time. Through the killing or damaging of trees they: 1) create snags and down wood that provide habitat for a variety of wildlife species and serve an important link in the cycling of nutrients, and 2) cause changes in the amount of sunlight that enters the canopy and reaches the forest floor, thus causing changes in the types, sizes, and amounts of vegetation. Insects and disease are also an important link in the ecosystem's food chain (e.g., wildlife feed on insects and the fruiting bodies of fungi that cause tree disease and decay).

Insects

Currently, based on FPM aerial surveys and ground observations, the insect that has been observed causing the most notable damage to trees in the watershed over the past 7 years (1994-2001) since the Middle and Upper Cispus Pilot Watershed Analysis was written is the western spruce budworm. It appears that low levels of defoliation from the w. spruce budworm was picked up by aerial surveys in the Walupt Lake area in 1997 and was estimated to infect about 600 acres. In 1998, this had increased to 1150 acres. Nothing was noted in 1999 but it's expected the insect was there but not picked up on the aerial survey. In 2000, damage was noted as moderate and had increased in spread to about 1500 acres. Another large area to the south in the Muddy Fork and Adams Fork was also noted as having light defoliation on an area about 8,000 acres in size. This particular area has not been ground verified. The balsam woolley adelgid (in Pacific silver fir), the Douglas-fir beetle (in Douglas-fir) and other insects are at work in this watershed (e.g., fir engraver beetle [in all true fir tree species], mountain pine beetle [in western white pine]), but the level of their presence and activity is relatively small and very sporadic and scattered.

For more information on insect activity between 1974 and 1994 within the watershed analysis area refer to Appendix R pp.5-9 of Middle and Upper Cispus River Pilot Watershed Analysis.

Western Spruce Budworm (*Choristoneura occidentalis*)

The western spruce budworm is a small, inconspicuous moth with a one-year life cycle. Larvae feed on host true fir and Douglas-fir trees, consuming primarily current-year foliage. Budworm populations undergo periodic widespread outbreaks. Outbreaks most commonly occur on the eastside of the Cascade Mountains crest in mixed conifer stand types on grand fir and Douglas-fir plant associations. Significant defoliation sometimes occurs in the transitional zone between Eastside and Westside conditions. It is somewhat unusual, but not altogether unheard of, for a budworm outbreak to occur on the Westside.

Given the geographical location and pattern of the defoliated area near Walupt Lake, and what is generally accepted regarding budworm population dynamics and stand hazard, it appears unlikely that the budworm population that caused defoliation in the area west of Walupt Lake derived from an "on-site" increase in endemic population numbers. It seems more likely that dispersal processes in outbreak areas on the Yakima Indian Reservation, aided by weather events, may have resulted in the movement of budworm moths in a westerly direction over the crest of the Cascades and down the Cispus River drainage.

Due to the Westside character of this area, there is a fairly low probability that budworm defoliation will reach sufficient intensity to result in significant stand damage. However, it is probable that some level of defoliation will continue in this area so long as high populations remain to the east. (Beth Willhite, Sept. 2000).

Balsam Woolley Adelgid (*Adelges piceae*)

This aphid-like insect feeds by sucking sap from cells beneath the bark of twigs, limbs, and boles of trees. As it feeds, it pumps a toxic salivary substance into the cells causing damage to them. The balsam woolley adelgid will attack all true fir trees (*Abies* spp.), but in this watershed its principle host is Pacific silver fir. Pacific silver fir susceptibility varies: on poor growing sites it is quite tolerant to the adelgid; on good growing sites it can be very susceptible.

The balsam woolley adelgid is probably the most serious enemy of true firs in the Pacific Northwest and had been shown to be a very damaging pest. It has tremendous reproductive capacity and epidemics can seemingly occur overnight. The degree of damage is greatest on dominant and co-dominant trees growing on the best growing sites. The most severe outbreaks occur at the lower ends of the host species' elevation range: from about 1500 to 3000 feet in Pacific silver fir. Stands along stream bottoms and in flat, terraces or benches (i.e., good growing sites) are highly susceptible to attack (Mitchell, 1966).

Based on the review of the FPM aerial survey maps, balsam woolley adelgid activity is light to moderate in this watershed. The occurrences of this insect are generally scattered in a wide distribution across the watershed. It has been documented most often at the upper elevations in the watershed. The majority of the documented occurrences have been characterized as having caused light damage, with an occasional level of moderate damage. The nature of the damage/mortality in the patches of infestation is such that not every tree in the patch is damaged or killed.

Douglas-fir Beetle *(Dendroctonus pseudotsugae)*

The Douglas-fir beetle is a native insect that occurs throughout the range of Douglas-fir. It is considered the most important bark beetle which causes mortality in Douglas-fir. Douglas-fir bark beetles attack a tree by boring a tunnel through the bark, where they live and mine between the bark and the wood. A tree is killed when a large number of beetles attack it and effectively girdle it.

The greater portion of tree mortality is a result of endemic infestations, continually present in mature forests, where the beetle inhabits diseased (especially root-diseased trees), felled, or damaged trees. This normal mortality can be large in number, but is usually widely scattered. Epidemic outbreaks generally develop when conditions are adverse for the host tree, as in drought periods or defoliation by other agents, or when an abundance of favorable breeding material is available to the beetles, as in extensive windthrow or large wildfires. Epidemic outbreaks can spread over large areas and kill vast numbers of apparently healthy trees. In the coastal Douglas-fir region of western Washington, outbreaks are sporadic and of short duration, but can kill large numbers of trees. These outbreaks are usually connected to windthrow or wildfire events, although relatively small outbreaks can be a result of localized root disease infections. Resistance of the host tree usually keeps the Douglas-fir beetle under control most of the time. But even when outbreaks occur, following stand disturbance by fire, wind, or disease, they abruptly subside because the beetles do not thrive in normal, vigorous trees (Furness, *et al*, 1977).

The occurrences of Douglas-fir beetle are generally scattered across the watershed where Douglas-fir is dominant. They have been documented most often at the middle to lower elevations in the watershed.

The majority of the documented occurrences can be characterized as having caused light mortality, with an occasional level of moderate mortality. Most of the Douglas-fir beetle activity has occurred from 1989 through 1994. This activity is sometimes linked directly to laminated root rot infections.

Generally, the patches of Douglas-fir beetle mortality range anywhere from less than a quarter acre to 10 acres in size (rough estimates based on FPM aerial survey sketch maps and local experience), with most being less than one acre. Not every tree in these patches dies.

Disease

Currently, based on the TRI Pest Management Subsystem and Forest Pest Management Pest Evaluations, the disease that has been observed causing the most notable damage to trees in the watershed over the last 20 years is laminated root rot (caused by *Phellinus weirii*). There are, without doubt, other disease agents (e.g., Armillaria root disease, dwarf mistletoe, annosus root disease, white pine blister rust, western gall rust, and various butt/stem rots) present and working in the watershed, but there was not sufficient time and/or data to determine the level of their presence and activity. Disease activity has not significantly changed in the watershed since the Pilot watershed analysis was completed in 1995. Few additional formal disease surveys have been completed since 1995 due to lack of funding for such work. For additional information about diseases in the watershed refer to the Middle and Upper Cispus River Pilot Watershed Analysis Appendix R pp.10-14.

A number of young western white pine plantations and mixed conifer platations with 30 percent or greater stocking of western white pine were informally surveyed for the incidence of white pine blister rust. These plantations varied in their degree of infection from low to high with most of the plantations being moderately infected. The incidence of blister rust indicates a need for active pruning in these stands to prevent or at least reduce mortality of planted white pine trees.

2. Forest Vegetation

a. Forest Zones

Data Sources/Data Gaps

The data source for production of the forest zones map was the GPVEG (Gifford Pinchot Vegetation) database.

Assumptions

For the purposes of this large-scale analysis, the forest zones are reasonably accurate given the time allowed and method used to determine their boundaries. It is assumed that the boundaries and acreages of the forest zones have not changed over the last several hundred years.

Reference (Historic) and Current Conditions

Terrestrial ecosystems develop and are affected by the influence of geology, landform, climate, and soils. Natural plant communities reflect these influences on the ecosystem. As a way of classifying these plant communities, forested ecosystems are divided into smaller systems (called forest series or forest zones) based on the climax tree species (i.e., potential natural vegetation) on a site. The four forest zones found in the Upper Cispus River fifth-field watershed are typical of those found in the southern Cascades of Washington State. Along with the four forest zones there is a non-forest zone above tree line. The five zones are:

Western Hemlock Zone -- *Tsuga heterophylla* (TSHE)
Pacific Silver Fir Zone -- *Abies amabalis* (ABAM)
Mountain Hemlock Zone -- *Tsuga mertensiana* (TSME)
Subalpine Fir Zone -- *Abies lasiocarpa* (ABLA)
Alpine – Non-Forest

TABLE 3-14 below displays the number of acres (forest and non-forest) comprising each of the forest zones across the watershed. For a visual display of each zone's distribution across the watershed see Map 12, Forest Zones.

Table 3-14: Forest Zones

Zone	**Forest and Non-forest**	
	Acres	**(%)**
Western Hemlock	16,976	11
Pacific Silver Fir	68,071	44
Mountain Hemlock	47,944	31
Subalpine Fir	15,866	10
Alpine	6,254	4
Totals	**155,111**	**100**

Western Hemlock Zone - This forest zone includes the lower elevation, warm and moist forests. It is the most environmentally moderate zone of the four forested zones found in this watershed. Its upper elevation occurs at about 3000 feet where it begins to transition into the Pacific Silver Fir Zone. This zone covers the third largest portion of the watershed. It is located primarily in the western portion of the watershed around the confluence of the Cispus and North Fork Cispus Rivers, with narrow arms extending up those river valleys. It covers 16,976 acres (11%) of the watershed.

Pacific Silver Fir Zone - This forest zone includes the mid to upper elevation, cool and moist forests. It occupies sites of upper elevation between approximately 3000 to 4500 feet where it begins to transition into the Mountain Hemlock Zone. This zone covers the largest portion of the watershed. It occurs throughout most portions of the watershed except for the northeastern and southeastern corners. It covers 68,071 acres (44%) of the watershed.

Mountain Hemlock Zone - This forest zone includes the upper elevation, cold forest environments. It occupies sites of high elevation between approximately 4500 to 5600 feet where it begins to transition into the Subalpine Fir Zone. This zone covers the second largest portion of the watershed. It is located primarily in narrow bands near the edges of the watershed in the Goat Rocks Wilderness, Mt. Adams Wilderness, Juniper Ridge, Table Mountain, Bishop Ridge and Mission Mountain areas. Within the interior area it occupies the Blue Lake Ridge, Cozy Ridge, East Canyon Ridge, Hamilton Buttes, and Elk Peak areas. It covers 47,944 acres (31%) of the watershed.

Subalpine Fir Zone - This forest zone includes the upper elevation forests in very cold environments. It occupies sites at the very high elevations from about 5600 feet upward to the tree line. This zone covers the fourth largest portion of the watershed. It is located primarily in narrow bands near the edges of the watershed in the Goat Rocks Wilderness, and Mt. Adams Wilderness. It covers 15,866 acres (10%) of the watershed.

Alpine Zone - The non-forest communities that occur at elevations above tree line make up the remainder of the watershed acreage, covering 6,254 acres (4%). The alpine communities are located primarily in Mt. Adams Wilderness on the upper northwest flanks of Mt. Adams, with some minor alpine acreage also occurring near Ives Peak and Old Snowy in the Goat Rocks Wilderness.

For more detailed information on the four forest zones refer to the Gifford Pinchot National Forest Plant Association and Management Guide for the Western Hemlock Zone (Topik, *et al* 1986), the Gifford Pinchot National Forest Plant Association and Management Guide for the Pacific Silver Fir Zone (Brockway, *et al* 1983), and the Gifford Pinchot National Forest Plant Association and Management Guide for the Mountain Hemlock Zone (Diaz, *et al* 1997).

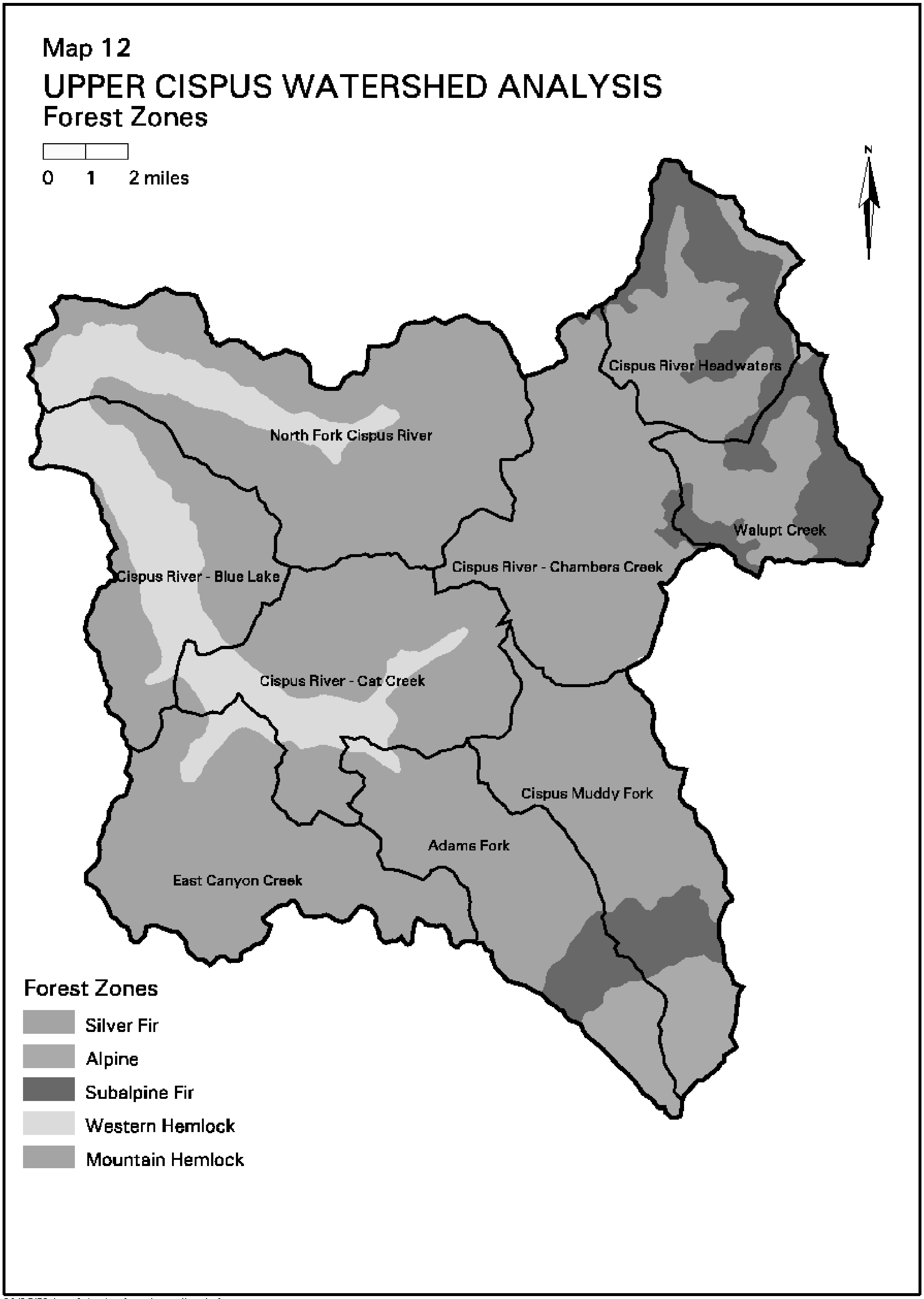
b. Vegetation Structural Stages

Data Sources/Data Gaps

The primary source for current vegetation descriptions on Forest Service land is the Gifford Pinchot National Forest GPVEG (Gifford Pinchot Vegetation) database. The GPVEG database was initially installed in 1993-94 and is updated annually. The GPVEG data is based on a mixture of stand exam data (of various ages), aerial photo interpretation (especially in the wilderness areas), and on-the-ground knowledge of Forest Service personnel. The GPVEG database is reasonably accurate, but it is highly probable that some of the data is not accurate (due to such things as poor aerial photo interpretation, outdated stand exam data, input errors, etc.).

Reconstruction of historic vegetation conditions relied on known current stand information (e.g., stand year-of-origin), observation of aerial photos, and on-the-ground knowledge of Forest Service personnel. There are very few sources of historic stand information available for this watershed, and what is available is of very limited usefulness.

Assumptions


Map 12
UPPER CISPUS WATERSHED ANALYSIS
Forest Zones
0 1 2 miles
N
Cispus River Headwaters
North Fork Cispus River
Walupt Creek
Cispus River - Blue Lake
Cispus River - Chambers Creek
Cispus River - Cat Creek
Cispus Muddy Fork
Adams Fork
East Canyon Creek
Forest Zones
Silver Fir
Alpine
Subalpine Fir
Western Hemlock
Mountain Hemlock
11/16/01 /cv_gis/wa/upcispus/pvsgplt.aml rfp

The GPVEG database (and the resultant vegetation classification based on that database) is reasonably accurate, providing a general description of current vegetation structure that is accurate enough for this large-scale analysis.

Riparian vegetation is often different than upland vegetation in size, structure, and species composition; but for the purposes of this analysis it will be considered the same.

Before 1930, fire (natural and man-caused) was the most significant disturbance that caused stands to revert to a early successional stage in this watershed.

The classification of historic vegetation structure is reasonably accurate for this large-scale analysis. There are undoubtedly errors in the classification due to the lack of historic vegetation information.

Reference (Historic) and Current Conditions

In this watershed analysis, we are describing forest vegetation structural stages at two points-in-time to illustrate and compare historic and current situations across the watershed. The year 1880 was chosen as the historic point-in-time, with 2001 being the current point-in-time. The historic forest vegetation structural stages were reconstructed by reclassifying the structural stages of the current vegetation polygons based on their current age, aerial photos, and on-the-ground knowledge of Forest Service personnel. The year 1880 serves as a "snapshot" of the vegetation in the watershed when the landscape had not yet been significantly altered by Euro-American settlers.

Structural Stages

The range of vegetation characteristics and conditions in the watershed results from succession and disturbance (both natural and human-induced). Structural stages describe and define this range of vegetation characteristics and conditions. Four broad structural stages were defined for the Historic vegetation portion of this watershed: early successional, mid-successional, late successional, and non-forest (Note: open and closed early successional stages are combined into early successional). Five broad structural stages were defined for the Current vegetation portion of this watershed: early successional open, early successional closed, mid-successional, late successional, and non-forest. The five stages are described below.

Early Successional Open - It includes one-storied forest stands whose trees range in size from seedlings (less than 4.5 feet tall) to poles less than 9.0" dbh and have a canopy cover less than 41%. (Note: roughly, stands with an avg. stand dbh of 0 to 3 inches).

Early Successional Closed - It includes one-storied forest stands whose trees range in size from seedlings (less than 4.5 feet tall) to poles less than 9.0" dbh. and have a canopy cover greater than 40%. (Note: roughly, stands with an avg. stand dbh of 4 to 8 inches).

Mid Successional - It includes one- or two-storied forest stands of 9.0" dbh up to 15.0" dbh (for the Pacific Silver Fir, Mountain Hemlock, and Subalpine Fir Zones) or 18.0" dbh (for the Western Hemlock Zone).

Late Successional - It includes one-, two-, or more-storied forest stands greater than 18.0" dbh, greater than 59% canopy cover and age greater than 119 years (for Western Hemlock Zone) or greater than 15.0" dbh, greater than 59% canopy cover and age greater than 159 years (for Pacific Silver Fir Zone) or greater than 15.0" dbh, greater than 59% canopy cover and age greater than 199 years (for Mountain Hemlock and Sub-alpine Fir Zones).

Non-forest - It includes rock, water, avalanche chutes, administrative sites with little or no vegetation, meadows, grasslands, forblands, and shrublands.

c. Historic Vegetation: Amount, Distribution, and Location

The amount of historic (1880) early successional, mid successional, and late successional forest vegetation (and areas of non-forest) in the watershed is shown in Table 15, Historic Vegetation by Structure, below. In 1880 the acres of forest land in this watershed were dominated by stands in the mid successional structural stages. See Map 13, Historic (1880) Vegetation Structure.

Table 3-15: Historic (1880) Vegetation by Structural Stage

Structural Stage	Acres	Percent Total Acres	Percent Forested Ac.
Early Successional	18,867	12.2	15.0
Mid Successional	81,042	52.2	64.2
Late Successional	26,269	16.9	20.8
Non – Forest	29,014	18.7	N/A
Totals	**155,192**	**100.0**	**100.0**

Early Successional

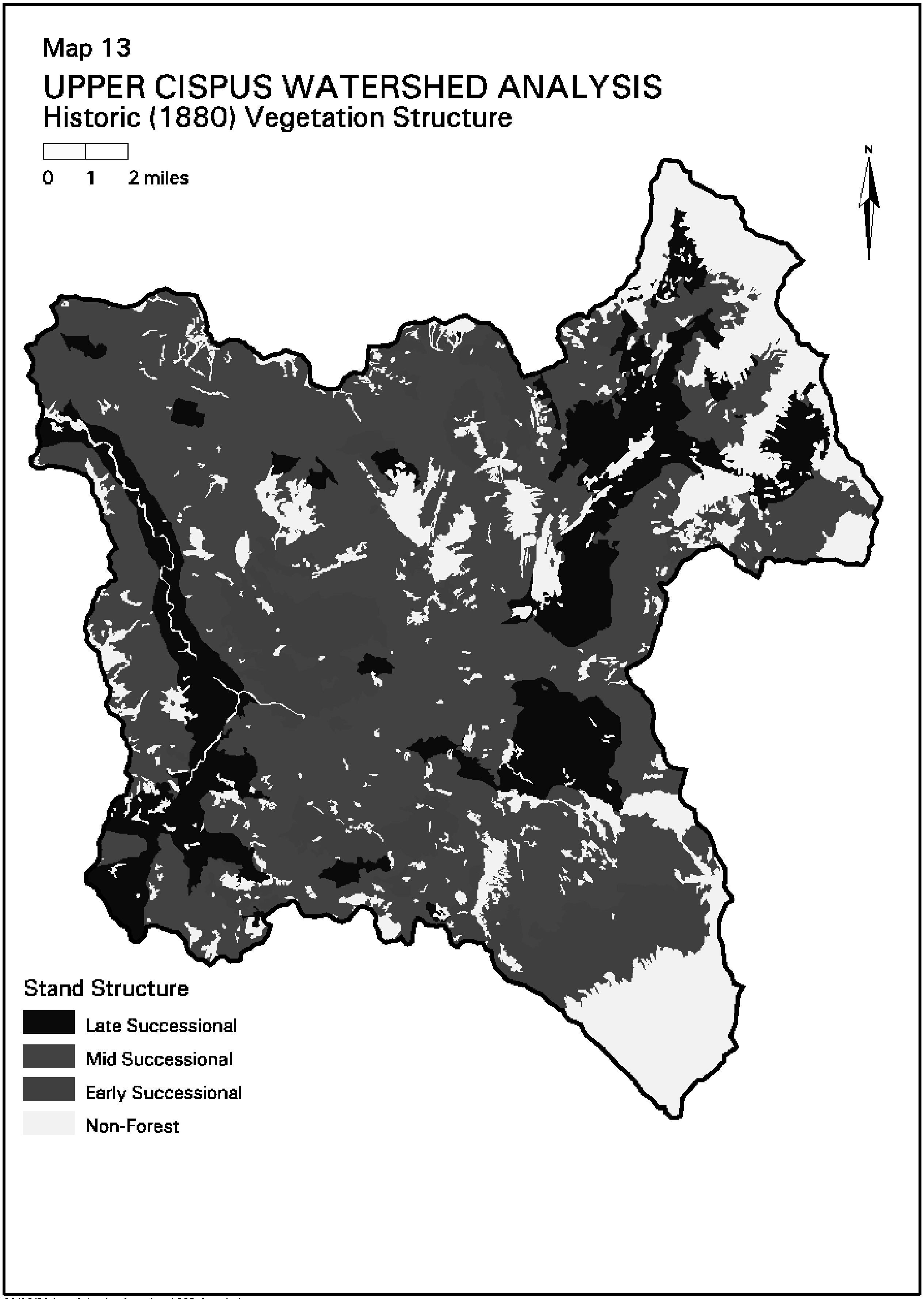
At 18,867 acres, the early successional forest had the smallest number of acres of the three forested structural stages (15% of the watershed's productive forest land and 12% of the total watershed acres). Most of the early successional forest was located in the Mountain Hemlock Zone.

Early successional forest occurred in all of the sixthfield subbasins, but was the most prominent (in terms of acres relative to other sixthfields) in the Muddy Fork (2,326 acres), Cat Creek (4,662 acres), Adams Fork (4,461 acres), E. Canyon Creek (1,967 acres), and North Fork Cispus River (3,219 acres) sixthfields.

Early successional forest was a minor component in the Cispus River Headwaters (195 acres), Walupt Lake (297 acres), Chambers Creek (797 acres), and Blue Lake (945 acres) sixthfields.

Mid Successional

At 81,042 acres, the mid successional forest had the largest number of acres of the three forested structural stages (64% of the watershed's productive forest land and 52% of the total watershed



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acres). Much of the mid successional forest was located in the Pacific Silver Fir Zone and Mountain Hemlock Zone.

Mid successional forest occurred in all of the sixthfields in prominent amounts. Cispus River Headwaters had 3,481 acres, Walupt Lake 2,968 acres, Chambers Creek 9,369 acres, Muddy Fork 5,947 acres, Cat Creek 11,896 acres, Adams Fork 7,194 acres, E. Canyon Creek 9,200 acres, Blue Lake 10,449 acres, and North Fork Cispus River had 20,539 acres, the most of all the sixthfields.

Late Successional

At 26,269 acres, the late succesional forest covered 21% of the watershed's productive forest land and 17% of the total watershed acres. The largest contiguous patches were located in the Chambers Creek and Upper Cispus River area, the lower portion of the Muddy Fork and in a stringer along the lower portions of the Cispus River and E. Canyon Creek. Most of the late successional forest was located in the Western Hemlock and Pacific Silver Fir Zone.

Late successional forest occurred in all of the sixfields and was prominent (in terms of acres) in all but the Adams Fork sixthfield. Cispus River Headwaters had 2,931 acres, Walupt Lake 2,298 acres, Chambers Creek 5,606 acres, Muddy Fork 3,986 acres, Cat Creek 1,648 acres, E. Canyon Creek 5,638 acres, Blue Lake 2,755 acres, and North Fork Cispus River had 1,130 acres.

Late successional forest was minor component in the Adams Fork (277 acres) sixthfield.

Historic Landscape Patterns: Patch Size, Shape, Spatial Arrangement, and Connectivity

No detailed analysis was performed to calculate statistics concerning historic vegetation landscape patterns. Therefore, a basic qualitative description is provided here, based on Map 13, Historic (1880) Vegetation Structure.

In 1880, the mid successional forest structural stage was the most dominant forest vegetation across the watershed, with the late successional and non-forest areas also being very significant.

Most of the early successional forest was located in four large, unfragmented blocks; one located in the Killen Creek/East Fork Adams Creek area in the Muddy Fork and Adams Fork 6th field watersheds; a second block located in the upper E. Canyon Creek/Chain of Lakes area in the Muddy Fork and E. Canyon Creek 6th field watersheds; a third block located around Blue Lake Ridge in the Blue Lake and Cat Creek 6th field watersheds; and a fourth block located in the upper North Fork Cispus River 6th field watershed. It should be noted that much of the Blue lake, Cat Creek and Muddy Fork 6th field watersheds were shifted to an early successional stage in the early 1900's due to large fires. Much of this area, most notably the Blue Lake and Cat Creek 6th fields have now developed into mid successional forest.

As mentioned above, in 1880 the forest land in this watershed was dominated by mid successional vegetation (64%). These stands formed the largest, most connected and unfragmented blocks of forest in the watershed. It was the dominant vegetation structural stage of the three structural stages in all nine 6th field watersheds. As was noted above in the early successional stage, much of the mid successional stage was set back to an early successional stage for a period of time due to large fires.

In 1880, late successional vegetation was the second most dominant (21% of the forested vegetation) of the three successional stages. Most of the late successional stands were located in three large, unfragmented blocks; one located in the middle Cispus River, Dark Creek and E. Canyon Creek drainages within the Blue Lake and E. Canyon Creek 6th fields; a second block located in the Spring Creek/Muddy Fork area within the Muddy Fork 6th field; and a third block located in the upper Cispus River/Chambers Creek area within Cispus River Headwaters and Chambers Creek 6th fields.

The patches of forest vegetation in 1880 generally consisted of large, unfragmented blocks except where fragmented by areas of natural non-forest structure (rock, meadows, shrublands, wetlands, etc.). The mid successional forest was the dominant forest vegetation across the watershed, forming the matrix within which the other successional patches were imbedded. Most early successional forest vegetation was in four large, unfragmented blocks, while the late successional forest vegetation waas contained in three large, unfragmented blocks. These large, unfragmented patches of forest were irregular in shape and ranged in size from 2500 acres to over 10,000 acres. The late successsional blocks were well connected by the mid successional matrix. The 1880 landscape was relatively stable, coarse-grained landscape with less edge and contrast than the current landscape.

By 1940, the character of this landscape changed considerably due to large wildfires in the early 1900's and through natural succession. The mid successional vegetation was dramatically reduced and was no longer the matrix. The early successional forest became dominant in the watershed. There was undoubtedly more unfragmented blocks in 1940 than in 1880 but there average size was smaller.

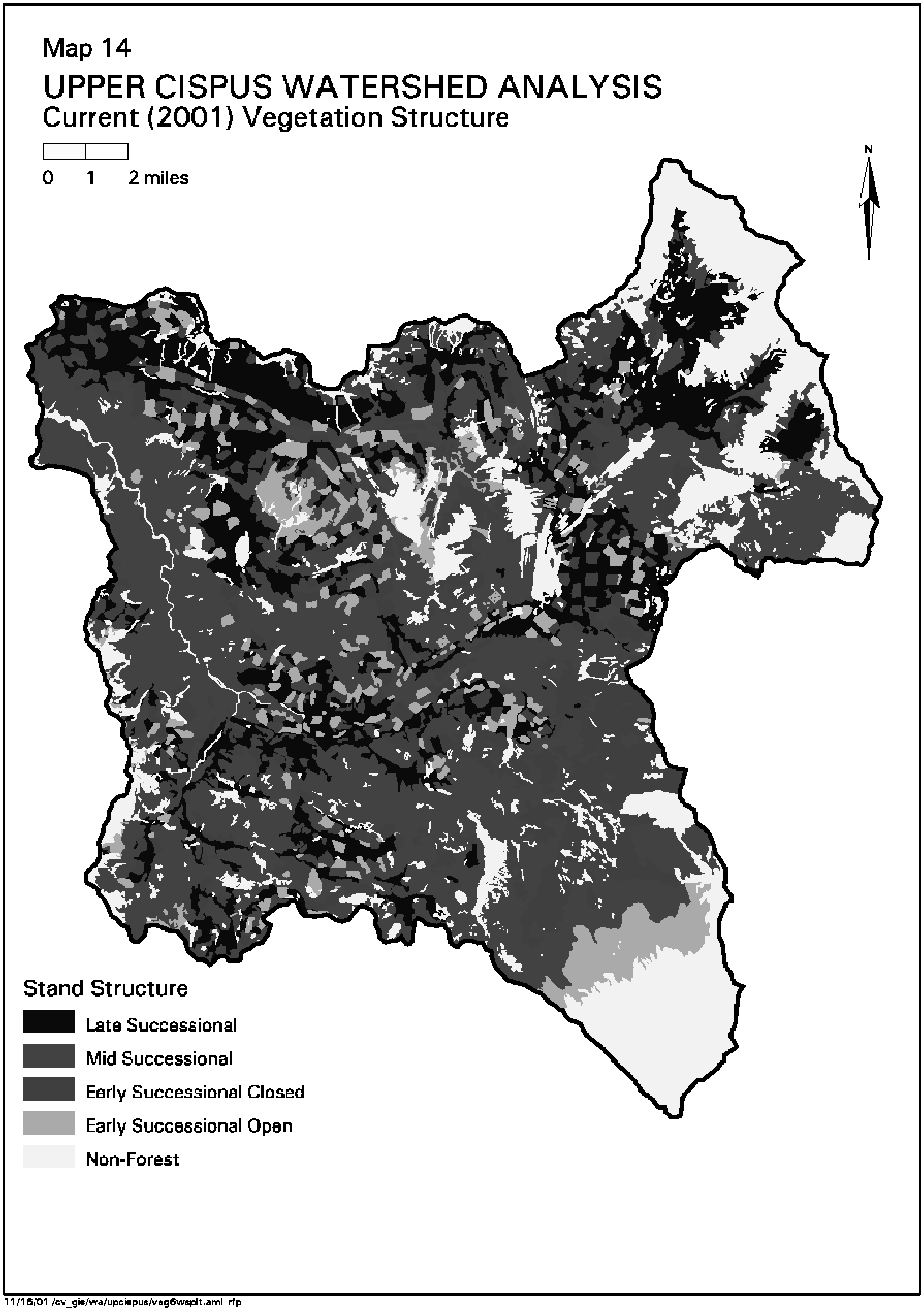
d. Current Vegetation: Amount, Distribution, and Location

The amount of current (2001) early successional-open and closed, mid successional, and late successional forest vegetation (and areas of non-forest) in the watershed is shown below in Table 3-16, Current Vegetation by Structural Stage. Currently, the acres of forest land in this watershed are dominated by stands with mid successional structure. See Map 14, Current (2001) Vegetation Structure.

Table 3-16: Current (2001) Vegetation by Structural Stage

Structural Stage	Acres	% Total Acres	% Forested Ac.
Early Successional – Open	10,938	7.1	8.7
Early Succesional – Closed	21,926	14.1	17.4
Mid Successional	62,414	40.2	49.6
Late Successional	30,651	19.8	24.3
Non – Forest	29,174	18.8	N/A
Totals	**155,103**	**100.0**	**100.0**

For a more detailed listing of the amounts and distribution of current vegetation structure by sixthfield subbasin see Apendix F:


Map 14
UPPER CISPUS WATERSHED ANALYSIS
Current (2001) Vegetation Structure
0 1 2 miles
N
Stand Structure
Late Successional
Mid Successional
Early Successional Closed
Early Successional Open
Non-Forest
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Early Successional - Open

At 10,938 acres, the early successional-open forest has the least number of acres of the four forested structural stages (8.7% of the watershed's productive forest land or 7.1% of the watershed). Early successional forest is mainly concentrated in the central portion of the watershed with a large area near the southeast corner of the watershed. Most of the early successional-open forest is equally divided between the Pacific Silver Fir Zone and Mountain Hemlock Zone with minor amounts in the Western Hemlock and Subalpine Fir Zones.

Early successional-open forest occurs in each of the sixthfield subbasins, but it is most prominent (in terms of acres relative to other sixthfields) in the Muddy Fork (1,749 acres), Cat Creek (1,737 acres), Adams Fork (1,351 acres), and North Fork Cispus River (3,737 acres). It is moderately prominent in the Chambers Creek (849 acres), E. Canyon Creek (949 acres) and Blue Lake (477 acres) 6th fields. It is the least prominent in the Cispus River Headwaters (60 acres) and Walupt Creek (29 acres) 6th fields.

Early Successional - Closed

At 21,926 acres, the early successional-closed forest is the third smallest number of acres of the four forested structural stages (17% of the watershed's productive forest land or 14% of the watershed). It has about two times the number of acres in the open category. Early successional-closed forest is scattered throughout with some large concentrations in the Muddy Fork drainage. Most of the early successional-closed forest is equally divided between the Pacific Silver Fir Zone and Mountain Hemlock Zone with some in the Western Hemlock Zone.

Early successional-closed forest occurs in each of the sixthfield subbasins, but it is most prominent (in terms of acres relative to other sixthfields) in the Muddy Fork (5,654 acres), Cat Creek (2,622 acres), Adams Fork (1,932 acres), North Fork Cispus River (5,199 acres), Chambers Creek (3,348 acres), and E. Canyon Creek (1,902 acres). It is moderately prominent in the and Blue Lake (541 acres), Cispus River Headwaters (497 acres), and Walupt Creek (230 acres) 6th fields.

Mid Successional

At 62,414 acres, the mid successional forest covers 50% of this fifth-field watershed's productive forest land or about 40% of the watershed. Most of the mid successional stands are scattered throughout the watershed, except for the uppermost elevations in the Goat Rocks and Mount Adams Wilderness areas. Several large contiguous patches can be found in the watershed, with the largest contiguous patch being located along the lower portion of the Cispus River. Much of the mid sucessional forest is proportionately divided between the Western Hemlock, Pacific Silver Fir, and Mountain Hemlock Zone with only minor amounts in the Subalpine Fir Zone.

Mid successional forest occurs in each of the sixthfield subbasins, but it is most prominent (in terms of acres relative to other sixthfields) in Blue Lake (11,157 acres), Cat Creek (9,673 acres), E. Canyon Creek (9,457 acres), Adams Fork (7,913 acres), North Fork Cispus River (6,957 acres), Chambers Creek (6,796 acres), Muddy Fork (4,776 acres), and Walupt Creek (4,412 acres). It is only moderately prominent in the Cispus River Headwaters (1,274 acres) 6th field.

Late Successional

At 30,651 acres, the late successional forest has the second largest number of acres of the four forested structural stages (24% of the watershed's productive forest land and 20% of the watershed). The late successional stands are a result of wildfires that occurred prior to 1880 in the Western Hemlock Zone, 1840 in the Pacific Silver Fir Zone and 1800 in the Mountain Hemlock and Subalpine Fir Zones. Much of the late successional forest is located in the Pacific Silver Fir and Mountain Hemlock Zones, with a fair amount also located in the Western Hemlock Zone. Very little is noted in the Subalpine Fir Zone.

Late successional forest is well dispersed across the watershed, except for the southeast corner of the watershed. It occurs in each of the sixthfield subbasins, but it is the most prominent (in terms of acres relative to other sixthfields) in the North Fork Cispus River 9,254 acres), E. Canyon Creek (4,014 acres), Cat Creek (4,197 acres), Cispus River Headwaters (4,736 acres), Chambers Creek (4,743 acres), and Blue Lake (1,928 acres). It is moderately prominent in the Walupt Creek (861 acres), Adams Fork (647 acres), and Muddy Fork (269 acres) 6^{th} fields.

Non-Forest

At 29,174 acres, the areas of non-forest structure (rock, water, avalanche chutes, admininstrative sites with little or no vegetation, meadows, grasslands, forblands, shrublands, glaciers) cover 19% of the total watershed acreage. Most of the non-forest acreage is concentrated in the watershed's northeast corner in the Goat Rocks Wilderness and the southeast corner in the Mount Adams Wilderness. Other substantial acreage occurs in the Hamilton Buttes, Elk Peak, Juniper Ridge and other ridgetop areas throughout the watershed. Much of the non-forest structure is located in the Alpine, Subalpine Fir and Mountain Hemlock Zone.

Non-forest structure occurs in each of the sixthfield subbasins, but it is most prominent (in terms of acres relative to other sixthfields) in Cispus River Headwaters (6,413 acres), Muddy Fork (5,246 acres), Walupt Creek (4,188 acres), Adams Fork (3,842 acres), North Fork (2,752 acres), Chambers Creek (2,666 acres), East Canyon Creek (1,984 acres), and Blue Lake (1,534 acres).

Non-forest structure is the least prominent in Cat Creek (547 acres).

Current Landscape Patterns: Patch Size, Shape, Spatial Arrangement, and Connectivity

No detailed analysis was performed to calculate statistics concerning current vegetation landscape patterns. Therefore, a basic qualitative description is provided here, based on Map 14, Current (2001) Vegetation Structure.

The current size, shape, spatial arrangement, connectivity, and structural stages of vegetation patches in the watershed have been heavily influenced by U.S. Forest Service management policies concerning fire suppression (suppress most fires immediately) and timber harvest activities (allowed in most areas outside of National Forest wilderness. Since the 1930's, when fire suppression activities began in earnest, the role of fire as a significant, large-scale disturbance agent in the watershed has been reduced dramatically. With the advent of timber harvest in the watershed in the mid-1950's, it became the disturbance agent (outside wilderness) largely responsible for moving forest stands into the early successional structural stage, instead of fire. There have been three types of timber harvest activity in the watershed: regeneration harvest (mainly by clearcut but some shelterwood and a minor amount of regeneration harvest with moderate or high forest retention), commercial thinning, and partial-cut salvage.

The early successional open and closed structural stages that currently exist in the watershed were created by a combination of regeneration harvest using the clearcut method and lightening fires which primarily occurred during the early part of the century. Regeneration harvest on National Forest land in this watershed totals approximately 18,618 acres since it began in the mid-1950's which amounts to about 57% of the early successional open and closed structural stages. A large portion of the fire-caused early successional structural stages occurred in the Mount Adams Wilderness within the Muddy Fork and Adams Fork 6th fields and also in the North Fork Cispus River 6th field.

The estimated amount of regeneration harvest on Forest Service land, stratified by decade and sixthfield subbasin is shown below in Table 3-17. These acres are based on GPVEG completed harvest activities and year of activity.

Table 3-17: Regeneration Harvest Acres by Decade and 6th Field

6th Field	1950's	1960's	1970's	1980's	1990's	Total Ac.	%
C.Riv. Headwaters	43	0	53	0	0	96	0.5
Walupt Creek	0	0	0	0	0	0	0
Chambers Creek	574	1093	870	444	149	3130	16.8
Muddy Fork	0	59	170	148	0	377	2.0
Cat Creek	772	782	1438	756	734	4482	24.1
Adams Fork	0	0	159	84	0	243	1.3
E. Canyon Creek	778	225	1021	657	228	2909	15.6
Blue Lake	0	63	320	67	313	763	4.1
North Fork C. Riv.	366	1748	2498	1483	523	6618	35.6
Totals	**2533**	**3970**	**6529**	**3639**	**1947**	**18618**	**100.0**
% of Regen. Ac.	**13.6**	**21.3**	**35.1**	**19.5**	**10.5**		**100.0**

Although commercial thinning does not alter stand structure as dramatically as regeneration harvest, it certainly has an affect on it. Commercial thinning (depending on the site specific prescription) can change stand structure in a number of ways: by causing the leave trees to grow larger faster, affecting the number of canopy layers, affecting canopy closure, affecting the number of snags and amount of down wood, affecting species composition, etc.

The estimated amount of commercial thinning harvest completed in this watershed on National Forest land is 2,358 acres; all of it occurred in the 1970's, 1980's and 1990's, and the majority of it occurred in the Blue Lake (1,503 acres), Cat Creek (629 acres), and East Canyon Creek (202 acres) sixthfields.

The amount of partial cut salvage harvest that has occurred in the watershed is unknown, but it has been a common practice since the 1960's. It has been linked primarily with the salvage of down or damaged trees related to windthrow/storm events. The number of partial cut salvage sites has been relatively moderate over the years; usually relatively small in size, and usually located along the edges of existing clearcuts or road prisms where windthrow has most often occurred. Changes in stand structure due to partial cut salvage is usually slight, compared to regeneration harvest and commercial thinning, but it does have an influence (something similar, but less impactive, than those mentioned for commercial thinning).

Today (2001), the mid successional forest structural stage is the most dominant forest vegetation across the watershed, with the early successional (open and closed combined), late succesional and non-forest structural stages being very similar in size and providing very significant features in the landscape.

Many of the early successional-open forest patches tend to be small in size (less than 100 acres) and regular in shape (having been created by clearcut regeneration harvest, they are often square or rectangular with straight edges of high contrast). There are some larger patches of early successional-open forest where high elevation stands have naturally regenerated following wildfires. These larger patches of early successional-open stands are located in the North Fork, Adams Fork, and Muddy Fork sixthfields in patches greater than 1000 acres. Many of the early successional-closed forest patches are similar to the open forest patches since they too have been created by clearcut regeneration harvest. When these two categories are looked at together, they have been connected together over the years forming contiguous blocks of several hundred acres. There is a very large patch of early successional-closed forest primarily in the Muddy Fork sixthfield but extends into adjacent sixthfields that is several thousand acres in size. Much of today's early successional forest which was a result of clearcut regeneration harvest is structurally simple and homogenous; stands with a single tree layer, possessing few (if any) snags or large, live remnant trees, or pieces of large down wood.

The current mid successional forest is largely comprised of natural fire-origin stands (generally irregular in shape and form) at middle to high elevations. The mid successional forest form the largest, most connected, and least fragmented blocks in the watershed but its connected and unfragmented nature is not nearly as well connected and unfragmented as it was in 1880 primarily due to timber harvest activities. There is one block, primarily within the Blue Lake sixthfield, that’s in excess of 10,000 acres and several other blocks in excess of 1000 acres. There are a few old clearcuts that have grown into mid successional forest, but unlike their natural-origin counterparts, they are structurally simple and homogenous; stands with a single tree layer, possessing few (if any) snags or large, live remnant trees, or pieces of large down wood.

The late successional forest located <u>outside</u> wilderness has been heavily fragmented, with patch sizes dramatically reduced. Most of the regeneration harvest over the past 50 years came out of late successional forest, converting it to early successional open and closed forest in a staggered block pattern, with some of the later harvest beginning to remove some of the earlier late successional forest leave blocks to form larger, more connected patches of early successional forest. The late successional forest patches that currently exist in the watershed are irregular shaped and highly fragmented except for some blocks in the North Fork and Cispus River Headwaters sixthfields.

As in 1880, the patches of forest vegetation today are often fragmented by areas of natural non-forest structure. Natural fragmentation by non-forest areas (non-forest areas represent a significant acreage in the watershed) reduce forest connectivity in some portions of the watershed.

Currently, there are many areas across the watershed that have been little impacted by human management activities; the pattern of their forest vegetation being the most "natural" in terms of patch size, shape, and connectivity. Those areas are: Mt. Adams Wilderness (Muddy Fork and Adams Fork sixthfields) and Goat Rocks Wilderness (Cispus River Headwaters and Walupt Creek sixthfields).

In the areas of high management use, today's landscape is a relatively unstable, fine-grained landscape with a high amount of edge and contrast, and with a much reduced connectivity when compared to the 1880 landscape. The drainages whose vegetation has been the most highly impacted by human management are in the Chambers Creek, Cat Creek, East Canyon Creek, North Fork, and to a lesser degree, Blue Lake sixthfields. The pattern of forest vegetation in the above drainages is the most "unnatural" in terms of patch size, shape, connectivity, and structural diversity.

Overall, the 2001 landscape pattern has moderate stability because of its large amount of generally unfragmented mid successional forest and to some degree the late successional forest within the Wilderness but also a lot of fine-grained area with high amounts of edge and contrast where regeneration harvest has taken place within the late successional stands.

3. Wildlife, Plants, Fish

Introduction

The Upper Cispus watershed provides habitat for a wide variety of wildlife, fish and plant species, including some listed as Threatened, Endangered, and Sensitive. Additionally, it contains habitat for species listed as survey and manage under the Northwest Forest Plan, as amended by the January, 2001 “Survey and Manage EIS”, as well as for Management Indicator Species as listed in the Gifford Pinchot National Forest Plan. It also contains habitat and sites for other species of note, including some non-native, invasive animal and plant species.

Data Sources and Data Gaps

Information presented in this report was gathered from a wide range of sources, including the personal knowledge of district biologists, botanists and other people, historic sighting records and habitat information, literature reviews, recent survey information, aerial photos, and GIS-generated maps and data. No field studies or surveys were done specifically to gather data for this report. The most prominent data gaps found after gathering the above data are:

- Historical information about species occurrence and relative numbers in the watershed
- Historical stream habitat conditions
- Current occurrence and density information about many species in the watershed, particularly rare, uncommon and difficult-to-detect species
- Habitat information for many areas, particularly concerning forest stand characteristics such as coarse woody debris, snags, and other intra-stand features.
- Stream habitat information in particular for the Cispus River below the Muddy Fork, Muddy Fork sub-watershed, Walupt Lake sub-watershed, Chambers Creek, fine sediment levels in all streams, instream cover all streams and pocket water all streams

Assumptions

The following are some assumptions used for this report:

- As survey activity is spotty or absent for many species, a species is assumed to be present if suitable habitat in sufficient patch size is available.
- Non-native, invasive plant and animal species were not present in large numbers prior to approximately 1940.
- Species oriented to late-successional and interior forest habitats were more abundant historically than at present, as were species that utilize snags and coarse woody debris in logged areas.
- Opening and edge-oriented species are more abundant at present than they were historically in logged areas in the watershed.
- Recent habitat disturbance from timber harvest is different in nature from historic disturbance from fire, windthrow and other sources and have produced different distribution and abundance patterns of both animals and plants

a. Proposed, Endangered, Threatened, and Sensitive Species

The following table lists all proposed, threatened, endangered, and sensitive wildlife, fish and plant species that are officially listed, documented to occur, or suspected to occur in the Upper Cispus watershed as of July 2001. Also included are “candidate” and “Species of Concern” (SOC), as identified by the U.S. Fish and Wildlife Service.

Table 3 – 18: Proposed, Endangered, Threatened, and Sensitive Species

Species	Status	Occurrence
WILDLIFE SPECIES		
Gray wolf *(Canis lupus)*	E,e	Suspected*
Grizzly bear *(Ursus arctos)*	T,t	Suspected
Northern spotted owl *(Strix occidentalis caurina)*	T,e	Documented
Northern bald eagle *(Haliaeetus luecocephalus luecocephalus)*	T,t	Documented
Canada lynx *(Felis lynx canadensis)*	T,t	Suspected
Mardon skipper [butterfly] *(Polites mardon)*	C,e	Suspected
California wolverine *(Gulo gulo leutus)*	S	Suspected*
Larch Mountain salamander *(Plethodon larselli)*	S,s	Documented

Van Dyke's salamander *(Plethodon vandykei)*	S	Suspected*
Cope's giant salamander *(Dicamptodon copei)*	S	Documented
Cascade torrent salamander *(Ryacotriton cascadae)*	S	Suspected
Oregon spotted frog *(Rana pretiosa)*	S,e	Suspected
Northwestern pond turtle *(Clemmys marmorata marmorata)*	S,e	Suspected
Townsend's big-eared bat *(Corynorhinus townsendii)*	S	Suspected
American peregrine falcon *(Falco peregrinus anatum)*	S,e	Documented
Common loon *(Gavia immer)*	S	Suspected
Pacific fisher (*Martes pennanti pacifica*)	SOC, e	Suspected (x ?)
Fringed myotis bat *(Myotis thysanoides)*	SOC	Suspected
Long-legged myotis bat *(Myotis volans)*	SOC	Suspected
Long-eared myotis bat *(Myotis evotis)*	SOC	Suspected
Northern goshawk *(Accipter gentilis)*	SOC	Documented
Olive-sided flycatcher *(Contopus borealis)*	SOC	Documented
Cascade frog *(Rana cascadae)*	SOC	Documented
Tailed frog *(Ascaphus truei)*	SOC	Documented
FISH SPECIES		
Steelhead (*Oncorhynchus Mykiss*)	T, soc	Documented
Chinook salmon (*Oncorhynchus tshawytscha)*	T, soc	Documented
Bull trout (*Salvelinus confluentus*)	T, soc	Suspected
Coastal cutthroat trout (*Oncorhynchus clarki clarki*)	P	Documented
Coho salmon	C	Documented
PLANT SPECIES		
Agoseris elata	s	Suspected
Bolandra oregana	s	Suspected
Botrychium pinnatum	s	Documented
Calochortus longebarbatus var. *longebarbatus*	s	Suspected
Carex atrata var. erecta	s	Suspected
*Carex densa**	s	Documented
Carex stenophylla	s	Suspected
Chrysolepis chrysophylla	s	Suspected
Cicuta bulbifera	s	Suspected
Cimicifuga elata	t	Suspected
Corydalis aquae-gelidae	t	Suspected
Cryptantha rostellata	s	Suspected
Cyperus bipartitus	s	Suspected
Cypripedium fasciculatum	t, SOC	Suspected
Damasonium californicum	S	Suspected
Erigeron howellii	t, SOC	Suspected
Eryngium petiolatum	t	Suspected
Euonymus occidentalis	s	Suspected
Fritillaria camschatcensis	s	Suspected
Heuchera grossulariifolia var. *tenuifolia*	s	Suspected
Howellia aquatilis	t,T	Suspected
Linanthus bolanderi	s	Suspected

Liparis loeselii	e	Suspected
Lomatium suksdorfii	s, SOC	Suspected
Luzula arcuata	s	Documented
Meconella oregana	t, SOC	Suspected
Microseris borealis	s	Documented
Mimulus jungermannioides	x, SOC	Suspected
Mimulus pulsiferae	s	Suspected
Mimulus suksdorfii	s	Suspected
Montia diffusa	s	Suspected
Navarretia tagetina	t	Suspected
Ophioglossum pusillum	t	Suspected
Parnassia fimbriata var. *hoodiana*	s	Suspected
Pedicularis rainierensis	s	Suspected
Pityopus californica	s	Suspected
Platanthera sparsifora	s	Suspected
Poa laxiflora	t	Suspected
Poa nervosa var. *nervosa*	s	Suspected
Polemonium carneum	t	Suspected
Potentilla breweri	s	Suspected
Ranunculus populago	s	Documented
Ranunculus reconditus	t, SOC	Suspected
Rorippa columbiae	t, SOC	Suspected
Scribneria bolanderi	s	Suspected
Sidalcea hirtipes	e	Documented
Sisyrinchium sarmentosum	t, SOC	Documented
Utricularia intermedia	s	Suspected
Veratrum insolitum	s	Suspected

United States Fish and Wildlife Service status:
E- Federally Endangered
F- Federally Threatened
P- Proposed Federally Threatened
C- Candidate
S- Forest Service Sensitive
SOC- Species of Concern
Washington Natural Heritage Program status:
e = endangered in Washington State
t = threatened in Washington State
s = sensitive in Washington State
x = possibly extinct or extirpated
soc = species of concern Washington State

*- Historic sighting record in watershed, but needs confirmation

Individual Wildlife Species Discussions

Gray wolf and grizzly bear

There have been several gray wolf sightings in the watershed, all from the Walupt Lake area and the Goat Rocks Wilderness. It is not known if these animals were wolves, wolf-dog hybrids, or some other canid, and additional survey effort is needed to determine the status of the gray wolf in this area. There are no historic sightings of grizzly bears in the watershed, and grizzlies would likely occur only as a very rare transient, although they were likely historic residents in suitable habitats such as the Goat Rocks and Mt. Adam wilderness areas. Wolves and grizzlies would be expected to occur in areas with low road densities such as the Cispus Headwaters, Walupt Creek, Muddy Fork, and Adams Fork sub-basins, all of which have road densities less than .5 miles per square mile. The highest road densities are found in the Chambers Creek, Cat Creek, East Canyon Creek, and North Fork sub-basins, each containing densities above one mile per square mile; these sub-basins are much less suitable for both wolves and grizzly bears.

Northern spotted owl

There are a total of 20 known historic spotted owl pairs in the watershed, eight of which occur in the North Fork sub-basin. Of these 20 pairs, 18 are below the “incidental take” thresholds established by the U.S. Fish and Wildlife Service of 500 acres of suitable habitat within .7 mile of the pair’s activity center, and 2663 acres within 1.82 miles (i.e. outer limits of potential home range). Spotted owl survey activity in this watershed has been minimal since 1995, and as of July, 2001 no areas are surveyed to valid protocol standards. Some historic pairs have been checked for occupancy and reproduction, however these activity center surveys have not been comprehensive in nature, and have generally focused on readily accessible owl pairs or those potentially affected by management activities.

In addition to concerns with the amount of suitable habitat in the home ranges of spotted owl pairs and uncertainties due to reductions in survey activity, the numbers of barred owls in the watershed appear to have increased during the last decade or more. This species is attracted to wet areas, such as those found over much of the Upper Cispus watershed, and may be displacing spotted owls from traditional use areas- research is needed to determine if this is, in fact, occurring. There are a total of 15 identified barred owl pairs in the watershed (R. Pearson, pers. comm.); this is a minimum figure, as other identified single barred owls are likely pairs. A cluster of five barred owl pairs occurs in the Adams Fork and Cat Creek sub-basins, with other clusters in Chambers Creek and Cispus River Headwaters.

<u>Suitable spotted owl habitat</u> - The following list displays the suitable habitat situation for the northern spotted owl in the Upper Cispus watershed: (See Map 15, Northern Spotted Owl Habitat)

Nesting and Roosting (Suitable) Habitat= 18,635 acres
Foraging (Suitable) Habitat= 24,482 acres
Total Suitable Habitat: Nesting and Roosting + Foraging= 43,117 acres
Dispersal Habitat (Not considered suitable habitat)= 20,039 acres

Although “nesting and roosting” habitat comprises 43% of the total amount of suitable spotted owl habitat, much of this is either fragmented or occurs at higher elevations in wilderness. Large patches of “nesting and roosting” habitat appear to be unoccupied by spotted owls, and the effectiveness of this habitat type in supporting spotted owl pairs in this watershed is less than the above figures would indicate. The largest and most intact patch of “nesting and roosting” habitat occurs in the

North Fork sub-basin.

“Foraging” habitat is very important to the persistence of spotted owls in the watershed, but varies structurally to a wide degree. Some stands mapped as “foraging” contain many legacy features such as large, “remnant” live trees, large snags, and high levels of down wood, while others do not. There are large, unfragmented patches of “foraging” as well as “dispersal” habitat in Upper Cispus, but their exact role in spotted owl fecundity and survival is not known.

<u>Spotted owl Critical Habitat</u> - A small piece of spotted owl Critical Habitat Unit WA-37 is found in the North Fork sub-basin of the watershed. As this is a very limited patch of the CHU, most of which is located in other watersheds to the north, no specific analysis was conducted for this area. This CHU patch contains two of the twenty owl pairs identified in the watershed.

Northern bald eagle

Bald eagles are observed during the fall and winter months along the main Cispus River, with numbers recently increasing due to the stocking of salmon into this system. Eagles are occasionally observed in the summer months at Walupt Lake and other suitable foraging sites. No eagle nests or winter roost sites have been identified in the watershed, and the potential for nesting is probably low.

Canada lynx

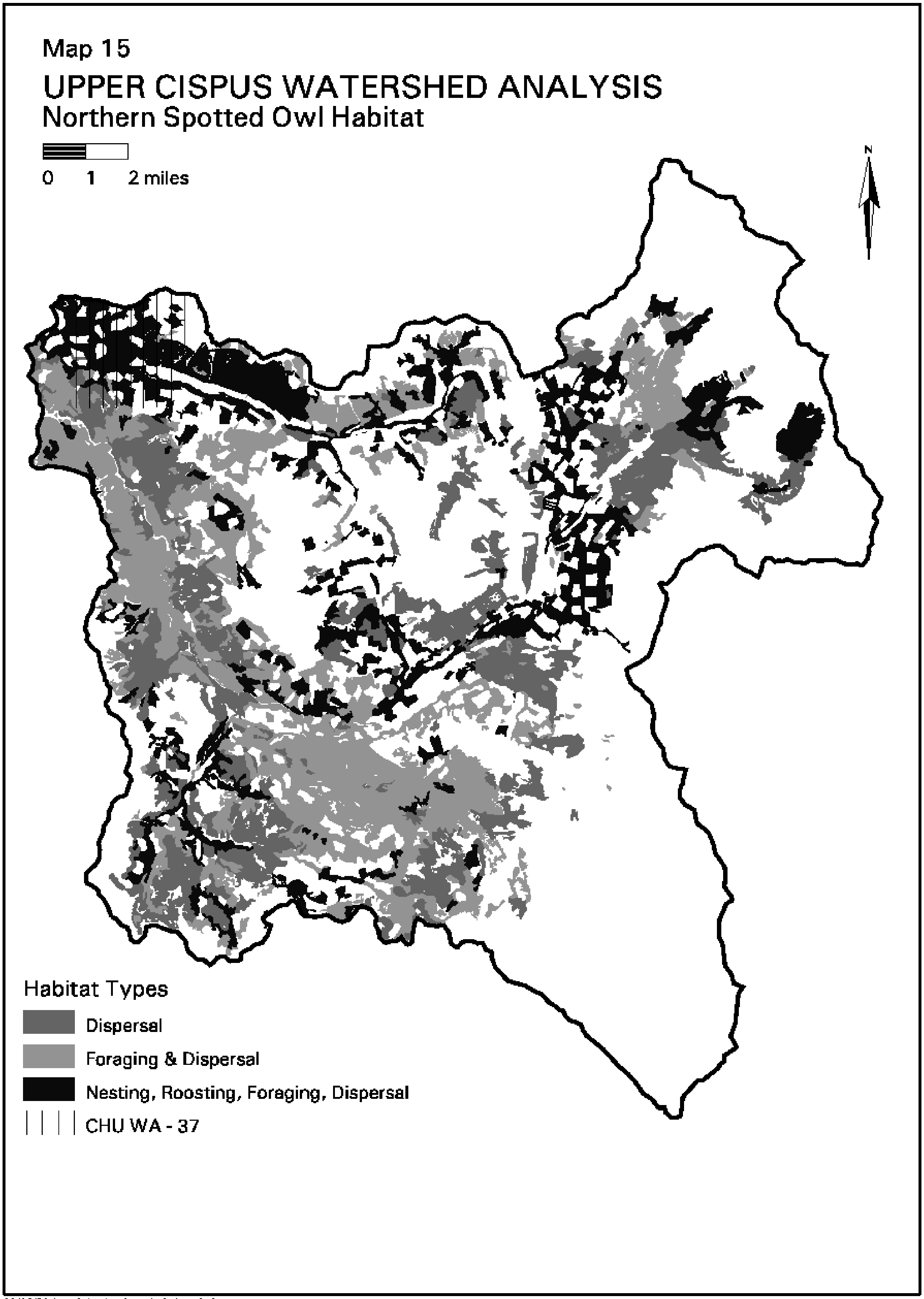
Surveys have been conducted in the watershed in an effort to determine the presence or absence of lynx since 1998. These surveys have utilized “hair snags” and DNA analysis, and are ongoing as of July, 2001. In addition, winter “camera trap” carnivore surveys have been conducted in the watershed, although these did not specifically target lynx. The results obtained so far have not confirmed the presence of lynx in the watershed or other areas on the Forest. Lynx habitat has been mapped on the Forest using GIS, and within the watershed lynx habitat occurs in the Goat Rocks and Mt. Adams Wilderness areas, based on current mapping criteria. This may change in the future as additional surveys are completed, and the status and distribution of the lynx in the southern Cascades is clarified.

California wolverine

There has been one unconfirmed wolverine sighting in the watershed (Goat Rocks Wilderness), with other sightings outside the watershed boundary. This wide-ranging and elusive species may utilize high-elevation habitats in the watershed for travel, foraging or possibly denning. No wolverine surveys have been conducted to date on the District, and the status of this species is unknown.

Other listed species

There are eight amphibian species listed as sensitive or “species of concern”. The Larch Mt. and Van Dyke’s salamanders are discussed in the next section on survey and manage species. Both project-related amphibian surveys, and general inventories have been conducted in the watershed during the last decade. The Cascades and tailed frogs are fairly common in suitable habitats, with Cope’s giant salamander occasional. The other species have not been detected to date in the watershed, although



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the Cascade torrent salamander is fairly common to the east in drainages approaching Mt. St. Helens. The Northwestern pond turtle and spotted frog probably do not occur in the watershed, although they are considered as potentially occurring during surveys.

None of the listed bat species have been reported from the watershed, which is a reflection of the absence of bat surveys in the area. Townsend's big-eared bat has been located under concrete bridges elsewhere on the District, and the long-legged myotis has been reported as well.

The Pacific fisher is a forest carnivore that may be almost extirpated in Washington; there are very few recent records of this species despite intensive survey activity during the past decade. Lower elevation, late-successional forests, such as those in the North Fork sub-basin, are likely the most suitable fisher habitat in the watershed.

Of the bird species listed above, surveys have been conducted since 1990 for the northern goshawk, with a total of seven goshawk nest territories identified in the Upper Cispus watershed. Three of these nests are in the North Fork sub-basin in the large, unfragmented forest patch that occurs there. There are no known peregrine falcon nest sites in the watershed, and potential nesting sites appear to be very limited. The distinctive call of the olive-sided flycatcher ("Quick, free beer!") is often heard in the watershed near forest edges; no surveys have been conducted specifically for this species or other neotropical migrants in this watershed, although a "Breeding Bird Survey" route does start in the northern part of the watershed and extends to the Packwood area. Common loons may occasionally occur at Walupt or Blue Lake on migration, however there have been no reported sightings to date at these sites.

The mardon skipper, a small butterfly that has been documented on the Mt. Adams Ranger District south of the watershed boundary, may occur in Upper Cispus in dry, grassy meadows with flowers such as lupine and yarrow. No surveys have been conducted for this species in the watershed.

TES Plant Species

Botrychium spp.

The Upper Cispus watershed hosts four species of rare grape-ferns, including *Botrychium pinnatum, Botrychium lunaria*, *Botrychium minganense* and *Botrychium lanceolatum*. The Washington Natural Heritage Program (WNHP) lists all of these species as Sensitive (vulnerable or declining) in the state of Washington, with a state rank of S3 (only 21-100 occurrences statewide). Although *B. lunaria, B. minganense* and *B. lanceolatum* were removed from the Gifford Pinchot National Forest Sensitive Plant List in July 2000, *B. pinnatum* remains on this list as a sensitive species. Within the Upper Cispus watershed, *Botrychium* species often grow intermixed, with a number of populations occurring in the southern part of the watershed.

Microseris borealis

Northern microseris (*Microseris borealis*) is a WNHP listed sensitive species with a state rank of S2 (vulnerable to extirpation in the state, with only 6 to 20 occurrences statewide). This species grows in moist to wet meadows and in Sphagnum bogs, and ranges from Alaska to California. A large population or populations of this species is located in the southwestern portion of the Upper Cispus watershed.

Luzula arcuata

Luzula arcuata (curved woodrush), a WNHP listed sensitive species with a state rank of S1 (critically imperiled in the state, with 5 or fewer occurrences) is found in the southeastern part of the Upper Cispus watershed, near Mt. Adams. This species is generally found in areas with rocky or gravelly soil, such as on moraines and above timberline.

Carex densa

There is a historical report of *Carex densa* (dense sedge) from the southeastern part of the watershed (near Mt. Adams), dating from 1904. The population has not been recently verified. This species is found in moist mountain meadows or riparian areas from ~ 2800– 4200 ft in elevation. It is ranked by WNHP as a sensitive, S1 species (critically imperiled within the state).

Githopsis specularioides

Githopsis specularioides (common bluecup) belies its name with a WNHP state rank of S3 (rare or uncommon with 21 to 100 occurrences statewide). Although this species is not found within the boundaries of the watershed, it is found approximately 900 m outside the northwest boundary of the watershed. This species is generally found in dry, open areas in valleys and foothills, often with oak.

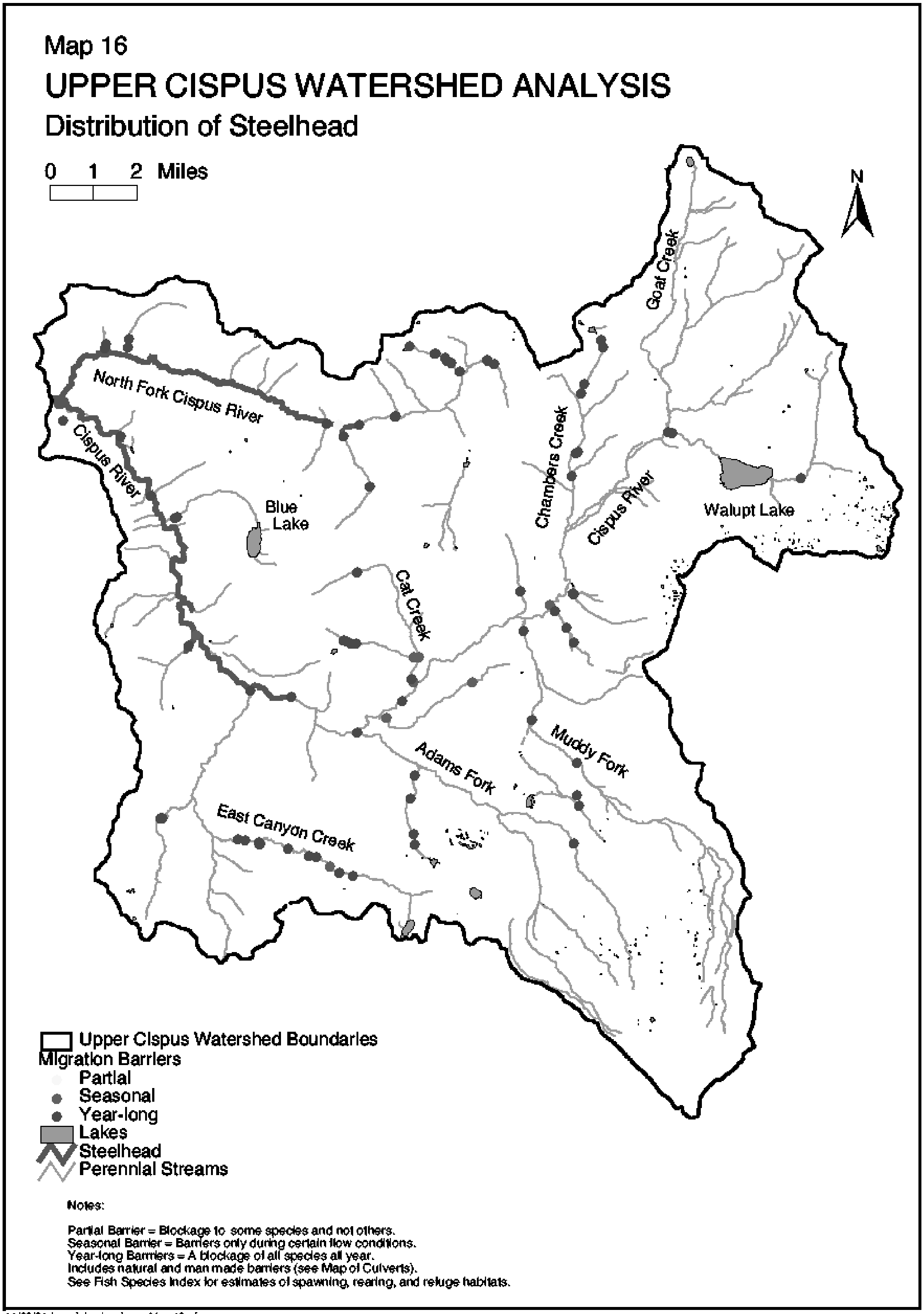
Rare Lichens

Three species of very rare lichens have been found within the southeastern part of the watershed, near Mt. Adams. These species are tracked by WNHP on working lists, and are assigned preliminary ranks, which reflect their rarity within the state. As these lists are preliminary, they have not been included in Table 3-18.. *Usnea sphacelata* is a fruticose species that grows on rocks in windswept subalpine to alpine areas; it is ranked as critically imperiled in the state (S1) with five or fewer reported occurrences. *Umbilicaria vellea* is a foliose species that grows on rock faces in subalpine environments, and is considered imperiled due to rarity or vulnerability, with less that 20 occurrences reported statewide (S2). *Lecanora pringlei* is a rare, crustose lichen for which a rank is undetermined at present.

TES Fish Species

The Upper Cispus watershed has habitat for five threatened or sensitive fish species steelhead, chinook salmon, bull trout, coastal cutthroat trout, and coho salmon. The anadromous (steelhead, chinook salmon, sea-run coastal cutthroat, and coho salmon) fish are being re-introduced to the watershed. A “trap and haul” program provides passage around the three Cowlitz River dams. In addition, steelhead and Chinook salmon hatchery fry are planted in the watershed.

Maps 16-20 display the habitat for these species. Appendix A displays the amount of habitat by species for each sub-watershed and for the entire watershed.



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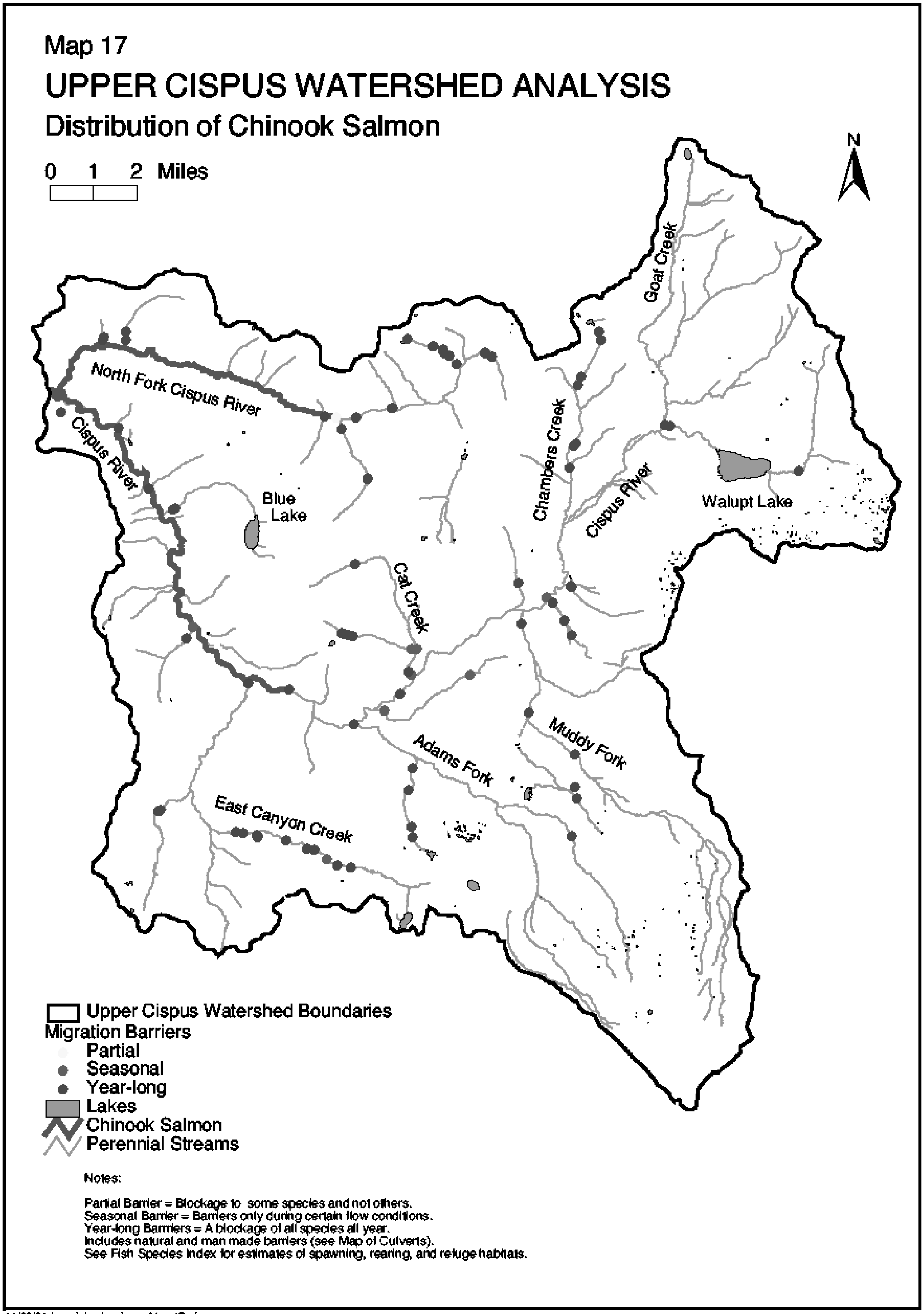

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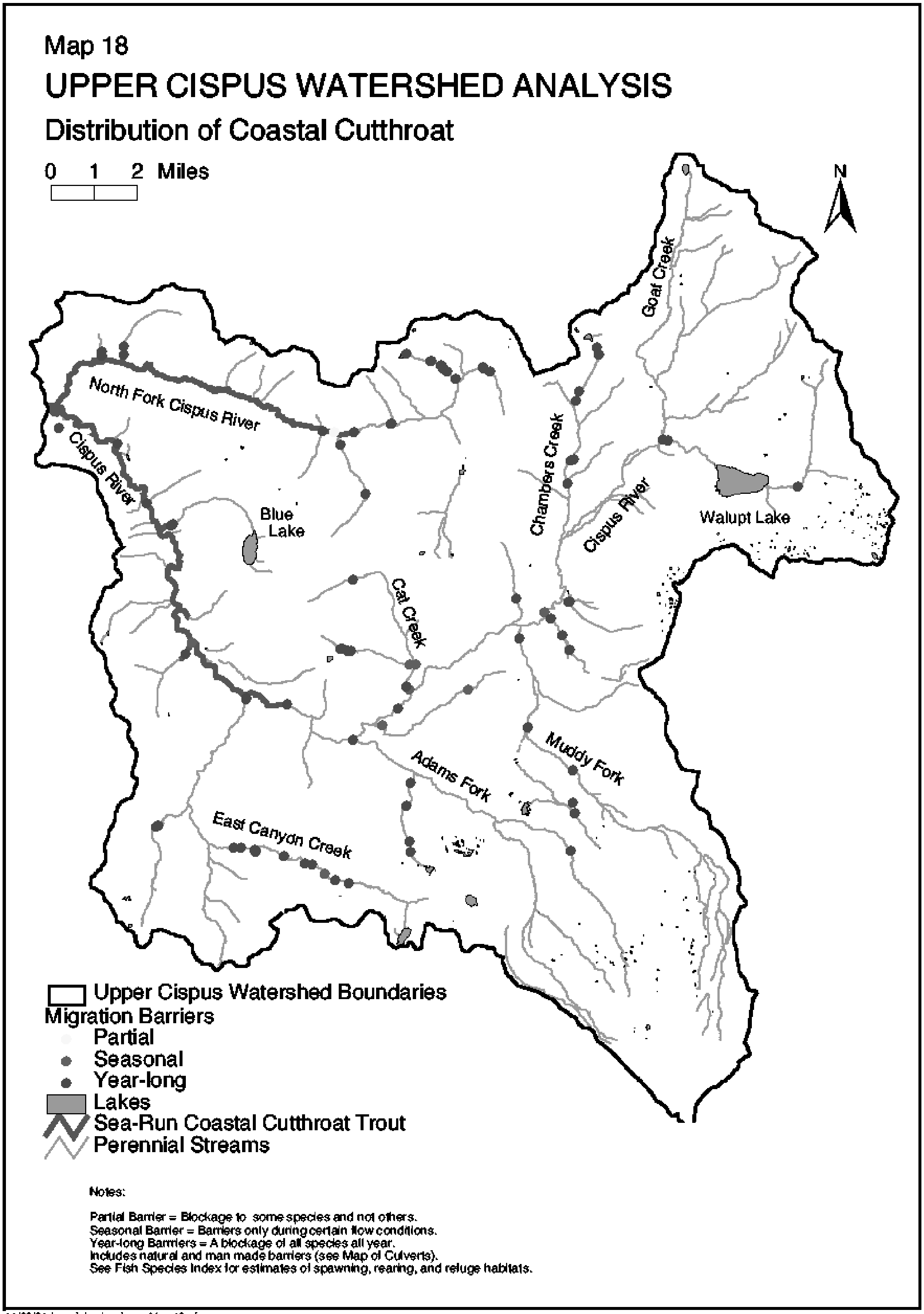

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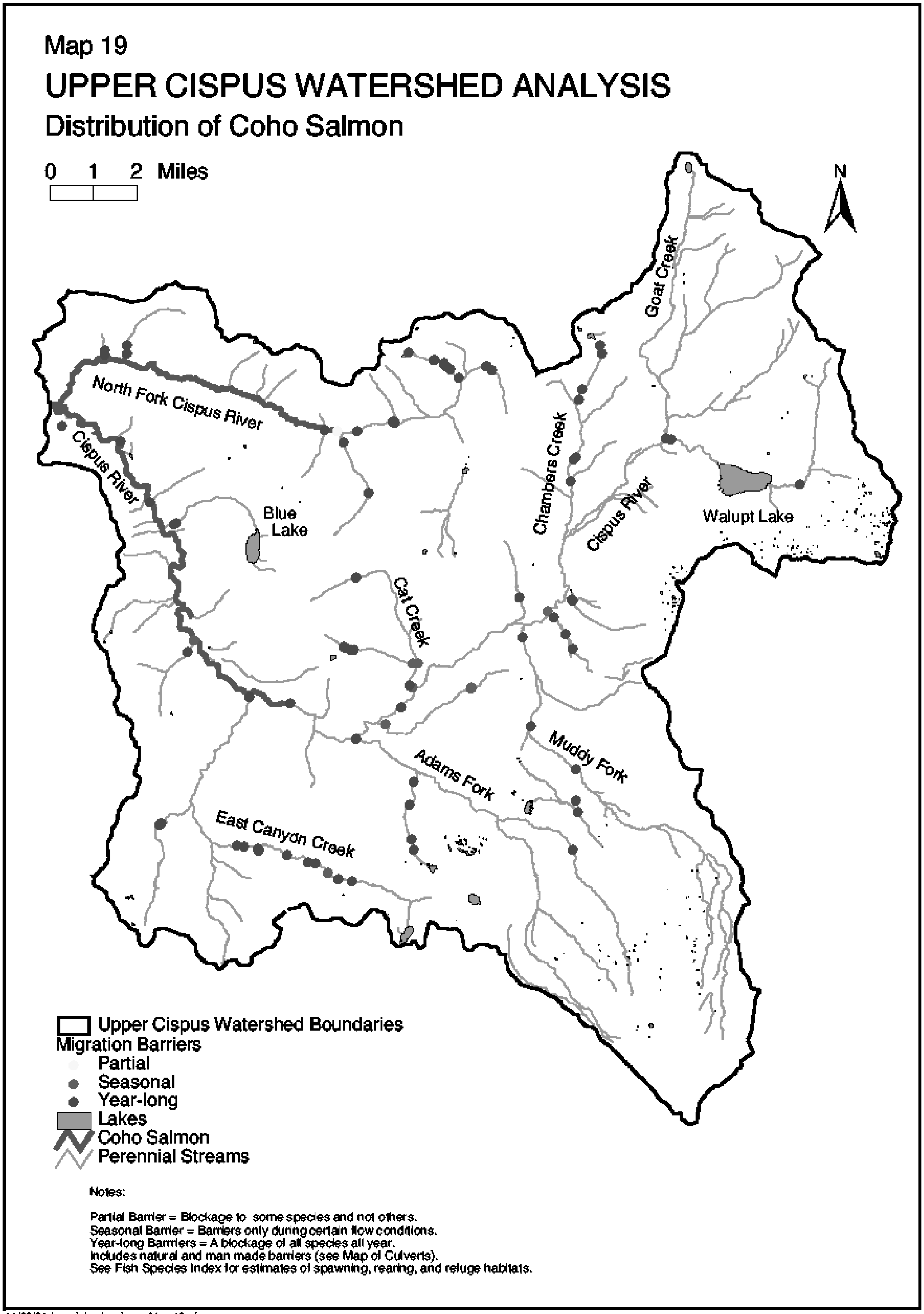

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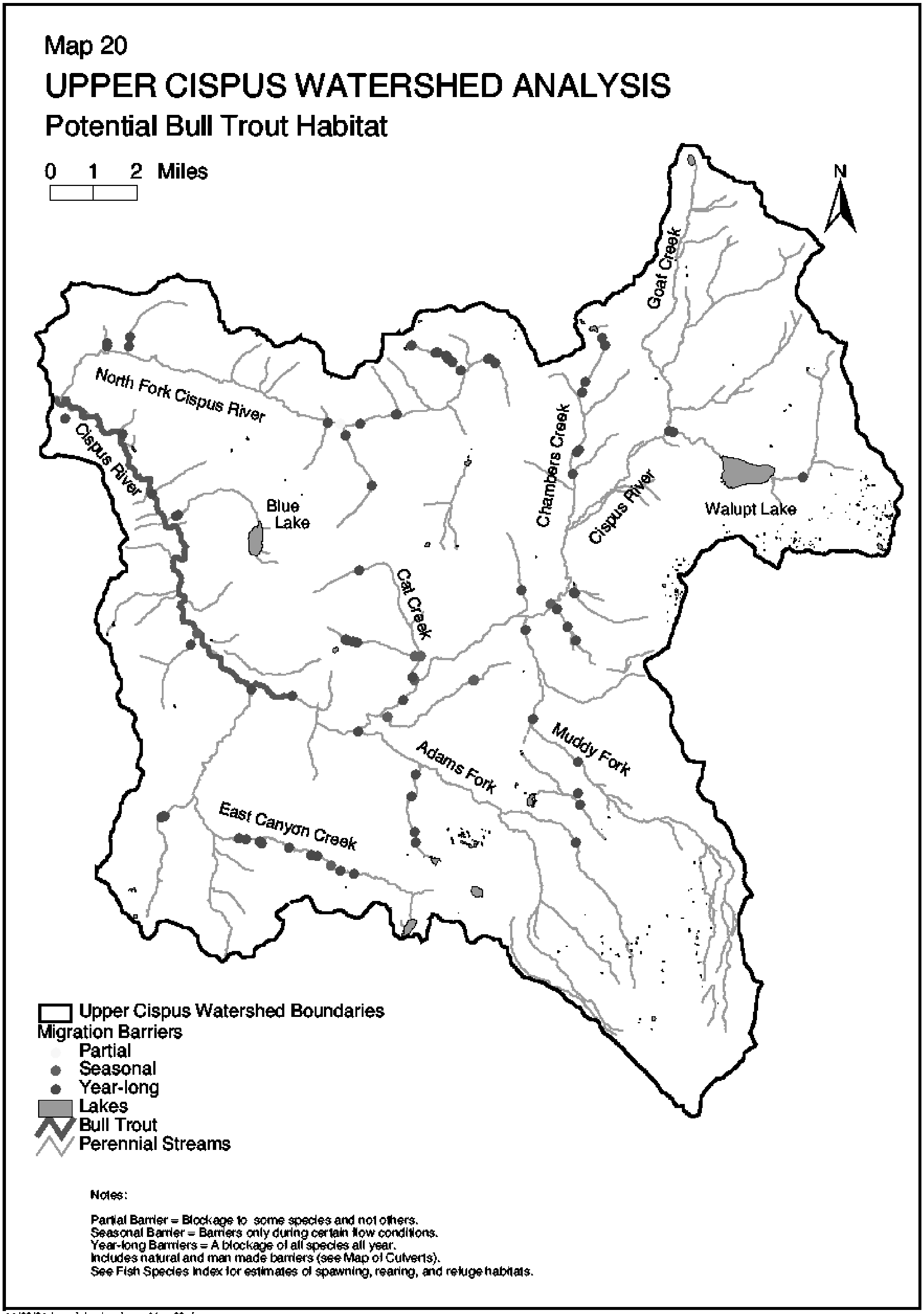

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Steelhead

Steelhead use the Cispus River and many of the tributary streams up to the anadromous barriers. Over 500 adult steelhead were transported above the Cowlitz River dams in the 2001 spawning season. The number of steelhead returning fish is well below the estimated potential abundance levels of 2,835 (Middle and Upper Cispus WA) for the entire upper Cowlitz River. We have no way of monitoring returns to the Upper Cispus Watershed.

Chinook Salmon

Chinook salmon use the Cispus River and North Fork Cispus River below the anadromous barriers. Tributaries to these streams are smaller than those generally used by Chinook salmon. Radio tracking of adult Chinook salmon released at the Spud Hill bridge on the Cispus River found that they used the river up to the anadromous barrier (Personal Communication, John Serl, WDFW).

Only about 200 adult spring Chinook were released in the upper Cowlitz River system during the last spawning season. Adult fall Chinook were released unio the Upper Cowlitz River in the fall of 2001. Release of adult Chinook salmon is being limited until the efficiency of the smolt traps at Cowlitz Falls dam is improved.

The Middle and Upper Cispus Watershed analysis reported the potential Chinook returns as 6,357 for the entire upper Cowlitz River system.

Bull Trout

The presence of bull trout in the Upper Cispus watershed is only suspected at this time. None of the stream surveys or other sampling by Forest Service or Washington Department of Fish and Wildlife employees has ever found a bull trout in this watershed. The only reliable report of bull trout in the Cispus River is from Yellowjacket Creek, which has its confluence with the Cispus River approximately 2 miles downstream from the watershed boundary. The Forest Service occasionally receives unconfirmed reports of "bull trout" by non-fisheries biologists.

Historically bull trout may have occupied the watershed. There are unconfirmed reports of people catching bull trout in the Cispus River. In addition, bull trout currently occupy watersheds to the north, south and east of the Cowlitz River.

Coastal Cutthroat Trout

Coastal cutthroat trout are found throughout the watershed. They are the most widely spread of any of the species. They tend to be the furthest upstream than any of the salmonid species. The true anadromous form only occurs below the migration barriers. This population appears to be very low in number as relatively few smolts are captured at Cowlitz Falls dam and only a handful of adults have been transported upstream of the dams. Recent genetic studies, however, have discovered that coastal cutthroat trout living above migration barriers (resident coastal cutthroat trout) are contributing to anadromous runs. This appears to be occurring in the Cowlitz River system as well. Before adults were transported upstream of the Cowlitz Falls dam, coastal cutthroat smolts were captured at the Cowlitz Falls fish facility. Adult sea run cutthroat are now being transported to locations above Cowlitz Falls dam.

We have no records or estimates of the historic abundance of coastal cutthroat trout.

Coho Salmon

Coho salmon are the most abundant of the Threatened and Sensitive fish species. Over 30,000 adult salmon were passed to the upper watershed during the last spawning run (2000-2001). They use the Cispus River and most of the low gradient tributaries below anadromous barriers. Coho salmon use the side channels and back water habitats of the Cispus River that are abundant in the Blue Lake sub-watershed.

The Middle and Upper Cispus watershed reported an estimated potential population of 8,078 returning adults to the upper Cowlitz River; however, over 27,000 adults have been returned to upper Cowlitz River in each of the last two years. Therefore the estimate of the just over 8,000 may be quite low.

b. Survey and Manage Species

The Record of Decision for the Northwest Forest Plan contained a listing of survey and manage plant and animal species. This was amended by the "Record of Decision and Standards and Guidelines for Amendments to the survey and manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines" document issued in January, 2001. This latter document revised the survey and manage categories, as well as dropped some species from the list. The following table displays the status and occurrence of survey and manage species known or suspected to occur in the watershed, as of July, 2001:

Table 3-19: Survey and Manage Species Known or Suspected in the Upper Cispus Watershed

Species	Category*	Occurrence
AMPHIBIANS		
Larch Mountain salamanader *(Plethodon larselli)*	A	Documented
Van Dyke's salamander *(Plethodon vandykei)*	A	Suspected
MOLLUSKS		
Puget Oregonian snail *(Cryptomastix devia)*	A	Documented
Evening field-slug (*Deroceras hesperium*)	B	Suspected
Malone jumping-slug (*Hemphillia malonei*)	C	Suspected
Warty jumping-slug (*Hemphillia glandulosa*)	C	Suspected
Keeled jumping-slug (*Hemphillia burringtoni*)	C	Suspected
Panther jumping-slug (*Hemphillia pantherina*)	B	Suspected
Blue-gray tail-dropper (slug) (*Prophysaon coeruleum*)	A	Suspected
Columbia duskysnail (*Lyogyrus* n. sp. 1)	A	Suspected
Washington duskysnail (Lyogyrus n. sp. 2)	A	Suspected
LICHENS		
Bryoria subcana	B	Suspected
Bryoria tortuosa	B	Suspected

Calicium abietinum	B	Suspected
Calicium adspersum	E	Suspected
Calicium glaucellum	F	Suspected
Calicium viride	F	Documented
Cetrelia cetrarioides	E	Suspected
Chaenotheca chrysocephala	B	Suspected
Chaenotheca ferruginea	B	Suspected
Chaenotheca furfuracea	F	Suspected
Chaenotheca subroscida	E	Suspected
Chaenothecopsis pusilla	E	Suspected
Cladonia norvegica	B	Suspected
Dendriscocaulon intricatulum	B	Documented
Dermatocarpon luridum	B	Suspected
Hypogymnia duplicata	A	Suspected
Hypogymnia oceanica	F	Documented
Hypogymnia vittata	E	Suspected
Leptogium cyanescens	A	Suspected
Leptogium rivale	B	Suspected
Leptogium teretiusculum	E	Suspected
Lobaria linita	A	Suspected
Microcalicium arenarium	B	Suspected
Nephroma bellum	F	Suspected
Nephroma isidiosum	E	Suspected
Nephroma occultum	B	Suspected
Pannaria saubinetii	F	Suspected
Peltigera pacifica	E	Suspected
Platismatia lacunosa	C	Suspected
Pseudocyphellaria rainierensis	A	Documented
Ramalina pollinaria	E	Suspected
Ramalina thrausta	A	Suspected
Stenocybe clavata	E	Suspected
Usnea longissima	F	Documented
BRYOPHYTES		
Brotherella roellii	E	Suspected
Buxbaumia viridis	D	Documented
Diplophyllum plicatum	B	Suspected
Encalypta brevicolla v. *crumiana*	B	Suspected
Herbertus aduncus	B	Suspected
Marsupella emarginata v. *aquatica*	B	Suspected
Racomitrium aquaticum	B	Suspected
Rhizomnium nudum	B	Suspected
Schistostega pennata	A	Suspected
Tetraphis geniculata	A	Documented

Tritomaria exsectiformis	B	Suspected
Tritomaria quinquedentata	B	Suspected
VASCULAR PLANTS		
Arceuthobium tsugense mertensianae	F	Suspected
Botrychium montanum	A	Suspected
Coptis aplenifolia	A	Suspected
Coptis trifolia	A	Suspected
Corydalis aquae-gelidae	C	Suspected
Cypripedium fasciculatum	C	Suspected
Cypripedium montanum	C	Suspected
Galium kamtschaticum	A	Suspected
Platanthera orbiculata var. *orbiculata*	C	Suspected
FUNGI		
Acanthophysium farlowii	B	Suspected
Albatrellus avellaneus	B	Suspected
Albatrellus caeruleoporus	B	Suspected
Albatrellus ellisii	B	Suspected
Albatrellus flettii	B	Suspected
Alpova alexsmithii	B	Suspected
Arcangeliella camphorata	B	Suspected
Asterphora lycoperdoides	B	Suspected
Asterophora parasitica	B	Suspected
Baeospora myriadophylla	B	Suspected
Boletus haematinus	B	Suspected
Boletus pulcherrimus	B	Suspected
Bondarzewia mesenterica	B	Suspected
Bridgeoporus nobilissimus	A	Suspected
Cantharellus subalbidus	D	Suspected
Catathelasma ventricosa	B	Suspected
Calciporus piperatus	D	Suspected
Chamonixia caespitosa	B	Suspected
Choiromyces alveolatus	B	Suspected
Choiromyces venosus	B	Suspected
Chromosera cyanophylla	B	Suspected
Chrysomphalina grossula	B	Suspected
Clavariadelphus ligula	B	Suspected
Clavariadelphus occidentalis	B	Suspected
Clavariadelphus sachalinensis	B	Suspected
Clavariadelphus subfastigiatus	B	Suspected
Clavariadelphus truncatus	B	Suspected
Clavulina castonopes v. lignicola	B	Suspected
Clitocybe senilis	B	Suspected
Clitocybe subditopoda	B	Suspected
Collybia bakerensis	B	Suspected
Collybia racemosa	B	Suspected

Cordyceps capitata	B	Suspected
Codyceps ophioglossoides	B	Suspected
Cortinarius barlowensis	B	Suspected
Cortinarius boulderensis	B	Suspected
Cortinarius cyanites	B	Suspected
Cortinarius depauperatus	B	Suspected
Cortinarius magnivelatus	B	Suspected
Cortinarius olympianus	B	Suspected
Cortinarius speciosissimus	B	Suspected
Cortinarius tabularis	B	Suspected
Cortinarius umidicola	B	Suspected
Cortinarius valgus	B	Suspected
Cortinarius variipes	B	Suspected
Craterellus tubaeformis	D	Suspected
Cudonia monticola	B	Suspected
Cyphellostereum laeve	B	Suspected
Dichostereum boreale	B	Suspected
Elaphomyces anthracinus	B	Suspected
Elaphomyces subviscidus	B	Suspected
Endogone acrogena	B	Suspected
Entoloma nitidum	B	Suspected
Fayodia bisphaerigera	B	Suspected
Galerina atkinsoniana	B	Suspected
Galerina cerina	B	Suspected
Galerina heterocystis	E	Suspected
Galerina sphagnicola	E	Suspected
Galerina vittaeformis	B	Suspected
Gastroboletus ruber	B	Suspected
Gastroboletus turbinatus	B	Suspected
Gautieria magnicellaris	B	Suspected
Gautieria otthii	B	Suspected
Gelatinodiscus flavidus	B	Suspected
Gomphus bonarii	B	Suspected
Gomphus clavatus	B	Suspected
Gomphus kauffmanii	B	Suspected
Gymnomyces abietis	B	Suspected
Gymnopilus punctifolius	B	Documented
Gyromitra californica	B	Suspected
Gyromitra esculenta	F	Suspected
Gyromitra infula	B	Suspected
Gyromitra melaleucoides	B	Suspected
Gyromitra montana	F	Suspected

Hebeloma olympianum	B	Suspected
Helvella crassitunicata	B	Suspected
Helvella elastica	B	Documented
Helvella maculata	B	Suspected
Hydnotrya subnix	B	Suspected
Hydnum umbilicatum	B	Suspected
Hydropus marginellus	B	Suspected
Hygrophorus caeruleus	B	Suspected
Hygrophorus karstenii	B	Suspected
Hygrophorus vernalis	B	Suspected
Hypomyces luteovirens	B	Suspected
Leucogaster citrinus	B	Suspected
Leucogaster microsporus	B	Suspected
Macowanites lymanensis	B	Suspected
Macowanites mollis	B	Suspected
Martellia fragrans	B	Suspected
Martellia idahoensis	B	Suspected
Mycena hudsoniana	B	Suspected
Mycena monticola	B	Suspected
Mycena overholtsii	B	Suspected
Mycena quinaultensis	B	Suspected
Mycena tenax	B	Suspected
Mythicomyces corneipes	B	Suspected
Neournula pouchetii	B	Suspected
Otidea leporina	B	Suspected
Otidea onotica	F	Suspected
Otidea smithii	B	Documented
Phaeocollybia attenuata	D	Suspected
Phaeocollybia californica	B	Suspected
Phaeocollybia fallax	D	Suspected
Phaeocollybia kauffmanii	D	Suspected
Phaeocollybia olivacea	B	Suspected
Phaeocollybia oregonensis	B	Suspected
Phaeocollybia piceae	B	Suspected
Phaeocollybia pseudofestiva	B	Suspected
Phaeocollybia spadicea	B	Suspected
Phellodon atratus	B	Suspected
Pholiota albivelata	B	Suspected
Pithya vulgaris	D	Suspected
Plectania melastoma	F	Suspected
Plectania milleri	B	Suspected
Podostroma alutaceum	B	Suspected
Polyozellus multiplex	B	Documented
Ramaria abietina	B	Suspected

Ramaria amyloidea	B	Suspected
Ramaria araiospora	B	Suspected
Ramaria aurantiisiccescens	B	Suspected
Ramaria botryis var. *aurantiiramosa*	B	Suspected
Ramaria celerivirescens	B	Suspected
Ramaria claviramulata	B	Suspected
Ramaria concolor f. marrii	B	Suspected
Ramaria concolor f. tsugina	B	Suspected
Ramaria conjunctipes var. *sparsiramosa*	B	Suspected
Ramaria coulterae	B	Suspected
Ramaria cyaneigranosa	B	Suspected
Ramaria gelatiniaurantia	B	Suspected
Ramaria gracilis	B	Suspected
Ramaria hilaris var. *olympiana*	B	Suspected
Ramaria largentii	B	Suspected
Ramaria lorithamnus	B	Suspected
Ramaria maculatipes	B	Suspected
Ramaria rainierensis	B	Suspected
Ramaria rubella var. *blanda*	B	Suspected
Ramaria rubribrunnescens	B	Suspected
Ramaria rubrievanescens	B	Suspected
Ramaria rubripermanens	B	Suspected
Ramaria spinulosa var. *diminutiva*	B	Suspected
Ramaria stuntzii	B	Suspected
Ramaria suecica	B	Suspected
Ramaria thiersii	B	Suspected
Ramaria verlotensis	B	Suspected
Rhizopogon abietis	B	Suspected
Rhizopogon atroviolaceus	B	Suspected
Rhizopogon chamaleontinus	B	Suspected
Rhizopogon evadens var. *subalpinus*	B	Suspected
Rhizopogon exiguus	B	Suspected
Rhizopogon flavofibrillosus	B	Suspected
Rhizopogon inquinatus	B	Suspected
Rhizopogon truncatus	D	Suspected
Rhodocybe speciosa	B	Suspected
Rickenella swartzii	B	Suspected
Russula mustelina	B	Suspected
Sarcodon fuscoindicus	B	Suspected
Sarcodon imbricatus	B	Suspected
Sarcosoma latahense	B	Suspected
Sarcosoma mexicana	F	Suspected
Sarcosphaera coronaria	B	Suspected

Sedecula pulvinata	B	Suspected
Sowerbyella rhenana	B	Documented
Sparassis crispa	D	Suspected
Spathularia flavida	B	Suspected
Stagnicola persplexa	B	Suspected
Tremiscus helvelloides	B	Suspected
Tricholoma venenatum	B	Suspected
Tricholomopsis fulvescens	B	Suspected
Tuber asa	B	Suspected
Tylopilus porphyrosporus	D	Suspected

*- Categories indicate management direction and survey requirements, based on relative rarity of the species. See "Survey and Manage EIS, Standards and Guidelines" Section, page 7.

Amphibians

There are two Larch Mt. salamander sites in the watershed, both located during a timber sale survey. There is one reported Van Dyke's salamander site in the North Fork sub-basin, but this site has not been verified. There is the potential for additional sites for both species in the watershed, although habitat for the Larch Mt. salamander is not as abundant as some other watersheds due to unfavorable soil conditions (i.e. deep pumice) and large areas devoid of rock outcrops and talus, and the Van Dyke's salamander is very rare even where apparently suitable riparian habitat occurs.

Mollusks

The only known survey and manage mollusk species known to occur in the watershed at present is *Cryptomastix devia*, the Puget Oregonian snail, which is associated exclusively with big-leaf maple trees. Sites occur both in the Blue Lake and North Fork sub-basins, with most having been located during timber sale surveys. This species likely occurs in the watershed wherever patches of big-leaf maple are present, which is mainly along the Cispus River and tributaries to approximately 3000 feet in elevation. The other species, based on District surveys completed to date, appear to be either very rare (e.g. *Hemphillia malonei*, *Prophysaon coeruleum*) or absent (e.g. *Hemphillia glandulosa, H. burringtoni*) in the Cispus and Cowlitz River basins. Additional surveys, both project-related and general inventories, will help to clarify the distribution of these animals in the future.

Lichens

There are nine species of survey and manage lichens known to occur within the watershed, and many more that are likely to be found there. Many of these species are associated with older forests containing legacy trees and shrubs. There are increasing indications that dispersal is a limiting factor in the distribution of these species. Thus, sites where these species persist are important as dispersal centers.

Calicium viride is a small "pin lichen" that grows on the bark of old conifers with highly textured bark. This species is found in open, well-lit sites such as canopy gaps, open conifer stands, on conifer trees around rocky outcrops, and at the edges of beaver ponds and bogs. It is a survey and manage category F species, indicating that it is uncommon rather than rare.

Dendriscocaulon intricatulum is a minute, fruticose species. In the northern part of its range, including the Gifford Pinchot National Forest, it is found on the twigs and boles of trees in shady habitats. This species is a survey and manage category B species, indicating that it is rare.

Hypogymnia oceanica is a foliose lichen species that is found primarily on the bark and wood of conifers; in the Cascades it is found in *Pseudotsuga/Tsuga* forests. This species is a survey and manage category F species, indicating that it is uncommon rather than rare.

Pseudocyphellaria rainierensis is a large, foliose, arboreal lichen species that is strongly associated with old growth conifer forests. This species is dispersal limited; it requires long periods of time to disperse and colonize new sites. It is likely that timber harvest and other management activities have extirpated this species from many sites where it historically resided. Sites where this species persists are especially valuable as dispersal centers; these sites act as long-term propagule depositories and distribution centers, allowing the species to colonize new sites over time. This species is a survey and manage category A species, indicating that it is rare.

Usnea longissima is a pendulous “hair” lichen species, with patchy distribution across its range. It is likely that this species is dispersal limited. It is a survey and manage category F species (in Washington and Oregon), indicating that it is uncommon rather than rare.

Four additional survey and manage lichen species have only recently been discovered within the Upper Cispus Watershed area. *Nephroma occultum* is a very rare, foliose, arboreal lichen species that is strongly associated with old growth conifer forests and which is a survey and manage category B species. *Ramalina thrausta* is a rare, pendulous, survey and manage category A lichen species usually associated with old, conifer dominated, riparian forests. *Peltigera pacifica* is a survey and manage category E foliose lichen species that grows on soil or old decaying logs in moist forests. *Platismatia lacunosa* is found in moist, often riparian influenced, conifer forests, growing on hardwood trees or shrubs; it is a survey and manage category C species, a status indicating that it is uncommon rather than rare.

Bryophytes

Microclimatic factors, such as moisture and light, are important to many bryophyte species. Changes in microclimate may result in decreased vitality or extirpation of sensitive bryophyte populations.

There are two species of survey and manage bryophytes known to occur within the watershed. *Buxbaumia viridis* (green bug moss) grows on recumbent, moist, rotting logs in shady forests, or on soil in cool, shaded, humid locations. *Tetraphis geniculata* inhabits rotten stumps and logs in shady, humid localities. Both species are sensitive to changes in light and moisture levels, and depend on large coarse woody debris for substrates. *Buxbaumia viridis* is a survey and manage category D species, indicating that it is uncommon rather than rare. *Tetraphis geniculata* is a survey and manage category A species, indicating that it is rare.

Fungi

As with the bryophytes, microclimate (especially moisture) is important to many species of fungi. Since the “body” of the fungus consists of the mycelium (mushrooms and cups are fungus “fruits”), fungi don’t tend to do well in areas where there is a lot of substrate disturbance.

There are five species of survey and manage fungi known to occur within the watershed. *Gymnopilus punctifolius* is a saprophyte that fruits on large, rotting conifer stumps and snags with brown cubicle rot. This species is a survey and manage category B species, indicating that it is rare. *Helvella elastica* may be a saprophyte or mycorrhizal with the family Pinaceae, and has been found in a variety of habitats. It is a survey and manage B species, indicating that it is rare. *Otidea smithii* and *Sowerbyella rhenana* are cup fungi – little is known about their specific habitat needs. Both species are survey and manage category B species, indicating that they are rare.
Polyozellus multiplex is mycorrhizal with true firs (*Abies* spp.) in montane conifer forests. It is a survey and manage category B species, indicating that it is rare.

c. Management Indicator Species

Management Indicator Species are those identified in the GP Forest Plan as being in demand for consumptive or non-consumptive use, or to represent other species with similar habitat requirements. See the GP Forest Plan for further information.

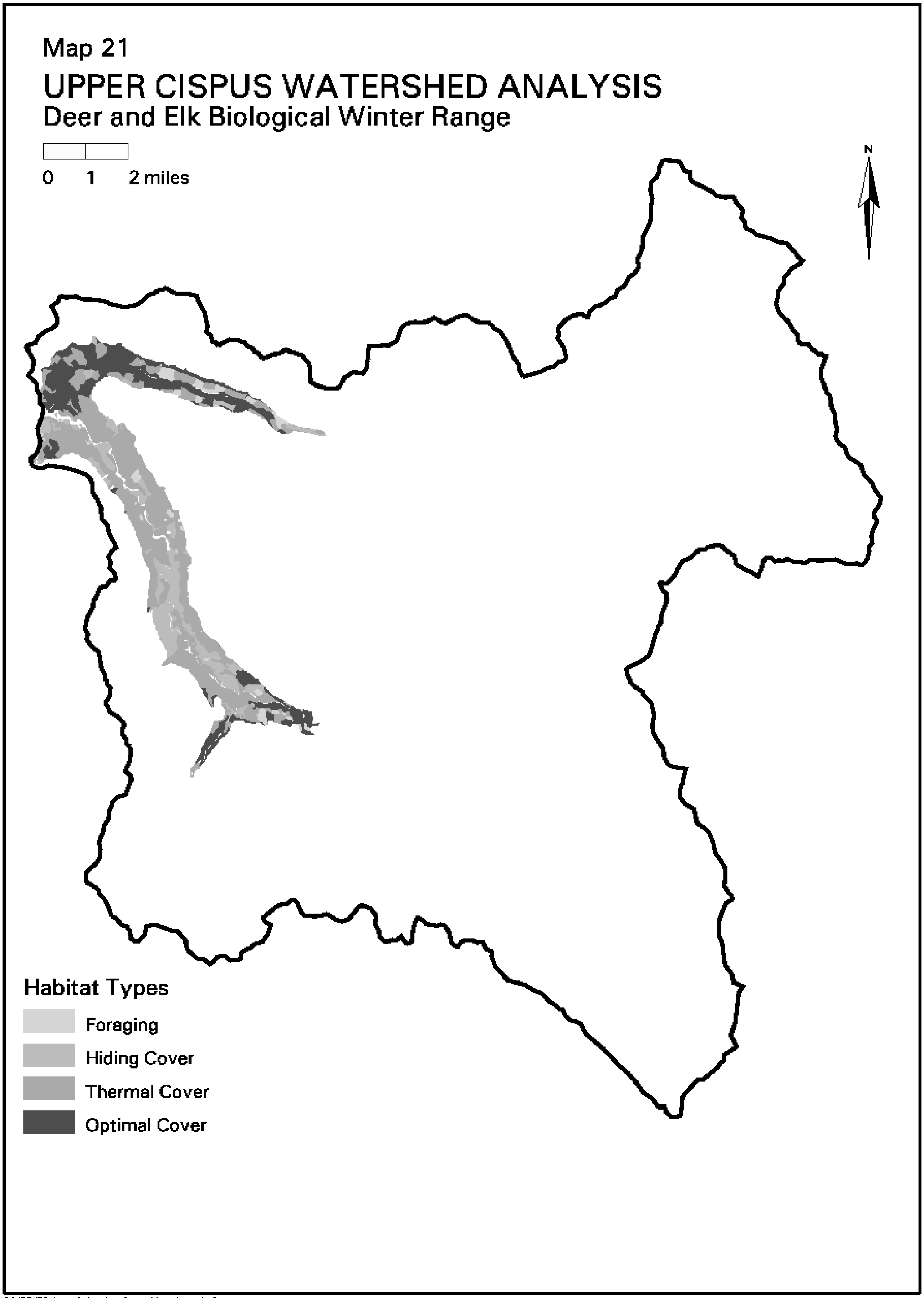
Deer and elk

The watershed contains large numbers of deer and elk, and is a popular area for hunting as well as viewing of these animals. The majority of the watershed is summer range for deer and elk, who move to lower-elevation winter range from December to April; many, probably most, of the animals who summer in the Upper Cispus watershed leave the watershed and winter elsewhere. There are 9,645 acres of winter range in the watershed, located along the main Cispus River and the North Fork Cispus below 2400 feet in elevation. See Map 21, Deer and Elk Biological Winter Range. These acres are distributed as follows:

Foraging areas- 481 acres (5%)
Hiding cover- 1795 acres (19%)
Thermal cover- 4755 acres (49%)
Optimal cover- 2213 acres (23%)

See “Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington, Part 1, Chapter Narratives” for a description of these habitat categories.

The watershed is presently below the Gifford Pinchot NF plan goal of 44% of the winter range in optimal cover, which is utilized by big game during severe winter weather conditions. There is, however, sufficient thermal cover (which is utilized during “normal” winter conditions) which will succeed to optimal cover in the future; this process may be accelerated in some cases by commercial thinning to promote tree growth and understory development in both thermal and hiding cover stands.



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The amount of forage on the winter range is limited in this watershed. The existing amount of forage at 5% is less that the desired amount of 10-15%, and will be decreasing quickly as regenerating timber harvest areas mature into hiding and thermal cover. This situation will also eventually affect the quality of summer range as well, but this will take somewhat longer. In the absence of regeneration harvest on the winter range, or other disturbances that produce early-successional forage areas, the carrying capacity of the Upper Cispus winter range can be expected to decline over the long-term, with increasing mortality during severe winter periods and lowered productivity during the spring.

The open road density on deer and elk winter range is approximately 2.9 miles per square mile. This exceeds the Gifford Pinchot Forest Plan goal of 1.7 miles per square mile in winter range. Opportunities to significantly reduce this figure through road closures are limited, as most of the open roads are major arterials such as Roads 23, 21, and 22.

Mountain goats

The Upper Cispus watershed contains patches of mountain goat habitat in the North Fork sub-basin, along Juniper Ridge at the western boundary of the watershed, and the Goat Rocks Wilderness. The North Fork patch is part of the larger Smith Creek Unit (Wash. Dept. of Fish and Wildlife designation). Mountain goat helicopter surveys have been conducted for the Cispus AMA (including the North Fork sub-basin and Juniper Ridge) since 1996, and the Goat Rocks Wilderness beginning in 2000. Goat numbers appear to be stable in both areas, with excellent productivity observed in 2001. Surveys have also revealed that distinctions between summer and winter range in the Cispus AMA appear to be arbitrary, with at least some goats residing in the AMA year-round. Sites utilized by mountain goats should simply be referred to as “mountain goat range” and defined by the presence of steep, rocky “escape terrain”. No specific analysis was conducted for mountain goat habitat in the Upper Cispus watershed due to the relatively small and disjunct nature of the habitat patches- refer to the Upper Cowlitz document for this range analysis.

Cavity Excavators

Several species of woodpeckers occur in the watershed, including the uncommon black-backed woodpecker and the pileated, which is listed separately as an Management Indicator Species representing “moderate sized areas of mature and old-growth.” Until recently, logged areas did not retain snags or live trees that would eventually become snags, so there are thousands of acres in the watershed with no potential to support this species group at present. Mid-seral, “Cispus Burn” stands have variable snag densities, ranging from low to moderate depending on the site. Old-growth forest stands, such as those in the North Fork and Adams Creek sub-basins possess the highest snag densities, and contain the large-diameter snags preferred for nesting and foraging by the pileated woodpecker and other species. Overall, the watershed contains sufficient habitat to sustain viable populations of cavity nesters, and the habitat capability will increase in the future as mid-seral stands succeed to late-successional habitat.

Fish Species

The Management Indicator Species for fish, steelhead and coastal cutthroat trout were previously addressed under TES species.

Other Management Indicator Species

The pine marten is an MIS representing “smaller areas (160 acres) of mature and old-growth forest”. This species has been confirmed in the watershed based on “camera trap” surveys conducted in 1997 and 1998. This species appears to be fairly common in higher-elevation forests, especially near water. Timber harvest has removed suitable habitat for this species, particularly in the Chambers Creek sub-basin, although this species will forage at the edges of forest openings for berries and small mammals. The wood duck and “goldeneye duck” (i.e. Barrow’s and common goldeneyes) occur in the watershed, although neither is common. Both species nest in natural tree cavities, and both will use artificial nest boxes if provided in suitable habitat. No nest boxes have been installed in the watershed due to lack of identified opportunities. The bald eagle and peregrine falcon are MIS species that are also listed as “threatened” and “sensitive”, and were discussed under the previous section.

d. Other Notable Species

Wildlife

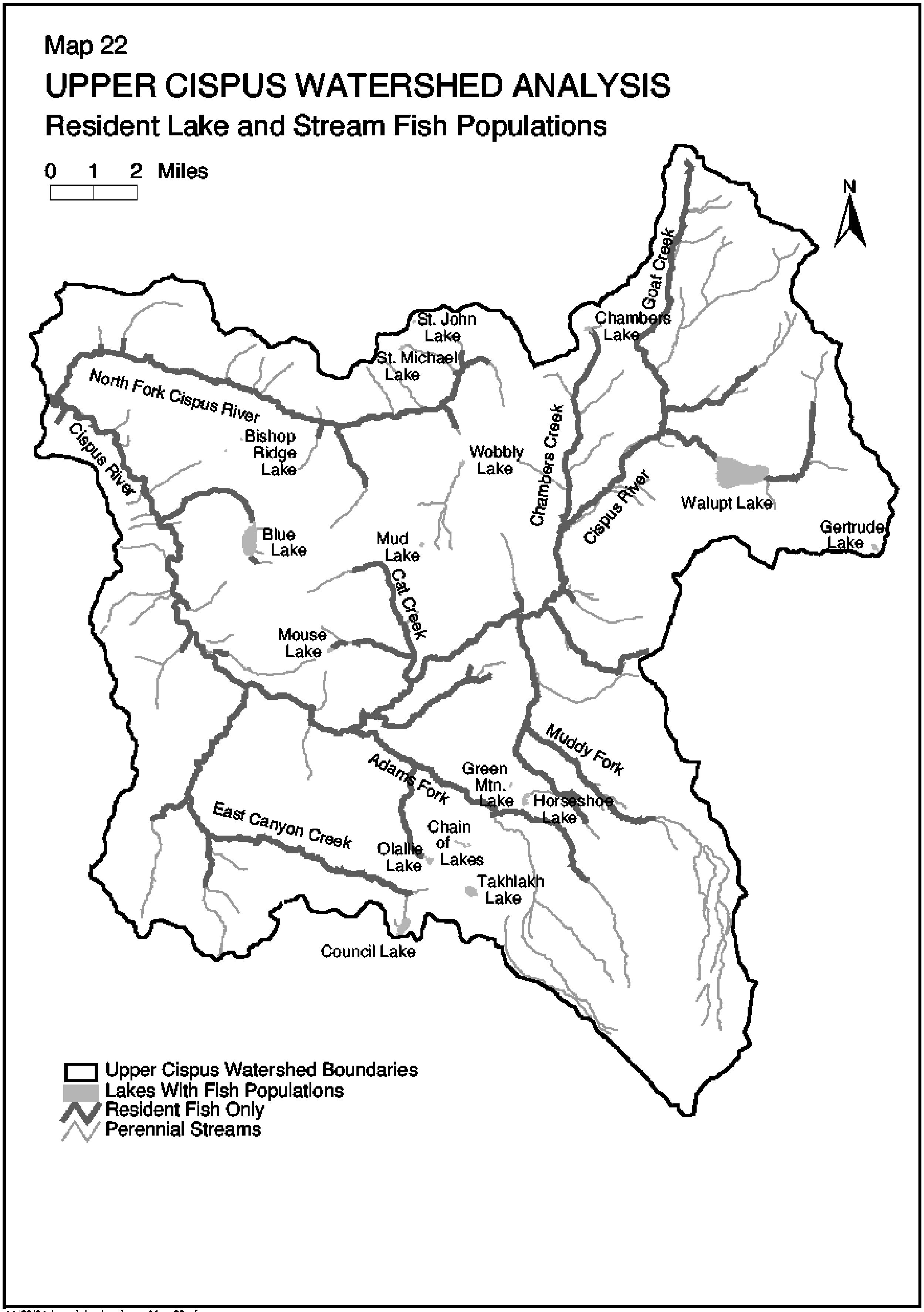
The harlequin duck is an uncommon species confined to fast moving waters of larger streams. It has been observed on the Cispus River, and may potentially occur on the North Fork as well. Nesting has been documented for this species on the District, which has been cited as an bird which may be declining in parts of its range.

The status of large carnivores, such as the mountain lion and black bear, in the watershed is unclear. Both species occur throughout the area, but both are elusive and rarely sighted. There is the potential that both species may be increasing due to more restricted hunting regulations recently put into effect.

The watershed contains a population of spruce grouse (uncommon in western Washington) in the eastern sub-basins such as Walupt Creek and Chambers Creek. Other rare species, such as the boreal owl, may potentially occur as well in higher-elevation forest habitats, but no surveys have been conducted.

Fish

<u>Common Fish Species</u> – Map 22 – Resident Stream and Lake Fish Populations shows the location of fish populations that remain in the watershed year round. Among these resident fish there are two relatively common well-known game fish species, rainbow trout and cutthroat trout.


Map 22
UPPER CISPUS WATERSHED ANALYSIS
Resident Lake and Stream Fish Populations
0 1 2 Miles
N
Goat Creek
Chambers Lake
St. John Lake
St. Michael Lake
North Fork Cispus River
Cispus River
Bishop Ridge Lake
Wobbly Lake
Chambers Creek
Cispus River
Walupt Lake
Gertrude Lake
Blue Lake
Mud Lake
Cat Creek
Mouse Lake
Muddy Fork
Adams Fork
Green Mtn. Lake
Horseshoe Lake
East Canyon Creek
Chain of Lakes
Olallie Lake
Takhlakh Lake
Council Lake
Upper Cispus Watershed Boundaries
Lakes With Fish Populations
Resident Fish Only
Perennial Streams
11/20/01 /cv_gis/wa/upcispus Map 22 rfp

Resident rainbow trout (*Oncorhynchus mykiss*)

Resident Rainbow trout are relatively common in the watershed. They are found in streams of all sizes and some lakes. See Map 23 – Distribution of Rainbow Trout.

Resident rainbow are native to the watershed. The most notable native population is the one found in Walupt Lake, which has a self-sustaining population of rainbow trout. The range of distribution of resident rainbow trout has been expanded by both regular, state-sponsored stocking programs and undocumented transportation of fish by individuals. Populations of rainbow trout in lakes other than Walupt Lake are most likely the result of fish planting because of the small size and isolated nature of these lakes. Because of a lack of records for non-state-sponsored fish plants it is not practical to determine which stream populations of rainbow were originated by fish planting.

Rainbow trout are the same species as steelhead, but have no protected status. Juvenile steelhead that remain in fresh water for their entire life (residualize) contribute to resident rainbow trout populations. The opposite process, resident rainbow trout producing offspring that migrate to the ocean, may also occur but is not well documented. Therefore, steelhead and resident rainbow trout are considered separate populations under the Endangered Species Act. The name red band trout is reserved for desert-adapted resident rainbow trout, which are not found is this watershed. Thus, coastal populations of resident rainbow trout, such as those found in this watershed, do not have any special status.

Resident coastal cutthroat trout (*Oncorhynchus clarki clarki*)

Resident coastal cutthroat are probably the most common game fish in the watershed. They occur in streams of all sizes, often occurring in first or second order headwater tributary streams and a few lakes. They often occur further upstream than rainbow trout. See Map 24 – Distribution of Resident Cutthroat Trout.

Coastal cutthroat trout are native to the watershed. The range of distribution of resident coastal cutthroat trout has been expanded by both regular, state-sponsored stocking programs and un-documented transportation of fish by individuals. Because of a lack of records for non-state-sponsored fish planting, it is not practical to determine which populations of coastal cutthroat trout were established by fish planting.

Resident coastal cutthroat are presently proposed for listing as threatened, because it is well documented that resident populations contribute to the much smaller, listed, sea-run populations of cutthroat trout.

<u>Other Fish Species</u> - There are several other species or groups of species that are found in the watershed. These are the non-glamorous, non-game (or at least less-preferred game fish) species, and as such, records of their presence are not complete.

Mountain Whitefish (*Prosopium williamsoni*)

This species tends to live in larger streams, but has not been reported outside of the Cispus River. In other places, it has been found above anadromous barriers, but because of incomplete records we are not sure if mountain whitefish occur above the anadromous barrier in the Cispus River.

Sculpin (*Cottus spp*.)

Sculpin are a small fish, rarely exceeding 4 inches in length, with relatively large flat heads and pectoral fins, giving them a strange appearance. They are largely bottom dwellers living in the spaces between rocks. They are commonly found in fast water such as riffles, but some species also occur in the slowest waters. Given the opportunity they will prey on fry and eggs of other fish, but also eat invertebrates. They are extremely abundant in some streams and absent from others. Where they occur they are often found in the very headwaters.

Suckers (*Catostomas spp*)

Suckers are likely to be in the Cispus River, but they have not shown up in any of the sampling reports.

Lamprey (*Lampetra spp*)

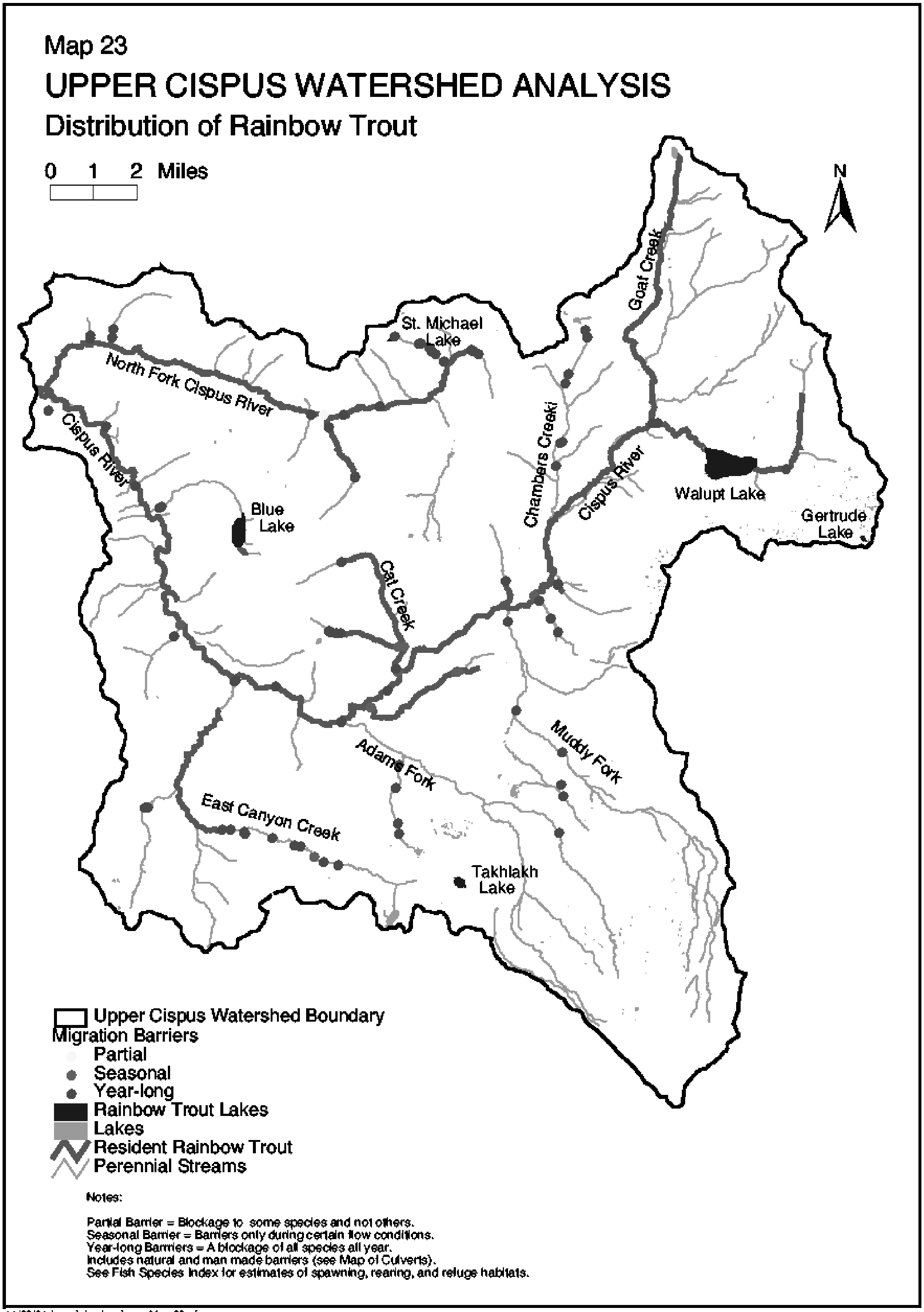
Sea Lamprey may have spawned in the upper Cispus River prior to the installation of the Cowlitz River dams. Lamprey have not been reported in the streams. However, lamprey (species unknown, but most likely Western Brook Lamprey *Lampetra richardsoni*) were observed in Walupt Lake and upper Walupt Creek. Unlike its more famous relatives this species is non-parasitc (Page and Burr, 1991)

e. Non-native Species

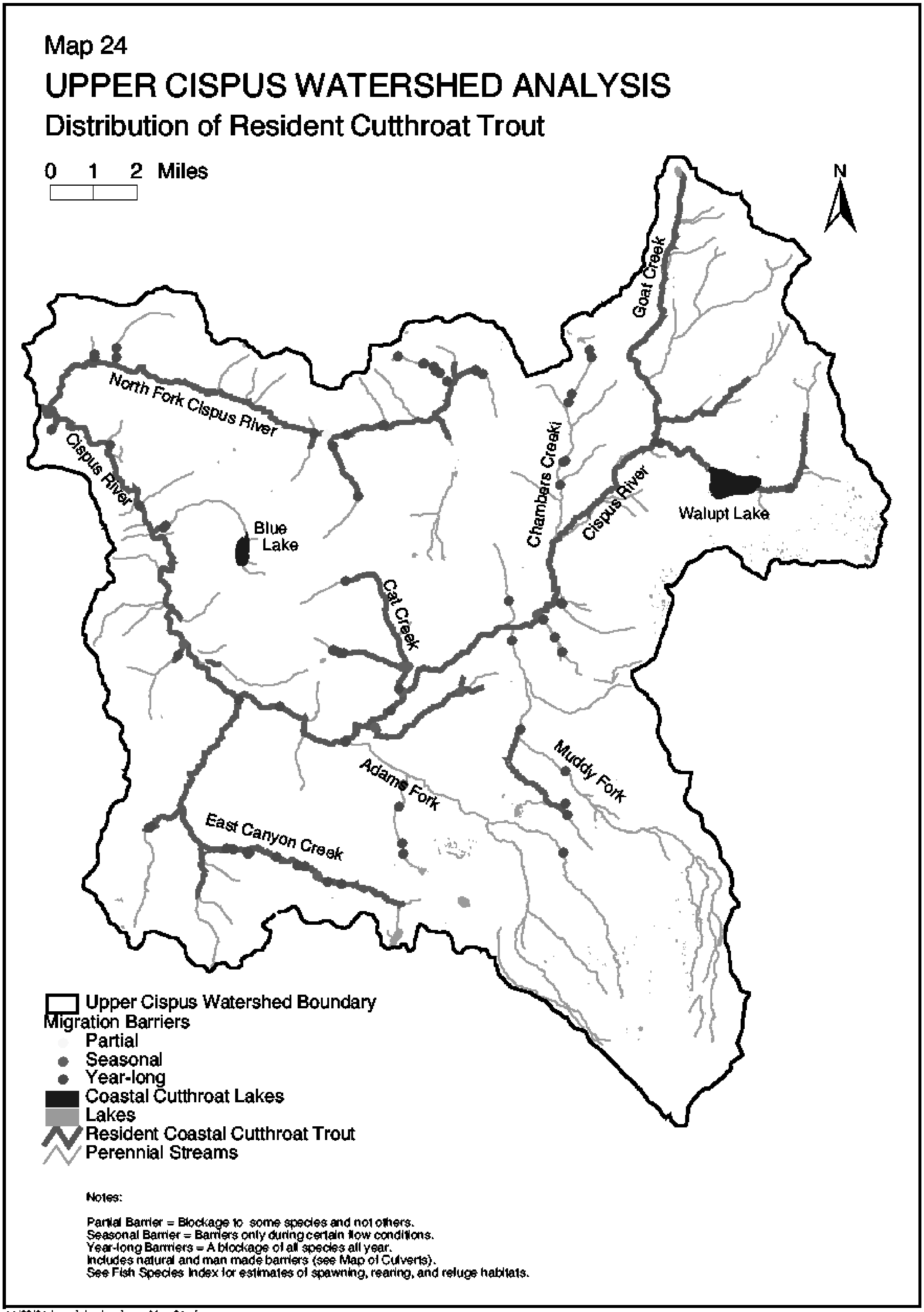
Introduced, non-native species are an increasing concern throughout the landscape, including the Upper Cispus watershed. Historically, these species were either absent or present in very small numbers in the watershed until relatively recent times. Their status and distribution is poorly known for the most part. Following is a discussion of some of these exotic species:

Wildlife

Introduced wildlife species do not appear to be a large problem in the watershed at present. Bird species such as the starling and house sparrow are either absent or present in very low densities. Mammals such as the Norway rat are likely present, but presumed to also be scarce. Introduced mollusks, such as slugs in the genus *Arion,* appear to be an increasing problem in other parts of the District, and are likely present in the watershed. These animals have potential to compete with native gastropod (snail and slug) species, and their abundance and distribution should be monitored, particularly near campgrounds, dispersed recreation sites, firewood cutting areas, etc.. There is no evidence of introduced amphibians, such as the bullfrog, in the watershed at present. The bullfrog does occur at other District locations, however, and may spread to the watershed in the future.



11/20/01 /cv_gis/wa/upcispus Map 23 rfp



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Plants

Noxious weeds are non-native plants that are aggressive growers and colonizers, and that possess few natural enemies. This combination of characteristics causes these plants to be difficult to control, and a threat to native ecosystems. At the present time, in Lewis County alone there are 86 species present that are considered to be noxious weeds.

To date, there have been no district-wide comprehensive surveys for noxious weeds, and much of what is known about the distribution and abundance of weeds is based on reports from incidental findings. However, systematic surveys of approximately 320 miles or road corridor were conducted during the period of 9/12 to 9/23, 1994. Surveys were conducted by slowly driving along the roads and noting populations of designated noxious weeds, and were therefore limited to populations of weeds visible from the road system. These surveys focused on weeds from the Forest weed list, and did not include all state or county designated noxious weeds reported from the Gifford Pinchot National Forest. This methodology is biased toward locating those populations of weed species that are most visible at the time of year that the surveys are conducted. All other reports of noxious weeds are based on incidental sightings. It is clear that our understanding of the distribution and abundance of noxious weeds on the district is rudimentary, and undoubtedly reflects a gross underestimate of the problem.

Within the Upper Cispus watershed analysis area, incidental sightings of seven noxious weed species have occurred. Four species of knapweed have been found, including *Centaurea diffusa* (diffuse knapweed), *C. jacea* (brown knapweed), *C. jacea* x *nigra* (meadow knapweed), and *C. biebersteinii* (spotted knapweed). These species are often found in frequently disturbed areas, such as along roadsides, in clearcuts, and in rock pit areas; they may also be found in rangelands, meadows and forested areas. These species are ranked as class B weeds by the Lewis County Noxious Weed Control Board, which means that their distribution is limited to portions of the state, and preventing infestation is a priority. Tansy ragwort (*Senecio jacobaea*), Scotch broom (*Cystisus scoparius*), and Japanese knotweed (*Polygorum cuspidatum*) are also class B weeds found within the analysis area. These species typically colonize and persist in disturbed sites, including roadsides, logging landings and clearcuts. Control of tansy ragwort and Scotch broom is mandatory in selected areas of Lewis County. Roads provide dispersal corridors for all of these species, as well as habitat.

Road based surveys in 1994 of the watershed area detected 187 populations of noxious weeds representing ten different species, including seven species that had not previously been reported from the analysis area (Table 3-20).

Table 3-20: Noxious Weed Species Detected During Surveys, 1994.

Scientific Name	Common Name
Centaurea biebersteinii	spotted knapweed
Chrysanthemum leucanthemum	oxeye daisy
Cyperus esculentus	yellow nutsedge
Cystisus scoparius	Scotch broom
Hieracium pratense	yellow hawkweed
Hypericum perforatum	St. John’s wort
Hypochaeris radicata	spotted cats-ear

Lythrum salicaria	purple loosestrife
Senecio jacobaea	tansy ragwort
Sonchus arvensus	perennial sowthistle

Fish

There are four known introduced species in the watershed: brown trout (*Salmo trutta*), eastern brook trout (*Salvelinus fontinalis*), Twin Lakes cutthroat trout – also known as westslope cutthroat trout (*Oncorhynchus clarki lewisi*), and golden trout (*Oncorhynchus aguabonita)*.

Maps 25 and 26 display the habitat for these species. Appendix A displays the amount of habitat by sub-watershed and the total watershed. All of these have been planted at least in the area lakes. Brown trout and brook trout now occur in the Cispus River and some tributary streams.

Brown trout

Brown trout are native to Europe. They were planted in the United States to increase sport-fishing opportunities in 1883 (Page and Burr, 1991). They can grow to relatively large sizes (over 20 inches). As they become large they become somewhat piscivorous (fish eating), and may reduce native species.

Eastern brook trout

As the full name implies, eastern brook trout are native to eastern half of the United States (Page and Burr, 1991). They were planted in the west to increase fishing opportunities. This species is in the char genus of the salmon family.

Brook trout have been implicated in the decline of native aquatic species on the west coast. They both interbreed with and out compete the west coast's native char, bull trout, and are listed as one of leading causes of the decline of bull trout. If bull trout occurred historically in the watershed, eastern brook trout now occupy most of the bull trout habitat.

Eastern brook trout have also been implicated in the decline of native amphibians and invertebrates where they were planted in previously fishless waters (likely most of the lakes in the watershed).

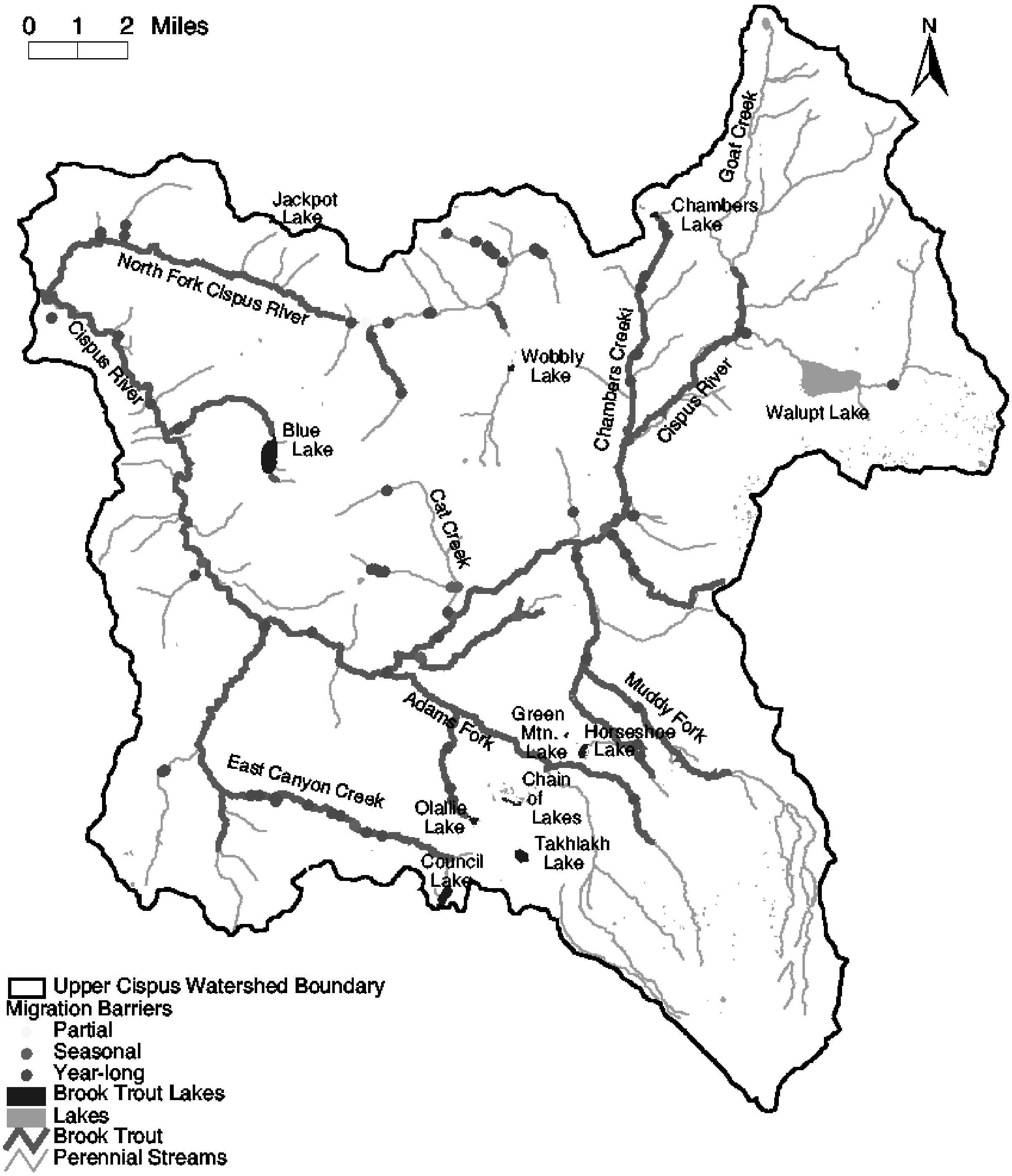
Twin Lakes cutthroat trout

Outside of western Washington this species is known as westslope cutthroat trout. It is native to the westslope of the Rocky Mountains, but may be native to eastern Washington (Behnke, 1992). It is a subspecies of cutthroat, the name coming from the lake where this stock originated. It has been planted in several of the lakes in the watershed. As such it can easily interbreed with the native coastal cutthroat. Like eastern brook trout, they may be reducing the populations of native amphibians and invertebrates where they were planted in previously fish-less waters.

Map 25

UPPER CISPUS WATERSHED ANALYSIS

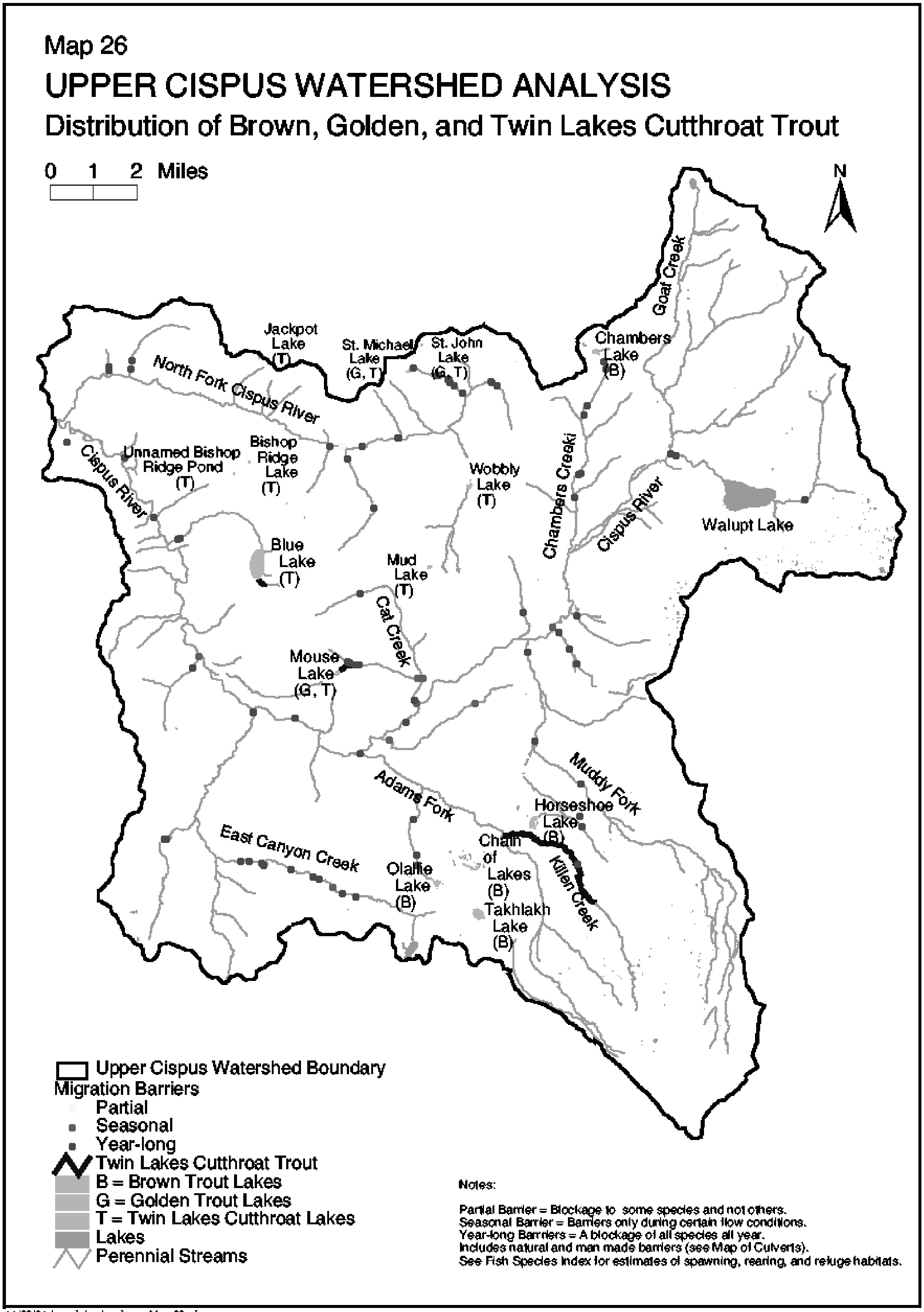
Distribution of Eastern Brook Trout



Notes:

Partial Barrier = Blockage to some species and not others.
Seasonal Barrier = Barriers only during certain flow conditions.
Year-long Barriers = A blockage of all species all year.
Includes natural and man made barriers (see Map of Culverts).
See Fish Species Index for estimates of spawning, rearing, and refuge habitats.

11/20/01 /cv_gis/wa/upcispus Map 25 rfp



11/20/01 /cv_gis/wa/upcispus Map 26 rfp

In an ironic twist this species is doing poorly in its native range where it is at least listed as a sensitive species. One of the reasons for its decline is planting of non-native species.

Golden Trout

Golden trout are native to central California near the Kern River (Pister, 1991). This species is near extinction in its native waters, due to invasive species and loss of habitat (Pister, 1991).

Golden trout have been planted in a few lakes in the watershed. Like eastern brook trout, they may be reducing the populations of native amphibians and invertebrates where they were planted in previously fish-less waters.

4. Habitat Assessments – Forest Fragmentation, Connectivity, and Special Habitats

Fragmentation

Forests in the Upper Cispus watershed have been naturally fragmented for centuries, mainly from wildfires, as well as other agents such as windthrow, volcanic eruptions, and flooding. During the last 50 years, timber harvest and road building have caused increasing forest fragmentation, in a temporal and spatial pattern unlike historic disturbance regimes. A fragmentation analysis was done for the watershed, using GIS-generated data. Forest vegetation was delineated as “small tree” and “large tree” for the purposes of the analysis, and the amount of interior forest habitat, beyond the influence of forest edges, was calculated. See Map 27, Interior Forest Habitat for locations of this type of habitat. The following table displays the results of this analysis:

Table 3-21: Interior Forest Habitat by 6th Field Watershed

Sub-watershed	Acres “small tree” interior habitat	Acres “large tree” interior habitat	Comments
Cispus R. Headwaters	565	2373	Large tree interior patch is in Goat Rocks wilderness, mostly above 4000 ft elevation
Walupt Creek	2299	539	Same as above
Chambers Creek	3007	869	All large tree interior patches are small and disconnected
Cispus Muddy Fork	2153	48	Larger small tree patches are in Mt. Adams wilderness
Cat Creek	4226	1822	
Adams Fork	3638	1124	Large patch of large tree interior habitat along Adams Creek in north end of sub-basin
East Canyon Creek	3754	1929	
Blue Lake	6364	755	Very large patches of small tree interior habitat are “Cispus burn” stands that are well-connected
North Fork Cispus River	2409	2810	Big patch of large tree interior habitat is on hillside which drains into North Fork

There is a total of 40,684 acres of forested interior habitat in the watershed; the majority of it (28,415 acres; 70%) is small tree interior, most of which are fire-origin, mid-seral stands such as the "Cispus burn" areas. The 12,269 acres (30%) of large tree interior habitat are scattered throughout the watershed, with the largest patches in the Goat Rocks wilderness and North Fork Cispus areas. Over the next 50 to 100 years, in the absence of disturbance, the amount of large tree interior habitat in the watershed will increase dramatically due to natural succession; however, it is likely that some disturbance, either natural or man-made, will occur in some locations and limit the patch sizes and total amount of large tree interior habitat that will develop. In some areas, commercial thinning may accelerate the development of small tree interior patches to large tree, although the long-term benefits to interior-oriented wildlife species such as the northern spotted owl and northern flying-squirrel from silvicultural treatments have not been quantified.

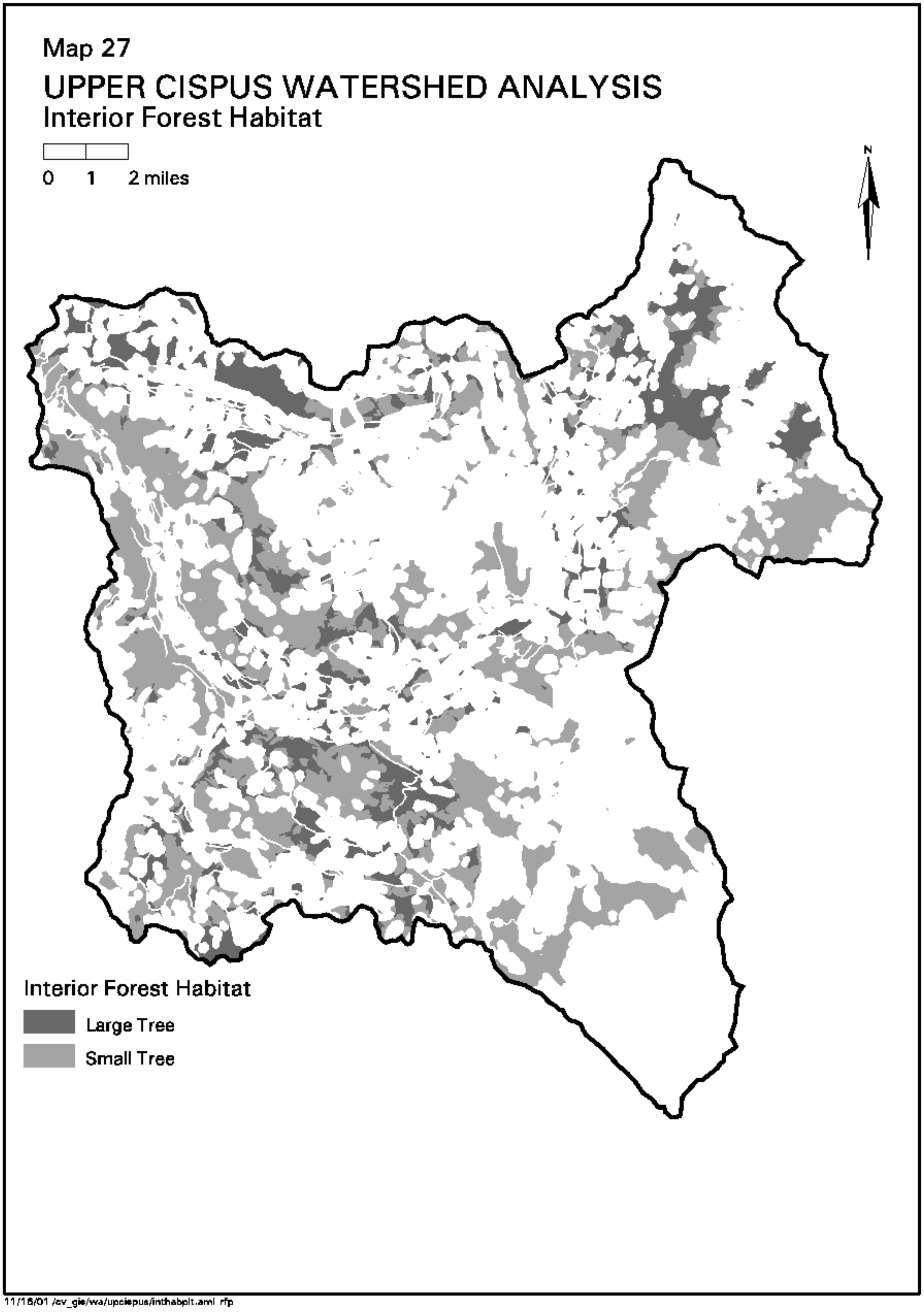
Table 3-22: Habitat Type Acres by 6th Field Watershed

Sub-basin	Grass/pole	Hardwoods	Small tree	Large tree	Non-forest
Cispus R. Headwaters	110	0	315	1211	1746
Walupt Creek	54	0	1215	248	2092
Chambers Creek	804	0	1657	1179	1158
Cispus Muddy Fork	1407	14	1139	78	1007
Cat Creek	954	1	2179	1977	213
Adams Fork	657	0	2151	1111	525
East Canyon Creek	1308	16	2778	2387	1620
Blue Lake	243	17	4302	544	961
North Fork Cispus River	2357	33	1700	2269	698

Connectivity

Riparian zones and ridge tops such as Blue Lake and Juniper ridges are the main providers of connectivity in the watershed. Connectivity is, however, is difficult to quantify, and the amount of use by various species of these corridors is not known. Also, it is not known how much connectivity is provided by upland, forested habitats and "leave blocks" between early-successional patches, away from riparian zones and ridges. The watershed does appear to be important for travel for at least some species; notable areas are the Cispus River corridor, North Fork Cispus, Chambers Creek (which provides connectivity with the Johnson Creek drainage and Cowlitz River corridor to the north), Juniper Ridge (for mountain goats, elk and carnivores), Adams Fork and East Canyon Creeks. Topography in the watershed affords connectivity from lower elevation habitats to high elevation through forested uplands on relatively gentle terrain, for example in the Chambers Creek sub-basin.

Habitat connectivity is important to many plants because it provides an avenue for dispersal to new suitable habitat, and prevents genetic isolation of populations. In general, interior forests (away from edges created by roads, timber harvest or other disturbances) are better habitat for native plant species than edge habitat, and are less susceptible to invasion by noxious weeds. Connectivity of interior forests containing legacy elements, such as old growth trees, shrubs and large woody debris, is especially important to many rare and uncommon epiphytes.



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Based on a query of the database associated with the existing vegetation GIS layer (see v-17, Middle and Upper Cispus Watershed Analysis for more detailed description of query technique), acreages of potential habitat for late-successional forest dependent species were summarized (see Table 3-23). The President's Forest Plan includes guidelines for managing late-successional habitats in a way that will be beneficial to late-successional dependent species. The importance of late seral habitat within the analysis area to late seral associated species is not solely dependent upon acreage, but also upon its distribution. Large patches of habitat may be "unusable" if isolated from a source of plant propagules. Propagule dissemination may occur in a variety of different ways, and may not require a direct connection of habitat. For those species with dispersal limitations, however, connectivity of habitat is especially important.

Table 3-23: Potential Habitat for Late Successional Species within The Upper Cispus Watershed (note: riparian buffers based on SAT buffers)

Zone	Potential Late-Successional Species Habitat
Western Hemlock Zone	6,609 acres
Pacific Silver Fir Zone	17,220 acres
Mountain Hemlock Zone	11,080 acres
TOTAL	**34,909 acres**
Riparian (across all zones)	14,164

Special Habitats

More than half of the TES plant species suspected within the analysis area may occur in meadows. Based upon data from the existing vegetation layer, there are approximately 3,075 acres of meadow habitat within the analysis area. Red alder forests, wet shrublands, rocky outcrops, wetlands and seeps are also important as unique habitats for rare species within the watershed. See Map 28, Special Habitats and Map 29, National Wetland Inventory for locations of various types of special habitats.

5. Aquatic Habitats

We use the Matrix of Pathways and Indicators to evaluate habitat conditions for the existing Threatened and Sensitive fish species (none of the fish species is listed as endangered) in the watershed. This section also serves as a discussion for habitat conditions for the other aquatic species. Table 3-24 displays the summaries of the ratings by 6th field sub-watershed. Appendix B contains tables, which display the rationale and references for these ratings. Appendix C contains tables for each 6th field sub-watershed and lists the criteria that was used for rating each indicator. The watershed ratings are:

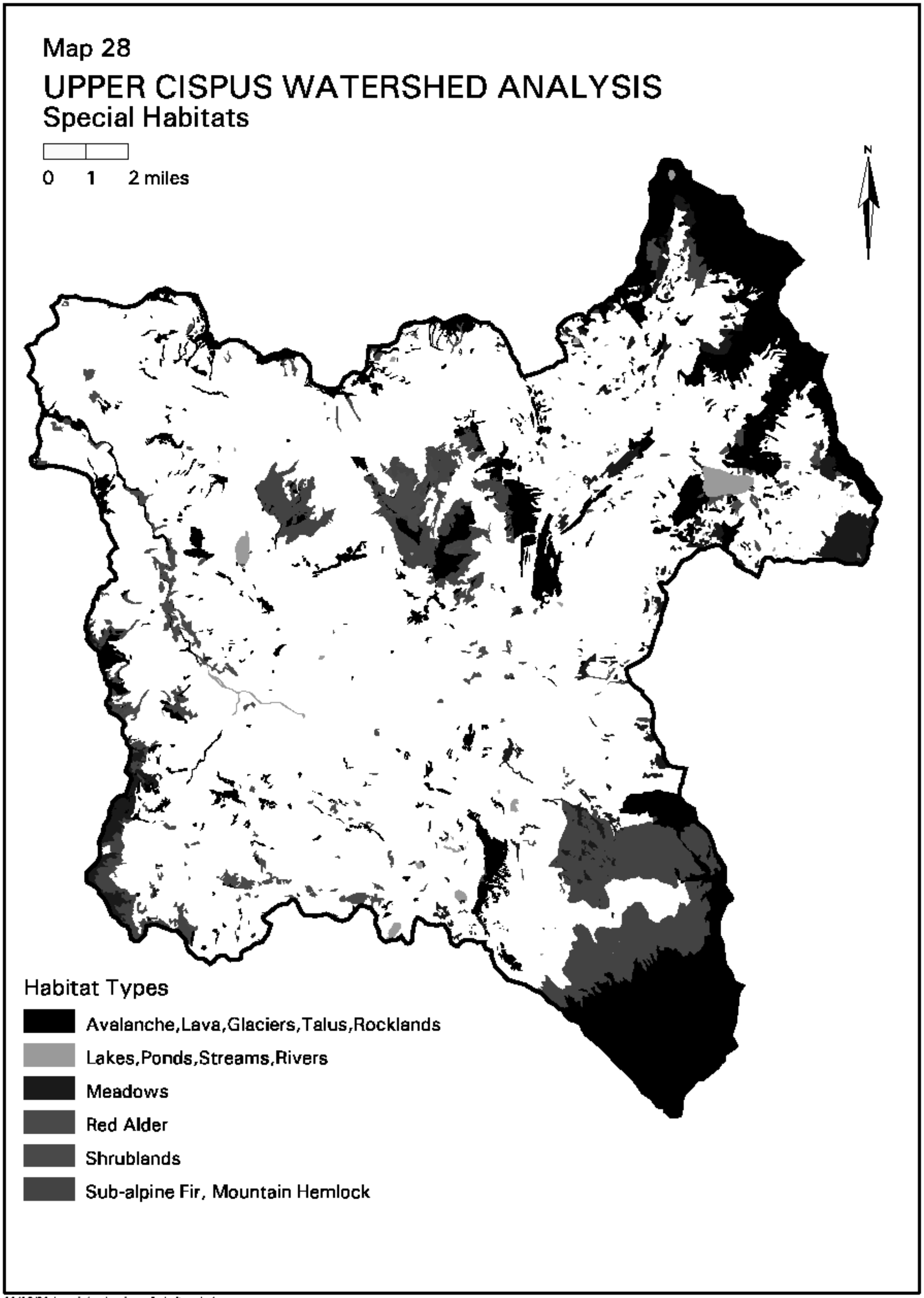
Functioning Appropriately – The existing conditions would allow for a large, persistent population of fish.

Functioning At Risk - The existing conditions would allow for persistent population of fish, but further declines in these habitat conditions may lead to a decline in the fish population.

Functioning At Unacceptable Risk – The existing conditions are likely contributing in a cumulative way to decreased fish populations.

Table 3-24: Matrix of Pathways and Indicators Ratings by 6th Field Watershed

Pathway	Indicator	Functioning Appropriately	Functioning At Risk	Functioning At Unacceptable Risk
WATER QUALITY	Temperature - Bull Trout	Muddy Fork, Adams Fork	Cat	Headwaters, Walupt Lake, Chambers, East Canyon, Blue Lake, North Fork
	Temperature - Cutthroat and Anadromous Species		Headwaters, Walupt Lake, Chambers, Muddy Fork, Cat, Adams Fork, Blue Lake, North Fork,	East Canyon
	Sediment (in spawning areas)	Muddy Fork	Headwaters, Walupt Lake, Chambers, Cat, Blue Lake, North Fork, East Canyon	Adams Fork
	Chemical Contamination/ Nutrients	All sub-watersheds		
HABITAT ACCESS	Physical barriers	Headwaters, Walupt Lake,	Adams Fork, Blue Lake, Muddy Fork, Cat, East Canyon.	Chambers, North Fork
HABITAT ELEMENTS	Substrate character and embeddedness (in rearing areas)	Muddy Fork,	Headwaters, Walupt Lake, Chambers, Cat, Blue Lake, North Fork, East Canyon	Adams Fork
	Large Woody Debris (LWD)	Walupt Lake	Muddy Fork, Adams Fork, Blue Lake, North Fork	Headwaters, Chambers, Cat, East Canyon
	Pool Frequency and Quality	Walupt Lake, Muddy Fork	Chambers, Cat	Headwaters, Adams, East Canyon, Blue Lake, North Fork
	Large Pools (in streams with > 3m in wetted width at baseflow)	Headwaters, Walupt Lake, Muddy Fork	Chambers, Cat, Adams Fork, East Canyon, Blue Lake, North Fork	
	Off-channel habitat	Walupt Lake, Chambers, Muddy Fork, North Fork	Headwaters, Cat, Adams Fork, East Canyon, Blue Lake,	
	Refugia (at 6th to 7th field watershed scale)		Headwaters, Walupt Lake, Muddy Fork, Adams Fork,	Chambers, Cat, East Canyon, Blue Lake, North Fork
CHANNEL CONDITION AND DYNAMICS	Width/Depth Ratio in riffles	Walupt Lake, Muddy Fork, Adams Fork	Headwaters, Chambers, Cat, East Canyon, North Fork	Blue Lake
	Streambank Condition	Headwaters, Walupt Lake, Muddy Fork. Adams Fork	Chambers Creek, Cat, Blue Lake, North Fork	East Canyon Creek
	Floodplain Connectivitiy	Headwaters, Walupt Lake, Chambers, Muddy Fork, Adams Fork, Blue Lake	Cat, East Canyon, North Fork	
FLOW / HYDROLOGY	Change in Peak/Base Flows	Headwaters,	Walupt Lake, Chambers, Muddy Fork, Cat, Adams Fork, East Canyon, Blue Lake, North Fork	
	Drainage Network Increase	Headwaters, Walupt Lake, Muddy Fork, Adams Fork,	Chambers, Cat, East Canyon, Blue Lake, North Fork	
WATERSHED CONDITIONS	Road Density and Location	Headwaters, Walupt Lake, Muddy Fork, Adams Fork,	Chambers, Cat, Blue Lake, North Fork	East Canyon
	Riparian Reserves	Headwaters, Walupt Lake,	Chambers, Muddy Fork, Cat, Adams Fork, East Canyon, Blue Lake, North Fork	
	Disturbance Regime	Headwaters, Walupt Lake,		Chambers, Muddy Fork, Cat, Adams Fork, East Canyon, Blue Lake, North Fork
	Disturbance History	Headwaters, Walupt Lake,	Muddy Fork, Adams Fork, Blue Lake	Chambers, Cat, East Canyon, North Fork
SUB-POPULA-TION CHARACTER-ISTICS	Subpopulation Size other species not rated	Coho Salmon	Resident Coastal Cutthroat	Steelhead, Chinook Salmon, Sea-Run Coastal Cutthroat, Bull Trout
	Growth and Survival	No Rating	No Rating	No Rating
	Life History Diversity and Isolation No rating for Bull trout or other species.		Steelhead, Chinook Salmon, Coho Salmon	Coastal Cutthroat
	Persistence and Genetic Integrity		Coho Salmon and Costal Cutthroat	Steelhead, Chinook Salmon, Bull Trout
SPECIES and HABITAT	Integration of Species and Habitat Conditions		Coho Salmon	All other species



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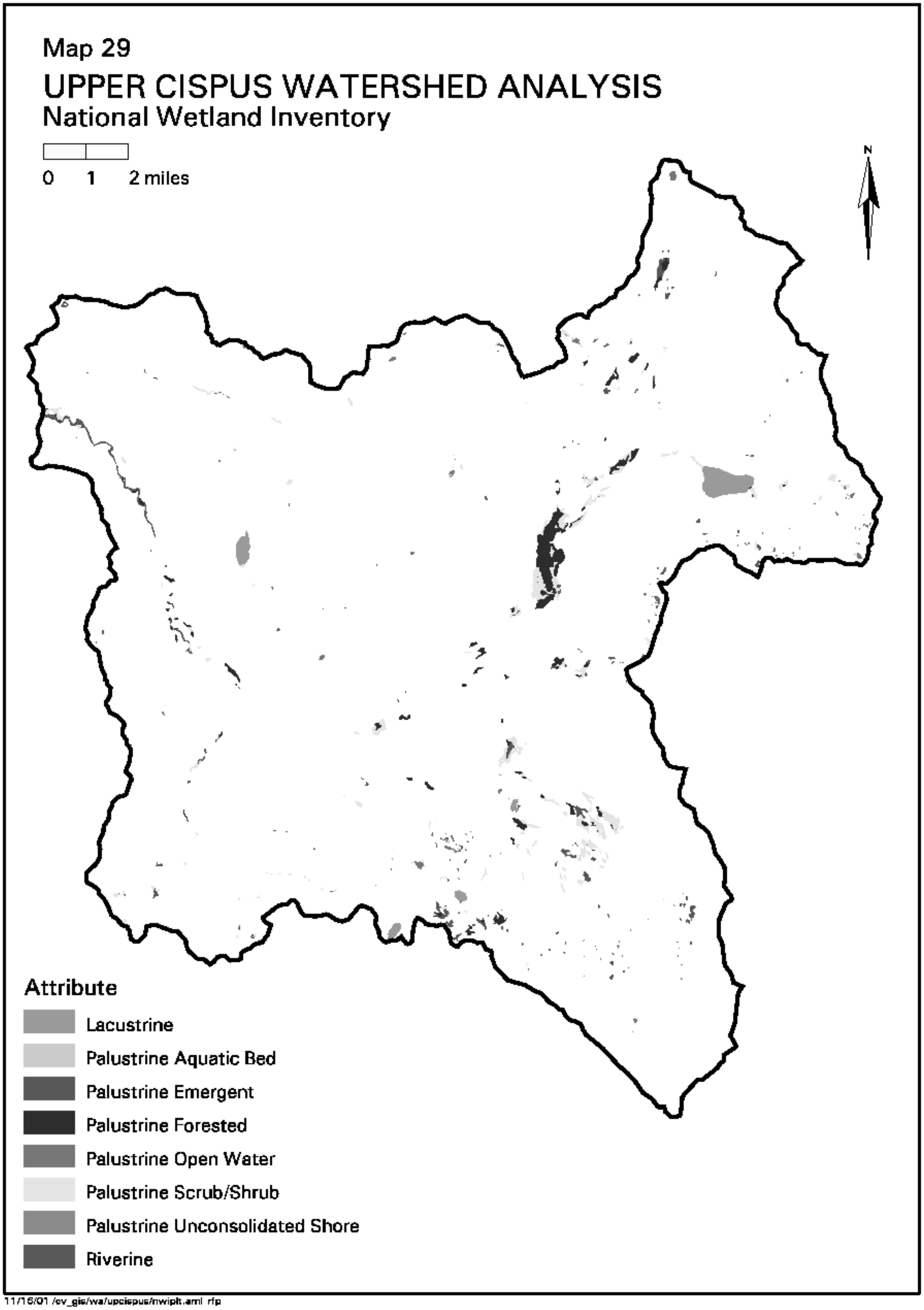
Map 29
UPPER CISPUS WATERSHED ANALYSIS
National Wetland Inventory
0 1 2 miles
N
Attribute
Lacustrine
Palustrine Aquatic Bed
Palustrine Emergent
Palustrine Forested
Palustrine Open Water
Palustrine Scrub/Shrub
Palustrine Unconsolidated Shore
Riverine
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Organization of This Section

The Matrix of Pathways and Indicators are 19 indicators of habitat conditions grouped into somewhat related pathways of effects. In the following section the indicators for each pathway are discussed under four subheadings. Under *Background* we briefly discuss how the indicator is related to aquatic species and their habitat. The *Analysis Tools* briefly discusses the tools we used to analyze the current condition. The *Data Gaps* subheading discusses missing data information and weaknesses in the analysis. Finally, the *ratings* subheading summarizes the condition for the watershed. More detailed information about the conditions can be found in the nine Matrix and Pathways Indicators tables in the Appendix C, one for each subwatershed. Chapter 4 will further discuss areas of concern.

Water Quality

Water Temperature

<u>Background</u> - Water temperature is an important component of fish habitat. Elevated water temperature decreases the amount of oxygen contained in the water (Bjornn and Reiser, 1991), increases the vulnerability of fish to resist diseases and parasites (Bjornn and Reiser, 1991), and decreases the ability of fish to compete for food and territory (Bjornn and Reiser, 1991).

<u>Analysis Tools</u> - We use the results of the water temperature monitoring in the Hydrology Section to evaluate habitat conditions. The Hydrology Report thoroughly discusses the temperature monitoring results.

<u>Data Gaps</u> - We generally lack long-term stream temperature data. We have only recently (1991) started temperature monitoring on many of the streams in the watershed. Some of the pre-2000 data is of questionable quality. In addition, temperature monitoring does not cover the spawning and incubation period of most of the species.

<u>Ratings</u> - The rating for stream temperature for the entire watershed is Functioning At Unacceptable Risk for Bull Trout and Functioning At Risk for the other species. Water temperatures generally are warm enough to impair all life stages of bull trout. This is especially true in East Canyon Creek and Blue Lake 6th field sub-watersheds. Exceptions are the Adams Fork and Muddy Fork watersheds, where glaciers or ground water feed the streams and water temperature is rated as Functioning Appropriately for Bull Trout.

The rating is less severe for the other species, since they are adapted to warmer water temperatures. Water in the Adams Fork and Muddy Fork may be slightly cold for these species and inhibit their ability to feed.

Sediment (sediment in spawning gravel)

Background - It is well documented in laboratory studies (Bjornn and Reiser, 1991; Hicks *et al*. 1991) that fine-grained sediments (< 8 mm) impair spawning success. These finer particles block the flow of water through (salmon and trout) nests, thus limiting the amount of oxygen reaching the eggs and developing fry. To put it simply, these fine sediments smother the eggs.

Analysis Tools - We use data collected in level II stream surveys and observations by aquatic personnel over the last decade.

Data Gaps - We lack data that directly addresses this indicator. None of our surveys measured this indicator. Early surveys did make a visual estimate of cobble embeddedness. The surveyors recorded whether or not the estimated cobble embeddedness was greater than 35%. This is a highly subjective rating, but it is the best available information. See Appendix E for a table that summarizes level II stream survey data, including cobble embeddedness.

Where we did not collect this data we are limited to observations by aquatics personnel made over the past five years (Blue Lake, Cat, Muddy Fork, Walupt Lake, East Canyon, North Fork and Chambers Creek watersheds).

Ratings – Sediment is rated as Functioning At Risk for the watershed as a whole. The Stream Survey Data, Appendix E, displays the cobble embeddedness ratings. In addition, we also have observations and indications from previous reports. The Middle and Upper Cispus Watershed Analysis, 1995 reported that fine sediments impaired spawning habitats in the Cispus and North Fork Cispus rivers. This rating is consistent with recent observations on these streams. Fine-grained sediment in the Muddy Fork is largely derived from the glacial flour and represents the potential for this system. Likewise, the sediments observed in Walupt Creek originate in the wilderness and represent the natural potential. The level of harvest activity in the Chambers Creek drainage is likely to have increased fine sediment levels.

Sediments in Adams Fork are also likely derived from glaciers, but the sediments in the Sheep Creek portion are more likely derived from a combination of management actions (Road 5601 and older timber harvest units); therefore, we rate this sub-watershed as functioning at unacceptable risk.

Chemical Contamination/Nutrients

Background - Chemicals or acid rock drainage can literally poison streams. Excessive nutrients from human or domestic animal waste can create algal blooms, which use most of the available oxygen.

Analysis Tools – For this indicator we used field observations of algal levels. We also examined records for stream or lakes on the Washington State 303(d) list for pollutants.

Data Gaps - We have no data on chemical contamination or excess nutrients for streams in the watershed.

Ratings - We rated this indicator as Functioning Appropriately for the watershed as a whole and for all 6th field sub-watersheds. There are no 303(d) listed water bodies in the watershed that are listed for parameters other than temperature. The potential sources of pollution in the watershed are limited to campgrounds, dispersed sites, and occasional spills from automobile or heavy machinery accidents. Given the presence of outhouses and manure control measures at all of the developed campsites, and the relatively low levels of pollution observed at dispersed sites, we consider these to present a low pollution hazard.

Habitat Access

Physical Barriers

Background - Dams and culverts can block access to potential habitats for fish and other aquatic species.

Analysis Tools - Anadromous salmonids are being reintroduced to the upper Cowlitz River system including the Upper Cispus Watershed. We report some of the results from the last couple of years of the reintroduction program. In addition, the Gifford Pinchot National Forest is conducting a fish passage at culvert survey. We use the preliminary results to evaluate the culverts in the watershed.

Data Gaps - Several of the culverts identified in the survey require further analysis to determine if they are migration barriers. Many of these do not appear to be barriers at low flows, but they do constrict the channel and may be barriers during higher flows. We identify these as seasonal migration barriers. The exact distribution of fish is unknown on several of the small, steep streams (such as Timonium Creek), so the culverts that are shown as barriers may actually be upstream of the upper limit of fish distribution.

Ratings - Three dams on the Cowlitz River block volitional passage of anadromous fish to the Upper Cispus watershed. A two-way trap and haul system currently provides passage around these dams. Adult Chinook salmon, coho salmon, steelhead, and sea-run coastal cutthroat trout are captured at the Barrier Dam on the Cowlitz River near Salkum and transported to several places upstream from Cowlitz Falls Dam. Smolts (juvenile anadromous fish heading to the ocean) are captured at Cowlitz Falls dam and transported to near the Barrier Dam.

During the last spawning season over 30,000 (personal communication, Mark LaRiviere, Tacoma Power, 2000) adult coho salmon, over 500 steelhead, and around 200 chinook salmon were placed above the dams. The vast majority of the Chinook salmon was placed in the Cispus River. Some of these chinook salmon were radio tracked to where they spawned in the Upper Cispus watershed (John Serl, WDFW, presentation at Cowlitz River TAC Meeting, 2000.

Research is planned to study the feasibility of providing volitional passage around these dams (fish ladders or dam removal). The biggest obstacle is volitional passage at Mossyrock Dam and Riffe Lake. Juvenile fish (particularly Chinook salmon and coho salmon) rarely are successful in navigating this 20-plus mile long reservoir.

Within the Upper Cispus watershed the only potential man-made barriers are culverts at road crossings. The ranger district is in process of finishing a fish passage culvert survey (Table 3-25). This data is also displayed in Map 30, Culverts That May Be Migration Barriers.

Table 3-25: Fish Passage Culvert Survey Results by 6th field Watershed

Sixth field sub-watershed Hydrologic Unit Code 1708000404 _ _	Stream name (downstream order)	Location of culvert - road number and routed distance	Barrier to upstream fish passage?	Stream miles that could be restored to upstream fish passage	Comments
01 Headwaters	None				
02 Walupt Lake	None				
03 Cispus R. – Chambers Cr.	Pimlico Creek	2100000 mp 19.6	ND[1]	None	Pipe Arch Vert Leap Dist = 4.59
	Wesley Creek	5600000 mp 6.38	Seasonal[2]	0.2	Pipe Arch Vert Leap Dist = 1.20’
	Midway Creek	5600000 mp 5.77	Seasonal	3.5	Twin Culverts Vert Leap Dist = 1.48’ and 2.60’
	Midway Creek	5600059 mp 1.98	Seasonal	2.6	Box Culvert-channel gradient = 43%
	Midway Creek	2329000 mp 10.28	Seasonal	1.1	Vert Leap Dist = 0.79’
	Chambers Ck	2150000 mp 0.95	Yes	None	Fish barrier: 30’ falls located downstream from pipe. Vert Leap Dist = 3.44
	Chambers Ck	2160000 mp 0.28	Yes	3.7	Twin Culverts Vert Leap Dist = 1.8’ and 4.1’
04 Muddy Fork	Muddy Fork	5600000 mp 4.9	ND		No survey to date
	Muddy Fork	5603000 mp 3.4	ND		No survey to date
	Muddy Fork	2329000 mp 8.45	Yes	An assumption of 2.0 mi. was made from District Map. No survey data available.	Twin Culverts – Vert Leap Dist = 2.39’ and 3.02’
	N.Fk.Spring Cr.	2329000 mp 7.39	Seasonal	0.2	Pipe Arch Vert Leap Dist = 0.66’
	S. Fk. Spring Ck	2329000 mp 7.89	Yes	0.5	Twin Culverts Vert Leap Dist = 0.5’ and 0.3’
05 Cat Cr.	Cat Creek	2100000 mp 22.5	Seasonal	3.8	Pipe Arch = Vert Leap Dist = 1.02’
	Cat Creek	7812000 mp 0.14	Seasonal	3.1	Twin Culverts Vert Leap Dist = 0.05’ and 0.04’
	Mouse Creek	7812000 mp 0.20	Seasonal	1.4	Pipe Arch = Vert Leap Dist = 0.69’
	Orr Creek	5600000 mp 0.79	Seasonal	3.2	Pipe Arch – twin culverts Vert Leap Dist = 0.60’ and 0.49’
	Orr Creek Trib.	5603000 mp 0.32	Seasonal	0.3	Beaver dam at inlet Vert Leap Dist = 1.18’
	Orr Creek	5603000 mp 0.39	Seasonal	0.6	Pipe Arch Vert Leap Dist = 1.01’
06 Adams Fork	Killen Creek	2329000 mp 6.41	Yes	1.1	Twin Culverts Vert. Leap Dist = 4.51’ and 4.86’

07 East Canyon Cr.	East Canyon Cr	2300292 mp 0.1	Seasonal	2.4	Pipe Arch Vert Leap Dist = 0.31
08 Blue Lake	Unnamed Creek	2801000 mp 2.56	Yes	0.1	Vert. Leap Dist. 8.55’
	Prospect Creek	2801000 mp 9.60	Yes	0.2	Box Culvert (Concrete) Vert Leap Dist = 2.29’
09 North Fork	Irish Creek	2200000 mp 2.06	Yes	0.08	Concrete Vented Ford Vert Leap Dist = 1.29’
	Swede Creek	Road 2200000 mp 2.67	Yes	0.2	3 ft. vertical drop at outlet. Vert Leap Dist = 0.54’
	Timonium Creek	7800060 mp 0.10	Yes	None	Pipe Arch Vert Leap Dist = 1.79’
	Wobbly Creek	2208000 mp 2.60	Yes	0.4	Vert Leap Dist = 4.26’ (resident fish)

1 ND = Not documented – the survey has not been completed for this culvert.
2 Seasonal = Further evaluation is needed to determine if this culvert is a barrier. These culverts maybe barriers to fish migration at stream flows, which are greater or less than the stream flows observed during the survey.

Culverts block only 0.3 miles of potential anadromous habitat. This habitat is of marginal quality, because it is in high gradient sections of streams with small pools. At most, culverts block 9.0 miles of resident habitat on a year round basis. In addition, there are 22.4 miles of habitat that may be blocked on a seasonal basis. Both the year round and seasonal blockages may not prevent the habitation of upstream habitats, but they do prevent the complete interaction between fish upstream and down stream. In many cases fish are found upstream of blockages.

Habitat Elements

General Data Collection

The Gifford Pinchot National Forest has conducted (or contracted out) Level II stream surveys over the past 13 years. The table in Appendix E displays the results of these. There are several data gaps with this set of data.

1) We do not have data for several key sections of stream - Cispus River, below the Muddy Fork, the Muddy Fork of the Cispus River, Walupt Creek, and Chambers Creek. Evaluation of these sections of streams in the watershed depends on very limited observations, and notes gathered from other documents.
2) The surveys rarely collected data concern the amount of fine sediment in streams, and when they did collect this information it was somewhat subjective.
3) The surveys rarely quantified bank stability. When surveyors did quantify bank stability, they did so only in a fraction of the areas sampled and may have missed many eroding areas.

Substrate Character and Embeddedness

Background - This indicator is slightly different from sediment in that it examines the amount of spaces between rocks (interstitial spaces) available for juvenile hiding and an macroinvertebrates (crayfish, stream insects, worms, etc.) habitat. Juvenile fish and many macroinvertebrates also use the interstitial spaces to get protection of high flows and predators (Bjornn and Reiser, 1991; Furniss *et al*., 1991). When the interstitial spaces are filled with fine sediments or the substrate is bedrock these spaces are absent and the quality of habitat is low.

Analysis Tools - We use the cobble embeddedness ratings from level II stream surveys (Stream Survey Data, Appendix E). In the absence of these ratings we use observations from various other trips to the stream. As a last resort we use professional judgment based on the knowledge of the watershed.

Data Gaps - We have very little information about substrate embeddedness. The information we have is reported in the Stream Survey Data Appendix E.

Ratings - We rated most of the 6^{th} field sub-watersheds as Functioning At Risk. The ratings are the same as for the sediment indicator of water quality, because the same sediments that impair the quality of spawning habitat fill interstitial spaces and degrade the quality of juvenile and invertebrate habitats.

Large Woody Debris

Background -Woody debris provides several functions in terms of fish habitat. Wood provides hiding cover, creates pools and pool-like habitats, helps to stabilize banks and is a source of food for some invertebrates, which in turn are food for fish and other aquatic and riparian species (Bjornn and Reiser, 1991; Chamberlin *et al*., 1991). Habitat quality increases with amount of large and stable pieces of wood in a stream.

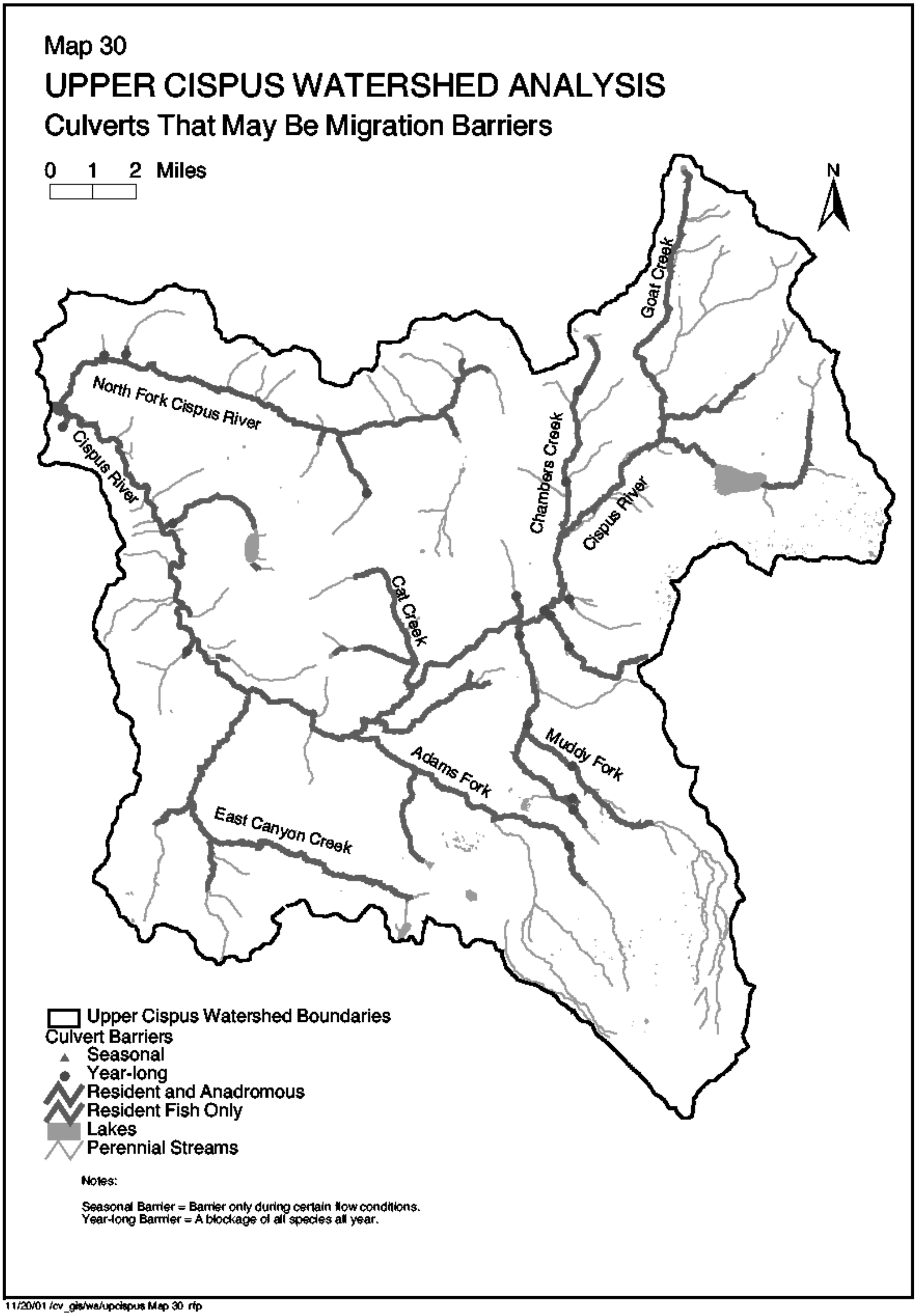
Analysis Tools – We use the counts of pieces of wood from the level II stream surveys (Stream Survey Data, Appendix E). In the absence of these counts we use observations from various other trips to the stream. As a last resort we use professional judgment based on the knowledge of the watershed.

Data Gaps - We have very little information about woody debris. The information we have is reported Stream Survey Data, Appendix E. We have no counts of wood for the Cispus River below the Muddy Fork, Muddy Fork sub-watershed, Chambers Creek, Midway Creek, Wesley Creek, and Walupt Creek. Several of the pre-1990 surveys did not contain information about the size of the wood.

Ratings - We rated only one stream system (Walupt Lake and Walupt Creek) rated as Functioning Appropriately. Fires and past stream side regeneration harvest and past salvage have reduced the level of wood in streams below the potential. Levels of wood are the lowest in the Headwaters, Chambers, Cat, and East Canyon subwatersheds.

Pool Frequency and Quality

Background - Pools provide slow water where fish do not have to fight the current (Bjornn and Reiser, 1991). The quality of pools is dependent on the size (depth) and cover in the pools.


Map 30
UPPER CISPUS WATERSHED ANALYSIS
Culverts That May Be Migration Barriers
0 1 2 Miles
N
Goat Creek
North Fork Cispus River
Chambers Creek
Cispus River
Cispus River
Cat Creek
Muddy Fork
Adams Fork
East Canyon Creek
Upper Cispus Watershed Boundaries
Culvert Barriers
Seasonal
Year-long
Resident and Anadromous
Resident Fish Only
Lakes
Perennial Streams
Notes:
Seasonal Barrier = Barrier only during certain flow conditions.
Year-long Barrier = A blockage of all species all year.
11/20/01 /cv_gis/wa/upcispus Map 30 rfp

Analysis Tools - We use the counts of pools from the level II stream surveys (Stream Survey Data, Appendix E). In addition, to the pool frequency we rated quality of pools. The quality of a pool depends on its size relative the stream and cover in the pool. The only item the level II survey provides for rating cover is woody debris. We rated a pool as a quality pool if it had one or more pieces of wood or its wetted width-to-depth-ratio was less than 7. The latter is based on unpublished analysis of differences in pools located in managed streams and relatively unmanaged streams in Idaho.

In the absence of level II data we use observations from various other trips to the stream. As a last resort we use professional judgment based on the knowledge of the watershed.

Data Gaps - We have very little information about pool frequency and quality. The information we have is reported Appendix E. We have no counts of pools for the Cispus River below the Muddy Fork, Muddy Fork sub-watershed, Chambers Creek, Midway Creek, Wesley Creek, and Walupt Creek.

Ratings – For the entire watershed we rated this indicator as Functioning at Unacceptable Risk. Few of the stream reaches meet the criteria for pool frequency (See Stream Survey Data and individual rating summaries). In addition the quality of the pools was generally fair. The exception to the general rule was Walupt Creek and the Muddy Fork, which were rated as Functioning Appropriately.

In addition to the data from Level II surveys we have some observations. The Middle and Upper Cispus watershed analysis rated pool frequency as poor, citing unpublished data showing a 38% decrease in pools, between 1935 and 1991 for the Cispus River from the Cowlitz River confluence to Blue Lake Creek. The assumption is that the general decrease in pool habitat occurred evenly throughout the study area.

Large Pools

Background - Large pools provide a large amount of space for holding fish. This is particularly important to anadromous fish prior to spawning. They can also provide thermal refuges in streams that otherwise have higher water temperatures.

Analysis Tools - We use the counts of pools and pool depths from the level II stream surveys to evaluate this indicator (Stream Survey Data, Appendix E). Only pools greater than 3 feet deep were rated as large pools.

In the absence of level II data we use observations from various other trips to the stream. As a last resort we use professional judgment based on the knowledge of the watershed.

Data Gaps - We have very little information about pool size. The information we have is reported in Appendix E. We have no counts of pools for the Cispus River below the Muddy Fork, Muddy Fork sub-watershed, Chambers Creek, Midway Creek, Wesley Creek, and Walupt Creek.

Ratings – For the entire watershed we rated large pools as Functioning At Risk. As expected for a river of this size, there are many pools in the Cispus River that would qualify as a large pool (> 3 feet deep). We rated Headwaters, Walupt Lake, and Muddy Fork as Functioning Appropriately because they are nearly at their potential. The other streams have fewer large pools than expected based on comparisons to relatively unmanaged streams.

Off Channel Habitats

Background - Off channel habitat provide spawning and juvenile habitats for coho salmon, cutthroat and bull trout. Chinook salmon and steelhead will also use off channel habitats but are more often found in the main channel.

Analysis Tools - We used observations from level II surveys, aerial photo analysis of the Cispus River downstream from Adams Fork and other stream studies.

Data Gaps - We have no data for Muddy Fork Creek, Chambers Creek, Midway Creek, Wesley Creek, and Walupt Creek.

Ratings - We rated off channel habitats as Functioning At Risk. Off channel habitats are generally, abundant where the valley type is conducive to the formation of these habitats. The At Risk rating comes from low quality and low stability of these habitats.

Refugia (at 6th and 7th field scales)

Background - Refugia are defined as areas of functioning habitat that would provide a refuge for a fully functional population of fish at least until habitat conditions improve elsewhere.

Analysis Tools - We used compilations of the stream data previously rated along with observations from less formal stream surveys to evaluate this indicator.

Data Gaps - We have no data for Muddy Fork Creek, Chambers Creek, Midway Creek, Wesley Creek, and Walupt Creek.

Results - None of the 6th fields or 7th field sub-watersheds meet this definition. The sub-watersheds that are nearly at their potential are isolated from the rest of watershed by natural barriers. The other sub-watersheds lack the habitat quality to qualify as refugia.

Channel Conditions and Dynamics

Width/Depth Ratio

Background - Width-to-depth ratio is a measure of balance in the sediment transport regime (Rosgen, 1996). Low width-to-depth-ratios are generally considered to be better than high width to depth ratios. Streams with low width to depth generally have deep pools and have cool water temperatures.

The exception to the rule of the smaller width-to-depth ratio the better, occurs when streams are down cutting and disconnected from the floodplain.

Analysis Tools - We examined the width-to-depth-ratios as reported by level II stream surveys and other studies of channel width. We compared the observed channel width with those expected based on the geology and stream gradient. Where we had data we also examined how channel width changed over time.

Data Gaps - We have many data gaps for this indicator.
Level II surveys collected very few measurements of bankfull width and depth.
Using channel type to evaluate width-to-depth-ratio is difficult, because there are no standard criteria for bankfull width-to-depth ratios.

Results - Overall we rated width-to-depth-ratios as Functioning At Risk. The width-to-depth-ratios on a few streams are nearly at their potential (Walupt Lake, Adams Fork, and Muddy Fork).

We considered these ratios on the other streams to be slightly to greatly modified. The previous watershed analysis (Middle and Upper Cispus WA, 1995) reported on stream channel widening in the Blue Lake watershed. The hydrology section also discusses channel widening.

Streambank Condition

Background - Streambank stability is a measure of the sediment/stream flow balance in a stream. Streams with large areas of unstable bank are thought to be out of balance. Streams that are out of balance often are wide and shallow (and lack deep, and quality pool habitats). They often have elevated levels of sediment.

Analysis Tools - We quantify the amount of unstable or potentially unstable bank.

Data Gaps - We lack information about stream bank condition. The level II surveys at best collected this information for only sub-samples of the reaches. Therefore it is not possible to quantify the amount of stable streambank. The ratings are thus based upon observations made by aquatics professionals (noted by hydrology and fisheries personnel during stream surveys) over the last two decades and professional judgment based the amount of stream side disturbance. In addition the Middle and Upper Cispus Watershed Analysis, 1995 also mentions areas of unstable streambanks.

Ratings - The Headwaters, Walupt Lake, Muddy Fork, and Adams Fork 6^{th} field sub-watersheds are thought to be nearly at the potential for these areas, because the areas are relatively unmanaged. Chambers, Cat, Blue Lake, and North Fork 6^{th} field sub-watersheds were rated as Functioning At Risk, because of observed areas of instability, wider than expected channels, or relatively high levels of streamside activities when compared to other 6^{th} field sub-watersheds. The East Canyon sub-watershed was rated as Functioning At Unacceptable Risk, because of a large number of unstable areas reported in the stream survey notes.

Floodplain Connectivity

Background - Modifications along the streambanks, such as road building, bank revetments and other developments, can affect the function of floodplain as pressure relief valve during floods and disconnect streams from wetlands and other off-channel habitats.

Analysis Tools - As an initial evaluation we examined the density of roads within riparian reserves (see Table 3-26), we then refined this with observations of road locations from the field.

Table 3-26: Road Information as it relates to streams.

Sub-Watershed	**Total Road Density**	**Riparian Road Density**	**Stream Crossing Density**	**Drainage Extension**
	Miles of Road/ Square Miles of Watershed	*Miles of Road/ Square Miles of Riparian Reserve*	*Number of Crossings/ linear mile of stream*	*% of linear stream length*
Headwaters	0.02	0.00	0.00	0.0
Walupt	0.07	1.17	0.06	0.2
Chambers	1.22	14.7	1.32	5.0
Muddy Fork	0.32	6.63	0.15	0.6
Cat	1.40	21.81	1.60	6.0
Adams	0.31	8.41	0.28	1.0
East Canyon	1.05	14.94	1.03	4.3
Blue Lake	0.87	14.26	1.29	4.9
North Fork	1.26	17.80	1.57	5.7

Ratings - We rated the Cat, North Fork, and East Canyon 6^{th} field sub-watersheds as Functioning At Risk. Roads are located on the banks of Cat Creek and East Canyon Creek for substantial portions of these streams. At least one wetland has been affected in the North Fork sub-watershed.

We rated the rest of the sub-watersheds as Functioning Appropriately. Although there are roads in the riparian reserves, the roads are for the most part outside of the floodplains.

Flow/Hydrology

Change in Peak and Base Flows

Background - When the magnitude or frequency of peak flows is increased they can change pool frequency and quality. They can also erode banks leaving stream channels wider and shallower than before or create gullies, both result in the reduction of the quality of fish habitat.

We use a combination of a conservative Aggregate Recovery Percentage (ARP) value, drainage network increase (a separate indicator), and observed channel changes and observed flow records to evaluate this indicator.

Stands of larger trees outside of riparian areas are also important for aquatic habitats. Relatively dense stands of trees intercept snowfall before it hits the ground, melts, and contributes to peak flows. The degree to which this occurs is dependent on the size and density of a stand. Stands with an average diameter of 8 inches and canopy closure of 70% are rated as being hydrologically mature. Stands with average diameters smaller than 8 inches or canopy closures of less than 70% intercept less snow and allow this snow to contribute to peak flows when it melts. These stands are rated as hydrologically immature.

Analysis Tools - We use the combination of average tree size in stands, evidence from stream channels, and drainage network extension to predict the risk of increased in peak flow.

Stand size - Because the Aggregate Recovered Percentage (ARP) Wizard (a computer-based program for determining ARP) is not working, we queried the vegetation database for stands with an average diameter of greater than 8 inches then, using GIS, calculated the percentage of the potentially forested occupied by these stands.

Table 3-27: Summary of Average Tree Size in Stands and Successional Stages

Sub-Watershed	% Average DBH ≥8" (ARP)	Non Forest[2] %	Hard Woods %	Early Open %	Early Closed %	Mid Successional %	Late Successional %	Admin[1] Sites %	Missing[2] Data %
Headwaters	92.4	49	0.0	0	4	10	36	0.0	0.1
Walupt Lake	96.1	43	0.0	0	2	45	9	0.1	0.2
Chambers	76.1	14	0.0	5	18	37	26	0.0	0.0
Muddy	54.5	30	0.1	10	32	27	2	0.0	0.2
Cat	78.5	3	0.0	9	14	52	22	0.0	0.0
Adams	87.6	24	0.1	9	12	50	4	0.1	0.0
East Canyon	85.3	11	0.0	5	10	52	22	0.2	0.0
Blue Lake	90.1	10	0.2	3	3	71	12	0.0	0.0
North Fork	70.1	10	0.1	13	19	25	33	0.0	0.0

1- Admin sites are campgrounds or other facilities such as guard stations.
2- Non Forest stands are rock outcrops, meadows, and lakes.
3- Missing Data are data created by errors in watershed boundaries.

For this conservative ARP rating, we assumed values of 70% or less represent an elevated risk of increased peak flows, values of 70-85% represent a moderate risk of increased peak flows (particularly when drainage extension is higher), 85-95% represent only minor changes to watershed hydrology, and a value of 95% or greater is considered undisturbed. The values for the Cat, East Canyon, Chambers, and North Fork are indicative of moderate potential for increases in peak flow magnitude and frequency. The lower ARP values in these watersheds correspond with relatively high levels of regeneration harvest (See Harvest History Appendix).

The low value for Muddy Fork sub-watersheds is of lesser concern. This value is low primarily because this sub-watershed has large areas of naturally disturbed stands that are slowly recovering from fires 80 years or more ago. Further investigation showed many of these stands are near hydrological maturity (6-7 inches dbh and >70% crown closure) if not at maturity, based on the long-term potential conditions for the these high elevation stands.

Evidence from channels - We examined channels for evidence of debris flows and flow records. Although the stream gauge with the longest history is slightly below this watershed it would be a mistake to ignore this data.

In addition to the lower ARP values, stream channels in parts of the Cat (Cat Creek and Mouse Creek), East Canyon Creek, Cispus River and the North Fork Cispus River show signs of increased peak flows. The Middle and Upper Cispus Watershed Analysis reported that the channels of the Cispus River and North Fork Cispus River had increased in width since 1959. Evidence of channel scouring flows was observed during the 1998 stream surveys of Cat Creek and Mouse Creeks. There were numerous episodes of bank erosion in East Canyon Creek. Examination of peak flow records at downstream flow gauges shows at least four 20-year plus floods occurring during the last 30 years. It would be a mistake to totally ascribe these floods to the one major drainage between the stream gauge and this watershed.

Drainage Network Increases - Analysis of Drainage Network Increase - Road drainage ditches and road surfaces capture surface runoff and surface flows. Where roads cross streams, they route the captured water flows to the streams. In other words the roads act like extensions of the stream channels. This has two effects. First, it decreases the time it takes water to reach streams, and thus increases peak flows. Secondly, water captured by the road's surface and ditches often carries fine grained sediments to the streams, adding to the amount of fine grained sediments in the streams.

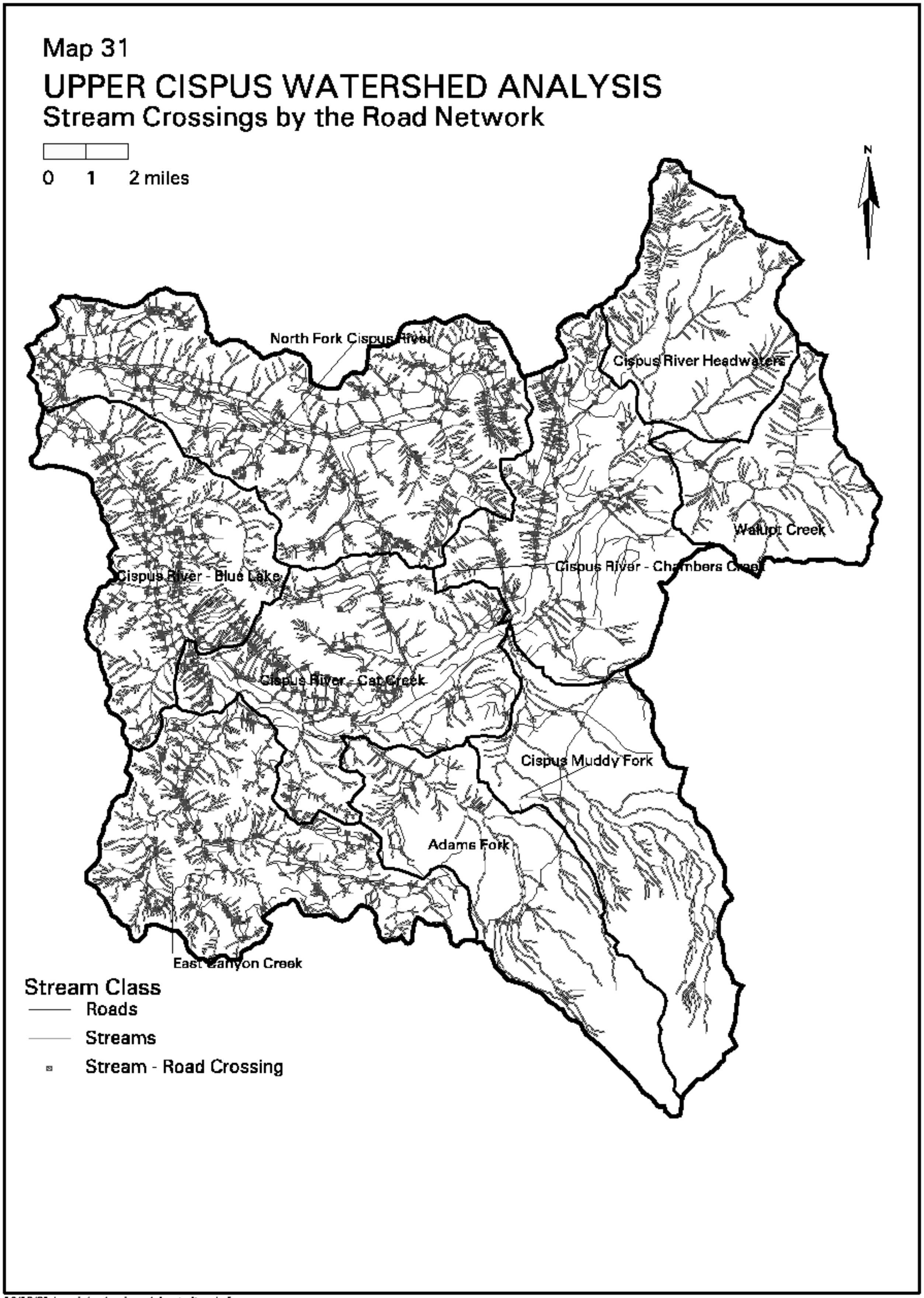
We model drainage network increase by using the GIS data to map roads and streams. See Map 31, Stream Crossings by the Road Network, for the location of stream crossings on roads. We add 200 feet to the stream for each stream crossing. The 200 feet of additional stream is based on earlier investigations of the average distance from the last drainage ditch relief culvert to the stream crossing. The later is nearly impossible to model. To scale this to the size of the existing drainage network, we divide the increase in stream length by the existing length of streams in the sub-watershed. The resulting value is a percent increase in the length of streams. We rated values of between 0 and 5% as Functioning Appropriately, values between 5% and 10% as Functioning At Risk and values greater 10% as Functioning At Unacceptable Risk.

<u>Data Gaps</u> - The tool Aggregate Recovered Percentage Wizard (ARP) is not working, so we used queries of the GIS forest vegetation database to approximate this value. We did not use canopy closure as part of the query, because this data is of questionable quality. This value is different from standard ARP in that it does not consider canopy closure nor does it assign partial recovery values of to hydrologically immature stands as they grow.

For drainage network increases we are dependent upon the accuracy of the GIS data in identifying stream crossings. The limitation of this method is that it does not account for ditch relief culverts that lead directly to streams. These situations are most likely to occur where roads parallel streams within 100 to 200 feet of the stream.

<u>Results</u> - Overall we would rate the condition as Functioning At Risk. Drainage network increases are fairly low throughout the watershed (See Table 3-26). They never exceeded 10% but equaled or exceeded 5% in 5 of the sub-watersheds.

Watershed Conditions



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Road Density and Location

Background - Roads have been demonstrated to affect both stream flows and sediment delivery (Furniss *et al*., 1991). We have previously evaluated the potential for effects to stream flow (Flow and Hydrology), which leaves the potential for roads to affect sediment delivery. Sediment is delivered in two forms, fine-grained sediments, which clog spawning gravels and juvenile habitats and coarse-grained sediments, which fill pools and make streams more shallow than normal. Coarse-grained sediments are delivered to streams by roads, when stream crossing fail and when road fill materials give way and create small landslides. Fine-grained sediments are delivered to streams by roads via surface runoff and when roads fail either at culvert or in the small landslides.

Analysis Tools - The potential for roads to affect streams increases with road density. Since the delivery of sediment is most often associated with stream crossings, roads near streams, and roads in otherwise unstable areas, we refine our analysis by concentrating on stream crossings, roads within the riparian reserves (near stream areas and unstable areas). We used the GIS database to map and quantify the areas of concern for roads. The Geology report further refines areas of concern.

Data Gaps - We are dependent on the accuracy of the GIS data used to make these maps. Some streams may not actually exist on the ground while other streams do not exist in the database.

Ratings - Overall we rated the condition as Functioning At Risk. Table 3-26 displays the results of the analysis.

Riparian Reserves

Background - Riparian connectivity is also a key habitat feature for aquatic species (particularly fish). Vegetation within the riparian reserves provide shade to the streams cool, root masses to stabilize banks and reduce sedimentation, and eventually down woody material creates current breaks and hiding cover. The general rule is that stands with larger trees and tight canopy closure are the most beneficial, where as the grass/shrub stands provide the least of the important characteristics. The large tree sands are most important along the mainstems of streams, but also provide key habitat features in other sub-watersheds as well.

Analysis Tools - A GIS analysis was done for riparian reserves in the watershed (Table 3-28). Vegetation was classified into grass/pole, hardwoods, small tree and large tree forested habitats, as well as non-forest. Map 32, Current Vegetation Structure in Riparian Reserves, displays the spatial distribution of this data. The following table displays the results of this analysis, in acres, by category:

Table 3-28: Seral Classes Within Riparian Reserves by 6th Field Watershed

Sub-basin	Non-Forest[1]	Early Open	Early Closed	Mid Successional	Late Successional
Headwaters	52	0	3	7	38
Walupt	58	0	1	34	7
Chambers	30	3	12	32	23
Muddy Fork	27	6	32	31	2
Cat	4	10	8	45	33
Adams Fork	12	6	9	66	8
East Canyon	20	5	12	40	23
Blue Lake	16	2	3	69	11
North Fork	10	14	19	26	32

[1] Rock outcrops, lakes, and non-vegetated flood plains

Ratings – The overall rating for the watershed is Functioning at Risk. Only Cispus Headwaters and Walupt Lake were rated as Functioning Appropriately, primarily due to the unmanaged condition within the Wilderness portions of these subwatersheds.

Disturbance Regime

Background - This indicator examines the frequency and magnitude of disturbances is the watershed. The focus is mainly on "natural disturbance" (ex., floods, fires, volcanic eruptions). Smaller and less frequent disturbances allow for refuges and the watershed more time for the watershed to recover.

Analysis Tools - We examined the fire history of the watershed and frequency of other disturbances such as volcanic eruptions and floods.

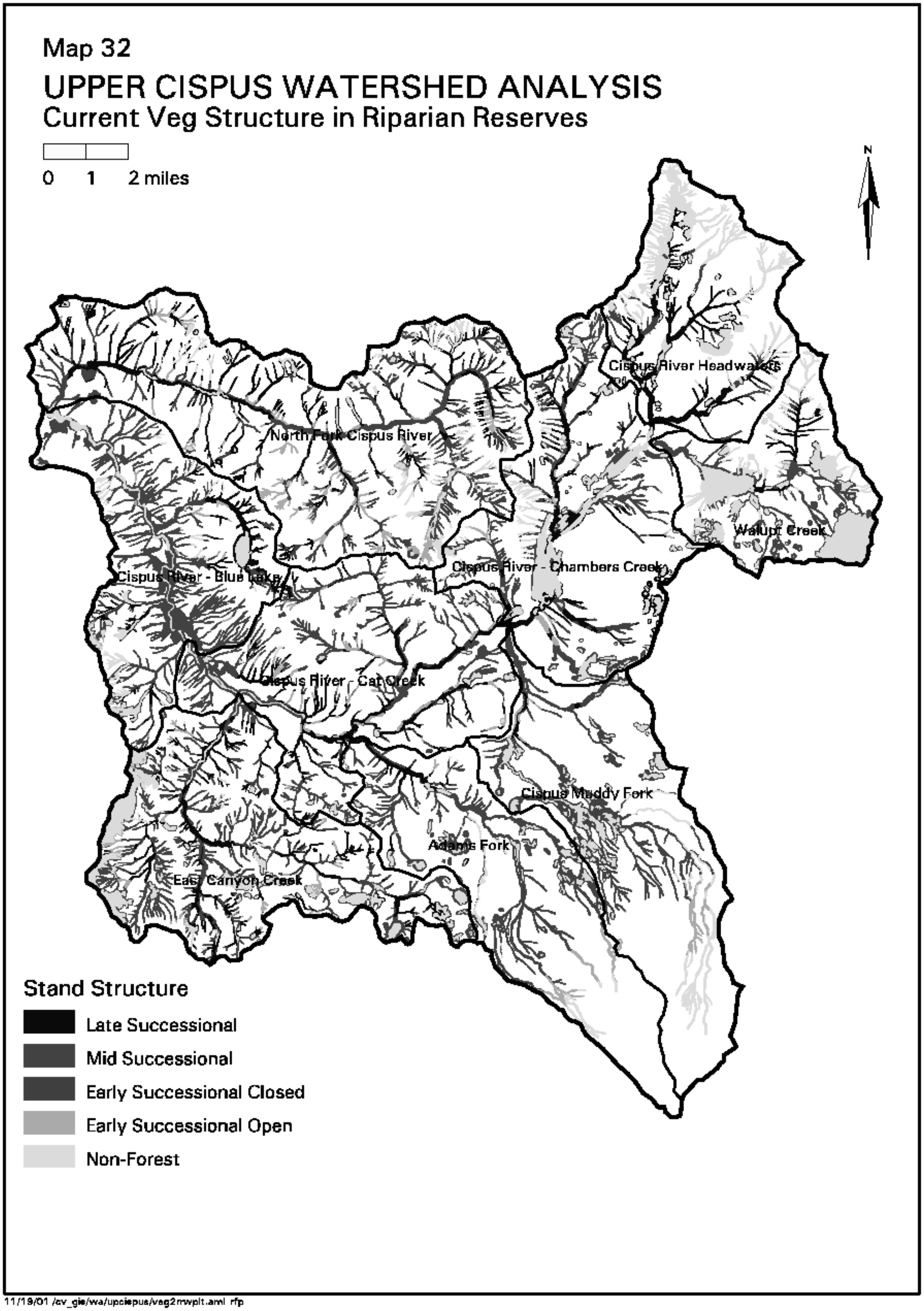
Ratings - Overall the watershed rated as Functioning At Unacceptable Risk. Disturbances were widespread and included large fires in late 1800s through the early 1900s, the eruption of Mount St. Helens in 1980 dumping volcanic ash throughout the watershed, and frequent large-magnitude floods over last 30 years.

Disturbance History

Background - This indicator is very close to the previous one (Disturbance Regime). The chief difference is that disturbance history focuses on "Human Caused" disturbances (timber harvest, road building, ect) and their location.

Analysis Tools - We examined the size and location of past timber harvest, road building and recreational uses.

Results – The overall rating is Functioning At Unacceptable Risk. Appendix D displays the location, timing, and magnitude of timber harvest. The disturbances are not particularly large, but they do occur, in part, within riparian reserves and unstable areas. The disturbances are not spread throughout the entire watershed. The Walupt Lake and Headwaters sub-watershed are largely


Map 32
UPPER CISPUS WATERSHED ANALYSIS
Current Veg Structure in Riparian Reserves
0 1 2 miles
N
Cispus River Headwaters
North Fork Cispus River
Walupt Creek
Cispus River - Chambers Creek
Cispus River - Blue Lake
Cispus River - Cat Creek
Cispus Muddy Fork
Adams Fork
East Canyon Creek
Stand Structure
Late Successional
Mid Successional
Early Successional Closed
Early Successional Open
Non-Forest
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unharvested, unroaded or wilderness areas. The Adams Fork, Muddy Fork, and Blue Lake sub-watersheds also contain relatively large unroaded or wilderness areas that are relatively undisturbed by human activities, but do have some harvested and roaded areas. The remaining sub-watershed are relatively heavily roaded and or harvested.

Subpopulation Characteristics

We address this pathway and its indicators only at the 5th field watershed level. We do not have the necessary information to begin to rate the associated indicators at a 6th field sub-watershed scale. The conditions of the indicators vary by species.

Subpopulation Size

<u>Background</u> - Population size is the key indicator for risk of extinction. The smaller a population becomes the greater the risk it will become extinct. Small populations are at great risk, because natural environmental fluctuations such as floods, fires and droughts can wipe out the population. In addition, small populations generally have low genetic variability making them vulnerable to disease.

<u>Analysis Tools</u> - We use trap and transport records from the reintroduction of anadromous salmonids in the upper Cowlitz River system.

<u>Data Gaps</u> - The only solid population data we have available are the trap and transport records from the reintroduction effort. Because these records cover the entire upper Cowlitz River, they are not specific to this watershed. Counts of fish in the level II surveys are old and not rigorous enough to provide meaningful measures of population size. In addition to lack of rigorous sampling it is impossible to tell steelhead and sea-run cutthroat trout fry from the resident form without laboratory analysis.

<u>Ratings</u> - The population of anadromous runs are entirely dependent upon how many fish are transported around the dams in the Cowlitz River. The number of fish transported above the dams are still heavily dependent on the number of fish perceived to be needed to run the hatchery program and the success of capturing smolt at Cowlitz Dam. Until recently only adult fish that were surplus to the hatchery needs were transported above the dams.

Steelhead - We rate the Steelhead population as Functioning At Unnaccptable Risk. Approximately 500 adult steelhead were placed in the upper Cowlitz River. Based on professional experience, this number of fish would barely be enough to occupy the available habitats in the Upper Cispus River let alone the entire upper Cowlitz River watershed.

Chinook Salmon - We rate the Chinook population as Functioning At Unacceptable Risk. Fewer than 500 adult Chinook salmon were transported to the upper watershed. The transport of adult Chinook salmon has been limited and the trapping rate of Chinook salmon smolts at Cowlitz Falls dam is low. Washington Department of Fish and Wildlife officials and other regulatory officials are reluctant to place adults in the upper Cowlitz watershed when fewer than 50% of their smolts have a chance of making it downstream past the Cowlitz River dams. Experimental efforts with designs of traps at the Cowlitz Falls fish facility are showing promising results.

Sea-Run Coastal Cutthroat Trout - We rate the sea-run coastal cutthroat population as Functioning At Unacceptable Risk. Fewer than 50 adult sea-run coastal cutthroat were transported to the upper Cowlitz River watershed.

Resident Coastal Cutthroat Trout - We rate the resident coastal cutthroat trout population as Functioning At Risk. Coastal cutthroat trout are spread throughout the Upper Cispus watershed, however, they seemed to have disappeared or greatly declined in numbers in several areas (Personal Communication, Terry Lawson, Fisheries Technician and 20 plus year resident of the area).

Bull Trout - We rate the bull trout population as Functioning At Unacceptable Risk. Despite wide ranging surveys and reports from anglers we have only one confirmed report of a bull trout in the Cispus River and that was from Yellowjacket Creek which is not in the Upper Cispus watershed.

Coho Salmon - We rated this coho salmon as Functioning Appropriately. Over 30,000 adult coho salmon were transported to the upper Cowlitz River watershed. Although monitoring efforts for these adults have been focused on the lower Cispus River and Cowlitz River, coho salmon seem to be spreading throughout the available habitats.

Other Species - We do not have enough information to address the other species in a meaningful manner. The only other population monitoring in the watershed is at Walupt Lake. The spawning records from Washington Department of Fish and Wildlife seem to indicate stable populations of these species. The remaining lakes are not tracked except to evaluate the need for planting fish.

Growth and Survival

<u>Background</u> – Populations need to have the size and genetic variation to weather environmental disturbance events such as floods.

<u>Analysis Tools</u> - Population numbers before and after disturbances such as floods.

<u>Data Gaps</u> - We do not have the information to confidently address this indicator.

<u>Ratings</u> - We do not have enough information to evaluate this indicator.

Life History Diversity and Isolation

<u>Background</u> - The existence of all migratory types and ages is the key to recovering quickly from disturbances.

<u>Analysis Tools</u> - We reviewed the life history forms and ages of fish existing the watershed.

<u>Data Gaps</u> - We do not have good population structure information on any of the species. This

condition is most evident in bull trout, where we have a record of one fish.

<u>Ratings</u> - Steelhead, Chinook salmon, and coho salmon - We rate these species as Functioning At Risk. The diversity of run timing has been reduced due to the combination of the Cowlitz dams and assignment of fish to various runs by hatchery practices. Hatchery practices have separated the timing of runs that may have overlapped historically. The potential effect is greatest on steelhead. Only steelhead arriving between certain dates are transported to the upper Cowlitz River. The reasoning at this time is that the "late winter run" is most representative of native stock. The potential for problems exist when these fish arrive either early or late because of environmental fluctuations. In addition, few if any fall Chinook salmon are transported to the upper Cowlitz River.

Bull Trout – We have no information to make a rating for this species.

Coastal Cutthroat – We rate this species as Functioning At Unacceptable Risk. The sea-run life history is barely hanging on. Fewer than 50 adults have transported to the upper Cowlitz River watershed.

Persistence and Genetic Integrity

<u>Background</u> - Sub-populations of species need to be large and well connected with others to avoid problems associated with a lack of genetic variability.

<u>Analysis Tools</u> - We examined the sub-population size and its connection to other sub-populations.

<u>Data Gaps</u> - We have very little information about population size.

<u>Ratings</u> - Steelhead and Chinook salmon - We rate these species as Functioning At Unacceptable Risk. The sub-population in the Upper Cispus Watershed is well under 1,000 (transport records) and the Cowlitz River Dams isolate this sub-population from the lower Cowlitz River sub-populations.

Coho Salmon - We rate this species as Functioning At Risk. The over 30,000 adult coho transported to upper Cowlitz River is certainly large enough to maintain genetic variability, however, stock has been heavily influence by hatcheries, and the Cowlitz River Dams isolate this sub-population from the lower Cowlitz River populations.

Coastal Cutthroat - We rate this species as Functioning At Risk. The sub-population size is unknown and some parts may be isolated in the headwaters. Like the other species there is very little connection to the lower Cowlitz River.

Bull Trout - We rate this species as Functioning At Unacceptable Risk. If a bull trout population exists it is extremely small and isolated.

Species and Habitat

Integration of Species and Habitat

The title of this indicator is self-explanatory; this is combination of the previous ratings. All of the previously mentioned analysis tools and data gaps also apply for this rating. Given the lack of crucial data, the confidence in the rating is low.

Ratings - We rate this indicator as Functioning At Unaceptable Risk. Habitats have definitely been altered, and fish populations seem to be in a slow downward trend.

C. PHYSICAL RESOURCES

1. Current and Reference Conditions – Geologic Processes

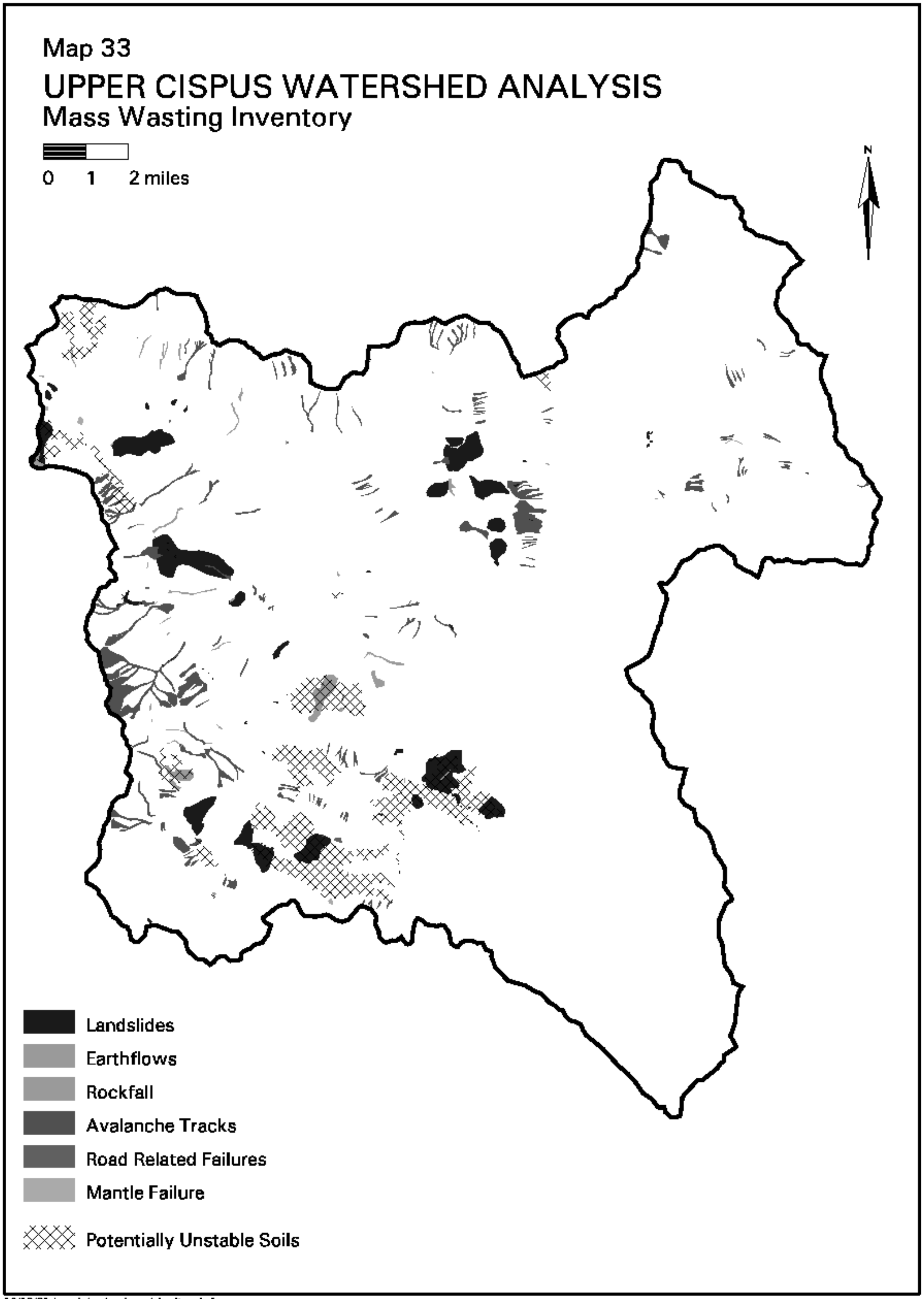
a. Mass Wasting

Current conditions of the Upper Cispus Watershed and its sub-basins are not very dissimilar than the reference conditions in a geologic time scale. Major geologic processes such as glaciation, volcanic activity and seismic activity have been occurring in the area for 40 million years. Some small glaciers and snowfields are still present in the high elevation areas of the Goat Rocks and on the flanks of Mt. Adams. Volcanic activity, as recent as 1980, has deposited ash and pumice in the area. The large deep-seated landslides in the watershed, even though inactive at the present may have been triggered by seismic activity in the past.

The unstable ground and potentially unstable ground as shown on Map 33, Unstable and Potentially Unstable Areas, consists of landslides, earthflows, rockfall, and debris flows/avalanche tracks from the geologic database and unstable soils from the soils resource inventory. The table below shows a breakdown of these features by each sub-basin. The percent of sub-basin affected is a little misleading in that there is some overlap in the mapped unstable ground and the potentially unstable soils. This overlap can be seen on the map.

Table 3-29: Unstable and Potentially Unstable Area by Sixthfield Watersheds

Sub-basin Name	Sub-basin Number	Total Acres	Unstable Acres	Percent of Sub-basin Unstable	Potentially Unstable Acres	Percent of sub-basin Potentially Unstable
Headwaters	01	12994	115	0.89	0	0
Walupt Creek	02	9742	108	1.11	0	0
Chambers Cr.	03	18410	626	3.40	76	0.41
Muddy Fork	04	17732	0	0	0	0
Cat Creek	05	18777	603	3.21	1389	7.40
Adams Fork	06	15686	679	4.33	1615	10.30
E. Canyon Cr.	07	18307	1213	6.63	2393	13.07
Blue Lake	08	15637	2310	14.78	671	4.29
N.Fork Cispus	09	27907	1154	4.13	500	1.79
Total 5th field		**150314**	**6809**	**4.53**	**6644**	**4.28**



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As can be seen from the map the areas of concern from mass wasting are mainly in the western two thirds of the watershed. The eastern third of the watershed is characterized by younger lava flows and higher elevations that are not affected by rain on snow events that trigger many of the debris flows that occur in the rest of the watershed. Appendix L of the Middle and Upper Cispus River Pilot Watershed Analysis completed in 1995 gives a good breakdown of the different events. Total numbers from the previous analysis and this analysis may vary somewhat because of updated information and the major storm event that occurred in the area in 1996. From the data it appears that East Canyon Creek and Cispus River- Blue Lake sub-basins have the highest area of unstable and potentially unstable ground in the watershed. Material that is transported during large stormevents by debris flows can impact fisheries habitat either positively or negatively. Usually debris flows scour channels in high gradient areas and deposit the material in lower gradient areas. Much of this material can be coarser gravels and cobbles that could enhance spawning areas. These events also have a tendency to move large woody debris into and through the stream system, which in turn could help create the pools, and riffles that enhance the fisheries habitat.

b. Surface Erosion

Prior to management activities in the area surface erosion was perceived to be low except for short periods of time following catastrophic events such as wildfires or volcanic activity. Stand replacement fires would burn the vegetation and duff layers completely leaving mineral soil, which was susceptible to erosion until vegetation had a chance to reestablish on the landscape. With the advent of human activity surface erosion probably increased mainly in areas of road construction and where mineral soil became exposed to the weather. In some areas this was probably significant and others little or no effect. Volcanic activity, mainly from Mount St. Helens, would deposit tephra throughout the watershed during most of its eruptive cycles. This material was very loose and easily eroded again until vegetation would hold the new soils in place.

Most of the material being transported by the rain and wind is fine sands and silts. When this material reaches streams it will usually be transported through areas of high stream gradients and deposited in the lower gradient areas. These fine sediments could diminish spawning habitat.

Surface erosion can be split into two main categories, hill slope and roads. Hill slope erosion can vary greatly depending on percent slope, soil type and vegetative cover. Based on slope and soil type, the watershed would have an overall rating of moderate with valley bottoms being slight. See Map 34, Soil Erosion Potential for areas and their erosion potential. The key factor that reduces hill slope erosion is vegetation cover. If cover were removed to mineral soil, surface erosion on steep slopes would be much higher. The potential for surface erosion is greatly reduced if a management activity occurs in an area leaving some vegetation or duff layer.

Erosion from roads is based on gradient of the road, surface type, and cut/fill slope materials. Appendix N of the Middle and Upper Cispus Pilot Watershed Analysis gives good background information on determining the amount of sediment routed from roads to streams. Converting this data to the present sub-basins shows that the North Fork Cispus, Cat Creek and Chambers Creek as having the highest rate of sediment being routed to streams. This data does not take into account any new information from changes in the road system and storm events. The roads data does point out numerous red flag areas that should be reviewed to determine the extent of repair completed. This information is also based on slightly different boundaries so the numbers will be somewhat different than the actual numbers for this iteration.

Table 3-30: Estimates of Sediment Originating From Roads

Sub-basin	Watershed Acres	Road Length Miles	Road Prism Acres	Routed Sediment T/Yr	Watershed Sq. Mi.	T/Sq. Mi/Yr
N. Fork	27632	102.69	522.14	965.13	43.18	22.35
Blue Lake	15055	35.47	155.22	247.98	23.52	10.54
E. Canyon	17336	51.2	199.75	313.69	27.09	11.58
Adams Fork	16264	14.07	51.36	365.85	25.41	14.40
Cat Creek	20015	75.49	319.77	813.09	31.27	26.00
Muddy Fork	17367	14.59	53.44	186.33	27.14	6.87
Chambers Creek	18258	59.38	192.94	462.95	28.53	16.23
Walupt Creek	10094	3.14	9.83	14.59	15.77	0.93
Cispus Headwaters	12931	0.44	1.37	2.96	20.20	0.15

This information should be used as a comparison between sub-basins and not used as a quantitative analysis of actual amounts.

D. SOCIAL AND ECONOMIC RESOURCES

1. Recreation

Introduction

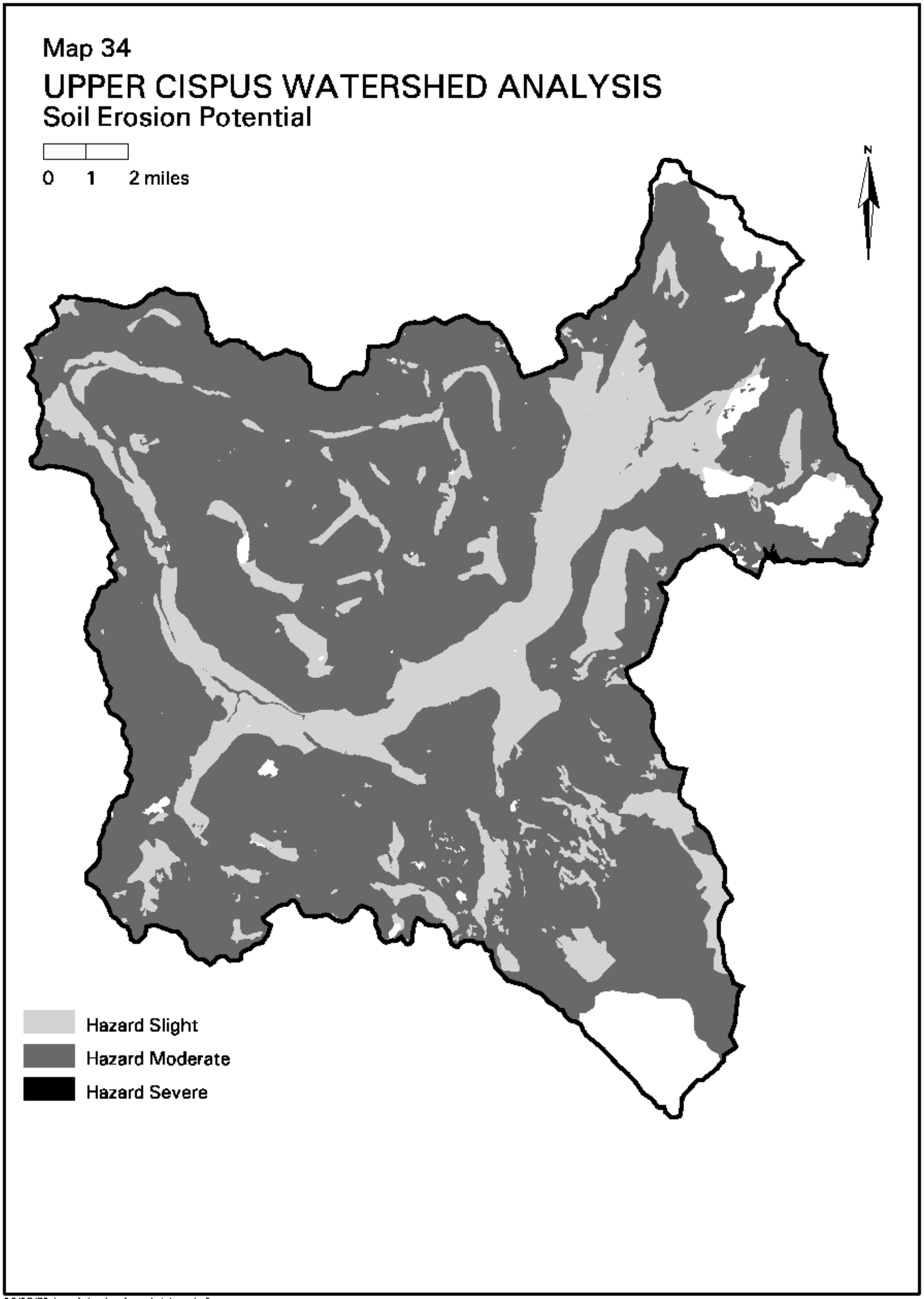
Recreation within the watershed is varied and complex. It includes many facilities, such as developed campgrounds, isolated toilets, signs, information boards, parking facilities, and trails. It includes all types of uses, including hiking, bicycling, backpacking, camping, picnicking, horse riding, trail riding on motorcycles and 4-wheel ATV's, driving for pleasure, photography, hunting, fishing, and others.

At this time, we have little conclusive information about the level of use and condition of facilities, although that is changing with current inventory efforts related to trails, facilities, and use levels. These inventory and survey projects will eventually give us much better information on trail features and condition, the number and condition of dispersed sites, and the number of users who visit the forest and take part in various activities.

General direction

The "Guide to Adaptive Management on the Cispus AMA" provides the following direction:

- provide a full range of ROS classes



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- S&G's for riparian reserves prohibit or regulate activities that prevent or retard achievement of ACS objectives
- The AMA is suitable for semi-primitive recreation…with rustic or no facilities, few social encounters, and, ideally, opportunities for quiet, solitude and diversity
- Suitable activities are driving, hiking, camping, nature study, photography, forest products harvest, hunting, fishing, mountain biking, horseback riding,
- Despite the substantial presence of motorized trails in the AMA, there is no mention of motorized recreation.
- Maintain high quality scenic viewsheds along major corridor access routes

Monitoring opportunities:

Assessment of impacts on old growth species
Assessment of effects of developed facilities and dispersed sites near riparian areas
Assessment of relationships between recreation use and habitat capabilities
What is the public seeking?
Compatible recreation opportunities or separation of uses?
Do road conditions support recreation uses?

Direction varies slightly for each landscape design unit. Consult the AMA Guide for more specific information.

Wilderness management within the watershed is directed by rules, regulations, plans and policies associated with the Wilderness Act of 1964. In general, that overall direction meets or exceeds all more specific resource management objectives or standards.

a. Recreation Use

Early recreation use centered on fishing and mountaineering. As early as 1910, recreational groups such as the Mountaineers were using the Forest trails. Later, the Portland-based Mazamas organized mountain climbing trips into the Goat Rocks and on Mt. Adams, using routes within the watershed. Visitors came by horse to fish in high-elevation lakes: Walupt, Council, Tahklakh, Chain of Lakes; and ride the trails around Mt. Adams. The first established Forest Camps were at North Fork, Chambers Lake, Council Lake, and Tahklakh Lake, in use by 1937. With the establishment of a loop road to these lakes, berry picking became a popular recreation activity for the motoring public. Beginning in the 1930's and 1940's, trails originally built for administrative use and grazing were increasingly being used for recreation. Chief among these were the Cascade Crest Trail and the Boundary Trail. By 1955 visitor use in the high lakes area of the watershed was estimated at approximately 30,000 visitor days per calendar year, with most visitation occurring in July, August and September. See Map 35, Recreation, for the location of current popular recreation sites within the watershed.

Small-scale commercial trapping occurred in the watershed around 1912. Trapping of marten, fisher, and fox took place in the winter months. Some mineral prospecting also occurred in the watershed, reportedly along East Canyon Creek. No claim records have been found for this area.

2. Transportation System

a. Historic Conditions

This historic information is based on maps, photos and verbal reports generated at the Cowlitz Valley ranger station office.

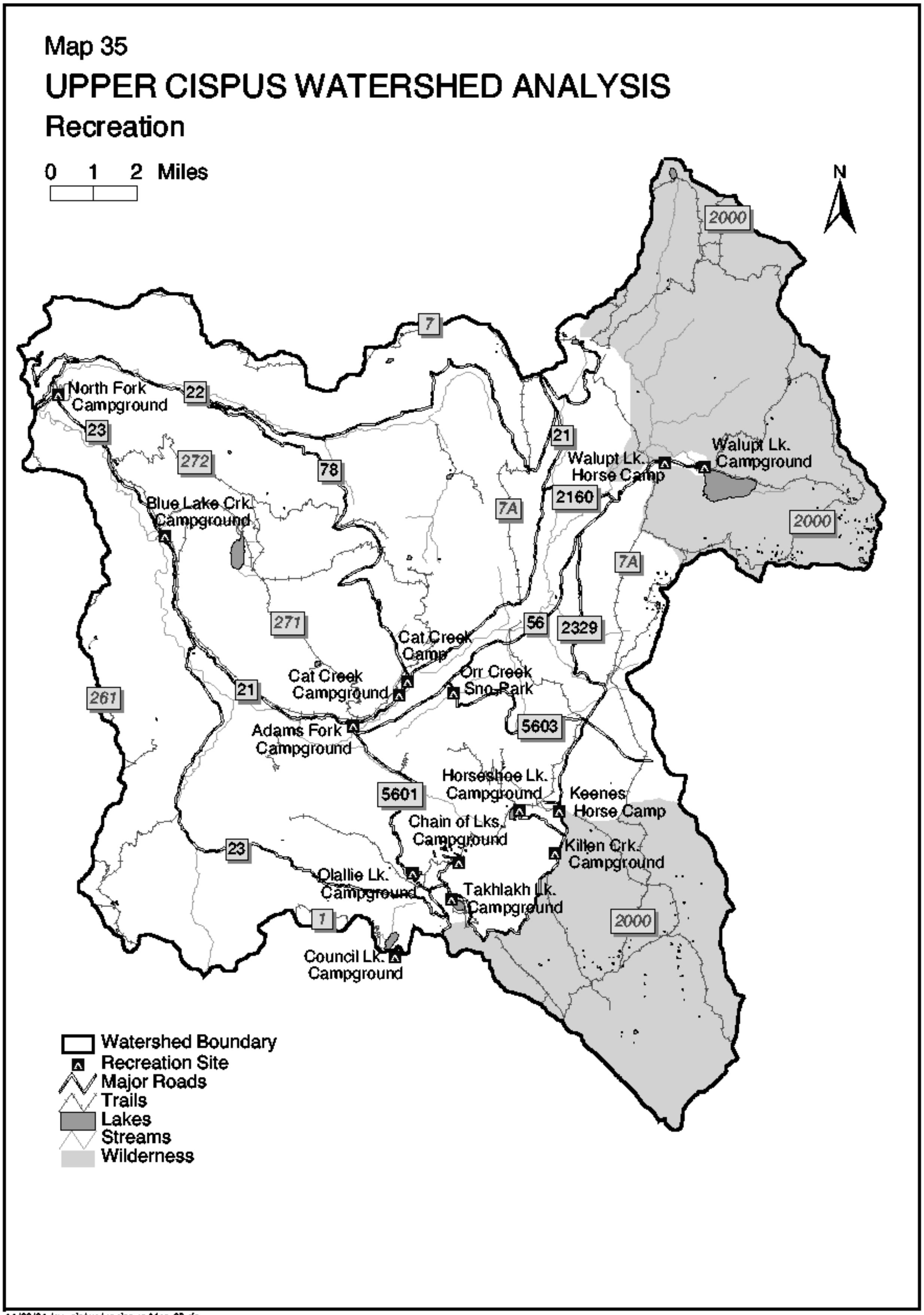
The earliest maps we have date from 1926. On this map the only road existing in the middle to upper cispus area is what is now Road 23. In 1926 this road ends at Doe Creek. The next map reference is a 1932 fire map. By this date the road system extends up the Cispus to Chambers Lake with two side roads going to Walupt Lake and up Pimlico Creek, with the Pimlico Creek road ending on top of the ridge separating the Pimlico and Wobbly Creek drainages.

Our next map reference is a 1945 map. Additions to the road system include what is currently called Road 5601 which goes from Adams Fork Campground up Adams and Sheep Creek drainages to Ollalie Lake. Another road begins on what is presently Road 21 and starts approximately one mile West of Pimlico Creek. This road crosses the Cispus at about river mile 39.5, then crosses Muddy Fork and Midway Creeks, goes to the Midway Guard Station and continues east onto the Yakama Indian reservation. There is an extension of this road going northeast to the Midway Lookout. Also existing at this time is what is presently Road 2329 from Midway Guard Station going south past Council Lake and continuing south. Roads branching from this system go to Horseshoe Lake, Taklhlakh Lake, Chain of Lakes, Council Lake, Council Bluff and Table Mountain. The last addition on the 1945 map is the Pimlico Creek road, which is currently Road 7807, that extends past Mud Lake approximately one mile toward Timonium Creek. Also branching from this road are short roads to Hamilton Buttes and down the Wobbly Creek drainage. We have a 1950 fireman’s map of the area and the only addition during this five years is a road paralleling Spring Creek, which is in the Muddy Fork drainage.

The next maps we have date from 1967 thru 1970. By this time major tie-thru roads including Road 22, with the exception of about a one-mile piece at the headwaters of the North Fork River, Road 23, Road 56 and Road 78 had been completed. The completion of Road 78 connected to the west end of the old Pimlico Creek from Road 21. Other roads existing at this time included Road 2203 and 2208, Road 2322, Road 2324 to Spud Hill, a portion of Road 5603, a portion of Road 7802, Road 7808 and Road 7800120. There were a few shorter local roads constructed during this time period as well.

The early 1970’s saw the construction of road systems including the completion of Road 2324, Road 2325, and Road 2328. The late 1970’s saw the construction of Road 2801. During the 1970’s Road 5603 was tied thru and roads within Road 2150 and 2160 systems were being added. The 1980’s saw the completion of the majority of the remaining roads with the exception of a few roads completed on the early 1990’s that include Roads 2317 and 2124.

b. Current Conditions



11/20/01 /cv_gis/wa/upcispus Map 35 rfp

This following table lists all the roads in this analysis area that are presently identified as existing system forest roads. System roads that have been decommissioned are not addressed. The present management plan and the desired future condition columns in the table are based on management direction formulated in the mid 1990's and identified in an access and travel management plan.

There are basically three categories of road status listed. These are roads which are open to use and maintained to a level suitable for passenger cars, roads which are open for use and maintained to a level suitable of high clearance vehicles and roads which are closed. The desired future condition for each road would occur if the funding were available to achieve it and it was determined in a separate analysis to be consistent with current management direction. Roads listed as closing naturally will normally be the most difficult to travel based on the lower levels of maintenance they receive. See Maps 35 and 36 for the current and desired future status for roads within the Upper Cispus Watershed.

Based on the present management plan there are 103.1 miles of passenger car accessible, 195.9 miles of high clearance accessible and 56.3 miles of closed road within the analysis area. If all the desired future condition strategies were implemented the numbers would change to 100.2 miles of passenger car accessible, 163.7 miles of high clearance accessible, and 83.7 miles of closed road. There would also be 3.1 miles of roads converted to trails and 4.6 miles of existing roads decommissioned.

One variable which is affecting certain road systems and which was not directly addressed in the access and travel management plan is the condition of three log stringer bridges located within this analysis area. On Road 2300304 at milepost 0.3 the 29-foot long bridge is no longer suitable for vehicular traffic. This has caused the closure of this road. On Road 2322 at milepost 0.3 the 49-foot long bridge is no longer suitable for vehicular traffic. This closes the Road 2322 system and vehicular traffic to the northern-most trail head to Trail #265, the East Canyon Ridge trail. On Road 2325 at milepost 0.1 is a 54-foot long bridge which is presently open for recreational use but has a projected lifespan of as little as one to three more years. When this bridge becomes unusable this will block vehicular access to.14.9 miles of system road.

There is presently no funding available to replace these bridges.

Table 3-31: Current and Desired Future Road Management from Ranger District Access and Travel Management Plans

ROAD NUMBER	LENGTH IN MILES	PRESENT MANAGEMENT PLAN	DESIRED FUTURE CONDITION
21	15.6	OPEN PASSENGER CARS	OPEN PASSENGER CARS
2100155	0.6	CLOSED	CLOSED
2100170	0.1	CLOSED	CLOSED
2100171	0.9	CLOSED	CLOSED
2100196	0.7	CLOSED	CLOSED
2100216	0.9	CLOSING NATURALLY	CLOSING NATURALLY
2100236	0.1	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
2100242	0.1	OPEN PASSENGER CARS	OPEN PASSENGER CARS
2100244	0.8	OPEN HIGH CLEARANCE	CLOSED
2100268	0.9	CLOSING NATURALLY	CLOSED
2100269	0.3	CLOSING NATURALLY	CLOSED
2100278	1.0	CLOSING NATURALLY	CLOSING NATURALLY
2100279	0.1	CLOSED	ROAD TO TRAIL
2100280	0.2	CLOSED	ROAD TO TRAIL
2100405	0.4	CLOSING NATURALLY	CLOSING NATURALLY

2100450	0.5	CLOSED	CLOSED
2100657	0.1	CLOSED	DECOMMISSION
2100664	0.2	CLOSED	ROAD TO TRAIL
2100667	0.2	CLOSED	CLOSED
2100684	0.4	CLOSED	CLOSED
2124	4.3	SEASONALLY OPEN HIGH CLEARANCE	CLOSED
2124024	0.9	OPEN HIGH CLEARANCE	CLOSED
2150	3.7	SEASONALLY OPEN PASSENGER CARS	SEASONALLY OPEN PASSENGER CARS
2150013	0.8	CLOSED	CLOSED
2150026	0.7	CLOSED	CLOSED
2150036	0.1	CLOSING NATURALLY	CLOSED
2150040	0.8	SEASONALLY OPEN PASSENGER CARS	SEASONALLY OPEN PASSENGER CARS
2150404	0.6	CLOSING NATURALLY	CLOSING NATURALLY
2150405	1.1	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
2150410	0.2	CLOSED	CLOSED
2152	2.7	SEASONALLY OPEN HIGH CLEARANCE	SEASONALLY OPEN HIGH CLEARANCE
2152011	0.3	SEASONALLY OPEN HIGH CLEARANCE	CLOSING NATURALLY
2152016	1.7	SEASONALLY OPEN HIGH CLEARANCE	SEASONALLY OPEN HIGH CLEARANCE
2152017	1.3	SEASONALLY OPEN HIGH CLEARANCE	SEASONALLY OPEN HIGH CLEARANCE
2152024	0.5	SEASONALLY OPEN HIGH CLEARANCE	CLOSING NATURALLY
2152032	0.3	SEASONALLY OPEN HIGH CLEARANCE	CLOSING NATURALLY
2152405	1.1	SEASONALLY OPEN HIGH CLEARANCE	CLOSING NATURALLY
2152410	0.2	CLOSED	CLOSED
2160	5.4	SEASONALLY OPEN PASSENGER CARS	SEASONALLY OPEN PASSENGER CARS
2160013	0.1	CLOSED	CLOSED
2160015	0.4	CLOSED	CLOSED
2160017	0.4	CLOSED	CLOSED
2160020	0.7	CLOSED	ROAD TO TRAIL
2160025	0.2	CLOSED	CLOSED
2160047	0.2	OPEN HIGH CLEARANCE	CLOSING NATURALLY
2160050	0.2	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
2160055	0.3	CLOSED	CLOSED
2160405	0.2	CLOSED	CLOSED
2164	4.0	SEASONALLY OPEN HIGH CLEARANCE	SEASONALLY OPEN HIGH CLEARANCE
2164031	0.2	CLOSED	CLOSED
2164034	2.6	SEASONALLY OPEN HIGH CLEARANCE	SEASONALLY OPEN HIGH CLEARANCE
2164036	0.9	CLOSED	CLOSED
2164044	0.6	CLOSED	CLOSED
2164404	0.2	CLOSING NATURALLY	CLOSING NATURALLY
2164405	2.6	SEASONALLY OPEN HIGH CLEARANCE	SEASONALLY OPEN HIGH CLEARANCE
2164410	1.0	CLOSED	CLOSED
2164415	0.2	CLOSED	CLOSED
22	13.9	OPEN PASSENGER CARS	OPEN PASSENGER CARS
22	4.0	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
2200043	1.2	OPEN HIGH CLEARANCE	CLOSING NATURALLY
2200043	0.3	CLOSED	ROAD TO TRAIL
2200044	0.3	CLOSED	ROAD TO TRAIL
2200055	0.3	OPEN HIGH CLEARANCE	CLOSING NATURALLY
2200056	3.2	OPEN HIGH CLEARANCE	CLOSING NATURALLY
2200062	0.9	OPEN HIGH CLEARANCE	CLOSING NATURALLY
2200063	0.6	OPEN HIGH CLEARANCE	CLOSING NATURALLY
2200064	0.5	OPEN HIGH CLEARANCE	CLOSING NATURALLY
2200068	0.5	OPEN HIGH CLEARANCE	CLOSING NATURALLY
2200094	1.5	OPEN HIGH CLEARANCE	CLOSED
2200160	2.0	SEASONALLY OPEN HIGH CLEARANCE	CLOSED
2200160	0.7	CLOSING NATURALLY	CLOSED
2200170	0.2	CLOSING NATURALLY	CLOSING NATURALLY
2200175	0.2	CLOSED	CLOSED
2200178	0.3	CLOSED	CLOSED
2200620	0.1	CLOSED	CLOSED
2200664	0.7	CLOSED	CLOSED
2200667	0.1	CLOSED	CLOSED
2200669	0.3	CLOSED	CLOSED
2200670	0.5	CLOSED	CLOSED
2203	3.5	SEASONALLY OPEN HIGH CLEARANCE	CLOSING NATURALLY
2208	2.6	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE

2208	1.9	OPEN HIGH CLEARANCE	CLOSING NATURALLY
2208037	0.3	OPEN HIGH CLEARANCE	CLOSING NATURALLY
2212	1.0	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
2212	4.4	OPEN HIGH CLEARANCE	CLOSED
2212025	0.6	CLOSED	CLOSED
2212670	0.3	CLOSED	CLOSED
23	20.4	OPEN PASSENGER CAR	OPEN PASSENGER CAR
2300124	0.1	CLOSING NATURALLY	CLOSING NATURALLY
2300129	0.3	OPEN PASSENGER CAR, NORTH FORK C.G.	OPEN PASSENGER CAR
2300131	0.5	CLOSED	ROAD TO TRAIL
2300132	0.5	OPEN PASSENGER CAR, NORTH FORK C.G.	OPEN PASSENGER CAR
2300135	0.7	OPEN HIGH CLEARANCE	CLOSING NATURALLY
2300140	0.5	CLOSING NATURALLY	CLOSED
2300161	0.8	CLOSING NATURALLY	CLOSED
2300165	0.7	OPEN HIGH CLEARANCE	CLOSED
2300171	1.3	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
2300172	0.1	OPEN HIGH CLEARANCE	CLOSING NATURALLY
2300173	0.3	OPEN PASSENGER CAR, BLUE LAKE C.G.	OPEN PASSENGER CAR
2300180	0.1	OPEN PASSENGER CAR, TRAIL HEAD	OPEN PASSENGER CAR
2300181	1.1	CLOSED	CLOSED
2300202	0.8	CLOSED	CLOSED
2300203	0.1	CLOSING NATURALLY	CLOSING NATURALLY
2300208	0.1	OPEN HIGH CLEARANCE	CLOSING NATURALLY
2300217	1.3	CLOSING NATURALLY	CLOSING NATURALLY
2300218	0.5	CLOSED	CLOSED
2300246	0.8	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
2300292	2.2	OPEN HIGH CLEARANCE	CLOSING NATURALLY
2300294	1.2	CLOSED	CLOSED
2300304	0.8	OPEN HIGH CLEARANCE, PRESENTLY CLOSED AT MILEPOST 0.1 BY FAILED BRIDGE	CLOSING NATURALLY
2300306	0.5	CLOSED	CLOSED
2300335	0.3	OPEN HIGH CLEARANCE	CLOSING NATURALLY
2300337	0.3	OPEN HIGH CLEARANCE	CLOSING NATURALLY
2300657	0.3	CLOSED	CLOSED
2300689	0.1	OPEN HIGH CLEARANCE	CLOSING NATRUALLY
2317	3.2	CLOSED	CLOSED
2317041	1.1	CLOSED	CLOSED
2322	2.2	OPEN HIGH CLEARANCE, AT MILEPOST 0.3 IS A BRIDGE WHICH HAS FAILED CAUSING THIS ROAD TO BE CLOSED.	OPEN HIGH CLEARANCE
2322020	0.2	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
2322601	0.4	CLOSED	CLOSED
2322618	0.3	CLOSED	CLOSED
2324	5.3	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
2324	0.7	OPEN HIGH CLEARANCE	CLOSING NATURALLY
2324058	0.7	CLOSED	CLOSED
2324063	0.3	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
2324694	0.1	CLOSED	CLOSED
2325	3.3	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
2325	4.3	OPEN HIGH CLEARANCE	CLOSED
2325	0.3	CLOSED	CLOSED
2325042	4.8	SEASONALLY OPEN HIGH CLEARANCE	CLOSED
2325049	0.7	CLOSING NATURALLY	CLOSED
2325051	0.4	CLOSED	CLOSED
2325078	0.5	CLOSED	CLOSED
2325088	0.3	CLOSED	CLOSED
2325607	0.3	CLOSED	CLOSED
2328	6.0	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
2328	0.6	CLOSED	CLOSED
2328021	2.7	CLOSING NATURALLY	CLOSING NATURALLY
2328045	0.5	CLOSED	CLOSED
2328602	0.3	CLOSING NATURALLY	CLOSED
2328604	0.7	CLOSED	CLOSED
2328609	0.2	CLOSED	CLOSED
2328611	0.9	CLOSED	CLOSED

2328623	0.4	CLOSED	CLOSED
2329	16.0	OPEN PASSENGER CAR	OPEN PASSENGER CAR
2329022	1.1	OPEN PASSENGER CAR, CHAIN OF LAKES C.G.	OPEN PASSENGER CAR
2329026	0.9	OPEN PASSENGER CAR, TAKHLAKH LAKE C.G.	OPEN PASSENGER CAR
2329045	0.1	OPEN HIGH CLEARANCE	DECOMMISSION
2329069	0.1	CLOSING NATURALLY	DECOMMISSION
2329073	0.2	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
2329078	1.3	OPEN PASSENGER CAR, HORSESHOE LAKE C.G.	OPEN PASSENGER CAR
2329080	0.2	CLOSING NATURALLY	DECOMMISSION
2329081	0.1	CLOSING NATURALLY	CLOSING NATURALLY
2329082	0.2	OPEN PASSENGER CARS, KEENES HORSE CAMP	OPEN PASSENGER CARS
2329084	0.1	CLOSING NATURALLY	CLOSING NATURALLY
2329085	0.3	OPEN HIGH CLEARANCE	DECOMMISSION
2329087	0.3	OPEN PASSENGER CAR, SPRING CREEK HORSE CAMP	OPEN PASSENGER CAR
2329115	1.3	OPEN HIGH CLEARANCE	DECOMMISSION
2329116	0.2	CLOSED	DECOMMISSION
2329117	1.1	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
2329118	0.2	CLOSED	CLOSED
2329120	0.5	CLOSING NATURALLY	CLOSING NATURALLY
2329124	0.5	CLOSED	CLOSED
2329126	0.1	CLOSED	CLOSED
2326134	0.2	CLOSED	CLOSED
2329139	0.2	CLOSED	CLOSED
2329143	0.2	CLOSED	CLOSED
2329655	1.0	CLOSED	DECOMMISSION
2334	0.3	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
2334	1.2	CLOSED	CLOSED
2334048	0.1	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
2801	7.6	SEASONALLY OPEN HIGH CLEARANCE	SEASONALLY OPEN HIGH CLEARANCE
2801030	0.1	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
2801040	0.8	CLOSED	CLOSED
2801041	0.1	CLOSED	CLOSED
2801044	0.1	SEASONALLY OPEN HIGH CLEARANCE	CLOSING NATURALLY
2801079	1.6	CLOSED	CLOSED
2801080	0.7	CLOSED	CLOSED
2801100	0.8	CLOSED	CLOSED
2801101	0.7	CLOSED	CLOSED
2900040	0.1	CLOSED	CLOSED
2904	1.9	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
55	3.2	OPEN PASSENGER CAR	OPEN HIGH CLEARANCE
5500103	0.4	CLOSED	CLOSED
5500105	0.3	OPEN HIGH CLEARANCE	CLOSED
5500116	0.1	CLOSED	CLOSED
5500128	3.1	OPEN HIGH CLEARANCE	CLOSING NATURALLY
5500129	1.0	CLOSING NATURALLY	CLOSING NATURALLY
5508	0.3	OPEN HIGH CLEARANCE	OPEN PASSENGER CAR
5508	3.7	OPEN HIGH CLEARANCE	CLOSING NATURALLY
5508019	0.5	CLOSED	CLOSED
5508023	0.1	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
5508024	0.3	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
5508608	0.6	CLOSED	CLOSED
5508609	0.1	CLOSED	CLOSED
5508611	0.1	CLOSED	CLOSED
5508677	0.1	CLOSED	CLOSED
56	6.7	OPEN PASSENGER CAR	OPEN PASSENGER CAR
56	2.6	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
5600012	0.5	OPEN PASSENGER CAR, ADAMS FORK C.G.	OPEN PASSENGER CAR
5600030	0.8	CLOSED	CLOSED
5600042	0.6	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
5600054	0.9	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
5600057	0.4	CLOSED	CLOSED
5600059	0.8	OPEN HIGH CLEARANCE	CLOSING NATURALLY
5600060	0.3	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
5600061	0.3	CLOSED	CLOSED
5600068	0.3	CLOSED	CLOSED
5600081	0.8	CLOSING NATURALLY	CLOSING NATURALLY

5600088	0.1	CLOSING NATURALLY	CLOSING NATURALLY
5600094	0.1	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
5600632	0.3	CLOSED	CLOSED
5600634	0.1	CLOSED	CLOSED
5600649	0.7	CLOSED	CLOSED
5600658	0.1	CLOSING NATURALLY	CLOSING NATURALLY
5600659	0.1	CLOSED	CLOSED
5600660	0.3	CLOSED	CLOSED
5601	5.8	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
5601	0.5	OPEN PASSENGER CAR	OPEN PASSENGER CAR
5601018	0.1	CLOSING NATURALLY	ROAD TO TRAIL
5601062	0.5	OPEN HIGH CLEARANCE	CLOSING NATURALLY
5601068	0.1	OPEN PASSENGER CAR, OLALLIE LAKE C.G.	OPEN PASSENGER CAR
5601644	0.2	CLOSING NATURALLY	CLOSING NATURALLY
5601645	0.2	CLOSING NATURALLY	ROADS TO TRAIL
5603	7.3	OPEN PASSENGER CAR	OPEN PASSENGER CAR
5603011	0.1	OPEN PASSENGER CAR. ORR CREEK SNOWPARK	OPEN PASSENGER CAR
5603014	0.7	CLOSED	CLOSED
5603017	2.5	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
5603020	0.8	OPEN HIGH CLEARANCE	CLOSING NATURALLY
5603032	0.6	CLOSING NATURALLY	CLOSING NATURALLY
5603039	1.4	OPEN HIGH CLEARANCE	CLOSING NATURALLY
5603040	0.2	CLOSING NATURALLY	CLOSING NATURALLY
5603042	0.5	OPEN HIGH CLEARANCE	ROAD TO TRAIL
5603046	0.3	CLOSED	CLOSED
5603047	0.3	CLOSING NATURALLY	CLOSING NATURALLY
5603636	0.1	CLOSED	CLOSED
5603638	0.1	CLOSED	CLOSED
5603639	0.1	CLOSING NATURALLY	CLOSING NATURALLY
5603641	0.3	CLOSING NATURALLY	CLOSING NATURALLY
5603643	1.2	CLOSING NATURALLY	CLOSING NATURALLY
5603645	0.2	CLOSING NATURALLY	CLOSING NATURALLY
5603686	0.3	CLOSED	CLOSED
78	8.4	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
78	3.8	OPEN PASSENGER CAR	OPEN PASSENGER CAR
7800020	0.5	CLOSED	CLOSING NATURALLY
7800021	0.5	CLOSING NATURALLY	CLOSING NATURALLY
7800042	1.1	CLOSED	CLOSING NATURALLY
7800058	0.9	OPEN HIGH CLEARANCE	CLOSING NATURALLY
7800060	2.6	OPEN HIGH CLEARANCE	CLOSING NATURALLY
7800062	0.7	CLOSING NATURALLY	CLOSED
7800063	1.1	CLOSED	CLOSED
7800072	1.0	OPEN HIGH CLEARANCE	CLOSING NATURALLY
7800075	0.3	CLOSING NATURALLY	CLOSED
7800086	0.6	CLOSING NATURALLY	CLOSING NATURALLY
7800111	0.3	CLOSING NATURALLY	CLOSED
7800120	3.4	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
7800123	1.8	OPEN HIGH CLEARANCE	CLOSING NATURALLY
7800624	0.3	CLOSING NATURALLY	CLOSED
7800632	0.5	CLOSED	CLOSED
7800638	0.5	CLOSED	CLOSED
7800644	0.4	CLOSED	CLOSED
7800647	0.2	CLOSING NATURALLY	DECOMMISSION
7800688	0.2	CLOSED	CLOSED
7800689	0.1	CLOSED	CLOSED
7800690	0.1	CLOSED	CLOSED
7802	7.1	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
7802040	1.8	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
7802048	0.6	CLOSED	CLOSED
7802061	0.2	CLOSING NATURALLY	CLOSED
7802070	0.2	CLOSED	CLOSED
7802668	0.2	CLOSED	CLOSED
7802670	0.3	CLOSED	CLOSED
7802671	0.5	CLOSED	CLOSED
7802691	0.2	CLOSING NATURALLY	CLOSING NATURALLY
7802692	0.3	CLOSED	CLOSED

7802693	0.4	CLOSED	CLOSED
7802697	0.5	CLOSED	CLOSED
7807	7.7	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
7807027	0.1	CLOSED	CLOSED
7807029	0.5	CLOSED	DECOMMISSION
7807060	0.5	OPEN HIGH CLEARANCE	DECOMMISSION
7807680	0.1	CLOSED	DECOMMISSION
7807682	0.1	CLOSED	CLOSED
7807683	0.1	CLOSED	CLOSED
7808	1.5	OPEN HIGH CLEARANCE	CLOSING NATURALLY
7808	0.4	CLOSING NATURALLY	CLOSING NATURALLY
7808023	2.3	OPEN HIGH CLEARANCE	CLOSING NATURALLY
7808025	0.4	CLOSING NATURALLY	CLOSING NATURALLY
7808683	0.2	CLOSING NATURALLY	CLOSING NATURALLY
7812	6.4	OPEN HIGH CLEARANCE	OPEN HIGH CLEARANCE
7812044	2.2	OPEN HIGH CLEARANCE	CLOSED
7812045	0.5	CLOSING NATURALLY	CLOSED
7812074	0.2	CLOSED	CLOSED
7812630	0.4	CLOSING NATURALLY	CLOSED
7812631	0.1	CLOSING NATURALLY	CLOSED
7812633	0.1	CLOSED	CLOSED
7812635	0.2	CLOSED	CLOSED
7812638	0.1	CLOSING NATURALLY	CLOSED
7812640	0.5	CLOSED	CLOSED
7812642	0.1	CLOSED	CLOSED

3. Special Forest Products

Data Sources/Data Gaps

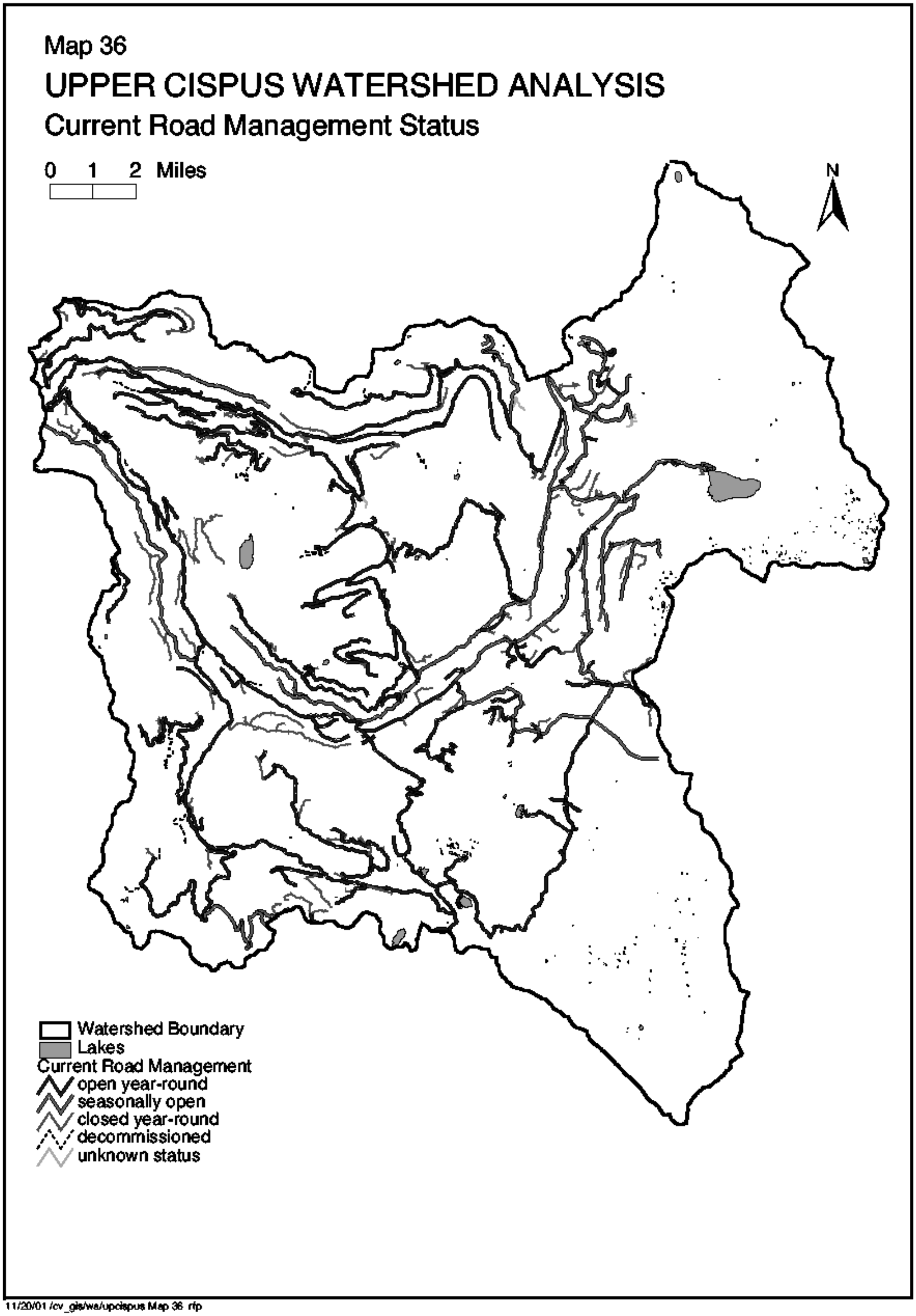
Information on the number of special forest product permits issued and the value of these products is summarized from information contained in the Cowlitz Valley Ranger District permit database. Only generalized information is known about where harvest is occurring on the district. This information is primarily from knowledge of where products grow, administration of Special Forest Product permits, law enforcement personnel and other forest users. The number of permits issued and amount of harvest specific to the Little Nisqually watershed is not known.

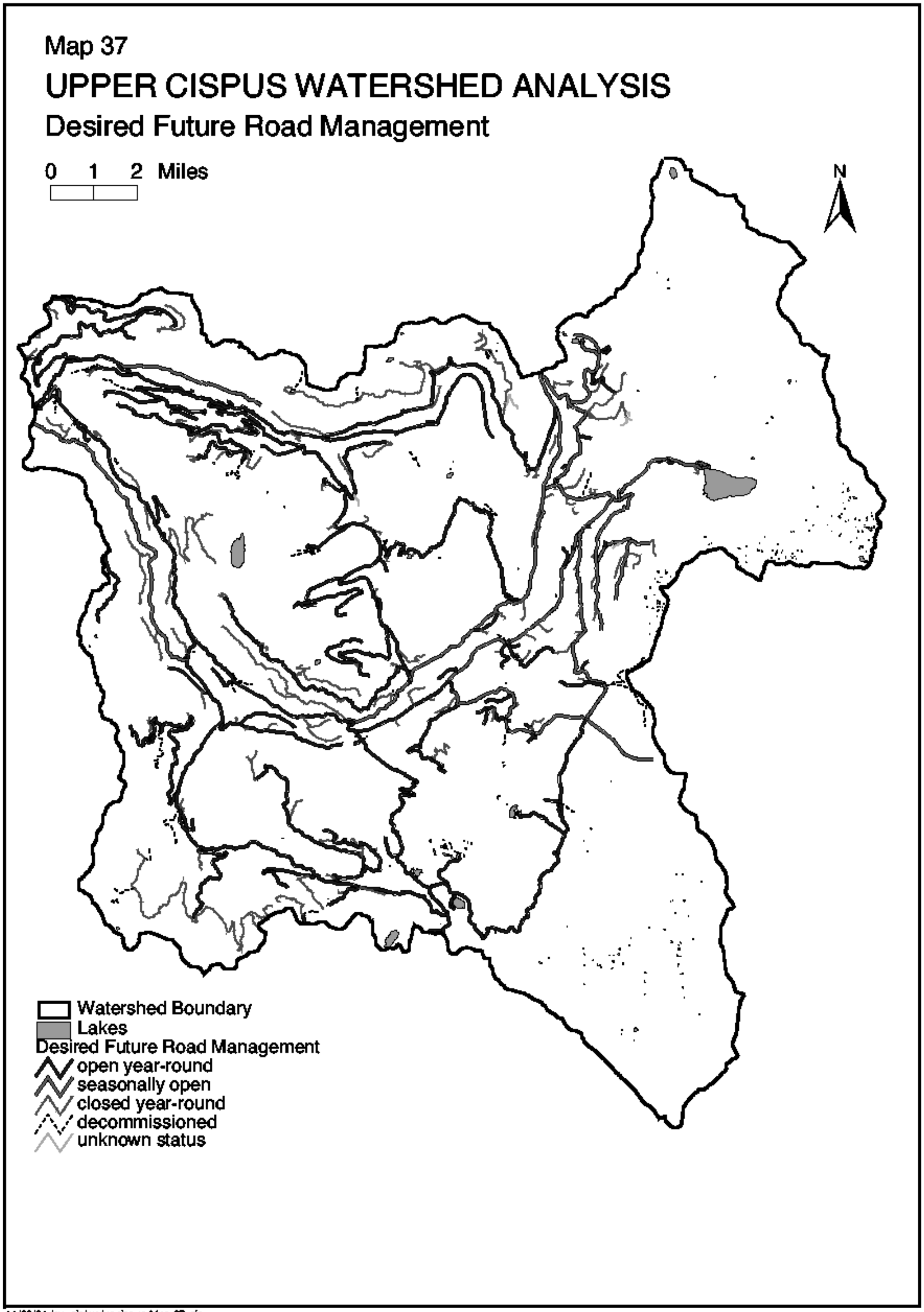
Assumptions

A permit is required to remove any product from National Forest lands. For purposes of this analysis, it is assumed that no illegal harvest is taking place. Estimates of the amounts of harvest are based on permit sales.

a. Reference (Historic) and Current Conditions

Special forest products have been gathered throughout the Cowlitz Valley Ranger District and the watershed for at least the last 6,000 years. There are a wide variety of special forest products which may be harvested. Many of the products collected are not site-specific (i.e., they are harvested over wide-ranging areas within the Gifford Pinchot National Forest).


Map 36
UPPER CISPUS WATERSHED ANALYSIS
Current Road Management Status
0 1 2 Miles
N
Watershed Boundary
Lakes
Current Road Management
open year-round
seasonally open
closed year-round
decommissioned
unknown status
11/20/01 /cv_gis/wa/upcispus Map 36 rfp


Map 37
UPPER CISPUS WATERSHED ANALYSIS
Desired Future Road Management
0 1 2 Miles
N
Watershed Boundary
Lakes
Desired Future Road Management
open year-round
seasonally open
closed year-round
decommissioned
unknown status
11/20/01 /cv_gis/wa/upcispus Map 37 rfp

In the past decade, demand for traditional and non-traditional products has increased substantially. Many native plants, including trees, shrubs, forbs and mosses are currently harvested. Plants such as salal, sword-fern, evergreen huckleberry and beargrass have increased in popularity as floral greens. Noble fir is popular for Christmas greens and boughs. Huckleberries, mushrooms and fiddlehead fern are collected for consumption. Medicinals and herbs harvested on the district include Pacific yew, cascara, devil's club, prince's pine and stinging nettle. Oregon grape, red alder and Western red cedar are commonly used for dyes. Unusual burls, conks, stumps, cones and twigs are gathered for decoratives.

There are four types of collection "allowed" on the forest:

1. Tribal Use: Traditional noncommercial gathering by Native Americans affiliated with a federally recognized tribe.

2. Incidental Use: On-site product consumption/use, usually associated with recreation activities.

3. Personal Use: Collection of materials for personal use/consumption, not for sale or resale after any intermediate processing.

4. Commercial Use: Collection of materials for the primary purpose of sale, resale, or use in a manufacturing process resulting in a finished product that will be sold.

A permit is required to remove all forest products other than edible berries from the Gifford Pinchot National Forest. Nearly 5,000 permits were issued in 1998 on the Cowlitz Valley Ranger District, yielding approximately $400,000 in revenues. In addition, nearly 1,000 free-use permits were issued with an estimated value of $10,000. A total of almost $500,000 worth of products were removed from the Cowlitz Valley Ranger District in 1998.

Tables 3-8 through 3-10 list the primary special forest products commonly harvested on the Cowlitz Valley Ranger District. Currently there are few special forest products offered for harvest within the Little Nisqually watershed due to the checkerboard ownership in the Mineral area and lack of funds to administer permits. Currently, due to the location of this watershed to urban areas, there is a high rate of theft of special forest products as well as a number of other illegal activities. In response to the high theft rate and private ownership, special forest products will be offered by contract for commercial use only in 1999. Estimates of the amounts of harvest are based on permit sales. Most permits are sold on a per-day basis. Markets and weather conditions dictate the demand for permits to harvest these products.

Table 3-32: Commercial Use Special Forest Products - Primary Products Harvested on the Cowlitz Valley Ranger District

Product	Permits Issued (1998)	Year Permits First Issued	$ Value	Elevation Typically Found
Mushrooms	640	1991	$26,699	< 3,000 ft
Beargrass	841	1989*	$41,672	> 3,000 ft
Salal	680	1989*	$35,180	< 2,500 ft

Product	Permits Issued (1998)	Year Permits First Issued	$ Value	Elevation Typically Found
Stewardship/ Boughs	16	1989*	$179,403	> 3,000 ft
Ferns	112	1989*	$2,250	< 1,500 ft
Moss	20	1989*	$480	Restricted to Timber sale areas

** First year data was recorded*

Table 3-33: Personal Use Special Forest Products - Primary Products Harvested on the Cowlitz Valley Ranger District

Product	Permits Issued (1998)	Year Permits First Issued	$ Value	Elevation Typically Found
Christmas Trees	1,560	1989*	$7,800	2,000 - 4,000 ft
Firewood	762	1989*	$9,340	1,000 - 4,500 ft

** First year data was recorded*

Table 3-34: Free-Use* Special Forest Products - Primary Products Harvested on the Cowlitz Valley Ranger District

Product	Permits Issued (1998)	Year Permits First Issued	$ Value
Mushrooms	700	1991	$7,000
Transplants	67	1989**	$1,340
Cuttings	31	1989**	$140

** Free-Use means no fee for the permit*
*** First year data was recorded*

Forest management activities affect availability and distribution of special forest products. The effects of management activities depend on site treatment. For example, Chantrelle mushrooms often take 20 to 30 years to return in abundance following stand treatments such as regeneration harvest or burning. Special forest product harvest can also benefit forest management goals. For example, the fungus that produces Chantrelles forms mycorrhizal relationships with trees that benefit the growth of trees by providing nutrients for the trees in forms that are easy to utilize. In addition, pruning white pine boughs may significantly reduce mortality form white pine blister rust.

Road access is a key factor in determining where forest products are harvested. Gatherers will walk to harvest products, but prefer not to carry forest products to a road. Harvesters often have to carry products a couple of miles out of the forest to a road. All Terrain Vehicles (ATV's) are used where roads are not passable to standard passenger vehicles or pickups.

Chapter 4 - Interpretations/Areas of Concern

Introduction

This chapter focuses on the interpretation of data presented in Chapter 3 as it pertains to current and proposed management within the watershed. It is through understanding of the function of the various ecosystem elements that the context for future management is set. As in Chapter 3, the information is presented for the major water resources, biological resources, physical resources, and social and economic resources within the Upper Cispus watershed.

A. WATER RESOURCES

1. Stream Temperature

Peak summer stream temperatures are a concern for the three streams on the 303(d) list – the North Fork Cispus River, East Canyon Creek, and the Cispus River. Temperatures of these streams are discussed in detail in Chapter 3. The likelihood for decreased temperatures on these streams in the future rests largely on increasing the growth of streamside vegetation to its potential condition[1] – this may in time increase the amount of shade on the stream surface. The Water Quality Restoration Plan (WQRP) for the Upper Cispus River watershed discusses this for the three streams on the 303(d) list, and below is a summary of that discussion.

a. North Fork Cispus River

The growth of streamside vegetation on the North Fork Cispus River and its tributaries to its potential condition - through natural means or treatment by man - would at most result in a minor reduction on the temperature of the North Fork Cispus River for the reasons listed below.

1 - Approximately 90 percent of the mainstem of the North Fork Cispus River is currently lined with trees between 130 and 205 feet in height. This means that the amount of shade is currently near its potential and will not increase substantially in the future. The mature trees lining most of both sides of the river do not prevent direct sunlight from striking east-west trending reaches of the river from 1000 to 1500 in the summer – this is the primary reason why the river approaches or slightly exceeds 16.0^{o}C on the warmest days.

2 - Each of the individual tributaries contributes to less than 8 percent of the baseflow of the North Fork Cispus River. This means that reducing the temperature of any single tributary would have no effect in reducing the temperature of the North Fork Cispus River – reducing the temperature of a number of tributaries would be necessary.

3 - All of the “shade improvement areas” combined border only 16 percent (12.3 km. of 75.9 km.) of the perennial stream length in the sub-watershed.

[1] The potential condition is defined as when trees reach a height of 160 feet.

The growth of vegetation by itself may not bring East Canyon Creek into compliance with Washington’s temperature standard of 16.0^{o}C – the stream exceeds the standard by more than 0.5^{o}C on a number of days of each year.

It should be noted, however, that the North Fork Cispus River only exceeds Washington's 16.0^{o}C temperature standard by less than 0.5^{o}C for only one or two days per year. As a result, an improvement in shade to the potential condition on the North Fork Cispus River and its tributaries might bring the 303(d) listed stream into compliance.

b. East Canyon Creek

The growth of streamside vegetation on East Canyon Creek and its tributaries to its potential condition - through natural means or treatment by man - would at most result in a minor reduction of the temperature of East Canyon Creek for several reasons.

1 - The width of the floodplain of much of the lowermost three miles of the river exceeds 110 feet. This allows a substantial part of the stream surface to receive direct sunlight from 10:00 a.m. to 3:00 p.m. in the summer, irregardless of the height of trees next to the floodplain.

2 - Low summer baseflow (15 cubic feet per second) and wide stream width (at some locations in the lower three miles of the stream) allows rapid heating by direct sunlight in the summer.

3 - The "shade improvement areas" - those locations where the potential shade to the stream surface would be at least 25 percent greater than the current shade – occupy only 10 percent of the length of perennial streams in the watershed.

c. Cispus River

The growth of streamside vegetation on the Cispus River and its tributaries to its potential condition - through natural means or treatment by man - would at most result in a minor effect on the temperature of Cispus River for several reasons.

1 - Two long reaches of the river receive direct sunlight during most of the day in the summer. These reaches are contained in wide floodplains that severely limit the amount of shade that vegetation – current and potential - can provide to the surface of the river.

- The 0.8 kilometer (0.5 mile) reach upstream from the confluence with the North Fork Cispus River is contained in floodplain with an average width of 455 feet. It is in this reach that the river approaches or exceeds 16.0^{o}C for at least a few days in the summer of every year.

- The 3.3 kilometer (2.0 mile) reach downstream of the confluence with Chambers Creek is contained in a floodplain that in many locations exceeds 100 feet in width. It is in this reach that the river approaches 16.0^{o}C for at least a few days in the summer of every year.

2 - The mainstem of the Cispus River – from the North Fork Cispus River to 3 kilometers upstream of Chambers Creek - is currently lined with trees between 100 and 173 feet in height.[1] This

means that the amount of shade is currently near its potential and will not increase substantially in the future.

3 - The "shade improvement areas" - those locations where the potential shade to the stream surface would be at least 25 percent greater than the current shade – are only 11 percent of the perennial stream length in the watershed. The actual value is not this high.

- Trees will not reach 160 feet in height – the tree height used as the potential condition - in some of these shade improvement areas. This is certainly the case in the Muddy Fork and Adams Fork, where the shade improvement areas are above 5,200 feet in elevation.

- The improvement in shade in some areas will occur in the morning or late afternoon, not during the 1000 to 1600 time period when solar heating of streams is high.

4 - Approximately 35 percent of the baseflow of the Cispus River in the summer is from two extremely cold streams. There is nothing that can be done to further reduce the temperature of the Muddy Fork and Adams Fork.

- The maximum average 7-day average temperature of the Muddy Fork was 9.7^{o}C in the year 2000.

- The maximum average 7-day average temperature of the Adams Fork was 8.2^{o}C in the year 2000.

2. Channel Widths

There is a concern that the widths of the channels of the three streams on the 303(d) list – the North Fork Cispus River, East Canyon Creek, and the Cispus River – will continue to limit the amount of shade that streamside vegetation can provide to the surface of these streams. A decrease in the width of the channel of these streams would result in an increase in the amount of shade covering the surface of these streams, which in turn could reduce stream temperatures. The implementation of the Northwest Forest Plan since 1994 may in time result in such a decrease in the widths of the channels of the 303(d) listed streams and their tributaries for one specific reason. The creation of Riparian Reserves – buffer zones of limited timber harvest adjacent to all perennial and intermittent streams – should reduce the amount of sediment being carried by streams. Such a reduction in sediment delivery by streams is conducive to channel stability and narrowing. The amount of such channel narrowing, the increase in shade on the stream surface, and resulting stream temperature reduction is a theoretical modeling exercise that has not been conducted.

3. Lakes

The overall condition of Takhlakh Lake is a concern. Heavy recreational use has resulted in a shoreline that is denuded in a number of locations.

4. Sediment Delivery to Streams

The delivery of sediment to streams from roads and slides is a concern in this watershed for several reasons.

- Fine sediment can reduce the amount of spawning habitat for fish. It is likely that this has occurred in some streams in the watershed.

- Excess sediment can contribute to the widening of stream channels, which in turn can lead to increased stream temperatures because more of the stream surface is exposed to sunlight. It is likely that this has occurred in some stream sections in the watershed.

Table 4-1 lists a number of locations where sediment from roads and slides is being contributed to the stream system in the Upper Cispus River watershed.

TABLE 4-1: Locations where sediment from roads and slides is being contributed to streams.

Sub-watershed name and number	Project name (total acres)	Location(s) [MP = mile post]	Erosion Problem(s)
Headwaters (01)	Road 2152016 (1 acre)	Road 2152016, MP 1.6	Water flows in old vehicle tracks down spur road – sediment settles on landing. Goat Cr. nearby.
*Walupt Cr. (02)	Road 2160 (3 acres)	Road 2160, MP 1.8-2.0, 3.9, 4.0-4.2	MP 1.8-2.0 : Unvegetated cutslopes contribute sediment to Cispus R. and class III tributary. MP 3.9 : Sediment from spur road enters wetland. MP 4.0-4.2 : Unvegetated cutslope contributes sediment to wetland.
Chambers (03)	Road 2150 (1 acre)	Road 2150, MP 0.0-0.5	Sediment erodes off road cutslope and into a class IV stream.
Chambers (03)	Road 2160047 (1 acre)	Road 2160047	Surface flow on road is causing rill erosion, gully is forming, sediment may be entering nearby wetland.
Chambers (03)	Road 2152017 (2 acres)	Road 2152027, MP 0.2-0.4, 0.7	MP 0.2-0.4 : Unvegetated cutslopes erode sediment into wetland. MP 0.7 : Old spur road concentrates surface flow on to road 2152017, causing rill/gully in road surface.
Chambers Cr. (03)	Road 2164 (8 acres)	Road 2164, MP 0.0-3.6 (end of road)	Unvegetated cutslopes eroding sediment to nearby class III/IV streams.
*Chambers Cr. (03)	Road 2164034 (1 acre)	Road 2164034, MP 0.4	Sediment from spur road plugs ditch, forcing water in ditch on to road – surface erosion from road reaches int. stream near junction of roads 2164 and 2164034.
Chambers Cr. (03)	Road 2164405 (1 acre)	Road 2164405, end of road	Berm is slowly eroding away, adding sediment to class IV stream.
Chambers Cr. (03)	Road 2329 (1 acre)	Road 2329, MP 2.5	Slumping cutslope adds sediment to Wesley Cr.
*Muddy Fork (04)	Road 5603 (9 acres)	Road 5604, MP 0.2-4.0	Unvegetated road cutslopes contributes sediment via ditch to adjacent streams
Cat (05)	Road 5603039 (1 acre)	Road 5603039, MP 0.2-0.3	Unvegetated cutslopes contribute sediment to intermittent streams. Landing fill slope is eroding into wet area.
Cat (05)	Road 5603032 (1 acre)	Road 5603032, MP 0.1	Stream is headcutting up from road for 100 ft., creating channel as it deposits material below the road.
Cat (05)	Road 5603017 (1 acre)	Road 5603017, MP 1.2-1.5	Unvegetated cutslopes contribute sediment to nearby intermittent streams.
Cat (05)	Road 78	Road 78, approximate mile posts of 2.3 to 2.6	Dust from a section of the road is reaching Cat Creek.

Sub-watershed name and number	Project name (total acres)	Location(s) [MP = mile post]	Erosion Problem(s)
Cispus River – Cat Creek (05)	Road 21 projects (9 acres)	Road 21 at mileposts 17.5 to 24.9.	Unvegetated road cutslopes add sediment to stream system during rainfall events.
Cispus River – Cat Creek (05)	Road 2124 projects (10 acres)	Road 2124, MP 0.5. 0.7-0.8, 1.0, 2.1, 2.4-2.5, 2.9, 3.1,3.4-3.5, 3.7-3.8, 4.0-4.1.	Unvegetated road cuts channels add sediment to stream system during rainfall events.
Cispus River - Cat Creek (05)	Road 78 projects (15 acres)	Road 78, MP 1.4, 2.1, 4.3. Road 7812, MP 0.3, 2.2. Road 7800120, MP 1.6-1.7, 1.9, 2.1, 2.3. Road 7800123, MP 0.5, 0.8-0.9. Road 7800086, MP 0.2-0.3. Road 7807, MP 0.2, 1.0, 1.1, 1.3	Eroding cutslopes add sediment to stream system during rainfall events.
*Adams Fork (06)	Road 5603020 slides (2 acres)	Road 5603020, MP 0.3 and end of road.	MP 0.3 : Unvegetated slide contributes sediment to class IV stream. End of road : Unvegetated areas in gully headwall contribute sediment to class IV stream, runoff from spur road prevents headwall from healing.
*Adams Fork (06)	Road 5601 system (5 acres)	Roads 5601, MP 1.9, 4.7-5.0, 5.7, 6.0. 5601062, MP 0.3 to end of road.	SluMP contributing sediment to Adams Creek. Eroding slopes and headcuts contribute sediment to Sheep Creek.
East Canyon Cr (07) and Cat (05)	Road 2328 system projects (9 acres)	Road 2328, MP 0.25, 0.5, 0.6 1.2, 2.8, 3.2, 4.2, 4.9. Road 2328021, MP 0.1, 0.9.	Eroding cutslopes, unvegetated areas, 1 slide, 2 gullies.
East Canyon Creek (07)	Road 2300304 projects (3 acres)	Road 2300304 at MP 0.1, 0.2, 1.3	Headcut in ephemeral streams. Gully in landing.
East Canyon Creek (07)	Road 2300292 (1 acre)	Road 2300292, MP 0.2	Unvegetated area adds sediment to East Canyon Creek during rain events.
East Canyon Creek (07)	Road 2324 projects (5 acres)	Road 2324 at MP 0.6, 1.8, 4.0, 5.3. Road 2424054, MP 0.3	Streams with unvegetted upper banks adds sediment. Road failure near streams add sediment to streams.
East Canyon Creek (07)	Road 2325 (16 acres)	Road 2325 at MP 2.2, 2.7, 3.4, 3.6-3.9, 4.3, 4.7, 5.0, 5.6-5.8, 6.3, 6.9, 7.9. Road 2325042 at MP 0.4, 1.2-1.3, 2.1, 2.4, 2.6-2.7.	Unvegetated road cuts and fill slopes add sediment to streams during rain events.
East Canyon Cr. (07)	East Canyon Creek erosion sites (1 acre)	East Canyon Creek, approximately 4.6 kilometers upstream of Cispus River and 0.4 kilometers downstream of where road 23 crosses stream.	3 Unvegetated slopes (2 are slump failures) adjacent to East Canyon Creek are eroding sediment directly into the stream.
*North Fork Cispus River (09)	Road 55 system projects (4 acres)	Road 5508, MP 2.3, 3.0. Road 5500128, MP 0.5, 1.1.	Eroding areas are contributing sediment to several streams.
North Fork Cispus River (09)	Road 2208 system projects. (6 acres)	Road 2208 at MP 1.02, 1.70, 4.63. Road 2200037	Eroding cutbanks, 2 small slides, and gully erosion are contributing sediment to North Fork Cispus River.
North Fork Cispus River (09)	Road 2203 system projects (8 acres)	Road 2203 at MP 1.7, 1.9, 2.1, 2.1,2.3-2.4, 2.55, 2.9, 3.7.	Eroding cutbanks are contributing sediment to intermittent streams.
North Fork Cispus River (09)	Road 2200 system projects (12 acres)	Road 2200 at MP 10.2, 10.7, 11.3, 11.48, 11.8, 13.05, 13.17, 13.16, 13.9, 14.0-14.1, 14.3, 14.4.	Unvegetated cutbank contribute sediment to streams. Shot gun pipes cause gully erosion. Overwidened turnout in road is slumping and susceptible to fill failure.
Cispus River – Blue Lake	Road 2300171 projects (2 acres)	Road 2300171, MP 0.7, 1.1	Unvegetated road cutslopes.
North Fork Cispus River (09)	Road 78 projects (15 acres)	Road 78, MP 3.0, 4.2, 5.2, 7.0-7.1, 2.5, 2.1. Road 7802, MP 0.5, 2.0-2.6. road 780042, MP 0.4. Road 7800062, MP 0.3. Road 7800060, MP 0.5-0.6, 0.8, 1.-1.3. Road 7800072, MP 0.1-0.25, 0.9.	Unvegetated road cutslopes add sediment to stream system during rainfall events.

5. Agreements with other Agencies

In December of 1997, a Memorandum of Understanding (MOU) was signed between the Washington Department of Fish and Wildlife and the USDA Forest Service, Region 6. The original document is over 64 pages long, and should be consulted for provisions pertaining to the following types of projects:

- Bank protection
- Conduit crossing
- Felling and yarding of timber
- Permanent culvert installation, replacement, and removal
- Temporary culvert installation, replacement, and removal
- Bridge maintenance
- Culvert and bridge debris removal
- Permanent ford construction, removal and maintenance
- Permanent ford construction, removal and maintenance
- Outfall structure
- Debris jam repositioning and removal
- Instream retoration/enhancement
- Water diversion
- Fish trapping
- Pier, dock and float

.In June of 2000, the Memorandum of Understanding (MOU) between the Washington State Department of Ecology (DOE) and the USDA Forest Service, Region 6 was edited. A brief summary of the items in the MOU that are the most relevant to the Upper Cispus River watershed is listed below.

- Water temperature monitoring data for each District will be summarized and sent to the DOE by December 2, 2001. This will probably be required every year that the MOU is in effect.
- A Water Quality Restoration Plan for the Upper Cispus River watershed has been completed by the Forest Service as of the end of fiscal year 2001.
- A fish passage culvert inventory has been completed Forest as of the end of fiscal year 2001. Results have been entered into a database.
- Forest Plan monitoring has been conducted by each district in 2001, and a report will be sent to the DOE. This will probably be required every year that the MOU is in effect.
- The Forest Service members of the MOA implementation team will compile a list of BMP's that will achieve outcomes required by the MOA.
- A road analysis will be initiated in fiscal year 2002 for the entire Gifford Pinchot National Forest.

B. BIOLOGICAL RESOURCES

1. Disturbance Regimes

a. Fire and Windthrow

Fire

Pilsun Park"s fire and windthrow hazard analysis affords an opportunity for use as a management tool for the prediction of high fire risk areas. However, more confidence is needed in the model and the ratings. Depending on management area guidelines from the Forest Plan and Cispus Adaptive Management Area Guide and conditions on the ground, some management activities may be appropriate to reduce fire risk in those areas rated as "severe", particularly in large contiguous areas such as the Cispus River-Cat Creek, Cispus River-Blue Lake, and North Fork Cispus River sixth-fields displayed in the map of Fire and Windthrow Risk (Map 11, Chapter 3).

Windthrow

Available evidence indicates that timber harvest activities (mainly regeneration harvest by clearcut) have increased the amount of windthrow and the number of windthrow events in this watershed. Prior to the start of timber harvest activities in the mid-1950's it appears (from looking at the aerial photos) that very little windthrow of significance took place in the watershed. Future windthrow events are likely to occur along the margins of existing clearcuts, future regeneration harvest units and to a lesser degree in commercial thinning units when windthrow conditions are right. Under the right conditions (high wind and water-saturated soils) these events could impact significant acres, but not necessarily in large patches; more likely in a large number of smaller patches.

Pilsun Park"s fire and windthrow hazard analysis affords an opportunity for use as a management tool for the prediction of high windthrow risk areas. However, more confidence is needed in the model and the ratings. Depending on management area guidelines and recommendations from the Forest Plan and Cispus Adaptive Management Area Guide, and conditions on the ground, some management activities may be proposed or adjusted to reduce windthrow risk. This applies particularly to those areas rated as "high-medium" or "severe," and especially in large contiguous areas such as parts of the North Fork Cispus, Cat Creek, and Blue Lake sixth-field watersheds as displayed in the map of Fire and Windthrow Risk (Map 11, Chapter 3).

b. Insects and Disease

Our limited knowledge indicates that current insect and disease occurrences in this watershed appear to be within the range of natural variability. However, we don't know the precise limits of that range. In general, the insects and diseases residing in western Washington forests (and in this watershed) seem to have a relatively narrow range of natural variability. There are no records or data that indicate any past insect or disease disturbance in this watershed was of such magnitude as to adversely affect the ecosystem.

The generally moderate environment of western Washington forests leads to less drought and other tree stresses that are often related to insect outbreaks (and sometimes to disease occurrence). Consequently, insect outbreaks will tend to be infrequent, small in size (usually less than 5 acres), and very low to moderate in severity. We can expect most insect and disease occurrences to be widely and irregularly distributed across the parts of the watershed occupied by their respective hosts, with attacks often being associated with host trees under environmental stress. The exception may be the western spruce budworm which is believed to have originated from a large outbreak on the Yakima Indian Reservation adjacent to this watershed (see below).

Insects

Balsam woolley adelgid occurrences/outbreaks have the potential to be rather large. Although we have no record of large outbreaks of this insect in the watershed, a large outbreak did occur on the Gifford Pinchot National Forest in 1954 near Mt. St. Helens (Johnson *et al*, 1963). Being a recently introduced insect into this forested ecosystem, it is unclear how it will react over the long-term. It is probably the one insect present in the watershed that could cause a large, widespread outbreak across a large number of acres in stands in which Pacific silver fir is either a dominant or important secondary tree species.

We can expect the balsam woolley adelgid to continue (mostly in scattered, small patches) affecting the growth and vigor of Pacific silver fir (as well as killing them) in this watershed. As an introduced species, this insect has no natural enemies to help control it. Large, significant outbreaks of this insect are possible in portions of the watershed where Pacific silver fir is dominant, but that is most likely to happen only in those areas of high site productivity where this species is most susceptible.

Another insect, the western spruce budworm which as far as we know is relatively new to the watershed but has recently appeared (first noticed in 1997 in the Walupt Lake area) and continues to spread to date according to FPM (Forest Pest Management) aerial surveys which are done in late summer on an annual basis. Aerial surveys recently showed a very large outbreak in the Muddy Fork and Adams Fork sixthfields on the northwest flank of Mt. Adams. This outbreak has not been ground verified but aerial surveys estimate it to be about 8,000 acres in size with light defoliation.

According to Beth Willhite, Entomologist at the Westside Service Center, Mt. Hood National Forest, there is a fairly low probability that budworm defoliation will reach sufficient intensity to result in significant stand damage due to the Westside character of the Walupt Lake area. The western spruce budworm is generally an Eastside species that normally does not do well under Westside forest conditions. The area on the northwestern flank of Mt. Adams is still in question as to how the budworm will react. This area is primarily in the Mt. Adams Wilderness and options for controlling the outbreak are very limited.

We can expect the Douglas-fir beetle (mostly in small, scattered patches) to continue killing Douglas-fir in this watershed, especially in connection with areas of unsalvaged windthrow and/or root disease. Large, significant outbreaks of this insect are possible in portions of the watershed where Douglas-fir is dominant, but that would be most likely to happen in the event of a large windthrow event or wildfire, especially if there was no significant salvage of the dead/down material.

Disease

Disease infections generally move slowly through the forest. In this watershed, root disease occurrences are generally small in size (<1 acre to 10+ acres), and the number of infection centers in the Western Hemlock Zone and Pacific Silver Fir Zone portion of the watershed (while generally small in size) can be relatively high. The damage severity of disease occurrences in the watershed ranges from very low to severe, but for most diseases it is most often in the very low to moderate range; although for laminated root rot, damage severity can often be in the high to severe range.

Laminated root rot is expected to continue killing trees as the infections move through the stands where they are currently located. In some managed stands reforested with highly susceptible Douglas-fir during the 1950's, 1960's, and 1970's, where laminated root rot was located prior to harvesting, the level of disease inoculum and the virulence of the disease has increased. The disease has been provided a new generation of highly susceptible host trees. Young stands of this type are not likely to reach maturity before they are effectively destroyed by the disease, if they were moderately to heavily infected before regeneration harvest.

It is unknown how many stands like this exist, but this type of situation is one which has the potential to increase the amount of laminated root rot in the watershed, as well as prolong the time it takes for the disease to naturally subside in these stands. On a site specific basis, the significant presence of laminated root rot in some portions of this watershed may have a detrimental effect on the future production of deer and elk winter range optimal cover and the hydrologic recovery of some young stands. These problems will most likely increase in the lower half of the North Fork sixthfield and the Cat Creek sixthfield.

In the recent past (1980's and 1990's), efforts have been made to reduce the level and spread of laminated root rot through the regeneration harvest of infection centers, followed by the planting of intermediately susceptible, tolerant, resistant, or immune tree species to grow for a rotation. Managing regenerated infection centers with a mix of tree species less susceptible to the disease will slow or limit its damage and spread.

2. Forest Vegetation

a. Vegetation Structural Stages

Chapter 3 described what is known about the forest vegetation structural stages at two discrete points-in-time (1880 and 2001). Natural variability is a complex temporal and spatial property of all ecosystems. There is insufficient vegetation data over a long span of time to accurately or meaningfully describe the range of natural variability for forest vegetation in this watershed. It would be erroneous to conclude that the differences described between forest vegetation in 1880 and 2001 constitute the range of natural variability. Therefore, we will simply compare the historic or reference forest vegetation structural stage data to the current forest vegetation structural stage data to determine trends and possible areas of concern within the watershed.

The current structural stages existing in this watershed are significantly different than those found in 1880 (see Table 4-2 Comparison of Historic and Current Vegetation, below). From 1880 to 2001, forest vegetation has shifted somewhat. Currently there are larger amounts of early successional forest and a reduction in mid successional forest with late successional forest being slightly higher in amount than in 1880. During this period, the following factors have influenced forest vegetation structure: a large amount of regeneration timber harvest in the watershed (18,618 acres in the last 45-50 years), the vigorous suppression of wildfires, and forest growth (natural succession).

The amount of late successional forest has increased in this watershed by 4,382 acres (3%) since 1880. This is a result of a large amount of the mid successional forest (and some of the early successional forest) that existed in 1880 having grown into the late successional forest condition over the last 121 years.

Table 4-2: Comparison of Historic and Current Vegetation

Structural Stage	**Year 1880**		**Year 2001**	
	Acres	**%**	**Acres**	**%**
Early Successional	18,867	12	32,864	21
Mid Successional	81,042	52	62,414	40
Late Successional	26,269	17	30,651	20
Non-Forest	*29,014	19	*29,174	19

* Note: The difference in these two non-forest acreage figures is due to the fact that some areas of the watershed that were forested before the Euro-American settlers arrived have been converted to permanent non-forest acres (e.g., recreation sites, highways, etc.).

For a more detailed comparison of the amount and distribution of historic (1880) and current (2001) vegetation structure by sixthfield subbasin see Appendix F, Comparison of Historic and Current Vegetation by Structural Stage and Sixthfield Subbasin.

With the advent of fire suppression activities in the 1930's, the number of acres lost to wildfire has dropped substantially. This meant that the early successional forest component of 1880 moved undisturbed into the mid successional condition of today. The amount of early successional forest in 2001 is primarily attributed to regeneration harvest activity but can also be attributed to wildfires prior to 1930 at upper elevations with low site productivity such as those stands in the Muddy Fork and upper Adams Fork areas. Overall though, regeneration harvest has acted as a surrogate for wildfires.

A major difference exists in the location, size, timing of initiation, structure, and shape of the early successional forest patches created by timber harvest from the early successional forest patches that are created by wildfire events. The early successional patches resulting from clearcut harvest and broadcast burning contain very few snags; large, live remnant trees; or large down woody material (as a general rule). Until recently, the nature of timber harvest activities (both regeneration harvest and commercial thinning) across the watershed has meant the simplification of forest structure. Harvest activities tended to eliminate snags, live remnant trees, less vigorous/diseased/damaged trees, large down wood, and multi-layered canopies. Often patches were created with hard, distinct, straight edges, single-layered canopies, a less diverse species composition, and generally healthy undamaged trees with few deformities (i.e., a much simpler and less diverse structure -- both vertically and horizontally).

As these simplified early successional patches grow into mid successional forest, (and eventually late successional forest patches) they will carry forward the more simplified structural characteristics of their clearcut harvest origin. Future management activities (e.g., precommercial thinning, commercial thinning) should attempt to create more diversity in the current early successional stands over time.

The mid successional forest currently forms the largest, and most connected forest patches in the watershed. The size of large, intact patches of mid successional forest has been reduced from what existed in 1880. This is because a portion of it has grown into late successional forest but to a larger extent, because wildfires in the early 1900's set it back to an early successional stage, some of which is still early successional due to poor site and harsh growing conditions. Some of the mid successional stands in the watershed have been commercially thinned in the 1970's, 1980's and 1990's, especially in the Blue Lake, Cat Creek and East Canyon Creek subbasins, for growth and vigor. Where management allows, these mid successional natural and managed stands throughout the watershed, in accordance with management direction in the Cispus AMA, should continue to be treated through density management to insure healthy stands that can attain late successional conditions.

Between the mid-1950's and today much of the late successional forest in a portion of the North Fork and to a greater extent in Chambers Creek, Cat Creek, and East Canyon Creek subbasins have been highly fragmented, disconnected, and isolated by a high concentration of clearcut harvest. The nature of many of these currently narrow, gangly, (and sometimes isolated) late successional forest patches has been dramatically altered. The interior characteristics and nature of the sunlight, shade, canopy closure, vegetation species composition, large standing and down wood, and moisture regimes in these narrow patches are much different than those found in the large tree patches prior to the start of timber harvest activities. This can have dramatic impacts to a variety of forest resources. The nature of these narrow patches may also make them more unstable, that is, more susceptible to windthrow and the quickening of their natural aging/deterioration process. One concern for the future will be how to restore larger, more connected patches of late successional forest in this area of heavy fragmentation that will have the structural and spatial characteristics needed to meet this area's mangement direction (which is currently Old growth, Habitat Development, and Managed Habitat within the Cispus AMA).

The Northwest Forest Plan's emphasis on leaving snags, live remnant trees in various states of health and condition in patches and as scattered individuals; pieces of large down wood; more varied tree species composition; unthinned patches and canopy gaps in thinnings; variety in tree sizes and spacings, etc.; will slowly return some of the structural complexity lost over the past few decades through clearcut timber harvest.

Under today's emphasis of an ecosystem approach to management, the rate, type, and nature of timber harvest has changed dramatically, altering the successional trends in the watershed as well as the locations and configurations of current and future vegetation structural stage patches. The watershed is dominated by management allocations/direction within the Cispus AMA guidelines that limits the amount of future timber harvest. Wilderness designation drives the management on approximately 27% of the watershed. These are areas that allow no timber harvest at all. Another

1% is managed as Late-Successional Reserve (LSR). In the LSR, only treatments that will hasten the development of late-successional forest (such as precommercial thinning and commercial thinning in stands up to 80 years of age) are permitted. The majority (71%) of the watershed is within the Cispus AMA and is managed under the LAD (Landscape Analysis and Design) guidelines which include a number of design units. These design units include Habitat Development 20%, Lodgepole 9%, Managed Habitat 13%, Managed Mosaic 12%, Natural Mosaic 16%, and Old Growth 30%.

Most of the current early successional open and closed forest (past clearcuts) reside in the AMA. Over the next few decades, much of the early successional forest in the AMA (the vast majority of it being in portions of the Chambers Creek, Cat Creek, East Canyon Creek, and North Fork sixthfields) will become mid successional forest. Much of the current mid successional forest will succeed to late successional forest. This means that over the next 80-90 years much of the forested landbase in the watershed will be late-successional forest, assuming continued absence of large wildfires.

In the Matrix allocation (a very minor portion [less than 1/2%] of the watershed) where timber harvest is allowed in most areas, the initiation of early successional forest (and succession from early successional to mid successional to late successional) will continue to occur over time in a somewhat regulated manner. Regeneration harvest will not occur in the Riparian Reserves within the Matrix, thus succession of current structural stages in those reserves will continue toward a late successional forest condition (if they are not already in that condition). Although the overall amount of timber harvest in the watershed has declined in the 1990's (and will in all likelihood remain low in the future), the amount of probable harvest has been shifted to a much smaller land base of allocations that allow harvest, thus the rate of harvest on that reduced land base may be somewhat similar to what it was prior to the advent of the Northwest Forest Plan.

One of the tools used to control the stocking of managed early successional stands to meet a variety of resource objectives is precommercial thinning. Since 1991, the budgets and acres treated for timber stand improvement have dropped precipitously, while the acres of early successional stands needing stocking control (those acres initiated by clearcut harvest in the late 1970's and early 1980's) continue to come on line each year. There is a concern that the stocking levels of many of those early successional stands will not be managed, foregoing the opportunity to accelerate the early and important development of various desired conditions, depending on the management allocations in which they reside (thus affecting future wildlife habitat, hydrologic recovery, production of large woody debris and large snags, and timber production, etc.). There are currently about 100 acres of known/documented precommercial thinning needs in this watershed and an additional 300 acres of potential stewardship units where bough material or Christmas trees may be removed in return for precommercial thinning of these stands. White pine blister rust is also a concern in the watershed. It has affected many of the planted white pine seedlings and saplings within plantations primarily located in the North Fork and Muddy Fork subbasins. This amounts to about 16 known plantations on approximately 425 acres. Pruning of the lower portion of the tree will reduce the mortality of individual white pine seedlings and saplings.

3. Wildlife, Botany, Fisheries

There are several areas of concern within the watershed for wildlife, fisheries and botany. One obvious area of concern is the lack of survey information for many species of animals and plants, including habitat surveys. Although there has been a considerable amount of data collected since the Middle and Upper Cispus Pilot Watershed Analysis was completed in 1995 for some listed and survey and manage species, much of this has been limited to sites where proposed projects have been located, which in Upper Cispus has usually been mid-seral forest stands proposed for commercial thinning. Other habitat types have occasionally been surveyed for other projects, or as part of general inventories, but many habitats have been greatly under-represented, or absent in survey efforts.

a. Listed Species

Wildlife

Northern spotted owl - As identified in the previous chapter, almost all of the northern spotted owl pairs in the watershed are below the “incidental take” habitat thresholds within their potential home ranges. Additionally, and cumulatively, the increasing presence of barred owls in the landscape may make it very difficult for spotted owls to persist in the watershed at current numbers. Presently, few owl surveys are being conducted, and these are mostly of an opportunistic nature. Also, the habitat use patterns in the watershed are poorly understood, particularly use of the thousands of acres of mid-seral, “foraging” stands that are present, and their contribution to owl productivity and survival. There is no data available on the use of commercially thinned, mid-seral stands by spotted owls or barred owls as well.

Other listed terrestrial species - As stated above, the largest area of concern is the lack of status and distribution information for many listed wildlife species. Of particular importance are the large forest carnivores- gray wolf, Canada lynx, grizzly bear and wolverine- who range over several watersheds and are difficult to detect. No data is available for listed bat species in the watershed, and these animals should be a high priority for surveys and monitoring. An area of concern is the long-term status of the Cascades frog (as well as other amphibians) in the watershed, which contains some high-quality habitat for this species south of Walupt Lake in the Goat Rocks wilderness and other areas. This species is thought to be declining in other parts of the Northwest, and the Upper Cispus area contains opportunities for monitoring, a limited amount of which is already occurring.

Plants

The greatest area of concern is the lack of distribution and abundance information for most of the listed plant species. Also of concern is a general lack of knowledge on the status and trends of certain habitats important to TES plant species. For example, meadows appear to play an important ecological role for many plant species, including a number of TES species. Previous analyses of the trends of meadow habitat (see V-5, Middle and Upper Cispus Watershed Analysis) have suggested that significant losses of meadow habitat may be occurring. Future management directives within the analysis area should include schemes that maintain and favor existing meadow habitat, in order to ensure that quality habitat is available for the numerous species of TES plants that occur in these areas.

b. Survey and Manage Species

Wildlife

Salamanders and Mollusks - In addition to a lack of survey information in many habitat types across the watershed, an area of concern is the effect of timber harvest, particularly commercial thinning, on both known sites (particularly mollusks) and future habitat conditions. The size of protected areas in different situations, microclimatic effects of reducing canopy, and the treatment of deciduous trees like big-leaf maple in thinned areas need further monitoring and study. In the Blue Lake and Adams Fork sub-basins, some mid-seral stands contain big-leaf maple trees that are being over-topped by Douglas-fir and other conifers, which will eventually reduce or eliminate their habitat suitability for species such as *Cryptomastix devia.* Active management may be necessary to reduce competition and retain the deciduous component in some of these stands, if managing these sites for survey and manage mollusks is a priority.

Lichens, Bryophytes and Fungi

Surveys for survey and manage plants, including vascular plants, lichens, bryophytes and fungi have been heavily concentrated in project areas; as a result, our understanding of the distribution and abundance of these species is limited within the watershed analysis area. In order to manage these species for persistence in the long term, a better understanding of their distribution across the watershed is needed. This information could help managers maintain connectivity of important habitat, both in the short and long term.

c. Management Indicator Species

Deer and Elk - The amount of forage in deer and elk winter range (North Fork, Blue Lake and East Canyon sub-basins) comprises only 5% of the total acres at present, which is much less than the desired level of 10-15%. The amount of forage will be declining further as young, regenerating forest stands mature into hiding and thermal cover. In the absence of disturbance, either natural or man-made (e.g. timber harvest), the carrying capacity of the winter range will be decreasing in future decades.

Road densities on deer and elk winter range are well above the Gifford Pinchot Forest Plan goal of 1.7 miles of open road per square mile. Opportunities to reduce road densities, however, appear to be limited as much of these open roads are main arterials such as Roads 23 and 21.

Mountain goat- Mountain goat habitat in the watershed, as stated previously, occurs in patches that are parts or extensions of much larger habitat areas surrounding them. A concern is the lack of understanding of this species' habitat requirements in the area, and how disturbance, or the absence of disturbance, may affect mountain goats (either positively or negatively). Forage appears to be in short supply in some areas, and meadows that provide goat foraging areas are being lost to conifer intrusion in the Smith Creek area, north of the watershed boundary. Mountain goat habitat relationships are much less clear than they are for deer and elk, and further data is needed before conclusions about cover, forage, and other habitat variables can be made. This is particularly true for the Cispus AMA goat range, with is year-round habitat for many goats.

d. Non-native Species

The extent to which exotic species are affecting native plant and animal species is an unknown in the watershed. Areas of potential concern include disturbed sites, dispersed camping areas, roadsides, trails, and other areas subject to concentrated human use.

Noxious Weeds

Roads are one of the primary corridors for weed dispersal. Weed seeds may be carried along roads by motorized vehicles, by animals that use the roads, or by the wind. Other corridors for propagule movement between the analysis area and surrounding areas include trails (especially those used by pack animals), riparian areas and stream channels. Of particular interest are corridors that link otherwise isolated patches. These corridors have the potential to bring propagules of species into areas that they otherwise could not reach. Road 5603 is such a corridor; it links areas east of the Cascades directly to the analysis area. Other areas of special interest include where weeds may have been introduced through past land use activities, such as historic sheep drive routes, or dispersed campsites.

In addition to these general areas, there are a number of specific areas of concern for noxious weed invasion or spread within the watershed analysis area. In the area around Walupt Lake, a population of *Lythrum salicaria* has been detected. This species, also known as purple loosestrife, is an aggressive colonizer of wetland and lakeshore habitats and is a threat to biodiversity in areas where it becomes established. Walupt Lake is at the boundary of the Goat Rocks Wilderness and is a critical area to restrict the dispersal of propagules, in order to prevent the spread of this species into the Wilderness.

Populations of *Hypericum perforatum* (St. John's wort) are of special concern where they occur along Road 2208 below Timonium Creek, and along Road 22 where it parallels the North Fork of the Cispus River, along Road 21, and on Road 56 along the Cispus River. All of these populations are found in close proximity to riparian zones where the species may become established and disperse downstream. This species is also found on Road 5601 near Olallie Lake, where it threatens to invade the meadow near the shoreline of the Lake, which hosts the federally ranked Sensitive plant *Microseris borealis*. It is also found along Road 2329 near Midway Meadows, where two species of rare grape ferns (*Botrychium pinnatum* and *Botrychium lanceolatum*) are found.

Several populations of *Cystisus scoparius* (scotch broom) are of concern within the analysis area, including populations located on Roads 55 and 5500128 in the vicinity of Tyler and Polk Creeks, on Road 21 near the intersection with Road 2100216 along the Cispus River, on Road 56 near the intersection with Road 5600042 and on Road 2324 along East Canyon Creek.

One large, roadside population of Japanese knotweed (*Polygonum cuspidatum*) borders Road 20 just south of the bridge over Smith Creek. This population is of special concern due to the probability that it may disperse downstream and continue to disperse along Road 20.

e. Forest Fragmentation and Connectivity

The watershed contains thousands of acres of mid-seral, interior forest habitat at present, in some very large patches, but much less late-seral ("large tree") interior habitat. This is particularly true for lower-elevation (less than 3500 feet) late-successional, interior habitat in larger (greater than 100 acres) patch sizes, as occurs in the North Fork sub-basin. A concern is the maintenance of these areas until the mid-seral stands succeed to late-successional, interior habitat in the sizes and amounts desired based on management direction.

Connectivity is a concern in Upper Cispus, particularly in the North Fork sub-basin where one third of the riparian reserves occur in the "grass/pole" stage, which may be a problem for species oriented to late-successional habitats as they travel and disperse in these areas.

Plants

On a landscape level, the connectivity of special habitat types is important for many reasons, including the dispersal of propagules (e.g. seeds, spores, vegetative offsets). One area of significance can be seen around Mt. Adams, where relatively continuous bands of sub-alpine and alpine habitats are connected around the mountain. Because of the diversity in climatic conditions that vary with aspect around the mountain, this area may represent an important ecocline for the transfer of genetic variation within species.

The connectivity of late-successional or old growth habitat may be important for many old growth associated species, and is of particular importance to some survey and manage epiphytic lichens and bryophytes. As a general trend, the watershed analysis team (see V-18, Middle and Upper Cispus Watershed Analysis) found that historically, most of the late seral habitat within the analysis area was found in valley bottoms and the riparian areas of large streams, where the cool, moist microclimates protected these areas from the effects of large fires. Currently, though, late seral habitat is found along the upper reaches and slopes where steeper conditions have limited access for timber harvest. The resulting pattern is that late seral habitat is highly fragmented and is no longer present in large amounts in the valley bottoms where it historically occurred.

f. Aquatic Species

The matrix of pathways and indicators (see Table 4-3) is one way of rating habitat conditions. In general sub-watersheds that are rated as Functioning At Unacceptable Risk are areas of concern and these areas should be targets for restoration projects. Those sub-watersheds that are rated as Functioning At Risk are areas that could easily become areas of concern. A cautious approach to project planning is advised in both of these situations. The following discussion further refines the location of the concerns and points out exception to the general rule.

Table 4-3: Matrix of Pathways and Indicators

Pathway	Indicator	Functioning Appropriately	Functioning At Risk	Functioning At Unacceptable Risk
WATER QUALITY	Temperature Bull Trout	Muddy Fork, Adams Fork	Cat	Headwaters, Walupt Lake, Chambers, East Canyon, Blue Lake, North Fork

Pathway	Indicator	Functioning Appropriately	Functioning At Risk	Functioning At Unacceptable Risk
	Temperature Cutthroat and Anadromous Species		Headwaters, Walupt Lake, Chambers, Muddy Fork, Cat, Adams Fork, Blue Lake, North Fork,	East Canyon
	Sediment (in spawning areas)	Muddy Fork	Headwaters, Walupt Lake, Chambers, Cat, Blue Lake, North Fork, East Canyon	Adams Fork
	Chemical Contamination/ Nutrients	All sub-watersheds		
HABITAT ACCESS	Physical barriers	Headwaters, Walupt Lake,	Adams Fork, Blue Lake, Muddy Fork, Cat, East Canyon.	Chambers, North Fork
HABITAT ELEMENTS	Substrate character and embeddedness (in rearing areas)	Muddy Fork,	Headwaters, Walupt Lake, Chambers, Cat, Blue Lake, North Fork, East Canyon	Adams Fork
	Large Woody Debris (LWD)	Walupt Lake	Muddy Fork, Adams Fork, Blue Lake, North Fork	Headwaters, Chambers, Cat, East Canyon
	Pool Frequency and Quality	Walupt Lake, Muddy Fork	Chambers, Cat	Headwaters, Adams, East Canyon, Blue Lake, North Fork
	Large Pools (in streams with > 3m in wetted width at baseflow)	Headwaters, Walupt Lake, Muddy Fork	Chambers, Cat, Adams Fork, East Canyon, Blue Lake, North Fork	
	Off-channel habitat	Walupt Lake, Chambers, Muddy Fork, North Fork	Headwaters, Cat, Adams Fork, East Canyon, Blue Lake,	
	Refugia (at 6th to 7th field watershed scale)		Headwaters, Walupt Lake, Muddy Fork, Adams Fork,	Chambers, Cat, East Canyon, Blue Lake, North Fork
CHANNEL CONDITION AND DYNAMICS	Width/Depth Ratio in riffles	Walupt Lake, Muddy Fork, Adams Fork	Headwaters, Chambers, Cat, East Canyon, North Fork	Blue Lake
	Streambank Condition	Headwaters, Walupt Lake, Muddy Fork. Adams Fork	Chambers Creek, Cat, Blue Lake, North Fork	East Canyon Creek
	Floodplain Connectivitiy	Headwaters, Walupt Lake, Chambers, Muddy Fork, Adams Fork, Blue Lake	Cat, East Canyon, North Fork	

Pathway	Indicator	Functioning Appropriately	Functioning At Risk	Functioning At Unacceptable Risk
FLOW / HYDROLOGY	Change in Peak/Base Flows	Headwaters,	Walupt Lake, Chambers, Muddy Fork, Cat, Adams Fork, East Canyon, Blue Lake, North Fork	
	Drainage Network Increase	Headwaters, Walupt Lake, Muddy Fork, Adams Fork,	Chambers, Cat, East Canyon, Blue Lake, North Fork	
WATERSHED CONDITIONS	Road Density and Location	Headwaters, Walupt Lake, Muddy Fork, Adams Fork,	Chambers, Cat, Blue Lake, North Fork	East Canyon
	Riparian Reserves	Headwaters, Walupt Lake,	Chambers, Muddy Fork, Cat, Adams Fork, East Canyon, Blue Lake, North Fork	
	Disturbance Regime	Headwaters, Walupt Lake,		Chambers, Muddy Fork, Cat, Adams Fork, East Canyon, Blue Lake, North Fork
	Disturbance History	Headwaters, Walupt Lake,	Muddy Fork, Adams Fork, Blue Lake	Chambers, Cat, East Canyon, North Fork
SUBPOPULA-TION CHARACTER-ISTICS	Subpopulation Size other species not rated	Coho Salmon	Resident Coastal Cutthroat	Steelhead, Chinook Salmon, Sea-Run Coastal Cutthroat, Bull Trout
	Growth and Survival	No Rating	No Rating	No Rating
	Life History Diversity and Isolation No rating for Bull trout or other species.		Steelhead, Chinook Salmon, Coho Salmon	Coastal Cutthroat
	Persistence and Genetic Integrity		Coho Salmon and Costal Cutthroat	Steelhead, Chinook Salmon, Bull Trout
SPECIES and HABITAT	Integration of Species and Habitat Conditions			All Spcies

Water Quality

Water Temperature

Bull Trout - Bull trout are very temperature sensitive; they do not tolerate temperatures that most other salmon and trout find suitable. Water temperatures are suitable for bull trout in only the glacially and ground water fed streams found in the Muddy Fork and Adams Fork watersheds.

Other Species - Water temperatures in East Canyon Creek regularly exceed the temperature 16^{o}C for several days a year. The seven-day average maximum temperatures also exceed 16^{o}C. Which indicates that water temperatures are warm for an extended period of time and may influence the health and competitive ability of fish. These higher water temperatures are due the high wetted width-to-depth ratios observed in East Canyon Creek and some loss of shading from timber harvest and road building.

Water temperatures in the North Fork Cispus and lower 0.5 miles of the Cispus River exceed 16°C for a couple of days in the summer. These higher water temperatures are due the high wetted width-to-depth ratios, wide floodplains and east west orientation of the river.

Cat Creek is actually warmer than the Cispus River, but does not increase the temperature of the river because of its relatively small contribution to the river.

The warm water temperatures in the Walupt Lake and Chambers Creek sub-watersheds are related to the presence of lakes. Walupt Lake has a surface area of 384 acres and the surface waters warm to 20.8 °C (August 2001). The temperature of Walupt Creek mirrored this temperature increase. A similar affect is likely contributing to warm water in Chambers Creek.

The cold temperatures in Adams Fork and Muddy Fork may be limiting the production of fish species, except for the bull trout. We have no confirmed reports of bull trout in these watersheds.

Sediment

We base the Functioning At Unacceptable Risk rating for the Adams Fork watershed on the high amount of fine sediment in Sheep Creek. Road 5601is a good candidate for the source of some this sediment.

The seemingly high level of sediment in Adams Fork and Muddy Fork is most likely due to the natural erosion caused by glaciers that feed these streams. The heavy weight of ice in the glaciers grinds rock on Mt Adams into fine sediments. This sediment is routed down stream as glacial flour, which discolors the water and contributes fine sediment to the substrate. There is nothing that land management can do to influence the amount of glacial flour.

The amount of fine sediment in spawning areas is largely an unmeasured quantity. Observations of fine sediment in most of the streams, of various landslides and road failures suggests that the amount fine sediment is at an elevated level in most of the streams. The lower gradient sections of the North Fork Cispus River (scattered sections below the upper Road 22 crossing) and Cispus River (North Fork confluence to the Road 23 bridge) are of the greatest concern, because they provide the vast majority of spawning habitat for anadromous fish.

Chemical Contamination/Nutrient Enrichment

There are no areas of concern for this indicator in the watershed. A few campers at dispersed campsites, however, are careless with garbage and sewage. These sites are unsightly and smelly messes.

Habitat Access

Physical Barriers - There are only a few culverts that present passage barriers to fish. The obvious areas of concerns are on Road 22 at Swede and Irish Creeks, and the crossings of Chambers Creek on Roads 2160 and 2150. Although these are likely year-around barriers there is little opportunity to increase amount of fish habitat by replacing these culverts. There is only about a ¼ mile of habitat upstream from the Swede Creek and Irish Creek culverts. Chambers Creek is very steep with many natural migration barriers, therefore, we would give these culverts a low priority for replacement.

Of lesser concern are a few culverts in the Adams Fork, Blue Lake, Muddy Fork, Cat, and East Canyon (See Table 3-25 for locations) that may pose seasonal barriers to fish passage.

Habitat Elements

Substrate Character - These areas of concern are the same for substrate character as they are for sediment.

Woody Debris - The amount of woody debris is particularly low in Cat Creek, East Canyon Creek and Chambers watershed (includes portions of the Cispus River and several small tributaries). Large fires near the turn of the 20th century burned over most of watershed. Past harvest next to these streams also removed woody debris. The Stream Survey Summary Appendix E shows the reaches that have the least amount of wood.

Woody debris is also below its potential in portions of the Headwaters, Muddy Fork, Adams Fork, Blue Lake, and North Fork sub-watersheds. Unlike the previously listed sub-watershed the lack of wood is more due to fires rather than past harvest activities. This is particularly true of the Headwaters watershed, which is nearly all in the Goat Rocks Wilderness. The problem in the Blue Lake sub-watershed is not a lack of future woody debris from harvest, but rather that the trees are currently too small to produce stable woody debris in the Cispus River. When trees in this area do fall into the river, floods easily sweep them downstream.

Pool Frequency and Quality - The major fish bearing streams in the Headwaters, Adams Fork, East Canyon, Blue Lake, and North Fork sub-watersheds lack pool habitats and particular quality pool habitats (relatively deep pools or pools with abundant cover). The Stream Survey Summary Appendix indicates where pool frequencies are the lowest along the surveyed streams. The lack of quality pools is in part due to the low abundance of woody debris, which helps to form pools and provides cover in pools. In the main Cispus River it is also due to braiding created by the large amount of sediment routed to the river by its tributary streams. The large sediment load is the result of cumulative effects from of all of the tributaries, but East Canyon Creek, Juniper Creek, Prospect Creek, Smooth Rock and several other small tributaries are obvious contributors to this sediment load. The amount of sediment contributed by these streams is increased by road failures and other management induced land slide-like failures during floods and larger winter storms.

The low pool frequencies in the relatively unmanaged Adams Fork is misleading, when evaluating the effect of management on the condition of the stream. Because this is glacially fed system, the highest flows occur during the survey season (summer and early fall). These higher flows make it difficult to identify pools and pool-like habitats. Secondly glacially fed streams are subject to glacial out-burst type floods which naturally decrease the stability of these streams. Therefore, the level of concern for Adams Fork (the creek) is not as high as it is for the other streams listed as Functioning At Unacceptable Risk. The level of concern is still high for the tributary Sheep Creek, which is fed by Olallie Lake rather than by glaciers.

Pool frequencies in the Cat and Chambers sub-watershed are also considered to low, but are better than in the previously mentioned sub-watersheds. Care should be taken when planning projects in these sub-watersheds.

Large Pools - Large pools are key holding areas for fish prior to their spawning. Experience has shown that large pools in streams the size of the North Fork Cispus River and smaller hold more and larger resident fish than small pools or riffles. The keys are simply the larger areas of calm water, the hiding cover from terrestrial based predators, and thermal refuges provided by the deepest pools. There is a lack of large pools in the Chambers, Cat, Adams Fork, East Canyon, Blue Lake, and North Fork sub-watersheds. The Stream Survey Appendix shows the areas where large pools are lacking in surveyed streams. These areas lack the qualities provided by large pools.

The streams of greatest concern are the Cispus River and North Fork Cispus River. These are the major anadromous streams and thus the areas where large pools are most critical. In addition, although there are many pools that meet the definition of a large pool (>3 feet deep) in Cispus River, the potential of a river the size of Cispus River is for much deeper pools (at least 6 feet). As mentioned in the discussion of pools and quality pools, a major cause of the lack of deep pools is sediment from tributary streams filling pools.

The greatest stream of concern for resident fisheries is East Canyon Creek, where pools are generally much shallower than one would expect. Observations made during the summer of 2001 seemed to indicate that these pools have been filled with both large grained and fine-grained sediments. Similar observations were made on the North Fork Cispus River, but filling of pools seemed to be occurring to a lesser degree.

The problems in the Adams Fork sub-watershed are is Sheep Creek and not Adams Fork itself. There are very few management influences on Adams Fork.

Off-Channel Habitats - There are many off-channel habitats in the areas that are conducive to forming these habitats. The concern is that these habitats appeared to be unstable and in some cases ephemeral in nature. This can lead to the situation where fish become trapped in these habitats. It also contributes to warming of the Cispus River, particularly in the lower mainstem.

Refugia - There are no areas that would qualify as refugia in the Upper Cispus watershed. Most of the area lacks the habitat conditions to qualify as a refuge to support a population of fish. The areas with the best habitats (Headwaters, Muddy Fork, Adams Fork, and Walupt Lake sub-watersheds) are cutoff from the rest of the watershed by natural migration barriers.

Channel Condition and Dynamics

Width to Depth Ratios - The areas of greatest concern areas are the lower portion of the Cispus River near the mouth of the North Fork Cispus River. The Middle and Upper Cispus Watershed analysis of 1995 reported on channel widening in these areas. East Canyon Creek is also of relatively high concern. This watershed analysis covers this area of concern in more detail in the section on stream channel widening. A common past mistake has been to focus restoration activities on the response areas where channel widening is occurring. Channel widening is a symptom of watershed imbalance and attention must be paid to upstream source and transport areas. Only the relatively, unmanaged areas of the Headwaters, Walupt Lake, Muddy Fork and Adams Fork sub-watersheds should be considered areas of low concern.

Streambank Condition - Along with in-stream sediment streambank condition is somewhat unknown in this watershed. Although they noted areas of obvious erosion, previous surveys did little to quantify bank erosion. Areas of bank erosion are spread throughout the watershed.

From the level II stream survey data and other notes, the East Canyon Creek sub-watershed appears to be the area of highest concern. There also are several slump failures adjacent to East Canyon Creek .4 kilometers below the first Road 23 bridge. It is difficult to separate bank erosion from the upslope slumping processes in the survey notes.

The Chambers, Blue Lake, Cat, and North Fork sub-watersheds are of lesser concern. Small areas of bank erosion have been noticed just upstream of the North Fork confluence and down stream of the Road 23 bridge on the Cispus River. Other small areas of erosion are likely to be present within this area. The Upper Cispus Stream Survey noted several newly cut side channels in the area between the Muddy Fork confluence and Chambers Creek confluence. Bank erosion in Cat watershed occurred largely in the tributary streams (Cat Creek, and Mouse Creeks). Much of the Cispus River in this sub-watershed lies in a stable bedrock-boulder canyon. There are very few unstable areas on the North Fork Cispus River.

The Headwaters, Walupt Lake, Muddy Fork, and Adams Fork sub-watersheds are relatively unmanaged areas, therefore areas of unstable banks are relatively natural and of relatively little concern.

Floodplain Connectivity - The streams in this watershed are well connected to their floodplains and associated wetlands. There are only a few areas of concern. The 78 and 23 roads closely follow Cat Creek and East Canyon Creek respectively for approximately 2 miles in each case. A person standing on the road in the sections could throw a stone into these streams. In these cases the road fill material is constricting what was a naturally small floodplain and increasing the energy of the streams during floods. In addition, these sections of road also prevent the growth of shading vegetation.

In the North Fork sub-watershed, Raod 2200043 is hindering the drainage of a wet land on a bench above the North Fork Cispus River.

Roads 23 and 2801 briefly enter the floodplain of the Cispus River. The danger here is more the potential to loss of the road during the next large flood and rerouting of the river channel.

Flow/Hydrology

Change In Peak/Base Flows - Stream peak flows are likely higher than they were in historic times throughout the watershed. We rated most of the sub-watershed as Functioning At Risk, because of moderate losses of hydrologically mature vegetation from management actions and natural events, moderate increases in the drainage network and evidence of channel widening. These increases are from the cumulative effects of “natural events” (slow recovery form fires in the late 1800s and early 1900s) and management activities (timber harvest and road building). The “natural causes” are the main factors in Muddy Fork, Adams Fork and Walupt Lake. The management actions play larger roles in the other sub-watersheds. Regardless of the causes many of sub-watershed at “At Risk” of increased peak flow frequency and magnitude.

The areas of greatest concern are the North Fork, East Canyon, Chambers, and Cat sub-watershed. The loss of hydrologically mature vegetation due to harvest is greatest in these sub-watersheds. These areas also have relatively high increases in the drainage network created by building roads in the watershed. The areas of greatest concern are the Timonium Creek and upstream areas in the North Fork sub-watershed, Cat Creek and Mouse Creek in the Cat sub-watershed and the Dark Creek portion of the East Canyon sub-watershed.

Of lesser concern is the Blue Lake sub-watershed. It has a fairly high increase in the drainage network at the sub-sub-watershed scale. This increase is from the 2300 and 2801 roads along Cispus River. It is also one of the areas where channel widening is observed.

Although they were rated as Functioning At Risk, the Walupt Lake, Adams Fork and Muddy Fork sub-watersheds are of little current concern. The lack of hydrolgically mature vegetation in these watersheds is mostly related to the slow recovery of relatively high elevation lodgepole pine stands originating after fires. In addition, the majority of the land in these watersheds is above the elevation where rain-on-snow floods are initiated. Even though these are relatively natural conditions, care should be taken to not lower the amount of hydrologically mature vegetation until more stands of trees become hydrologically mature.

Drainage Network Increase - The presence of roads and particularly the road ditches have moderately increased the amount of functional stream channel in the Chambers, Cat, East Canyon, Blue Lake and North Fork sub-watershed. This increase in the length of functional stream channel helps to speed the rate at which rain and snow melt runoff. This can increase the frequency and magnitude of peak flow.

Watershed Conditions

Road Density and Location - The major area of concern is the location of roads in the riparian reserves. The riparian reserves are areas that are either relatively close to streams or unstable areas. East Canyon Creek stands out as the area of greatest concern. Nearly half of the roads are in the riparian reserves and Road 23 closely parallels East Canyon Creek for two miles.

Cat Creek is another stream with a road that closely parallels its banks.

The Chambers, Blue Lake and North Fork sub-watersheds are of moderate concern. These all have relatively high densities of roads in the riparian reserve but the roads are, for the most part, outside of the floodplain of the streams except at stream crossings.

Riparian Reserves **-** The condition of riparian reserves is only a moderate concern for fish species. The riparian reserves are only moderately fragmented. The sub-watersheds of greatest concern are North Fork, East Canyon, Cat, and Chambers. Streamside shade and woody debris recruitment are reduced in these areas.

The riparian reserves in the North Fork are moderately fragmented. As the result of past timber harvest much of the riparian reserves of Timonium Creek, the headwaters, and headwaters of many tributary streams are now in the early seral stages of development.

The areas of concern on East Canyon Creek are the unstable areas and Road 23. Several of the unstable riparian reserves are in the early seral stages of development. These area are more likely to slide and move sediment downhill towards streams. The section of Road 23 along East Canyon Creek reduce stream shading and woody debris recruitment in that 2 mile section.

As the result of past timber harvest much of the riparian reserves of lower Mouse Creek, and the headwaters of Cat Creek are now in the early seral stages of development.

As the result of past timber harvest scattered small patches of the riparian reserves of Midway Creek, Wesley Creek, Chambers and Cispus River are now in the early seral stages of development.

The Blue Lake sub-watershed is largely unfragmented, but the trees are not large enough to provide stable large woody debris for the Cispus River.

Of lesser concern are the large patches of riparian reserves in the early successional stages in the Muddy Fork and Adams Fork. These are the result of slow recovery from fires.

Disturbance Regime and Disturbance History - This watershed has been highly disturbed in the past. The some of the "natural disturbances" include the following events:

- Large fires near the turn of the 20th century which removed much of the vegetation from the watershed.
- Repeated eruptions of Mt St Helens which dumped large volumes of ash on the watershed.
- Four large floods since 1970, which have altered the stream channels.

Added to these natural disturbances are timber harvest and the associated road construction.

Records of timber harvest begin in the 1950s. It peaked in the 1980s and declined in the late 1990s. The areas of greatest concern are where timber harvest has been the heaviest (North Fork, East Canyon, and Cat sub-watersheds). The Muddy Fork, Adams Fork, and Blue Lake are of lesser concern, because of lower levels of timber harvest.

Subpopulation Characteristics

The current fish populations are a major concern in this watershed. Of the listed species populations only the coho and perhaps the resident coastal cutthroat trout are large enough to be considered stable and resilient to natural fluctuations in the environmental conditions. The anadromous populations are dependent upon the reintroduction program for transport around the dams on the Cowlitz River. In addition, much of the fish habitat is in a Functioning At Risk condition.

C. PHYSICAL RESOURCES

None

D. SOCIAL AND ECONOMIC RESOURCES

1. Recreation

The following are concerns and opportunities.

Roaded access

Road conditions within the watershed are deteriorating and frequently do not meet maintenance level standards for recreation destinations, primarily trailheads. This is particularly true for Level II Maintenance roads. Road maintenance priorities are set based loosely on volume and type of use and some recreation destinations are not high enough on the priorities list to receive consistent maintenance to standard. Of particular concern are some routes to trails and facilities more heavily used by horse riders. Potholes, washboarding, and lack of brushing can create damaging or hazardous conditions for people pulling trailers.

In the future, recreation managers should work closely with road maintenance personnel to ensure that needs for recreation access are considered in establishing overall District road maintenance priorities. Depending on the evolution of the Northwest Forest Pass system, use of roads for recreational purposes could be included in the system, thereby making making pass revenues available for road maintenance on high priority recreation routes.

Motorized trail use

Total demand for and use of motorized trails appear to be somewhat static and relatively low in comparison with other uses. There appears to be growing use of 4-wheel ATV’s or quads, partly because of a proliferation of models, heavy marketing, and the incorrect perception that they can be ridden almost anywhere.

While it would be desirable to provide more miles of ATV trail, new motorized trails are a very difficult “sell” in today’s environmental world. Compounding this, our terrain, soils, heavy rainfall, and many stream channels that are often deeply incised, combine to make it difficult and costly to build and maintain new trails to ATV standards.

A related issue is that of use of unlicensed ORV/ATV’s on open public roads. The District maintains a policy of unofficial tolerance in some areas where it is reasonable to travel safely from camp areas to trailheads or between trailheads to create loops. It would be desirable to develop a more formal agreement with County and State law enforcement agencies to approve limited use of unlicensed ORV/ATV's in specific routes under specific conditions to ensure safety.

We need to continue to work toward eliminating backlog trail maintenance and providing field monitoring of motorized use. Education and enforcement are critical to maintain these opportunities as motorized use of all types is being challenged for environmental reasons.

It is probable that the relatively large sytem of ATV/ORV trails that we maintain exists in a precarious balance between limited use, fairly intense maintenance, and moderate tolerance of the environmental community. Increases in use, decreases in maintenance, or decrease in tolerance could put the program at risk. Education and enforcement are important elements in maintaining this balance.

Dispersed camping

Dispersed use appears to be increasing due to overall increase in recreation demand, more people able to afford self-contained camp units, and increased fees in developed sites. Existing and developing dispersed use is heavily biased toward stream and lakeshores, including riparian habitat. Although we have little or no actual data that indicates that this is contributing to unacceptable levels of sedimentation, pollution, or other water degradation, some of it is fairly obvious and it is intuitively obvious that there is some level of cumulative impacts. However, the total contribution of sedimentation may well fall within the natural range of variability of sedimentation in affected streams, and certainly within the peaks created by recurring natural and seasonal events. Intensive monitoring and measurement would have to be done to identify and evaluate sedimentation and other impacts associated with dispersed use.

Ongoing inventories and surveys of dispersed areas (Concentrated Use Areas) will help to display the number and size of our dispersed camp areas, and will help to determine a priority for addressing this issue. Removing or rehabilitating such sites, as well as changing the expectations and behaviors of users, will be a major undertaking and will require better data upon which to make such a decision and significant resources to accomplish the objective. The well-defined need to address known, measurable adverse watershed impacts will be a key factor in attempting to make these changes.
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Developed Campgrounds

Although there are minor shortages of camp spaces in some campgrounds during the highest peak use periods, such as Labor Day, the existing capacity of campgrounds appears to be sufficient to meet demand. This takes into consideration that demand is somewhat modified by increasing fees and that capacity is established for some level below peak use in order to support reasonable occupancy percentages. Even with today's PAOT capacity (people at one time), overall occupancy figures expressed as a percent of total sites occupied are low, sometimes in the teens.

For the future, emphasis should be placed on upgrading existing campgrounds. The primary needs are for improved water sources that are compatible with current water quality and testing standards, improved water distribution systems, and improved facilities to meet ADA barrier-free/accessibility standards. A listing is not really meaningful or necessary because this situation changes incrementally from year to year and annual priorities are based on specific conditions or needs, and, not unusually, system failures.

A secondary need for upgrading campgrounds is improved opportunity for larger RV's. While the demand is certainly there, this is somewhat in contradiction to the AMA direction that encourages more rustic or no facilities. Campgrounds on the CVRD generally fall within this category. Neither the AMA Guide nor available funding nor other priorities indicate that any significant change in facilities or clientele is warranted.

Concession management of most campgrounds is here to stay. Success depends largely on their recruiting, training, and ongoing supervision of field site hosts. An opportunity for improvement is for the concession operator to be more involved as our partner in the field. This includes being a vendor source for passes, providing more information, becoming more aware of our policies and practices, having more written information to hand out to customers, etc. Concession campgrounds are managed to meet or approach the full service level.

We should attempt to maintain a few opportunities for no-fee camping, including campgrounds which require the Northwest Forest Pass. These sites are more rustic and consistent with direction for the AMA. Emphasis in management of these sites is for a reduced service level, meeting the critical MM standards for safety and sanitation.

Northwest Forest Pass

The pass and resulting revenues come with a significant obligation for facility operation and maintenance. It is important to balance the needs for maintenance of trails, trailheads, dispersed sites, low standard developed sites, overall signing, and enforcement. This balance will change as conditions change and as accomplishments with appropriated funds, grant funds, and volunteers change.

Focus NWFP funds on meeting basic standards of safety and sanitation in developed sites (MM standards), resource protection needs on trails, safety conditions at trailheads, and quality signing.

Continue to use grants to leverage all funds.

Wilderness use

Wilderness use appears to be stable at best. Problems are associated with overuse in specific areas during specific high use periods, typically nice weekends and summer holidays. Utilize permit systems or site-specific restrictions to address specifically identified problems.

Many popular trails and destinations are overused and require rehabilitation to meet Wilderness standards. However, rehabilitation efforts are usually costly and temporary. Reducing or eliminating use is usually required to be successful.

Signing in Wilderness is limited by intent, and may be further limited to the point of ineffectiveness by theft and vandalism or neglect due to limited budgets. Focus on ensuring that signing is sufficient to meet management intent.

Horse use

Horse use appears to be increasing. Since Wilderness use is of concern, and horses impose a greater impact on Wilderness trails and campsites, the emphasis is on creating new non-Wilderness trails and smaller, rustic horse camps that contribute minimally, or not at all, to increased use of Wilderness resources. Any new trails created for horse use should allow use by horse and hikers only.

2. Transportation System

Current areas of concern from a road maintenance standpoint are primarily centered around the log stringer bridges which provide access to Road 2300304, the Road 2322 system and the Road 2325 system. The typical log stringer bridge has a functional life expectancy of 20 to 25 years. The exact age of the bridge on Road 2300304 is unknown but it is in existence in photos from 1973. The bridge on Road 2322 was built in 1976 and the bridge on Road 2325 was built in 1973. At the present date the bridges on Roads 2300304 and 2322 have deteriorated to the extent that these roads have been closed to vehicular traffic. The bridge on Road 2325 has not had a recent evaluation on it's structural limitations but it is anticipated that this bridge will need to be closed to vehicular traffic within a very few years. There is currently no money available to replace these bridges.

In the second half of the 1990s several storm events occurred. The primary event occurred in February 1996. Money which became available to repair these damage areas has permitted a variety of completed and ongoing projects. These projects include but are not limited to road decommissioning, upgrading existing drainage structures, removing potentially unstable road fills, constructing low maintenance drainage devices such as drain dips and waterbars. This type of work has occurred on a relatively small portion of the roads existing within the analysis area but in the future these would be the types of roadwork that could be anticipated to happen given available funds for upgrades.

Chapter 5 - Sixth-field Watershed Evaluations

In the ensuing tables, each sixth-field watershed is evaluated in terms of meeting the nine Aquatic Conservation Strategy (ACS) objectives and additional management objective relating to the upland conditions. A brief description of each of the objectives follows, with an explanation of the evaluation criteria that were used to assign the various ratings. ACS objectives are presented as they appear in the *Northwest Forest Plan* (USDA, USDI 1994).

A. WATER RESOURCES

1. Watershed Riparian Evaluation

Aquatic Conservation Strategy objectives:

1. **"Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted." (ROD, page B-11)**

   Evaluation Criteria - Compare historic/reference and current conditions, examine aquatic features such as perennial streams, intermittent streams, wetlands, lakes and ponds. Note: We interpret this ACS objective to refer to the continued physical existence of the variety of aquatic features from historic or reference times to the present. It does not address the quality of aquatic conditions, as these are addressed in the other ACS objectives.

   Assumptions - The overall drainage networks have increased due to roading - roads intercept groundwater which increases the network of channels carrying water. New intermittent and ephemeral streams exist as road cross drains cause water to flow where channels previously did not exist.

   The following ratings were used:

   Good: Watershed conditions display a natural and relatively undisturbed drainage system.

   Fair: Watershed conditions display moderate human disturbance, with some road-caused interference of drainage patterns.

   Poor: Greater than 10% stream drainage increase from historic conditions.

2. **"Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species." (ROD, page B-11)**

Evaluation Criteria - Compare historic/reference and current conditions, examine spatial and temporal connectivity of aquatic and riparian systems. Note: The basis of this evaluation was on *hydrologic* connectivity; *riparian* connectivity is addressed in ACS # 8.

The following ratings were used:

Good: Roads cause no blockages or culvert obstructions, and no dams.

Fair: Roading along the floodplain. Some wetlands/floodplains are disconnected.

Poor: Subsurface flow, impassable culverts.

Assumptions: Human and natural features which influence hydrologic connections include hydroelectric facilities (or other stream flow diversions), road crossings of streams (primarily used to address barriers to fish migration, and does not account for possible barriers for other aquatic species because of data gaps), roads built along floodplains and wetlands, sediment deposits instream (gravel bars) or flow routed subsurface.

3. "Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations." (ROD, page B-11)

Evaluation Criteria - Compare historic/reference and current conditions, examine the physical integrity of the following aquatic systems: a) shorelines (lakes and ponds); b) stream banks - includes observations regarding channel widening, channel migration, and occurrence of large woody debris (LWD) as it relates to pool formation and stream bank cutting; c) stream bottom configurations; and d) condition of upper banks and inner stream gorges of deeply incised streams.

The following ratings were used:

Good: Shorelines of lakes and ponds, streambanks, channel conditions, channel migration, observed LWD concentrations, stream channel configuration, upper bank and inner gorge conditions resemble natural (historic) conditions.

Fair: Shorelines of lakes and ponds display moderate increases in erosion due to management influences. Moderate alterations in streambank and channel conditions, channel migration, stream channel configuration, upper bank and inner gorge areas when compared to historic conditions.

Poor: Shorelines of lakes and ponds display numerous signs of increased erosion due to management influences. **A**lterations in streambank and channel conditions, channel migration, stream bottom configuration, upper bank and inner gorge areas do not compare to historic conditions.

4. **"Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities." (ROD, page B-11)**

   Evaluation Criteria - Compare historic/reference and current conditions, examine water quality of aquatic, riparian, and wetland ecosystems:

   The following ratings were used:

   Good: Peak summer stream temperatures less than 14 degrees Celsius (^{o}C) and no known sources of contamination and pH and conductivity within expected ranges.

   Fair: Peak summer stream temperatures of 14.1°C to 15.9°C and no known sources of contamination and pH and conductivity within expected ranges.

   Poor: Peak summer stream temperatures greater than the Washington standard of 16°C and/or known sources of contamination and/or pH and conductivity outside of expected ranges.

5. **"Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport." (ROD, page B-11)**

   Evaluation Criteria - Compare historic/reference and current conditions, examine elements of the sediment regime (input, storage, and transport) including: timing, volume, rate, and character of sediment.

   Assumptions - Erosion from roads delivers fine sediment to streams. Sediment delivered to streams from mass wasting is both fine and coarse.

   The following ratings were used:

   Good: The timing, volume, and rate of sediment delivery to streams is similar to historic conditions. Spawning areas for fish are not impaired by fine-grained material.

   Fair: The timing, volume, and rate of sediment delivery to streams has been moderately altered throughout the watershed as a result of management activities. Some spawning areas for fish show are slightly to moderately impaired by an excess of fine-grained material.

   Poor: The timing, volume, and rate of sediment delivery to streams has been severely altered throughout the watershed as a result of management activities. Spawning areas for fish are being impaired by an excess of fine-grained material

6. **"Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected." (ROD, page B-11)**

   Evaluation Criteria - Compare reference and current conditions, examine the ability of in-stream flows to create and sustain riparian, aquatic, and wetland habitats by looking at timing, magnitude, duration, and spatial distribution.

   The following ratings were used:

   Good: Hydrologic maturity of greater than 85% and Drainage Extension (from roads) is less than 1.0 percent. Hydrologic maturity is defined as when trees reach a DBH of 8 inches.

   Fair: Hydrologic maturity of 71 to 84 percent. Drainage extension greater than 1.0 percent.

   Poor: Hydrologic maturity of less than 71 percent. Drainage extension greater than 5 percent.

7. **"Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands." (ROD, page B-11)**

   Evaluation Criteria - Compare historic/reference and current conditions, examine floodplain inundation and the elevation of water tables in meadows and wetlands. All evaluations presented in the following tables are based on observation factors such as roading along floodplains or near wetlands. Road density in Riparian Reserves is the only quantitative data that exists for this topic.

   Assumptions - The majority of inventoried wetlands are associated with either high ridges and talus slopes or floodplains adjacent to streams. The majority of wetlands under the forest canopy are not inventoried. The floodplain area considered for stream channels is the area located in the two-year peak flow riparian zone.

   The following ratings were used:

   Good: Predominately Natural and undisturbed floodplain and wetland conditions. No roads in the floodplain.

   Fair: Moderate disturbance to wetlands, water tables, and channel conditions as a result of management activities. Floodplain may or may not contain roads.

   Poor: Moderate to high disturbance of wetlands, water tables, and channel conditions as a result of management activities. Floodplain contains roads, and roads cross streams.

8. **"Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter**

thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability." (ROD, page B-11)

Evaluation Criteria - Compare historic/reference and current conditions, and examine the composition and structural diversity of plant communities in riparian areas, looking specifically for functions regarding the following:

a. thermal regulation (summer and winter)
b. nutrient filtering
c. rate of surface and bank erosion and channel migration
d. amount and distribution of coarse woody debris
e. structural diversity of forest in the riparian zone

Assumptions - Because we don't have specific data to address each of the functions (a. through e.) above, we are using forest vegetation structure to act as a surrogate for these functions. Large tree forest generally provides all of the above functions (a. through e.). Small tree forest generally provides functions a, b, and c. Grass/pole forest has the potential to provide functions a and b, though to a lesser degree than the other forest structural stages. Exceptions to the above will be described in the rationale column of the individual sixth-field evaluations. For a description of the physical characteristics used to define large tree, small tree, and grass/pole forest structure, see Chapter 3, Forest Vegetation - Vegetation Structural Stages.

The following ratings were used:

Good: The Riparian Reserves are dominated by connected large tree forest, or by some combination of large and small tree forest.

Fair: The Riparian Reserves contain a varied combination of large tree, small tree, and grass/pole forest.

Poor: The Riparian Reserves are dominated by grass/pole forest, or by some combination of grass/pole and small tree forest. Large tree forest may exist in small isolated stands.

9. "Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species." (ROD, page B-11)

Evaluation Criteria - Assess current conditions and examine the ability of the area to support well-distributed populations of native plants, invertebrates, and vertebrate riparian-dependent species by reviewing the following conditions:

a. forested riparian habitat connectivity
b. percent and distribution of small and large tree habitat in Riparian Reserves
c. riparian-dependent species presence (plants and animals)

Note: Data on species occurrence and populations in riparian areas is non-existent in this watershed.

The following ratings were used:

Good: Riparian Reserves that are dominated by connected large tree forest, or by some combination of large and small tree forest. Grass/pole forest and/or non-forest disruptions in the connectivity would be very small and would not represent a dispersal barrier for less mobile species.

Fair: Riparian reserves that possess a varied combination of large tree, small tree, and grass/pole forest. Large and small tree forest do not provide consistent connectivity throughout the sixth-field. Patches of non-forest habitat resulting from management activities may also represent a dispersal barrier for less mobile species.

Poor: Riparian Reserves that are dominated by grass/pole forest, or by some combination of grass/pole and small tree forest. Large tree forest may exist in small isolated stands. Patches of non-forest habitat resulting from management activities may also represent a dispersal barrier for less mobile species.

Ratings Confidence

The evaluation ratings are assigned a level of confidence for accuracy according to the following scale:

High: High confidence that the assigned rating is accurate. That confidence is based on data gathered from recent exams, surveys, and/or personal on-the-ground knowledge. Data directly pertains to the condition being evaluated.

Moderate: Moderate confidence that the assigned rating is accurate. That confidence is based on data gathered from a combination of exams, surveys, personal on-the-ground knowledge, aerial photograph interpretation, and/or professional judgement. Data collected in stand exams and surveys may not be recent.

Low: Low confidence that the assigned rating is accurate. Lack of field data or data that pertains directly to the condition being evaluated.

B. BIOLOGICAL RESOURCES

1. Watershed Upland Evaluation

a. Late-Successional Habitat Condition

Evaluation Criteria - Assess and examine the current condition of late-successional habitats with respect to amount, distribution and condition. The following criteria will be used:

a. fragmentation/connectivity of late-successional forest habitat
b. amount and condition of late-successional forest habitat

The following ratings were used:

Good: Late-successional habitat occurs in larger patches of interior forest habitat, and is well –connected to other patches of LS forest. Organisms oriented to LS forest can both breed and travel/disperse in the the area with few problems.

Fair: Late-succesional forest occurs in moderate-sized patches of interior forest habitat, and connectivity although of concern on a localized basis, is still possible. Organisms oriented to LS forest can both breed and travel/disperse the area, although at reduced levels due to some local "problem areas."

Poor: Late-successional forest occurs in small, isolated patches and interior forest habitat is rare or occurs in very small patches. Connectivity is a concern due to the disjunct nature of the LS forest patches, and organisms oriented to LS forest have minimal opportunities for both breeding and travel/dispersal in the area.

b. Plant and Animal Distributions and Abundance

Evaluation Criteria - Assess and examine the current road network with respect to road type (primary, secondary, local) and use (open, closed, restricted). The following criteria will be used:

a. Total road density
b. Open road density

The following ratings were used:

Good: Native plant and animal species are well-distributed and occur at "natural" levels in the existing habitat base.

Fair: Native plant and animal species are moderately well-distributed, and/or occur at lower than "natural" levels due to localized areas of non-native species invasion, high road densities, or other factors that have resulted in displacement of native species form some sites.

Poor: Native plant and animal species are not well-distributed and/or face obstacles to natural abundance levels due to either invasion of non-native species, high road densities, or other factors which have resulted in substantial displacement of native species from the area.

c. Susceptibility to Large-Scale Disturbance

Evaluation Criteria - Assess and examine the current condition of the stands in the watershed with respect to the risk of large-scale disturbances that might result from fire, windthrow, insects or disease. The following criteria will be used:

a. Fire and windthrow risk.
b. Insect and disease risk.

The following ratings were used:

Good: The majority of the 6th field has a medium or lower risk of a stand replacing crown fire, contigous areas of stands having a moderate or severe risk of fire and windthrow don't exist. Insect infestations are at low levels and disease is of low severity over the majority of the watershed

Fair: There may be large numbers of stands with a medium or high-medium risk of fire and windtrow but they are not contiguous. Insect infestations are at moderate levels and disease is of moderate severity or lower over the majority of the watershed.

Poor: The majority of the 6th field contains stands with a high-medium or severe risk of fire or windthrow. There area large, contiguous areas of these stands with high risk. Insect infestations are at high levels and disease is of high severity over the majority of the watershed.

Ratings Confidence

The evaluation ratings are assigned a level of confidence for accuracy according to the following scale:

High: High confidence that the assigned rating is accurate. That confidence is based on data gathered from recent exams, surveys, and/or personal on-the-ground knowledge. Data directly pertains to the condition being evaluated.

Moderate: Moderate confidence that the assigned rating is accurate. That confidence is based on data gathered from a combination of exams, surveys, personal on-the-ground knowledge, aerial photograph interpretation, and/or professional judgement. Data collected in stand exams and surveys may not be recent.

Low: Low confidence that the assigned rating is accurate. Lack of field data or data that pertains directly to the condition being evaluated.

Table 5-1: Watershed Evaluations - Sixth-field 01 – Cispus River Headwaters

Management Objectives	Rating	Confidence	Rationale
Riparian Conditions			
1) Existence of aquatic features at landscape scale	Good	High	Mostly Wilderness, near natural conditions
2) Connectivity between watersheds	Good	High	Mostly Wilderness, near natural conditions
3) Integrity of aquatic systems	Good	High	Mostly Wilderness, near natural conditions
4) Water quality for healthy ecosystems	Good	High	Mostly Wilderness, near natural conditions
5) Appropriate sediment regime	Good	Moderate	Mostly Wilderness, near natural conditions
6) In stream flow	Good	High	Mostly Wilderness, near natural conditions
7) Floodplain function	Good	High	Mostly Wilderness, near natural conditions
8) Structural diversity of plant communities in Riparian Reserves	Good	High	Mostly Wilderness, near natural conditions
9) Habitat to support well-distributed populations of riparian species	Good	High	Mostly Wilderness, near natural conditions
Upland Conditions			
1) Late-successional habitat condition	Good	High	Mostly Wilderness, near natural conditions
2 Plants and Animal Distibution/Abundance	Good	High	Mostly Wilderness, near natural conditions
3) Resistance to large-scale disturbances	Data missing	N/A	Low risk for insect and disease, no data for fire and windthrow.

Table 5-2: Watershed Evaluations - Sixth-field 02 – Walupt Creek

Management Objectives	Rating	Confidence	Rationale
Riparian Conditions			
1) Existence of aquatic features at landscape scale	Good	High	Mostly Wilderness, near natural conditions Drainage Extension: 0.2%
2) Connectivity between watersheds	Good	High	Mostly Wilderness, near natural conditions Mid or Late Seral Stands: 99%
3) Integrity of aquatic systems	Good	Moderate	Mostly Wilderness, near natural conditions
4) Water quality for healthy ecosystems	Good	High	Mostly Wilderness, near natural conditions
5) Appropriate sediment regime	Good	Moderate	Mostly Wilderness, near natural conditions
6) In stream flow	Good	High	Mostly Wilderness, near natural conditions
7) Floodplain function	Good	High	Mostly Wilderness, near natural conditions
8) Structural diversity of plant communities in Riparian Reserves	Good	High	Mostly Wilderness, near natural conditions
9) Habitat to support well-distributed populations of riparian species	Good	High	Mostly Wilderness, near natural conditions
Upland Conditions			
1) Late-successional habitat condition	Good	High	Mostly Wilderness, near natural conditions
2 Plants and Animal Distibution/Abundance	Good	High	Mostly Wilderness, near natural conditions
3) Resistance to large-scale disturbances	Poor	Moderate	High levels of western spruce budworm causing growth loss and top kill, no data for fire and windthrow

Table 5-3: Watershed Evaluations - Sixth-field 03 – Cispus River - Chambers Creek

Management Objectives	Rating	Confidence	Rationale
Riparian Conditions			
1) Existence of aquatic features at landscape scale	Fair	High	Perennial Streams: No change Intermittent Streams: Some changes due to roads. Wetlands: No change. Lakes and Ponds: No change. Drainage Network Extension: 5.0%
2) Connectivity between watersheds	Fair	High	Connection To Anadromous: N/A Physical Barriers: 3 culverts are migration barriers, and 3 other culverts need further evaluation. Mid and Late Seral Stands: 85%
3) Integrity of aquatic systems	Fair	Moderate	Pool Frequency: Lower than expected. Woody Debris: lower than expected. Width/Depth: Moderate increases in Cispus R. and some tributaries.
4) Water quality for healthy ecosystems	Fair	High	Temperature: Cispus River and Chambers Cr. peak at 15-16^{o} C in the summer. Other: No known sources of contaminants. PH and conductivity within expected ranges.
5) Appropriate sediment regime	Fair	Moderate	Spawning Gravel: Impaired at some locations due to fine sediment. Cobble Embeddedness: Elevated from desired conditions.
6) In stream flow	Fair	Moderate	Hydrologic maturity: 76.1% Drainage Network Extension: 5.0% Riparian road density: 14.7 mi./mi.^{2}
7) Floodplain function	Good	Moderate	Floodplain relatively undisturbed - few roads in the floodplain.
8) Structural diversity of plant communities in Riparian Reserves	Fair	Moderate	Mid and late-Seral Stands: 85%
9) Habitat to support well-distributed populations of riparian species	Fair	Moderate	Some reduced connectivity due to large meadows along Cispus River and harvest areas along Midway, Chambers and Wesley Creeks.
Upland Conditions			
1) Late-successional habitat condition	Poor	High	All large tree interior patches are small and disconnected.
2 Plants and Animal Distibution/Abundance	Fair	Moderate	High road and trail density.
3) Resistance to large-scale disturbances	Good	Low	Moderate levels of spruce budworm acitivity. Good diversity of age and size classes to break up large scale disturbances.

Table 5-4: Watershed Evaluations - Sixth-field 04 – Cispus Muddy Fork

Management Objectives	Rating	Confidence	Rationale
Riparian Conditions			
1) Existence of aquatic features at landscape scale	Good	High	Perennial Streams: No change Intermittent Streams: Little change Wetlands: No change Lakes and Ponds: No change Drainage Network : 0.6%
2) Connectivity between watersheds	Good	Moderate	Connection To Anadromous: N/A Barriers: Several culverts need further evaluation.
3) Integrity of aquatic systems	Good	Low	Little management activity within watershed.
4) Water quality for healthy ecosystems	Good	High	Temperature: <10^{o} C. in Muddy Fork. Other: No known sources of contaminants. PH and conductivity within expected ranges.
5) Appropriate sediment regime	Good	Moderate	Little management activity within watershed
6) In stream flow	Good	Moderate	Little management activity within watershed, natural stands nearing hydrologic maturity, much of watershed above rain-on-snow zone.
7) Floodplain function	Good	High	Few roads in Riparian Reserves, almost none in floodplains
8) Structural diversity of plant communities in Riparian Reserves	Fair	Moderate	Mid and Late-Seral Stands: 62%
9) Habitat to support well-distributed populations of riparian species	Fair	Moderate	Connectivity gaps due to fire history.
Upland Conditions			
1) Late-successional habitat condition	Poor	High	Lack of LS due to fire history.
2 Plants and Animal Distibution/Abundance	Good	High	Mostly wilderness, near natural conditions
3) Resistance to large-scale disturbances	Fair	Low	Spruce budworm damage is light but extensive, fire and windthrow risk missing for 75% of watershed

Table 5-5: Watershed Evaluations - Sixth-field 05 – Cispus River - Cat Creek

Management Objectives	Rating	Confidence	Rationale
Riparian Conditions			
1) Existence of aquatic features at landscape scale	Fair	High	Perennial Streams: No change. Intermittent Streams: Some changes. Wetlands: No changes. Lakes and Ponds: No changes. Road Density: 1.4 mi./mi.^{2}
2) Connectivity between watersheds	Fair	Moderate	Connection to anadromous: N/A Barriers: Several culverts may be barriers to fish passage at high flows.
3) Integrity of aquatic systems	Fair	Moderate.	Pool Frequency: Smaller in size than expected in Cispus River. Woody Debris: Less than expected. Width/Depth: Generally OK.
4) Water quality for healthy ecosystems	Good	High	Temperature: Less than 14.0^{o}C. Other: No known sources of contaminants. PH and conductivity within expected ranges.
5) Appropriate sediment regime	Fair	Moderate	Spawning Gravel: Excess fine-grained material in the spawning gravel of a few streams.
6) In stream flow	Fair	Moderate	Hydrologic maturity: 78.5% Drainage network extension: 6% Riparian road density: 21.81 mi./mi.^{2}
7) Floodplain function	Fair	High.	Road Density in RR: 21.81 mi./mi.^{2} Other Development in RR: Road 78 is within 75 feet of stream for approx. 2 miles.
8) Structural diversity of plant communities in Riparian Reserves	Fair	High	18% of Riparian Reserves in early successional, primarily in Cat and Mouse creeks. Approx. 2 miles of Road 78 are adjacent to Cat Creek.
9) Habitat to support well-distributed populations of riparian species	Fair	Moderate	Same as #8 above.
Upland Conditions			
1) Late-successional habitat condition	Fair	Moderate	Some moderate sized patches of LS habitat connected by small tree habitat.
2 Plants and Animal Distibution/Abundance	Fair	Moderate	Main arterial Roads 21 and 23 may provide vectors for introduced species.
3) Resistance to large-scale disturbances	Fair	Low	Moderate amount of insect activity with high disease severity, much high-medium and severe fire and windthrow risk but areas are not contiguous.

Table 5-6: Watershed Evaluations - Sixth-field 06 – Adams Fork

Management Objectives	Rating	Confidence	Rationale
Riparian Conditions			
1) Existence of aquatic features at landscape scale	Good	Moderate	Perennial Streams: No change. Intermittent Streams: No change. Wetlands: No change. Lakes and Ponds: No change. Road Density: 0.31 mi./mi.^{2}
2) Connectivity between watersheds	Fair	High	Connection To Anadromous: N/A Barriers: Fish pasage on Killen Creek blocked by road.
3) Integrity of aquatic systems	Fair	Moderate	Pool Frequency: Lower than expected. Woody Debris: Lower than expected. Width/Depth: OK.
4) Water quality for healthy ecosystems	Good	High	Temperature: Less than 9.0^{o}C Other: No known sources of contaminants. PH and conductivity within expected ranges.
5) Appropriate sediment regime	Poor	Moderate	Spawning Gravel: High level of embeddedness and silt.
6) In stream flow	Good	Moderate	Hydrologic maturity: 87.6% Drainage extension: 1.0%
7) Floodplain function	Good	Moderate	Road Density in RR: 8.41 mi./mi.^{2} Other: There is only one road near a stream, and it is outside of the floodplain.
8) Structural diversity of plant communities in Riparian Reserves	Fair	Moderate	15% in early successional, mostly due to fires.
9) Habitat to support well-distributed populations of riparian species	Fair	Moderate	Habitat quality reduced at higher elevations due to poor site and fire history.
Upland Conditions			
1) Late-successional habitat condition	Good	High	Large patch of LS interior habitat in N, 50% in Wilderness, near natural conditions.
2 Plants and Animal Distibution/Abundance	Good	High	Low road density, mostly Wilderness.
3) Resistance to large-scale disturbances	Good	Low	Moderate insect activity, light damage; low fire and windthrow risk.

Table 5-7: Watershed Evaluations - Sixth-field 07 – East Canyon Creek

Management Objectives	Rating	Confidence	Rationale
Riparian Conditions			
1) Existence of aquatic features at landscape scale	Fair	Moderate	Perennial Streams: Some changes. Intermittent Streams: Some changes. Wetlands: No changes. Lakes and Ponds: Shoreline of Takhlakh Lake has been altered. Road Density: 1.05 mi./mi.^{2}
2) Connectivity between watersheds	Fair	Moderate	Connection To Anadromous: N/A Barriers: One culvert may be a barrier to fish passage.
3) Integrity of aquatic systems	Fair	Moderate	Pool Frequency: Lower than expected. Woody Debris: Less than expected. Width/Depth: Greater than expected in sections of East Canyon Creek.
4) Water quality for healthy ecosystems	Poor	High	Temperature: >16^{o}C. Other: No known sources of contaminants. PH and conductivity within expected ranges.
5) Appropriate sediment regime	Fair	Low	Spawning gravel: Somewhat embedded.
6) In stream flow	Fair	Moderate	Hydrologic maturity: 85.3% Drainage extension: 4.3%
7) Floodplain function	Fair	Moderate	Road Density in RR: 14.94 mi./mi.^{2} Other Development in RR: Road 23 is next to East Canyon Creek for two miles.
8) Structural diversity of plant communities in Riparian Reserves	Fair	High	17% early successional, about 2 miles of Road 23 is adjacent to East Canyon Creek.
9) Habitat to support well-distributed populations of riparian species	Fair	High	Road 23 adjacent to East Canyon Creek for 2 miles.
Upland Conditions			
1) Late-successional habitat condition	Fair	Moderate	Scattered medium-sized patches of interior LS habitat.
2 Plants and Animal Distibution/Abundance	Fair	Moderate	Moderate road density.
3) Resistance to large-scale disturbances	Good	Low	Light insect activity, moderate root disease severity, low risk of fire and windthrow.

Comments:

ACS #8: See Map 32, Current Vegetation Structure in Riparian Reserves.

LS Habitat: See Map 14, Current (2001) Vegetation Structure.

Table 5-8: Watershed Evaluations - Sixth-field 08 – Cispus River - Blue Lake

Management Objectives	Rating	Confidence	Rationale
Riparian Conditions			
1) Existence of aquatic features at landscape scale	Fair.	Moderate.	Perennial Streams: Some changes. Intermittent Streams: Some changes. Wetlands: No change. Lakes and Ponds: No change. Road Density: 0.87 mi./mi.^{2}
2) Connectivity between watersheds	Fair	High	Connection To Anadromous: Two culverts block fish passage.
3) Integrity of aquatic systems	Poor	Moderate	Pool Frequency: Much lower than expected. Woody Debris: Lower than expected. Width/Depth Ratio: Generally OK.
4) Water quality for healthy ecosystems	Fair	High	Temperature: Approaches 16.0^{o}C in the Cispus River. Other: No known sources of contaminants. PH and conductivity within expected ranges.
5) Appropriate sediment regime	Fair	Moderate	Excess of fine-grained material in some spawning areas.
6) In stream flow	Fair	Moderate	Hydrologic recovery: 81.1% Drainage extension: 4.9%
7) Floodplain function	Good	High	Roads within riparian reserves are outside of the floodplain. No crossing of Cispus River by roads.
8) Structural diversity of plant communities in Riparian Reserves	Fair	Moderate	Mostly mid-successional stands in Riparian Reserves due to fires. Cispus River lacks shade and woody debris.
9) Habitat to support well-distributed populations of riparian species	Fair	High	Good connectivity, but mostly mid-successional stands due to fires.
Upland Conditions			
1) Late-successional habitat condition	Poor	High	Scattered small patches of LS interior habitat.
2 Plants and Animal Distibution/Abundance	Fair	Moderate	Low road density, but motorized trails and primary Road 23 in area.
3) Resistance to large-scale disturbances	Fair	Low	Moderate Douglas fir bark beetle activity, high root disease severity, high fire and windthrow risk in east half.

Table 5-9: Watershed Evaluations - Sixth-field 09 – North Fork Cispus River

Management Objectives	Rating	Confidence	Rationale
Riparian Conditions			
1) Existence of aquatic features at landscape scale	Fair	Moderate	Perennial Streams: Some changes. Intermittent Streams: Some changes. Wetlands: No changes. Lakes and Ponds: No changes. Road Density: 1.26 mi./mi.^{2}
2) Connectivity between watersheds	Poor	High	Connection To Anadromous: Several culverts block fish passage.
3) Integrity of aquatic systems	Fair	Moderate	Pool Frequency: Much lower than expected. Woody Debris: Lower than expected. Width/Depth Ratio: Slightly higher than expected.
4) Water quality for healthy ecosystems	Fair	High	Temperature: Approaches 16.0^{o}C. Other: No known sources of contaminants. PH and conductivity within expected ranges.
5) Appropriate sediment regime	Fair	Moderate	Spawning habitat is being impaired as a result of an excess of fine-grained material.
6) In stream flow	Fair	Moderate	Hydrologic maturity: 70.1% Drainage extension: 5.7%
7) Floodplain function	Fair	Moderate	Road Density in RR: 17.80 mi./mi.^{2,} but most roads in riparian reserves are outside of the floodplain.
8) Structural diversity of plant communities in Riparian Reserves	Fair	High	Timonium Creek and upstream, and headwaters are fragmented by early successional stands. Lower portions of North Fork are well-connected.
9) Habitat to support well-distributed populations of riparian species	Fair	High	Large amounts of LS habitat but fragmented.
Upland Conditions			
1) Late-successional habitat condition	Good	High	Largest interior LS Western hemlock patch in Upper Cispus WS is located in northern half of sub-watershed.
2 Plants and Animal Distibution/Abundance	Fair	Moderate	High road density, but some unroaded areas, some invasive species along main roads.
3) Resistance to large-scale disturbances	Fair	Low	Light to moderate insect acitivity, moderate root disease severity, high fire and windthrow risk in west half.

C. PHYSICAL RESOURCES

None

D. SOCIAL AND ECONOMIC RESOURCES

None

Chapter 6 - Management Recommendations

Introduction

The purpose of this chapter is to identify those management activities which will contribute to closing the gap between the present condition and the desired future condition of this watershed. All proposed activities will be consistent with management direction from the *Gifford Pinchot Land and Resource Management Plan*, as amended by the *Northwest Forest Plan*.

In order to best recommend the appropriate management activities that will close the gap between the present condition and the desired future condition of this watershed, we first need a picture of that desired future condition. Management direction from the Forest Plan plays a major role in defining this condition. Historic/reference and current conditions for various resources of the watershed were described in Chapter 3. The historic condition, although valuable for a reference, is not the goal for the future condition in most instances. While we may desire to restore certain portions or elements of the watershed to conditions similar to those that existed in historic times, the entire watershed will not reflect historic conditions.

Recommendations are provided at both the fifth-field watershed scale spanning the entire Upper Cispus River watershed and at the sixth-field scale. This will help avoid duplication of broad recommendations when listing specific recommendations at the sixth-field scale.

The following is a description of the desired future condition for the Upper Cispus watershed.

A. MANAGEMENT DIRECTION

1. Desired Future Condition (Vegetation)

Management direction from the Forest Plan consists of overall forest direction and more site-specific direction associated with designated land allocations. There are six broad categories of land allocations that define the desired course for vegetation development in the Upper Cispus watershed: Adaptive Management Area, Administratively Withdrawn Areas, Congressionally Reserved Areas, Late-Successional Reserves, Riparian Reserves, and Matrix.

a. Adaptive Management Area

Cispus AMA Guide and Landscape Design

A key part of the shared vision for the future of the Cispus AMA is contained in the Landscape Analysis and Design, or Cispus LAD. The Cispus LAD is part of the Cispus AMA Guide, a set of recommendations for managing the AMA. It is a technique to graphically represent a long-term vision of landscape level planning. The LAD was developed by and incorporates the shared vision of many participants, including the public, Forest Service, Fish and Wildlife Service and others. It was extended into the Southwest Washington Province through collaboration with the Provincial Interagency Executive Committee.

The landscape design utilizes landscape design units to provide graphic descriptions, functions, and management strategies for various resource areas. It is intended to be in harmony with existing policies and direction, including the Northwest Forest Plan and the Gifford Pinchot Forest Plan. It provides recommendations for how to implement the Standards and Guidelines of the Forest Plans.

The six types of landscape design units in the Cispus LAD are Old Growth and Riparian Reserves, Managed Habitat, Habitat Development, Managed Mosaic, Natural Mosaic, and Lodgepole. A brief description of each unit follows. For the location of the various design units within the Upper Cispus Watershed, see Map 38, Cispus AMA Landscape Analysis and Design. For more detailed descriptions and further information, see the Cispus AMA Guide.

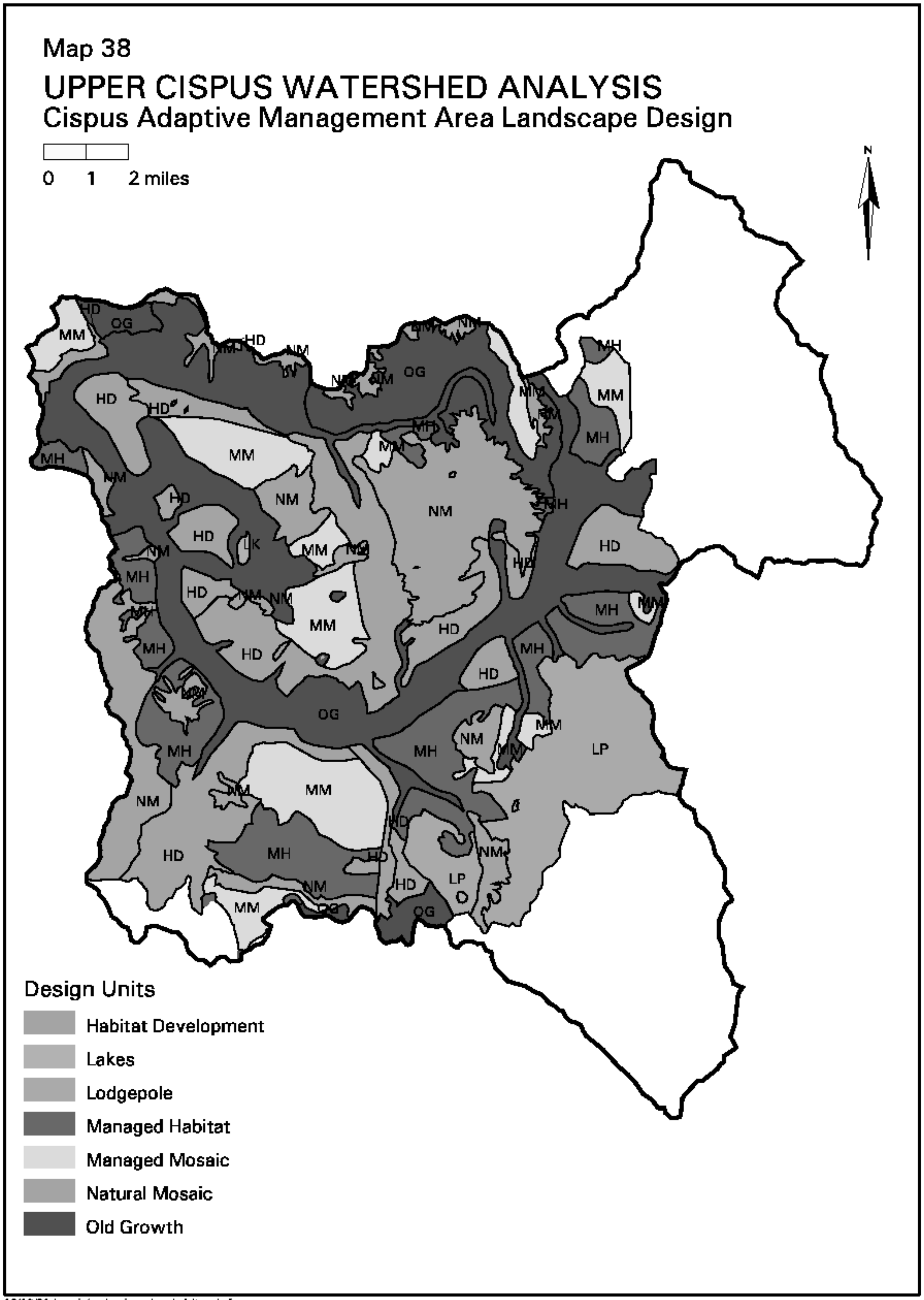
Old Growth and Riparian Reserves

The desired future condition of areas designated as Old Growth or Riparian Reserves is characterized by the presence of old and typically large diameter trees. Stands are 170 years old, or more, with average diameters of 30 inches or greater. The trees provide a variety of habitats whether alive or dead, standing or fallen, on the ground, or in streams. Important structural elements include snags and living trees, coarse woody debris, down logs in various states of decay, patches or shrubs, and deep canopy layers. Canopy gaps and small openings throughout the stand also provide for structural diversity. In low lying areas, tree species such as Douglas fir, western hemlock, western redcedar, and grand fir are found.

Riparian Reserves include areas within or adjacent to streams, lakes, ponds and wetlands, and areas considered to be unstable or potentially unstable. They are critical to providing habitat for riparian-dependent species, travel and dispersal corridors for many animals and plants, and connectivity within watersheds. Riparian vegetation moderates high stream flows by decreasing water velocity, enhancing the deposition of fine sediments and organic debris, and providing shade to moderate water temperatures. Tree-dominated riparian plant communities are a source of large wood, essential for creation of structural habitat for aquatic organisms. The wildlife habitat provided by riparian vegetation also influences terrestrial animal diversity. See also the management direction from the Northwest Forest Plan relating to Riparian Reserves, following this section.

Managed Habitat and Habitat Development

The desired future condition of areas designated as Managed Habitat is characterized by a mix of young, middle-aged, and older forest stands. Tree species vary throughout a range of elevation bands. As a result, scenery may change frequently as one moves though these areas. Small openings may be created though activities such as timber harvests and habitat enhancement projects, or naturally occurring openings such as old landslides, rocky outcrops, and meadows. With its diversity of stand structures, Managed Habitat provides for both small, open forage areas (such as young stands favored by deer, elk and mountain goats), dispersal habitat and cover within the older,



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more dense stands. Late-successional stands would be maintained within riparian reserves in Managed Habitat to provide riparian protection as well as travel corridors for late-successional dependent species.

The desired future condition of areas designated as Habitat Development are similar to the character and management objectives of Managed Habitat. A range of elevations results in a variety of forest types, habitat, and recreational opportunities. However, harvest openings are generally smaller in size than in Managed Habitat, intended to mimic small, naturally occurring openings. This design unit places additional emphasis on the restoration, maintenance, and connectivity of late-successional forest. An active thinning regime may be used to develop structural features characteristic of older forest types. Silvicultural treatments could include manipulation of the distribution and abundance of coarse woody debris, down logs and snags, and the creation for habitat of cavity-dependent species.

Managed Mosaic

Compared to other landscape units, Managed Mosaic is subject to more human activity and vegetation alteration on a landscape scale. These areas include an abundance of early and mid-successional stands, with fast growing young trees. The patterns of stands with different tree ages reflect the underlying landforms, with old growth remaining in riparian or specially protected areas. Openings may be large scale, depending on other resource objectives for the area. This landscape unit is where harvest activity is most evident, intended to mimic past natural disturbances such as wildfires within the Cispus area. Large areas will be open, attracting animals which prefer early successional habitat. The variety of stand structures creates abundant forage and edge habitat.

Natural Mosaic

The Natural Mosaic design unit is located primarily in high elevation areas dominated by large scale natural openings and scattered forest. The area consists of high-elevation meadows, subalpine parkland, and alpine lakes. Subalpine forests thin out with increasing elevation , due to a short growing season and a snowpack that is deep and slow to melt. The elevation and openness of these areas make for many spectacular views. Changes to vegetation are generally the result of natural processes.

Lodgepole

The Lodgepole landscape unit is characterized by mixed stands of lodgepole pine and mountain hemlock that are the result of frequent wildfires. Containing high elevation lakes and adjacent to the Mt. Adams Wilderness, the Lodgepole area is the site of substantial recreation, mainly in developed sites. Changes to vegetation are generally the result of natural processes

b. Administratively Withdrawn Areas

Administratively Withdrawn Areas within the Upper Cispus watershed consist of three Management Area Categories (MAC's): Scenic River (NA), Developed Recreation (2L), and Administrative Sites (3W). These areas are not managed to provide timber outputs; there is no scheduled timber harvest. Vegetation in these areas (with exception of the Utility Sites and Corridors MAC) is generally the product of natural disturbance and succession. Fire (natural or human caused) is aggressively suppressed during periods of high fire hazard. Vegetation is varied in size, age, and species; ranging from natural openings of young immature trees or herb/shrub species to stands of mature and old-growth trees. Over time, forest stands in these allocations are expected to produce large trees, snags, multiple-layered canopies, and large coarse woody debris on the forest floor. Average tree diameters will exceed 21 inches on the majority of the acres. Trees will be smaller in stands located on less productive sites. Douglas-fir, western hemlock, or Pacific silver fir will be the dominant large trees in most of these stands. The proportion of each species is determined by elevation and aspect. Other associated tree species may include red alder, black cottonwood, western white pine, bigleaf maple, and Pacific yew (at lower elevations); and noble fir, mountain hemlock, subalpine fir, western white pine, and Engelmann spruce (at higher elevations). A relatively high percentage of the area (likely greater than 75%) in most of the MAC's is expected to remain in (or develop into) the large tree structural stage.

c. Congressionally Reserved Areas

Congressionally Reserved Areas consist of only one MAC, Wilderness (WW). The desired condition in Wilderness is the retention of primitive characteristics which are affected primarily by the forces of nature. No human-initiated vegetation management activities are allowed. Naturally-initiated fire may be allowed to burn uncontrolled under very specific conditions. Vegetation is the result of natural disturbance and succession. Desired vegetation conditions are similar to those described above. Large tree stands may be less frequent if fires are allowed to play a larger role in the area. Alpine areas where other vegetation predominates are also included.

d. Late-Successional Reserves

Late-Successional Reserves (LSR's) consist of lands set aside to protect and enhance conditions of late-successional and old-growth ecosystems. Late-Successional Reserves within the Upper Cispus watershed consist of General Late-Successional Reserves (LS), Mountain Goat Winter Range (QL), and Mountain Goat Summer Range (ML). The long-term objective is to provide for the protection of current, and enhance the development of future, late-successional habitat for all species that depend on it. The goal of wildfire suppression is to limit the size of all fires. Regeneration harvest is prohibited, although it may have occurred in the past. Precommercial and commercial thinning may occur in stands up to 80 years of age if the purpose is to benefit the creation and/or maintenance of late-successional forest conditions. Future vegetation will be primarily the result of natural disturbance and succession, except in past harvest plantations or natural stands less than 80 years of age where thinnings will occur. The desired future condition of vegetation in LSR is similar to that described above for Administratively Withdrawn Areas.

e. Riparian Reserves

Riparian Reserves provide an area along all streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis. Riparian Reserves are used to maintain and restore riparian structures and functions of streams, confer benefits to riparian-dependent and associated species other than fish, enhance habitat conservation for organisms that are dependent on the transition zone between upslope and riparian areas, improve travel and dispersal corridors for many terrestrial animals and plants, and provide for greater connectivity of the watershed. Riparian Reserves also serve as connectivity corridors among the Late-Successional Reserves.

f. Matrix

Matrix within the Upper Cispus watershed consists of the following MAC's: General Forest (TS), Deer and Elk Winter Range (ES), Visual Emphasis (VL, VM), Mountain Goat Winter Range (QM, QX), Mountain Goat Summer Range (MM, MX), and Scenic Rivers (NL). These allocations all have some level of scheduled timber harvest based on predetermined rotation ages. The timber harvests will include both thinnings and regeneration harvests. Fire is aggressively suppressed during periods of high fire hazard. As a result, the landscape within these allocations will consist of a mosaic of stands of many different sizes and ages at any one point-in-time. Stand sizes will range from grass/pole to large tree and will vary widely over the landscape, consistent with other resource objectives and limitations. The percent distribution of grass/pole, small tree, and large tree structural stages will vary over time, with each represented. Stand stocking, canopy closure, and structural development across the landscape will vary depending on the MAC and the amount and types of thinning (precommercial and commercial) and regeneration treatments. Structural diversity within stands will be affected by Riparian Reserves, TES/survey and manage species, aggregate retention patches, unthinned patches, and created canopy gaps. The tree species mix will be similar to that described for Administratively Withdrawn Areas. The desired future condition for Matrix land is specified by the MAC of that particular area.

B. WATER RESOURCES

The aquatic component of this analysis is based on data available from state, private, and U.S. Forest Service stream surveys, the current condition, and the ability to meet the Desired Future Condition (DFC) as defined in the National Marine Fisheries Service Matrix of Pathways and Indicators, a U.S. Fish and Wildlife Service document called *A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation*

Watershed Scale, the GP Forest Plan, Amendment 11, and state and federal laws and interpretation of ACS objectives.

The desired future condition of the various physical components of streams is evaluated primarily using NMFS Guidelines. Since 1989, standards such as 80 or more pieces of LWD per mile are considered "good"; 40 - 80 pieces, "moderate"; and < 40 pieces, "poor". Note that these criteria apply only to streams west of the Cascade crest. Large woody debris was defined by the National Marine Fisheries Service (1996) as 24 inches in diameter and at least 50 feet in length. Evaluation of width-to-depth ratios was based on Rosgen's (1994) stream channel classification.

Water temperatures below 16° Celsius and dissolved oxygen standards above 9.5 mg/l for class AA waters are commonly used state standards. The desired future condition for peak flow is to achieve a value of Hydrologic Recovery (also referred to as Aggregrate Recovery Percentage) of greater than 85% as defined in the Gifford Pinchot Cumulative Assessment Report (USDA Forest Service 1988) Other desired future conditions for the aquatic component are to meet the ACS objectives (see Chapter 5 of this document for interpretation of ACS objectives), and to meet NMFS and USFWS matrix values.

Sediment delivery to streams via erosion and mass wasting processes has been, and will continue to be, a natural part of the aquatic system. The rates of sediment delivery varied substantially during natural (pre-management) conditions, with relatively higher rates occurring during times of disturbance such as wildfire, flood, earthquake, and volcanic eruption, and lower rates delivered during "quiet" times between disturbance events. With the advent of intensive forest management during the 1950's, road construction and timber harvest have often contributed to sediment delivery rates many times greater than what occurred under most natural conditions, except perhaps during the more extreme disturbance events. As long as roads exist on steep and rugged slopes within the Upper Cispus River basin, sediment delivery rates will continue to be elevated above the background rate. However, aquatic systems in the basin have experienced many disturbances, and are resilient and adaptable to change. What is desired, is a reduction in the chronic, near-annual rates of sediment delivery, and a reduction in the magnitude of sediment pulses that occur during the increasingly frequent major flood events.

It is desired that stream channel systems and the associated floodplain areas are not blocked as a result of management activities. The desired future condition of Riparian Reserves is continued large tree development.

C. BIOLOGICAL RESOURCES

1. Wildlife and Plants

The desired future condition relative to wildlife and botanical resources is to maintain viable populations of all native and desired non-native species known or suspected to occur within the watershed.

Habitat enhancement projects would be encouraged to maintain a diversity of habitat conditions. Projects may include prescribed or natural fire, meadow restoration, snag creation, increasing the amount of coarse woody debris, and revegetation with native species.

Within Late-Successional Reserves (LSR's), current grass/pole and small tree stands will be silviculturally treated, where appropriate, to develop large tree character at a quicker rate. Some roads within LSR's may be allowed to close naturally or could be mechanically obliterated. Within several decades, these factors would increase the amount of interior forested habitat within LSR's, thereby improving habitat conditions for dependent species, particularly those requiring large home ranges.

Populations of noxious weeds would be mapped and prioritized for treatment to contain and control established infestations. New infestations would have early treatment to contain the spread, and priority would be given to prevent the introduction of new species.

Within the National Forest deer and elk biological winter range (outside LSR's), optimal cover acreage would be at specified levels and well-distributed across the winter range. Forage openings would also be well-distributed and in amounts as specified by current GP Forest Plan guidelines.

In mountain goat ranges, optimal cover acreage would be maintained. In thermal cover stands, innovative commercial thinning approaches could be used to advance succession of stands to an optimal cover condition. Thinning would only be applied if the stands would benefit from a treatment. A fire management plan should be drafted to ensure continued viability of meadows and other goat foraging sites.

Threatened and endangered species surveys would be conducted to monitor population trends and recommend management actions. Special habitat sites would be located and protected where appropriate. The Forest Service would also continue to seek partnerships with individuals, county and state governments, and other federal agencies for species surveys, habitat improvements and general sharing of knowledge.

D. PHYSICAL RESOURCES

None.

E. SOCIAL AND ECONOMIC RESOURCES

1. Human Uses within the Watershed

The desired future condition for lands within the Upper Cispus watershed is to provide a variety of human uses in a variety of vegetation and land form settings.

Road facilities provide access for passenger and high clearance vehicles to a variety of developed and dispersed recreation settings (lakes, streams, trailheads). Where necessary to allow for reliable access, road surface drainage should be improved. Where not needed for vehicular access, roads should be closed and/or converted to trails. Roads to trailheads, dispersed camping areas, and other popular recreation sites should be maintained to meet user needs per recommendations in the District Access and Travel Management Plan.

Winter and summer trails provide access to a variety of destinations and scenery. Trail facilities should be well-maintained for intended users. Trails that are difficult to maintain and that receive light use may be abandoned. Recreation access to areas with semi-primitive and primitive settings will be in greatest demand. These include areas without roads or other evidence of management activities where existing and proposed trails provide access.

Use within designated Wilderness will be managed to provide opportunities for solitude and to minimize physical site impacts. Overnight use adjacent to Wilderness lakes and streams should be managed to protect riparian vegetation and maintain high water quality while providing for reasonable access. Fire should be allowed to burn under certain conditions to encourage natural vegetation patterns.

Vegetative scenery from primary roads in the watershed is varied, and roadside vegetation should be managed to allow for a variety of viewing opportunities into stands. Natural looking stands and vegetative landscape should dominate views from road and trail travel corridors.

F. RECOMMENDATIONS AT THE FIFTH-FIELD WATERSHED LEVEL

Recommendations provided here span the sixth-field subwatersheds and are provided to eliminate the need for duplication within the sixth-field management recommendation tables.

Boundary Changes of Riparian Reserves

This watershed analysis does not identify site-specific, or general changes in Riparian Reserve boundaries. Interim Riparian Reserves, as they are prescribed in the *Northwest Forest Plan*, are recommended based on the evaluation of each sixth-field relative to ACS objectives 1 through 9. Deviation from this course should only occur after thorough review by an interdisciplinary team comprised of a hydrologist, soil scientist, botanist, wildlife biologist, fisheries biologist, and silviculturist. Changes to Riparian Reserve boundaries are not forseen, however any proposed changes should be based on "on-the-ground" reviews, and determining that such a change would not affect maintenance of the Aquatic Conservation Strategy objectives. Any changes to Riparian Reserve boundaries are to be evaluated and documented as part of the NEPA process.

Regeneration Harvest Within Riparian Reserves

Pages C-31 and C-32 of the ROD describe conditions of acceptable regeneration harvest and salvage activities within Riparian Reserves. Recommendations other than those identified in the *Northwest Forest Plan* should be developed through interdisciplinary, site-specific analysis.

Other Silvicultural Activities (Inside and Outside of Riparian Reserves)

Other silvicultural activities (including precommercial thinning, pruning, fertilization, and conifer release) should be reviewed by an interdisciplinary team to develop joint proposals for such activities both inside and outside of Riparian Reserves. Within Riparian Reserves, proposals should be designed to improve aquatic conditions and promote the Aquatic Conservation Strategy objectives.

Recreation

Wilderness

Implement methods to manage and control user impacts in high use areas to meet Wilderness management standards.

Improve enforcement of camping setbacks along streams and lakes. Consider area closures for camping where necessary to meet Wilderness standards and meet watershed objectives.

Limit rehabilitation of dispersed campsites to critical, high payoff sites for which we are willing to commit time, resources, and enforcement to follow through.

Trails

Address backlog maintenance needs with priority on reconstructing and/or relocating trail segments in wet areas and improving and maintaining drainage structures.

Emphasize late-season drainage structure maintenance to prepare for fall/winter/spring surface runoff impacts.

Consider seasonal use restrictions on trails where use, especially stock and/or ORV use, during wet spring and fall seasons creates the majority of adverse impacts.

Dispersed Areas (Concentrated Use Areas)

Continue with ongoing CUA inventory process; expand to include all known dispersed sites as funding and priority allow.

Identify key CUA’s along streams or lakes and monitor water quality above and below site to determine if adverse impacts are occurring as a result of site use.

Based on results of water quality monitoring, harden or close and rehabilitate high priority sites that are preventing accomplishment of ACS objectives.

Increase Recreation patrol activities for site signing, policing, etc.

Install toilets in key CUA’s to improve sanitation conditions for watershed and users, as indicated by volume of use, resource impacts, and funding available for purchase, installation, and O&M of each facility.

Roads

Roads have caused erosion and mass wasting at a number of locations in the watershed. This has increased the amount of sediment delivered to streams above historic conditions, and is a cumulative, long-term problem. The challenge is how best to effectively meet management goals while simultaneously reducing the hydrologic effects that an extensive road network on steep slopes tends to produce.

The Desired Future Condition for each permanent Forest road is identified in the Access and Travel Management Plan. These are only recommendations, however, and can be changed during individual project analysis with additional public involvement. Roads Analysis, a Forest-Service wide process that is expected to be implemented during the next year, will re-evaluate the entire road network and possibly identify additional or different recommendations for roads.

It is recommended that the unpaved portions of Roads 21, 23, and 56/5603 be paved to reduce the amount of sediment being routed to streams from the gravel surfaces of these high traffic volume roads.

There are many opportunities to increase the harvest and gathering of special forest products while providing for their long-term sustainability. The Upper Cispus watershed has lands where new harvest opportunities should be explored, including those within Late-Successional Reserves (LSRs) following the Forestwide Late-Successional Reserve Assessment (USDA Forest Service 1997e). Where feasible, stewardship forest product contracts should be established. They allow for more close administration of on-the-ground harvesting. There is also interest in the local community to expand the gathering, storage, and processing of forest products to provide additional local employment.

Theatened and Endangered, Sensitive, and Survey and Manage Species

Explore opportunities for funding surveys for selected species of concern. This will increase our knowledge of the status and distribution of these species within the watershed.

Introduced and Invasive Plant and Animal Species including Noxious Weeds

Determine status and distribution of noxious weeds and other non-native species. Where appropriate and feasible, implement control and/or eradication measures and monitor the success of these activities.

Fine-grained Sediment in Stream Substrates

There is a need to determine the amount of fine-grained sediment in the substrates of fish-bearing stream; this will required farily extensive on-the-ground surveys.. Where excessive fine-grained sediments are found in the substrates of streams, the sources of such sediment need to be identified and, if possible, the amounts reduced.

G. RECOMMENDATIONS AT THE SIXTH-FIELD WATERSHED SCALE

The following tables contain recommendations and concerns related to specific management activities for each sixth-field watershed. It is important to note that the recommendations are based on current resource conditions and management direction that are not expected to change dramatically. While a sixth-field may not have identified opportunities for certain management activities now, it does not preclude future opportunities.

Table 6-1: Watershed Recommendations - Sixth-field 01 – Cispus River Headwaters 98%Wilderness, 2% Adaptive Mangement Area		
Activity	**Recommendations**	**Rationale**
Regeneration Harvest	No specific recommendations. Follow current direction.	
Commercial Thinning	No specific recommendations. Follow current direction.	
Roads	Install drainage dips, Rd. 2152016, m.p 1.6 (see 6-10).	Reduce the amount of sediment delivered to Goat Creek.
Recreation and Trails		
Fish, Plants Wildlife		
Other Restoration		

Table 6-2: Watershed Recommendations - Sixth-field 02 – Walupt Creek 95% Wilderness, 5% Administratively Withdrawn		
Activity	**Recommendations**	**Rationale**
Regeneration Harvest	No specific recommendations. Follow current direction.	
Commercial Thinning	Consider thinning within areas infested with spruce budworm.	Reduce future damage and spread within susceptible stands.
Roads	Seed unvegetated cutslopes, Rd. 2160 (see Table 6-10)	Reduce sediment delivery to streams.
Fish, Plants Wildlife	Place interpretive signing at Walupt Lake explaining unique fish species, special fishing regulations, and lake ecology	Increase fish regulation compliance, education to reduce damage to lake shore areas.
Recreation and Trails	Improve drainage on Trail #7A between Road 2160 and Cispus River. Thin stands within Walupt Lake CG.	Erosion and user safety in rutted areas. Reduce future hazard trees, improve aesthetics by opening up stand.
Other Restoration	None.	

Table 6-3: Watershed Recommendations - Sixth-field 03 – Cispus River – Chambers Creek 85% Adaptive Management Area, 11%Wilderness, 3% Matrix, 1% Administratively Withdrawn		
Activity	**Recommendations**	**Rationale**
Regeneration Harvest	No specific recommendations. Follow current direction	
Commercial Thinning	Consider thinning within areas infested with spruce budworm.	Reduce future damage and spread within susceptible stands
Roads	Seed unvegetated cutslopes at a number of road locations (see Table 6-10). Restore fish passage at culverts on Roads 2160, 2150 (see Table 3-25 in Chapter 3) Close Road 2164405 at Trail #7A crossing	Reduce the amount of sediment delivered to streams. Culverts block fish passage Limit wilderness access.
Fish, Plants Wildlife	Restrict motorized vehicle use in meadow near Road 2329655. Control conifer encroachment along Trail #7A in meadow near Midway Cr. and in Midway Meadows. Control/eradicate weed populations along Roads 21 and 56 where they parallel the Cispus River and along Road 2329 near Midway Meadows (*Hypericum perforatum*).	Threat to population of TES plant species Threat to populations of TES plant species Control spread of noxious weeds
Recreation and Trails	Consider horse camp site near Muddy Fork and jct. of Road 56.	Reduce wilderness trail use and high use at Keenes Horse Camp
Other Restoration	Thin conifers next to Chambers Creek in timber stand tags #405767 and #405768. Plant willow next to Chambers Creek in timber stand tag #405435.	Increase the amount of shade on Chambers Creek.

Table 6-4: Watershed Recommendations - Sixth-field 04 – Cispus Muddy Fork 57% Wilderness, 43% Adaptive Management Area		
Activity	**Recommendations**	**Rationale**
Regeneration Harvest	No specific recommendations. Follow current direction	
Commercial Thinning	Where management allocations allow, thin mid-succesional stands to reduce risk of spruce budworm damage.	Reduce future risk of spruce budworm damage to susceptible stands.
Roads	Seed unvegetated cutslopes on Road 5604 at MP 0.2-4.0.	Reduce the amount of sediment delivered to the stream system.
Recreation and Trails		
Fish, Plants Wildlife	Control/eradicate weed populations along Road 5603.	Control spread of noxious weeds.
Other Restoration	Relocate Trail #115 or add drainage to areas where springs or water piping occur.	Reduce erosion and improve trail user safety.

Table 6-5: Watershed Recommendations - Sixth-field 05 – Cispus River – Cat Creek 100% Adaptive Management Area		
Activity	**Recommendations**	**Rationale**
Regeneration Harvest	No specific recommendations. Follow current direction	
Commercial Thinning	Thin stands identified as Severe or High-Medium risk of windthrow and fire. (see Map 11, Fire and Windthrow Risk)	Reduce risk of large-scale disturbances.
Roads	Seed unvegetated cutslopes at a number of road locations (see Table 6-10).	Reduce the amount of sediment delivered to the stream system.
Recreation and Trails		
Fish, Plants Wildlife	Control/eradicate weed populations along Roads 21 and 56, where they parallel the Cispus River (*Hypericum perforatum*), on Road 21 near the intersection with Road 2100216, on Road 56 near the intersection with Road 5600042 (*Cystisus scoparius*), and along Road 5603. Consider browse topping for big game forage along Road 2124.	Control spread of noxious weeds. Shortage of forage in winter range.
Other Restoration	Plant alder and conifers along left bank of Orr Creek in timber stand tag #540554. Plant willow and alder along a 100 foot stretch of Cat Creek in timber stand tag #540510.	Increase the amount of shade on Orr Creek. Increase the amount of shade on Cat Creek.

Table 6-6: Watershed Recommendations - Sixth-field 06 – Adams Fork 53% Adaptive Management Area, 47% Wilderness		
Activity	**Recommendations**	**Rationale**
Regeneration Harvest	No specific recommendations. Follow current direction.	
Commercial Thinning	No specific recommendations. Follow current direction.	
Roads	Seed unvegetated cutslopes at a number of road locations (see Table 6-10).	Reduce the amount of sediment delivered to the stream system.
Recreation and Trails		
Fish, Plants Wildlife	Control/eradicate weed populations along Road 5601 near Ollallie Lake (*Hypericum perforatum*).	Control spread of noxious weeds.
Other Restoration	Reduce trail access to Killen Cr. from campground by rehabilitation and signing.	Reduce the amount of sediment delivered to the stream system.

Table 6-7: Watershed Recommendations - Sixth-field 07 – East Canyon Creek 87% Adaptive Management Area, 12%Late-Successional Reserves, 1% Wilderness		
Activity	**Recommendations**	**Rationale**
Regeneration Harvest	No specific recommendations. Follow current direction	
Commercial Thinning	No specific recommendations. Follow current direction.	
Roads	Evaluate fish passage at East Canyon Creek on Road 2300292 Stabilize roads behind failing wooden bridges on Roads 2300304, 2322 and 2325. Seed unvegetated cutslopes at a number of road locations (see Table 6-10).	Restore fish passage at culverts. Prevent road-related failures due to lack of maintenance. Reduce the amount of sediment delivered to streams.
Recreation and Trails	Reconstruct and relocate Trail #261 and #263	Reduce erosion and improve motorized user safety.
Fish, Plants Wildlife	Introduce large woody debris to lower portion of East Canyon Creek near Road 23. Control/eradicate weed populations along Road 2324 near East Canyon Creek (*Cystisus scoparius*).	Improve fish habitat and stabilize sediment movement in stream. Control spread of noxious weeds.
Other Restoration	Release conifers from alder competition at four locations in timber stand #539328 along East Canyon Creek. Plant alder on two gravel bars in timber stand #539328 along East Canyon Creek. Stabilize unvegetated slopes along East Canyon Creek 0.4 km downstream of bridge on Road 23.	Increase the amount of shade on East Canyon Creek Increase the amount of shade on East Canyon Creek Reduce sediment delivery to stream.

Table 6-8: Watershed Recommendations - Sixth-field 08 – Cispus River – Blue Lake 100% Adaptive Management Area		
Activity	**Recommendations**	**Rationale**
Regeneration Harvest	Consider creating forage openings within Deer and Elk Winter Range.	Limited forage in winter range.
Commercial Thinning	Thin conifer stands to reduce competition with upland bigleaf maple. Thin to promote optimal cover development in D&E winter range. Thin stands with Severe or High-Medium fire and windthrow risk in east half of drainage. (see Map 11, Fire and Windthrow Risk)	Loss of habitat for S&M mollusks associated with bigleaf maple. Shortage of optimal cover in winter range. Reduce risk of large-scale disturbance.
Roads	Seed unvegetated cutslopes along Road 2300171, m.p. 0.7 and 1.1.	Reduce erosion.
Recreation and Trails	Place interpretive signing at Blue Lake explaining lake origins, etc. Reconstruct and relocate Juniper Ridge Trail #261	Encourage use that doesn't degrade the lake environment. ??? what are we trying to prevent? Reduce erosion and improve motorized user safety.
Fish, Plants Wildlife	None.	
Other Restoration	Consider planting alder on point bars and mid-channel bars in the floodplain of the lower 0.5 miles of the Cispus River above its confluence with the North Fork Cispus River.	Increase the amount of shade on the Cispus River.

Table 6-9: Watershed Recommendations - Sixth-field 09 – North Fork Cispus River 100% Adaptive Management Area		
Activity	**Recommendations**	**Rationale**
Regeneration Harvest	Consider creating forage openings within Deer and Elk Winter Range.	Limited forage in winter range.
Commercial Thinning	Thin to increase tree size within Riparian Reserves. Thin stands with Severe and High-Medium fire and windthrow risk in west half of drainage. (see Map 11, Fire and Windthrow Risk)	Provide more shade to streams. Reduce risk of large-scale disturbance.
Roads	Seed unvegetated cutslopes at a number of road locations (see Table 6-10). Restore fish passage on Road 22 at Swede and Irish and an unnamed creek.	Reduce the amount of sediment delivered to streams. Fish passage restricted by culverts.
Recreation and Trails		
Fish, Plants Wildlife	Cut browse species in existing plantations where feasible within winter range. Control/eradicate weed populations along Road 22 where it parallels the North Fork Cispus River, and along Road 2208 below Timonium Creek (*Hypericum perforatum*), and along Road 55, near Tyler Creek, and Road 5500128 near Polk Creek (*Cystisus scoparius*).	Limited forage in winter range. Control spread of noxious weeds.
Other Restoration		

H. OTHER RECOMMENDATIONS

1. Lakes

For Blue Lake, recommendations (made jointly by the Gifford Pinchot National Forest and the Washington Department of Fish and Wildlife) for recreation use include:

- The posting of interpretative information on an existing sign at the north end of the lake. This sign could contain waterproof sheets explaining the origin of the lake, the existing water quality of the lake, and recommendations for use at the lake that will maintain water quality.
- No changes to existing fishing regulations.
- No future stocking of the lake with fish. The lake has not been stocked since 1989.

For Olallie Lake, there are several management recommendations (made jointly by the Gifford Pinchot National Forest and the Washington Department of Fish and Wildlife) for Olallie Lake.

- Include the dispersed camping site with the rest of the campground. A fee should be charged for the use of the dispersed campsite.
- No changes to existing fishing regulations.
- No changes to fish stocking frequency and levels. Olallie Lake has been stocked with fish nearly every year since 1984.

For Chain-of-Lakes, there are several management recommendations.

- Include the dispersed camping site with the rest of the campground. A fee should be charged for the use of the dispersed campsite.
- No changes to existing fishing regulations.
- No changes to fish stocking frequency and levels. Chain-of-Lakes has been stocked with fish intermittently since 1938.

For Takhlakh Lake, management recommendations will be contained in the survey report to be written in 2002.

2. Sediment Delivery to Streams

A number of projects are recommended in order to reduce the delivery of sediment to streams, as listed in the table below.

Table 6-10: Locations of Projects to Reduce Sediment Input to Streams

Sub-watershed name and number	Project name (total acres treated)	Location(s) [MP = mile post]	Problem(s)	Description of Work	Estimated cost of work[1]
Headwaters (01)	Road 2152016 (1 acre)	Road 2152016, MP 1.6	Water flows in old vehicle tracks down spur road – sediment settles on landing. Goat Cr. nearby.	Install large drainage dips in road surface.	No estimate at this time.
*Walupt Cr. (02)	Road 2160 (3 acres)	Road 2160, MP 1.8-2.0, 3.9, 4.0-4.2	MP 1.8-2.0 : Unvegetated cutslopes contribute sediment to Cispus R. and class III tributary. MP 3.9 : Sediment from spur	MP 1.8-2.0, 4.0-4.2 : Seed areas of unvegetated cutslopes, groove steep slope with	$300 total cost. 6 lbs. fertilizer. Labor: 8 hours. Vehicle: 1 day.

Sub-watershed name and number	Project name (total acres treated)	Location(s) [MP = mile post]	Problem(s)	Description of Work	Estimated cost of work[1]
			road enters wetland. MP 4.0-4.2 : Unvegetated cutslope contributes sediment to wetland.	garden rake to prepare seed bed. MP 3.9 : Seed surface of spur road.	
Chambers (03)	Road 2150 (1 acre)	Road 2150, MP 0.0-0.5	Sediment erodes off road cutslope and into a class IV stream.	Prepare seed bed by grooving cutslope perpendicular to fall line, then seed unvegetated areas on road cutslope.	$300 total cost. 10 lbs. seed, Labor: 8 hours. Vehicle: 1 day.
Chambers (03)	Road 2160047 (1 acre)	Road 2160047	Surface flow on road is causing rill erosion, gully is forming, sediment may be entering nearby wetland.	Seed and fertilize 400 ft. of road 2160047 to prevent surface erosion.	$300 total cost. 5 lbs. seed. 20 lbs. fertilizer Labor: 8 hours. Vehicle: 1 day.
Chambers (03)	Road 2152017 (2 acres)	Road 2152017, MP 0.2-0.4, 0.7	MP 0.2-0.4 : Unvegetated cutslopes erode sediment into wetland. MP 0.7 : Old spur road concentrates surface flow on to road 2152017, causing rill/gully in road surface.	MP 0.2-0.4 : Groove cutslopes with rake, then seed cutslopes. MP 0.7 : Install several waterbars on spur road to divert water off of road.	$400 total cost. 5 lb. seed 10 hours labor. Vehicle: I day.
Chambers Cr. (03)	Road 2164 (8 acres)	Road 2164, MP 0.0-3.6 (end of road)	Unvegetated cutslopes eroding sediment to nearby class III/IV streams.	Seed unvegetated cutslopes at MP 0.0-0.2, 0.3, 0.4, 1.0, 2.3, 2.4, 2.5, 2.7, 3.6.	$800 total cost. 40 lbs. Seed. Labor: 20-25 hours. Vehicle: 2 days.
*Chambers Cr. (03)	Road 2164034 (1 acre)	Road 2164034, MP 0.4	Sediment from spur road plugs ditch, forcing water in ditch on to road – surface erosion from road reaches int. stream near junction of roads 2164 and 2164034.	Hand construct 2 large cross-drains, breaching the side of the spur road so that water drains off of the spur road.	$200 total cost. Labor: 8 hours. Vehicle: 1 day.
Chambers Cr. (03)	Road 2164405 (1 acre)	Road 2164405, end of road	Berm is slowly eroding away, adding sediment to class IV stream.	Place erosion blanket on upper part of road closure berm. Seed both sides of berm.	$300 total cost. 5 lbs. seed. Labor: 6 hours. Vehicle: 1 day.
Chambers Cr. (03)	Road 2329 (1 acre)	Road 2329, MP 2.5	Slumping cutslope adds sediment to Wesley Cr.	Plant trees (willow, alder) on upper part of cutslope. Seed cutslope.	$300 total cost.5 5 lbs. seed. 100 trees. Labor: 8 hours. Vehicle: 1 day.
*Muddy Fork (04)	Road 5603 (9 acres)	Road 5603, MP 0.2-4.0	Unvegetated road cutslopes contributes sediment via ditch to adjacent streams	Seed unvegetated cutslopes (after grooving slope with rake) at MP 0.2, 1.0, 1.1, 1.2, 1.4, 1.7, 1.8, 4.0, 4.9.	$600 total cost. 15 lbs. seed. 16 hours labor. Vehicle: 2 days.
Cat (05)	Road 5603039 (1 acre)	Road 5603039, MP 0.2-0.3	Unvegetated cutslopes contribute sediment to intermittent streams. Landing fill slope is eroding into wet area.	Seed unvegetated cutslopes (after grooving slopes with rake). Place check dams in rills, plant trees, seed and fertilize..	$400 total cost. 10 lbs. seed. 20 lbs. fertilizer. 10 hours labor. Vehicle: 2 days.
*Cat (05)	Road 5603032 (1 acre)	Road 5603032, MP 0.1	Stream is headcutting up from road for 100 ft., creating channel as it deposits material below the road.	Construct permeable check dams in stream channel. Slash near the site will provide materials for check dams.	$300 total cost. Labor: 8 hours. Vehicle: 1 day.

Sub-watershed name and number	Project name (total acres treated)	Location(s) [MP = mile post]	Problem(s)	Description of Work	Estimated cost of work[1]
Cat (05)	Road 5603017 (1 acre)	Road 5603017, MP 1.2-1.5	Unvegetated cutslopes contribute sediment to nearby intermittent streams.	Seed unvegetated cutslopes (after preparing with rake). Plant trees on fill slope where possible.	$400 total cost. 5 lbs. seed. 200 trees. Labor: 8 hours. Vehicle: 1 day.
Cispus River – Cat Creek (05)	Road 2124 projects (10 acres)	Road 2124, MP 0.5. 0.7-0.8, 1.0, 2.1, 2.4-2.5, 2.9, 3.1,3.4-3.5, 3.7-3.8, 4.0-4.1.	Unvegetated road cuts channels add sediment to stream system during rainfall events.	Seed unvegetated areas.	$500 total cost. 30 lbs. seed. 14 hours labor. Vehicle: 1 day.
Cispus River - Cat Creek (05)	Road 78 projects (15 acres)	Road 78, MP 1.4, 2.1, 4.3. Road 7812, MP 0.3, 2.2. Road 7800120, MP 1.6-1.7, 1.9, 2.1, 2.3. Road 7800123, MP 0.5, 0.8-0.9. Road 7800086, MP 0.2-0.3. Road 7807, MP 0.2, 1.0, 1.1, 1.3	Eroding cutslopes add sediment to stream system during rainfall events.	Seed all unvegetated areas. Plant trees on some eroding areas.	$800 total cost. 30 lbs. seed. 20 hours labor. Vehicle: day.
Cispus River – Cat Creek(05)	Road 21 projects (9 acres)	Road 21 at mileposts 17.5 to 24.9.	Unvegetated road cutslopes add sediment to stream system during rainfall events.	Seed all unvegetated areas.	$500 total cost. 30 lbs. seed. 10 hours labor. Vehicle: 1 day.
*Adams Fork (06)	Road 5603020 slides (2 acres)	Road 5603020, MP 0.3 and end of road.	MP 0.3 : Unvegetated slide contributes sediment to class IV stream. End of road : Unvegetated areas in gully headwall contribute sediment to class IV stream, runoff from spur road prevents headwall from healing.	MP 0.3 : plant trees in headwall of slide, seed and fertilize entire slide. End of road : Plant trees in headwalls of slide, seed and fertilize. Construct cross-drains in lower part of spur road to divert water off of road.	$700 total cost. 12 lbs. seed. 50 lbs. fertilizer. Labor: 16 hours Vehicle: 1 day.
*Adams Fork (06)	Road 5601 system (5 acres)	Roads 5601, MP 1.9, 4.7-5.0, 5.7, 6.0. 5601062, MP 0.3 to end of road.	SluMP contributing sediment to Adams Creek. Eroding slopes and headcuts contribute sediment to Sheep Creek.	Plant trees, seed and fertilize cutbanks, place boulders in headcuts.	$800 total cost. 20 lbs. seed. 100 trees. Labor: 18 hours. Vehicle: 1 day.
East Canyon Cr (07) and Cat (05)	Road 2328 system projects (9 acres)	Road 2328, MP 0.25, 0.5, 0.6 1.2, 2.8, 3.2, 4.2, 4.9. Road 2328021, MP 0.1, 0.9.	Eroding cutslopes, unvegetated areas, 1 slide, 2 gullies.	Seed and fertilize all cutslopes. Plant trees on upper parts of some cutslopes. Place check dams in gullies.	$1,000 total cost. 30 lbs. seed. 15 lbs. fertilizer. Labor: 20 hours. Vehicle: 2 days.
East Canyon Creek (07)	Road 2300304 projects (3 acres)	Road 2300304 at MP 0.1, 0.2, 1.3	Headcut in ephemeral streams. Gully in landing.	Place rocks and slash in headcuts. Place two wood check dams in landing above road.	$400 total cost. 12 lbs. seed. 12 hours labor. Vehicle: 1 day.
East Canyon Creek (07)	Road 2300292 (1 acre)	Road 2300292, MP 0.2	Unvegetated area adds sediment to East Canyon Creek during rain events.	Seed unvegetated area.	$200 total cost. 5 lbs. seed. 5 hours labor.
East Canyon Creek (07)	Road 2324 projects (5 acres)	Road 2324 at MP 0.6, 1.8, 4.0, 5.3. Road 2424054, MP 0.3	Streams with unvegetted upper banks adds sediment. Road failure near streams add sediment to streams.	Plant trees and seed unvegetated areas	$500 total cost. 12 lbs. seed. 12 hours labor. Vehicle: 1 day.
East Canyon Cr. (07)	East Canyon Creek erosion sites (1 acre)	East Canyon Creek, approximately 4.6 kilometers upstream of Cispus River and 0.4 kilometers downstream of where road 23 crosses stream.	3 Unvegetated slopes (2 are slump failures) adjacent to East Canyon Creek are eroding sediment directly into the stream.	Seed and plant trees on sites. Installation of erosion control blankets may be necessary.	$1,200 total cost.
Cispus River	Road	Road 2300171, MP 0.7,	Unvegetated road cutslopes	Seed and fertilize	$150 total cost.

Sub-watershed name and number	Project name (total acres treated)	Location(s) [MP = mile post]	Problem(s)	Description of Work	Estimated cost of work[1]
– Blue Lake (08)	2300171 projects (2 acres)	1.1		eroding areas.	5 lbs. seed. 3 hours labor. Vehicle: 1 day.
*North Fork Cispus R. (09)	Road 55 system projects (4 acres)	Road 5508, MP 2.3, 3.0. Road 5500128, MP 0.5, 1.1.	Eroding areas are contributing sediment to several streams.	Plant trees, seed and fertilize all eroding areas. Place check dams in gullies.	$500 total cost. 6 lbs. seed. 60 trees. Labor: 12 hours. Vehicle: 1 day.
North Fork Cispus R. (09)	Road 2208 system projects. (3 acres)	Road 2208 at MP 1.02, 1.70, 4.63.	Eroding cutbanks, 2 small slides, and gully erosion are contributing sediment to North Fork Cispus River.	Depending on location, do one or more of the following: plant of willow and trees, seed, installation of waterbars, reshape oversteepened bank,.	No estimate at this time.
North Fork Cispus R. (09)	Road 2203 system projects (8 acres)	Road 2203 at MP 1.7, 1.9, 2.1, 2.1,2.3-2.4, 2.55, 2.9, 3.7.	Eroding cutbanks are contributing sediment to intermittent streams.	Scarify and seed eroding cutbanks.	$600 total cost. 50 lbs. seed. 12 hours labor.
North Fork Cispus R. (09)	Road 2200 system projects (12 acres)	Road 2200 at MP 10.2, 10.7, 11.3, 11.48, 11.8, 13.05, 13.17, 13.16, 13.9, 14.0-14.1, 14.3, 14.4.	Unvegetated cutbank contribute sediment to streams. Shot gun pipes cause gully erosion. Overwidened turnout in road is slumping and susceptible to fill failure.	Depending on location, do one or more of the following: plant trees, seed, fertilize. Also, repair culvert at two locations.	$3500 total cost. 50 lbs. seed. 70 trees. 25 hours labor.
North Fork Cispus River (09)	Road 78 projects (15 acres)	Road 78, MP 3.0, 4.2, 5.2, 7.0-7.1, 2.5, 2.1. Road 7802, MP 0.5, 2.0-2.6. road 780042, MP 0.4. Road 7800062, MP 0.3. Road 7800060, MP 0.5-0.6, 0.8, 1.-1.3. Road 7800072, MP 0.1-0.25, 0.9.	Unvegetated road cutslopes add sediment to stream system during rainfall events.	Seed all unvegetated areas.	$1300 total cost. 90 lbs. seed. 24 hours labor. Vehicle: 2 days.

[1]Seed costs $6 per pound. Fertilizer costs $6 per pound. Trees cost approximately $200 for 100 trees.

3. Shade on Streams

The table below lists timber stands where treatment of vegetation would likely improve shade on streams.

Table 6-11: Locations of Projects to Increase Shade on Streams

Timber stand # and/or routed stream distance	Name of adjacent stream	Length of the stream next to treated area	Treatment to vegetation	Sub-watershed
405435	Chambers Creek	46 meters (150 feet)	Plant willow next to the edge of the stream.	03
405768	Chambers Cr.	61 meters (200 feet)	Thinning of conifers next to stream.	03
405767	Chambers Cr. and Elk Cr.	61 meters (200 feet)	Thinning of conifers next to stream.	03
540553	Orr Creek	91 meters (300 feet)	Plant conifers and alder along left bank within areas void of vegetation.	05
540554	Orr Creek	200 meters (656 feet)	▪ Plant alder and willow next to the stream. ▪ Plant conifers 10 to 30 feet away from the edge of the stream.	05
540510	Cat Creek	30.5 meters (100 feet)	Plant willow and alder along a 100-foot length of the stream.	05
539328	East Canyon Creek	200 meters (656 feet)	▪ Plant Douglas fir or alder on three floodplain terraces. ▪ Fertilize Douglas fir to accelerate their growth.	07
539328	East Canyon Creek	450 meters (1444 feet)	▪ Thin alder at four locations to accelerate the growth of existing small Douglas fir. ▪ Fertilize Douglas fir.	07
539328	East Canyon Creek	91 meters (300 feet)	Plant alder on two mid-channel gravel bars.	07
539328	East Canyon Creek	100 meters (328 feet)	Plant willow next to stream.	07
2.1 kilometer reach above North Fork Cispus R.	Cispus River	2100 meters (6890 feet)	Plant alder on point bars and mid-channel bars in the floodplain. Alder is currently well established in several point bars in this reach of the river.	08
		3430.5 meters (11,255 feet) 3.43 kilometers (2.13) miles		

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Appendix A - Fish Habitat Stream Miles by Species

Fish Habitat Stream Miles by Species for each Sixthfield Watershed

Watershed Number	Common Name	Scientific Name	Life History	Total Length
170800040401	Eastern Brook Trout	Savelinus fontinalis	Resident	1.2
170800040401	Resident Coastal Cutthroat	Oncorhynchus clarki clarki	Resident	10.3
170800040401	Resident Rainbow Trout	Oncorhynchus mykiss	Resident	7.4
170800040401	Sculpin	Cottus	Resident	1.2
170800040402	Resident Coastal Cutthroat	Oncorhynchus clarki clarki	Resident	4.6
170800040402	Resident Rainbow Trout	Oncorhynchus mykiss	Resident	4.6
170800040402	Western Brook Lamprey	Lampeta richardsoni	Resident	0.9
170800040403	Eastern Brook Trout	Savelinus fontinalis	Resident	16.8
170800040403	Mountain Whitefish	Prosopium williamsoni	Resident	7.7
170800040403	Resident Coastal Cutthroat	Oncorhynchus clarki clarki	Resident	7.7
170800040403	Resident Rainbow Trout	Oncorhynchus mykiss	Resident	8.9
170800040403	Sculpin	Cottus	Resident	7.7
170800040404	Eastern Brook Trout	Savelinus fontinalis	Resident	11.4
170800040404	Resident Coastal Cutthroat	Oncorhynchus clarki clarki	Resident	3.0
170800040405	Chinook Salmon	Oncorhynchus tshawyscha	Anadromous	3.2
170800040405	Coho Salmon	Oncorhynchus kisutch	Anadromous	3.2
170800040405	Sea-Run Cutthroat Trout	Oncorhynchus clarki clarki	Anadromous	3.2
170800040405	Steelhead	Oncorhynchus mykiss	Anadromous	3.2
170800040405	Bull Trout	Salvelinus confluentus	Resident	3.2
170800040405	Eastern Brook Trout	Savelinus fontinalis	Resident	15.1
170800040405	Mountain Whitefish	Prosopium williamsoni	Resident	11.2
170800040405	Resident Coastal Cutthroat	Oncorhynchus clarki clarki	Resident	20.9
170800040405	Resident Rainbow Trout	Oncorhynchus mykiss	Resident	20.2
170800040405	Sculpin	Cottus	Resident	11.2
170800040405	Westslope Cutthrout Trout	Onchorhychus clarki lewisi	Resident	0.4
170800040406	Eastern Brook Trout	Savelinus fontinalis	Resident	10.6
170800040406	Westslope Cutthrout Trout	Onchorhychus clarki lewisi	Resident	3.4
170800040407	Coho Salmon	Oncorhynchus kisutch	Anadromous	0.1
170800040407	Sea-Run Cutthroat Trout	Oncorhynchus clarki clarki	Anadromous	0.1
170800040407	Steelhead	Oncorhynchus mykiss	Anadromous	0.1
170800040407	Eastern Brook Trout	Savelinus fontinalis	Resident	12.0
170800040407	Resident Coastal Cutthroat	Oncorhynchus clarki clarki	Resident	13.3
170800040407	Resident Rainbow Trout	Oncorhynchus mykiss	Resident	4.4
170800040408	Chinook Salmon	Oncorhynchus tshawyscha	Anadromous	9.1
170800040408	Coho Salmon	Oncorhynchus kisutch	Anadromous	9.4
170800040408	Sea-Run Cutthroat Trout	Oncorhynchus clarki clarki	Anadromous	10.2
170800040408	Steelhead	Oncorhynchus mykiss	Anadromous	9.9
170800040408	Bull Trout	Salvelinus confluentus	Resident	9.1
170800040408	Eastern Brook Trout	Savelinus fontinalis	Resident	12.3
170800040408	Mountain Whitefish	Prosopium williamsoni	Resident	9.1
170800040408	Resident Coastal Cutthroat	Oncorhynchus clarki clarki	Resident	10.7
170800040408	Resident Rainbow Trout	Oncorhynchus mykiss	Resident	9.6
170800040408	Sculpin	Cottus	Resident	9.4
170800040408	Twin Lake Cutthroat	Oncorhynchus clarki lewisi	Resident	0.2
170800040409	Chinook Salmon	Oncorhynchus tshawyscha	Anadromous	8.6
170800040409	Coho Salmon	Oncorhynchus kisutch	Anadromous	8.7
170800040409	Sea-Run Cutthroat Trout	Oncorhynchus clarki clarki	Anadromous	9.3
170800040409	Steelhead	Oncorhynchus mykiss	Anadromous	9.4
170800040409	Eastern Brook Trout	Savelinus fontinalis	Resident	10.6
170800040409	Mountain Whitefish	Prosopium williamsoni	Resident	8.6
170800040409	Resident Coastal Cutthroat	Oncorhynchus clarki clarki	Resident	17.3
170800040409	Resident Rainbow Trout	Oncorhynchus mykiss	Resident	15.4

170800040409	Sculpin	Cottus	Resident	13.4

Fish Habitat Stream Miles by Species – Upper Cispus Watershed Summary

Watershed Number	Common Name	Scientific Name	Life History	Total Length
1708000404*	Eastern Brook Trout	Savelinus fontinalis	Resident	90.0
1708000404*	Resident Coastal Cutthroat	Oncorhynchus clarki clarki	Resident	87.8
1708000404*	Resident Rainbow Trout	Oncorhynchus mykiss	Resident	70.5
1708000404*	Sculpin	Cottus	Resident	42.9
1708000404*	Western Brook Lamprey	Lampeta richardsoni	Resident	0.9
1708000404*	Mountain Whitefish	Prosopium williamsoni	Resident	36.6
1708000404*	Bull Trout	Salvelinus confluentus	Resident	12.3
1708000404*	Westslope Cutthrout Trout	Onchorhychus clarki lewisi	Resident	3.8
1708000404*	Twin Lake Cutthroat	Oncorhynchus clarki lewisi	Resident	0.2
1708000404*	Chinook Salmon	Oncorhynchus tshawyscha	Anadromous	20.9
1708000404*	Coho Salmon	Oncorhynchus kisutch	Anadromous	21.4
1708000404**	Sea-Run Cutthroat Trout	Oncorhynchus clarki clarki	Anadromous	22.8
1708000404*	Steelhead	Oncorhynchus mykiss	Anadromous	22.6

Appendix B - Rationale and References for Matrix and Pathways Indicators

TABLE B-1. MATRIX of DIAGNOSTICS / PATHWAYS AND INDICATORS

(The values of criteria presented here are NOT absolute, they may be adjusted for local watersheds given supportive documentation)

DIAGNOSTIC OR PATHWAY	INDICATORS	FUNCTIONING APPROPRIATELY	FUNCTIONING AT RISK	FUNCTIONING AT UNACCEPTABLE RISK
SPECIES:				
Subpopulation Characteristics within subpopulation watersheds	Subpopulation Size	Mean total subpopulation size or local habitat capacity more than several thousand individuals. All life stages evenly represented in the subpopulation.	Adults in subpopulation are less than 500 but > 50.	Adults in subpopulation has less than 50 individuals.
	Growth and Survival	Subpopulation has the resilience to recover from short-term disturbances (e.g. catastrophic events, etc.) or subpopulation declines within one to two generations (5 to 10 years). The subpopulation is characterized as increasing or stable. At least 10+ years of data support this estimate.	When disturbed, the subpopulation will not recover to predisturbance condiitions within one generation (5 years). Survival or growth rates have been reduced from those in the best habitats. The subpopulation is reduced in size but the reduction does not represent a long-term trend. At least 10+ years of data support this characterization. If less data is available and a trend cannot be confirmed , a subpopulation will be considered at risk until enough data is available to accurately determine its trend.	The subpopulation is characterized as in rapid decline or is maintaining at alarmingly low numbers. Under current management the subpopulatiion condition will not improve within two generations (5 to 10 years). This is supported by a minimum of 5+ years of data.
	Life History Diversity and Isolation	The migratory form is present and the subpopulation exists in close proximity to other spawning and rearing groups. Migratory corridors and rearing habitat (lake or larger river) are in good to excellent condition for the species. Neighboring subpopulations are large with high likelihood of producing surplus individuals or straying adults that will mix with either subpopulation groups.	The migratory form is present but the subpopulation is not close to other subpopulations or habitat disruption has produced a strong correlation among subpopulations that do exist in proximity to each other.	The migratory form is absent and the subpopulation is isolated to the local stream or a small watershed not likely to support more than 2,000 fish.[1]
	Persistence and Genetic Integrity	Connectivity is high among multiple (5 or more) subpopulations with at least several thousand fish each. Each of the relevant subpopulations has a low risk of extinction. The probability of hybridization or displacement by competitive species is low to nonesixtent.	Connectivity among multiple subpopulations does occur, but habitats are more fragmented - Only one or two of the subpopulations represent most of the fish production. The probability of hybridization or displacement by competitive species is imminent, although few documented cases have occurred.	Little or no connectivity remains for refounding subpopulations in low numbers, in decline, or nearing extinction. Only a single subpopulation or several local populations that are very small or that otherwise are at high risk remain. Competitive species readily displace cutthroat trout. The probability of hybridization is high and documented cases have occurred.
HABITAT:				

Water Quality:	Temperature	7 day average maximum temperature in a reach during the following life history stages:[1, 3] rearing: 10 - 14EC	7 day average maximum temperature in a reach during the following life history stages:[1, 3] rearing: 14 - 18EC spawning: 14 - 16EC	7 day average maximum temperature in a reach during the following life history stages:[1, 3] rearing: > 18EC spawning: > 16EC
	Sediment (in areas of spawning and incubation; rearing areas will be addressed under "substrate embeddedness")	< 12% fines (<0.85mm) in gravel[4];	12-17% fines (<0.85mm) in gravel[4];	>17% fines (<0.85mm) in gravel[4];
	Chemical Contamination/ Nutrients	low levels of chemical contamination from agricultural, industrial and other sources, no excess nutrients, no CWA 303d designated reaches[8]	moderate levels of chemical contamination from agricultural, industrial and other sources, some excess nutrients, one CWA 303d designated reach[8]	high levels of chemical contamination from agricultural, industrial and other sources, high levels of excess nutrients, more than one CWA 303d designated reach[8]
Habitat Access:	Physical Barriers (address subsurface flows impeding fish passage under the pathway "flow/hydrology")	human-made barriers present in watershed allow upstream and downstream fish passage at all flows for all life history stages	one or more human-made barriers present in watershed do not allow upstream and/or downstream fish passage at base/low flows for at least one life history stage	one or more human-made barriers present in watershed do not allow upstream and/or downstream fish passage at a range of flows for at least one life history stage
Habitat Elements:	Substrate Character and Embeddedness in rearing areas (spawning an1d incubation areas were addressed under the indicator "sediment")	reach embeddedness <20%[9] dominant substrate is gravel or cobble	gravel and cobble are subdominant, or if dominant, reach embeddedness 20-30%[9,10]	bedrock, sand, silt, or small gravel dominant, or if gravel and cobble dominant, reach embeddedness >30%[4,10]
	Large Woody Debris	current values are being maintained at greater than 80 pieces/mile that are >24"diameter and >50 ft length ; also adequate sources of woody debris are available for both long and short-term recruitment	current levels are being maintained at minimum levels desired for "functioning appropriately", but potential sources for long term woody debris recruitment are lacking to maintain these minimum values	current levels are not at those desired values for "functioning appropriately",

	Pool Frequency and Quality	pool frequency in a reach closely approximates [5]: Wetted width (ft) — #pools/mile 0-5 — 39 5-10 — 60 10-15 — 48 15-20 — 39 20-30 — 23 30-35 — 18 35-40 — 10 40-65 — 9 65-100 — 4 (can use formula: pools/mi = 5,280/wetted channel width #channel widths per pool); also, pools have good cover and cool water[4], and only minor reduction of pool volume by fine sediment	pool frequency is similar to values in "functioning appropriately", but pools have inadequate cover/temperature[4], and/or there has been a moderate reduction of pool volume by fine sediment	pool frequency is considerably lower than values desired for "functioning appropriately"; also cover/temperature is inadequate[4], and there has been a major reduction of pool volume by fine sediment
	Large Pools (in adult holding, juvenile rearing, and overwintering reaches where streams are >3m in wetted width at baseflow)	each reach has many large pools >1 meter deep[4]	reaches have few large pools (>1 meter) present[4]	reaches have no deep pools (>1 meter)[4]
	Off-channel Habitat	watershed has many functional high water velocity refugia such as ponds, oxbows, backwaters, and other off-channel areas with cover; and side-channels are complex, low energy areas[4]	watershed has some functional high water velocity refugia such as ponds, oxbows, backwaters, and other off-channel areas with cover; but side-channels are generally high energy areas[4]	watershed has few or no functional high water velocity refugia such as ponds, oxbows, backwaters, or other off-channel areas[4]
	Refugia (at 6th to 7th field subwatershed scale) (see Checklist footnotes for definition of this indicator)	habitats capable of supporting strong and significant populations are protected and are well distributed and connected for all life stages and forms of the species [12, 13]	habitats capable of supporting strong and significant populations are insufficient in size, number and connectivity to maintain all life stages and forms of the species[12, 13]	adequate habitat refugia do not exist[12]
Channel Condition & Dynamics:	Mean Bankfull Width/ Mean Bankfull Depth Ratio in riffles in a reach	W/D ratios and channel types are well within historic ranges and/or site potentials in watershed. Rosgen Type — W/D Ratio A, E, G — < 12 B, C, F — 12 - 30 D — > 40	W/D ratios and/or channel types in portions of watershed are outside historic ranges and/or site potentials.	W/D ratios and channel types throughout much of the watershed are outside of historic ranges and/or site potentials.
	Streambank Condition	>80% of any stream reach has ≥90% stability[5]	50 - 80% of any stream reach has ≥90% stability[5]	<50% of any stream reach has ≥90% stability[5]
	Floodplain Connectivity	off-channel areas are frequently hydrologically linked to main channel; overbank flows occur and maintain wetland functions, riparian vegetation and succession	reduced linkage of wetland, floodplains and riparian areas to main channel; overbank flows are reduced relative to historic frequency, as evidenced by moderate degradation of wetland function, riparian vegetation/succession	severe reduction in hydrologic connectivity between off-channel, wetland, floodplain and riparian areas; wetland extent drastically reduced and riparian vegetation/succession altered significantly

Flow/Hydrology:	Change in Peak/ Base Flows	watershed hydrograph indicates peak flow, base flow and flow timing characteristics comparable to an undisturbed watershed of similar size, geology and geography	some evidence of altered peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology and geography	pronounced changes in peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology and geography
	Increase in Drainage Network	zero or minimum increases in active channel length correlated with human caused disturbance	low to moderate increase in active channel length correlated with human caused disturbance	greater than moderate increase in active channel length correlated with human caused disturbance
Watershed Conditions:	Road Density & Location	<1mi/mi² [13]; no valley bottom roads	1 - 2.4 mi/mi² [13]; some valley bottom roads	>2.4 mi/mi² [13]; some to many valley bottom roads
	Disturbance History	<15% ECA (>85% ARP/HRP) of entire watershed with no concentration of disturbance in unstable or potentially unstable areas, and/or refugia, and/or riparian area;	<15% ECA (>85% ARP/HRP) of entire watershed but some disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area;	>15% ECA (< 85% ARP/HRP) of entire watershed and some disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area;
	Riparian Reserves	the riparian reserve system provides adequate shade, large woody debris recruitment, and habitat protection and connectivity in subwatersheds, and buffers or includes known refugia for sensitive aquatic species (>80% previously unmanaged); adequately buffers impacts from grazing; percent similarity of riparian vegetation to the potential natural community/composition and structure >50%[15]	moderate loss of connectivity or function (shade, LWD recruitment, etc.) of riparian reserve system; , or incomplete protection of habitats and refugia for sensitive aquatic species (.70-80% previously unmanaged) including from grazing impacts; percent similarity of riparian vegetation to the potential natural community/composition and structure 25-50%	riparian reserve system is fragmented, poorly connected, or provides inadequate protection of habitats for sensitive aquatic species (<70% previously unmanaged,), including from grazing impacts; percent similarity of riparian vegetation to the potential natural community/composition and structure <25%[15]
	Disturbance Regime	Environmental disturbance is short lived; predictable hydrograph, high quality habitat and watershed complexity providing refuge and rearing space for all life stages or multiple life-history forms. [1] Natural processes are stable.	Scour events, debris torrents, or catastrophic fire are localized events that occur in several minor parts of the watershed. Resiliency of habitat to recover from environmental disturbances is moderate.	Frequent flood or drought producing highly variable and unpredictable flows, scour events, debris torrents, or high probability of catastrophic fire exists throughout a major part of the watershed. The channel is simplified, providing little hydraulic complexity in the form of pools or side channels. [1] Natural processes are unstable.
SPECIES AND HABITAT:				
Integration of Species and Habitat Conditions		Habitat quality and connectivity among subpopulations is high. The migratory form is present. Disturbance has not altered channel equilibrium. Fine sediments and other habitat characteristics influencing survival or growth are consistent with pristine habitat. The subpopulation has the resilience to recover from short-term disturbance within one to two generations (5 to 10 years). The subpopulation is fluctuating around an equilibrium or is growing.	Fine sediments, stream temperatures, or the availability of suitable habitats have been altered and will not recovery to predisturbance conditions wtihin one generation (5 years). Survival or growth rates have been reduced from those in the best habitats. The subpopulation is reduced in size, but the reduction does not represent a long-term trend. The subpopulation is stable or fluctuating in a downward trend. Connectivity among subpopulations occurs but habitats are more fragmented.	Cumulative disruption of habitat has resulted in a clear declining trend in the subpopulations size. Under current management, habitat conditions will not improve within two generations (5 to 10 years). Little or not connectivity remains among subpopulations. The subpopulation survival and recruitment responds sharply to normal environmental events.

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TABLE B-2. CHECKLIST FOR DOCUMENTING ENVIRONMENTAL BASELINE AND EFFECTS OF PROPOSED ACTION(S) ON RELEVANT INDICATORS

	POPULATION AND ENVIRONMENTAL BASELINE (list values or criterion and supporting documentation)			EFFECTS OF THE ACTION(S)			
DIAGNOSTICS/ PATHWAYS: INDICATORS	**Functioning Appropriately**	**Functioning At Risk**	**Functioning at Unacceptable Risk**	**Restore[1]**	**Maintain[2]**	**Degrade[3]**	**Compliance with ACS**
Subpopulation Characteristics							
Subpopulation Size							
Growth and Survival							
Life History Diversity and Isolation							
Persistence and Genetic Integrity							
Water Quality:							
Temperature							
Sediment							
Chem. Contam./Nutrients							
Habitat Access:							
Physical Barriers							
Habitat Elements:							
Substrate Character and Embeddedness							
Large Woody Debris							
Pool Frequency and Quality							
Large Pools							
Off-channel Habitat							
Refugia[4]							
Channel Cond. & Dynamics:							
Bankfull Width/ Mean Bankfull Depth Ratio							
Streambank Condition							
Floodplain Connectivity							
Flow/Hydrology:							
Change in Peak/Base Flows							
Drainage Network Increase							
Watershed Conditions:							
Road Density & Location							
Disturbance History							
Riparian Reserves							
Disturbance Regime							
Integration of Species and Habitat Conditions							

1 For the purposes of this checklist, "restore" means to contribute to a restorative trend for a particular indicator. . Restoration from a worse to a better condition does not negate the need to consult/confer if take will occur.

2 For the purposes of this checklist, "maintain" means that the function of an indicator does not change (i.e., it applies to all indicators regardless of functional level).

3 For the purposes of this checklist, "degrade" means to contribute to a trend toward degradation of an indicator toward the next functional category (i.e., it applies to all indicators regardless of functional level). In some cases, a "functioning at unacceptable risk" indicator may be further worsened, and this should be noted.

4 Refugia = watersheds or large areas with minimal human disturbance having relatively high quality water and fish habitat, or having the potential of providing high quality water and fish habitat with the implementation of restoration efforts. These high quality water and fish habitats are well distributed and connected within the watershed or large area to provide for both biodiversity and stable populations.

(adapted from discussions on "Stronghold Watersheds and Unroaded Areas" in Lee, D.C., J.R. Sedell, B.E. Rieman, R.F. Thurow, J.E. Williams and others. 1997. Chapter 4: Broadscale Assessment of Aquatic Species and Habitats. *In* T.M. Quigley and S. J. Arbelbide eds "An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins Volume III". U.S. Department of Agriculture, Forest Service, and U.S. Department of Interior, Bureau of Land Management, Gen Tech Rep PNW-GTR-405).

Appendix C –Matrix and Pathways Indicators Tables for 6^{th} Field Watersheds

TABLE C-1: Baseline conditions for fish habitat in 2001 for the Cispus River Headwaters watershed (170800040401).
(Ratings were made using the "Matrix of Diagostics / Pathways and Indicators" from the US Fish and Wildlife Service)

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
WATER QUALITY	Temperature	Bull Trout Functioning At Unacceptable Risk	USFWS Criteria 7-day average maximum temperature in a stream reach for the following life history stages: Incubation: <1°C or > 6°C Rearing: > 15 °C Spawning: <4°C or >10°C.	No stream temperature data exists. Rating is based on data from the adjacent downstream 6th field watershed (Cispus R. – Chambers Cr.) where all 6 monitoring sites were between 12.4° C and 15.0°C.	• 2000 and 1994 Stream temperature Monitoring
		Cutthroat and Other Species Functioning At Risk	USFWS draft criteria for coastal cutthroat 7-day ave. max. temp. in a stream reach during the following life history stages: Rearing: 14 – 18°C Spawning: 14 – 16°C. NMFS criteria for anadromous fish Spawning: 13.9 –15.6°C/Migration and rearing: 13.9 –17.8°C	No stream temperature data exists. Rating is based on data from the adjacent downstream 6th field watershed (Cispus R. – Chambers Cr.) where all 6 monitoring sites were between 12.4° C and 15.0°C.	• 2000 and 1994 Stream temperature Monitoring
	Sediment (in spawning areas)	Functioning At Risk	12-17% fines (<0.85mm) in gravel[4];	The 1994 stream survey only recorded whether or not substrate embeddedness was greater than 35%. Only two out six samples were recorded as embedded. Because, this section of stream is in the wilderness this fine sediment is of natural origin.	• 1994 Level II Stream Survey
	Chemical Contamination/ Nutrients	Functioning Appropriately	Low levels of chemical contamination from agricultural, industrial …	There are no known sources of either chemical or nutrient contamination in the watershed. There are no towns, homes, factories, or agricultural activities in the watershed.	• Field observations by the USFS,
HABITAT ACCESS	Physical barriers	Functioning Appropriately	Human-made barriers present in watershed allow upstream and downstream fish passage at all flows for all life history stages	There are no known man-made barriers to fish passage in the sub-watershed.	• Culvert Surveys 2001
HABITAT ELEMENTS	Substrate character and embedded-ness (in rearing areas)	Functioning At Risk	Gravel and cobble are subdominant, or if dominant, reach embeddedness 20-30%[9,10]	The 1994 stream survey only recorded whether or not substrate embeddedness was greater than 35%. Only two out six samples were recorded as embedded. Because, this section of stream is in the wilderness this fine sediment is of natural origin.	• 1994 Level II Stream Survey
	Large Woody Debris (LWD)	Functioning At Unacceptable Risk	Current levels are not at those desired values for "functioning appropriately",	Neither of two surveyed reaches meet the criteria (80 pieces mile) for properly functioning.	• 1994 Level II Stream Survey
	Pool Frequency and Quality	Functioning At Unacceptable Risk	Pool frequency is considerably lower than values desired for "functioning appropriately"; also cover/temperature is inadequate[4], and there has been a major reduction of pool volume by fine sediment	Neither of the surveyed reaches met the criteria for properly functioning. Criteria for pool frequency: Wetted width in feet, # pools per mile 0-5, 39 5-10, 60 10-15, 48 15-20, 39 20-30, 23 30-35, 18 35-40, 10 40-65, 9 65-100, 4	• 1994 Level II Stream Survey

	Large Pools (in streams with > 3m in wetted width at baseflow)	Functioning Appropriately	Each reach has many large pools >1 meter deep[4]	Many pools greater than 1 meter were observed in the two reaches of Cispus River.	• 1994 Level II Stream Survey
	Off-channel habitat	Functioning At Risk	Watershed has some functional high water velocity refugia such as ponds, oxbows, backwaters, and other off-channel areas with cover; but side-channels are generally high energy areas[4]	This section had some side-channels but not as many as the next section down stream.	• 1994 Level II Stream Survey
	Refugia (at 6th to 7th field watershed scale)	Functioning At Risk	Habitats capable of supporting strong and significant populations are insufficient in size, number and connectivity to maintain all life stages and forms of the species[12, 13]	The habitat is of marginal quality to support a large population of fish and several of water falls present migration barriers to fish moving upstream.	• Professional Judgment
CHANNEL CONDITION AND DYNAMICS	Width/Depth Ratio in riffles	Functioning At Risk	W/D ratios and/or channel types in portions of watershed are outside historic ranges and/or site potentials.	▪ The survey report mentions that the stream is wide and shallow. ▪ The width-to-depth ratios are at upper end of what would be expected for the observed channel types.	• 1994 level II stream survey.
	Streambank Condition	Functioning Appropriately	80% of any stream reach has ≥90% stability[5]	▪ The stream survey notes mention very little erosion.	• Professional Judgment
	Floodplain Connectivitiy	Functioning Appropriately	Off-channel areas are frequently hydrologically linked to main channel; overbank flows occur and maintain wetland functions, riparian vegetation and succession	▪ There are no stream crossings in the entire subwatershed R ▪ Road density in riparian reserve is 0.0.	• GIS Analysis of Road Location.
FLOW / HYDROLOGY	Change in Peak/Base Flows	Functioning Appropriately	Some evidence of altered peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology and geography	Stands with an average diameter ≥ 8" occupy 92.4% of the forested area. The high elevation of this sub watershed places it outside of the rain-on-snow zone, thus the rain-on-snow event floods are less likely to occur in this watershed than in the 4 lowest elevation watersheds.	• GIS Analysis of Stand Structure.
	Drainage Network Increase	Functioning Appropriately	Zero or minimum increases in active channel length correlated with human caused disturbance	A drainage extension of 0.0% would fit into the low drainage extension.	• GIS Analysis of Road Location.
WATERSHED CONDITIONS	Road Density and Location	Functioning Appropriately	<1mi/mi² [13]; no valley bottom roads	The overall road density of 0.02 miles per square mile is a low impact, and the road density in riparian reserves is also low at 0.0 miles per square mile.	• GIS Analysis of Road Location.
	Riparian Reserves	Functioning Appropriately	The riparian reserve system provides adequate shade, large woody debris recruitment, and habitat protection and connectivity in subwatersheds, and buffers or includes known refugia for sensitive aquatic species (>80% previously unmanaged); adequately buffers impacts from grazing; percent similarity of riparian vegetation to the potential natural community/composition and structure >50%[15]	• 3% of the riparian reserves are in the Early Successional classes. The remaining areas are nearly all large tree or non-forest.	• GIS Analyisis ofStand structure in Riparian Reserves • 1992 Level stream survey.

	Disturbance Regime	Functioning Appropriately	Frequent flood or drought producing highly variable flows …. Channel is simplified … little hydrologic complexity … Natural processes are unstable.	In the 1900's, a number of natural events have significantly affected the watershed: ▪ 1980 eruption of Mount St. Helens covered the watershed in ash. ▪ There have not been any large fires 1800. Only small portions of the 1800 and 1920.	• Upper/Middle Cispus River Watershed Analysis (1995), pages 4-1 to 4-16.
	Disturbance History	Functioning Appropriately	>15% ECA (< 85% ARP/HRP) of entire watershed and some disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area;	▪ 3.3% of the Riparian Reserves are in the Early Successional lasses. The low ARP and is due to the lower productivity of the area. ▪ 98% of the sub-watershed is within the Goat Rocks Wilderness. ▪ There are no roads in the riparian reserve. ▪ There is no harvest recorded for this watershed.	• GIS Analysis of Harvest History, Stand Structure, Stand Structure RR, Road Location.
SUBPOPULATION CHARACTER-ISTICS	Subpopulation Size	No Rating		• We rate these indicators for the 5th field watershed. • This is not anadromous sub-watershed. • This is not a bull trout consultation sub-watershed.	• Level II stream survey 1994.
	Growth and Survival	No Rating			
	Life History Diversity and Isolation	No Rating			
	Persistence and Genetic Integrity	No Rating			
SPECIES and HABITAT	Integration of Species and Habitat Conditions	No Rating		• We rate these indicators for the 5th field watershed.	• All previously cited sources.

[1]Anadromous fish include Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*), steelhead (*Oncorhynchus mykiss*), and chum salmon (O*ncorhynchus* keta).

TABLE C-2: Baseline conditions for anadromous fish habitat in 2001 for the Walupt Lake watershed (170800040402).[1]
(Ratings were made using the "Matrix of Diagostics / Pathways and Indicators" from the US Fish and Wildlife Service)

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
WATER QUALITY	Temperature	Bull Trout Functioning At Unacceptable Risk	USFWS Criteria 7-day average maximum temperature in a stream reach for the following life history stages: Incubation: <1^{o}C or > 6^{o}C Rearing: > 15 ^{o}C Spawning: <4^{o}C or >10^{o}C.	• No stream temperature data exists. Rating is based on data from the adjacent downstream 6th field watershed (Cispus R. – Chambers Cr.) where all 6 monitoring sites were between 12.4^o C and 15.0^{o}C.	• 2000 and 1994 Stream temperature Monitoring
		Cutthroat and Other Species Functioning At Risk	USFWS draft criteria for coastal cutthroat 7-day ave. max. temp. in a stream reach during the following life history stages: Rearing: 14 – 18^{o}C / Spawning: 14 – 16^{o}C. NMFS criteria for anadromous fish Spawning: 13.9 –15.6^{o}C Migration and rearing: 13.9 –17.8^{o}C	• No stream temperature data exists. Rating is based on data from the adjacent downstream 6th field watershed (Cispus R. – Chambers Cr.) where all 6 monitoring sites were between 12.4^o C and 15.0^{o}C.	• 2000 and 1994 Stream temperature Monitoring
	Sediment (in spawning areas)	Functioning At Risk	12-17% fines (<0.85mm) in gravel[4];	• We have no measurements of fine-grained particles in the substrate for this watershed. Observations during spawner counts suggest that spawning success may be somewhat impaired the amount of fine sediment in the stream. Because the observed section of stream is in the wilderness this fine sediment is of natural origin.	• Spawning Surveys 1999 and 2001
	Chemical Contamination/ Nutrients	Functioning Appropriately	Low levels of chemical contamination from agricultural, industrial …	• There are no known sources of either chemical or nutrient contamination in the watershed. There are no towns, homes, factories, or agricultural activities in the watershed. There is 1 is designated horse camp in the subwatershed, however, it is well away from fish bearing streams. Although gas powered motor boats are allowed on the Walupt Lake there are no obvious signs of pollution.	• Field observations by the USFS, 1990 – 2001.
HABITAT ACCESS	Physical barriers	Functioning Appropriately	Human-made barriers present in watershed allow upstream and downstream fish passage at all flows for all life history stages	• There are no known man-made barriers to fish passage in the sub-watershed.	• Culvert Surveys 2001
	Substrate character and embedded-ness (in rearing areas)	Functioning At Risk	Gravel and cobble are subdominant, or if dominant, reach embeddedness 20-30%[9,10]	• Observations made during the spawner surveys suggest that there is some loss of cover due to fine-grained sediments in the stream. . Because the observed section of stream is in the wilderness this fine sediment is of natural origin.	• 1999 and 2001 Spawner Surveys

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
HABITAT ELEMENTS	Large Woody Debris (LWD)	Functioning Appropriately	Current levels are not at those desired values for "functioning appropriately",	• We have no counts of woody debris in this watershed. Observations made during spawner counts, however, suggest that large woody debris is abundant and large enough to remain stable. Because this watershed is in a nearly unmanaged condition we believe that the observed amount of woody debris is nearly at its potential for this watershed.	• 1999 and 2001 Spawner Surveys
	Pool Frequency and Quality	Functioning Appropriately	Pool frequency in a reach closely approximates potential for the Stream: also, pools have good cover and cool water[4], and only minor reduction of pool volume by fine sediment	• We have no standardize stream survey data for Walupt Creek. Observations made during spawner counts, however, suggest that the number, size and quality of pools are at the potential for the stream. In addition, because this watershed is in a nearly unmanaged state it is unlikely that any deviations from the potential are due to management actions.	• 1999 and 2001 Spawner Surveys • Professional Judgment
	Large Pools (in streams with > 3m in wetted width at baseflow)	Functioning Appropriately	Each reach has many large pools >1 meter deep[4]	• We have no standardize stream survey data for Walupt Creek. Observations made during spawner counts, however, suggest that the number of large pools is at the potential for the stream. In addition, because this watershed is in a nearly unmanaged state it is unlikely that any deviations from the potential are due to management actions.	• 1999 and 2001 Spawner Surveys • Professional Judgment
	Off-channel habitat	Functioning Appropriately	Watershed has many functional high water velocity refugia such as ponds, oxbows, backwaters, and other off-channel areas with cover; and side-channels are complex, low energy areas[4]	• The are many side channels and beaver dam along the upper Cispus River and lower ends of Wesley and Midway creeks.	• Field Observations 2001
	Refugia (at 6th to 7th field watershed scale)	Functioning At Risk	Habitats capable of supporting strong and significant populations are insufficient in size, number and connectivity to maintain all life stages and forms of the species[12, 13]	• Walupt Lake and its tributaries are capable of sustaining a large population of fish within the subwatershed. This watershed is islated from the rest of the upper Cispus River by at a large natural waterfall at the confluence of Walupt Creek and the Cispus River. In addition, there is not much pressure for fish to leave Walupt Lake.	• Professional Judgment

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
CHANNEL CONDITION AND DYNAMICS	Width/Depth Ratio in riffles	Functioning Appropriately	W/D ratios and/or channel types in portions of watershed are outside historic ranges and/or site potentials.	• We have no standardize stream survey data for Walupt Creek. Observations made during spawner counts, however, suggest that the width to depth ratio is at the potential for the stream. In addition, because this watershed is in a nearly unmanaged state it is unlikely that any deviations from the potential are due to management actions.	• 1999 and 2001 Spawner Surveys • Professional Judgment
	Streambank Condition	Functioning Appropriately	80% of any stream reach has ≥90% stability[5]	• We have no standardize stream survey data for Walupt Creek. Observations made during spawner counts, however, suggest that the bank stability is at the potential for the stream. In addition, because this watershed is in a nearly unmanaged state it is unlikely that any deviations from the potential are due to management actions	• 1999 and 2001 Spawner Surveys • Professional Judgment
	Floodplain Connectivitiy	Functioning Appropriately	Off-channel areas are frequently hydrologically linked to main channel; overbank flows occur and maintain wetland functions, riparian vegetation and succession	• The is only one stream crossing in the entire subwatershed and it does not interfere with the hydrologic connectivity of floodplains or wetalands.	• Field observations.
FLOW / HYDROLOGY	Change in Peak/Base Flows	Functioning At Risk	Some evidence of altered peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology and geography	• Stands with an average diameter ≥ 8" occupy 96.1 of the potentially forested area. This represents an area with very little distburbance.	• GIS Analysis of Stand Structure
	Drainage Network Increase	Functioning Appropriately	Zero or minimum increases in active channel length correlated with human caused disturbance	• A drainage extension of 0.2% would fit into the low drainage extension.	• GIS Analysis of Road Location.
WATERSHED CONDITIONS	Road Density and Location	Functioning Appropriately	<1mi/mi² [13]; no valley bottom roads	• The overall road density of 0.07 miles per square mile is a low impact, and the road density in riparian reserves is also low at 1.17 miles per square mile.	• GIS Analysis of Road Location • Field Observations.
	Riparian Reserves	Functioning Appropriately	The riparian reserve system provides adequate shade, large woody debris recruitment, and habitat protection and connectivity in subwatersheds, and buffers or includes known refugia for sensitive aquatic species (>80% previously unmanaged); adequately buffers impacts from grazing; percent similarity of riparian vegetation to the potential natural community/composition and structure >50%[15]	• 1.0% of the riparian reserves are in the Early Sucessional classes.	• GIS Anlysis of Stand structure in Riparian Reserves

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
	Disturbance Regime	Functioning Appropriately	Frequent flood or drought producing highly variable flows …. Channel is simplified … little hydrologic complexity … Natural processes are unstable.	• In the 1900's, a number of natural events have significantly affected the watershed: • 1980 eruption of Mount St. Helens covered the watershed in ash.	• Upper/Middle Cispus River Watershed Analysis (1995), pages 4-56, 4-70, 5-1. • USGS Stream Gauge data.
	Disturbance History	Functioning Appropriately	>15% ECA (< 85% ARP/HRP) of entire watershed and some disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area;	• 1 of the Riparian Reserves are in the early Successional classes. • The low ARP and is due to the lower productivity of the area. • Road density within the riparian reserves is low at 1.17 miles per square mile. • There is no harvest recorded for this watershed. • 95% of the sub-watershed is within the Goat Rocks Wilderness. • There 2 campgrounds (Walupt Lake and Walupt HorseCamp)	• GIS Analysis of Harvest History, Stand Structure, Stand Structure RR, Road Location.
SUBPOPULATION CHARACTER-ISTICS	Subpopulation Size	No Rating		• We rate this indicator for the 5th field watershed. • This is not an anadromous sub-watershed. • This is not a bull trout consultation sub-watershed.	• Walupt Lake Spawner Counts
	Growth and Survival	No Rating			
	Life History Diversity and Isolation	No Rating			
	Persistence and Genetic Integrity	No Rating			
SPECIES and HABITAT	Integration of Species and Habitat Conditions	No Rating		• We rate this indicator for the 5th field watershed.	• All of the previously cited sources

TABLE C-3: Baseline conditions for fish habitat in 2001 for the Cispus Chambers Creek watershed (170800040403)
(Ratings were made using the "Matrix of Diagostics / Pathways and Indicators" from the US Fish and Wildlife Service)

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
WATER QUALITY	Temperature	Bull Trout Functioning At Unacceptable Risk	USFWS Criteria 7-day average maximum temperature in a stream reach for the following life history stages: Incubation: <1°C or > 6°C Rearing: > 15 °C Spawning: <4°C or >10°C.	• All 6 monitoring sites were between 12.4° C and 15.0°C. • Notes: Water temperature monitoring does not cover the spawning or incubation periods. This is not a bull trout consultation sub-watershed.	• 2000 and 1994 Stream temperature Monitoring
		Cutthroat Functioning At Risk	USFWS draft criteria for coastal cutthroat 7-day ave. max. temp. in a stream reach during the following life history stages: Rearing: 14 – 18°C / Spawning: 14 – 16°C.	• All 6 monitoring sites were between 12.4° C and 15.0°C. • Notes: Water temperature monitoring does not cover the spawning or incubation periods. There are no anadromous fish in this sub-watershed.	• 2000 and 1994 Stream temperature Monitoring
	Sediment (in spawning areas)	Functioning At Risk	12-17% fines (<0.85mm) in gravel[4];	• Stream surveys did not quantify fine sediments using this measure. • 10 of 26 the samples from the upper Cispus River were rated as being greater than 35% embedded. • Observations on the fish bearing portions of Midway and Wesley Creek found relatively high levels of fine sediments. • Because the level of activity round Chambers Creek the amount of sediment is likely to be elevated.	• Stream survey summary. • Observations on Midway and Wesley creeks 1999. • Professional Judgment on Chambers Creek.
	Chemical Contamination/ Nutrients	Functioning Appropriately	Low levels of chemical contamination from agricultural, industrial …	• There are no known sources of either chemical or nutrient contamination in the watershed. There are no towns, homes, factories, or agricultural activities in the watershed. There is 1 is designated horse camp in the sub-watershed, however, it is well away from fish bearing streams.	• Field observations by the USFS, 1990 – 2001.
HABITAT ACCESS	Physical barriers	Functioning Unacceptable Risk	One or more human-made barriers present in watershed do not allow upstream and/or downstream fish passage at a range of flows for at least one life history stage	o There are no known man-made barriers to anadromous fish passage in the sub-watershed. o The culvert survey identified 3 culverts that are most-likely barriers to migration and 3 culverts that need further three that need further examination. All of these are upstream of anadromous barriers.	• Culvert Surveys 2001

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
HABITAT ELEMENTS	Substrate character and embedded-ness (in rearing areas)	Functioning At Risk	Gravel and cobble are subdominant, or if dominant, reach embeddedness 20-30%[9,10]	• 10 of 26 the samples from the upper Cispus River were rated as being greater than 35% embedded. • Observations on the fish bearing portions of Midway and Wesley Creek found relatively high levels of fine sediments. • Because the level of activity round Chambers Creek the amount of sediment is likely to be elevated.	• Level II Stream Survey Upper Cispus River 1994. • Observations on Midway and Wesley creeks 1999. • Professional Judgment on Chambers Creek.
	Large Woody Debris (LWD)	Functioning At Unacceptable Risk	Current levels are not at those desired values for "functioning appropriately",	• Only one of the reaches of the Cispus nearly meets the criteria for properly functioning. • Harvest near the mouths of Midway and Wesley Creeks have reduced the potential for future recruitment. • Harvest activities near Chambers Creek have likely reduced future recruitment in that stream.	• Stream survey summary. • Observations on Midway and Wesley creeks 1999. • Professional Judgment on Chambers Creek.
	Pool Frequency and Quality	Functioning At Risk	Pool frequency is similar to values in "functioning appropriately", but pools have inadequate cover/temperature[4], and/or there has been a moderate reduction of pool volume by fine sediment	• The first two reaches of the upper Cispus meet the criteria. • Of these less than ½ qualify as quality pools. • Activities near Midway, Wesley, Chambers creeks have likely altered the pool frequency and quality. • Criteria for pools: Wetted width in feet, # pools per mile • 0-5, 39 5-10, 60 10-15, 48 15-20, 39 20-30, 23 30-35, 18 • 35-40, 10 40-65, 9 65-100, 4	• Level II Stream Survey Upper Cispus River 1994. • Observations on Midway and Wesley creeks 1999. • Professional Judgment on Chambers Creek.
	Large Pools (in streams with > 3m in wetted width at baseflow)	Functioning At Risk	Reaches have few large pools (>1 meter) present[4]	• The pools on the Cispus are shallower than expected for a stream of it size. • Flows on Midway Creek and Wesley Creek often become subsurface during the later part of summer. • Activities along Chambers Creek have likely lead to an alteration of pool depths.	• Level II Stream Survey Upper Cispus River 1994. • Observations on Midway and Wesley creeks 1999. • Professional Judgment on Chambers Creek.
	Off-channel habitat	Functioning Appropriately	Watershed has many functional high water velocity refugia such as ponds, oxbows, backwaters, and other off-channel areas with cover; and side-channels are complex, low energy areas[4]	• The are many side channels and beaver dam along the upper Cispus River and lower ends of Wesley and Midway creeks.	• Field Observations • 1994 Stream survey raw data.
	Refugia (at 6th to 7th field watershed scale)	Functioning at Unacceptable Risk	Adequate habitat refugia do not exist[12]	• The habitat quality of the upper Cispus River is not quite good enough to qualify as a refugium. • In addition, all of the watersheds are isolated from the rest of the watershed by natural migration barriers.	• Professional Judgment

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
CHANNEL CONDITION AND DYNAMICS	Width/Depth Ratio in riffles	Functioning at Risk.	W/D ratios and/or channel types in portions of watershed are outside historic ranges and/or site potentials.	• The width-to-depth-ratios on the main Cispus River barely meet the expected values. • There is some evidence of channel widening upstream of Chambers creek. • Flows on Wesley Creek and Midway Creek become subsurface during late summer. This is an indicator of poor width-to-depth ratio. • There is no data for Chambers Creek.	• Level II Stream Survey Upper Cispus River 1994. • Observations on Midway and Wesley creeks 1999. • Hydrology Report Upper Cispus WA. • Professional Judgment on Chambers Creek.
	Streambank Condition	Functioning At Risk	80% of any stream reach has $\geq$90% stability[5]	• The notes from the 1994 survey of the Cispus River seem to indicate that the main river is on the borderline of Functioning Appropriately and at Risk (mainly new side channels). • Observations of lower Midway Creek also indicate some channel potential problems with channel stability. We have no data with which to evaluate the stability of Chambers Creek.	• 1994 Upper Cispus Level II stream Survey. • Field Observations Midway Creek 1999 and 2000.
	Floodplain Connectivitiy	Functioning Appropriately	Off-channel areas are frequently hydrologically linked to main channel; overbank flows occur and maintain wetland functions, riparian vegetation and succession	• Although road density in the riparian reserves (14.7 m/sq mile) and road stream crossing (1.32 crossing per linear mile of stream) are moderately high, the wetlands and off-channel habitats appear to be well connected to the main channels.	• Field Observations 1997 to 2001
FLOW / HYDROLOGY	Change in Peak/Base Flows	Functioning At Risk	Some evidence of altered peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology and geography	• The area occupied by stands with an average diameter $\geq$ 8" is low 76.1. This is a large due previous harvest activities. In addition a stream drainage network extension of 5% more evidence for altered peak flows.	• GIS Analysis of Stand Structure Analysis
	Drainage Network Increase	Functioning At Risk	low to moderate increase in active channel length correlated with human caused disturbance	• A drainage extension of 5% would fit into the low drainage extension.	• GIS Analysis of Road Location Analysis table this document.
WATERSHED CONDITIONS	Road Density and Location	Functioning At Risk	1 - 2.4 mi/mi² [13]; some valley bottom roads	• The overall road density of 1.22miles per square mile is a moderate impact, and the road density in riparian reserves is also moderate at 14.7 miles per square mile. Although the road density in riparian reserves moderate there are no sections of road that closely (with in a couple of hundred feet) follow stream.	• GIS Analysis of Road Location Analysis table this document. • 1997-2001Field Observations.

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
	Riparian Reserves	Functioning At Risk	Moderate loss of connectivity or function (shade, LWD recruitment, etc.) of riparian reserve system; , or incomplete protection of habitats and refugia for sensitive aquatic species (.70-80% previously unmanaged) including from grazing impacts; percent similarity of riparian vegetation to the potential natural community/composition and structure 25-50%	• 15% of the riparian reserves are in the Early Successional class. The amount of vegetation in the Early Successional stage in this sub-watershed is much greater than that in the two neighboring sub-watersheds, which represent nearly undisturbed conditions. The moderate amount of area in the grass pole class is due past harvest.	• GIS Analysis of Stand structure in Riparian Reserves
	Disturbance Regime	Functioning at Unacceptable Risk	Frequent flood or drought producing highly variable flows …. Channel is simplified … little hydrologic complexity … Natural processes are unstable.	• In the 1900's, a number of natural events have significantly affected the watershed: • 1980 eruption of Mount St. Helens covered the watershed in ash. • Fires burned 42% of the watershed between 1900 and 1950. • A number of large flood events occurred - 4 events occurred in the 1970's alone. • This subwatershed is completely within the AMA, which is treated similar to Matrix, but with some innovation in management practices.	• Upper/Middle Cispus River Watershed Analysis (1995), 41 to 4-16 • USGS Stream Gauge data Cispus River near Yellowjacket Creek.
	Disturbance History	Functioning at Unacceptable Risk	>15% ECA (< 85% ARP/HRP) of entire watershed and some disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area;	• The area occupied by with an average stand diameter ≥ is low at 76.1. • 15 of the Riparian Reserves are in the Early Sucessional class primarily due to past harvest. • The low ARP and moderately high amount grass pole in the riparian reserve are largely due to past harvest. • Road density within the riparian reserves is moderate at 14.7 miles per square mile. • Only 11 5 of the sub-watershed is within the Goat Rocks Wilderness. • 3141 acres (regen 3130 and 11thin) have been harvested since 1950. This is 17.16% of the watershed. • Regeneration harvest began in ernest in the 1950s, doubled in the 1960s, and then decreased to 150 acres of thinning in the 1990s. See harvest history table. • There is campground (Chambers Lake) and major trailhead (Berry Patch) in the watershed. • Chambers Lake campground is a lakeside and has no potential to affect TES fish species.	• GIS report of Harvest History, Stand Structure, Stand Structure RR, Road Location.
SUBPOPULATION CHARACTER-	Subpopulation Size	No Rating			• Field Observations, Bull trout surveys 2000 and Level II
	Growth and Survival	No Rating		• Rated at the 5th field watershed.	

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
ISTICS	Life History Diversity and Isolation	No Rating		• This sub-watershed contain no anadromous fish and is not a bull trout consultation sub-watershed.	2000 and Level II survey 1994.
	Persistence and Genetic Integrity	No Rating			
SPECIES and HABITAT	Integration of Species and Habitat Conditions	No Rating		Rated at the 5th field watershed.	• All of the previously cited sources.

TABLE C-4: Baseline conditions for fish habitat in 2001 for the Muddy Fork watershed (170800040404).
(Ratings were made using the "Matrix of Diagostics / Pathways and Indicators" from the US Fish and Wildlife Service)

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
WATER QUALITY	Temperature	Bull Trout Functioning Appropriately	USFWS Criteria 7-day average maximum temperature in a stream reach for the following life history stages: Incubation: 2-5°C / Rearing: 4-12°C / Spawning: 4-9°C.	▪ Max. 7-day ave. was 10.3 and 8.1° C for all monitored sites. ▪ Note: Monitoring was terminated prior to the spawning season.	▪ 2000 Stream temperature Monitoring
		Cutthroat and Other Species Functioning At Risk	USFWS[2] draft criteria for coastal cutthroat 7-day average maximum temperature in a stream reach during the following life history stages: Rearing: 10 –14°C.	▪ Maximum 7-day ave. temp. of monitoring sites was between 10.3 and 8.1°C; such cold stream temperatures may be a limiting factor for these fish species. ▪ Note: Monitoring was terminated prior to the spawning season. No anadromous fish are found in this sub-watershed.	▪ 2000 Stream temperature Monitoring
	Sediment (in spawning areas)	Functioning Appropriately	Not Used because of a lack of Supporting Data	▪ We have no comprehensive stream surveys of the Muddy Fork or its fish bearing tributaries. ▪ Observations on Spring Creek found that fine material dominated the low gradient (meadow sections approximately 2 miles) and the steeper gradient sections were relatively clean. ▪ The conditions were considered to represent nearly natural conditions. Given the glacial source of the Muddy Fork, its substrate is likely naturally high in fine sediment.	▪ Field observations by the USFS, 1990 – 2001.
	Chemical Contamination/ Nutrients	Functioning Appropriately	Low levels of chemical contamination from agricultural, industrial …	▪ There are no known sources of either chemical or nutrient contamination in the watershed. There are no towns, homes, factories, or agricultural activities in the watershed. ▪ There is 1 is designated horse camp in the sub-watershed, waste material is store in a concrete container then hauled off site and away from streams.	▪ Field observations by the USFS, 1990 – 2001.
HABITAT ACCESS	Physical barriers	Functioning At Risk		▪ Several culverts need further evaluation to determine if they are migration barriers.	. ▪ Culvert Surveys 2001

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
HABITAT ELEMENTS	Substrate character and embedded-ness (in rearing areas)	Functioning Appropriately	Not Used because of a lack of supporting Data	▪ We have no comprehensive stream surveys of the Muddy Fork or its fish bearing tributaries. ▪ Observations on Spring Creek found that fine material dominated the low gradient (meadow sections approximately 2 miles) and the steeper gradient sections were relatively clean. ▪ The conditions were considered to represent nearly natural conditions. Given the glacial source of the Muddy Fork, its substrate is likely naturally high in fine sediment.	▪ Bull Trout Snorkel of Spring Creek 2000 ▪ Professional Judgment
	Large Woody Debris (LWD)	Functioning At Risk	Not Used because of a lack of supporting Data	▪ We have no comprehensive stream surveys of the Muddy Fork or its fish bearing tributaries. ▪ Observations of woody debris during the bull trout surveys suggest that woody debris is not at the potential for the stream, because of some previous timber harvest. ▪ Woody debris on the Muddy Fork, however, is probably near its potential because of the relatively unmanaged nature of the watershed.	▪ Bull trout Snorkel Spring Creek 2000 Professional Judgment.
	Pool Frequency and Quality	Functioning Appropriately	Not Used because of a lack of supporting Data	▪ We have no comprehensive stream surveys of the Muddy Fork or its fish bearing tributaries. ▪ Observations during the bull trout surveys on Spring Creek found many pool-like habitats with good cover in the meadow sections and fewer pool-like habitats in the steeper areas. ▪ Because of the relative lack of management in this watershed pool habitat in the Muddy Fork is probably near its natural potential.	▪ Bull trout Snorkel Spring Creek 2000 Professional Judgment.
	Large Pools (in streams with > 3m in wetted width at baseflow)	Functioning Appropriately	Not Used because of a lack of supporting Data	▪ We have no comprehensive stream surveys of the Muddy Fork or its fish bearing tributaries. ▪ Most of the pools in the meadow section of Spring Creek would qualify as large pools. ▪ Given the relatively unmanaged nature of the Muddy Fork it is likely that the conditions nearly represent the potential for this stream.	▪ Bull trout Snorkel Spring Creek 2000 Professional Judgment.

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
HABITAT ELEMENTS (continued)	Off-channel habitat	Functioning Appropriately	Watershed has many functional high water velocity refugia such as ponds, oxbows, backwaters, and other off-channel areas with cover; and side-channels are complex, low energy areas[4]	▪ We have no comprehensive stream surveys of the Muddy Fork or its fish bearing tributaries. ▪ The meadow sections of Spring Creek contain many beaver ponds and side channel. ▪ Aerial photo analysis shows that the Muddy Fork has relatively little meadow habitat.	▪ Bull trout Snorkel Spring Creek 2000 Professional Judgment.
	Refugia (at 6th to 7th field watershed scale)	Functioning at Risk	habitats capable of supporting strong and significant populations are insufficient in size, number and connectivity to maintain all life stages and forms of the species[12, 13]	▪ The entire watershed has been relatively unmanaged. ▪ The combination of being fed by glaciers and the relatively unmanaged condition make it a source of cold water for the Cispus River. ▪ It would serve as refuge for the Cispus River population except that water may be to cold to support growth and the high turbidtity would discourage fish from using this stream.	▪ Professional Judgment
CHANNEL CONDITION AND DYNAMICS	Width/Depth Ratio in riffles	Functioning Appropriately	W/D ratios and channel types are well within historic ranges and/or site potentials in watershed. <u>Rosgen Type</u> — <u>W/D Ratio</u> A, E, G — < 12 B, C, F — 12 - 30 D — > 40	▪ We have no comprehensive stream surveys of the Muddy Fork or its fish bearing tributaries. ▪ The width to depth ratio of Spring Creek was at its potential. Because relatively little of this watershed has been managed (harvested or otherwise manipulated), we expect the width-to-depth ratios to be near their potential.	▪ Professional Judgment ▪ Bull trout surveys Spring Creek 2000
	Streambank Condition	Functioning At Appropriately	80% of any stream reach has $\geq$90% stability[5]	▪ We have no comprehensive stream surveys of the Muddy Fork or its fish bearing tributaries. Little bank erosion was observed in Spring Creek. ▪ Because relatively little of this watershed has been managed (harvested or otherwise manipulated) we expect the much bank instability.	▪ Professional Judgment
	Floodplain Connectivitiy	Functioning Appropriately	Off-channel areas are frequently hydrologically linked to main channel; overbank flows occur and maintain wetland functions, riparian vegetation and succession	▪ We have no comprehensive stream surveys of the Muddy Fork or its fish bearing tributaries. Spring Creek was linked to its off channel habitats.	▪ Field Observations 1997-2001

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
FLOW / HYDROLOGY	Change in Peak/Base Flows	Functioning At Risk	Some evidence of altered peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology and geography	The area occupied by stands with an average diameter $\geq$ 8" is very low at 54.5. This ARP value is misleading for several reasons. ▪ This is mainly due to a large natural fire, which burned lodgepole pine stands. The resulting stands have been very slow to recover. ▪ In addition this sub-watershed is above the rain-on-snow, therefore, the larger floods usually associated with rain-on-snow storm events are unlikely to occur in this sub-watershed.	▪ GIS Analysis of Stand Structure.
	Drainage Network Increase	Functioning Appropriately	zero or minimum increases in active channel length correlated with human caused disturbance	▪ A drainage extension of 0.6% would fit into the low drainage extension.	▪ GIS Analysis of Road Location.
WATERSHED CONDITIONS	Road Density and Location	Functioning Appropriately	1mi/mi² [13]; no valley bottom roads	▪ The overall road density of 0.32 miles per square mile is a low impact, however, road density in riparian reserves is moderate at 6.6 miles per square mile. ▪ Although the road density in riparian reserves moderate only one section of road closely (with in a couple of hundred feet) follows stream and that is only for a short distance (1/2 mile).	▪ GIS Analysis of Road Location ▪ Field Observations.
	Riparian Reserves	Functioning At Risk	Moderate loss of connectivity or function (shade, LWD recruitment, etc.) of riparian reserve system; , or incomplete protection of habitats and refugia for sensitive aquatic species (.70-80% previously unmanaged) including from grazing impacts; percent similarity of riparian vegetation to the potential natural community/composition and structure 25-50%	▪ 38% of the riparian reserves are in the Early Successional Classes. This is much greater than the two headwater watersheds which a nearly undisturbed. The high amount of the riparian reserve in the grass pole class is due to a large fire and slow re-growth rather than harvest. ▪ The glacial water that feeds Muddy Fork keeps this stream cool.	▪ GIS Analysis Stand Structure in Riparian Reserves
	Disturbance Regime	Functioning at Unacceptable Risk	Frequent flood or drought producing highly variable flows …. Channel is simplified … little hydrologic complexity … Natural processes are unstable.	In the 1900's, a number of natural events have significantly affected the watershed: ▪ 1980 eruption of Mount St. Helens covered the watershed in ash. ▪ Fires burned 42% of the watershed between 1900 and 1950. ▪ A number of large flood events occurred - 4 events occurred in the 5th field watershed 1970's alone. ▪ This sub-watershed is glacially fed and subject to large amounts of glacial flour and glacial outburst floods.	▪ Upper/Middle Cispus River Watershed Analysis (1995), pages 4-56, 4-70, 5-1. ▪ USGS Stream Gauge data.

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
	Disturbance History	Functioning at Risk	<15% ECA (>85% ARP/HRP) of entire watershed but some disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area;	▪ 38 of the Riparian Reserves are in the Early Successional classes. ▪ The low ARP and moderately high amount grass pole in the riparian reserve are mostly likely due fire follow by slow re-growth at high elevations. ▪ Road density within the riparian reserves is low at 6.6 miles per square mile. ▪ 57% of the sub-watershed is within the Mt. Adams Wilderness. ▪ 382 acres (regen 377 and 5 thin) have been harvested since 1960. This is 2.15% of the watershed. ▪ Regeneration harvest began in earnest in the 1960s, tripled in the 1970s and 1980s, and then decreased to 5 acres of thinning in the 1990s. See harvest history table. ▪ There are two campgrounds in the watershed. ▪ Horseshoe Lake campground is a Lakeside and has little potential to affect TES fish species. ▪ Keenes Horse campground is streamside and maybe affecting this tributary to Muddy Fork. The Forest Service is in the process of moving half of this campground to an area outside of the riparian reserve.	▪ GIS Analysis of Harvest History, Stand Structure, Stand Structure RR, Road Location.
SUBPOPULATION CHARACTERISTICS	Subpopulation Size	No Rating		We rate these indicators for the 5th field watershed. This is not an anadromous sub-watershed. This is not a bull trout consultation sub-watershed.	• Bull trout Surveys 2000
	Growth and Survival	No Rating			
	Life History Diversity and Isolation	No Rating			
	Persistence and Genetic Integrity	No Rating			
SPECIES and HABITAT	Integration of Species and Habitat Conditions	No Rating		We rate these indicators for the 5th field watershed.	• All previously cited sources.

TABLE C-5: Baseline conditions for fish habitat in 2001 for the Cispus River-Cat Creek watershed (170800040405)
(Ratings were made using the "Matrix of Diagostics / Pathways and Indicators" from the US Fish and Wildlife Service)

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
WATER QUALITY	Temperature	Functioning at Risk Bull Trout	USFWS Criteria 7-day average maximum temperature in a stream reach for the following life history stages: Incubation: <2°C or > 6°C Rearing: < 4°C or > 13-15 °C Spawning: <4°C or >10°C. .	▪ 7 of 9 monitored sites had max. 7-day ave. temperatures between 10.6°C and 12.7°C. Note* Temperature monitoring was terminated prior to the spawning season and did not start until after the incubation season..	▪ Stream temperature monitoring from 1994 through 2000.
		Functioning At Risk Coastal Cutthroat, Sea-Run Cutthroat, Chinook Salmon, Coho Salmon, Steelhead	USFWS draft criteria for coastal cuttthroat 7-day ave. max. temp. in a stream reach during the following life history stages: Rearing: 14 – 18°C / Spawning: 14 – 16°C. NMFS criteria for anadromous fish Spawning: 13.9 –15.6°C Migration and rearing: 13.9 –17.8°C	▪ All 6 monitoring sites had max. 7-day ave. temperatures between 12.4 and 14.2°C. Note* Temperature monitoring was terminated prior to the spawning season and did not start until after the incubation season. The exception is for Chinook salmon.	o Stream temperature monitoring from 1994 through 2000.
	Sediment (in spawning areas)	Functioning at Risk	12 –17% fines (<0.85mm) in gravel	o Spawning habitat in the Cispus River, and Orr Creek is currently being impaired as a result of an excess fine-grained material contained in gravel deposits. The problems with fine sediment in Cat and Mouse creeks appeared to be less severe in 1998.	▪ Upper/Middle Cispus River Watershed Analysis (1995), page 4-78. ▪ 1998 Cat Creek and Mouse Creek stream surveys. ▪ Orr Creek Stream Survey 1999. ▪ Field observations by the USFS, 1990 – 2001.
	Chemical Contamination/ Nutrients	Functioning Appropriately	Low levels of chemical contamination from agricultural, industrial …	o There are no known sources of either chemical or nutrient contamination in the watershed. There are no towns, homes, factories, or agricultural activities in the watershed. There are no designated horse camps in the subwatershed.	▪ Field observations by the USFS, 1990 – 2001.
HABITAT ACCESS	Physical barriers	Functioning At Risk	One or more human-made barriers present in watershed do not allow upstream and/or downstream fish passage at base/low flows for at least one life history stage	o The culvert survey identified several culverts as potential barriers at high flows. The Gifford Pinchot National Forest will evaluate with further field inspections.	▪ Stream Surveys, 1991 – 2000. ▪ Culvert Surveys 2001

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
	Substrate character and embedded-ness (in rearing areas)	Functioning at Risk	Gravel and cobble are subdominant, or if dominant, reach embeddedness 20-30%.	o The same fine-grained sediment that is impairing spawning success is also filling the interstitial spaces between cobbles that provide juvenile escape cover. The problems with fine sediment in Cat and Mouse creeks appeared to be less severe in 1998.	▪ Upper/Middle Cispus River Watershed Analysis (1995), page 4-78. ▪ Field observations by the USFS, 1990 – 2001. ▪ Stream Survey summaries. ▪ Orr Creek Stream Survey 1999. ▪ 1989 and 1998 Cat Creek Stream Surveys
HABITAT ELEMENTS	Large Woody Debris (LWD)	Functioning at Unacceptable Risk	Current levels are not at those desired values for "functioning appropriately",	o Stream surveys show that Cat, Mouse and, Orr creek have over 100 pieces of wood per mile, but less than 30 pieces per mile meet the 24 inch criteria for large woody debris. o Large wood is also lacking from the main stem of the Cispus River. Low level aerial photo graphs (1:6000 scale) show much less wood than is seen in down stream reaches. o The reach of the Cispus River between East Canyon Creek and the 56 bridge is a boulder bedrock canyon that does not store woody debris.	▪ Field observations by the USFS, 1990 – 2001. ▪ Stream Surveys Cat and Mouse creeks 1998 and Orr Creek 1999. ▪ 1999 aerial photo graphs of the Cispus (scale 1: 6000).
	Pool Frequency and Quality	Functioning at Risk	Pool frequency is similar to values in "functioning appropriately", but pools have inadequate cover/temperature[4], and/or there has been a moderate reduction of pool volume by fine sediment	▪ Approximately one half of Cat Creek and two thirds of Orr Creek meet criteria shown below. Although many of the pools meet the liberal criteria for quality, the pools found in these reaches are small and taken together make up less than 35% of the reach and lack cover. ▪ Mouse Creek does meet the criteria. ▪ The size and high-energy nature of Cispus River have prevented detailed surveys. Examination of low level aerial photographs anecdotes and spot checks suggest that this section of river is mostly white water with pocket pools. Wetted width in feet, # pools per mile 0-5, 39 5-10, 60 10-15, 48 15-20, 39 20-30, 23 30-35, 18 35-40, 10 40-65, 9 65-100, 4 The rest of the streams in this watershed do not provide enough fish habitat to influence the rating.	▪ Cat Creek and Mouse Creek Surveys 1998, Orr Creek survey 1999, ▪ Low level (1:6000) aerial photography of the Cispus River 1999. ▪ Field observations 1990-2001.

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
	Large Pools (in streams with > 3m in wetted width at baseflow)	Functioning at Risk	Reaches have few pools greater than 1 meter in depth.	▪ The pools in the Cispus River are not as large as they should be for a stream of that size. Depth of many pools in the Cispus River has decreased as a result of being filled in with coarse-grained sediment. ▪ There are few large pools in Cat, Mouse and, Orr Creeks	▪ ▪ Cat Creek and Mouse Creek Surveys 1998, Orr Creek survey 1999, ▪ Field observations 1990-2001.
	Off-channel habitat	Functioning at Risk	Some high water velocity refugia such as ponds, oxbows, backwaters …	▪ Orr Creek is the only channel that is conducive to the formation of these habitats and it has abundant side channels and beaver ponds.	▪ Cat Creek and Mouse Creek Surveys 1998, Orr Creek survey 1999. ▪ Aerial photographs of the Cispus River 1999.
	Refugia (at 6^{th} to 7^{th} field watershed scale)	Functioning at Unacceptable Risk	Adequate habitat refugia do not exist[12]	▪ None of the habitat elements rates as properly functioning.	▪ Field observations, 1990-2001.
CHANNEL CONDITION AND DYNAMICS	Width/Depth Ratio in riffles	Functioning at Risk	W/D ratios and/or channel types in portions of watershed are outside historic ranges and/or site potentials.	▪ Although they meet the width to depth ratios for their channel types the channels Cat Creek, Mouse Creek and to a lesser Orr Creek appear to be altered.	▪ Observations form the tributary stream surveys 1998 and 1999.
	Streambank Condition	Functioning At Risk	50 – 80% of any stream reach has greater than 90% stability.	▪ Cat and Mouse Creek show sign of bank erosion and instability, ▪ This portion of the Cispus River is relatively stable, nearly half of the reach is in a bedrock and boulder canyon. ▪ The portion of the Cispus River below East Canyon Creek is less stable than the canyon section.	▪ Observations from the 1998 Cat and Mouse Creek Surveys. ▪ Post 1996 flood observations.
	Floodplain Connectivitiy	Functioning At Risk	Reduced linkage of wetland, floodplains and riparian areas to main channel; overbank flows are reduced relative to historic frequency, as evidenced by moderate degradation of wetland function, riparian vegetation/succession	▪ Road 78 closely (within 75 feet of the stream) parallels Cat Creek for approximately 2 miles and its fill material has likely modified the floodplain of Cat Creek. ▪ There are a moderate number of stream crossings (1.6 crossings per stream mile). Many of these crossings constrict the flood plain and modify the transport of sediment through the system.	▪ Field observations, 1996-2001.
FLOW / HYDROLOGY	Change in Peak/Base Flows	Functioning at Risk	Some evidence of altered peak flow, baseflow and /or flow timing relative to an undisturbed watershed of similar size, geology, and geography.	▪ Mouse Creek shows signs of recent debris flows. ▪ The area occupied stands with an average diameter of $\geq$ 8" is low at 78.5%, which places the sub-watershed in the moderate risk category for increased peak flow. The Cat Creek and Mouse Creek drainages are the area of greatest concern. ▪ Stream drainage network show a moderate amount of extension (see below), which also increases the risk of peak flow.	▪ Upper/Middle Cispus River Watershed Analysis (1995), pages 4-57, 4-58. ▪ Smooth Juniper Timber Sale Analysis ▪ GIS Analysis of Stand Structure.

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
	Drainage Network Increase	Functioning at Risk	Low to moderate increase in active channel length correlated with human caused disturbance.	▪ We calculated drainage extension by adding 200 feet (the an estimated average distance between the nearest ditch relief culvert and the stream) of stream for each stream crossing. This sub-watershed had low to moderate extension (6%)	▪ GIS Analysis of Road Location Analysis
	Road Density and Location	Functioning at Risk	1 – 2.4 miles per square mile; some valley bottom roads.	▪ Road density is 1.40 miles per square mile. ▪ Road density within the riparian reserves is 20.3 miles per square mile.	▪ GIS Analysis of Road Location.
	Riparian Reserves	Functioning at Risk	Moderate loss of connectivity or function (shade, LWD, etc.) …	Timber stands in the Early Seral classes 18% of the Riparian Reserves. The riparian reserves for Cat and Mouse Creeks are relatively fragmented. The Orr Creek riparian reserve is fragmented to a lesser degree. The Cispus River riparian reserve is relatively unfragmented.	▪ Analysis of GIS data Stand Strucutre in Riparain Reserves. ▪ Field observations.
	Disturbance Regime	Functioning at Unacceptable Risk	Frequent flood or drought producing highly variable flows …. Channel is simplified … little hydrologic complexity … Natural processes are unstable.	In the 1900's, a number of natural events have significantly affected the watershed: ▪ 1980 eruption of Mount St. Helens covered the watershed in ash. ▪ Fires burned 42% of the watershed between 1900 and 1950. ▪ A number of large flood events occurred - 4 events occurred in the 1970's alone – resulting in pronounced stream channel erosion, channel widening, increasing channel instability, and reducing hydrologic complexity. ▪ This subwatershed is completely within the AMA, which is treated similar to Matrix, but with some innovation in management practices.	▪ Upper/Middle Cispus River Watershed Analysis (1995), pages 4-56, 4-70, 5-1. ▪ USGS Stream Gauge data.
WATERSHED CONDITIONS	Disturbance History	Functioning at Unacceptable Risk	>15% ECA (< 85% ARP/HRP) of entire watershed and some disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area;	▪ 18% of the Riparian Reserves are in an Early Successional condition due to past harvest. ▪ Road density within the riparian reserves is 20.3 miles per square mile. ▪ The 78 road closely parallels Cat Creek for a couple of miles. ▪ There are two campgrounds plus numerous dispersed sites within the riparian reserves. ▪ 5111 acres (regen 4482, thin 629) have been harvested since 1950. This is 27.22 % of the watershed. ▪ Regeneration harvest began in earnest in the 1950s, doubled in the 1970s, and then decreased to half in the 1990s See harvest history table.	▪ Analysis of GIS data. ▪ Field observations by aquatics personnel. ▪ Harvest History Table.
SUBPOPULA-TION CHARACTER-ISTICS	Subpopulation Size	No Rating		We rate these indicators for the 5th field watershed.	▪ Transport records from the reintroduction of anadromous fish.
	Growth and Survival	No Rating			
	Life History Diversity and Isolation	No Rating			
	Persistence and Genetic Integrity	No Rating			

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
SPECIES and HABITAT	Integration of Species and Habitat Conditions	No Rating		We rate these indicators for the 5th field watershed.	▪ All previously cited sources.

TABLE C-6: Baseline conditions for fish habitat in 2001 for the Adams Fork watershed (170800040406)

(Ratings were made using the "Matrix of Diagostics / Pathways and Indicators" from the US Fish and Wildlife Service)

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
WATER QUALITY	Temperature	Bull Trout Functioning Appropriately	USFWS Criteria 7-day average maximum temperature in a stream reach for the following life history stages: Incubation: 2-5°C / Rearing: 4-12°C / Spawning: 4-9°C.	▪ Max. 7-day ave. was 8.6° C for all monitored sites. ▪ Notes:Monitoring was terminated prior to the spawning season.	▪ 2000 Stream temperature Monitoring
		Cutthroat Functioning At Risk	USFWS[2] draft criteria for coastal cutthroat 7-day average maximum temperature in a stream reach during the following life history stages: Rearing: 10 –14°C.	▪ Maximum 7-day ave. temp. of 3 monitoring sites was 8.6°C; such cold stream temperatures may be a limiting factor for these fish species. ▪ Notes: No anadromous fish occur in this watershed. Monitoring was terminated prior to the spawning season.	▪ 2000 Stream temperature Monitoring
	Sediment (in spawning areas)	Functioning At Unacceptable Risk	>17% fines (<0.85mm) in gravel[4];	▪ Stream surveys have not measured sediment in fashion suggested by the matrix. ▪ The survey rated cobble embeddedness as greater than 35% in 38 of 47 samples is the watershed.This condition in Adams Fork is most likely caused by deposition of glacial flour from Mt. Adams. The high levels of embeddedness in Sheep Creek cannot be explained by deposit of glacial flour.	▪ Level II Stream Survey 1992
	Chemical Contamination/ Nutrients	Functioning Appropriately	Low levels of chemical contamination from agricultural, industrial …	▪ There are no known sources of either chemical or nutrient contamination in the watershed. There are no towns, homes, factories, or agricultural activities in the watershed. There are no designated horse camps in the sub-watershed.	▪ Field observations by the USFS, 1990 – 2001.
HABITAT ACCESS	Physical barriers	Functioning At Risk	One or more human-made barriers present in watershed do not allow upstream and/or downstream fish passage at base/low flows for at least one life history stage	▪ There was one road crossing on Killen Creek that blocked access to approximately 0.8 miles of habitat.	. ▪ Culvert Surveys 2001
HABITAT ELEMENTS	Substrate character and embedded-ness (in rearing areas)	Functioning at Unacceptable Risk	Bedrock, sand, silt, or small gravel dominant, or if gravel and cobble dominant, reach embeddedness >30%[4,10]	The survey rated embeddedness as greater than 35% in 38 of 47 samples is the watershed.This condition in Adams Fork is most likely caused by deposition of glacial flour from Mt. Adams. The high levels of embeddedness in Sheep Creek cannot be explained by deposit of glacial flour.	▪ Level II Stream Survey 1992
	Large Woody Debris (LWD)	Functioning at Risk	Current values are being maintained at greater than 80 pieces/mile that are >24"diameter and >50 ft length ; also adequate sources of woody debris are available for both long and short-term recruitment	Current amount of wood ranges from 66 pieces per mile to 1104 pieces per mile. The extremely large (1104 per miles) amount of wood is a bit misleading, because this wood was found in log jams where the number of pieces of wood was estimated rather than being counted.	▪ 1992 Level II Stream Survey.

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
HABITAT ELEMENTS (continued)	Pool Frequency and Quality	Functioning At Unacceptable Risk	Pool frequency is considerably lower than values desired for "functioning appropriately"; also cover/temperature is inadequate[4], and there has been a major reduction of pool volume by fine sediment	▪ Only stream three reaches meets the criteria for pool frequency. ▪ Pools made up less than 5% of the habitat. ▪ Only 56% of the pools would qualify as quality pools. Criteria for pool frequency : Wetted width in feet, # pools per mile 0-5, 39 5-10, 60 10-15, 48 15-20, 39 20-30, 23 30-35, 18 35-40, 10 40-65, 9 65-100, 4	▪ 1992 Level II Stream Survey.
	Large Pools (in streams with > 3m in wetted width at baseflow)	Functioning at Risk	Reaches have few large pools (>1 meter) present[4]	▪ Only about 15% of the pools would qualify as large pools.	▪ 1992 Level II Stream Survey.
	Off-channel habitat	Functioning at Risk	Watershed has some functional high water velocity refugia such as ponds, oxbows, backwaters, and other off-channel areas with cover; but side-channels are generally high energy areas[4]	▪ Adams Fork has very little off-channel habitat, but the geomorphology of the stream is not conducive to forming this type of habitat.	▪ 1992 Level II Stream Survey.
	Refugia (at 6th to 7th field watershed scale)	Functioning at Risk	Habitats capable of supporting strong and significant populations are insufficient in size, number and **connectivity** to maintain all life stages and forms of the species[12, 13]	▪ The entire watershed is in a relatively unmanaged condition. The combination of being fed by glaciers and the relatively unmanaged condition make it a source of cold water for the Cispus River. Therefore, it would serve as refuge for the Cispus River, but migration barriers near the mouth prevent the free exchange of fish and other aquatic species.	▪ Professional Judgment
CHANNEL CONDITION AND DYNAMICS	Width/Depth Ratio in riffles	Functioning Appropriately	W/D ratios and channel types are well within historic ranges and/or site potentials in watershed. Rosgen Type — W/D Ratio A, E, G — < 12 B, C, F — 12 - 30 D — > 40	▪ Width to depth ratios range from 7 to 14. I consider these to be within the range given the Rosgen A and B channel type.	▪ 1992 Level II Stream Survey.
	Streambank Condition	Functioning At Appropriately	80% of any stream reach has ≥90% stability[5]	▪ The stream survey report mentions only small areas of instability.	▪ 1992 Level II Stream Survey.
	Floodplain Connectivitiy	Functioning Appropriately	Off-channel areas are frequently hydrologically linked to main channel; overbank flows occur and maintain wetland functions, riparian vegetation and succession	▪ The only road near a stream (5601) is located out side of the floodplain.	▪ Field Observations 1997-2001

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
FLOW / HYDROLOGY	Change in Peak/Base Flows	Functioning At Risk	Some evidence of altered peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology and geography	The value 87.6% for area occupied by stands greater 8" in diameter would place this in low risk for increased peak flow, This value, however, is misleading for several reasons. ▪ The small size of the trees in this sub-watershed is mainly due to a large fire and slow re-growth of logdepole pine at high elevations. ▪ Drainage extension value of 1% would place this watershed in a low risk for increased peak flows. ▪ This sub-watershed is above the rain-on-snow zone, therefore, the rain-on-snow triggered floods are rare. ▪ These stands are nearly at the potential for high elevation lodgepole pine.	▪ GIS Analysis of stand Structure. ▪ Drainage Network Increase Analysis this document.
	Drainage Network Increase	Functioning Appropriately	zero or minimum increases in active channel length correlated with human caused disturbance	▪ A drainage extension of 4.3% would fits into the low drainage extension category.	▪ Drainage Network Increase Analysis this document.
WATERSHED CONDITIONS	Road Density and Location	Functioning At Risk	<1mi/mi² [13]; no valley bottom roads.	▪ The overall road density of 0.31 miles per square mile is a low impact ▪ Road density in riparian reserves is moderate at 8.3 miles per square mile. ▪ Although the 5601 lies within the riparian reserve it outside of the valley bottom.	▪ Road Location Analysis from the GIS data set ▪ Field observations 1997-2001.
	Riparian Reserves	Functioning At Risk	Moderate loss of connectivity or function (shade, LWD recruitment, etc.) of riparian reserve system; , or incomplete protection of habitats and refugia for sensitive aquatic species (.70-80% previously unmanaged) including from grazing impacts; percent similarity of riparian vegetation to the potential natural community/composition and structure 25-50%	▪ 15% of the riparian reserves is in the Early Successional classes. This is much greater than the two headwater watersheds which a nearly undisturbed. ▪ The glacial water that feeds Adams Fork keep this stream cool. The stream survey found an abundance of woody debris in Adams Fork.	▪ GIS Analysis of stand Structure in Riparian Reserves.
	Disturbance Regime	Functioning at Unacceptable Risk	Frequent flood or drought producing highly variable flows …. Channel is simplified … little hydrologic complexity … Natural processes are unstable.	In the 1900's, a number of natural events have significantly affected the watershed: • This is a glacial fed system, whish is subject to large amounts of glacial flour and glacial outburst floods. ▪ 1980 eruption of Mount St. Helens covered the watershed in ash. ▪ Fires burned 42% of the watershed between 1900 and 1950. ▪ A number of large flood events occurred - 4 events occurred in the 1970's alone.	▪ Upper/Middle Cispus River Watershed Analysis (1995), pages 4-1 to 4-16. ▪ USGS Stream Gauge data Cispus River Near Yellowjacket Creek.

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
	Disturbance History	Functioning at Risk	<15% ECA (>85% ARP/HRP) of entire watershed but some disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area;	▪ 47% of the sub-watershed is in the Mt. Adams Wilderness. ▪ Road density within the riparian reserves is only 1 mile per square mile. The 5601 road closely parallels Adams Fork for a couple of miles, but is largely outside of the floodplain. ▪ Regeneration harvest began in earnest in the 1970s, increased in the 1970s, and then decreased to a third in the 1980s See harvest history table. 233 acres (regen 233) have been harvested since 1970. This is less than 1% of the watershed. ▪ There are 4 campgrounds in the watershed. Takhlakh Lake, Olallie Lake and Chain of Lakes campgrounds are Lakeside and have little potential to affect TES fish species. Killen Creek campground is streamside and maybe affecting this tributary to Adams Fork.	▪ GIS Data Reports, Harvest History, Stand Structure, Stand Structure RR, Road Location, Wilderness.
SUBPOPULATION CHARACTERISTICS	Subpopulation Size	No Rating		o This is not an anadromous or bull trout watershed. o Rated at the 5th field Watershed.	▪ Level II stream surveys 1988-2000.
	Growth and Survival	No Rating			
	Life History Diversity and Isolation	No Rating			
	Persistence and Genetic Integrity	No Rating			
SPECIES and HABITAT	Integration of Species and Habitat Conditions	No Rating		o Rated at the 5th field Watershed.	All of the previously cited sources.

TABLE C-7: Baseline conditions for fish habitat in 2001 for the East Canyon watershed (170800040407).
(Ratings were made using the "Matrix of Diagostics / Pathways and Indicators" from the US Fish and Wildlife Service)

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
	Temperature	Bull Trout Functioning At Unacceptable Risk	USFWS Criteria 7-day average maximum temperature in a stream reach for the following life history stages: Incubation: <1°C or > 6°C Rearing: > 15 °C Spawning: <4°C or >10°C.	▪ 4 of 5 monitoring sites had max. 7-day ave. temperatures above 12.3°C, and 7 sites had max. 7-day ave. temperatures above 16° C ▪ Notes: Monitoring was terminated prior to the spawning and incubation seasons.	▪ Stream temperature monitoring 1994, and 2000
		Cutthroat Functioning At Unacceptable Risk	USFWS draft criteria for coastal cutthroat 7-day average maximum temperature in a stream reach during the following life history stages: Rearing: > 18°C / Spawning: > 16°C. NMFS criteria for anadromous fish Spawning: .> 15.6°C Migration and rearing: >17.8°C	o Maximum 7-day ave. temp. was 16.4° C. State standard of 16.0°C was exceeded on 12 days. o Notes: Monitoring was terminated prior to the spawning and incubation seasons. Anadromous fish do not occur in the sub-watershed, but it does feed the anadromous portion of the Cispus River.	▪ Stream temperature monitoring 1994, and 2000
WATER QUALITY	Sediment (in spawning areas)	Functioning At Risk	12-17% fines (<0.85mm) in gravel[4];	o Stream surveys have not measured sediment in fashion suggested by the matrix. o The amount of fine sediment in spawning gravels is likely to be impairing spawning success.	▪ Field Observations by the District Fisheries Biologist Sept 2001
	Chemical Contamination/ Nutrients	Functioning Appropriately	Low levels of chemical contamination from agricultural, industrial …	▪ There are no known sources of either chemical or nutrient contamination in the watershed. There are no towns, homes, factories, or agricultural activities in the watershed. There are no designated horse camps in the sub-watershed.	▪ Field observations by the USFS, 1990 – 2001.
HABITAT ACCESS	Physical barriers	Functioning At Risk	One or more human-made barriers present in watershed do not allow upstream and/or downstream fish passage at base/low flows for at least one life history stage	o The 2001 culvert survey found one culvert that maybe a migration barrier. This culvert needs to be evaluate more closely.	▪ Stream Surveys, 2000 ▪ 2001 Culvert Surveys
HABITAT ELEMENTS	Substrate character and embedded-ness (in rearing areas)	Functioning At Risk	gravel and cobble are subdominant, or if dominant, reach embeddedness 20-30%[9,10]	o Stream surveys have not measured sediment in fashion suggested by the matrix. o Field observations, found that the substrate is moderately embedded and the interstitial spaces were reduce by fine sediments	▪ Field Observations Sept 2001 District Fisheries biologist.
	Large Woody Debris (LWD)	Functioning at Unacceptable Risk	current levels are not at those desired values for "functioning appropriately",	▪ Large woody ranges between 9 and 84 pieces per mile. Although the reach with 84 pieces mile would meet the criteria it represent less than 1/3 of the entire stream.	▪ 2000 Level II stream survey.

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
	Pool Frequency and Quality	Functioning At Unacceptable Risk	Pool frequency is considerably lower than values desired for "functioning appropriately"; also cover/temperature is inadequate[4], and there has been a major reduction of pool volume by fine sediment	▪ The first .9 mile of East Canyon Creek the meets the criteria but are largely inaccessible, because of a series of falls. ▪ The remaining 7 miles of stream does not meet the criteria, lacks cover in the pools but has good residule pool depth. ▪ Only 0.3 miles meets the criteria in Dark Creek. ▪ Pool frequency in the first 0.1 mile of Summit Prairie Creek meets the criteria listed below. ▪ The frequency of quality pools is relatively high. Criteria for pool frequency Wetted width in feet, # pools per mile 0-5, 39 5-10, 60 10-15, 48 15-20, 39 20-30, 23 30-35, 18 35-40, 10 40-65, 9 65-100, 4	▪ 2000 and 1988 Level II Stream Surveys.
	Large Pools (in streams with > 3m in wetted width at baseflow)	Functioning at Risk	Reaches have few large pools (>1 meter) present[4]	▪ Less than half of the pools found in the surveyed would qualify as large pools.	▪ 2000 and 1988 Level II Stream Survey.
	Off-channel habitat	Functioning at Risk	Watershed has some functional high water velocity refugia such as ponds, oxbows, backwaters, and other off-channel areas with cover; but side-channels are generally high energy areas[4]	▪ East Canyon Creek has very little off-channel habitat, but it geomorphology is not conducive to forming this type of habitat.	▪ 2000 and 1988 Level II Stream Survey.
	Refugia (at 6^{th} to 7^{th} field watershed scale)	Functioning at Unacceptable Risk	Adequate habitat refugia do not exist[12]	▪ The entire watershed has been relatively heavily managed and there no areas that would serve as a population sink.	▪ Professional Judgment
CHANNEL CONDITION AND DYNAMICS	Width/Depth Ratio in riffles	Functioning At Risk	W/D ratios and/or channel types in portions of watershed are outside historic ranges and/or site potentials.	▪ The bankfull width-to-depth-ratios for East Canyon Creek are all above 21. ▪ Although these are not outside the range for the channel types, they higher than expected.	▪ 2000 Level II Stream Survey.
	Streambank Condition	Functioning At Unacceptable Risk	<50% of any stream reach has $\geq$90% stability[5]	▪ Reaches 2 and 4 have unstable areas. and 4.	▪ 2000 Level II Stream Survey.
	Floodplain Connectivitiy	Functioning At Risk	Reduced linkage of wetland, floodplains and riparian areas to main channel; overbank flows are reduced relative to historic frequency, as evidenced by moderate degradation of wetland function, riparian vegetation/succession	▪ The 23 road closely East Canyon Creek for approximately 2 miles. There is practically no buffer between the road and stream in this section.	▪ Field Observations 1997-2001

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
FLOW / HYDROLOGY	Change in Peak/Base Flows	Functioning At Risk	Some evidence of altered peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology and geography	▪ The area occupied stands with an average diameter $\geq$ 8" is moderate and drainage extension value of 4.3% would place this watershed in the moderate risk for increased peak flows. ▪ The unstable areas in reaches 2 and 4 would also indicate an altered peak flow regime.	▪ 2000 Level II Stream Survey ▪ GIS Analysis of stand Structure ▪ Drainage Network Increase Analysis this document.
	Drainage Network Increase	Functioning At Risk	Low to moderate increase in active channel length correlated with human caused disturbance	▪ A drainage extension of 4.3% would fit into the low to moderate drainage extension.	▪ Drainage Network Increase Analysis this document.
WATERSHED CONDITIONS	Road Density and Location	Functioning At Unacceptable Risk	2.4 mi/mi^2 [13]; some to many valley bottom roads	▪ The overall road density of 1.09 is a moderate impact. ▪ Nearly half of the roads are in riparian reserves and the 23 road closely parallels East Canyon Creek with practically no buffer for approximately 2 miles.	▪ GIS Analysis of Road Density and Location in Relation to Streams.
	Riparian Reserves	Functioning At Risk	Moderate loss of connectivity or function (shade, LWD recruitment, etc.) of riparian reserve system; , or incomplete protection of habitats and refugia for sensitive aquatic species (.70-80% previously unmanaged) including from grazing impacts; percent similarity of riparian vegetation to the potential natural community/composition and structure 25-50%	▪ 17% of the riparian reserves are in the Early Successional classes. This is much greater than the two headwater watersheds which a nearly undisturbed. ▪ The high water temperatures and channel erosion are also a signs of disturbance to riparian disturbance.	▪ GIS Analysis of stand Structure in Riparian Reserves.
	Disturbance Regime	Functioning at Unacceptable Risk	Frequent flood or drought producing highly variable flows …. Channel is simplified … little hydrologic complexity … Natural processes are unstable.	In the 1900's, a number of natural events have significantly affected the watershed: ▪ 1980 eruption of Mount St. Helens covered the watershed in ash. ▪ Fires burned 42% of the watershed between 1900 and 1950. ▪ A number of large flood events occurred - 4 events occurred in the 1970's alone – resulting in pronounced stream channel erosion, channel widening, increasing channel instability, and reducing hydrologic complexity. ▪ This sub-watershed is completely within the AMA, which is treated similar to Matrix, but with some innovation in management practices.	▪ Upper/Middle Cispus River Watershed Analysis (1995), pages 4-1 to 4-16. ▪ USGS Stream Gauge data Cispus River near Yellowjacket Creek.

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
	Disturbance History	Functioning at Unacceptable Risk	>15% ECA (< 85% ARP/HRP) of entire watershed and some disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area;	▪ 17% of the Riparian Reserves are in the Early Sucessional classes. This condition primarily due to past harvest. ▪ Road density within the riparian reserves is 15.2 miles per square mile. ▪ The 23 road closely parallels East Canyon Creek for a couple of miles. ▪ Only 1% of the sub-watershed is in the Mt Adams Wilderness. ▪ 3111 acres (regen 2,901, thin 202) have been harvested since 1950. This is 17.0%% of the watershed. ▪ Regeneration harvest began in earnest in the 1950s, increased in the 1970s, and then decreased to a third in the 1990s See harvest history table.	▪ GIS Analysis of Harvest History, Stand Structure, Riparian Stand Structure RR, and Road Location.
SUBPOPULA-TION CHARACTER-ISTICS	Subpopulation Size	No Rating		▪ Rated at the 5th field watershed scale. ▪ This is not an anadromous watershed.	▪ Transport records from reintroduction of anadromous fish in the upper Cowlitz River. ▪ Level II stream surveys 1988-2000.
	Growth and Survival	No Rating			
	Life History Diversity and Isolation	No Rating			
	Persistence and Genetic Integrity	No Rating			
SPECIES and HABITAT	Integration of Species and Habitat Conditions	No Rating		▪ Rated at the 5th field watershed scale.	▪ All of the previously cited sources.

TABLE C-8: Baseline conditions for fish habitat in 2001 for the Blue Lake watershed (170800040408).

(Ratings were made using the "Matrix of Diagostics / Pathways and Indicators" from the US Fish and Wildlife Service)

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
WATER QUALITY	Temperature	Functioning At Unacceptable Risk **Bull Trout**	USFWS Criteria Bull Trout 7-day average maximum temperature in a stream reach for the following life history stages: Incubation: <1°C or > 6°C Rearing: > 15 °C Spawning: <4°C or >10°C.	▪ Two sites (Cispus River above Blue Lake Creek and Cispus River Above the North Fork confluence) had 7-day max averages above 15 °C but under 18 °C. ▪ Blue Lake Creek and the Cispus River immediately below Blue Lake Creek had 7-day ave max temperatures below 13 °C. **Notes.** Blue Lake Creek is steep and is not considered typical fish habitat, although a few escapees from Blue Lake survive in this stream. Monitoring was terminated prior to the spawning period.	▪ Stream temperature monitoring from 2000.
		Functioning At Risk **Coastal Cutthroat, Sea-Run Cutthroat, Chinook Salmon, Coho Salmon, Steelhead**	USFWS draft criteria for coastal cuttthroat 7-day ave. max. temp. in a stream reach during the following life history stages: Rearing: 14 – 18°C / Spawning: 14 – 16°C. NMFS criteria for anadromous fish Spawning: 13.9 –15.6°C Migration and rearing: 13.9 – 17.8°C	▪ Two sites (Cispus River above Blue Lake Creek and Cispus River Above the North Fork confluence) had 7-day max averages above 15 °C but under 18 °C. ▪ Blue Lake Creek and the Cispus River immediately below Blue Lake Creek had 7-day ave max temperatures below 13 °C. ▪ It is clear that Blue Lake Creek has a temporary cooling effect on the Cispus River. **Note.** Blue Lake Creek is steep and is not considered typical fish habitat, although a few escapees from Blue Lake survive in this stream. The only fish species that spawns during the monitoring period is chinook salmon.	▪ Stream temperature monitoring from 2000.
	Sediment (in spawning areas)	Functioning at Risk	12 –17% fines (<0.85mm) in gravel	o Spawning habitat is currently being impaired as a result of an excess fine-grained material contained in gravel deposits.	▪ Upper/Middle Cispus River Watershed Analysis (1995), page 4-78. ▪ Field observations by the USFS, 1990 – 2001.
	Chemical Contamination/ Nutrients	Functioning Appropriately	Low levels of chemical contamination from agricultural, industrial …	o There are no known sources of either chemical or nutrient contamination in the watershed. There are no towns, homes, factories, or agricultural activities in the watershed. There are no designated horse camps in the subwatershed.	▪ Field observations by the USFS, 1990 – 2001.
HABITAT ACCESS	Physical barriers	Functioning At Risk	One or more human-made barriers present in watershed do not allow upstream and/or downstream fish passage at base/low flows for at least one life history stage	o Cuverts on Prospect Creek and an unnamed tributary block access to 0.1 miles of anadromous habitat and 0.2 miles of resident habitat.	▪ Culvert surveys 2001
	Substrate character and embedded-ness (in rearing areas)	Functioning at Risk	Gravel and cobble are subdominant, or if dominant, reach embeddedness 20-30%.	o The same fine-grained sediment that is impairing spawning success is also filling the interstitial spaces between cobbles that provide juvenile escape cover.	▪ Upper/Middle Cispus River Watershed Analysis (1995), page 4-78. ▪ Field observations by the USFS, 1990 – 2001.

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
HABITAT ELEMENTS	Large Woody Debris (LWD)	Functioning at Risk	Current levels are being maintained at minimum levels desired for "Func. Appr." but potential sources are lacking to maintain these minimum values.	The number and size of LWD in many streams, particularly the Cispus River is not at its full potential for several reasons. o Recruitment of LWD has been affected by past timber harvest in riparian areas, o LWD has been removed from the floodplains of some streams by man. o Two large fires in the early 1900's destroyed many of the large trees in riparian areas. o Woody debris frequency in Blue Lake is also lower than the standard of 80 pieces per mile.	▪ Upper/Middle Cispus River Watershed Analysis (1995), 4-76, G-13. ▪ Field observations by the USFS, 1990 – 2001.
	Pool Frequency and Quality	Functioning at Unacceptable Risk	Pool frequency is considerable lower than values for "functioning appropriately" … ; inadequate cover; volume reduced by sediment.	▪ We do not have level II survey information for the major fish-bearing stream (Cispus River) for this sub-watershed. ▪ The previous watershed analysis rated pool frequency as poor citing unpublished data showing a 38% decrease in pools, between 1935 and 1991, for the Cispus River from the Cowlitz River confluence to Blue Lake Creek. The assumption is that the general decrease in pool habitat occurred evenly throughout the study area. ▪ We also have data from restoration projects just down stream of the watershed boundary that shows lower than expected pool frequency based principles of channel dynamic (i.e. a pool every 5 to 7 channel widths). ▪ Thus the conclusion is, the number of pools in the Cispus River does not meet the pool frequency evaluation criteria for "properly functioning" as listed below. ▪ Pool frequencies in Blue Lake Creek are well below the criteria shown below. Criteria for Pools:Wetted width in feet, # pools per mile 0-5, 39 5-10, 60 10-15, 48 15-20, 39 20-30, 23 30-35, 18 35-40, 10 40-65, 9 65-100, 4 The rest of the streams in this watershed do not provide enough fish habitat to influence the rating.	▪ Upper/Middle Cispus River Watershed Analysis (1995), pages 4-77, 4-80, K-22, G-13. ▪ Mainstem Survey for Cispus River Streambank Restoration and Road Protection Project 1998-1999. ▪ Level II Survey Blue Lake Creek 1988
	Large Pools (in streams with > 3m in wetted width at baseflow)	Functioning at Risk	Reaches have few pools greater than 1 meter in depth.	▪ The pools in the Cispus River are not as large as they should be for a stream of that size. Depth of many pools in the Cispus River has decreased as a result of being filled in with coarse-grained sediment.	▪ Upper/Middle Cispus River Watershed Analysis (1995), 4-77. ▪ Mainstem Survey for Cispus River Streambank Restoration and Road Protection Project 1998-1999.
	Off-channel habitat	Functioning at Risk	Some high water velocity refugia such as ponds, oxbows, backwaters …	▪ There is a sufficient amount of off-channel habitat in the Cispus River; however, much of the off-channel habitat that exists lacks cover and is not particularly stable.	▪ Field observations, 1996-2001.
	Refugia (at 6^{th} to 7^{th} field watershed scale)	Functioning at Unacceptable Risk	Adequate habitat refugia do not exist[12]	▪ None of the habitat elements rates as properly functioning. ▪ Although Blue Lake is supporting a viable population of fish it is inaccessible to the threatened and sensitive populations.	▪ Upper/Middle Cispus River Watershed Analysis (1995), pages 4-68 to 4-83. ▪ Field observations, 1990-2001.

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
CHANNEL CONDITION AND DYNAMICS	Width/Depth Ratio in riffles	Functioning at Unacceptable Risk	Width depth ratios and channel types throughout the watershed are outside historic ranges and/or site potentials.	▪ Channel widening of the lowest section of the Cispus River. ▪ Several major flood events are the primary reasons for this.	▪ Hydrology Report this WA.
	Streambank Condition	Functioning At Risk	50 – 80% of any stream reach has greater than 90% stability.	▪ Numerous streambanks experienced erosion during the flood of 1996, and some stream segments were scoured to bedrock. Because of the magnitude of the 1996 flood (considered to be at least a 100-year event), some erosion would have likely occurred even in a pristine watershed.	▪ Post 1996 flood field reconnaissance by the USFS.
	Floodplain Connectivitiy	Functioning Properly	Off-channel areas are frequently hydrologically linked to main channel …	▪ The because of the steep terrain, the high number of miles road miles in riparian reserves is not an accurate representation of floodplain connectivity. Although many roads are within the riparian reserves (approx. 300 ft) they are outside of the valley bottom. ▪ There is little interruption of the floodplain of the Cispus River by roads or other development. There are no crossings of the main Cispus River and observations show that only 2 miles or so of paralleling roads (2300, and 2801) are in the Cispus River floodplain. ▪ No roads parallel the tributary streams, all of tributaries watersheds are crossed at least once by the 2300 or 2801 near there confluence with the Cispus River, but only few (approximately 6) mapped channels are crossed twice or more.	▪ Field observations by Aquatic personnel, 1996-2001.
FLOW / HYDROLOGY	Change in Peak/Base Flows	Functioning at Risk	Some evidence of altered peak flow, baseflow and /or flow timing relative to an undisturbed watershed of similar size, geology, and geography.	▪ **The value of 90.1 is high, but this may hide effects on individual tributaries in composite watersheds.** ▪ **The observed channel alterations are more likely due to increased peak flows in the upstream sub-watershed (East Canyon, and Cat).** ▪ **The effects observed on the tributary streams (Juniper Cr, Prospect Cr., ect) are hard to separate from normal reactions of partially forested watersheds to 100 year plus storms.**	▪ % of area occupied stand >8" in diameter.
	Drainage Network Increase	Functioning at Risk	Low to moderate increase in active channel length correlated with human caused disturbance.	▪ Modeling of drainage network increase, little (4.9%) increase in the drainage network. ▪ Some parts of the subwatershed (Blue Lake Creek and Prospect Creek) show little increase 0.4% to 3.3%. ▪ While other sub 6th field sub-watersheds along the Cispus River range from 16.3 % to 23.5%.	▪ Drainage Network Increases based on GIS data this report ▪ Smooth Juniper Timber Sale Analysis 1999.
WATERSHED CONDITIONS	Road Density and Location	Functioning at Risk	1 – 2.4 miles per square mile; some valley bottom roads.	Overall road density is low at 0.9 miles per square mile. Roads are concentrated in the portions of the watershed with listed species. Road density in the riparian reserves is moderate at 14.3 miles per square mile.	▪ Road Location Analysis based on GIS Data this report.

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
	Riparian Reserves	Functioning at Risk	Moderate loss of connectivity or function (shade, LWD, etc.) …	▪ Stands of trees in the Mid Successional Class dominate the riparian reserves. This condition is largely the due to the larges fires in the late 1800s and early 1900s. ▪ Thus the riparian zones are not at their full potential for shading the Cispus River and providing largest classes of woody debris. ▪ The riparian reserves are the least fragmented of those outside of the wilderness/roadless areas in the Upper Cispus 5th field watershed.	▪ Analysis of stand structure in riparian reserves this document.
	Disturbance Regime	Functioning at Unacceptable Risk	Frequent flood or drought producing highly variable flows …. Channel is simplified … little hydrologic complexity … Natural processes are unstable.	In the 1900's, a number of natural events have significantly affected the watershed: ▪ 1980 eruption of Mount St. Helens covered the watershed in ash. ▪ Fires burned 42% of the watershed between 1900 and 1950. ▪ A number of large flood events occurred - 4 events occurred in the 1970's alone – resulting in pronounced stream channel erosion, channel widening, increasing channel instability, and reducing hydrologic complexity. ▪ This subwatershed is completely within the AMA, which is treated similar to Matrix, but with some innovation in management practices.	▪ Upper/Middle Cispus River Watershed Analysis (1995), pages 4-1 to 4-16.
	Disturbance Regime	Functioning at Unacceptable Risk	Frequent flood or drought producing highly variable flows …. Channel is simplified … little hydrologic complexity … Natural processes are unstable.	In the 1900's, a number of natural events have significantly affected the watershed: ▪ 1980 eruption of Mount St. Helens covered the watershed in ash. ▪ Fires burned 42% of the watershed between 1900 and 1950. ▪ A number of large flood events occurred - 4 events occurred in the 1970's alone – resulting in pronounced stream channel erosion, channel widening, increasing channel instability, and reducing hydrologic complexity. ▪ This sub-watershed is completely within the AMA, which is treated similar to Matrix, but with some innovation in management practices.	▪ Upper/Middle Cispus River Watershed Analysis (1995), pages 4-1 to 4-16.
	Disturbance History	Functioning at Risk	> 85% Hydrologic Recovery (ARP), but some disturbance in unstable areas and/or riparian areas.	▪ Roads increased the drainage network by approximately 4.5%. Roads are highly concentrated in riparian reserves. ▪ The riparian zone is largely un-fragmented, but lacks large trees. ▪ Some salvage logging may have occur after the late1800 and early1900 fires. Harvest records begin in the 1960's. A total of 2077 acres (574 regen and 1503 thinning) of harvest have been recorded. Harvest was greatest in the 1970s.	▪ GIS Analysis of Stand Structure ▪ GIS Analysis of Stand Structure in Riparian Reserves, ▪ GIS Analysis of Roads and Road Locations
SUBPOPULATION CHARACTERISTICS	Subpopulation Size	No Rating		• We rate these indicators for the entire 5th field watershed.	• Transport records from reintroduction of anadromous fish in upper Cowlitz River.
	Growth and Survival	No Rating			
	Life History Diversity and Isolation	No Rating			
	Persistence and Genetic Integrity	No Rating			

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
SPECIES and HABITAT	Integration of Species and Habitat Conditions	No Rating		• We rate these indicators for the entire 5th field watershed.	• All of the previously cited sources

TABLE C-9: Baseline conditions for fish habitat in 2001 for the North Fork Cispus River watershed (170800040409).
(Ratings were made using the "Matrix of Diagostics / Pathways and Indicators" from the US Fish and Wildlife Service)

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
WATER QUALITY	Temperature	Bull Trout Functioning At Unacceptable Risk	USFWS Criteria 7-day average maximum temperature in a stream reach for the following life history stages: Incubation: <1°C or > 6°C/Rearing: > 15 °C /Spawning: <4°C or >10°C.	▪ We have no temperature only for the bull trout spawning or incubation periods. ▪ The 7-day ave max temperature was 15.6 °C. ▪ Notes: Monitoring was terminated prior to spawning and incubation periods.	▪ Stream Temperature monitoring 2000
		Coastal Cutthroat, Steelhead, Chinook Salmon, Coho salmon Functioning at Risk	USFWS draft criteria for coastal cuttthroat 7-day ave. max. temp. in a stream reach during the following life history stages: Rearing: 14 – 18°C / Spawning: 14 – 16°C. NMFS criteria for anadromous fish Spawning: 13.9 –15.6°C Migration and rearing: 13.9 –17.8°C	▪ We have temperature data only for the Chinook salmon spawning period. ▪ The 7-day ave max temperature was 15.6 °C. ▪ Notes: Monitoring was terminated prior to spawning and incubation periods.	▪ Stream Temperature monitoring 2000
	Sediment (in spawning areas)	Functioning at Risk	12 –17% fines (<0.85mm) in gravel	▪ Spawning habitat is currently being impaired as a result of an excess fine-grained material contained in gravel deposits.	▪ Upper/Middle Cispus River Watershed Analysis (1995), page 4-78. ▪ Field observations by the USFS, 1990 – 2001.
	Chemical Contamination/ Nutrients	Functioning Appropriately	Low levels of chemical contamination from agricultural, industrial …	▪ There are no known sources of either chemical or nutrient contamination in the watershed. There are no towns, homes, factories, or agricultural activities in the watershed. There are no designated horse camps in the subwatershed.	▪ Field observations by the USFS, 1990 – 2001.
HABITAT ACCESS	Physical barriers	Functioning At Unacceptable Risk	One or more human-made barriers present in watershed do not allow upstream and/or downstream fish passage at a range of flows for at least one life history stage	o There are 3 known barriers on tributaries to the North Fork Cispus River. o They block access approximately 1 mile of marginal fish habitat. o Only 0.3 miles is potential anadromous habitat. o A 4th culvert is a potential barrier and we are currently evaluating the location of natural barriers.	▪ 2001 culvert surveys.
HABITAT ELEMENTS	Substrate character and embedded-ness (in rearing areas)	Functioning at Risk	Gravel and cobble are subdominant, or if dominant, reach embeddedness 20-30%.	▪ The same fine-grained sediment that is impairing spawning success is also filling the interstitial spaces between cobbles that provide juvenile escape cover.	▪ Upper/Middle Cispus River Watershed Analysis (1995), page 4-78. ▪ Field observations by the USFS, 1990 – 2001.
	Large Woody Debris (LWD)	Functioning at Risk	Current levels are being maintained at minimum levels desired for "Func. Appr." but potential sources are lacking to maintain these minimum values.	o The number and size of LWD in many streams, the North Fork of the Cispus River, is not at its full potential for several reasons o Recruitment of LWD has been affected by past timber harvest in riparian areas. o LWD has been removed from the floodplains of some streams by man, and c) two large fires in the early 1900's destroyed many of the large trees in riparian areas.	▪ Upper/Middle Cispus River Watershed Analysis (1995), pages 4-69, 4-76, G-13. ▪ Field observations by the USFS, 1990 – 2001. ▪ Stream Surveys from 1990

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
HABITAT ELEMENTS (continued)	Pool Frequency and Quality	Functioning at Unacceptable Risk	Pool frequency is considerable lower than values for "functioning appropriately" … ; inadequate cover; volume reduced by sediment.	▪ The number of pools in North Fork of the Cispus River sub-watershed does not meet the pool frequency evaluation criteria for "properly functioning" as listed below. Criteria for pool frequency: Wetted width in feet, # pools per mile 0-5, 39 5-10, 60 10-15, 48 15-20, 39 20-30, 23 30-35, 18 35-40, 10 40-65, 9 65-100, 4	▪ Stream Survey Summary table
	Large Pools (in streams with > 3m in wetted width at baseflow)	Functioning at Risk	Reaches have few pools greater than 1 meter in depth.	▪ Depth of many pools in the North Fork of the Cispus River has decreased as a result of being filled in with coarse-grained sediment.	▪ Upper/Middle Cispus River Watershed Analysis (1995), pages 4-68, 4-77. ▪ Stream survey summary.
	Off-channel habitat	Functioning Appropriately	Watershed has many functional high water velocity refugia such as ponds, oxbows, backwaters, and other off-channel areas with cover; and side-channels are complex, low energy areas[4]	▪ The North Cispus River and its tributaries are found in narrow relatively steep valleys (Rosgen A and B types) that are not conducive to the formation of off channel habitats. These streams are at or the potential for valley types, but do not provide the best habitats for species, which use these types of habitats (coho salmon, coastal cutthroat, and to some degree bull trout).	▪ Field observations, 1996-2001.
	Refugia (at 6th to 7th field watershed scale)	Functioning at Unacceptable Risk	Adequate habitat refugia do not exist[12]	▪ The entire stream course outside of roadless/wilderness areas. ▪ Few of the habitat elements rate as properly functioning.	▪ Field observations, 1990-2001.
CHANNEL CONDITION AND DYNAMICS	Width/Depth Ratio in riffles	Functioning at Unacceptable Risk	Width depth ratios and channel types throughout the watershed are outside historic ranges and/or site potentials.	▪ The lower 0.25 miles of the North Fork Cispus River has experienced channel changes - both widening and narrowing - of up to 141 feet between aerial photograph years. Flood events have been the primary cause of stream channel widening. However, timber harvest and road building may be a contributing factor in stream channel widening - the increase in sediment delivery to streams as a result of those activities may have resulted in more channel widening than would have occurred from flood events alone.	▪ Channel width discussion. Upper Cispus WA
	Streambank Condition	Functioning At Risk	50 – 80% of any stream reach has greater than 90% stability.	▪ Numerous streambanks experienced erosion during the flood of 1996, and some stream segments were scoured to bedrock. Because of the magnitude of the 1996 flood (considered to be at least a 100-year event), some erosion would have likely occurred even in a pristine watershed.	▪ Post 1996 flood field reconnaissance by the USFS.
	Floodplain Connectivitiy	Functioning At Risk	Reduced linkage of wetland, floodplains and riparian areas to main channel; overbank flows are reduced relative to historic frequency, as evidenced by moderate degradation of wetland function, riparian vegetation/succession	▪ There is little interruption of the floodplain the North Fork of the Cispus River by roads or other development. ▪ Previous salvage operations, however, removed large woody debris from portions of the North Fork Cispus River and channel is beginning to lose its connection to the floodplain. One objective of the North Fork Cispus restoration project is to reestablish this connection.	▪ Field observations, 1996-2001 for the North Fork Cispus restoration project.

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
FLOW / HYDROLOGY	Change in Peak/Base Flows	Functioning at Risk	Some evidence of altered peak flow, baseflow and /or flow timing relative to an undisturbed watershed of similar size, geology, and geography.	▪ Dramatic widening of segments of the North Fork of the Cispus River channels since timber harvest activities began in the 1950's. ▪ Modeling results indicated an increase of up to 22% in flow above hydrologically mature conditions for some streams during large storm events. ▪ Timonium Creek, a major tributary to the North Fork Cispus is showing a trend toward increased peak flows. ▪ Stands with an average diameter of ≥ 8" occupy 70.1 of the potentially forested area, which indicates a moderate risk for increased peak flow. A large percentage of this reduced ARP value is due to regeneration harvest. ▪ Roads increased the drainage network by approximately 5.7%.	▪ Upper/Middle Cispus River Watershed Analysis (1995), pages 4-57, 4-58. ▪ Dry Jackpot Timber Sale Analysis 1997. ▪ GIS Analysis of Stand Structure.
	Drainage Network Increase	Functioning at Risk	Low to moderate increase in active channel length correlated with human caused disturbance.	▪ Roads increased the drainage network by approximately 5.7%.	▪ Dry Jackpot Timber Sale Analysis 1997. ▪ GIS Analysis of Road Location.
WATERSHED CONDITIONS	Road Density and Location	Functioning at Risk	1 – 2.4 miles per square mile; some valley bottom roads.	▪ The road density for the entire watershed is 2.38 miles per square mile. The road density is variable throughout the watershed. ▪ Very few of the roads are in the valley bottom.	▪ Upper/Middle Cispus River Watershed Analysis (1995), pages 4-59, M-15, N-17, N-21.
	Riparian Reserves	Functioning at Risk	Moderate loss of connectivity or function (shade, LWD, etc.) …	Past timber harvest has resulted in many streams with fragmented riparian areas. Approximately 235 of the riparian reserves are in the Early Successional seral classes. ▪ The riparian zone is fragmented or reduced in width along most of the North Fork. ▪ Many of the headwaters of the tributaries have been converted to early seral stage. ▪ Timonium subbasin almost completely converted to early seral stage. St Michaels subbasin converted to more than half early seral stage. ▪ Conversion of most of the southern tributaries to early seral stage. ▪ The shade model depicts only a low to moderate loss of vegetative shading. This mainly due to the east /west orientation of the North Fork.	▪ Upper/Middle Cispus River Watershed Analysis (1995), Appendix C map Early, Mid and Late Seral Stage Groups Within Interim Riparian reserves. Appendix K p29 ▪ GIS Analysis of Stand Structure in Riparian Reserves.

Pathway	Indicator	Rating	Definition of Rating	Information used to make rating	Sources of information
	Disturbance Regime	Functioning at Unacceptable Risk	Frequent flood or drought producing highly variable flows …. Channel is simplified … little hydrologic complexity … Natural processes are unstable.	▪ In the 1900's, a number of natural events have significantly affected the watershed: ▪ 1980 eruption of Mount St. Helens covered the watershed in ash. ▪ Fires burned 42% of the watershed between 1900 and 1950. ▪ A number of large flood events occurred - 4 events occurred in the 1970's alone – resulting in pronounced stream channel erosion, channel widening, increasing channel instability, and reducing hydrologic complexity. ▪ This subwatershed is completely within the AMA, which is treated similar to Matrix, but with some innovation in management practices.	▪ Upper/Middle Cispus River Watershed Analysis (1995), pages. 4-1 to 4-16
	Disturbance History	Functioning at Unacceptable Risk	> 85% Hydrologic Recovery (ARP), but some disturbance in unstable areas and/or riparian areas.	▪ Roads increased the drainage network by approximately 5.7%. ▪ The riparian zone has been fragmented, but some late seral buffers remain. ▪ 6626 acres (23.7%) have been harvested (6608 regen, 18 thinned). Records begin with about 400 acres of regeneration harvest in the 1950s. Harvest was about six times greater in the 1970s and then reduced to about 500 acres in the 1990s.) since 1950.	▪ Upper/Middle Cispus River Watershed Analysis (1995). ▪ Road Location Analysis GIS data. ▪ Stands Structure Analysis GIS data.
SUBPOPULATION CHARACTERISTICS	Subpopulation Size	No Rating		We rate these indicators for the 5th watershed.	▪ Transportation records from the reintroduction of anadromous fish. ▪ Bull trout Surveys 2001
	Growth and Survival	No Rating			
	Life History Diversity and Isolation	No Rating			
	Persistence and Genetic Integrity	No Rating			
SPECIES and HABITAT	Integration of Species and Habitat Conditions	No Rating		We rate these indicators for the 5th watershed.	▪ All previously cited information

Appendix D - Harvest History by 6th Field Watershed

Table D-1: Harvest History – Acres and Percentage of the sub-watershed by sub-watershed, decade, and harvest type.

Sub-Watershed	Decade	Type	Acres	% of Sub-Watershed
Headwaters	1950s	Regeneration Harvest	43	0.33
Headwaters	1970s	Regeneration Harvest	53	0.41
Chambers	1950s	Regeneration Harvest	574	3.12
Chambers	1960s	Regeneration Harvest	1093	5.94
Chambers	1970s	Regeneration Harvest	870	4.73
Chambers	1980s	Regeneration Harvest	444	2.41
Chambers	1990s	Regeneration Harvest	119	0.65
Chambers	1990s	Regeneration Harvest Heavy Retention	30	0.16
Chambers	1990s	Thinning	11	0.16
Muddy Fork	1960s	Regeneration Harvest	59	0.33
Muddy Fork	1970s	Regeneration Harvest	170	0.96
Muddy Fork	1980s	Regeneration Harvest	148	0.83
Muddy Fork	1990s	Thinning	5	0.03
Cat	1950s	Regeneration Harvest	772	4.11
Cat	1960s	Regeneration Harvest	782	4.16
Cat	1970s	Regeneration Harvest	1438	7.66
Cat	1980s	Regeneration Harvest	756	4.03
Cat	1990s	Regeneration Harvest	703	3.74
Cat	1990s	Regeneration Harvest Heavy	20	0.11
Cat	1990s	Regeneration Harvest Moderate Retention	11	0.06
Cat	1980s	Thinning	251	1.34
Cat	1990s	Thinning	378	2.01
Adams Fork	1970s	Regeneration Harvest	159	0.1
Adams Fork	1980s	Regeneration Harvest	84	0.05
East Canyon	1950s	Regeneration Harvest	778	4.25
East Canyon	1960s	Regeneration Harvest	225	1.23
East Canyon	1970s	Regeneration Harvest	1021	5.58
East Canyon	1980s	Regeneration Harvest	657	3.59
East Canyon	1990s	Regeneration Harvest	228	1.25
East Canyon	1990s	Thinning	202	1.1
Blue Lake	1960s	Regeneration Harvest	63	0.4
Blue Lake	1970s	Regeneration Harvest	320	2.05
Blue Lake	1980s	Regeneration Harvest	67	0.43
Blue Lake	1990s	Regeneration Harvest	124	0.79
Blue Lake	1970s	Thinning	391	2.5
Blue Lake	1980s	Thinning	321	2.05
Blue Lake	1990s	Thinning	791	5.06
North Fork	1950s	Regeneration Harvest	366	1.31
North Fork	1960s	Regeneration Harvest	1748	6.26
North Fork	1970s	Regeneration Harvest	2498	8.95
North Fork	1980s	Regeneration Harvest	1473	5.28
North Fork	1990s	Regeneration Harvest	523	1.87
North Fork	1970s	Thinning	8	0.03
North Fork	1980s	Thinning	10	0.04

Appendix E - Summary of Level II Stream Survey Data

Habitat Elements

The Gifford Pinchot National Forest has conducted (or contracted out) Level II stream surveys over the past 13 years. In general, the quantity and quality of fish habitat increases with amount of pool habitat, size of pools, quality of pools and amount of woody debris. On the other hand it decrease with the amount of sediment and increasing width to depth ratios. Table E-1 on the next page displays the results of these surveys.

There are several data gaps with this set of data.

1) We do not have data for several key sections of stream—Cispus River, below the Muddy Fork, the Muddy of the Cispus River, Walupt Lake Creek, and Chambers Creek. We use limited observations, and notes gathered from other documents to rate the streams in the Matrix of Pathways and Indicators.
2) The surveys rarely collected data concern the amount of fine sediment in streams, and when they did collect this information it was somewhat subjective.
3) The surveys rarely quantified bank stability.

TABLE E-1: Summary of Level II Stream Survey Data

Watershed	Stream	Year	Reach	Miles	Average Width [2]	Pools// Mile	Large[3] Pools/Mi	Quality[4] Pools/Mile	Wood[5] /Mile	Sediment[6]	Mean Bankfull Width: Depth	Rosgen Type[7]
Head Waters	Cispus River	1994	3	1.7	42.5	5.8	4.0	0	0	0/2	23	B, A
			4	1.6	20.7	16.5	7.0	6.3	18.4	1/5	24	B
Chambers	Cispus River	1994	1	3.5	55.3	15.5	15.2	5.7	37.6	4/12	22	B, C, D
			2	4.3	31.8	17.1	14.1	8.1	72.0	6/14	18	B, C
Cat	Orr Creek	1999	1	1.3	36	11.7	10.2	3.1	23	ND[8]	22	B/C
			2	1.7	36	10.6	8.8	2.4	28	ND	17	B/C
			3	0.4	29	11.4	4.6	0	9	ND	15	B
	Cat Creek	1998	1	0.8	17.1	47.9	5.2	36.3	10.4	ND	21	A,B,C,F
			2	1.5	16.0	34.9	1.4	16.4	11.0	ND	13	B,C,F,G
			3	0.7	15.3	28.2	1.5	20.7	0.0	ND	14	F
			4	1.5	12.9	36.7	1.4	27.2	2.7	ND	12	B,C
	Mouse Creek	1998	1	0.9	10.0	39.9	1.1	29.9	8.9	ND	15	A,B,B/F,A/F,C
			2	0.9	8.8	48.4	0	46.2	5.5	ND	22	A,B,B/F,F
Adams	Adams Fork	1992	2	2.4	29.0		0	0	477.4	8/8	ND	B
			3	0.5	31.7	14.4	2.1	8.2	239.1	0/0	7	A,B
			4	0.1	19.8	41.4	41.4	41.4	273.1	2/2	ND	B
			6	0.6	18.8	19.5	3.5	12.4	37.2	2/2	ND	B
			7	0.3	10.5	13.2	0	13.2	167.7	2/2	13.2	A
			9	0.3	6.2	16.7	0	13.3	56.6	3/3	7	B
	Sheep Creek	1992	1	0.2	10.8	22.1	0	22.1	1103.9	2/2	ND	B
			2	1.2	14.5	39.5	0	11.5	212.0	9/9	6	A
			3	0.6	8.1	78.9	0	41.9	209.3	5/13	6	B
			4	0.8	6.0	49.0	0	3.8	64.1	5/6	ND	B,A
East Canyon	East Canyon Creek	2000	1	0.9	25.4	19.0	16.8	14.5	6.7	ND	30	A/F
			2	1.8	22.0	10.5	6.6	7.2	46.3	ND	21	C
			3	1.6	23.6	14.9	8.7	9.9	14.3	ND	22	B,F
			4	3.6	17.9	17.8	7.7	14.0	11.0	ND	24	A/F,F,G
	Dark Creek	1988	1	0.2	17.6	17.2	5.7	11.4	28.6	ND	ND	ND
			2	0.2	20.6	12.0	0	12.0	149.9	ND	ND	ND
			3	0.3	19.0	58.9	3.7	44.2	99.4	ND	ND	ND
	Summit Prairie Creek	1988	1	0.1	19.7	40.7	8.1	16.3	73.2	ND	ND	ND
Blue Lake	Blue Lake Creek	1988	1	0.4	11.1	9.5	0	9.5	90.0	ND	ND	B,A
			2	0.2	13.6	0	0	0	56.4	ND	ND	A
			3	0.1	9.4	13.0	0	13.0	77.9	ND	ND	A
			4	0.5	10.3	0	0	0	55.8	ND	ND	A
North Fork	North Fork Cispus River	1990	1	0.2	37.3	6.5	6.5	0	19.6	ND	ND	B
			2	0.7	49.9	1.4	1.4	0	7.0	ND	ND	B
			3	0.9	44.2	12.9	10.6	5.9	36.5	ND	22	A

Watershed	Stream	Year	Reach	Miles	Average Width[2]	Pools// Mile	Large[3] Pools/Mi	Quality[4] Pools/Mile	Wood[5] /Mile	Sediment[6]	Mean Bankfull Width: Depth	Rosgen Type[7]
North Fork (continued)	North Fork Cispus River (continued)	1990	4	0.9	40.3	13.0	10.9	4.3	45.6	ND	17	B
			5	0.8	37.9	9.1	9.1	7.8	37.6	ND	18	B
			6	0.8	35.0	7.4	3.7	3.7	53.2	ND	23	B
			7	1.3	33.0	11.0	8.7	7.9	164.9	ND	20	B
			8	0.3	35.3	9.1	6.1	0	3.0	ND	19	B
			9	0.8	55.6	4.9	4.9	1.2	30.6	ND	ND	B
			10	0.7	33.6	4.5	4.5	3.0	53.4	ND	ND	B
			11	0.8	37.4	15.8	13.1	6.6	24.9	ND	20	B,A
			12	0.6	30.8	14.8	13.2	11.5	9.9	ND	ND	A,B
			13	0.3	31.7	26.7	11.8	14.8	68.1	ND	11	B
			14	0.3	24.8	12.2	9.2	9.2	125.1	ND	ND	B
			15	0.2	20.8	20.1	8.0	20.1	870.5	ND	12	B
			16	0.3	17.5	31.2	27.3	31.2	39.0	ND	8.3	A
			17	1.3	32.1	11.9	7.9	5.5	64.9	ND	7.7	B
			18	0.2	19.3	5.3	0	5.3	36.8	ND	19	C
			19	0.8	17.1	13.1	5.9	13.1	139.0	ND	20	A
			20	0.3	21.4	15.1	3.8	7.6	276.4	ND	ND	A
			21	0.3	20.8	15.7	3.1	12.6	84.8	ND	ND	A
			22	0.3	15.6	11.9	3.0	8.9	83.4	ND	ND	A
			23	0.2	16.2	28.4	4.1	16.2	125.8	ND	ND	A
	St Michael Creek	1989	1	0.1	6.0	0	0	0	19.1	ND	ND	A
			2	0.2	5.9	0	0	0	5.0	ND	ND	A
			3	0.3	5.6	3.6	3.6	3.6	21.6	ND	ND	A
			4	0.2	14.5	5.1	5.1	0	50.6	ND	ND	A
			5	0.2	5.6	0	0	0	40.1	ND	ND	A
			6	0.2	6.2	0	0	0	48.3	ND	ND	A
			7	0.3	5.7	0	0	0	5.8	ND	ND	A
	St John Creek	1990	1	0.2	13.0	29.3	4.9	29.3	68.4	0/3	11	A
			2	0.6	13.3	23.5	10.8	23.5	54.2	0/6	13	A
			3	0.1	11.4	19.3	9.6	19.3	38.5	1/3	12	A
			4	0.3	6.7	3.0	0	3.0	126.9	2/2	16	A/F
			5	0.3	4.4	0	0	0	31.3	1/1	16	A/F
			6	0.2	5.4	0	0	0	50.1	1/1	26	A/F

1 Gifford Pinchot fisheries staff conducted the surveys from 1988 to 1998 and contracted out from 1999 to 2000. Region 6 protocols were not followed until after 1990. Many fish bearing streams or reaches of streams have not been surveyed, because of the large size of the stream (ex Cispus River below Muddy Fork), poor water clarity (Muddy Fork), higher priorities (ex Chambers Creek, Walupt Creek, ect.), Information about these streams is from casual observations, or other surveys, many with poorly documented protocols.
2 - Wetted width.
3 - Large = > 3 feet deep.
4- This value is based on a liberal definition of quality. A quality pool has a wetted-width to depth < 7, or at least one piece of woody debris.
5- A piece of wood must be ≥ 24" in diameter and 50' long.
6- The survey rated whether or not the substrate embeddedness in the habitat unit was greater 35%. Reported are the number of units with > 35% embeddedness/ the number of units sampled times 100.
7- A best estimate of Rosgen Channel type based on available information about stream gradient, channel entrenchment, bankfull width to depth ratio and sinuosity. We departed from standard Rosgen typing in two types of cases. 1) Many of reaches have more than one Rosgen type. In these cases, multiple Rosgen types were noted by separating them with a coma. 2) Some cross sections were wider and shallower than would be expected from the gradient, channel entrenchment and sinuosity alone. We noted these cases by placing a / between Rosgen types (ex A/F).
8- ND insufficient data documented.

Appendix F - Comparison of Historic and Current Structural Stages by Sixthfield Subbasin

Table F-1: Comparison of Historic and Current Structural Stages by Sixthfield Subbasin

6th Field	Hist. Early	Hist. Mid	Hist. Late	Hist. Non-Forest	Current *Early	Current Mid	Current Late	Current Non-Forest
Headwaters	195	3481	2931	6387	557	1274	4736	6413
Walupt Creek	297	2968	2298	4180	259	4412	861	4188
Chambers Creek	797	9369	5606	2638	4196	6796	4743	2666
Muddy Fork	2326	5947	3986	5474	7404	4776	269	5246
Cat Creek	4662	11896	1648	572	4360	9673	4197	547
Adams Fork	4461	7194	277	3754	3283	7913	647	3842
E. Canyon Creek	1967	9200	5638	1502	2851	9457	4014	1984
Blue Lake	945	10449	2755	1488	1018	11157	1928	1535
North Fork C. Riv.	3219	20539	1130	3020	8936	6957	9254	2752
Totals	**18869**	**81043**	**26269**	**29015**	**32864**	**62415**	**30649**	**29173**

*Note: Current Early Open and Closed structural stages have been combined for comparison with the Historic Structural Stage of Early, where the open or closed condition is unknown.