

ASOTIN CREEK
MODEL WATERSHED PLAN
ASOTIN COUNTY, WASHINGTON

April 1995

Sponsored by:

Asotin County Conservation District

PREPARED BY:

ASOTIN COUNTY CONSERVATION DISTRICT LANDOWNER STEERING
COMMITTEE

DAVE BROWNE

FRANK KOCH

GENE THIESSEN

JAY HOLZMILLER

STEVE POLUMSKY

CARROLL JOHNSON

DAN SCHLEE

WITH ASSISTANCE FROM:

MODEL WATERSHED TECHNICAL ADVISORY COMMITTEE

USDA NATURAL RESOURCES CONSERVATION SERVICE

WASHINGTON DEPARTMENT OF ECOLOGY

USDA FOREST SERVICE

WASHINGTON DEPARTMENT OF FISH &
WILDLIFE

CLEARWATER COMPANY

WASHINGTON DEPARTMENT OF NATURAL
RESOURCES

BONNEVILLE POWER ADMINISTRATION

EXECUTIVE SUMMARY

OVERVIEW

The Northwest Power Planning Council completed its "Strategy for Salmon" in 1992. This is a plan, composed of four specific elements, designed to double the present production of 2.5 million salmon in the Columbia River watershed. These elements have been called the "four H's":

- * improve harvest management
- * improve hatcheries and their production practices
- * improve survival at hydroelectric dams
- * improve and protect fish habitat

The Asotin Creek Model Watershed Plan is the first to be developed in Washington State which is specifically concerned with habitat protection and restoration for salmon and trout. The plan is consistent with the habitat element of the "Strategy for Salmon".

Asotin Creek is similar in many ways to other salmon-bearing streams in the Snake River system. Its watershed has been significantly impacted by human activities and catastrophic natural events, such as floods and droughts. It supports only remnant salmon and trout populations compared to earlier years. It will require protection and restoration of its fish habitat and riparian corridor in order to increase its salmonid productivity.

THE PROCESS

The watershed coordinator for the Asotin County Conservation District led a locally based process (similar to the coordinated resource management process of the USDA Soil Conservation Service) that combined local concerns and knowledge with technology from several agencies to produce the Asotin Creek Model Watershed Plan.

This process is guided by a plan of work developed jointly by the Landowner Steering Committee (local landowners) and the Technical Advisory Committee (local volunteers and agency representatives). Trust, credibility, commitment and active communication between the two committees are key to the process.

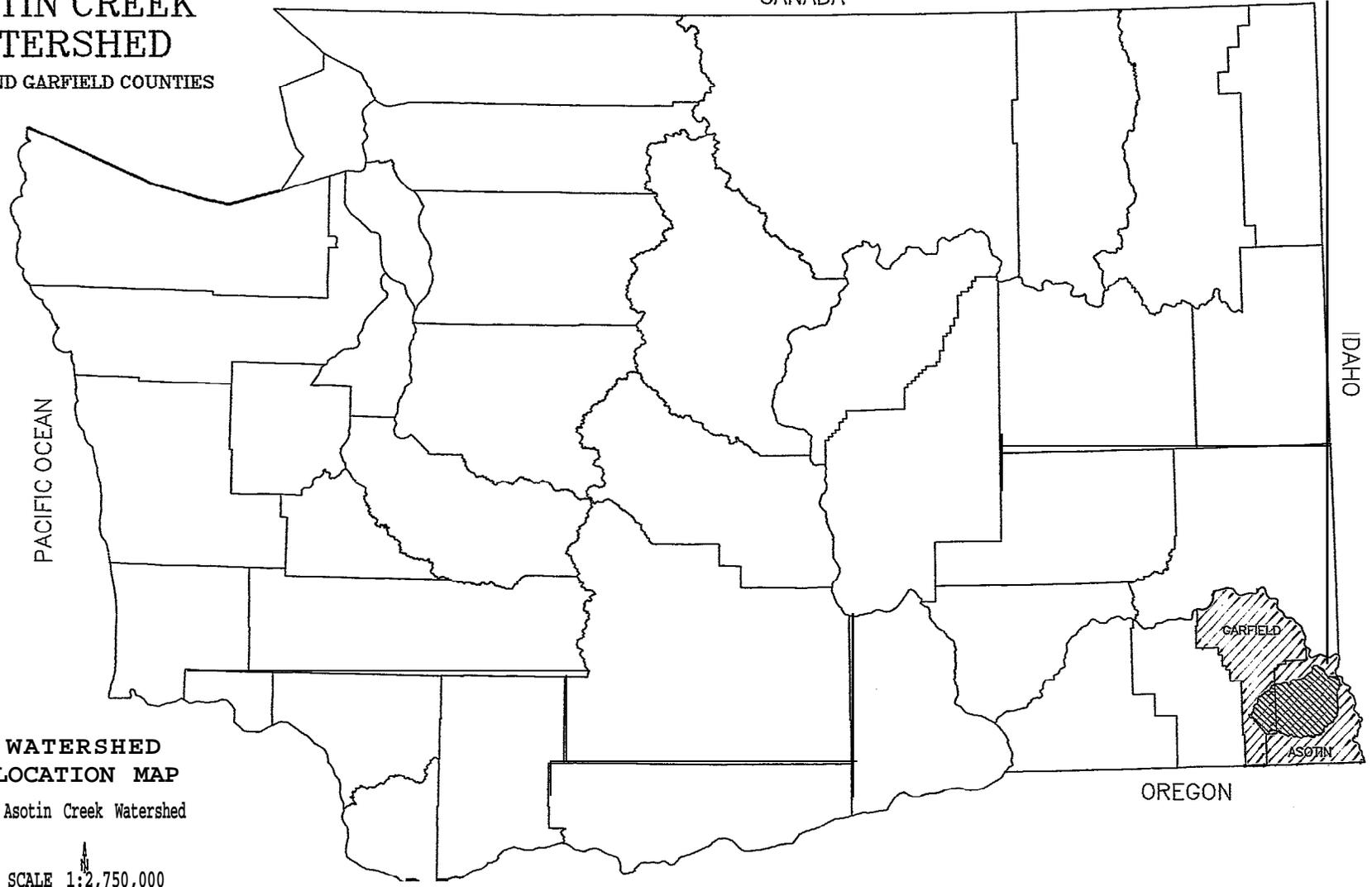
MISSION STATEMENT

A mission statement was developed by local landowners and volunteers, assisted by agency staff, which reads as follows: "Complete and implement an integrated plan for the Asotin Creek watershed which will meet landowner objectives and agency acceptance, in order to protect and enhance all resource bases with concern for long-term sustainability."

ASOTIN CREEK WATERSHED

ASOTIN AND GARFIELD COUNTIES

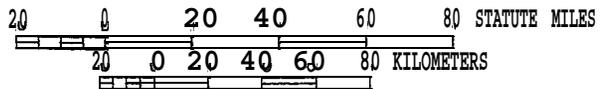
CANADA



WATERSHED LOCATION MAP

of Asotin Creek Watershed

SCALE 1:2,750,000



LAMBERT CONFORMAL CONIC PROJECTION

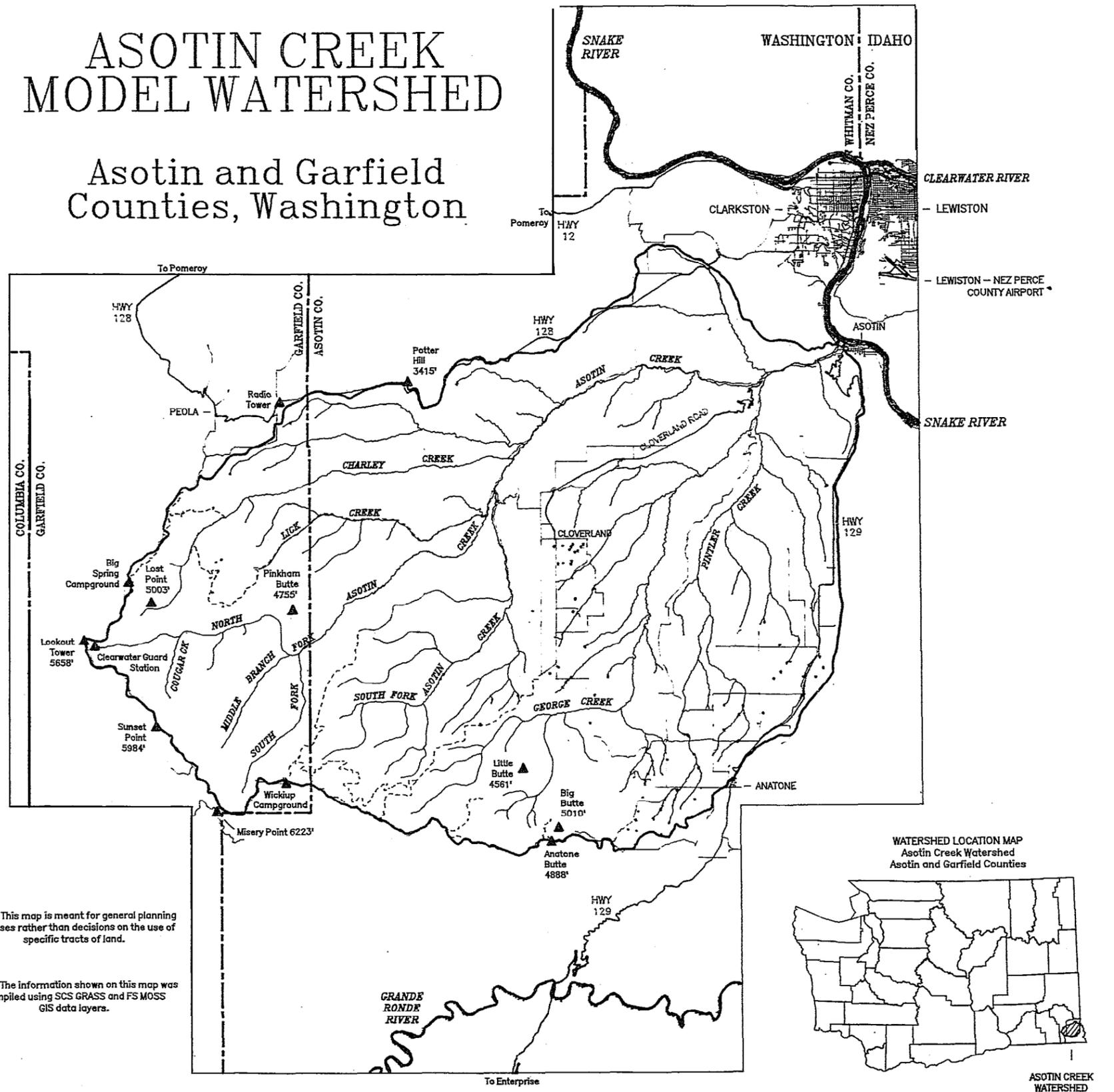


STATE OF WASHINGTON

USDA Soil Conservation Service, State Office, Spokane
MAP CONSTRUCTED USING GRASS4.0-MAPGEN INTERFACE. FEBRUARY 1993

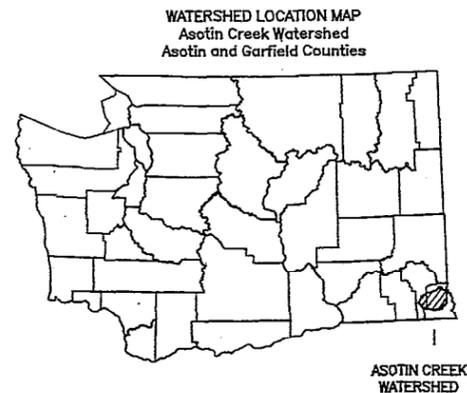
ASOTIN CREEK MODEL WATERSHED

Asotin and Garfield Counties, Washington



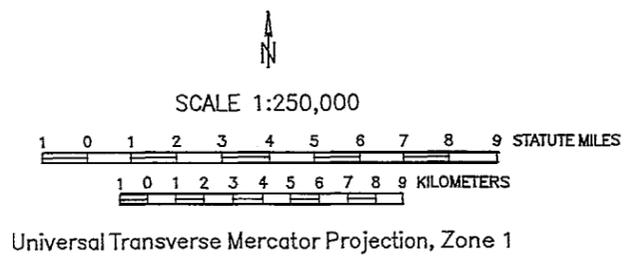
NOTE: This map is meant for general planning purposes rather than decisions on the use of specific tracts of land.

NOTE: The information shown on this map was compiled using SCS GRASS and FS MOSS GIS data layers.



VICINITY MAP

- Watershed Boundary
- Streams and Rivers
- County Boundaries
- Highways
- Improved Surface and USFS Maintained Gravel Roads
- USFS Improved Light Duty Roads
- Open Water



USDA Soil Conservation Service, May 1994
 Washington State Office, Spokane
 in cooperation with the
 Asotin County Conservation District
 Map Constructed Using SCS GRASS4.0-MAPGEN Interface

The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (braille, large print, audiotape, etc.) should contact the USDA Office of Communications at (202)720-5881 (voice) or (202)720-1127 (TDD).

To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, D.C., 20250, or call (202)720-7327 (voice) or (202)720-1127 (TDD).
 USDA is an equal employment opportunity employer.

GOALS

The following goals were also developed by both committees to support the mission statement:

1. Strive for substantially improved fish and wildlife habitat quality and quantity.
2. Involve community groups and volunteers outside of the farming and ranching industry to support the plan and help improve fish and wildlife habitat.
3. Prioritize habitat improvements to make cost-effective and responsible use of public funds.
4. Focus project efforts on a watershed/ecosystem approach rather than just the riparian area.
5. Create pro-active management of private resources without increasing government regulations.
6. Promote cooperative efforts between landowners and agencies.
7. Strive to reduce instream sediment levels by improving upland management practices.
8. Promote the use of conservation practices on all confined livestock winter feeding and calving areas, adjacent to Asotin Creek and its tributaries, to protect water quality and the riparian area.
9. Develop a public information and education program to raise the natural resource awareness of county residents.
10. Develop a watershed management plan that meets Section 10 requirements under the Endangered Species Act for a "habitat conservation plan".

WATERSHED PROBLEMS

The following problems were identified during the watershed analysis and are addressed in the plan:

1. High stream temperature
2. Lack of resting and rearing pools containing large woody debris (LWD)
3. Sediment deposition in spawning gravels
4. High fecal coliform counts

THE WATERSHED PLAN

Key components of the watershed plan include:

- 1, Stream and Riparian
 - A. Riparian native woody planting - 36,000 linear feet
 - B. Wetland enhancement (off-channel rearing sites) - 6
 - C. Stream meander reconstruction - 2640 linear feet
 - D. Instream habitat structures - 144
 - E. Fencing - 23,760 feet
2. Forestland
 - A, Stockwater and/or fish and wildlife ponds - 6
 - B. Critical area planting - 25 acres
 - C. Tree planting - 30 acres
3. Rangeland
 - A. stock trails and walkways - 26,400 feet
 - B. Noxious weed control - 16,000 acres
 - C. Well development - 4 I
 - D. *Fencing* - 26,400 feet
4. Cropland
 - A. Permanent grass cover - 3500 acres
 - B. Grassed waterways - 10 acres
 - C. Terraces - 150,000 feet
 - D. Filter *Strip*³ - 4 acres
 - E. Sediment basins - 40

The Landowner Steering Committee will also use this plan to: 1) streamline all permitting processes with local, state, federal and tribal agencies to reduce inefficiencies, duplication and red tape between them and all landowners who are willing to implement elements of the plan and 2) meet the "habitat conservation plan" requirements as described in Section 10 of the Endangered Species Act.

ANGUS DUNCAN
CHAIRMAN
Oregon

Joyce Cohen
Oregon

Mike Field
Idaho

Todd Madlock
Idaho

NORTHWEST POWER PLANNING COUNCIL
8.51 S.W. SIXTH AVENUE, SUITE 1100
PORTLAND, OREGON 97204-1337

Phone: 503-222-5161
Toll Free: 1-800-222-3355
FAX: 503-795-3370

John N. Etchart
Montana

Stan Grace
Montana

Mike Kreidler
Washington

Ken Casaantc
Washington

February 6, 1995

Landowner Steering Committee
Asotin County Conservation District
725 Sixth Street
Clarkston, WA 99403

Dear Steering Committee:

As you may know, the Northwest Power Planning Council has just finished the amadromous fish portion of our Columbia River Basin Fish and Wildlife Program. The Council is cognizant of the importance of the freshwater period in the life cycle of salmon and steelhead species. Improved habitat quality will allow greater juvenile and adult survival at each freshwater lifestage and can result in more offspring surviving to begin migration to the ocean. In these difficult times of reduced runs of many species, habitat improvements often become the critical linkages between salmon, steelhead and man.

Improving and maintaining critical habitat areas is no easy task. It requires vast amounts of cooperation and long-term commitment between landowners, state and federal agencies to undertake comprehensive watershed management. This is no small undertaking and must also be adopted to stream-specific conditions within a watershed, working with the values and history of the local communities.

During the Council's investigations of habitat issues, the Asotin Creek Model Watershed Plan was one of the private initiatives recognized for its outstanding contributions to comprehensive watershed management. The Council congratulates you, the Landowner Steering Committee, for your very worthy efforts in guiding this cooperative effort. You have made an outstanding effort to promote cooperation, reduce erosion rates, protect and enhance water quality, and provide outreach service to your fellow residents in Asotin County. This is no little endeavor and you should be very proud of your association with the watershed project.

The Council remains committed to the task of returning fish stocks to a biologically sustainable level by the year 2000. Because of model watersheds and private groups such as yours, the region is one step further along the path to our collective goal. We salute the magnitude of your endeavor.

Sincerely,

Northwest Power Planning Council Members

ASOTIN CREEK MODEL
WATERSHED PLAN

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Plate I - WATERSHED LOCATION MAP
Plate II - VICINITY MAP

I. WATERSHED SETTING .	1
A. LOCATION	1
B. SOCIAL AND ECONOMIC	1
c. CLIMATE	1
D. TOPOGRAPHY/GEOLOGY/SOILS	2
E. WATER QUANTITY	2
F. WATER QUALITY	6
G. ANIMALS/PLANTS/THREATENED/ENDANGERED SPECIES	6
H. CULTURAL RESOURCES	7
I. LAND USE	7
1. Cropland	7
2. Rangeland	10
a) historic livestock grazing	11
b) current livestock grazing	12
1. general	12
2. riparian	13
c) wildlife grazing	13
d) range condition	14
3. Forestland	15
4. Wetland	16
J. RIPARIAN VEGETATION	16
K. STREAM GEOMORPHOLOGY	19
II. FISH RESOURCES	21
A. CHINOOK SALMON	21
B. OTHER SALMONIDS	28
C. LAMPREYS	29
D. OTHER FISH	29
III. RESOURCE PROBLEMS AND OPPORTUNITIES	31
A. STREAM GEOMORPHOLOGY	31
B. SEDIMENTATION	33
C. WETLAND AND RIPARIAN VEGETATION	36
D. WATER TEMPERATURE	40
E. INSTREAM HABITAT: PAST AND PRESENT	47
F. HARVEST/HATCHERY	51
G. WATER QUANTITY	54
H. WATER QUALITY	55
I. RANGELAND	58
J. FORESTLAND	60
K. CROPLAND	63

IV.	ALTERNATIVES	65
A.	TEMPERATURE	66
B.	INSTREAM HABITAT	68
C.	SEDIMENT	70
D.	FECAL COLIFORM	72
V.	RECOMMENDED WATERSHED RESTORATION PLAN	74
A.	PURPOSE	74
B.	ALTERNATIVE EFFECTS ANALYSIS	75
C.	COST ESTIMATES	76
D.	POTENTIAL FUNDING SOURCES	79
E.	IMPLEMENTATION AND MONITORING	80
F.	ADAPTIVE MANAGEMENT	83
VI.	COORDINATION CONSULTATION AND PUBLIC PARTICIPATION	84
VII,	REFERENCES CITED	86
VIII.	GLOSSARY	94
IX.	LIST OF PREPARERS	99
X.	APPENDICES	

Appendix A: Resource Inventory Maps

Figure A-1	General Ownership Map
Figure A-2	Water Quality Monitoring Sites Maps
Figure A-3	General Soil Map
Figure A-4	Surficial Geology Map
Figure A-5	Sediment Yield Ratings Map
Figure A-6	Land Use Map
Figure A-7	General Wetlands Map
Figure A-8	Stream Classification Map
Figure A-9	Range Allotment Map

Appendix B: Proposed Instream Improvements Atlas

Figure B-1	Streams With Seasonally Elevated Temperatures Map and Index To Atlas Sheets
Figure B-2	Atlas Sheet #1
Figure B-3	Atlas Sheet #2
Figure B-4	Atlas Sheet #3
Figure B-5	Atlas Sheet #4
Figure B-6	Atlas Sheet #5
Figure B-7	Atlas Sheet #6
Figure B-8	Atlas Sheet #7
Figure B-9	Atlas Sheet #8

- Appendix C: Listed Plant and Animal Species in or Near
Asotin Creek Watershed
- Appendix D: A History of Fish Administration in
Washington State
- Appendix E: List of Abbreviations and Acronyms
- Appendix F: Wetland Type Descriptions
- Appendix G: Riparian Vegetation Species List
- Appendix H: Stream Inventory, Analysis, and
Alternative Generation (Geomorphic and
Fish)
- Appendix I: Asotin Basin Cobble Embeddedness
- Appendix J: Washington State Standards for Surface
Water Quality - Class "A" and "AA"
- Appendix K: Practices: Definition and Purpose
- Appendix L: Fish Habitat Structures vs. Stream Type
- Appendix M: List of Hatchery Trout Plants
- Appendix N: WDOE Draft Memo Regarding Riparian
Stockwatering

TABLES

Table 1	Range Condition By Site.....	15
Table 2	Riparian Vegetation Summary.....	17
Table 3	Asotin Chinook Spawning Surveys.....	23
Table 4	Asotin Creek Watershed PSIAC Ratings.....	35
Table 5	Range Condition Comparison.....	59

FIGURES

Figure 1a	Average Flows (10 Day Increment) for Asotin Creek (1929 - 1960).....	3
Figure 1b	Average Flows (10 Day Increment) for Asotin Creek (1960 -1992).....	4
Figure 2	Relative Seasonal Flows - Asotin Creek.....	5
Figure 3	Spring Chinook Redd Counts in the Imnaha River	24
Figure 4	Maximum Air and Water Temperatures.....	43
Figure 5	Comparison With 1992 Regression Lines.....	44

I . W A T E R S H E D S E T T I N G

I. WATERSHED SETTING

A. LOCATION

Asotin Creek, located in central Aspton and eastern Garfield Counties, drains a portion of the north slope of the Blue Mountains (Plate I). It enters the Snake River through the left bank at river mile (RM) 145 (Hydrology 1965). The Water Resources Council Hydrologic Number for this 208,260 acre (325, sq miles) watershed is 17060103040. The creek crosses under State Highway 129, very near its mouth at Asotin, Washington.

B. SOCIAL AND ECONOMIC

The population of Asotin County is estimated to be 18,900 (Cook & Jordan 1994). This includes the incorporated town of Asotin with a population of 1108, which is partly within the watershed boundary (Plate II). There are approximately 150 people who actually reside within the boundary of the watershed (Sangster 1994). The nearest large business and trading centers lie seven miles north of Asotin at the confluence of the Snake and Clearwater Rivers, These are the twin cities of Clarkston, Washington (pop. 6750), and Lewiston, Idaho.

Fifty eight percent of Asotin County residents live in unincorporated areas. The agriculture/ranching industry supports 4.4% of the 7,111 county work force. The remaining employment is as follows: 0.3% in forestry and mining, 5.5% in construction, 16.9% in manufacturing, and 73% in services (such as restaurant workers). With a 1989 median income of \$22,897 per household, Asotin County has one of the lower per capita income levels in Washington State (Hasslen & McCall 1992).

While most of this population resides outside the watershed boundary, the majority of the farming, ranching and forest activities occur within the boundary. There are 142 farm/ranches (1933 acre average) in Asotin county (Cook & Jordan 1994). Only 73 of these farms are managed by full time owner-operators. Crops are harvested on about 115 of these farms, annually producing over 700,000 bushels of wheat and 500,000 bushels of barley, An annual average of 3,500 tons of hay are produced for the 81 farms/ranches which raise primarily beef cattle. At least one ranch raises hogs, There are up to 11,000 head of cattle and calves foraging on private and public grazing lands within the county. Approximately 5,000 are cows that have calved.

C. CLIMATE

Average annual precipitation varies from 12 inches at the mouth of Asotin Creek to 45 inches in the upper reaches of

the watershed, occurring mainly in the winter and spring months. Temperatures can range from -20°F in the winter to 105°F in the summer. The growing season is 115 to 155 days.

D. TOPOGRAPHY/GEOLOGY/SOILS

The Asotin Creek watershed is bordered on the southwest by the Blue Mountains. Elevations range from 760 feet at the mouth to 6,223 feet at Misery Point. The Blue Mountains consist of volcanics which include ancient fractured and folded lava flows (Appendix A-4). These merge to the north and east as a gently tilted plateau. The increase in elevation from this uplift caused streams to cut down and form very steep, and generally narrow, V-shaped canyons.

Volcanic ash from the eruption of Mt. Mazama is found in soils located on top of the mountains and north-facing canyon slopes. Silt loams, formed in the loess (wind-blown silts), cover the plateau tops and shoulder slopes. They are moderately to well-drained and highly erosive.

Soils in the canyons and on steeper mountain areas are shallow to deep and formed in material weathered from basalt and loess (Appendix A-3). The basalts have weathered into coarse gravels, cobbles and boulders with fine silts and clays. There are few sand-sized particles.

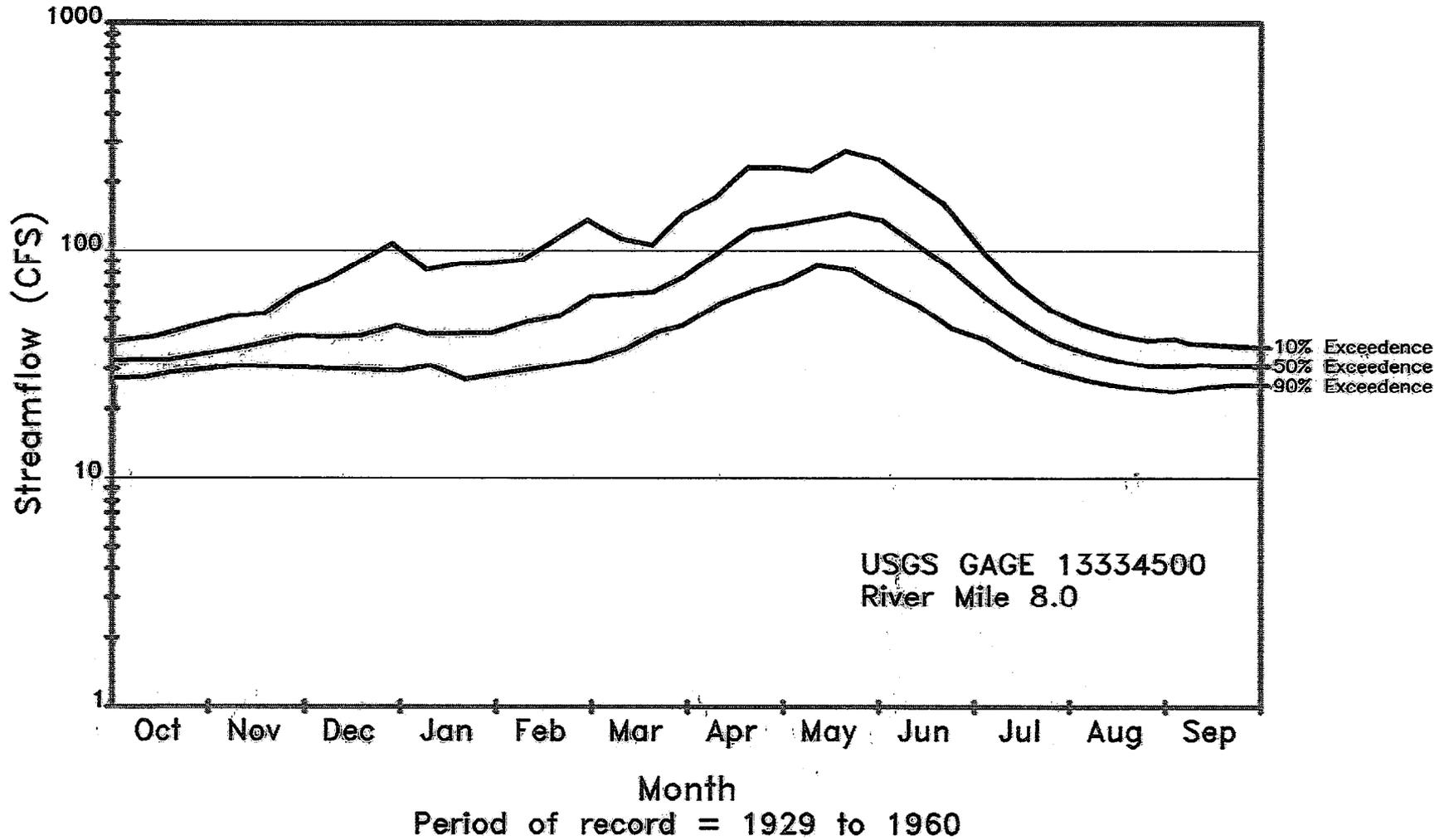
E. WATER QUANTITY

The Asotin Creek drainage is comprised of 360 miles of both perennial and intermittent stream channels (USDA Soil 1984). There are three U.S. Geological Survey (USGS) gage stations on the main channel (Appendix A-2). At gage #13335050, located near the mouth, flows were recorded only during the 1989 water year. The Kearney Gulch gage (#13334700), located at RM 5.3, just upstream of the mouth of George Creek, has records from 1960 to 1992. Gage #13334500, just upstream of Headgate Dam, at RM 8.0, was used to measure flows from 1929 to 1960. These records indicate a mean annual flow of 74 cubic feet/second (cfs); a normal low flow of 15-30 cfs in late summer; and a normal high flow of 200-400 cfs between February and June.

During a flood on December 23, 1964 a peak flow of 2580 cfs was measured at the Kearney Gulch gage, which represents fifty-two percent (170 square miles) of the watershed. This flow, coupled with the water from the George Creek basin, was estimated to be 6500 cfs at the mouth (U.S. Army 1966). It was the highest flow measured at the Headgate Dam since a 1904 flood of 1180 cfs. A peak flow of 3700 cfs was estimated at this gage on January 15, 1974. This flow was calculated to be only a 57 year flood event (Blomgren 1994). The lowest recorded flow was 13 cfs on January 11, 1963.

Figure 1a

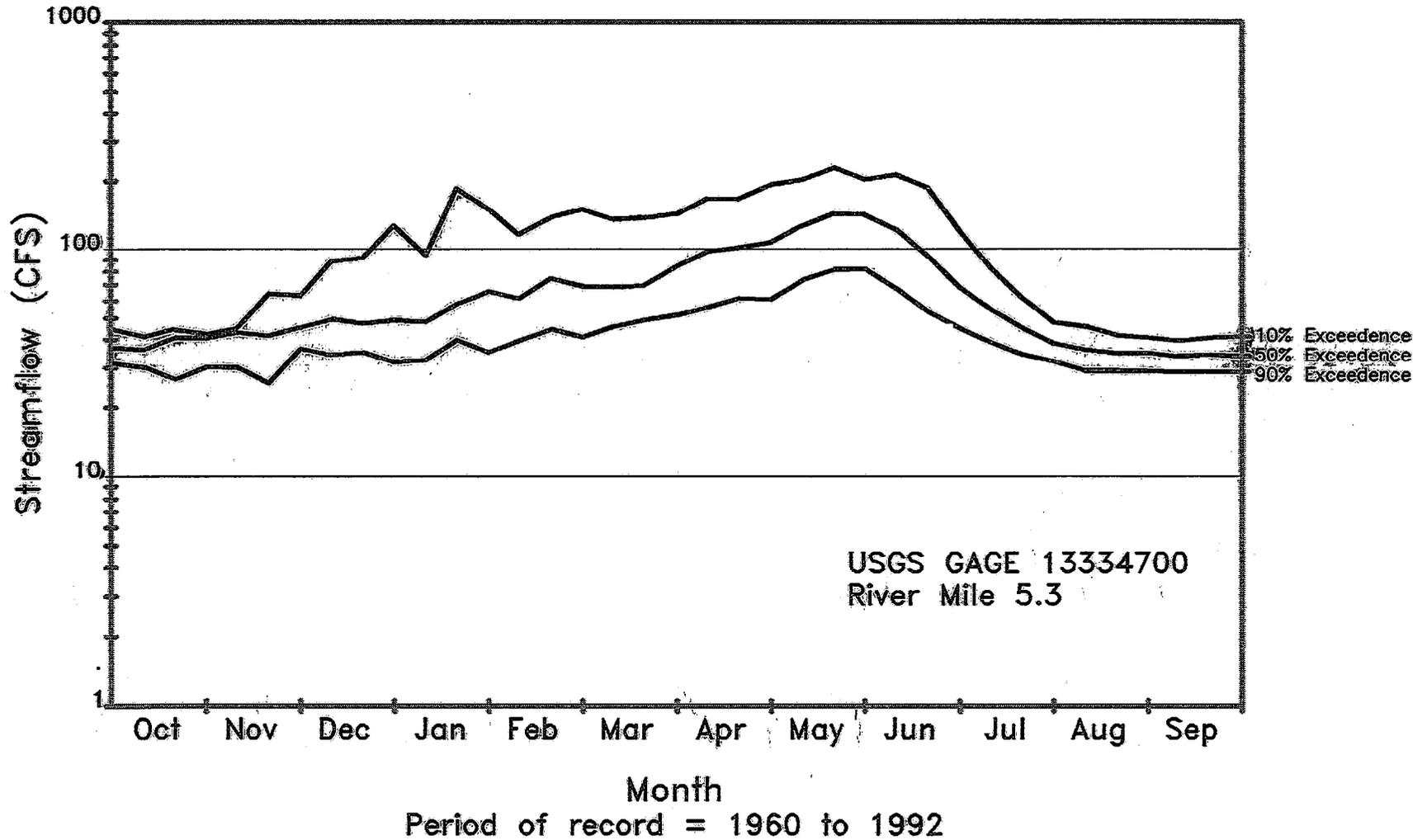
ASOTIN CREEK AVERAGE FLOWS (10 DAY INCREMENT)



Source: Washington State Department Ecology
1993 IFIM (Draft)

Figure 1b

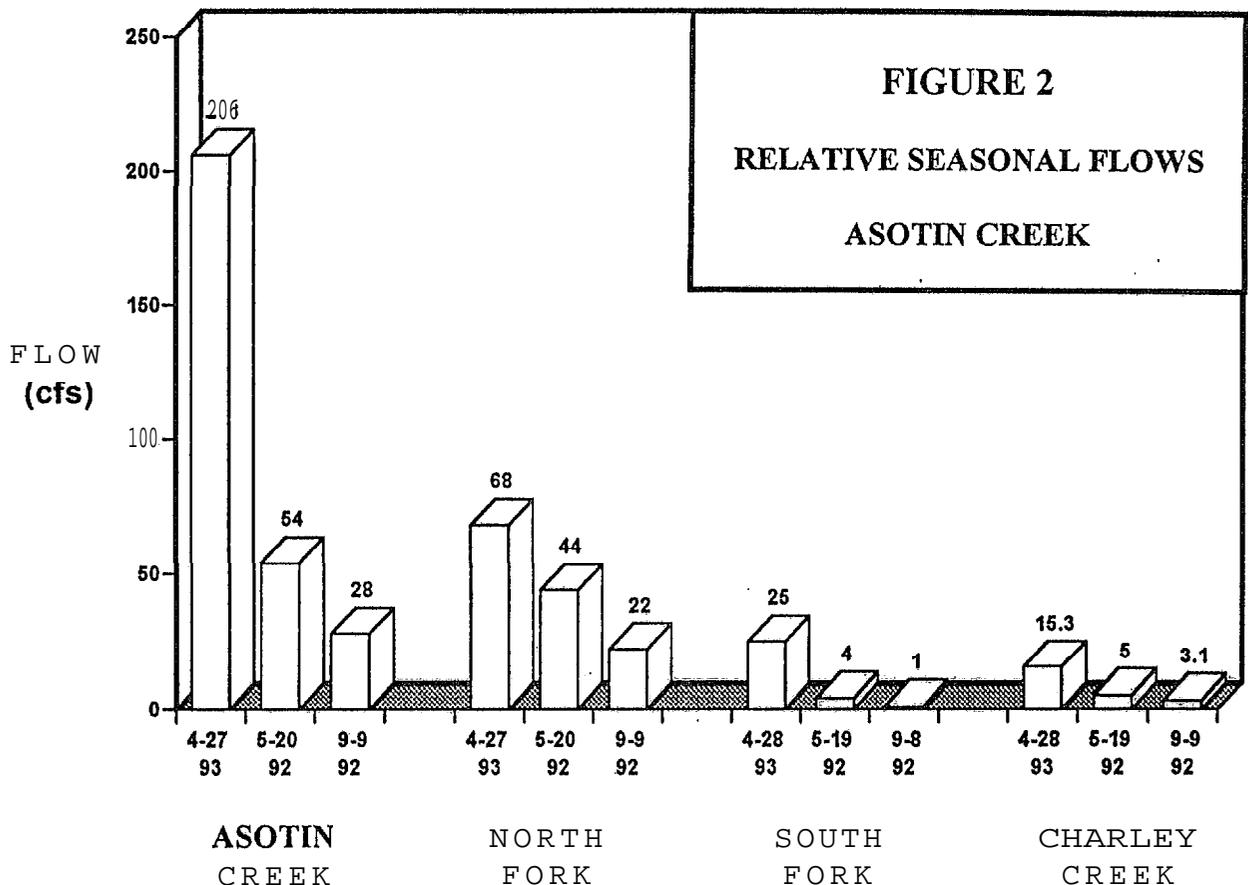
ASOTIN CREEK AVERAGE FLOWS (10 DAY INCREMENT)



Source: Washington State Department Ecology
1993 IFM (Draft)

In 1992, the Washington State Department of Ecology (WDOE) used USGS gage records to determine the hydrology of Asotin Creek as part of an Instream Flow Incremental Method (IFIM) study (Caldwell 1994). Figures 1a and 1b depict the average flows over 10 day intervals, which were then averaged over the period of record for each gage. Each line represents an exceedence probability for flow that can be expected on any given day. Gage #13335050 was not used.

George Creek (RM 3.1) and its main tributary, Pintler Creek (RM 1.1), form the largest subbasin. The upper reaches of these streams are perennial, but during summer and fall months George Creek usually has no surface flow connection to Asotin Creek. The North Fork (PM 14.7) and its main tributaries are also perennial. Although no accurate flow measurements are available for these tributaries, general observations were made by agency personnel from the former (Appendix D) Washington State Department of Wildlife (WDW) and Washington State Department of Fisheries (WDF) and the United States Forest Service (USFS). They indicate that at low flow the North Fork receives less than 1 cfs from Lick Creek (RM 0.9) and up to 7 cfs from each of the three upper tributaries: South Fork of the North Fork (PM 9.6), Middle Branch (RM 10.0), and Cougar Creek (RM 14.3).



Charley Creek and the South Fork of Asotin Creek (RM 14.7) also flow year-round, Flows in these streams, as well as the North Fork and main Asotin Creek, were measured by WDOE (Figure 2) during the IFIM study in 1992, the lowest flow year on record for the Snake River. Note: Charley and Lick are listed as "creeks" in this document and on USGS quadrangle maps, though some local residents have always called them "forks", such as "Charley Fork".

F. WATER QUALITY

Asotin Creek and its tributaries are designated as Class A outside the boundary of the Umatilla National Forest and Class AA inside (Appendix J). Waters within the Umatilla National Forest (herein, "Forest") usually meet state standards for temperature, turbidity, and bacteria levels. Stream temperatures, which have been measured during various studies since 1980, have exceeded state standards for surface waters on both private and state lands managed by the Washington State Department of Natural Resources (DNR) and the Washington State Department of Fish and Wildlife (WDFW), the agency formed by the union of the WDF and WDW in March 1994 (Appendix D).

The Asotin County Conservation District (ACCD), with a grant from the WDOE Centennial Clean Water Fund, sponsored a water quality study on Asotin Creek (Moore 1993). Water samples were taken and analyzed at various times, beginning in November 1990 and ending in January 1993. The study results indicated that waters in the mainstem of Asotin Creek do not meet state water quality standards for temperature and bacteria parameters.

G. ANIMALS, PLANTS, THREATENED & ENDANGERED SPECIES

Chinook salmon (*Oncorhynchus tshawytscha*), steelhead (0. mykiss), and bull trout (*Salvelinus confluentus*) are known to be in the Asotin drainage. Unidentified lamprey species have also been reported. A full discussion of Asotin Creek fish species is found in section II. FISH RESOURCES.

Yearly wildlife surveys indicate as many as -1300 mule deer (*Odocoileus hemionus*) and 300 white-tailed deer (*Odocoileus virginianus*) reside in the watershed. The watershed is home to over 1100 elk (*Cervus elaphus*), which were re-introduced during the early 1920's (Fowler 1993). Between 1989 and 1993 WDW released 15 Rocky Mountain bighorn sheep (*Ovis canadensis*) into the drainage to re-establish this species. Numerous sightings of black bear (*Ursus americanus*) and cougar (*Felis concolor*) reported by hunters and local residents in recent years indicate that these populations seem to be increasing (Fowler 1994). Other animals that are known to live in the watershed are: California quail (*Callipepla californium*), beaver (*Castor canadensis*),

shorttail weasel (*Mustela erminea*) and racoon (*Procyon lotor*).

Appendix C contains a list of the common game animals found in the Asotin watershed, as well as a list of plants and animal species which are considered to be in jeopardy.

H. CULTURAL RESOURCES

The State Historic Preservation Officer has been contacted for a determination of significant archaeological and historic resources located in the Asotin Creek watershed. The Washington State Archaeologist indicated there is a potential for unrecorded archaeological resources. It was recommended a professional cultural resources survey be conducted prior to project activities.

The Nez Perce Tribe was also contacted. Their Cultural Resource Archaeologist noted that such resources do exist in the Asotin Creek area and that they would be willing to participate in a professional survey. Until the survey takes place, the Tribe will maintain a high degree of confidentiality regarding the specific location of archaeological and historical sites. The Tribe considers cultural resources a high priority.

I. LAND USE

1. Cropland

There are 54,956 acres (26% of the watershed) of cropland in the watershed (**Appendix A-6**). Of this acreage, grasses and legumes occupy 2,885 acres, in rotation with annual crops. Also, there are 16,420 acres enrolled in the Conservation Reserve Program (CRP), which was designed by the U.S. Department of Agriculture (USDA) to take erodible cropland out of production for contracted periods of 10-15 years. This program provides annual rent payments on the retired land to land owners and operators. The USDA assistance also includes partial financial reimbursement for establishment of permanent vegetative cover (specified grasses, trees and shrubs) to protect the cropland from excessive soil erosion.

The first CRP contracts in the Asotin watershed began in 1986 with termination scheduled for September 30, 1995, at which time up to 70% of these acres will most likely be farmed again, using a "winter wheat/summerfallow" rotation (Schroeder 1994). This will probably increase sediment contribution to the Asotin Creek system.

The remaining 35,651 acres are cultivated cropland which have predominantly two crop rotations: 1) winter wheat/summerfallow and 2) winter wheat/spring barley/summerfallow. There can be variability in these rotations due to

conditions such as severe weather, commodity prices, and USDA program requirements. The majority of Asotin County farm producers are USDA program participants. As participants, if they produce commodity crops (e.g. wheat) on ground that is classified as highly erodible land (HEL) then, according to the Food Security Act (FSA) of the 1985 USDA Farm Bill, they must follow a conservation compliance plan approved by the local Conservation District. Most of the cropland in Asotin County is classified HEL.



Strip Cropping Near Cloverland

conservation compliance plan is designed to significantly reduce cropland erosion while still allowing for the viable production of commodity crops. It may include such practices as: conservation cropping sequence (crop rotation), conservation tillage, contour farming, field strip cropping, terraces, sediment basins and grassed waterways. At this time 78% of the cultivated cropland has a terrace system. Only one percent is part of a strip cropping system.

Farmers in the Asotin watershed have long recognized the need for conservation on their land. The first terrace system was established in the 1940's. Between then and 1985 they have installed 1,070,581 feet of terrace systems and 90.4 acres of grassed waterways; built 102 sediment basins; and converted 2,307 acres of erosive cropland to permanent grass. According to a life-long resident of the watershed: "Conservation has always been in style in Asotin County" (Carroll Johnson 1994).



Sediment Basin, Asotin Creek Watershed

Average annual soil loss from cropland acres, farmed with an approved FSA plan, is to be held to no more than 3.6 to 4.5 tons per acre. Predicted average annual soil loss from CRP lands ranges between 0.8 to one ton per acre. These predictions are based on the Universal Soil Loss Equation (USLE) which specifically addresses sheet and rill erosion. Past studies of cropped silt loam soils show that 16% of annual soil erosion leaves the field. By using this percentage as a sediment delivery rate, SCS estimates that 23,649 tons of soil from cropland are introduced annually into non-farmed areas such as grassed waterways, terraces, roadside ditches and drainage ways. Much of this is then transported into the stream system.

The following summary shows the amount of annual sheet and rill erosion for common rotations on cropland in the Asotin Creek Watershed, as it presently exists (FSA fully implemented):

Rotation	Acres	Sheet and Rill Erosion
WW/SF and 1. WW/SB/SF	35,651	132,310 tons
Grasses and Legumes in Rotation	2,885	1,432 tons
CRP	<u>16,420</u>	<u>14,064 tons</u>
	54,956	147,806 tons

1. ww = Winter Wheat SF = Summerfallow SB = Spring Barley

2. Rangeland

Rangeland and pastureland occupy 90,393 acres (43%) of the Asotin Creek Watershed (Appendix A-6). Rangeland is primarily located on valley sideslopes that are too steep to farm and which typically have shallow, stony soils with bedrock outcroppings. Pastureland is located on the valley floor. Grazeable areas are described as "ecological sites" which are local complexes of soil and plant communities that extend from low elevation areas dominated by bluebunch wheatgrass; to higher sites of mixed sagebrush and bluebunch wheatgrass; to the highest elevation sites where a variety of grasses and forbs are interspersed with trees. Typically, forested land occupies north-facing slopes and rangeland occupies south-facing slopes. Forested areas that provide understory forage vegetation are classified as "grazeable woodland". The USFS defines recently harvested forest areas as "transitory rangeland" and considers the amount of forage available in these areas when determining the grazing capacity within the National Forest boundary.

Rangeland ownership is divided between private, state (WDFW and DNR), and federal (Umatilla National Forest). Many cattle ranchers in the watershed depend on these public rangelands for leased summer pasture. Grazing leases are complicated because adjacent state and federal land management agencies often have different goals and mandates which may require different grazing practices. In 1986, a Coordinated Resource Management Plan (CRMP) was developed and implemented for private and public lands in the Lick Creek and Charley Creek portions of the watershed (Holland 1994). The purpose of this effort was to improve management and range condition for elk in this part of the watershed while still maintaining economically important livestock grazing leases.

The area covered by the Lick Creek CRMP contains 45,000 acres: 28,000 acres of Umatilla National Forest, 5,800 acres of private land, and 11,100 acres of state land administered by WDFW and DNR. These state lands are managed as the Asotin Unit of the Chief Joseph Wildlife Area. Forage was also reallocated in the Asotin Unit to release one third of the grazing capacity previously used by cattle for winter elk grazing. Forage enhancement, road closures and water developments were used in addition to planned grazing systems, to facilitate improved elk management.

The Lick Creek CRMP is currently being evaluated for its effectiveness for elk management. The WDFW will use forage utilization data which has been collected annually since 1989 by SCS personnel for selected portions of state and private grazing lands in this area. In addition, the WDFW is also mandated to protect riparian areas and certain other habitat communities on state lands per State Law - HB 1309 and on both state and private lands, following the agency's goals for "Washington's Priority Habitats and Species" (PHS). These mandates may change some existing grazing practices.

USFS personnel have monitored utilization on their allotments for many years. Their estimates show that actual use has generally conformed to planned levels. Use of key grasses has been under 50% for growing-season grazing, and usually less than 65% for dormant season use. Higher than desired use was observed during the drought years of 1992 and 1994 on some privately owned rangelands (Higgenbotham 1994).

a) Historic Livestock Grazing

Livestock grazing in the Asotin Creek Watershed began in the early 1800's. Native Americans first grazed cattle and horses in the watershed on lands that are now part of the Umatilla National Forest. European settlers moved into the area in the early 1870's and began to graze livestock as well. By the early 1900's, 3,000 cattle grazed the lower elevation ranges up to the edge of the timber for eight months of the year. The higher ranges were grazed in the four summer months by 30,000 sheep. In addition, herds of up to 500 wild horses grazed the watershed prior to 1900 (Groat & Sanchez 1994). In 1901 thousands of these animals died during an epidemic of epizootic fever which spread through Asotin and Garfield counties. The survivors were rounded up later that year and no horse grazing has since occurred on Forest lands in the Pomeroy District.

As logging activities opened up access through the forest to the higher elevation ranges, more conflicts occurred between cattle and sheep producers. In 1929, the USFS began regulating grazing on their lands and established a range area called the Asotin allotment. The Peola-Pomeroy

allotment was established in 1939 and later split into the Peola and the Pomeroy allotments in 1949. The Pomeroy allotment is not in the Asotin watershed. Sheep populations began to dwindle starting in 1939 and were not grazed in the Umatilla National Forest after 1952. By 1992, cattle numbers had also been significantly reduced to 500 cows on the Asotin allotment and 317 cows on the Peola allotment. This amounts to between 4,000 and 4,500 animal unit months (AUM's) of forage which is grazed between June 1 and October 15. An AUM is the amount of forage necessary to feed a 1000 pound cow and her calf (or their equivalent) for one month. This reduction in utilization has contributed to an upward trend in range condition on the Umatilla National Forest.



Excellent Condition Range, Asotin Creek Watershed

b) Current Livestock Grazing

General grazing: During summer months the upland areas of the watershed have 7,700 AUM's of livestock grazing. Up to 4,500 AUM's are provided on the Forest for six ranchers who hold grazing permits (Appendix A-9). Of these, five maintain all or most of the rest of their grazing use within the watershed. The sixth rancher brings cows into the watershed from another area only for the summer grazing season. The rest of the cattle are transported outside the watershed for the summer grazing season. The other 3200 AUM's come from private summer rangeland in the lower elevations. Approximately half of the livestock using rangelands remain in the watershed year round.

Riparian grazing: Guidelines for riparian grazing management on the Forest have focused on maintenance of herbaceous (non-woody) vegetation, utilization of browse, and inherent soil stability for judging suitability of livestock grazing use (Clary & Webster 1990). According to Higgenbotham (1995) this method of grazing management did not offer any specific protection for woody plants within the riparian area. Some indirect protection was given, however, with the use of seasonal grazing. Spring grazing occurs during the time when woody vegetation utilization is low and the cooler weather encourages grazing of uplands. This allows better regrowth of herbaceous vegetation, which is important for filtering sediments (Clary & Webster 1990; Chaney, et al. 1993). It also allows re-growth of woody vegetation.

c) Wildlife Grazing

Rocky Mountain elk, which became re-established in the Blue Mountains after 1920, have significantly influenced land use and management, especially on public lands. According to Roger Holland (1994) counties in the Blue Mountains account for approximately 15% of the Washington State annual elk harvest.

The largest concentration of elk in the Asotin Creek Watershed occurs in the 45,000 acres covered by the Lick Creek CRMP. A herd of about 1,100 elk spend the winter in this area and the adjoining federal and private lands. Approximately one-third of the forage in the Asotin Unit is maintained for elk use. Federal grazing units in the elk calving areas are rested from livestock grazing two years out of five. Big game winter ranges are generally rested on a two to three year rotation. These rotations, along with seasonal road closures, provide undisturbed space for wildlife. Other CRMP forage enhancements for big game include 1,070 acres of CRP, 400 acres of pasture plantings, and annual prescribed burning and fertilization of approximately 300 acres of range and pastures.

Following these guidelines, SCS personnel interviewed livestock owners in August and September 1993 to determine numbers and seasonal patterns of livestock utilization on private rangeland along Asotin Creek and its tributaries. Grazing exclusion and spring/early summer grazing (which terminates before the end of the growing season) were considered generally favorable toward maintaining residual and woody cover along the streams. Year-long access, or use from summer through winter, were considered unlikely to meet these guidelines.

They found that approximately 6,500 AUM's of livestock use occur along Asotin Creek, the South Fork, and Charley Creek, downstream of the Forest boundary. Between 4,000 and 5,000 AUM's of this use is by traditional cow/calf livestock

operations. Another 1,300 AUM's are provided as hay which is fed to wintering livestock that are confined in feeding areas along the mainstem and South Fork of Asotin Creek and Charley Creek. The balance is use by livestock owned by suburban residents who live immediately upstream of the town of Asotin.

Based upon the above they estimated that approximately 70% of the streambanks within the survey area were either excluded from livestock use or only used during spring or early summer. The remaining 30% were grazed year-long or between mid-summer and winter. The impacts of livestock grazing on the woody plant component of the riparian vegetation is discussed in the "Wetlands and Riparian Vegetation" section.

Personnel from the Pomeroy District of USFS have systematically monitored utilization of riparian vegetation only since 1993. Prior to that time only grass forage utilization was monitored, and then only as a uniform part of the open rangeland. They found that grazing of woody riparian vegetation on USFS allotments has been light, averaging less than 10% of the available brush (Higgenbotham 1994).

d) Range Condition

Current status of private upland rangelands in the watershed was inventoried by utilizing the SCS ecological site and condition classification. "Ecological sites" (loamy, north slope, shallow, etc.) represent distinct types of potential plant communities. These sites differ in the kind or amount of climax (presettlement vegetation. "Range condition" refers to the percentage of the existing plant community that is considered to be climax for the ecological sites within the range area. For example, the range condition is lowered when the choice native bunchgrasses are replaced with less palatable native species (sagebrush, rabbitbrush, etc.) or invading weeds (cheatgrass, yellow starthistle, etc.). If the survey area contains more than 50% climax vegetation it is classified as being in "Good" to "Excellent" range condition. Less than 50% is classified as "Poor" to "Fair". "Range trend" is the general direction (up or down) of range conditions over a given time period. "Good" to "Excellent" range condition provides better livestock and wildlife forage as well as better vegetative cover for protection from soil erosion.

Ecological sites on private rangeland were surveyed by Clarkston field office staff between 1986 and 1993. The relative condition of these sites is summarized in Table 1. These surveys covered only 26,000 acres (47%), of the private rangeland in the watershed. They showed that 68% of the surveyed rangelands were in "Good" or "Excellent"

condition. Native bunchgrasses were the dominant plant and provided most of the potential livestock forage and erosion control. Loamy sites, which are generally the most productive sites, were the exception. Two-thirds of these loamy sites were in "Poor" or "Fair" condition.

TABLE 1. RANGE CONDITION BY ECOLOGICAL SITE - PRIVATE LANDS"

SITE	ACRES		CONDITION CLASS (%)	
	"FAIR/POOR"		"GOOD/EXCELLENT"	
LOAMY	9,053	22	12	
NORTH SLOPE	4,700	5	13	
SHALLOW	12,629	5	43	
TOTALS	26,382	32	68	

* Selected areas from field office records

Range condition on 4,730 acres of state lands within the Lick Creek CRMP was evaluated prior to implementation of the CRMP. Range condition was "Poor" or "Fair" for 1,460 acres and "Good" for 3,270 acres (69%). Forage reallocated for use by elk totaled 737 AUM's. National Forest lands within the CRMP are currently being inventoried to determine range condition and trend.

Condition and trend transects were established in 1954 on the USFS Asotin allotment and were classified as follows: two transect clusters were in poor condition, three were in fair condition, and two were in good condition. When the same transects were measured in 1993, three transect clusters were considered to be in good condition and four were in excellent condition (Groat 1994). Similar transect clusters which were established on the Forest, within the CRMP in 1960 and 1965, are currently being reevaluated. A similar upward trend is expected in these transect areas. On private rangelands, however, the trend appears to be static, except where increasing invasion by noxious weeds is causing a further downturn.

3. Forestland

Forestland covers 62,621 acres (30% of the watershed), mostly in the upper and central portion of the Asotin Creek Watershed (Appendix A-6). The central part of the watershed is a transition zone between forested areas with deeper soils and a north aspect; rangeland on the shallow drier sites; and dry cropland on ridges where loess silt loams occur. Some forests were cleared for crop production.

The forest begins at the 22-24 inch precipitation zone. The primary timber type consists of Douglas fir which occurs in both open and dense stands. Other timber types are found in mixed stands of ponderosa (bull) pine, Douglas (red) fir,

grand (white) fir and western larch (tamarack). As the elevation increases, and aspect or direction of slope changes, the composition of the forest stand is influenced. Ponderosa pine is common on the south and west-facing slopes. Douglas fir is common on the north and east-facing slopes. Where the available water capacity is higher and the spring frosts are more severe, lodgepole pine and western larch are common. Generally, above 3,500 ft, Douglas fir, western larch, subalpine fir and lodgepole pine are common. At lower elevations western red cedar, Engelmann spruce, and grand fir are found in areas of deeper soils that hold more water.

The majority of the forestland is in the Umatilla National Forest and managed by the USFS according to its Forest Plan, which conforms to the "multiple use" concept. Besides timber management, other uses are livestock grazing, outdoor recreation, mining, and water management.

The remaining forestland is owned by Washington State (managed by DNR and WDFW) and non-industrial private forestland owners (NIPF). Most of the NIPF land has been harvested at least one time. Commercial timber harvest on NIPF and state lands is regulated by DNR through the Washington State Forest Practices Rules and Regulations.

4. Wetland

There are 406 acres of wetlands in the watershed. They include 319 acres associated with streams and 87 acres of isolated areas scattered throughout the cropland (Appendix A, Figure A-7). In 1990 the National Wetlands Inventory maps, prepared for the U.S. Fish and Wildlife Service (USFWS) in 1979 (Cowardin, et al.), were updated for the cropland areas using the Asotin County Soil Survey, high elevation infra-red photography, color slides from the USDA, Agricultural Stabilization and Conservation Service (ASCS), and field visits (Appendix F).

J. RIPARIAN VEGETATION

During the summer of 1993, USDA, Soil Conservation Service (SCS - now the Natural Resources Conservation Service, or NRCS) personnel (Burton 1994) classified the riparian vegetation along 69.1 miles of streams in the watershed according to dominant overstory species, percent of stream canopy cover, and age class (Table 2). This vegetation was inventoried because of its importance for fish habitat and its impact on water temperature. This general inventory was done using techniques described in a similar reconnaissance-level survey of riparian habitat (Bauer & Burton 1993). Dominant overstory was classified by plant community complexes similarly used in other riparian studies (Windward & Paggett 1987; Burton 1991). Also, USFS personnel (Heinlen

Table 2 - Riparian Vegetation Summary

Reach	Location	Distance (Miles)	Shade (Percent)	Dominant Plant Community	Dominant Age Class	Tree Planting (ft) Planned Action	Tree Planting (ft) Optimal Action
1	Mouth to section 20 road bridge	1.1	37	Alder/ Cottonwood	Sapling pole (< 8.0" dbh)	1400	2700
2	Section 20 Road bridge to Jerry Bridge	2.0	49	Alder/ Cottonwood	Small tree (8.0 to 20.9"dbh)	0	1700
3	Jerry Bridge to Headgate Park	6.0	63	Alder/ Cottonwood	Small tree	0	1900
4	Headgate Park to Charlie Creek Confluence	4.7	79	Cottonwood/Alder	Small tree	0	3800
5	Charlie Creek Confluence to Cloverland Bridge	1.4	50	Cottonwood/Alder	Small tree	2300	3900
6	(South Fork) Cloverland Bridge to Warner Gulch	4.0	61	Alder/ Cottonwood	Small tree	1000	5500
7	(South Fork) Warner Gulch to Ruins	3.4	58	Alder/ Cottonwood	Small tree	5300	9200
8a	(South Fork) Ruins to Redhill Gulch	1.5	65	Douglas fir/Grand fir	Small tree	3900	5850
8b	(South Fork) Redhill Gulch to the confluence of North Fork and South Fork of the South Fork	2.0	65	Douglas fir/Grand fir	Small tree	*1000	*2000
9	(North Fork) Cloverland Bridge to National Forest Boundary	4.0	68	Alder/Waterbirch	Small tree	4700	10000
10a	(North Fork) National Forest Boundary to South Fork of the North Fork	4.2	68	Alder/Grand fir	Small tree/ Large tree (21.0 to 32.0"dbh)	0	3000
10b	(North Fork) South Fork of North Fork to Clear water Guard Station	8.3	68	Alder/Grand fir	Small tree/ Large tree	*1500	*3000
11	(North Fork) South Fork of the North Fork	4.6	* >75	Douglas fir/Grand fir	Large tree	*0	*0
12	(North Fork) Middle Branch of the North Fork	2.5	* >75	Douglas fir/Grand fir	Large tree	*0	*0
13	(Cougar Creek)	2.8	43	Grand Fir/Subalpine fir	Large tree	*2000	*3000
14a	(Charley Creek) - Lower	9.0	65	Alder/Douglas fir	Sapling pole	11900	21150
14b	(Charley Creek) - Upper	7.6	65	Douglas fir	Sapling pole	*1000	*2500
						36,000	79,200

* Estimated from Hankin and Reeves inventory

& Crow 1992) surveyed streams within the Umatilla National Forest in order to classify salmon habitat, including riparian vegetation, using a method developed by Hankin & Reeves (1988). George and Pintler Creeks were excluded from these inventories because they do not support chinook salmon.

The dominant riparian plant community on 44.1 miles was black cottonwood and white alder, four miles was dominated by white alder and water birch, 18.2 miles was dominated by Douglas fir and grand fir and 2.8 miles was dominated by grand fir and subalpine fir. Ponderosa pine, Douglas hawthorn, and pacific yew were other common tree species in the riparian areas. Coyote willow, red-osier dogwood, and western clematis were the common shrub species and reed canarygrass, hardstem bullrush and horsetail were common in the herbaceous understory. See Appendix G for a more detailed species list.

The percent of canopy cover shading the stream was calculated using visual estimates from the ground; by the use of a densiometer; and from low level SCS aerial color slides. The aerial color slides were used because they give more detailed coverage of the stream corridor and are a permanent record that can be re-evaluated. Some of the high elevation areas were evaluated using a densiometer as the only method. Estimates of canopy cover ranged from 37% to 79% (Table 2). In general, the lower values were along the lower mainstem, and the values increased with elevation.



Mature Cottonwood Tree

Percent of each age class was also identified for each stream reach as either grassland/forb, shrub/seedling, sapling/pole, small trees, large trees, or mature trees. The sapling/pole stage was the most common age class on 17.7 miles of the stream, mostly on the lower mainstem, Charley Creek, and the South Fork. Small trees were dominant on 37.5 miles of the mid-elevation stream reaches and large trees were most common on 13.9 miles of the highest elevation stream reaches. During the survey, comments were recorded concerning sites where the local land use significantly impacted the riparian plant communities.

K. Stream Geomorphology

Most of the mainstem Asotin Creek and portions of major tributaries have been straightened, diked, or relocated. Many reaches have become braided. These alterations were due to flood events, flood-proofing for property protection, and road construction. These changes resulted in Asotin Creek becoming steeper, straighter (less sinuous), and more confined (less floodplain).



Geomorphic Features
Altered by County Road

Asotin Creek's historic geomorphic stream type was flatter, more sinuous, and less entrenched, with alternating point bars. These point bars served important roles in shape and function providing habitat for an entire aquatic community of plants and animals. The stream channel had longer, deeper pools, with a well developed thalweg (low flow channel). The loss of well developed thalwegs with naturally functioning point bars was responsible for much of the loss of fish habitat.

Today's straight, wide and shallow channel continuously adjusts in order to compensate for variables that affect shape and function. Mainstem Asotin Creek's original pool/riffle relationship has been changed to a riffle/glide system, having fewer pools.

II, FISH RESOURCES

II. FISH RESOURCES

A. Chinook Salmon

Spring/summer chinook have been documented in Asotin Creek, but fall chinook have not, although the mainstem has adequate flow and gravel size for these fish (Swift 1979). WDF conducted fall chinook spawning surveys each November, from 1988 through 1991, looking from the mouth upstream to the Cloverland bridge (RM 3.0) and found no adult salmon or redds (salmon and trout "nests"). Since the final listing for Snake River fall chinook "Critical Habitat", dated December 28, 1993, does not include Asotin Creek (Vol. 58; no. 24 of the Federal Register) this report will not address fall chinook issues. Generally, however, habitat (especially pool habitat) which is improved in the lower river for spring/summer chinook holding and rearing should also benefit fall chinook and steelhead.



Chinook Salmon in Spawning Colors

Snake River and Asotin Creek native chinook salmon were originally classified by National Marine Fisheries Service (NMFS) as a "threatened" species and listed in the Federal Register, as required by the Endangered Species Act (ESA), on April 22, 1992. The 1994 returns of these fish were the lowest in history, which caused NMFS to use an emergency rule to temporarily reclassify their status to "endangered" on August 18, 1994. On December 28, 1994 the agency issued a proposed rule to make this a permanent classification.

The first record of spring/summer chinook in Asotin Creek is found in a USFWS publication (Parkhurst 1950) which was an analysis of numerous stream surveys by the former Bureau of Commercial Fisheries during the 1930's. Evidently, most of the stream flow had been diverted from the channel at Headgate Dam in August 1934, leaving 25 adult chinook stranded in the downstream reach. Local citizens and Washington State Department of Game (WDG) personnel rescued the fish. They felt, at the time, that this was probably the entire run. A local landowner also told one of the surveyors that prior to 1935, there was a good run of chinook in the South Fork of Asotin Creek. Pirtle (1957) surveyed several Snake River tributaries from 1954-56 for the U.S. Corps of Engineers (COE) and estimated an average of 18 adult chinook passed Headgate Dam each of the three years. His counts are not in Table 3 because his 1956 count conflicts with a more reliable, higher count which was noted from a steelhead trap at the same site that year.

Don Steele, Game Agent for WDG during the 1960's in the Asotin Creek area, recalls seeing an occasional chinook in both the South Fork and Charley Creek (Steele 1993).

The first chinook spawning surveys were conducted by USFS in 1972 and 1973 (Table 3). Only the North Fork was surveyed. Since both of these surveys were on National Forest lands, they would have missed any spawning which might have occurred in the five miles of similar habitat downstream of the Forest boundary. Yearly surveys were then conducted by WDF, beginning in 1984. The 1986 count and the 1988-1992 counts did not include the upper reaches of the stream where much of the historical spawning occurred. Even though a few juvenile chinook have been found rearing in the South Fork, no adult surveys have been done there, or in Charley Creek, because adults were never seen during any of the previous electroshocking surveys done by WDW while looking for resident trout in August and September. Also, these streams did not appear to have enough flow for spawning chinook (Mendel 1994).

The Asotin Creek chinook counts follow the same trend in relative numbers as do historical counts in the Imnaha River of Oregon (Figure 3). The same index section has been used for redd counts in the Imnaha since 1957. The Imnaha is only 48 miles upstream of Asotin Creek and located on the same side of the Snake River. There are no dams between the two streams. Note that the 1972 count was the third highest in the Imnaha since the construction of The Dalles Dam. The 1973 count was the highest. Note, also, that this graph describes the general decline of chinook salmon in the Snake River watershed.

TABLE 3. NORTH FORK ASOTIN CREEK CHINOOK SPAWNING HISTORY

YEAR	DATE SURVEYED	REDDS	LIVE FISH	DEAD FISH	RIVER MILE	AGENCY
1954, 1955		average of 18	jumped over Headgate			COE
1956	-	-	50 at Headgate Dam			WDG <u>a/</u>
1972	29/30 AUG	12 <u>b/</u>	75 <u>c/</u>	1	5.0 - 16.0	USFS
1973	30 AUG	13	21	0	5.0 - 16.0	USFS
1980	(adults spawned, juveniles found in 1981)					WDW
1981	8 SEP	-	-	2	5.0 +	SCS <u>d/</u>
1982	(adults spawned, juveniles found in 1983)					WDW
1983	(adults spawned, juveniles found in 1984)					WDW
1984	12/13 SEP	21	12	5	0.0 - 10.0	WDF <u>e/</u>
1985	10 SEP	8	7	1	1.8 - 16.0	WDF <u>f/</u>
1986	4 SEP	1	1	0	0.0 - 5.0	WDF
	10 SEP	0	2	0	same	WDF
1987	14 SEP	3	4	0	0.0 - 10.0	WDF
	21 SEP	0	2	0	same	WDF
1988	1 SEP	1	0	0	1.0 - 5.0	WDF
	22 SEP	0	0	0	0.0 - 5.0	WDF
1989	18 SEP	0	0	0	0.0 - 5.0	WDF
	12 OCT	0	0	0	same	WDF *
1990	10 OCT	2	0	0	0.0 - 5.0	WDF
1991	10 OCT	0	0	0	0.0 - 5.0	WDF *
1992	17 SEP	0	0	0	1.5 - 6.0	WDF
1993	23 AUG	0	1	0	1.8	WDW
	9 SEP	2	0	1	1.0 - 10.0	WDF
	30 SEP	0	0	0	same	WDF

a. Estimated by WDF dam inspector from WDG steelhead trap.

b. May not be a complete count.

c. May include some carcasses.

d. Poached fish observed by SCS technician .

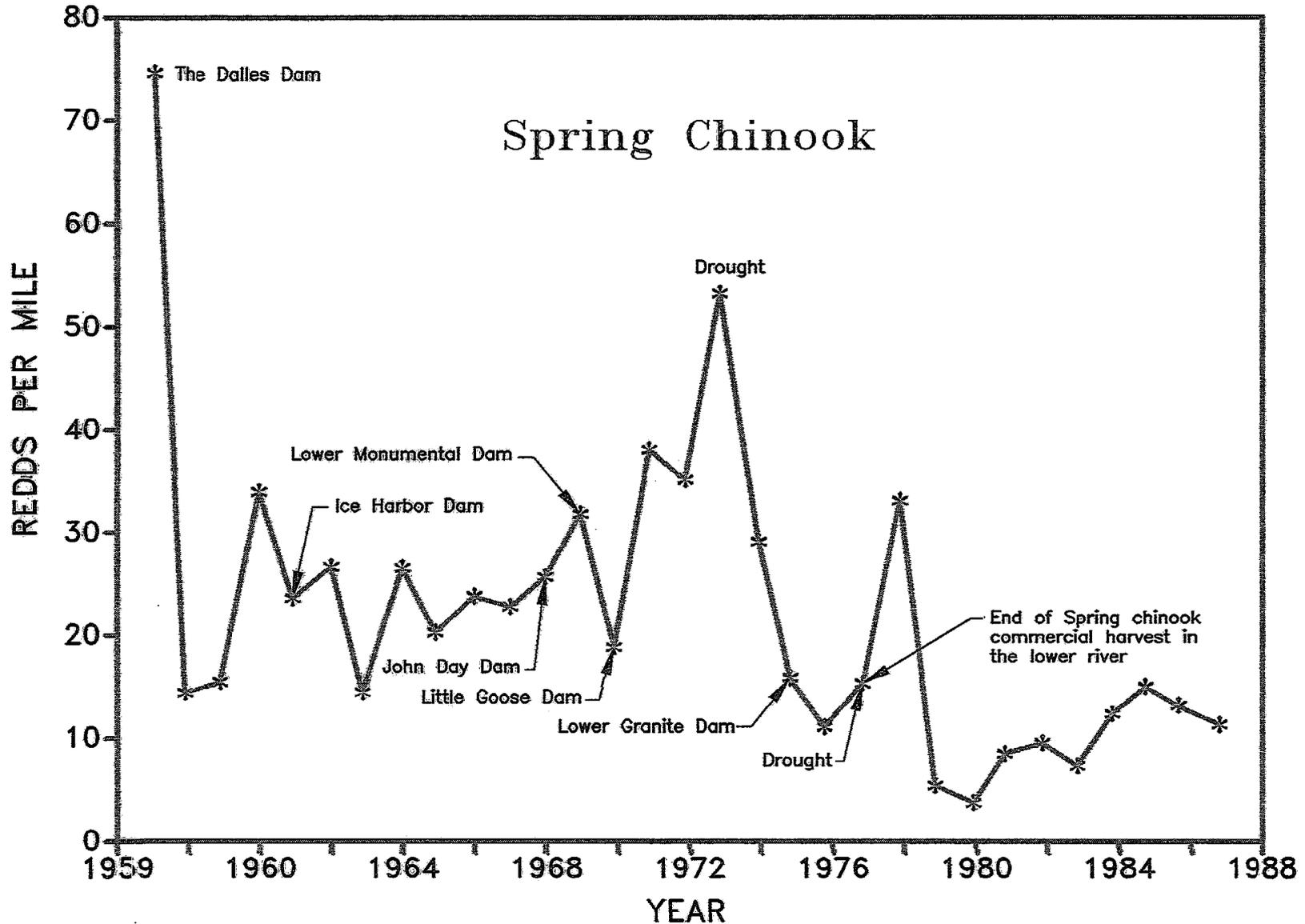
e. Includes upper three miles of mainstem.

f. Includes upper first mile of mainstem.

*. Adults spawned, as juveniles were found the next year.

Figure 3

Spring Chinook Redd Counts per mile in the Imnaha River Index Area (Blue Hole to Mac's Mine) for 1957-1987 (Selected Events and Construction of Selected Dams are Noted).



Source: 1993 Wallowa County Salmon Recovery Analysis (Draft)

(Mendel 1984), 1984 (Hallock & Mendel 1985), and again in 1989 (Viola, et al. 1991). Either adults spawned here or juveniles from the North Fork moved into it.

WDG installed and operated an adult steelhead trap on Headgate Dam from 1954 to 1961. It was maintained primarily by John Douglas, area fish biologist, from the last week of February through the second week of June. During this project several jack chinook (young adults) were also trapped, counted and passed over the dam, though Mr. Douglas recalls seeing up to a dozen adult chinook jumping completely over the trap in some flows (Douglas 1994). These chinook sightings were recorded by both he and his predecessor Tony Edred, but neither one can locate the data (Eldred 1994). A fish ladder inspector (Krakenberg 1957) for WDF reported that the WDG trap operator had passed "about 50" chinook over the dam in 1956, but that none had yet arrived when he inspected the trap on June 3, 1957.

Adult spring chinook (no record of fall chinook) information can be summarized as follows:

1. Chinook were present prior to at least 1934, but were already being impacted by water withdrawals.
2. Chinook may have spawned in the South Fork prior to 1935.
3. Adults were seen above Headgate Dam from 1954-1961.
4. Chinook may have spawned and/or reared in Charley Creek before the bridge was replaced with a culvert in 1965.
5. The highest recorded count of adult chinook occurred in 1972.
6. The second highest count was made in 1973, during the same time that the Imnaha River had its second highest count since 1957.
7. There was still a fair run in 1984.
8. From 1980-1993 chinook spawning can be documented every year except 1992. Also, no adults were found during two surveys in 1994 (Mendel 1994).
9. There is no way to determine if the high counts reflect a peak, a rise, or a decline in run size, though it is obvious that this run, much like that of the Imnaha, has steadily declined since 1984.

The limited data that has been collected for Asotin Creek Chinook indicates that their life history is similar to that of the Tucannon River spring/summer chinook. The adults enter the Columbia River in early spring, swim upstream 145 miles and cross the Bonneville Dam by August 15. They continue for another 324 miles and cross seven more dams before reaching the mouth of Asotin Creek. These fish must negotiate two more dams than fish se-turning to the Tucannon River,

Most adults probably enter the creek during high flows in May and June (-though, as already noted in 1957, none were seen at Headgate Dam prior to June 3) ! Once in the stream they move at varying speeds from pool to pool until they find a suitable holding area where they may stay from one week to over three months prior to spawning+ The preferred holding areas are usually pools which have large woody debris (LWD) or undercut banks for cover (Bugert, et al. 199%) ' They spawn in the North Fork, between late August and late September.

Fry emerge from the gravel in early spring of the next year and generally seek out deep, quiet pools. After living in the stream for approximately one year they become smolts and migrate to saltwater. Biologists of the Yakama Tribe have shown that some juveniles of Yakima River chinook move downstream during fall, while others may enter dead-end side channels (Fast, et al. 1991). These off-site rearing areas



Off Channel Rearing Site

have no surface flow connection to the main stream channel at the upstream end, but are connected at the downstream end with a surface outlet flow from a spring source or from subsurface mainstem flow.

In the spring of 1986 WDG personnel installed a smolt trap in the main channel about 200 feet downstream of the mouth of Charley Creek and trapped 181 juvenile chinook. The catch consisted of 165 fish which were classified as smolts (12 to 13 months old) and 16 fingerlings which were smaller and not ready to migrate to sea. These "pre-smolt" fish had moved downstream at least four miles from any known spawning areas. A few juvenile chinook have also been found in the South Fork, 3.2 miles upstream of its junction with the North Fork (Viola, et al. 1991) and were assumed to have swum there after hatching in the North Fork.

The trapping study showed that the peak of outmigration for Asotin Creek chinook was in early April and that most of the smolts had left by June 1. Since chinook smolts in the Tucannon River were found to move downstream at the rate of 25 miles in two to four days (Bugert, et al. 1991), smolts should be able to leave the North Fork of Asotin Creek and be in the Snake River within four days.

Personnel from WDFW have conducted tagging studies of naturally produced Tucannon River chinook each year since 1985. These studies indicate an overall return rate (egg to returning spawner) of 0.01-0.52% for Tucannon River chinook (Mendel, et al. 1993). Although no similar studies have been done for Asotin chinook, they probably have a lower return rate than the Tucannon fish, because they have two more dams to negotiate. One tagged adult carcass (about 11 lbs) was found in the North Fork on August 29, 1972 (Johnson). Evidently, this fish was captured and tagged at Ice Harbor Dam by NMFS, using a coded-wire tag and an adipose fin clip, as it headed downstream as a smolt during spring 1969. When it returned as an adult, it was identified as a marked fish (adipose clip) from a trap at Ice Harbor Dam. At this time it was tagged with an external jaw tag and released upriver to return to its parent stream (apparently, Asotin Creek).

Spring chinook return to the Tucannon River primarily as four year old adults, though some, called jacks, return at age three. Between 1985-1992 the age breakdown for 679 naturally spawned Tucannon River chinook is as follows: 1.8% for age three, 70.7% for age four, 27.4% for age five, and 0.1% for age six (Mendel, et al. 1993). The largest chinook reported in Asotin Creek was estimated to be 30-35 lbs. (Johnson 1972).

B. Other Salmonids

According to Schuck (1994) Asotin Creek had runs of over 1000 adult steelhead (*Oncorhynchus mykiss*) per year (range 408-1840) between 1954-1961. The creek still supports a fair run of native Snake River steelhead, even though this fish is considered a "depressed" stock by WDFW (Schuck 1994). Several environmental and sport groups have asked NMFS to list it as a "candidate" species. The escapement goal is 225 spawners each year, though the range has been between 120-170. Adults enter Asotin Creek between February and April and begin spawning, peaking in mid-April. They spawn primarily in the North and South Forks. Some use Charley Creek and main Asotin Creek, at least as far downstream as Headgate Dam.

Free-swimming fry emerge from the gravel from late May through July and move into shallow riffle areas until the fall months when they move into side channels, deeper pools, and backwater areas. They usually spend two years (rarely one or three) in the stream before migrating to saltwater during April through June.

The Asotin steelhead are considered as "A" Run fish which are smaller in size than the "B" Run fish of the Clearwater River. Asotin adults spend one or two years (predominantly one) in the ocean, returning to the Columbia River the following summer. They then move into the Snake River and its larger tributaries where they hold until the following spring, at which time they enter the spawning tributaries (Schuck 1994). Juvenile steelhead (or resident rainbows?) have been found in the North Fork at least up to Cougar Creek (Heinlen & Crow 1992).

Bull trout (*Salvelinus confluentus*) is generally listed in past Asotin Creek records as Dolly Varden (*Salvelinus malma*). WDFW considers the bull trout to be a "category 1" species on the state list of threatened and endangered species, but further ranks the Asotin Creek resident bull trout as a "high risk" population (Mongillo 1993). They prefer small spring-fed streams which have temperatures below 64°F and deep pools with plenty of cover. They spawn in September and October (Brown 1994).

During snorkeling surveys in August 1992 USFS personnel found adult and juvenile bull trout in the North Fork from the Forest boundary to 4.5 miles upstream, at the mouth of the South Fork of the North Fork. They were also found from the mouth of Cougar Creek (9.5 miles above the National Forest boundary) for another three miles, until the stream became too small to support these fish (Heinlen & Crow 1992).

Coho salmon (*Oncorhynchus kisutch*) were never documented in Asotin Creek, either in the literature, or by local accounts. The stream, however, is the typical size that would support these fish. They tend to spawn in small streams, such as the South Fork of Asotin Creek or Charley Creek. They were known to have used Snake River tributaries but were considered extinct in the Snake River system by 1986 (Wortman 1993). The last run in the Tucannon River was reported in October 1929 (Parkhurst 1950).

C. Lampreys

The name "Asotin" is derived from the Nez Perce description of "Hash Otin", translated as "Eel Creek" (Hitchum 1985). This implies that the stream probably had large runs of lampreys (commonly referred to as "eels" by Northwest residents). No adult Pacific lamprey (*Entosphenus tridentatus*) have been documented in Asotin Creek since at least 1980, though Glen Mendel (1994) and others have noticed small lampreys which they did not identify. These could be either river lampreys (*Lampetra ayresi*), which, like the Pacific lamprey, are also anadromous and parasitic on other fish as adults, or western brook lampreys (*Lampetra richardsoni*) which are blind and never leave the stream.

The Pacific lamprey spends up to six years in the stream and an unknown time in saltwater, where it grows up to 30 inches. The river lamprey has a similar life history, but grows only to 12 inches. The brook lamprey rarely exceeds seven inches. All lampreys spawn in clean gravel and cool, flowing water. Pacific lampreys spawn in June and July. Brook and river lampreys spawn in April, May or June. The adults of all three species die after spawning. The young hatch in two to three weeks.

Since their life histories are much the same as spring/summer chinook, lampreys suffer some of the same impacts. Lampreys, like Snake River steelhead, are considered by NMFS as a species of concern. According to Todd Kleist (1993) only 40 adults were counted going upstream through Ice Harbor Dam (12 in the day, 28 at night). Only ten were seen at Lower Granite Dam. Since 1980 there has been only one juvenile Pacific lamprey reported in traps in the Wallowa River (Wortman 1993). Between 1943-49 a commercial lamprey fishery in the Willamette River of Oregon harvested over 200,000 lbs/year, which was only 10-20 of the entire run (Wydoski & Whitney 1979). They were important in the diet of Native Americans.

D. Other Fish

Other fish that have been identified as living at least part of their life in Asotin Creek are sometimes referred to as

"rough fish" which generally increase their populations in warmer water conditions. These fish include: longnose and speckled dace (*Rhinichthys cataractae* and *R. osculus*); piute and margined sculpins (*Cottus beldingi* and *C. marginatus*); redbelt shiner (*Richardsonius balteatus*); peamouth chub (*Mylocheilus caurinus*); largescale sucker (*Catostomus macrocheilus*) and the northern squawfish (*Ptychocheilus oregonensis*). There may also be bridgelip suckers (*Catostomus columbianus*) as these have been identified in the nearby Tucannon River. Smallmouth bass (*Micropterus dolomieu*) have also been reported in Asotin Creek (Schroeder 1994). See Appendix C for a list of other flora and fauna which may be found in the Asotin watershed.

III. RESOURCE PROBLEMS
AND OPPORTUNITIES

III. RESOURCE PROBLEMS AND OPPORTUNITIES

A. STREAM GEOMORPHOLOGY

Asotin Creek, like all alluvial channels, has eight interrelated physical variables (referred to as geomorphic factors) which affect changes in all streams (Rosgen 1994): 1) Width, 2) Depth, 3) Slope (gradient), 4) Velocity, 5) Discharge, 6) Sediment Size, 7) Sediment Concentration, and 8) Channel Roughness. A change in any one of these variables sets up mutual adjustments in the others. Over time, streams seek out the path of least resistance until these factors are in equilibrium.

In Asotin Creek all of these factors have been altered to some degree since the first settlers arrived in the area. The hydrology of the watershed has been changed by tree removal, road-building, over-grazing of native forage, and soil compaction. This results in faster, more intense runoff during storm events and an increase in instantaneous discharge (more water in a shorter time). Sediment concentration has increased due to erosion from crop and rangeland, logging, road building and road maintenance. The very small size of these sediments allows them to fill in the spaces between streambed gravels, creating a smoother bottom. This, together with the replacement of streambank vegetation with armoring rock for protection from floods and bank erosion, has decreased the channel roughness. Much of the channel has been straightened, which increased the slope. All of these factors combine to make the stream flow faster (increased velocity). This combination has also caused the loss of instream fish habitat, especially pools.

Past flood control projects have resulted in a diked channel which does not allow the stream to dissipate its flood energy across the flood plain, as it would have in the past. The channel is now wider and shallower (less depth) than it was historically. Road building and maintenance are necessary activities for continued commerce and property access, but these activities often cause changes in the natural flow characteristics of the stream. When a road, such as the Asotin Creek Road, encroaches on the floodplain and is built across the channel it limits the number of practices that can be used to restore the stream's natural geomorphic stability. Placement of structures (houses, barns) within the floodplain is also a limiting factor.

For the Asotin Creek Model Watershed Plan, the entire mainstem and five miles of the South Fork were divided into reaches and field-surveyed by SCS personnel in order to describe their present geomorphic condition (Appendix A-8). Various stream measurements were taken (width, depth, bottom composition, etc). These reaches were then classified by Southerland (1993) according to a system described by D.L.

Rosgen (1985) and later amended (Rosgen, 1994). This system involves an alpha-numeric code and was used to decide which stream structures or practices would be appropriate for a given reach (Appendices H and L),

Asotin Creek, having been both channelized, resulting in entrenchment (confinement) and widened (shallower at bankfull height), has become incapable of handling significant floodstage events without damage to streambanks or property.



Asotin Creek, 1974 Flood

Although the amount of riparian vegetation (primarily alders) has improved since 1974, the ability to shade the stream throughout long periods of the day is reduced because these trees do not grow tall enough to shade such a wide channel. The water also warms up much faster because of its shallow depth,

These changes in geomorphic factors have been detrimental to fish life in Asotin Creek. Proper restoration of fish habitat will require manipulation of these geomorphic factors so that the stream can function more naturally. Practices, such as installing log or rock structures to form pools, must be compatible with the natural morphological form of a stable stream type for positive long term effects. Habitat structures are not a substitute for meander geometry, Where geomorphic stability, using channel

reconstruction is not feasible, fish habitat structures will be designed and located according to recommended practices for that particular geomorphic classification (Appendix L), and only after various stream measurements are made at the site.

One key stream measurement is the height of the "bankfull discharge (BFD)". This line, also known as the "ordinary high water mark", is found at the point on the stream banks where woody vegetation is able to become established. This line is formed as a result of all the above geomorphic elements, but primarily by the flow during a 1.5 year frequency event. This flow is considered to be the "channel-shaping flow" (Leopold et al, 1964). The BFD, estimated from USGS data, is 280 cfs for Asotin Creek,

Asotin Creek alternative formulation includes structural and vegetative components to address a resource management system level of planning. The formulation of alternatives was done with consideration for the geomorphic factors and problems mentioned above,

B, SEDIMENTATION

The Pacific Southwest Interagency Committee (PSIAC) sediment yield model was used to characterize and evaluate sediment yield for the 23 subwatersheds of the Asotin drainage (Appendix A, Fig, A-S). Their cumulative ranked sediment



Conservation Reserve Field

yields are displayed in Table 4. The total, 209 acre feet (ac ft), is the gross sediment yield, of which 24 ac ft (44,424 tons) is estimated to reach the Snake River. An undetermined amount is deposited in Asotin Creek.

Most of the potential sediment comes from cropland in the east portion (George and Pintler Creeks) of the watershed. Although 30% of the cropland in the watershed is in CRP and conservation practices are being used, the highly erosive nature of the loess soil assures a relatively high total contribution from watersheds that contain managed croplands. Using Table 4, the relative sediment delivery (to the Snake River) from the major subwatersheds are as follows:

- 5% from Charley Creek
- 8% from the South Fork
- 10% from the North Fork
- 23% from intermittent tributaries downstream of Charley
- 54% from George and Pintler Creeks

Only 18% of this sediment passes through the mainstem between the Forks and Charley Creek. This section of Asotin Creek supports most of the mainstem spawning (primarily steelhead), though some has occurred as far downstream as Headgate Dam. In general, mainstem spawning use decreases and sediment deposition increases from the mouth of the South Fork, downstream to the mouth of Asotin Creek. Gravel becomes noticeably impacted (visual observation) from the accumulation of fine sediments by the time the stream passes the mouth of Charley Creek.

When the CRP begins termination in 1995, much of the HEL land in this program will again be farmed with small grain crops, which will probably cause more sedimentation in the Asotin Creek system. There are 4.1 to 5.0 miles of road per square mile of land in some of the forested subwatersheds. This high road density may also be a contributing factor to sediment production, particularly in subwatersheds 8 and 11.

Improvement of range and forest conditions can reduce sediment quantities entering the stream. Other treatment measures are necessary for critically eroding areas such as streambanks, skid trails, and gullies to reduce the amount of sediment moving through the Asotin Creek watershed. Gradient terraces which do not have suitable outlets will require sediment basins to capture and hold sediments.

Numerous studies have been conducted in the Salmon and Fayette Rivers of Idaho to set standards for measuring the amount of sediment deposition and its relative impact at any location within a stream system. These standards could then be used to compare the health of different watersheds or portions of the same watershed. The most common standard which was developed is called "cobble embeddedness".

When gravels and cobbles are highly embedded (also called "cemented" or "paved") with fine sediments it affects fish life in the following ways: 1) makes spawning difficult or impossible 2) eliminates living spaces for aquatic insects; 3) eliminates hiding and resting places for juvenile fish (especially important during winter months); 4) decreases available space for attachment of periphyton; 5) decreases bed roughness, which increases flow velocities, making it difficult for aquatic insects and young fish to maintain position; 6) decreases or eliminates flow of oxygen through the gravel, suffocating fish eggs; 7) keeps fry from emerging out of the gravel after hatching, and 8) decreases bedload movement, a naturally occurring event in healthy streams.

Cobble embeddedness measurements have been shown to be too variable for use as a tool to monitor or compare the local health of a particular section of a stream (Peterson, et al. 1992), though the method is still being tested. The Pomeroy Ranger District of USFS measured embeddedness at various locations in the Asotin watershed (Appendix I). Each of the tributaries was divided into thirds, Reach I beginning at the USFS boundary and Reach III ending at the uppermost end where the flow starts. The left column are measurements made in 1993, using the "hoop method" and the right column are measurements which were made in 1992, using the more general "Hankin and Reeves" method. According to Groat (1994) cobble embeddedness of over 35% is bad for chinook, using the latter method. Using the hoop method, anything over 20% is bad. They could not find a correlation between the two methods.

The results, using either method, were inconclusive, with some of the highest readings coming from headwater areas where there should have been less impacts, although they may be related to past logging or grazing. In at least one clearcut a buffer of trees, left along both sides of Charley Creek, suffered blowdown and caused high cobble embeddedness immediately downstream of where the tree roots pulled out of the banks (Groat, 1994). Other high values were immediately downstream of heavily grazed stream sections on private lands along the South Fork and Charley Creek.

Improved riparian grazing management in these areas should reduce cobble embeddedness. Small areas of high cobble embeddedness can also be slightly improved by installing instream structures which will cause the flowing water to continually work at the bottom of the channel and flush out the sediment,

C. WETLAND AND RIPARIAN VEGETATION

The major cultural impacts on the riparian vegetation include forest harvest, roads, livestock confinement areas,

overgrazing, flood damage, and urban development on the floodplain. Historic timber harvesting, on both public and private lands, has removed blocks of merchantable trees from and adjacent to, the riparian zone (especially on the National Forest). This has caused loss of shade, bank instability, erosion and, together with the other upland practices, some hydrologic changes.

Some riparian reaches next to confined winter feeding areas lack trees, shrubs and effective ground cover due to a long history of overgrazing and trampling by livestock. Portions of riparian areas which are part of the open range also show signs of overgrazing, such as reduced ground cover, hedging of shrubs, decreased shrub vigor, low diversity of plant species and poor age class structure.

Road development and maintenance have impacted riparian vegetation in a number of ways. Roads in many areas have been located in the riparian zone and the floodplain. This has contributed to a loss of riparian vegetation. Streambed gradient has increased where the channel was straightened or relocated to protect a road.



Riparian Vegetation Removed, Warner Gulch, South Fork,
Area of High Stream Temperatures.

Urban development in the floodplain has affected the riparian vegetation in much the same way as roads. The floods of 1964, and especially 1974, eliminated many of the

riparian trees and caused braiding of several miles of the stream. Following the flood, much of the stream was channelized and diked to protect structures, property, and human life. In the process most of the remaining large riparian trees were also removed, as they were considered to be a future threat. The combination of flood damage and flood "proofing" resulted in the loss of an adequate riparian corridor for maintaining cool stream temperatures. The number and size of pools were also reduced by removing large snags and woody debris from the main channel,

Since the 1933-74 flood, the trend in the condition of riparian vegetation in Asotin Creek has been upward, but a few management problems still remain. Forest harvest has been reduced or eliminated in the riparian zone and no new roads are being constructed in the floodplain. The ACCD sponsored a water quality study which identified livestock confinement areas as sources of seasonally high fecal bacterial contamination and concentrated sediment loads (Moore, 1993). The loss of riparian vegetation was also noted in these areas. As a result, the ACCD initiated a program with local ranchers which encourages innovative livestock management practices to improve water quality,



"Frost-free" Livestock Watering Facility

In recent years, several ranchers have restricted access to the riparian area and the stream to prevent drowning of newborn calves. Some of the livestock confinement areas are no longer being used. Removal of livestock from these riparian areas has helped restore vegetation. Future use of these areas will include conservation practices to protect the riparian zone and water quality. Such practices include fencing, off-channel water development and site relocation. One Asotin rancher, working in cooperation with the ACCD and local agencies, recently installed a "frost-free" off-stream livestock watering trough on his winter feeding area as a demonstration project to improve water quality (pg 38).

Despite these changes in management, riparian vegetation is not expected to be fully recovered for many years. There are still some areas where grazing is allowed during the wrong time of year. Overgrazing also occurs even though the livestock are grazing during the right time. Both of these practices negatively impact plant growth and reproduction. The rate of progress toward establishment of a stable riparian plant community also depends on the geomorphic processes of the stream and the natural plant succession.

Geomorphically, past flood events have changed the "width to depth ratio" and resulted in a wider, shallower stream. In most areas, the banks of the stream have become revegetated but the entire stream is still not shaded because the stream is too wide. Also, since the stream has been straightened, stream gradient has increased and caused more streambank and vegetation instability. It should be expected then, that until the stream is allowed to return to its geomorphically stable state, additional measures will be necessary to avoid problems with streambank erosion. Until this stability is reached the riparian vegetation will be less effective in providing stream shade.

The second factor that controls the rate of progression to more stable riparian vegetation is the natural progression of plant communities themselves. Alder dominates much of the streambank under current conditions because it is well adapted and quick to respond after a disaster. Although it is one of the least-preferred woody species for grazing animals, it rarely dominates the stable natural community.

Cottonwood is the natural dominant species along most of the mainstem of Asotin Creek, but it can be held back by grazing animals who prefer it over alder. Once cottonwood replaces alder as the dominant in the lower elevation reaches, water temperature is expected to be reduced because the growth form of the cottonwood provides much better canopy cover over the stream. Conifers should also be encouraged to grow in the riparian areas because they last longer than any of the hardwood species for instream fish habitat and they provide added diversity for wildlife.

D. WATER TEMPERATURE

The floods of 1964 and 1974, combined with the flood control measures which followed, removed much of the riparian tree cover along the South and North Forks and the mainstem downstream of the USFS boundary. This led to elevated water temperatures throughout most of the rearing areas and some of the spawning areas.

In general, the effect of high water temperatures on fish varies between species and may vary between their different life stages. The effect of water temperature can also change due to other water quality parameters such as turbidity. Stream flow, stress from crowding and physical harassment also must be considered along with water temperature. As the temperature rises, so does the fish's metabolism. This increased demand for food requires an increase in oxygen consumption. There is generally less dissolved oxygen available in warmer water (dependent on elevation, aquatic plant photosynthesis, etc.). Hatchery-reared rainbow trout appear to be more tolerant of elevated water temperatures in Asotin Creek than salmon (Mendel 1994). Bell (1991) lists the upper lethal temperature for rainbow trout at 85°F; steelhead at 75°F; and chinook at 77°F. In 1993 Bumgarner (1994 et al.) found that nearly 10% of the entire run of Tucannon adult chinook suffered pre-spawning mortality. Though not stated, this may be caused by holding in water that is too warm.

In one study (Coombs 1965) there was significant loss of incubating chinook eggs in temperatures as low as 60-62°F. Significant mortality was documented by Royal (1953) for spawning Fraser River sockeye when the water temperature rose above 55°F.

According to Burck (1980 et al.) juvenile chinook in the John Day River of Oregon can only rear in the uppermost reaches of the mainstem, the Middle Fork and the North Fork because the rest of the river has temperatures over 73°F. In 1993 no juvenile chinook reared in the lower 12 miles of the Tucannon River where the maximum daily temperature averaged 74.5°F from July 25 to August 20 (Mendel, et al. 1993). During periodic electroshocking surveys, from 1980 to 1993, no chinook juveniles have been found rearing in the mainstem of Asotin Creek during the summer. Only one was found in 1994. Snake River investigators feel that temperatures above 68°F (Barrett 1994) or 70°F (Mendel 1994) can cause a migration barrier to adult chinook.

Local landowners feel that trees have grown back along the streams to the point that the water temperature has been lowered since the floods. A comparison of a few older ground photos with more recent ones confirms that noticeable re-growth of woody vegetation has occurred in at least

several places along the stream corridors. Most of this vegetation appears to be predominantly "even-age" (20-25 years old) stands of alder. These trees have probably increased the shading along the channel to some extent. A cursory analysis was made to determine how much change may have occurred in the water temperatures since the floods. Unless otherwise stated, the following temperature readings are the maximum for each day.

According to various WDOE temperature models stream temperature is directly related to solar radiation and ambient air temperature. Other factors include water depth, flow, and volume; bottom composition; and ground water intrusion. Solar radiation and ambient air temperature are, in turn, affected by elevation and shading, both topographic and vegetative. In most areas of Eastern Washington there is generally very little cloud cover at night to hold in the hotter air temperatures generated during the summer days. During August 1992 there was a difference of 18 to 41°F between the daily maximum and minimum air temperatures measured at the Lewiston Airport (elevation 1438 ft) during any given 24 hour period. Generally, the air temperature increases throughout the day, reaching a peak between 4pm and 6pm (Groat 1994).

Although weather station records show that August is usually the hottest month of the year, there can be tremendous variability between years. Data from the Lewiston Airport indicates that the month of August 1993 averaged 8°F cooler than August of 1992 (one of the hottest, driest years on record). Given these variations, it is not possible to simply take a water temperature and compare it directly to one taken previously, without also considering the air temperature.

In 1992 the Pomeroy Ranger District of the USFS installed continuous temperature recorders at six sites (Appendix A: Fig A-2) which read water temperatures hourly from late April to November. Four of these sites were located on USFS land and two on private land. A regression analysis was made comparing daily maximum water temperature from each of these sites with the maximum air temperature reading for each day in August 1992. These air temperature readings were taken from weather stations located at Dayton, WA, Pomeroy, WA and at the Lewiston Airport in Idaho.

Since the relationship between air and water temperatures for the gages located in the upper South Fork (USFS #11), the Middle Branch (USFS #9), and Charley Creek (USFS #A) were very similar, they were combined by using the average of the daily water temperatures (labeled "Average" in Figures 4 and 5).

The highest water temperatures were measured at the South

Fork (USFS #15) gage, located just downstream of the denuded cattle wintering area shown on page 37. Assuming that these water temperatures are related to air temperatures, especially where there is no riparian cover, a linear regression analysis was made between the daily water temperatures from the (USFS #15) thermograph and the corresponding air temperatures from each of the weather stations at Dayton, Pomeroy, and Lewiston. There was a similar relationship between all three, but the Lewiston Airport had the best regression correlation ($r^2 = .83$).

Figure 4 then compares Lewiston Airport air temperatures with water temperatures at each of the following gage sites: "Average", "North Fork" (USFS #3125), "North Fork at Cougar" (USFS #8), and "South Fork" (USFS #15). Since this graph shows an apparent relationship between the air and water temperature, a linear regression analysis was made between the daily air temperature and the corresponding water temperature for each thermograph. The graph of these four regression lines is shown as Figure 5.

Because of the noticeable, and sometimes severe, diurnal change in temperatures the following regressions were also analyzed: 1. minimum air vs maximum water, 2. minimum air vs minimum water, and 3. the difference between daily maximum air and minimum air vs maximum water temperatures. None of these regressions showed any direct correlation.

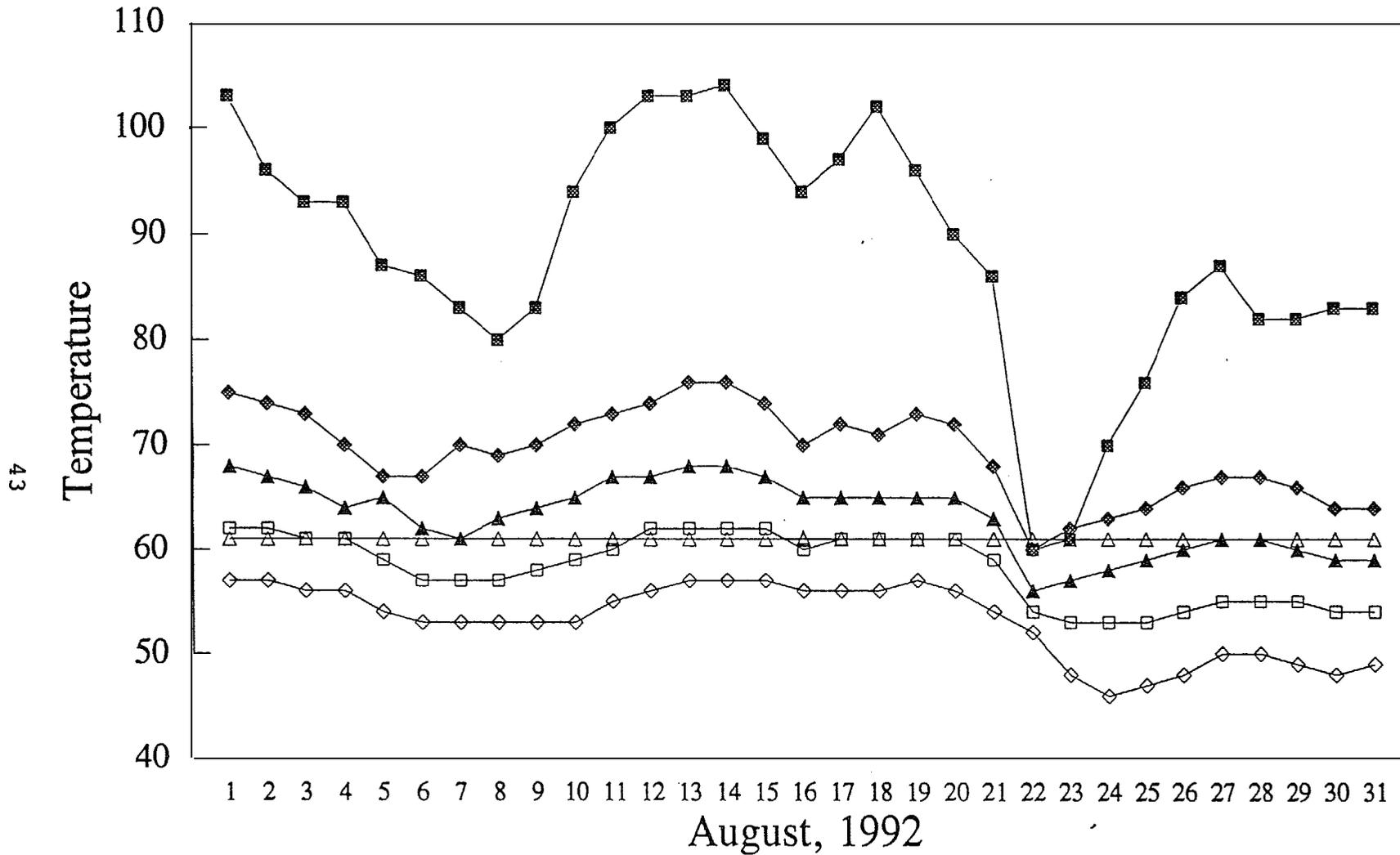
The scattered points in Figure 5 represent water temperatures, measured by WDG during August 1981, 1983, and 1984 at the following sites: 1. South Fork (S) near the USFS site #15; 2. North Fork (N) at Lick Creek; and 3. the mainstem (M) near Headgate Dam. Each of these water temperatures was then plotted against the air temperature which was recorded at the Lewiston Airport on that same date.

The 1981, 1983 and 1984 figures are not plotted as separate years because there was not enough data for each year to show any difference between years or to warrant adding confusion to the graph by labeling them as different years. The rationale for this is that if riparian tree growth had only been since 1975 then there would probably be little difference in the shading value between the three year classes of trees.

Note that all of the "S" measurements are situated above the South Fork line, indicating that for a given air temperature in the early 1980's the water temperature of the lower South Fork was consistently higher than would be expected using today's (1992) relationship between air and water temperatures.

Figure 4

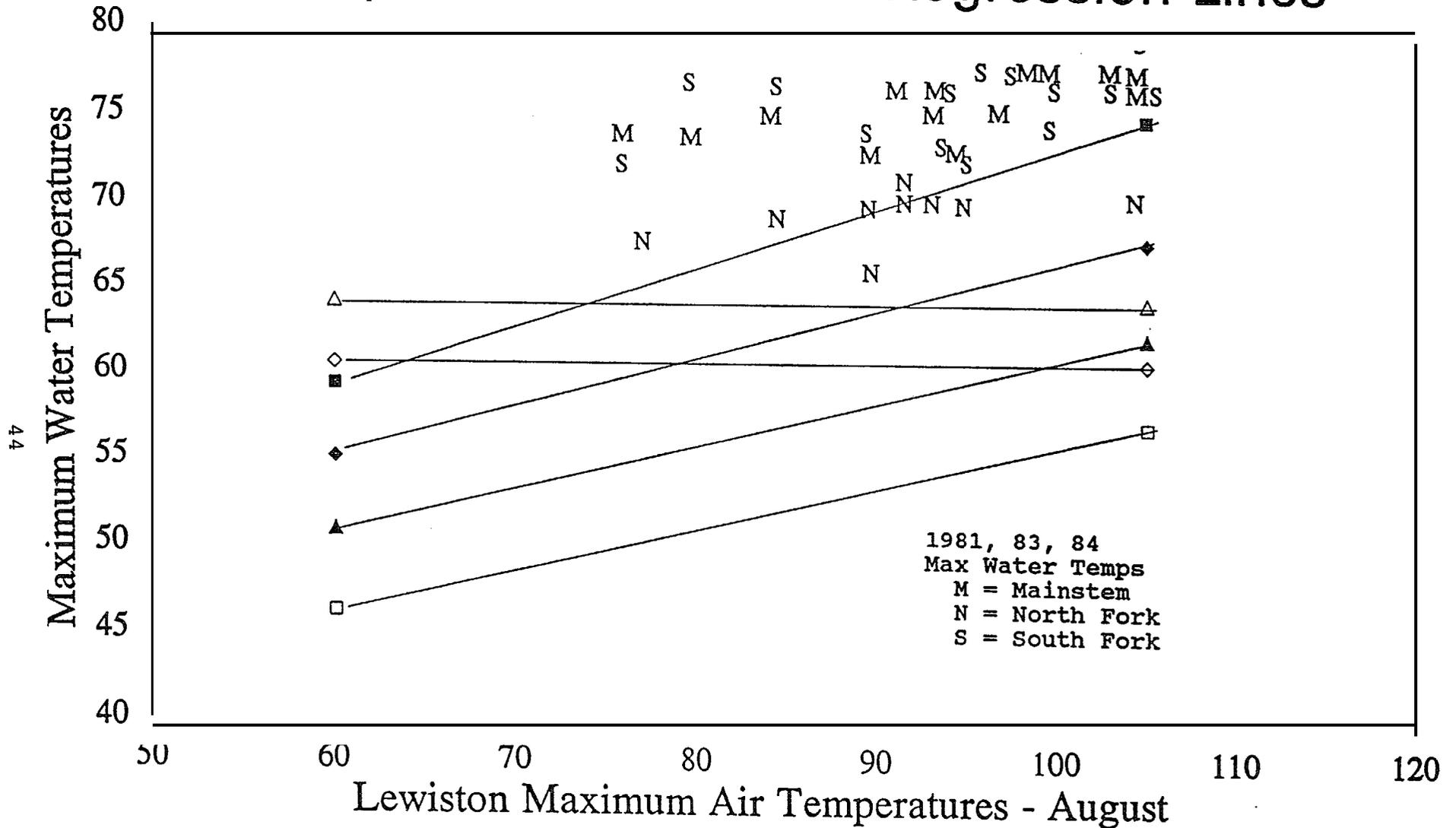
MAX AIR & WATER TEMPERATURES



- Lewiston Airport (1440 ft)
- ◆— South Fork (2350 ft)
- ▲— North Fork (2440 ft)
- Average (Charley, SF, NF)
- ◇— North Fork at Cougar (4385 ft)
- △— State Standard

Figure 5

Comparison With 1992 Regression Lines



- South Fork (#15)
- ◆ North Fork (#3125)
- ▲ Average (Charley, NF, SF)
- North Fork at Cougar (#8)
- ◇ State AA Standard (60.8 F)
- △ State A Standard (64.4 F)

Historic water temperature data was reviewed to find all "grab-sample" thermometer readings which were taken at different points, on the same day, at the same time (within one hour of each other). Using this information, it appears that the mainstem, below Headgate Dam, had similar or even slightly higher temperatures than the South Fork. Since all of the historic mainstem (M) readings are also above the South Fork line, it appears that the mainstem has also become cooler.

The North Fork (N) readings are very close to the South Fork line, which is surprising because the riparian zone along this tributary appears to be much more intact than that along the South Fork and parts of the mainstem. Evidently, according to Mendel (1994), there was less flood damage along the North Fork so that shade cover was able to re-establish quicker. Even though these "N" readings are elevated they are all lower than any of the "M" or "S" readings.

This analysis supports the general local feeling that stream temperatures have been reduced since the floods. It also indicates that the South Fork and mainstem have cooled by an average of 4°F and by 5°F in the North Fork.

Note also from Figure 5 that there is an average of 10°F difference between the USFS #8 (North Fork at Cougar) and USFS #3125 (North Fork) sites. Both of these sites are measuring the same stream (but with more flow at the USFS #3125 site) as it flows through similar riparian vegetation, topography and aspect. The main difference is that USFS #8 is at 4385 ft and USFS #3125 is almost 2000 ft lower, at 2440 ft.

According to "Fire Behavior" a publication of the National Wildfire Coordinating Group (1981), there is a drop of 5.5°F in air temperature for every 1000 ft of elevation rise. This coincides with the graph and indicates that even though the water temperatures at USFS #8 are always below 52°F the lowest we can expect the water outside the USFS boundary would be about 62°F on some of the hottest days of August.

The greatest opportunity for lowering the water temperature probably lies within the WDFW lands along the North Fork and the WDFW and private lands along the South Fork, as it will be much easier to cool the mainstem if the upstream waters are already cool before they reach the main channel. A possible attainable goal might be to lower the water temperature of the mainstem, at the mouth, to near the WDOE state standard of 64.4°F for Class A waters. It may not be possible to meet the Class AA (60.8°F) standard designated for waters within the boundaries of the USFS.

This goal will not be met, however, if all of the effort is

concentrated only on the South Fork and North Fork. The contribution of the South Fork to the mainstem may be masked because of its small volume of flow during the hottest days of the year.

Also, regardless of the temperature of the South Fork, the mainstem seems to get warmer as it flows from the forks down to its mouth. This was first noted during habitat surveys done by WDG (Mendel & Taylor 1981). Data collected by McIntosh (1992) seems to show that this still occurs. At RM 9.6 his surveyors measured the water temperature as 70.5°F at 4:45 pm. Two days earlier, at RM 3.3, the water temperature was measured as 75.2°F at 5 pm. even though the air temperatures were the same. Both the 1981 and 1992 water temperatures were taken in August, during the hottest time of the year, when the air temperatures at the Lewiston Airport averaged 102°F for a one week period.

Moore (1993) also noted that except on days when the air temperature dropped below 35°F, that the water at the City Park (near the mouth) was always warmer than at the forks on any single day of measurement. In 1991 (the only summer data taken) the following water temperatures (Fahrenheit) were measured. These are "grab samples" and may not be the maximum for each day:

SITES	JUNE 20	JULY 26	AUGUST 8	SEPT 20
1	50.9	56.8	59.4	52.5
2	52.9	60.3	62.4	54.5
(2-1)	2.0	3.5	3.0	2.0
10	55.9	68.9	73.2	61.0
(10-2)	3.0	8.6	10.8	6.5

Temperatures at site 1 (North Fork) and site 2 (mainstem, just below Charley Creek) were within the state standard. By the time the water reached the City Park (site 10), however, its temperature had increased an average of 7.2°F for the four months and exceeded the standard in July and August. This rise in temperature from the forks to the mouth is probably due to a combination of the drop in elevation (-1000 ft) and the lack of adequate shade from the riparian areas along the mainstem. Note also, that the temperature increases by an average of 2.6°F from site 1 to site 2. Evidently, the temperatures of the South Fork, and possibly Charley Creek, had an effect on the mainstem in 1991.

Past temperature records showed that the water was 78°F in 1981 at RM 6.0 and 72.5°F in 1992 at RM 6.4. Since these water temperatures were taken during similar weather conditions they can also be used as an indication that water temperatures of the main channel, regardless of air temperatures, do not get as high now as they did in 1981.

Results of a recent project installed by a Tucannon River landowner indicates that it may be possible to add cooler groundwater to the stream by excavating off-channel ponds. This particular pond currently supports juvenile salmonids though it was excavated for irrigation and is much larger than those proposed as habitat improvements in the Alternatives section of this plan.

E. INSTREAM HABITAT: PAST AND PRESENT

During March 1935 the U.S. Bureau of Fisheries (now the USFWS) surveyed Asotin Creek from its mouth up to the mouth of Cougar Creek, on the North Fork, and up the South Fork and Charley Creek. The stream channel was examined for its potential to support adult salmon and steelhead. The surveyors made various fish habitat measurements, such as number, size, and quality of pools; size and amount of spawning gravels; and estimated flows. The stream was broken into sections which were 100 to 300 meters long. They recorded the size and location of all water diversions and made estimates of the amount of water that was being withdrawn during the irrigation season. These surveys were then compiled into a single publication by the USFWS (Parkhurst 1950). During August 1992 personnel from the USFS Pacific Northwest Experimental Station at Corvallis, Oregon re-surveyed Asotin Creek (McIntosh, et al. 1993) using a standard method of fish habitat evaluation which was originated by Hankin and Reeves (1988).

The original 1935 survey described 12 unscreened water diversions in the main channel and four in the South Fork, all of which were thought to be impacting salmon and trout. The large diversion pipe at Headgate Dam was the only diversion that was screened. Surveyors were told, however, that during the previous August at least 25 adult chinook and over 1/4 million steelhead juveniles were stranded downstream of the dam because most of the flow was being diverted into the pipeline.

The surveyors also noted the presence of a two foot high dam located about four miles upstream of the mouth which was built by a former county Game Commissioner to stop the passage of suckers. The 1935 surveyor felt that it would block salmon during low flows. The impacts that this dam may have had on fish passage are unknown. The dam was either removed or it washed out on its own sometime since that survey. It was probably gone by 1980, because it was never mentioned in initial WDG habitat surveys (Mendel 1981).

The following information came from Bob Weatherly (1994), a local historian. The Headgate Dam diversion, built in 1906, replaced a ditch system which was dug in 1885 to carry water to Clarkston. The dam was .6 feet high and included a

concrete fish ladder which was not adequately maintained for fish passage (mentioned sporadically as a problem in various literature sources and by local citizens).

Another open ditch between George Creek and Headgate Dam diverted water to Asotin. In 1907 a penstock was connected from the Headgate Dam diversion mainline to a powerhouse turbine/generator to provide electricity for Asotin and Clarkston. This diversion was discontinued as a power generation site in 1928. Domestic water continued to be diverted at Headgate Dam for Clarkston Heights until 1964.

Currently, diversions are much less of a problem. All of the original diversions are now either abandoned or have been screened to exclude fish. The last remaining large diversion, located above the county road on Charley Creek, was screened by WDFW during the fall of 1994.

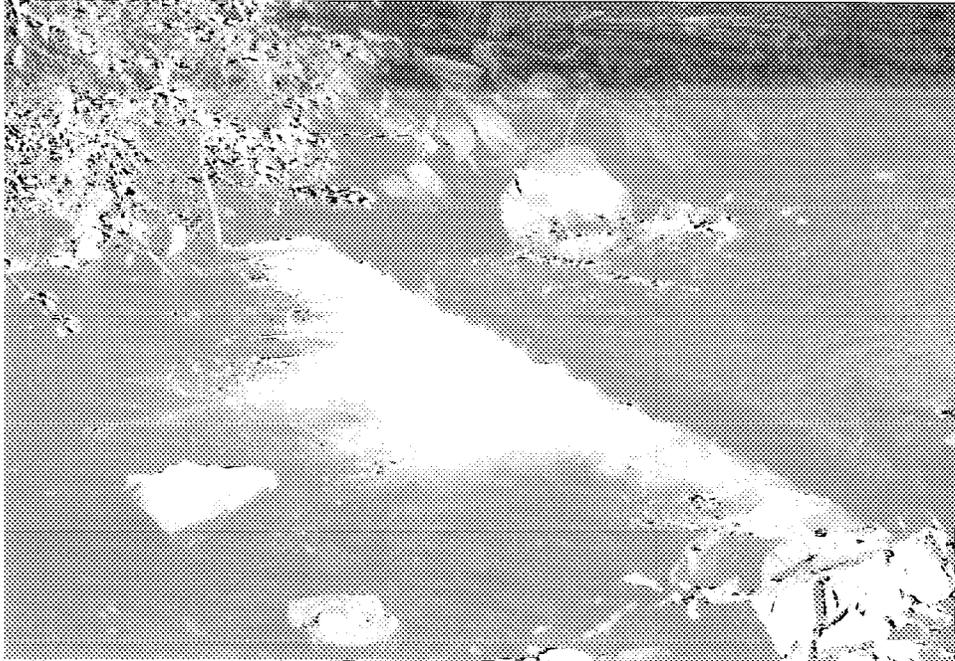
The fish ladder on Headgate Dam was abandoned in 1970, but the Asotin County road department had already constructed a second, lower elevation dam of large rocks, located 20 feet downstream, to make a jumping pool for salmon and steelhead. WDG agent, Don Steele (1994), periodically maintained the fish ladder and worked with the county to remove the top 18" of the dam during the 1960's. Fish passage specialists from WDFW are currently designing a better passage solution at this dam (Schuck 1994);

Charley Creek was reported as having no adult salmon, but it still flows more than three cfs at low flow, which would support juvenile chinook if the access and pool habitat are improved. In 1948, WDG built two earthen dams across the channel of Charley Creek, creating two ponds for rainbow trout fishing. Don Steele (1994) recalls seeing adult steelhead above these and adult chinook at least to the lower pond prior to 1965, the year the county replaced the bridge with a culvert. This culvert is probably impassable to all fish except adult steelhead. Fish passage can be obtained for both adults and juveniles by installing a series of log structures to back the water into the culvert. Baffles may also be required inside the culvert.

The flood of 1964 washed out the ponds and resulted in a very expensive court decision against WDG. This event, as well as the occurrence of a much larger flood in early 1974, caused local landowners to become less willing to allow logs and stumps to stay in the stream for fish habitat. This also made WDG more reluctant to try and re-create fish habitat on private lands. Since then, no resident hatchery trout have been planted in Charley Creek.

In 1980 WDG began looking for sites to improve habitat for better resident trout fishing in Asotin Creek (Ransom (et al. 1980)). By 1986 they had installed various instream

structures, including boulder placements, log weirs, and rock weirs at six sites in the main channel, 18 in the North Fork, and 31 in the South Fork.



Low Stage Log Weir, Mainstem Asotin Creek

Five of the sites in the mainstem were located on private land (four near Headgate Dam, one below the mouth of Charley Creek), These were all boulder placements, The rest of the sites were located on WDG land (Hallock & Mendel 1985). The project was funded by U.S. Army Corps of Engineers (COE) with the stipulation that no money could be spent on vegetative plantings (Mendel & Ross 1988).

The results of the se-survey by McIntosh (1992) indicate that there are now 34% less chinook holding pools in the 25 -miles of mainstem and North Fork Asotin Creek than there were in 1935, According to his analysis, holding pools had to be at least one meter deep, though a study on the John Day River in Oregon showed -that pools should be at least I-I/2 meters deep (Lindsay, et al, 1982). Since the WDG instream structures were designed for catchable-sized trout the pools (termed "large") that formed in the North Fork averaged less than two feet deep and so did not appear in McIntosh's list of "large" pools, Some habitat structures installed in the Tucannon did form very large and deep pools* Generally, log structures made deeper pools than boulder clusters (Hallock & Mended 1985).

Large pools create more than just rearing and resting areas for fish. The digging action of water spilling into the upper end of the pool moves the bed material to the downstream end of the pool while it washes out the finer sediments. Concentrated flows sort the gravels to form excellent spawning areas at the "tail-out" of each pool. In the North Fork there were 195% more steelhead redds in the constructed pool areas than in the untouched control areas. Chinook redds were compared only in the Tucannon River, but again, there was more use at the structures than in the control areas. In the South Fork there was no preference shown by steelhead for spawning, but adults were observed using the pools for cover (Viola, et al. 1991). The spilling water also adds more oxygen to the water.

The 1992 surveyors noted the presence or absence of LWD, which creates pools and hiding cover for fish, as well as habitat for aquatic insects. Numerous stream studies support the need for cover to be associated with pools for both adult holding and juvenile rearing for most salmonid species. This cover can take the form of undercut banks, submerged and floating logs, water-logged rootwads and overhanging trees. Any structures that are installed in the stream must create large pools with good cover. Some of the existing pools could be improved simply by adding cover.

As discussed in the Fish Resources section, small spring-fed, off-channel ponds can be important rearing areas for young salmonid fish. They are well-documented as over-wintering areas for juvenile coho salmon in streams west of the Cascades (Bustard & Narver 1975; Foy, et al. 1990). In the Columbia Basin, USFS biologists from the Naches Ranger District artificially created several of these off-channel rearing sites by excavating spring areas tributary to the Naches and Tieton Rivers in 1992 and 1993. These sites were dug as meandering channels, 3-6 feet wide and 2-4 feet deep, with plenty of cover in the form of stumps, logs, and root systems of large, standing trees where the bank was purposefully undercut. They removed obstacles (such as road culverts) which would stop upstream migration of juvenile fish and live-trapped fish that entered them,

Juvenile chinook, steelhead, sculpins and dace were captured in all but one of these sites (Nelson 1993) from mid-June to October. There was too much ice to continue this study into the winter months, but the researchers felt that they were being used by chinook and steelhead. Similar work was undertaken on the Yankee Fork of the Salmon River where isolated, abandoned mining ponds were connected to the river by excavating small channels. Most of these ponds were first planted with hatchery chinook fry, but have since become rearing areas for wild, native chinook juveniles (Richards & Cernera 1992; Cernera 1994). McIntosh did not take notice of these sites during his survey.

F. HARVEST/HATCHERY

According to the "Draft Snake River Salmon Recovery Plan Recommendations" (Snake 1993) many of the stream systems which have a history of hatchery fish introductions have shown a decline in their native salmon populations. The Snake River Salmon Recovery Team (SRSRT) feels that releases of hatchery steelhead and resident trout cause the death of an unknown number of native chinook juveniles because of direct predation and increased competition for food and living space. The SRSRT further states that no resident trout and no increased numbers of steelhead should be released into the Snake River system unless new studies and different planting strategies can be developed and tested which will reduce the predation and competition to acceptable levels.

There is no record of supplementation of hatchery chinook in Asotin Creek (Mendel 1994). There is, however, a long history of hatchery plants of resident rainbow trout, as well as steelhead smolts (Appendix N). According to WDFW planting records, the first recorded plant was 25,500 rainbow (2.5"-5") from the Walla Walla hatchery in 1935. From then until 1951 WDG planted up to 80,000 (55,000 average) fry, fingerling and legal-sized trout several times each spring and summer for local sportsmen. These plants also came from the Spokane hatchery, which according to Crawford (1979), started its brood stock using rainbow trout from the Cape Cod Hatchery in Massachusetts which, in turn, started its stock from native rainbows taken in 1882 from the McCloud River, near Mt. Shasta, California!

The Tucannon hatchery was finished in 1949 to hatch and raise rainbow trout for plants of up to 40,000 (9600 average) legal sized (8"-12") fish each year (at least until 1980). Most of these were planted in the North and South Forks, on WDFW land. In recent years the plants have been lowered to 4-6 thousand legal-sized trout (Schuck 1994). In the spring of 1994 these fish were planted only in the mainstem, downstream of the forks. No planting is proposed for the North Fork in the future (Maxie 1995).

From 1983 to 1986 up to 35,000 steelhead smolts were also planted each year near the forks. These fish were taken from original Asotin Creek stock, Wallowa River stock, and the Wells and Priest Rapids Hatcheries on the Columbia River. Since 1987, smolts have been planted only at the mouth of the creek (Schuck 1994). In 1994 there were 24,000 steelhead smolts released into the system.

Smolts and resident trout which are raised in hatcheries are much larger than the native chinook juveniles. Many fish biologists; including SRSRT experts, feel that this size difference leads to chinook losses from higher than normal

predation rates. Although predation has been documented, it is rare enough that it may have relatively little negative impact on chinook populations (Cannamela 1992 & 1994). The magnitude of the impact would be related to the time of year of the plants and the percentage of these plants that stay in the area inhabited by the young chinook.

WDW, with funding from USFWS, did a pilot project to study the interactions between hatchery trout and native juvenile chinook in Asotin Creek and the Tucannon River (Martin, et al. 1993). Since no chinook could be found in Asotin Creek, predation impacts were studied only in the Tucannon River. The researchers concluded that there is probably very little negative effect on native juvenile chinook by either hatchery, steelhead or resident rainbows in the study area. They felt that this effect could be further minimized by changing the release strategy for these hatchery fish. The changes which were already made from 1980 to 1986 most likely resulted in less chinook mortality than what may have existed previously. If the stream channel through the public property at Headgate Park (where an artificial pond is already stocked for fishing) is improved it may be possible to make this site the major planting and fishing area for hatchery trout.

A second, possible impact from hatchery releases could be competition for food and space. The younger, smaller chinook could be displaced into unfavorable habitats. Hatchery fish, when first released into the natural environment, tend to eat everything that passes by them. They constantly dart back and forth and take at least a week to adjust, to their surroundings. Although they consume much of the same food that juvenile chinook should normally get, it would only be a problem if the food supply is unusually low (Cannamela 1994). In Asotin Creek this competition for food is generally short-lived because the steelhead smolts and many of the legal-size rainbows move downstream and out of the impact area within two to three weeks after release. Most of the resident trout are assumed to be caught by the end of summer (Schuck 1994).

A third impact to juvenile chinook may have been an increased incidental catch of juvenile chinook due to increased fishing pressure in the North Fork, as a result of the relaxed catch regulations and historic yearly plants of rainbow trout. If this were true, then many of the "released" chinook would probably die, particularly if they were caught using baited, barbed hooks though Cannamela (1994) feels that juvenile chinook are too small to be caught using, baited hooks. He has only noticed them being caught occasionally 'with flies (smaller hooks).

As of April 1994 WDFW has restricted fishing in Asotin Creek to barbless hooks, using only artificial bait (flies,

lures). The 1995 daily catch limit, however, is still 8 fish in the North Fork and mainstem. In the South Fork (as well as most streams statewide) the limit is 2. This will still concentrate more fishing pressure in the North Fork, which could increase the incidental catching of juvenile chinook. WDFW has closed all fishing in the North Fork, within the Forest, to protect bull trout. Since bull trout were also historically found downstream of the 'Forest boundary, it may be necessary to close all fishing in the North Fork, or at least close the access road to motorized vehicles; Either of these actions would further protect chinook salmon (especially adults).

A final consideration involving hatchery plants relates to the unique nature of Asotin Creek's small size and low flows when adult salmon are present. Asotin Creek had very few restrictions for sport fishermen, especially in the North Fork, until 1985. The stream was generally open from April 15 to October 31, though steelhead over 20" were to be released. Salmon were not regulated until 1940, but then only in the main river. With these seasons and the size of the North Fork, adult chinook were probably very susceptible to poaching while holding and spawning on public lands.

According to Weatherly (1994), who owned property near Headgate Dam, local tribal members would snag adult chinook at the dam site during the late 1960's, after the fish ladder and diversion pipe were abandoned. Don Steele (1993) also remembers incidents of trout anglers snagging adults in the North Fork in the late 1960's. On September 8, 1981, while doing a cursory soil survey of the Asotin watershed, an SCS employee met two fishermen who each had an adult chinook spawner which they said they had caught "...in the North Fork, above the Forest Boundary" (Keller 1995). Recent tagging studies by WDF indicate that chinook poaching may even be a problem in the much larger Tucannon River (Bumgarner et al. 1994).

The practice of planting legal size trout in streams in southeast Washington is encouraged as part of the, Lower Snake River Compensation Plan (LSRCP) of 1976. The USFWS, through the LSRCP funds the operation of the former WDW (now WDFW) Tucannon trout hatchery which was rebuilt in 1979 as mitigation for lost fishing opportunity related to dam construction. It produces legal-sized trout which are outplanted into local waters for sport anglers, though many fish biologists feel that the former "resident" trout catch consisted mainly of juvenile steelhead.

The North and South Forks of Asotin Creek were especially important to the previous WDW program because much of this land is in public jurisdiction (WDFW and USFS) with easy access for anglers. There are also numerous camping areas and a riding trail along the creek. The fishing season

opens each year on June 1, after most of the chinook and steelhead smolts have emigrated, though steelhead fry are probably still emerging from the gravel. Small-sized yearling steelhead and sub-yearling chinook juveniles are also present during this time.

During the summer months adult chinook hold in the deeper pools until the September spawning season. These fish are trying to rest and hide during some of the lowest flows and highest temperatures of the year. They are very susceptible to poaching water-borne diseases, and changes in environmental conditions. Some could be stressed due to harassment by people who are camping or fishing along the stream. A motorcycle trail that starts at the USFS boundary and continues for 10 miles up the North Fork (Groat 1993) may increase the problems because it gives the public easier access to most spawning areas during the spawning season.

G. WATER QUANTITY

According to records maintained by WDOE, private surface water right holders can divert a total of five cfs flow continuously from the main channel for irrigation and stock watering. Although Asotin Creek is not formally closed for more water diversions, historic restrictions resulting from requests by the former WDF and WDG per the "Low Flow Status Law" (RCW 75.20.050) severely limit the amount of water that is available. This law allows these agencies (now combined as WDFW) to 'review all water right applications and add flow and timing restrictions which they deem necessary for the protection 'of fish life, If the flow, downstream of the proposed diversion point, drops below the requested flow, all junior water right holders are required to stop taking water. Requests by WDF on December 11, 1956 and June 6, 1969, as well as by WDG on May 28, 1981 require that junior diverters stop if the flow drops below:

1. 10 cfs anytime of the year; measured at Headgate Dam
- 2; 15 cfs July. 1 to March 31; measured at highway 129
3. 70 cfs April 1 to June 30; measured at Highway 129

Also, according to WDOE (Maher & Pilkey-Jarvis 1994) there are no existing water rights for diversion at Headgate Dam for either the towns of Asotin or Clarkston Heights. Washington Water Power (WWP) may have had a claim for up to 24 cfs but lost it several years after they stopped generating power because they stopped paying their "power License Fee". WWP did not file a claim for a "vested water right" per the "Water Right Claim Act" of 1969 (RCW 90.14). The IFIM study, done by WDOE in 1993, was initiated per the "Water Right Act of 1971" (RCW 90.54) in order to set minimum flows for fish life in the Asotin watershed. This study is not yet complete, but once these flows are

determined there probably will not be any water available for increased surface withdrawal (Caldwell 1994).

H. WATER QUALITY

The study, "Asotin Creek Water Quality Monitoring: 1990 to 1993", identified high stream water temperatures, high levels of fecal coliform and streptococci bacteria, and excess sediment deposition, as limiting factors for good water quality (Moore 1993). The study monitoring sites are shown on Fig. A-2 of Appendix A and summarized below:

Site No.	River Mile (RM)	Reach Length mi	Drainage Area sq mi	Site Elevation ft	Site Name
1	0.2		63	1830	N.Fork
2	12.5	2.4	-	-	Mainstem
3	12.0	0.5	-	-	"
4	9.3	2.0	-	-	"
5	9.0	0.3	150		"
6	7.8	1.2	-		"
7	6.0	1.8	-		"
8	0.1		126	1380	George
9	3.0	3.0	-	-	Mainstem
10	0.5	2.5	322	740	City Park

Site 1, the control station, had elevated coliform counts from June 1 to November 1, though none exceeded the state standard. These higher counts appeared during the time when range cattle were fenced into a large pasture where they had access for water along both banks of 250 ft of the channel of Lick Creek, which enters the North Fork 0.1 miles upstream of this site. Site 2 is four miles downstream of the livestock wintering area shown on page 37. Four other confined wintering areas and a number of private on-site domestic sewage disposal systems are located in the riparian zone of mainstem Asotin Creek. These activities were identified as the primary sources of coliform and streptococci bacteria. Moore suspects that the highest coliform count resulted from the above, combined with a sudden, severe rainstorm that washed soils and animal waste into the stream from the nearby Maguire Gulch, where livestock were concentrated and where one of the operators had placed barn scrapings. This gulch, like many that drain into Asotin Creek, is dry most of the year. Moore also noted that at confinement sites where livestock were not kept out of the channel there were high concentrations of sediment.

Nutrient (phosphorous and nitrogen compounds) levels were never very high. Total nitrogen and phosphorus were elevated in comparison to background levels but not high enough to cause adverse biological effects (such as dense

growth of emergent aquatic plants and algae). Moore (1993) felt that most of the nitrogen entered the stream more from erosion of soils from the adjacent road system, than from livestock. Nitrates, nitrites, ammonia, chlorides and phosphates were at low levels. Asotin Creek has a pH between 7.5 and 8.5, reflective of the alkaline levels of the parent basalt rock of the watershed.

He felt that the excellent dissolved oxygen readings (all within 80% of saturation) result from stream turbulence over riffle areas, rather than aquatic plant photosynthesis. Sixty water samples were taken during the late summer months of 1991 and the dissolved oxygen (D.O.) level was less than the state standard only nine and then only by 1 mg/L. The following are the study results:

Water Quality, Parameters	Washington Standard	Range of Site a/ Measurements
Fecal Coliform	< 100 colonies/100 ml	up to 6000
Temperature	< 64.4 ^o F	up to 74 ^o C
Dissolved Oxygen	> 8.0 mg/L	down to 6.8
PH	6.5 to 8.5	6.43 to 8.70
Total Nitrogen	NONE (mg/L) */	0.04 to 0.67
Total Phosphorous	NONE (mg/L)	op.01 to 0.37
Ammonia	NONE (mg/L)	0.01 to 0.08
Nitrate (no Nitrite)	NONE (mg/L)	0.01 to 0.37
Chlorides	NONE (mg/L)	0.04 to 1.7
Conductivity	NONE (mmho/cm)	0.06 to 0.14

a/ excludes site 1 (N. Fork) and site 8 (George Ck.)
*/ NONE - no state standards for non-point sources

George Creek had consistently worse water quality readings', than any of the seven upstream Asotin Creek stations. The water in George Creek was significantly more alkaline than water at all of the other sites. In general, water quality in the mainstem Asotin Creek worsened from upstream to downstream, and was always worse in George Creek. The North Fork had statistically better water quality than any other sampling station, for all parameters. Moore concluded that riparian fencing and off-site watering would have a positive impact toward reducing the bacterial, nutrient and sediment loads to the the stream.

The USFS livestock watering area on Lick Creek was put in to improve the riparian area along Lick Creek. Similar efforts have been undertaken in the dairy areas of western Washington. In most cases this effort does protect a substantial portion of the riparian zone and the integrity of the stream banks, It may not, however, protect water quality, as the watering area is often crowded with cattle, seeking water and escape from the heat. The concentrated nutrient load and siltation from streambank erosion that

results from this activity can create negative downstream water quality impacts, as noted at sites 1, 3, and 9. There are, however, alternative ways to provide water to livestock. Most of these involve a "water-gap", where the animals are fenced away from most of the stream, but are provided a small area of access where the streambank is nearly flat and only a few head of stock can water at one time. It may also be possible to divert water from the creek by digging a dead-end trench from the stream, back into the field, and fencing it so that the livestock do not need to enter the stream channel to water. These areas also could be incorporated into off-channel rearing sites. Where feasible, water can be diverted with a pipe from the channel to a trough, such as at the "frost-free" demonstration site,



Pasture Along Mainstem Asotin Creek

In Washington State it has always been legal, under a "livestock riparian water right", for livestock owners to water their animals in a natural stream course. Until recently, some owners who were willing to fence their animals away from the stream could not get a permit from WDOE to divert water from the stream because more recent laws had placed flow restrictions on the stream.

The ACCD worked with WDOE, local legislators, the Washington Cattlemen's Association, and the Northwest Power Planning Council to try and get this situation changed for

the benefit of the stream ecosystem. Such a change would allow livestock owners more flexibility when they are willing to work with others to protect natural resources. The ACCD was successful as shown by Appendix N, which is a recent response from WDOE concerning livestock water diversions. This new position on riparian water rights should make it easier for operators to install such things as "frost free" watering troughs, thereby making fencing a more feasible alternative to unrestricted grazing of the riparian zone.

I. RANGELAND

Upland Range condition and trend data were used to evaluate problems and opportunities on upland rangelands in the watershed. Rangeland trend appears to be generally stable or upward on most rangelands in the watershed since grazing pressure was reduced in the 1950's. Some problems remain because rangelands respond very slowly to most management changes. In some areas perennial grasses have been replaced by annual cheatgrass which is more or less stable on the site. Local ranchers have adjusted their grazing systems to maximize the use of these annual ranges. It is unlikely that these areas can be feasibly converted 'back to perennial species within the near future (Monsen 1984; Nelson, et al. 1970).

Current range condition data (Table 1) was compared with data from the Southeast Washington Cooperative River Basin Study (USDA Soil 1984). The new data shows only faint resemblance to earlier records. The River Basin Study reported that nearly 3/4 of all rangeland in the Asotin Creek watershed was in "Fair" to "Poor" condition (Table 5). This difference probably reflects dissimilar methods and definitions rather than a wholesale improvement in range condition in the last twelve years. In addition, SCS standards for potential vegetation in ecological sites have since been revised. Finally, the field office surveys cover only a portion of the watershed, generally taken in higher precipitation zones which are more resistant to range deterioration.

The clearest indication of upland range trend in the watershed is a decline in range condition due to spread of noxious weeds, primarily yellow starthistle. Asotin County weed board estimates show an increase from 2,000 acres infested in 1986 to over 15,000 acres infested in 1993. About 9,000 of these acres are in the Asotin Creek watershed. These occur primarily in the lower watershed, but isolated populations are also found along the South Fork and in George Creek above Wormell Gulch. Yellow starthistle thrives on south-facing, degraded sites formerly occupied by cheatgrass, but also invades good native rangeland and even CRP seedings.

TABLE 5. RANGE CONDITION BY ECOLOGICAL SITE, ASOTIN CREEK WATERSHED (1981 RIVER BASIN SURVEY)

ECOLOGICAL SITE	ACRES	CONDITION CLASS (PERCENT)	
		"FAIR/POOR"	"GOOD/EXCELLENT"
LOAMY	18,523	31	12
NORTH SLOPE	2,940	5	0
SHALLOW	<u>23,106</u>	38	14
TOTAL	59,967	74	26

Continued spreading of this weed will reduce the grazing capacity of these rangelands because starthistle has limited palability after seedheads are produced (Thornsen, et al. 1989). Areas dominated by starthistle may be more susceptible to soil erosion than areas of native perennial vegetation. This was shown for other knapweeds in Montana (Lacey & Marlow 1989).

Prospects for eradicating yellow starthistle are bleak. Biological control, using either livestock grazing (Thomsen, et al. 1989) or introduced insects (Johnson, et al. 1992), has been ineffective. Some seeded grasses can effectively compete with this weed (Larson & McInnis 1989; Northam & Callihan 1990), but reseeding is not feasible. on--the steep, rocky hills and canyons where starthistle thrives, Aerial herbicide treatments using "picloram" average \$23/acre, but provide at best, only three years of residual control (Tupper 1994).

Based on the above, eight to twelve years of repeated control would approximate the market value for all of the rangelands in Asotin County. The high cost of herbicide application, coupled with continually reduced. funding for weed control programs, discourage attempts to stop the spread of this weed (Thompsen, et al. 1989). Widespread chemical applications threaten to damage populations of non-target broadleaf plants. As with other knapweeds, however, dominance by starthistle may cause lower species diversity than what would occur with chemical control (Rice, et al. 1993). Finally, yellow starthistle has been reported to show tolerance for the auxin herbicide used to kill it, (Callihan, et al. 1990).

Maintaining a good ground cover of perennial grasses slows the spread of yellow starthistle. Timely herbicide treatments and management to maintain existing desirable vegetation are currently the only practical choices available for control of this weed species.

Riparian: The condition has improved in some areas but needs additional measures for the condition to improve in others. It is difficult to evaluate riparian condition using traditional range sampling methods because most sampling methods rely on key herbaceous species for

determining condition. In riparian areas, important woody species may be overgrazed or eliminated prior to reaching the accepted level of utilization for key herbaceous species. For this reason riparian areas were inventoried and alternatives developed separately in the Wetland and Riparian section of this report,

Trend in riparian vegetation condition on state land in the CRMP area is estimated to be stable (Holland 1994). Due to drought conditions, the rotational grazing system initially designed in the CRMP has not been successful at improving riparian vegetation condition. Availability of water in this part of the watershed limits livestock distribution. With the drought conditions, some springs and ponds have dried up and grazing use had to be shifted to pastures with available water (generally riparian areas). As a result, few of the goals for improvement in the riparian areas in the CRMP have been realized (Holland 1994). Opportunities exist for additional measures to improve riparian condition through the development of more dependable water sources and additional fencing.

Recently, WDFW received a \$193,000 grant through the Watershed Restoration Partnership Program, administered by DNR. These monies are ear-marked for the Asotin Unit of the Chief Joseph Wildlife Area and must be used by June 30, 1995. According to Robin Sherry, of the WDFW Habitat Division, it will be used for better rangeland management to buy and install fencing and plant trees and brush along:

- A. 0.5 mile of the left bank of North Fork Asotin Creek
- B. 2.5 miles of both banks of Charley Creek
- c. 3.0 miles of both banks of South Fork Asotin Creek

WDFW is currently re-evaluating the CRMP to make necessary adjustments in the plan to improve riparian vegetation condition.. No data is available for trend on upland range sites as none of the transects have been re-surveyed for condition on state lands since the establishment of the CRMP, National Forest rangeland within the CRMP was in good or excellent condition, though there may be some opportunity for improvement on specific sites

J. FORESTLAND

General Management: The quality and quantity of fish and wildlife habitat created in the forest depends on the timber management system that is used. There are two basic systems used in the watershed: even-aged (clear-cut) and uneven-aged (selective-cut), each fulfilling a different set of objectives.

Uneven-aged management is used to selectively harvest individual trees or groups of trees at frequent intervals.

Shade intolerant species tend to disappear since the canopy **is** always present. The age class is wide spread, from seedlings to mature dominant trees. This type of stand structure provides preferred habitat for some wildlife species but lacks the distinct successional stages of even-aged stands which favor other wildlife species, Uneven timber management, because it offers more age-class variety than clearcuts, generally supports more species of wildlife and is less damaging to the adjacent stream ecosystem. This type of management sometimes creates other negative impacts because it may require more roads to access the timber.

Federal Managuement: According to a "Final Report" for the Pomeroy Ranger District (Groat 1994), the Umatilla National Forest includes 63,140 acres of the Asotin watershed. This acreage is comprised of 40% forestland, 29% non-irrigated cropland and 30% rangeland. Nine percent of the 25,256 forestland acres is considered to be "old growth" (never logged). There are nearly 400 acres of old growth in the North Fork drainage and scattered old growth trees in the Charley Creek subwatershed (1995).

The USFS has developed a ten year "Umatilla National Forest Plan" that guides resource management on National Forest lands within the Asotin Creek watershed. The plan covers management activities from 1990 to 2000. Implementing the plan will also meet the objectives of the Asotin Creek Model Watershed Plan. This Forest Plan, however, has been withdrawn due to a recent federal court injunction.' In the meantime, the USFS is following guidelines established by biologists from the Bureau of Land Management (BLM) and the USFS and contained in an agreement entitled Pacific Fish (PACFISH).

The USFS, as a member of the Technical Advisory Committee agrees with the ACCD that the primary limiting factors for fish production in the Asotin Creek watershed are:

1. high stream temperature
2. low numbers of large pools
3. sediment deposition in spawning gravels.

While the USFS feels that conditions on the National Forest lands are good to excellent for fish, there are some areas which may be contributing to resource problems. in the watershed. They are addressed as follows:

1. Stream Temperature - In general, stream temperatures are cooler within the National Forest than in downstream areas of the lower watershed,, Many of the 7400 acres of clearcuts which were made between 1970 and 1989 lie along tributaries of Asotin Creek. Some of these were documented by the USFS as having caused temperature rises in the adjacent stream, but this is becoming less of a problem as

the second-growth replacement trees continue to grow. Since 1990 the area of harvest using clearcuts has been reduced to 2400 acres (5% of the fore&land).

Since 1970 there have also been 4500 acres (9%) harvested by selective-cut logging, which usually causes less erosion and smaller changes in stream temperature and watershed hydrology than clearcut logging. Future logging under the PACFISH guidelines will be very restrictive, with no-cut buffers of up to 300 feet on each side of fish-bearing streams. Harvest by selective-cut may become more common in the future.

Although stream temperatures are generally much cooler in the National Forest, there are still opportunities for improvement using riparian plantings, especially in the Charley and Lick Creek areas, where much of the woody vegetation has been lost to recent fires, as well as past grazing. Livestock grazing Practices such as "prescribed grazing" systems, will reduce the loss of woody material and stream shade. In some cases adjustments may be needed in the stocking rates and the length of the grazing season. Development of off-channel watering sites may be necessary to facilitate these changes.

2. Large Pools - Direct manipulation of the stream habitat may cause the most dramatic changes in the upper watershed condition. The addition of large woody debris (LWD) either naturally or artificially, will improve fish habitat. Not only will it create pools, sorting of spawning gravels, and cover, but it will also increase aquatic insect and macro-nutrient production. The Pomeroy District of the USFS has already been involved in successful stream improvement projects using logs and boulders, both in Charley Creek and tributaries of the Tucannon River. They plan to continue this work in Asotin Creek and help where possible on watershed projects outside the National Forest boundary.

3. Sediment Deposition - The USFS plans to directly reduce sediment input to the Asotin drainage by: obliterating some roads in the Charley and Lick Creek subwatersheds; resurfacing road #4100 (the main road in the Lick Creek drainage); and relocating trail #3125. Sediment input will be indirectly reduced by planting trees in the riparian area and making changes in livestock management. The continued growth of trees within the harvested areas will also help reduce sediment input.

State Management: The state forestland is managed by WDFW (1200 acres) and DNR (1250 acres). Only 78 acres have been logged on DNR land since 1970. Revenues from this logging go to the Washington State School Trust Fund. Timber harvest on WDFW land is done only to improve wildlife

habitat or to control pest infestations. Since 1970, only 3.2 acres have been logged on land managed by WDWF. The future use of these forested acres is outlined by WDFW in their Chief Joseph Wildlife Area Management Plan which addresses resource concerns such as water and habitat quality, as well as soil, range and riparian management,

Private (NIPF) Management: There is no overall comprehensive plan for long term forest management on NIPF land. Timber harvest and associated activities are subject to the "Washington Forest Practices Rules and Regulations" which are maintained by the Washington Forest Practices Board and administered and regulated by DNR..

Generally, harvest activity on NIPF land is in response to favorable local log market conditions and/or for those operators who include periodic "winter logging" as a farm practice during those times when normal agricultural practices cannot be done. This type of logging is done as economically as possible, usually by selecting only certain trees. The use of even-aged management is extremely limited in this watershed, About seven acres have been clearcut and regenerated since 1970. Harvest operations can include skidding, building new roads, re-opening abandoned roads, and constructing stream crossings, trails and landings. These activities have the potential to negatively impact fish and wildlife habitat as well as other resources. Managing for these resources, overall forest health, and long term sustainability of the forest are often not part of the NIPF harvest operation.

Forest management plans for NIPF can be designed to assist landowners with meeting their present goals and guiding their activities into the future so that impacts to fish and wildlife habitat will be minimized. This will also ensure the long term sustainability of the land and the timber resource. It will help them meet their future goals, both as individual landowners and as watershed owners who are working as a whole to cooperatively monitor the cumulative effects of each action.

The Landowner Steering Committee has the opportunity and potential to organize a program between DNR, USFS, NRCS and private forest consultants to develop management plans for NIPF operators.

K. CROPLAND

The resource problems on the cropland are sheet and rill erosion, concentrated flow erosion, loss of productivity due to erosion, weed control, and nutrient management. These problems were identified by the ACCD Board and the local District Conservationist while developing FSA plans in the late 1980's. Average erosion rates per acre for crop

rotations in each precipitation zone were determined by reviewing USLE worksheets from individual plans and the Asotin County Field Office Technical Guide. These rates were then used to determine the annual erosion from cropland, as summarized in the Alternative Section of this plan.

Several opportunities exist for improving the long term productivity of the cropland as well as improving water quality. The Land Owner Steering Committee has identified an opportunity to establish new perennial grass cover or maintain existing cover for 3,500 acres, using the following options:

- 1, Reauthorize CRP contracts for acreage determined to be the most critical or erodible.
2. Develop pasture and hayland management plans for up to 2,500 acres of either existing CRP land or other HEL cropland identified as a critical area in the lower portion of the watershed where sodic soils exist.
3. Develop conservation cover management plans for up to 1,000 acres of either existing CRP land or other HEL cropland in the lower portion of the watershed where sodic soils exist. This acreage would be used primarily by wildlife.
4. Encourage ASCS to allow for early implementation of these and other conservation practices on existing CRP fields prior to contract expiration.

Opportunities exist for improving water quality in the sub-watersheds of Kearny Gulch, McGuire Gulch, George Creek and Pintler Creek, by installing additional grassed waterways, sediment basins, terraces, and filter strips. Sediment basins are designed to store runoff water and capture silt, and can be an integral part of a terrace system. These catch basins could also be installed at the outlets of existing grassed waterways to improve their function. The installation of filter strips in upper Pintler and George Creeks, where cropland borders stream channels; is another effective practice. Filter strips can be installed above sediment basins to retard water flows and allow sediment deposition, extending the life of the sediment basins. Planting native shrubs in some of these areas would also increase wildlife diversity.

IV. ALTERNATIVES

IV. ALTERNATIVES

A project alternative is a combination of recommended practices and management systems designed to treat a documented problem. The ACCD identified the following as the primary fish habitat and water quality problems within the watershed:

- A. high stream temperature
- B. lack of instream fish rearing and resting habitat
- C. sediment deposition in spawning gravels
- D. high fecal coliform levels

For the Asotin Creek Model Watershed Plan the Landowner Steering Committee and the Technical Advisory Committee jointly developed three alternatives to address each problem. Each alternative represents a different level of treatment and is described as follows: 1. No Planned Action, 2. Planned Action, and 3. Optimal Planned Action.

Regardless of which alternative is applied, there will be more future protection for the fish and wildlife resources in this watershed as a result of recently proposed changes in the management of state and federal lands. These changes primarily address protection of the riparian zones on all fish-bearing streams within these lands. They are mandated by the following regulations and guidelines:

1. HB 1309 - a 1993 state law which is designed to protect and enhance fish and wildlife habitat on all state trust lands which are leased for farming and ranching.

2. Washington Priority Habitats and Species (PHS) - a state guide to management of fish and wildlife "critical areas" habitat on all state and private lands as they relate to the Growth Management Act of 1990. The recommendations address upland, as well as riparian habitat, and place emphasis on managing for the most critical species and its habitat.

3. WDFW Management Plan for the Asotin Unit of the Chief Joseph Wildlife Area - a revision of the existing management plan to reflect PHS and salmon concerns as they relate to WDFW lands within the watershed.

4. Pacific Fisheries (PACFISH) - 1991 guidelines developed by a team of fish biologists from USFS to protect and enhance anadromous fish habitat on National Forest lands. These guidelines (such as no logging within 300 feet of a fish-bearing stream) will be used as the interim policy until the currently proposed "Umatilla National Forest Plan" is approved by NMFS.

5. Forest Ecosystem Management Assessment Team (FEMAT) - a 1993 presidential team of scientists which developed various alternatives for management of federal lands under the jurisdiction of USFS and BLM, for the protection of spotted owls, marbled murrelets and anadromous fish. None of the FEMAT alternatives have yet been adopted but some of the PACFISH recommendations are being followed.

Additionally, private landowners can receive financial and technical assistance to improve management of their farm and rangelands through USDA programs such as the:

1. Agricultural Conservation Program
2. Conservation Reserve Program
3. Forest Stewardship Incentive Program

The USFWS also has a habitat program entitled the Washington State Ecosystem Conservation Program which has cost-share monies available for fish and wildlife enhancement.

At the state level there are two similar programs managed through WDFW:

1. Regional Salmon Enhancement Program
2. Habitat Development Program

The level of treatment from these sources is limited by available funds and is not necessarily coordinated on a watershed basis.

GOALS

Management of *forestland* and *rangeland* under federal and state control will improve even if the Asotin Model Watershed Plan is not implemented because of their respective goals in the Umatilla National Forest Plan, PACFISH, FEMAT, and the Chief Joseph Wildlife Area Plan. These goals will not be affected by Alternative selection. For private lands the Landowner Steering Committee and the Technical Advisory Committee agreed as a group that the success of this watershed plan is not to be measured by numbers of returning chinook. The group further stated that much of the salmon decline results from causes outside the Asotin Creek watershed (e.g. hydroelectric dams, harvest, hatchery practices and other habitat problems).

For these reasons a goal was established to improve habitat condition in the watershed so that it will support a viable anadromous fishery while still maintaining the economic sustainability of the other resources. The group felt that the best way to attain the ultimate goal was to divide it into smaller goals, one to address each of the identified

problems. The following are projections for attaining the stated goals for each problem, using the various alternatives:

A. TEMPERATURE The goal is to lower the maximum water temperature (measured at the mouth, when the air temperature is 100°F or higher) from its current mid 70's to the state standard of no higher than 64.4°F.

1. No Action: The temperature may never drop to the state standard because there are still long stretches of open water where trees have not, and will not, become established without a planned effort. It appears, from the Water Temperature section, that the water temperature may already be 4°F cooler under present conditions than it was in 1981-84. This occurred with natural regeneration of trees in the riparian zones. With continued growth, the temperature will probably continue to drop, but it will take a long time. Most of the existing riparian vegetation has very little species and age-class diversity. Monocultures and even-aged stands are vulnerable to diseases and parasites, which could trigger mass die off of trees. This would result in the majority of the channel being exposed to the sun. Also, this type of riparian area does not provide adequate bank stabilization and recruitment of LWD to the channel for fish cover and pool formation. The proposed 6 miles of fencing and riparian planting on state land will help lower the temperature of the South Fork and Charley Creek.

2. Planned Action (Appendix B): Cottonwoods, conifers and a mixed understory of native woody vegetation will be planted along 36,000 feet of exposed channel using mostly dormant stock material. This will improve the stream shading much faster than the "No Planned Action" alternative. New plantings will be interspersed with existing woody vegetation to improve age and species diversity. These plantings will eventually create the targeted 75% canopy cover, which is considered optimum for trout production (Raleigh, et al. 1980). Temporary exclusion of livestock from the riparian zone will be necessary to provide vigorous growth of these plantings. A riparian zone of mixed plant species with different age classes will also be less susceptible to catastrophic losses.

With the installation of instream structures, and the proposed reconstruction of some channel meanders, the stream will become narrower and deeper, which will help keep the water cooler, both by its shape and because overstory vegetation will be better able to cover the channel.

There are 24 possible sites for development of off-channel rearing which will be surveyed and prioritized for their

potential to act as cool-water refuges for juvenile fish. Six of these will be excavated and planted with riparian vegetation. Water temperatures and fish use will be monitored and recorded at these sites throughout one full year after construction. No more sites will be excavated unless agreed to by WDFW.

3. Optimal Planned Action: Native woody vegetation will be planted-along 50,000 feet of stream channel. This will increase the shading, as well as make a wider riparian zone, which will cool the air flowing across the channel. This should help lower the water temperature even more than the Planned Action Alternative. A decrease in stream temperature of 0.7°F is expected for every 10 % increase in shade (Brown 1972).

The water temperature at the National Forest boundary will set the baseline condition for water temperatures on downstream private lands. Under PACFISH, the water must meet the Washington State standard of 60.8°F for Class AA waters throughout the Umatilla National Forest. In the Asotin watershed, this goal is being met most of the time. It will be much easier to keep temperatures at or below the 64.4°F for Class A waters on private and state lands if USFS meets its temperature goal.

Under a proposal in the Umatilla Forest Plan Amendment, Policy Implementation Guide, the temperature goal is 55°F. In the Asotin watershed this goal may be unrealistic due to the physical limitations, of the watershed and the limited opportunity for increasing shading within USFS lands (Groat 1994).

If the six trial sites for off-channel rearing prove to be functional the remaining 18 sites will be surveyed and developed where feasible.

For all alternatives, tree planting should begin at the upstream limits of the project, because it is easier to maintain the temperature of the cool water that flows from the forested land than it is to lower the temperature, once it has risen.

B. INSTREAM HABITAT: The goal is to create at least as many large rearing and resting pools as existed according to a 1935 USFWS physical survey of Asotin Creek. The ideal method would be to restore the entire channel to its historic geomorphic stable type. Since this is not entirely feasible because of cost, adjacent land uses, roads, and the location of nearby private and public structures, channel reconstruction is planned for only small sections. A fish passage problem at the Asotin Road crossing of Charley Creek will also be corrected,

1. No Action: If no instream structures are installed, the stream will continue to be geomorphically unstable. It will continue its erratic movement in the floodplain, depositing its bedload, forming more braided channels, which will lead to more bank instability. The pool/riffle ratio for large pools will not improve, except on some National Forest land where larger trees will be allowed to fall or be purposely felled into the channel. The number of large pools will remain at 81, or 5.0 pools per mile. The stream will continue to be a series of long high-energy riffles that have minimal gravel sorting capability. The dominant bottom composition will be cobbles and boulders, rather than spawning-size gravels.

There will be very few large pools formed because there are not enough big trees in the riparian zone that can fall into the channel. Existing off-channel wetlands (old stream channels) will not be able to support more than a few juvenile fish and will continue to cause downstream water quality problems because of unrestricted livestock access.

Charley Creek will not be accessible to juvenile salmon due to the migration barrier at the Asotin Road culvert. Without any channel reconstruction there will be no way to demonstrate how a stream can function as it should, without negatively impacting the adjacent landowners.

2. Planned-Action (Appendix B): Installing 142 instream structures, using large rocks and logs, will restore the original number of large pools as recorded in 1935. Many of these new large pools will be formed by improving existing small pools. The pool:riffle ratio will be improved as the number of large pools will be increased to 151 or 9.4 per mile.

Reconstruction of 2640 feet of mainstem channel on state land, just downstream of the South Fork Road bridge, will provide a long section of geomorphically stable channel (Appendix B-5, Sheet #4). The improved stream section will provide excellent fish and wildlife habitat and riparian plant growth. This section could become a good recreational fishing area as well. Developing at least six off-channel rearing sites for juvenile fish will help determine if more should be built. At least one of these sites will also be used as a livestock watering area. The 4.5 miles of fencing will be used to protect these backwater sites and some of the instream improvement areas from potential livestock damage.

Additional off-stream watering areas can be installed, where needed, on private land along the rest of the stream. They may be similar to the off-channel rearing sites, or more elaborate, like the "frost-free diversion which was recently installed as a demonstration project.

3. Optimal Planned Action: Up to nine miles of the mainstem would be re-aligned, forming a more natural, geomorphically stable stream, having alternating point bars., deep pools and stable "large woody debris" for improved habitat for both adult and juvenile chinook and steelhead. This stream section would have an adequate floodplain and would be a demonstration for the potential of other degraded fish-bearing streams, It would have pools situated according to the dynamics of the stream (a large pool for every 5-7 bankfull widths), as described by Leopold (et al 1964). The pool:riffle ratio will be further improved as the number of large pools is increased to 354 or approximately 22 pools per mile.

For both the Planned and Optimal Action Alternatives, only a portion of the structures can be built in any one season. It would be best to start at the upstream end and work downstream so that siltation which occurs during instream work is not flushed downstream onto a completed site. This will also create more habitat where it will do the most good, at least until the mainstem is made cooler.

C. SEDIMENT: This goal will be met by promoting the development and use of conservation practices (such as fencing and filter strips) on all confined winter feeding and calving areas along mainstem Asotin Creek and its tributaries to protect water quality, streambank integrity and the riparian area. Management practices will be developed and implemented to reduce erosion from uplands. Eroded streambanks will be stabilized in identified reaches.

1. No Action: The current *cropland* erosion rate of 147,806 tons/year is based on acreage which includes 16,420 acres of CRP (Appendix A; Figure A-6). After 1995 these erosion rates are predicted to increase to 177,748 tons/year if the projected 70% (11,494 acres) of CRP is converted to cultivated *cropland*, even though this land will still be managed according to 'approved FSA conservation compliance plans. The remaining 4,926 acres of former CRP will be managed as pasture and hayland.

Crop Rotation	Acres	Sheet/Rill Erosion (tons/year)
Cultivated Cropland: WW/SF and WW/SB/SF	47,145	174,838
Grasses and Legumes in Rotation	2,885	1,432
Pasture and Hayland (30% of former CRP)	<u>4,926</u>	<u>1,478</u>
	54,956	177,748

Crop Rotation	Acres	Sheet/Rill Erosion (tons/year)
Cultivated Cropland: WW/SF and WW/SB/SF	47,145	174,838
Grasses and Legumes in Rotation	2,885	1,432
Pasture and Hayland (30% of former CRP)	<u>4,926</u>	<u>1,478</u>
	54,956	177,748

Erosion from private *forestland* should not change, but should decrease on National Forest lands when USFS completes its road obliteration and maintenance program for the watershed. It will decrease on *state* lands after the recently proposed fencing is installed and the riparian areas planted with woody vegetation.

2. Planned Action,: Up to 3500 acres of highly erodible *cropland* and 'former CRP land will be managed as permanent grass. Up to 150,000 feet of terraces, 40 sediment basins, four acres of filter strips, and ten acres of grassed waterways will be installed, The amount of soil saved as a direct result of these structural practices is estimated to be 2,100 tons per year.

Crop' Rotation	Acres	Sheet/Rill Erosion (tons/year)
Cultivated Cropland: WW/SF and WW/SB/SF	43,645	161,858
Grasses and Legumes in Rotation	same as No Action	same as No Action
Pasture and Hayland (30%,of former CRP)	same	same
Permanent Grass: Pasture and Hayland	2,500	750
Conservation Cover	<u>1,000</u>	850
	same	166,368

For *rangeland* Pest Management (weed control) plans will be developed on approximately 16,000 acres of private land that have identified infestations of noxious weeds which compete with native vegetation. These plans will identify the target weeds and the best method of control (mechanical or chemical), as well as the optimum time of the year. They

will require a plant inventory to determine if any federal or state "listed" plant species are present.

3. Optimal Planned Action: An additional 3,500 acres of *cropland* (or former CRP) will be managed as permanent vegetative cover and held in reserve, The 40,145 acres of cultivated cropland will be managed according to a Resource Management System (RMS) plan which will keep soil loss at or below the tolerable limit for the predominant soil type (known as meeting "T"). The structural practices will save 2,100 tons per year, as was the case in the planned action.

Crop Rotation	Acres	Sheet/Rill Erosion (tons/year)
Cultivated Cropland: WW/SF and WW/SB/SF	40,145	80,290
Grasses and Legumes in Rotation	same as No Action	same as No Action
Pasture and Hayland (30% of former CRP)	same	same
Permanent Grass: Pasture and Hayland	5,000	1,500
Conservation Cover	<u>2,000</u>	<u>1,700</u>
	54,956	86,400

Treatment for private *rangeland* will include fertilizing and grass-seeding of up to 10,000 acres of the 16,000 acres of the planned broadleaf weed control Prescribed grazing will be followed in combination with planned range improvements.

Erosion Comparison

The three alternative actions will have the following annual sheet and rill erosion (in tons) from the cropland. The sediment delivery (in tons) to Asotin Creek is estimated to be 16% of the erosion rate:

	Sheet & Rill Erosion	Sediment Delivery	Percent Reduction
No Action	177,748	28,440	
Planned Action	166,368	26,619	6%
Optimal Action	86,400	13,824	51%

D. FECAL COLIFORM: The goal is to reduce the fecal coliform levels to meet Washington State standards (less than 50 colonies/100 ml for *Class AA* waters and less than

100 colonies/100 ml for Class A waters), The seven livestock confinement areas where Moore found high coliform levels in Asotin Creek can be treated with waste management systems designed to reduce run-off to the stream. As an example, Larsen (et al. 1994) compared coliform loading in a stream using manure deposited directly in the water with similar amounts separated from the water by various widths of grass buffer strips, under different soil and rainfall conditions. They found that a 6-30 foot wide grass filter strip reduced the loading by up to 95%.

Water quality problems associated with septic systems should be addressed by the Asotin County Health Department. Moore suggests that other sources of water quality problems, such as disposing of grass clippings within the ordinary high water line of the stream and storing pollutants in intermittent gullies, could be adequately addressed by public education. The ACCD has already begun such a program and will continue to add to the program's scope as time and money allow.

1. No Action: Without managing waste runoff high levels of fecal coliform in Asotin Creek will continue. This problem impacts humans more than fish.

2. Planned Action: Installing practices such as seven , acres of filter strips, five off-channel water developments, two wells and 21,000 feet of fence will aid operators by Making their livestock feeding and calving Operations more efficient, while reducing runoff from the confinement areas. With less runoff there will be less movement of sediment and nutrients to the creek. Restricting livestock from direct access to the stream will also help restore the riparian area and improve its capabilities as a pollution buffer.

3. Optimal Planned Action: The planned practices identified in the planned action will be part of an overall waste management system that will be designed to not allow any surface runoff to the creek from the animal confinement locations. Additional practices such as diversions, lagoons, and concrete curbs may be needed in heavy use areas.

V . R E C O M M E N D E D W A T E R S H E D
R E S T O R A T I O N P L A N

V. RECOMMENDED WATERSHED RESTORATION PLAN

A. PURPOSE

The recommended plan, or Planned Action, has identified a number of practices which, depending on the land use, can be used to provide cumulative benefits to improve fish and wildlife habitat and water quality. The three major areas of treatment are:

Upland - Restoration activities will include: road improvements (e.g. surfacing, proper culvert installation), road obliteration, grass seeding critical areas, cropland erosion control practices, peat management practices, and prescribed grazing systems.

Riparian - Restoration activities include: planting and maintenance of native species of vegetation using dormant stock and cuttings, streambank stabilization, riparian grazing management, reduction of recreation impacts, and upgrading of roads within the watershed. off-channel rearing ponds will create more fish and wildlife habitat, wetland habitat,, and provide watering areas for livestock.

Stream Channels- Placing boulder clusters, anchoring large woody debris, and installing instream structures will create pools for rearing habitat used by juvenile fish. These same structures will capture and sort gravels for spawning adult fish which will also use the pools for resting and hiding areas. Portions of the main stem and/or tributaries will be reconfigured to improve instream habitat, aid in maintaining lower stream temperatures and improve stream channel dynamics.

B. ALTERNATIVE EFFECTS ANALYSIS

Problem	Goals	No Planned Action		Planned Action		Optimal Planned Action	
High Stream Temperature	<61°F at USFS boundary	meet goal		meet goal		55°F at USFS boundary	
	<65°F at mouth	goal not met		meet goal		meet goal	
Sediment in Upland Spawning Gravels	Reduce Erosion	Cropland Treated - (FSA Plans)		Cropland Treated - including FSA plans and additional support practices		Cropland Treated with RMS plans "Meets T value"	
		W/O CRP	W/CRP	W/O CRP	W/CRP	W/O CRP	W/CRP
	175,000 Tons Annual Erosion*	147,000 Tons Annual Erosion	162,000 Tons Annual Erosion	147,000 Annual Erosion	80,000 Annual Erosion	85,000 Annual Erosion	
	Permanent Vegetative Cover 3,000 Tons	Permanent Vegetative Cover 1,000 Tons	Permanent Vegetative Cover 5,000 Tons	Permanent Vegetative Cover 1,000 Tons	Permanent Vegetative Cover 6,000 Tons	Permanent Vegetative Cover 1,000 Tons	
	Forest/Rangeland State, Federal, and Private 41,000 Tons - Annual Erosion		Forest/Rangeland State, Federal, and Private 35,000 Tons - Annual Erosion		Forest/Rangeland State, Federal, and Private 14,000 Tons - Annual Erosion		
	219,000 total tons/year	189,000 total tons/year	202,000 total tons/year	183,000 total tons/year	100,000 total tons/year	100,000 total tons/year	
	to get <20% Cobble Embeddedness	goal not met		not-established**		not-established**	
or <15% Fines by Volume	goal not met		not-established**		not-established**		
Few Resting & Rearing Pools	Establish Pools with LWD Using Stream Geomorphology	81 pools (5 per mile)		151 pools (9.4 per mile)		354 pools (22 per mile)	
High Fecal Coliform Levels	<50 colonies/100ml on USFS	meet goal		meet goal		meet goal	
	<100 colonies/100 ml downstream	goal not met		meet goal		meet goal	

75

* Annual erosion values include sheet and rill only.

** The relationship between sediment delivery ratio and sediment deposition in spawning gravels has not been established.

c. COST ESTIMATE

<u>Item</u>	<u>Practice*</u>	<u>Unit</u>	<u>Number</u>	<u>Unit Cost</u>	<u>Amount</u>
Identified Problem #1 - Lack of Quality Resting and Rearing Pools					
1.	Fish Stream Improvement (Asotin Creek RM 0.0 to 16.1)				
	(Components May Include:)				
	a.	Vortex Rock Weir			
	b.	Low Stage Log Barb			
	c.	Boulders with Footer			
	d.	Single Wing Deflector			
	e.	Low Stage Log Weir			
	f.	Root Wads with footer and Deflector Log			
	g.	Medium Stage Check			
	h.	Off-Channel Rearing Site			
	(Total a - h)	No.	144	1,560.00	224,640.00
2.	Fish Stream Improvement (Charley Creek RM 0.2)				
	a.	Low Stage Log Weir	4	1,560.00	6,240.00
	b.	Baffles in Culvert	10	50.00	500.00
3.	SUBTOTAL				231,380.00
Identified Problem #2 - High Water Temperature					
4.	Streambank & Shoreline Protection (Meander Reconstruction) Ft.				
			2,640	35.00	92,400.00
5.	Channel Vegetation (Dormant Stock Planting) Ft.				
			36,000	5.00	180,000.00
6.	Fencing (Riparian) Ft.				
			23,760	.40	9,504.00
7.	SUBTOTAL				281,904.00

<u>Item</u>	<u>Practice*</u>	<u>Unit</u>	<u>Number</u>	<u>Unit Cost</u>	<u>Amount</u>
Identified Problem #3 - Excessive Sedimentation					
Rangeland					
8.	Fencing	Ft.	26,400	.60	15,840.00
9.	Well	No.	4	5,000.00	20,000.00
10.	Stock Trail and Walkway	Ft.	26,400	.20	5,280.00
11.	Pest Management (Noxious weed control)	AC.	16,000	23.00	368,000.00
12.	Spring Development	No.	6	1,500.00	9,000.00
13.	Pond	No.	6	1,200.00	7,200.00
14.	SUBTOTAL				425,320.00
Cropland					
15.	Terrace	Ft.	150,000	1.20	30,000.00
16.	Sediment Basin	No.	40	1,000.00	40,000.00
17.	Filter Strip	AC.	4	150.00	600.00
18.	Grassed Waterway	AC.	10	3,000.00	30,000.00
19.	Conservation Cover	AC,	1,000	300.00	300,000.00
20.	Pasture/Hayland Management	AC.	2,500	300.00	750,000.00
21.	SUBTOTAL				1,150,600.00
Forestland					
22.	Critical Area Planting	AC.	2.5	500.00	12,500.00
23.	Tree Planting (Reforestation)	AC.	30	250.00	7,500.00
24.	SUBTOTAL				20,000.00

<u>Item</u>	<u>Practice*</u>	<u>Unit</u>	<u>Number</u>	<u>Unit Cost</u>	<u>Amount</u>
Identified Problem #4 - Elevated Fecal coliform Level					
25.	Fencing	Ft.	21,000	.40	8,400.00
26.	Filter Strip	AC.	7	150.00	1,050.00
27.	Spring Development (Off Channel Water)	No.	5	4,000.00	20,000.00
28.	Well	No.	2	5,000.00	10,000.00
29.	SUBTOTAL				39,450.00
30.	TOTAL				2,148,654.00
31.	Administration (@ 10% line 30)				214,865.00
32.	Technical Assistance (@ 15% line 30)				322,298.00
33.	GRAND TOTAL				2,685,817.00

SEE APPENDIX K FOR PRACTICE DEFINITION AND PURPOSE

* The practice names are from Section IV of the Clarkston NRCS Field Office Technical Guide.

D. POTENTIAL FUNDING SOURCES

AGENCY	PROGRAM	ASSISTANCE	RECIPIENTS	PURPOSE	COMMENTS
FEDERAL					
NRCS	SMALL WATERSHED PROGRAM (566)	TECHNICAL ASSISTANCE \$\$\$ SHARE	STATE AGENCIES MUNICIPALITIES CONS. DISTRICT	PLANNING AND CONSTRUCTION OF PROJECTS WHICH USE WATERSHED RESOURCES	UP TO 100% \$\$ FOR FLOOD CONTROL UP TO 50% FOR MOST OTHER PURPOSES
	WETLAND RESERVE PROGRAM (WRP)	\$\$\$ SHARE TECHNICAL ASSISTANCE	PRIVATE LANDOWNERS	RESTORE & IMPROVE AGRICULTURAL WETLANDS	STATE PRIORITY BY COST/BENEFIT BY VALUE RATINGS
CFSA	AGRICULTURAL CONSERVATION PROGRAM (ACP)	COST SHARE TECHNICAL ASSISTANCE	PRIVATE LANDOWNERS	LAND & WATER CONSERVATION	UP TO \$3,500/YR PER PRODUCER
USFW	WASHINGTON STATE ECO-SYSTEM CONSERVATION	COST SHARE TECHNICAL ASSISTANCE	PRIVATE LANDOWNERS CONS. DISTRICT	PROTECT, ENHANCE, RESTORE WETLAND & RIPARIAN AREAS	EMPHASIS ON FISH AND WILDLIFE
STATE					
WDFW	REGIONAL FISH ENHANCEMENT	COST SHARE TECHNICAL ASSISTANCE MATERIALS	PRIVATE LANDOWNERS	IMPROVE FISH HABITAT, RAISE & PLANT FISH	RELIES ON LOCAL VOLUNTEER GROUPS
	UPLAND RESTORATION PROGRAM	COST SHARE TECHNICAL ASSISTANCE MATERIALS	PRIVATE LANDOWNERS	UPLAND BIRD HABITAT ENHANCEMENT	EMPHASIS ON COVER RIPARIAN PLANTS
	LOWER SNAKE RIVER COMPREHENSIVE PROG.	COST SHARE TECHNICAL ASSISTANCE	PRIVATE LANDOWNERS	UPLAND BIRD & STREAM HABITAT	EMPHASIS ON BIRD HABITAT ALONG STREAMS
	BACKYARD WILDLIFE SANCTUARY	TECHNICAL ASSISTANCE MATERIALS	PRIVATE LANDOWNERS	URBAN WILDLIFE ENHANCEMENT	BIRD BOXES PLANT INFO
WDNR	FOREST STEWARDSHIP INCENTIVE PROGRAM (SIP)	COST SHARE TECHNICAL ASSISTANCE	PRIVATE LANDOWNERS <1,000 ACRES	FOREST HABITAT ENHANCEMENT	FUNDED BY CFSA
WDOE	CLEAN WATER ACT-SECTION 319	GRANTS	CONSERVATION DISTRICTS	IMPROVEMENT OF SURFACE WATER QUALITY	ALSO WORK WITH GROUND WATER
	CENTENNIAL CLEAN WATER	GRANTS	CONSERVATION DISTRICTS	IMPROVE WATER QUALITY	NON-POINT POLLUTION

E. IMPLEMENTATION AND MONITORING

IMPLEMENTATION: This plan has been written without an identified funding source. As a result, it is difficult to predict exactly how actual implementation will occur because different funding programs have different guidelines. The SCS has dedicated two conservation planners and an engineer to do follow-up planning and implementation with individuals and groups of landowners in the watershed. Regardless of the funding source, this staff will develop agreements with participating landowners that will itemize, design, and schedule specific management on their land. These practices will be consistent with the goals and priorities of this plan. Where structural practices are needed, the staff will assist the landowners in finding the necessary means to do this. The Landowner Steering Committee members have agreed to remain together as an ACCD committee through the project implementation phase.

IMPLEMENTATION SCHEDULE: The program and source of funds have not been selected by the sponsor. In most cases, an implementation plan will be prepared describing in detail the participant eligibility, participation criteria, participation rate, strategy for structure installation, priority system for treatment of selected areas, and schedule of installation. An example of a possible schedule of installation for a cropland owner may be as follows:

Coordinate practice installation with existing programs such as CRP and FSA Conservation Compliance. Conservation cover will be planned for former CRP acres as these CRP contracts expire. Grassed waterways, sediment basins and terraces will be constructed during periods when the adjacent fields are not in a crop. Fifty percent of planned practices will be installed during the first three years, 75% installed by year five and 100% by the seventh year of implementation.

The sponsor may target participation by 75% of landowners in the watershed, but strive for 100% treatment of the riparian areas identified as needing restoration.

The implementation of both the USFS Umatilla National Forest Plan (when authorized) and the Chief Joseph Wildlife Area Plan will be coordinated with planned practices identified in the Asotin Creek Model Watershed Plan. Coordination is necessary in order for the individual practices to function as a system and provide positive cumulative effects.

MONITORING: The ACCD will provide leadership in the administration of a monitoring plan for private, state and federal lands in the Asotin Creek watershed. The ACCD will act as the "clearing house" for all information gathered as part of the monitoring effort in the Model Plan. This

recommended practices, conservation systems, and management changes are toward meeting the goals stated in the Plan.

Private: Landowners who participate in the recovery program will have implemented practices evaluated by technical staff annually. Those who are currently participants in the USDA farm program are already required to have an applied conservation plan approved by the SCS. This plan is subject to compliance reviews as part of a five percent random sample each year. It may be possible to improve some of these plans to better meet the stated goals of the Model Watershed Plan.

State: WDFW is currently developing a management plan for the Asotin Unit of the Chief Joseph Wildlife Area which will be far more specific than the Model Watershed Plan but which is expected to be consistent with its goals. It is likely that state rangelands will be monitored using the condition and trend transects already established in the CRMP. Fish populations will continue to be monitored and evaluated by WDFW, using current methods.

Federal: Since an injunction has been filed against the USFS, relating to the Umatilla National Forest Plan, their plan has not been implemented. It is not clear whether USFS will manage National Forest lands under the old plan, under a new plan, or by following PACFISH guidelines. It is therefore assumed that evaluation and sampling methods will be similar to former years. The grazing program will continue to be monitored using range condition, trend transects and utilization checks, except that riparian grazing will be monitored separately from upland grazing. Instream habitat will be assessed yearly, using a published standard method such as Hankin and Reeves.

Managers of state and federal lands within the Asotin watershed will be contacted periodically by the ACCD for progress reports outlining the status of scheduled items in the plan. As a minimum, the following actions are recommended for inclusion into the monitoring plan:

- * Establish ten permanent stream reaches, each with at least three representative cross-sections. These reaches will be inventoried every year, preferably during August. Site selection will be determined by the Technical and Landowner Steering Committees and will include grazed sites and non-grazed sites as well as improved and unimproved sites. Information collected at each site should include:
 - stream type (Rosgen)
 - pool to riffle ratio
 - cobble embeddedness at cross-sections
 - solar pathfinder readings shade cover
 - stream flow

- juvenile fish counts and species diversity
 - adult salmon and trout spawning surveys
 - vegetation belt transect
 - grazing utilization
 - water and air temperatures
 - photo points
 - water quality (fecal, dissolved oxygen) levels
- * Evaluate representative riparian planting sites two and ten years following planting for:
 - plant survival rate
 - plant species diversity
 - percent of stream shade
 - * Evaluate all instream structures two and ten years following construction for:
 - structural integrity
 - fish use
 - pool size
 - pool quality (instream cover and complexity)
 - changes in streambed at structure installations
 - gravel composition at tail-out of pools
 - * Measure upland range utilization annually.
 - * Evaluate upland range condition every five years using permanently established transects.
 - * Measure condition and utilization in grazed riparian areas using woody vegetation as the key indicator species. Also measure:
 - plant species diversity
 - plant age class structure
 - * Upgrade the two USGS gaging stations (#13334700 and #13335050) to monitor both stream discharge and suspended sediment.
 - * Measure sediment in 6 sediment basins.
 - yearly, for the life of the structure
 - following major storm events
 - * Continue to monitor ephemeral gully erosion.

The Asotin Creek Model Watershed Plan has identified both short and long-term objectives. Short-term objectives can be met by following the project implementation schedule and the monitoring and evaluation plan. The short term success of the project can be measured in many ways, such as ease of implementation, public acceptance and efficiency of the administration. However, in order to quantify the long term success of the project, a post monitoring and evaluation plan needs to be followed. Most long term solutions carry uncertainties about how well they address long-term

restoration objectives, and require periodic site-specific evaluations.

These evaluations need to answer questions such as: Was the project implemented as planned? Did the project accomplish the desired changes in habitat and water quality? Did fish populations and riparian communities respond as anticipated?

These long-term objectives can be achieved with a built-in, flexible approach to project implementation. This flexible approach is often referred to as "adaptive management".

F. ADAPTIVE MANAGEMENT:

The Asotin Creek Model Watershed Plan is an attempt to use the "ecosystem approach" to watershed restoration. Through an inter-disciplinary team, a watershed analysis was completed which identified some areas of concern that collectively contribute to the degradation of fish habitat in Asotin Creek. The approach may have been general, with many limitations, but important information was gathered within the allotted time and monetary budget. Total watershed restoration is desirable, but all too often, as in the case of Asotin Creek, not feasible. The plan pursues a "practical" level of restoration. This level was determined to meet the goal because resources in the watershed are still at a "treatable" level; recommended treatment is considered cost-effective; funding expectation is high with the sponsor; administrative and institutional functions (ACCD) are in place; and there is a positive feeling in the socio-political arena regarding the recommended plan.

Adaptive management is a continuing process of action based on planning, monitoring, evaluation, and adjustment. Project managers will be able to tell how well the designed activities are functioning and how well they contribute toward meeting the project objectives. Adaptive management is a process, that ensures effective implementation of the project. The benefit of adaptive management is being able to respond to new information and technology and changes in societal demands and legislation which could cause shifts in the goals and objectives. This flexibility needs the "buy in" from the sponsor, cooperating agencies and participants in order to meet the project objectives.

The project sponsor will use this management approach during the implementation, monitoring, and evaluation phases of the Asotin Creek Model Watershed project.

VI, COORDINATION, CONSULTATION,
AND PUBLIC PARTICIPATION

VI COORDINATION, CONSULTATION, AND PUBLIC PARTICIPATION

The Asotin County Conservation District (ACCD) began a two year water quality monitoring study in Asotin Creek in 1991. The study was designed to obtain water quality information to be used for determining if a water quality problem exists, develop baseline data, and use the information for a basis for the application for the Model Watershed Program. The original study also involved the landusers and public. Signs were installed, pamphlets distributed, and public meetings held.

In 1993, the ACCD was selected by the Northwest Power Planning Council to develop a Model Watershed Plan that would identify the resource problems, formulate alternatives, evaluate the alternatives, and recommend a salmon recovery plan and its effects.

The ACCD, also called project sponsor, began the salmon recovery planning effort by involving the community. They formed a technical advisory committee, called the **Landowner Steering Committee (LSC)** to represent the views and needs of the community. The LSC members are:

Dave Browne	Frank Koch	Gene Thiessen
Jay Holzmiller	Steve Polumsky	
Carroll Johnson	Dan Schlee	

The ACCD established a **Technical Advisory Committee (TAC)** to assist the LSC with meeting their goals. Groups and agencies represented on the TAC committee are:

- USDA Soil Conservation Service**
- USDA Forest Service**
- Washington Department of Fisheries**
- Washington Department of Wildlife**
- Washington Department of Ecology**
- Washington Department of Natural Resources**
- WSU Cooperative Extension Service**
- Bonneville Power Administration**
- Clearwater Company**

The primary duties of the TAC was to conduct a resource inventory of the watershed, identify resource problems, develop alternatives, evaluate the alternatives, and recommend a salmon recovery plan. Both committees met regularly during 1993 and reviewed progress and information.

The ACCD prepared several news articles for local papers and the local radio station. The district also created the "Model Watershed News" to keep Asotin County residents informed of the progress of the Asotin Creek Watershed Plan and associated activities within the watershed. They made a

display for use at the Asotin County Fair and developed a demonstration site at Gene Thiessen's Ranch using an alternative livestock watering facility. A conservation field trial was also conducted at Thiessen's using several varieties of trees and shrubs planted along the creek. They held public tours, including a Tri-State Commission (Washington, Oregon, and Idaho) tour, and a personal tour for Washington State Governor, Mike Lowry. Members from the Landowner Steering Committee met with SCS Chief, Paul Johnson and provided a tour of the watershed. The project coordinator and committee members made numerous public presentations to groups such as the Soil and Water Conservation Society, Northwest Power Planning Council, and community citizens.

A key to the success of the Asotin Creek Model Watershed Program was selecting a project coordinator who was a resident and native of the area. This individual was familiar with watershed residents and shared their ideas and concerns for the future of the watershed. Also, of equal importance was directly involving local landowners in the decision making process, especially when decisions involved private land management. Together, these factors suppressed the bureaucratic overtones that local people were afraid a project of this nature could have and helped to promote a proactive approach to resource management in the Asotin Creek Model Watershed.

V I I . R E F E R E N C E S C I T E D

VII. REFERENCES CITED

- Barrett, D. 1994. Fish Biologist with the Cooperative Fisheries and Wildlife Unit of the University of Idaho. Personal Communication.
- Bauer, S.B. and T.A. Burton. 1993. Monitoring Protocols to Evaluate Water Quality Effects of Grazing Management on Western Rangeland Streams. U.S. Environmental Protection Agency #910/R-93-017
- Bell, Milo C. 1991. Fisheries Handbook of Engineering Requirements and Biological Criteria. For: U.S. Army Corps of Engineers - Fish Passage Development and Evaluation Program.
- Blomgren, S.W. 1994. Planning Engineer for NRCS, Spokane.
- Brown, George Wallace. 1972. An Improved Temperature Prediction Model for Small Streams. In: Ecological investigations on the Tucannon River, Washington. Esmaili and Associates, 1982.
- Brown, Larry. 1994. The Zoogeography and Life History of Washington Native Char. Washington Department of Fisheries, November 1992. Report #94-04.
- Bugert, R., K. Peterson, G. Mendel, L. Ross, D. Milks, J. Dedloff and M. Alexandersdottir. 1991. Tucannon River Spring Chinook Salmon Hatchery Evaluation Program. Washington Department of Fisheries. Progress Report #AFF-1/LSR-92-08.
- Bumgarner, Joseph, Glen Mendel, Lance Ross, Deborah Milks, and Jerry Dedloff. 1994. Tucannon River Spring Chinook Salmon Hatchery Evaluation Program - Lower Snake River Compensation Plan. Washington Department of Fisheries Annual Report, June 1994. for USFWS.
- Burck, W.A., R.B. Lindsay, B.J. Smith and E.A. Olsen. 1980. Oregon Department of Fish & Game, Annual Progress Report; Fish Research Project.
- Burton, M.L. 1991. Relationships Between Geomorphology and Riparian Complex Types in Southern Idaho. MS Thesis. Washington State University, Pullman, WA.
- Bustard, David R. and David W. Narver. 1975. Aspects of the Winter Ecology of Juvenile Coho Salmon (*Oncorhynchus kisutch*) and Steelhead Trout (*Salmo gairdneri*). Journal of the Fisheries Research Board of Canada. Vol. 32, #5, 667-680.

- Caldwell, Brad. 1994. Asotin Creek Instream Flow Incremental Method (Draft). for: Washington Department of Ecology.
- Caldwell, Brad. 1994. WDOE employee- Water Rights Division.
- Callihan, R.H., O. Schirman and F.E. Northam. 1990. Picloram Resistance in Yellow Starthistle. Western Society of Weed Science Research Progress Reports. 89-90.
- Cannamella, D.A. 1992. Potential Impacts of Releases of Hatchery Steelhead Trout "Smolts" on Wild and Natural Juvenile Chinook and Sockeye Salmon; a White Paper. Idaho Department Fish & Game, Boise, Idaho.
- Cannamella, D.A. 1994. Personal Communication. Idaho Dep. of Fish and Game, Boise.
- Certera, Phillip J. 1994. Personal Communication. Biologist with Coeur d'Alene Tribe, Plummer, Idaho.
- Chaney, Ed, Wayne Elmore and William S. Platts. 1993. Managing Change-Livestock Grazing on Western Riparian Areas. for: U.S. Environmental Protection Agency, Region 6. Denver, CO.
- Clary, Warren P. and Burt F. Webster. 1990. Riparian Grazing Guidelines for the Intermountain Region. Rangelands 12:209-212.
- Cook, Annabel and Mary Jordan. June 1994. Assessing County Change - the Implications of Social and Demographic Change in Southeastern Washington; Washington State University, Geography Department.
- Coombs, Bobby D. 1965. Effect of Temperature on the Development of Salmon Eggs. July, Progressive Fish Culturist.
- Cowardin, L.M., V. Carter, F.C. Golet and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79/31.
- Crawford, Bruce A. 1979. The Origin and History of the Trout Brood Stocks of the Washington Department of Game. for: Washington Department of Game.
- Douglas, J. 1994. Former WDG Area Fish Biologist for Southeastern Washington. Personal Communication.
- Eldred, T. 1994. Former WDG Area Fish Biologist in Southeastern Washington. Personal Communication.

- Fast, D., J. Hubble, M. Kohn and B. Watson. 1991. Yakima Spring Chinook Enhancement Study. Final Report by the Yakama Tribe for: Bonneville Power Administration, May.
- Fowler, P. 1993. Local Big Game Biologist with WDW in Walla Walla. Personal Communication and Letter Dated October, 1993.
- Foy, M., R.F. Brown and A.Y. Federenko. 1990. An Assessment of Three Improved Groundwater-Fed Side Channels as an Enhancement Technique for Chum and Coho in British Columbia. MS Report. Ministry of Fisheries.
- Groat, D. 1993, 1994. Local Fish Biologist for Umatilla National Forest, Pomeroy Ranger District. Personal Communication.
- Groat, D. and John Sanchez. 1994. Final Report for Asotin Creek Watershed. for USFS, Umatilla National Forest.
- Hallock, D. and G. Mendel. 1985. Instream Habitat Improvement in Southeastern Washington. Phase III of 1984 WDW Annual Report. USACE Contract #DACW 68-81-C-0128. February.
- Hankin, D.G. and G.H. Reeves. 1988. Estimating Total Fish Abundance and Total Habitat Area in Small Streams Based on Visual Estimation Methods. Canadian Journal of Fisheries and Aquatic Sciences 45: 834-844.
- Hasslen, D. and Jerry McCarl. 1992. Washington Agricultural Statistics Service. October. Tumwater, WA.
- Heinlen, Jeff and Rod Crow. 1992. North Fork of Asotin Creek, Stream Survey. unpublished data from USFS, Pomeroy Ranger District.
- Higgenbotham, Fred. 1995. USFS biologist. Pomeroy Ranger District. Personal Communication.
- Hitchcock, C.L. and A. Cronquist. 1981. Flora of the Pacific Northwest. University of Washington Press, Seattle, WA.
- Hitchum, R. 1985. Place Names of Washington.
- Holland, Roger. 1994. WDFW Area Manager of Chief Joseph Wildlife Area. Personal Communication.
- Hydrology Subcommittee. 1964. January. River Mile Index-Snake River. Part of Columbia Basin Interagency Committee for the Water Resources Committee, Washington, D.C. .
- Johnson, Carroll. 1994. Asotin Watershed Rancher on Landowner Steering Committee.

- Johnson, J.B., J.P. McCaffrey and F.W. Merickel, 1992.
Endemic Phytophagous Insects Associated with Yellow
Starthistle in Northern Idaho pan-Pacific Entomologist
68:169-173.
- Johnson, Rod. 1972. Asotin Chinook Survey for USFS.
- Johnson, Rod. 1993. Technician with USFS, Walla Walla, WA.
Personal Communication.
- Keller, Will. 1995. NRCS range conservationist in Okanogan
County, WA. 'Personal Communication
- Kleist, Todd. 1993. Former WDFW fish biologist in charge of
Columbia River fish counts at dams. Personal
Communication.
- Krakenberg, John. 1957.. June 5.. fish ladder inspector for
WDF, in: Memorandum H.T. Heg.
- Lacey, J.R. and C.B. Marlow, 1989. Spotted Knapweed Invasion
of Bunchgrass Ranges - A Concern for Soil and Water
Conservation. ~~Range Weeds~~ Revisited, pg 43. in Symposium
Proceedings, January 24-26, '1989. WSU Extension Service.
Spokane, WA.
- Larsen, R.E., J.R. Miner, J.C. Buckhouse, and J.A. Moore.
1994 Water Quality Benefits of Having Cattle Manure
Deposited Away From Streams Bioresource Technology
48:113-118.
- Larson, L.L. and M.L. McInnis. 1989. Impact of Grass
Seedlings on Establishment and Density of Diffuse Knapweed
and Yellow Starthistle. Northwest Science 63:162-166.
- Leopold, L.B., Wolman G.M., Miller J.P. 1964. Fluvial
Process in Geomorphology. W.H. Freeman and Company,
San Francisco, CA.
- Lindsay, R.B., B.J. Smith, E.A. Olsen and M.W. Flesher.1982.
Spring Chinook Studies in the John Day River.
- Maher, M. and L. Pilkey-Jarvis. 1994. Water Right
specialists for WDOE, Olympia, WA.
- Martin, S.W., A.E. Viola and M.L. Schucl. 1993.
Investigations of the Interactions Among Hatchery Reared
Summer Steelhead, Rainbow Trout and Wild Spring Chinook
Salmon in Southeast Washington. WDW Fisheries Management
Division Report #93-4. January.
- Maxie, Doug. 1995, Manager of WDFW Tucannon Hatchery,
Dayton, WA. Personal Communication.

- McIntosh, Bruce A. 1992. Stream Survey Summary for Asotin Creek and the Tucannon River. USFS PNW Research Station, Corvallis, OR.
- McIntosh, B.A., J.R. Sedell, J.E. Smith, R.C. Wissmar, S.E. Clarke, G.H. Reeves and L.A. Brown. 1993. Management History of Eastside Ecosystems: Changes in Fish Habitat Over 50 Years, 1935 to 1992.
- Mendel, Glenn. 1981. Lower Snake River Fishery Enhancement Study. Phase 1 Report, March 31. for: U.S. Army Corps of Engineers.
- Mendel, G. 1984. Instream Habitat Improvement in Southeastern Washington, Phase II of 1983 WDW Annual Report. USACE Contract #DACW 68-81-C-0128. February.
- Mendel, G. 1994. Local Fish Research Biologist for WDF&W in Dayton. Personal Communication.
- Mendel, G. and Mark Taylor. 1981. Lower Snake River Fishery Enhancement Study. WDG. Phase II Report. U.S. Corps of Engineers contract #DACW 68-81-C-0107.
- Mendel, G. and Rocky Ross. 1988. Instream Habitat Improvement in S.E. Washington - A Summary with Guidelines for Construction. May. WDF.
- Mendel, G., J. Bumgarner, K. Petersen, R. Bugert, L. Ross, D. Milks, J. Dedloff, J. Shaklee and C. Knutson. 1993. Tucannon River Spring Chinook Salmon Hatchery Evaluation Program. 1992 WDF Annual Report. USF&WS Cooperative Agreement #14-16-0001-92542. December.
- Mongillo, Paul E. 1993. The Distribution and Status of Bull Trout/Dolly Varden in Washington State, June 1992. WDW/Fisheries Management Division. Report #93-22.
- Monsen, S.B. 1984. The Competitive Influences of Cheatgrass (*Bromus tectorum*) on Site Restoration. Pg 43-50, in: Proceedings-Ecology and Management of Annual Rangelands; May 18-21, Boise, ID USDA, USFS Intermountain Research Station General Technical Report INT-GRT-313. Ogden, UT.
- Moore, Barry C. 1993. Asotin Creek Water Quality Monitoring: 1990 to 1993 (DRAFT). Clearwater Company, Pullman, WA.
- National Wildfire Coordinating Group. 1981. Fire Behavior. Boise, ID.
- Nelson, Derek. 1993. Off Channel Report for Naches Ranger District; student project through Central Washington College, Ellensburg, WA. 22 pg, unpublished.

- Nelson, J.R., A.M. Wilson and C.J. Goebel. 1970. Factors Influencing Broadcast Seeding in Bunchgrass Range. *Journal of Range Management*. 23:163-170.
- Northam, F.E. and R.H. Callihan. 1990. Grass Adaption to Semi-arid, Yellow Starthistle Infested Canyonlands.
- Parkhurst, Zell E. 1950. Survey of the Columbia River and its Tributaries, Part 6. Special Scientific Report - Fisheries #39. USF&WS. October.
- Petersen, N. Phil, Andrew Hendry, Dr. Thomas P. Quinn. 1992. Assessment of Cumulative Effects on Salmon Habitat: Some Suggested Parameters and Target Conditions. March 2. Center for Streamside Studies, University of Washington, for DNR.
- Pirtle, Ralph B. 1957. Field Studies to Estimate the Size and Timing of Runs of Anadromous Species in the Columbia and Spokane Rivers and Their Tributaries above the Confluence of the Snake River. Final Report to U.S. Army COE. IDFG, Boise.
- Raleigh, R.F., T.J. Hickman, K.L. Nelson, O.E. Maughan. 1980. Riverine habitat evaluation procedures for rainbow trout stream improvement workshop; 1980. USFS and Trout Unlimited: 50-59.
- Ransom, B., David Mudd, Mark Taylor. 1980. Feasibility of Improving Resident Rainbow Trout Production in Southeastern Washington by Habitat Improvement. WDG Phase 1 Report. December.
- Rice, P.M., J.C. Toney, D.J. Beduna and C.L. Carlson. 1993. Plant Biodiversity after Herbicide Applications. Knapweed 7:1-7. Washington Interagency Knapweed Committee Newsletter, WSU Extension Service, Pullman, WA.
- Richards, Carl, Phillip Cernera, Michael Ramey and Dudley Reiser. 1992. Development of Off Channel Habitats for Use by Juvenile Chinook Salmon. *North American Journal of Fisheries Management*. 12:721-727.
- Rosgen, D.L. 1985. A Stream Classification System. in: *Symposium-Riparian Ecosystems and Their Management*. First North American Riparian Conference. Rocky Mountain Forest and Range Experiment Station, Room 120, pg 91-95.
- Rosgen, Dave. 1994. Classification of Natural Rivers. *Catena* 22, No. 3, June, 169-199. Elsevier Publications, Amsterdam.

- Rosgen, D.L. and B.L. Fittante. 1986. Fish Habitat Structures-A Selection Guide Using Stream Classification. 5th Trout Stream Habitat Improvement Workshop. Lockhaven University, Lockhaven, PA. Pennsylvania Fish Commission Publications, Hamsburg, PA.
- Royal, Lloyd A. 1953. Effects of Regulatory Selectivity on the Productivity of Fraser River Sockeye. Canadian Fish Culturist. Issue 14:1-12.
- Sangster, Brian. 1994. Manager, Asotin County Conservation District. Personal Communication.
- Schroeder, Jim. 1994. Asotin District Conservationist and local sport fisherman. Personal Communication.
- Schuck, M.L. 1993. Fish Research Biologist with WDFW in Dayton, WA. Personal Communication.
- Snake River Salmon Recovery Team (SRSRT). 1993. Snake River Salmon Recovery Plan Recommendations (Draft). October.
- Southerland, W.B. 1993. Asotin Creek Stream Classification and Analysis Inventory Report. NRCS, Spokane, WA.
- Steel, Don. 1993. Former Game Agent for WDW in Southeastern Washington. Personal Communication.
- Swift, C.H. 1979. Preferred Stream Discharges for Salmon Spawning and Rearing in Washington. Open File Report #77-422. USGS and WDF.
- Thomsen, C.D., W.A. Williams, M.R. George, W.B. McHenry, F.L. Bell and R.S. Knight. 1989. Managing Yellowstar Thistle on Rangelands. California Agriculture 43:4-7.
- U.S. Army Corps of Engineers. January, 1966. Post Flood Report - December 1964, January 1965, Spring 1965. Walla Walla District (Washington).
- U.S.D.A. Soil Conservation Service. 1984. Southeast Washington Cooperative River Basin Study. 109 p.
- U.S.D.A. Soil Conservation Service. 1990. Soil Survey of Asotin County Area, Washington. 376 p. plus maps.
- Viola, A.E., M.L. Schuck and S.A. Nostrant. 1991. An Evaluation of Instream Habitat Alterations in Southeastern Washington 1983-1989. April.
- Weatherly, R. (Bob) 1994. Local Historian in Asotin County. Personal Communication.

Winward, A.H. and W.G. Padgett, 1987. Special Considerations When Classifying Riparian Areas. in: Proceedings-Land Classification Based on Vegetation: Applications for Resource Management. USFS. General Tech Report INT-257.

Wortman, Pat. 1993. Nez Perce Tribe Salmon Recovery Program for Wallowa County (Draft). County Commissioner.
Wydoski, Richard: S. and Richard R. Whitney. 1979. Inland Fishes of Washington'.

NOTE: The following references were used indirectly for background information but were not cited in this document. These refernces are useful for more detailed information concerning fluvial geomorphology and interactions of fish with their physical environment:

Dunne, T. and L.B. Leopold. 1978. Water in Environmental Planning. W.H. Freeman and Company, New York, NY.

King S.D. and G, Norman, editors. 1993. Status Report - Columbia River Fish Runs-and Fisheries, 2983-1992. By the Columbia River Management Joint Staff from the Oregon Department of Fish & Wildlife and Washington Department of Fish and Wildlife August,

Leopold; L.B. 1994. A View of the River, Harvard University Press. Cambridge, MA.

NOTE: Maps were developed from the following U.S.- Geological Survey 7.5' Quadrangles, 1:24,000 scale bade maps (paper):

Anatone, WA 1971(PR-83);
Asotin, WA-ID 1971
Clarkston., WA-ID 1971:
Fields Springs, WA 1971(PR-83);
Harlow Ridge, WA 1971 (PR-83)
Mountain View, WA 1971(PR-83);
Peola, WA 1971(PR-83);
Pinkham Butte, WA 1971(PR-83)
Potter Hill, WA 1971(PR-83.)
Rockpile Creek, WA 1971
Rose Springs, WA 1972(PR-83)
Saddle Butte, WA 1971(PR-83);
Silcott Island, Wa 1971:
Stentz, Spring WA 1971(PR-83);
Weissenfels Ridge, WA 1971;

VIII. GLOSSARY

VIII. GLOSSARY

anadromous fish: Adults ascend rivers from the ocean at certain seasons to reproduce; young rear partially in freshwater then in saltwater; for example, salmon, steelhead, and shad.

average annual erosion: The average amount of erosion that occurs during the period of one year.

braided stream: A stream with several unstable channels; usually the result of high sediment deposition.

chinook salmon: A variety of Pacific salmon common to the Columbia River system that utilize tributary streams and the main channel of the Columbia and Snake for spawning and early stages of the life cycle.

concentrated flow erosion: Erosion that may include channels of any size but usually is located in depressional areas. It is often caused by drill rows or tillage marks which "lead" the water to erode fields. It usually is wider and deeper than rill erosion and occurs in the main stems of the topographic drainage network. It is a one year event which is removed during tillage operations. It can occur where terraces "pipe" or overtop and can occur in the bottom of gradient terraces.

conservation district: A public organization created under state enabling law as a special-purpose district to develop and carry out a program of soil, water, and related resource conservation use, and development within its boundaries; usually a subdivision of state government with a local governing body.

conservation practices: Practices used to control erosion, conserve water, protect plants, or generally improve soil, water and plant resources. A technique or measure used to meet a specific need in planning and to carry out soil and water conservation programs for which standards and specifications have been developed. Practices identified in this report are from the Clarkston NRCS Field Office Technical Guide.

ecological site: In range terms its a kind of land with potential natural community and specific physical site characteristics, differing from other kinds of land in its ability to produce vegetation and to respond to management.

ecosystem: An interacting system of organisms considered together with their environment; for example: watershed, wetland or lake ecosystems.

erosion: The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep. The following terms are used to describe different types of Water erosion:

gully erosion: The erosion process whereby water accumulates in narrow channels or depressions which are on an incline and, over short periods,, removes the soil from this narrow area to considerable depths, ranging from 1 foot to as much as 100 feet.

natural erosion: Wearing away of the earth's surface by water, ice or other natural agents under natural environmental conditions of climate, vegetation, etc., undisturbed by man.

rill erosion: An erosion process in which numerous small channels, only several inches deep are formed; occurs mainly on recently cultivated soils,

sheet erosion: The removal of a fairly uniform layer of soil from the land surface by runoff water

stream channel erosion: Lateral recessions of the streambanks and/or degradation of the streambed by stream flow action.

tillage erosion: The downhill movement of soil caused during use of tillage implements for crop production.

erosion rate: The amount or degree of wearing away of the land surface.

fingerling; A juvenile salmonid, generally the stage between fry and smolt. Roughly equivalent to a "parr".

fish habitat: An area in a stream or lake that is suitable for fish to live and which includes food,, hiding cover, suitable water quantity and quality, spawning areas, -etc.

floodplain: Nearly level land situated on one or both sides of a stream channel that is "constructed. by the stream in [historically] recent climate-and overflow during moderate flow events.

forage production: The weight of forage that is produced within a designated period of time on a, given area; 'may' be, expressed as either green, air-dry, or oven-dry; may also be modified as to time of production such as annual, current year's, or seasonal forage production.

fry: The first free swimming stage of a juvenile salmonid fish (after emerging from the gravel).

geomorphic: Of or pertaining to the shape of the earth's surface features. Called fluvial geomorphology when describing the shape, of a channel

habitat: The environment which is needed to support an individual plant or animal or a population or community of plants and animals. It must supply food, water, shelter and reproductive amenities.

instream structure: Features such as logs, rocks, and root wads that create pools and provide resting and hiding areas for fish and their food supply.

key climax species: Important plant species on a specific ecological site that are used to base management decisions and determine trend.

loess: Material transported and deposited by wind and consisting of predominantly silt-sized particles.

native grasses: Grasses that are part of an area's original (generally pre-settlement) fauna or flora.

rangeland: Land on which the native vegetation (climax or natural potential) is predominantly grasses, grass-like plants, forbs, or shrubs suitable for grazing or browsing use. Includes lands revegetated naturally or artificially to provide a forage cover that is managed like native vegetation. Rangelands include natural grassland, savannas, shrublands, most deserts, tundra, alpine communities, coastal marshes, and wet meadows.

range management systems: Grazing systems applied on rangeland.

rearing habitat: Living area for juvenile fish.

redd: A spawning nest, containing incubating eggs, made in the gravel bed of a stream or lake by a fish.

resident fish: Non-migratory fish such as certain trout, dace and sculpin.

riparian vegetation: A water influenced plant community; water loving plants along streambanks such as willows and cottonwoods.

river basin: The area drained by a river and its tributaries.

salmonids: Trout, salmon, chars, whitefish, and grayling.

sediment: Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface either above or below sea level.

sediment yield: The sediment discharge from a unit of drainage area, generally expressed in tons per square mile or acre.

silt: (1) A soil consisting of particles between 0.05 and 0.002 millimeter in equivalent diameter or (2) a class of soil texture.

silt loam: A soil texture class containing a large amount of silt and small quantities of sand and clay

silty clay: A soil texture class containing a relatively large amount of silt and clay and a small amount of sand.

smolt: The life stage of anadromous fish during which physiological changes prepare it for transition from freshwater to marine life; generally occurs at onset of active downstream migration,

soil loss tolerance levels: The maximum rate of annual soil loss that will permit crop productivity to be obtained economically and indefinitely.. To many this means "meeting T"

spawning beds: Areas within a stream or lake containing clean gravel in which fish deposit eggs to complete their embryonic development.

stream glide: That area of the water column that does not form distinguishable pools, riffles, or runs because it is usually too shallow to be a pool and too slow to be a run, Water surface gradient over the glide is nearly zero.

stream reach: A length of stream channel selected for use in hydraulic computations or for comparison of all of its attributes with other reaches

stream riffle: Riffles are portions of the water column where water velocity is fast, stream depths are relatively shallow., and water surface gradient is relatively steep: Channel profile is usually straight to convex. Fish expend high amounts of energy in riffles to maintain position.

stream system: A stream and its tributaries into which water within the confines of a watershed will drain.

summerfallow: The tillage of uncropped land during the summer in order to control weeds and store moisture in the soil for the growth of a later crop.

technical assistance: providing practical assistance to land users in planning and applying conservation practices. Technical assistance is often provided by SCS in addition to financial assistance such as ACP cost-sharing.

tillage: The operation of implements through the soil to prepare seedbeds' and root beds.

topography: The relative positions and elevations of the natural or man-made features of an area that describe the configuration of its surface.

topsoil: The surface plow layer of a soil; also called surface soil. The original or present dark-colored upper soil that ranges from a mere fraction of an inch to two or three feet thick. The original or present "A horizon", varying widely among different kinds of soil. Applied to soils in the field, the term has no precise meaning unless defined as to its depth or the productivity in relation to a specific kind of soil.

tributary: Secondary or branch of a stream, drain, or other channel that contributes flow to the primary or main channel.

universal soil loss equation (USLE): An equation used to design water erosion control systems: $A = RKLSPC$ wherein A is average annual soil loss in tons per acre per year; R is the rainfall factor, K is the soil erodibility factor; L is the length of the slope; S is the percent slope; P is the conservation practice factor; and C is the cropping and management factor. $T =$ soil loss tolerance value that has been assigned each soil, expressed in tons per acre per year).

upland. areas: The higher part of a region or tract of land; generally described as everything higher than the floodplain or water body; similarly: inland country upcountry.

urban area: An area predominantly occupied by manmade structures: the Bureau of census defines communities of over 2,500 as urban areas.

water quality: The chemical, physical and biological condition of water related to beneficial. use.

watershed area: All land and water within the confines of a drainage divide. Also, a water "problem area" consisting in whole; or in part, of land needing drainage or irrigation.

wetland Land where water on or near the soil surface is the dominant factor determining the types of plant and animal communities living in the soil or on its surface.

wildlife: Undomesticated animals (does not include feral animals), generally assumed to be living in their natural habitat.

IX. LIST OF PREPARERS

IX. LIST OF PREPARERS

	PRESENT TITLE Time on Job (Yrs)	EDUCATION Degrees	PRIOR EXPERIENCE (Titles & Time in Job - Yrs)	OTHER
<u>NRCS Field Office Staff</u>				
Jim R. Schroeder	Dist Cons-7	BS Range Science	Soil cons-5	
Courtney B. Smith	Range Cons-10	BS History MS Range Ecology	Range Tech-5	
Brian Sangster(District)	Dist Manager-3	AAS Livestock Production & Ag Production	'Resource Tech-2	
<u>NRCS Area Office Staff</u>				
Stephen G. During	Area Enge-4	BS Social Sciences Bs Civil/Env Enge MS public Admin	Civil Engr-4 Project Engr-7	PE, Washington PE Montana
<u>NRCS State Office Staff</u>				
Frank R. Easter	Asst State Cons Programs-4	AS Forestry B'S Range Mgmt	Area Cons-9 Dist cons-7 Soil Cons-2 Range Cons-2	
G. Larry Edmonds	State Economist-4	BS Ag	Ag Economist-20	
David R. Brower	NRP cartographer-3	BA Geography Cartography	Prod Supr U of Kan Cart Serv-1.5 Senior Map Ed Johnson Co Kan-1	
Wm Barry Southerland	NRP Resource Cons-4	BS Range/Soil MPA Natr Res Mgmt	HU Proj coord-2.5 Supr Soil Cons-2 Soil Cons-5 Range Cons-3	Soil & Water Cons Soc CPESC #514
Larry C. Cooke	NRP Eny Spec-2	BS Natural Res. Mgmt	Dist Cons-14 Soil Cons-2 Soil Cons Tech-2	State Certified Pesticide Consultant
Michael L. Burton	NRP Soil Cons-2	BS Range Mgmt MS Riparian Ecology	Soil Cons-1 Resource Cons-3 Soil cons-2	
Mark H. Schuller	NRP Biologist-Z	BS Fishery Sci Minor Wildlife Mgmt	Regional Habitat Manager Washington ST Dept of Fisheries-19	

	PRESENT TITLE Time on Job (Yrs)	EDUCATION Degrees	PRIOR EXPERIENCE (Titles & Time in Job - Yrs)	OTHER
Stephen W. Blomgren	NRP Planning Engr-4	BS Ag Engr	Ag Engr-10 Proj Engr-3 RC&D Proj Engr-6 Field Engr-5	PE Washington Ag Engr #18229
Joan E. Mattson	State Geologist-2	BS Geology	Geologist-6 Minerology Tech-4	
<u>OTHER Agencies</u>				
Mark A. Shaw (BPA)	Fisheries Habitat Biologist-4	BS Fish & Wild- life Mgmt	US Forest Service Fisheries/Habitat Biologist-13	
Robert D. Housley (USFS)	District Planner-3	BS Economics BS Forest Mgmt	USFS Sale Admin.-7	
Del Groat (USFS)	District Fisheries Biologist-4	BS Fish Biology	Bio. Tech.-6	Utah State (Continuing Ed.)
Mark Schuck (WDFW)	Fishery Biologist-17	BS Fishery Sci	Asst. Dist. Biologist US BLM-2	
Barry C. Moore (WSU)	Aquatic Ecologist-16	BS Environ Sci wS Environ Sci PhD Environ Engr		

X . A P P E N D I C E S

APPENDIX A: RESOURCE INVENTORY MAPS

ASOTIN CREEK MODEL WATERSHED

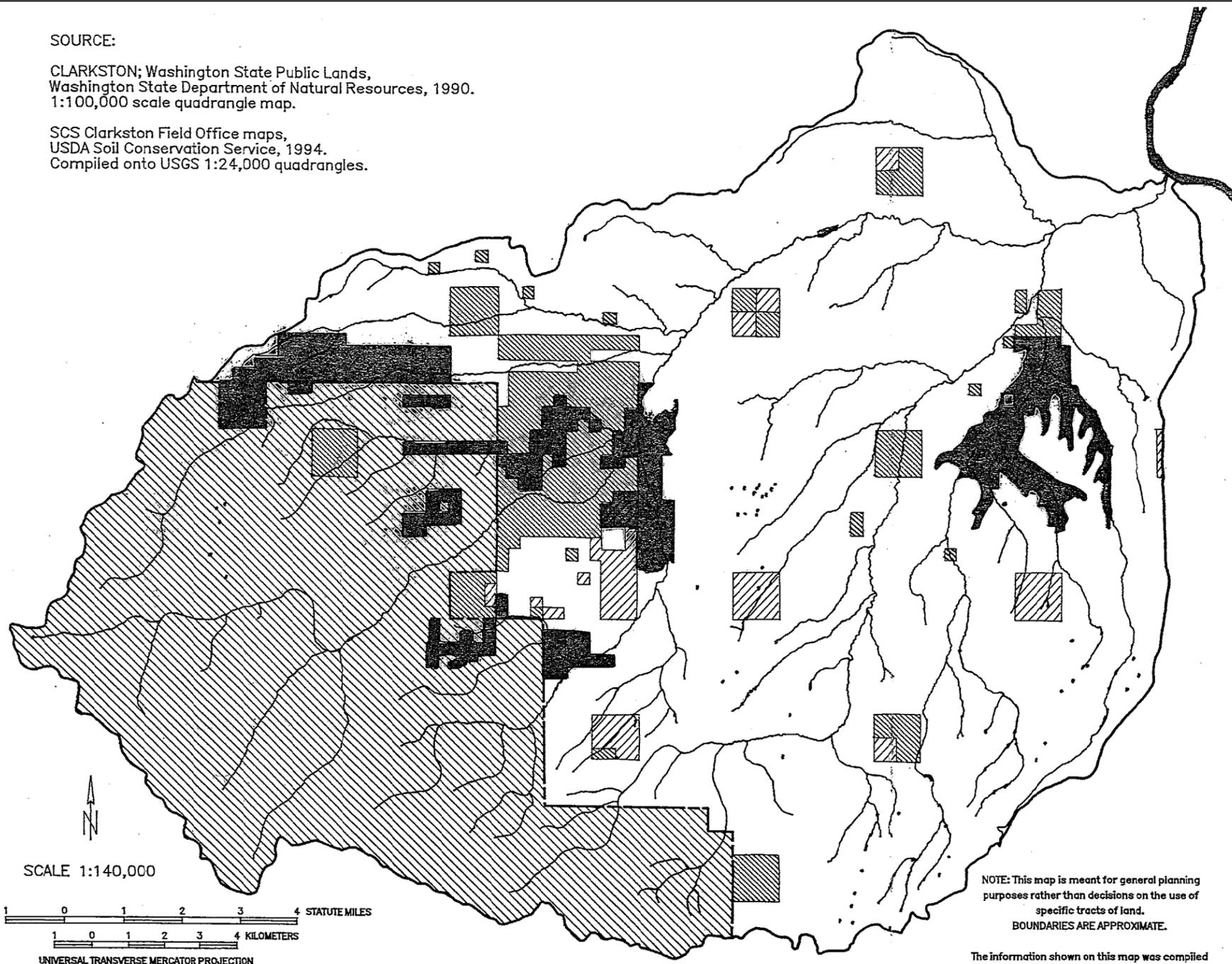
Asotin and Garfield Counties, Washington

GENERAL OWNERSHIP MAP

SOURCE:

CLARKSTON; Washington State Public Lands,
Washington State Department of Natural Resources, 1990.
1:100,000 scale quadrangle map.

SCS Clarkston Field Office maps,
USDA Soil Conservation Service, 1994.
Compiled onto USGS 1:24,000 quadrangles.



- Watershed Boundary
- Streams and Rivers
- General Land Ownership Boundaries
- Umatilla National Forest Boundary
- Open Water
- Private Lands
- ▨ State Lands – WDNR
Department of Natural Resources
- ▩ State Lands – WDNR
Department of Natural Resources
(Mineral Rights Only)
- State Lands – WDFW
Department of Fish and Wildlife
- ▨ Federal Lands – USFS
US Forest Service
(Umatilla National Forest)
- ▨ Federal Lands – BLM
US Bureau of Land Management
- Public Parks
Headgates County Park



USDA Soil Conservation Service, May 1994
Washington State Office, Spokane
in cooperation with the
Asotin County Conservation District

Map Constructed Using SCS GRASS4.0-MAPGEN Interface

The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (braille, large print, audiotape, etc.) should contact the USDA Office of Communications at (202)720-5881 (voice) or (202)720-1127 (TDD).

To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, D.C., 20250, or call (202)720-7327 (voice) or (202)720-1127 (TDD).
USDA is an equal employment opportunity employer.

NOTE: This map is meant for general planning purposes rather than decisions on the use of specific tracts of land.
BOUNDARIES ARE APPROXIMATE.

The information shown on this map was compiled using SCS GRASS and USFS MOSS GIS data layers.

SCALE 1:140,000
1 0 1 2 3 4 STATUTE MILES
1 0 1 2 3 4 KILOMETERS
UNIVERSAL TRANSVERSE MERCATOR PROJECTION
ZONE 11

ASOTIN CREEK MODEL WATERSHED

Asotin and Garfield Counties, Washington

WATER QUALITY MONITORING SITES MAP

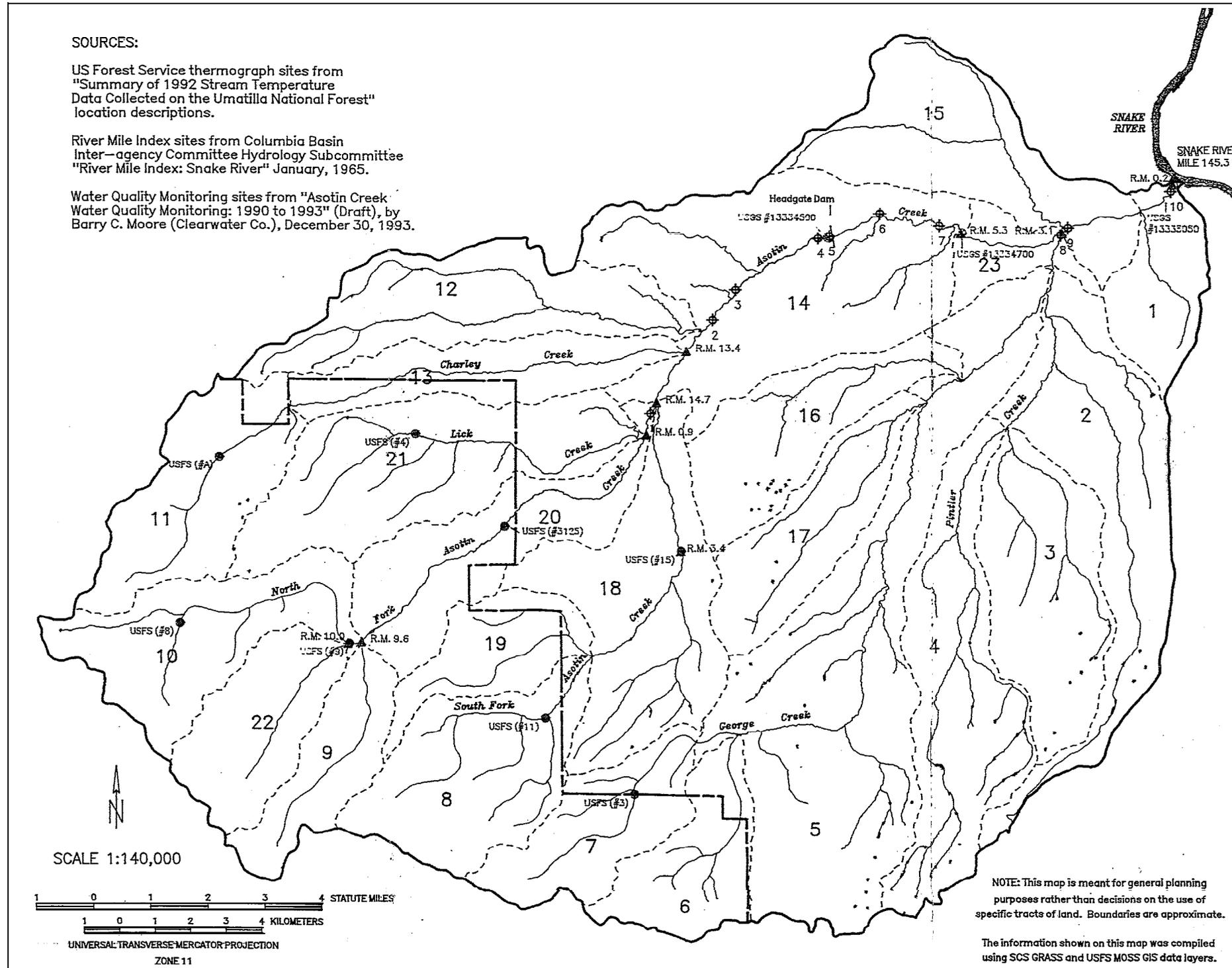
SOURCES:

US Forest Service thermograph sites from "Summary of 1992 Stream Temperature Data Collected on the Umatilla National Forest" location descriptions.

River Mile Index sites from Columbia Basin Inter-agency Committee Hydrology Subcommittee "River Mile Index: Snake River" January, 1965.

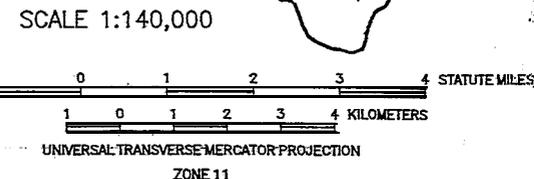
Water Quality Monitoring sites from "Asotin Creek Water Quality Monitoring: 1990 to 1993" (Draft), by Barry C. Moore (Clearwater Co.), December 30, 1993.

- Watershed Boundary
- Sub-watershed Boundaries
- Streams and Rivers
- Umatilla National Forest Boundary
- USFS Thermograph Sites
- ▲ River Mile Index Sites
- ⊕ Water Quality Monitoring Sites #1-10
- ⊕ USGS Gauges 13335050, 13334700 and 13334500
- Open Water



RIVER MILE INDEX SITES	USFS THERMOGRAPH SITES	WQ MONITORING SITES
Snake River River Mile 145.3	(#3) George Creek	1 River Mile 14.9
Asotin Creek River Mile 0.2	(#4) Lick Creek	2 River Mile 12.9
Asotin-Creek River Mile 3.1	(#8) N.F. Asotin Creek:	3 River Mile 12.0
Asotin Creek River Mile 5.3	Above Cougar Creek	4 River Mile 9.3
Asotin Creek River Mile 5.4	(#9) N.F. Asotin Creek	5 River Mile 9.0
Asotin Creek River Mile 4.7	(#11) S.F. Asotin Creek	6 River Mile 7.8
N.F. Asotin Creek River Mile 0.9	(#15) S.F. Asotin Creek	7 River Mile 6.0
N.F. Asotin Creek River Mile 9.6	(#3125) N.F. Asotin Creek:	8 River Mile 3.1
N.F. Asotin Creek River Mile 10.0	Trail Head	9 River Mile 3.0
S.F. Asotin Creek River Mile 3.4	(#A) Charley Creek	10 River Mile 0.5

ASOTIN CREEK SUB-WATERSHEDS	
1 - Asotin Town Subshed	12 - Blankenship Gulch
2 - Ayers Gulch	13 - Charley creek
3 - Kelly Gulch	14 - Asotin Creek Main Stem
4 - Pintler Creek	15 - Maguire Gulch
5 - George Creek	16 - Rockpile Creek
6 - Coombs Canyon	17 - Long, Stringtown Gulch
7 - Upper Segment of George Creek	18 - Lower Reach, South Fork Asotin Creek
8 - Hogback/Park Ridge	19 - Dark/Cooper Canyons
9 - South Fork of North Fork	20 - North Fork Asotin Creek, Main Stem
10 - North Section: Upper Reach	21 - Lick Creek
North Fork	22 - Middle Branch, South Fork
11 - Upper Reach Charley Creek	23 - Jerry



NOTE: This map is meant for general planning purposes rather than decisions on the use of specific tracts of land. Boundaries are approximate.

The information shown on this map was compiled using SCS GRASS and USFS MOSS GIS data layers.

USDA Soil Conservation Service, May 1994
 Washington State Office, Spokane
 in cooperation with the
 Asotin County Conservation District

Map Constructed Using SCS GRASS4.0-MAPGEN Interface
 The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (braille, large print, audiotape, etc.) should contact the USDA Office of Communications at (202)720-5881 (voice) or (202)720-1127 (TDD).

To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, D.C., 20250, or call (202)720-7327 (voice) or (202)720-1127 (TDD).
 USDA is an equal employment opportunity employer.

ASOTIN CREEK MODEL WATERSHED

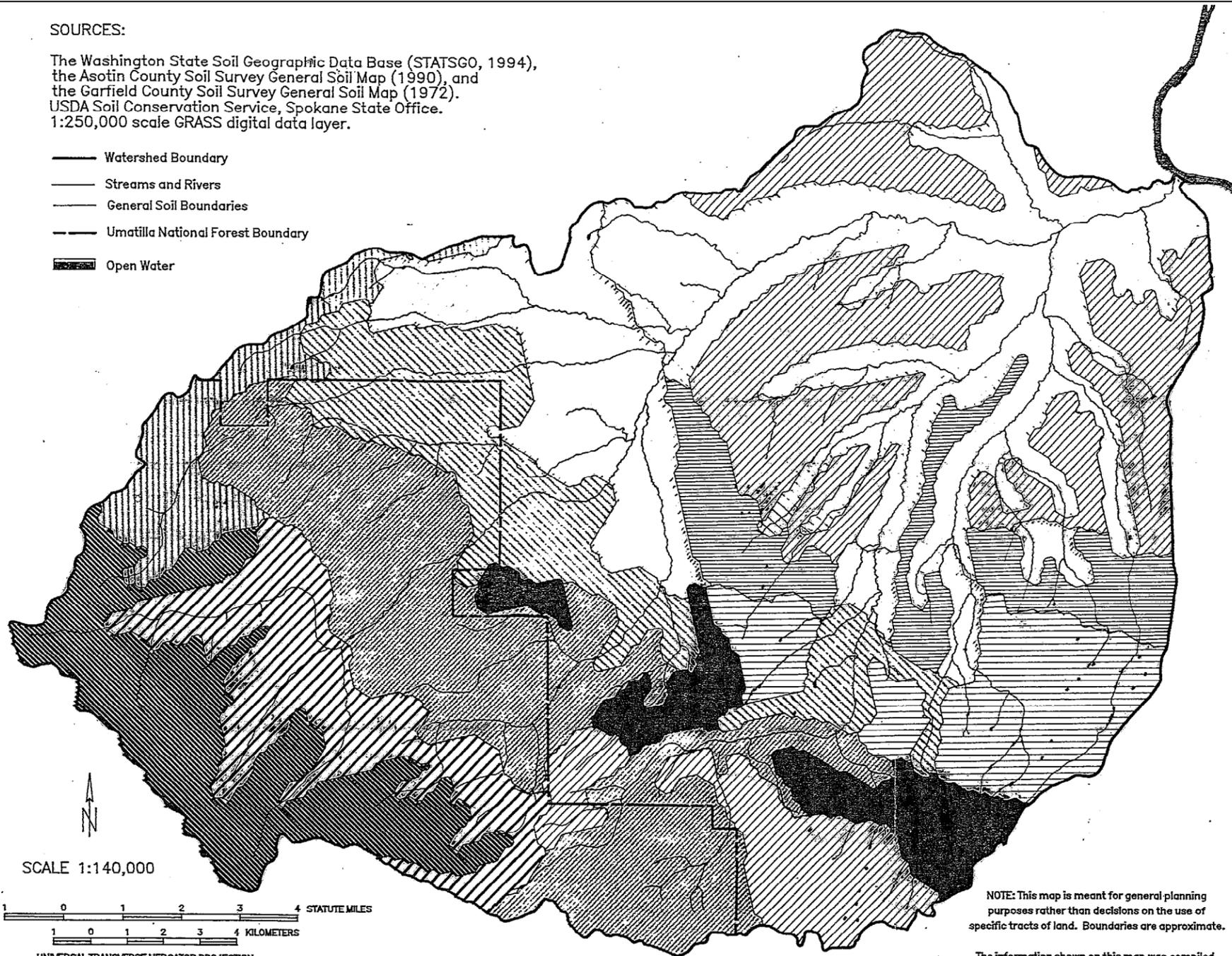
Asotin and Garfield Counties, Washington

GENERAL SOIL MAP

SOURCES:

The Washington State Soil Geographic Data Base (STATSGO, 1994), the Asotin County Soil Survey General Soil Map (1990), and the Garfield County Soil Survey General Soil Map (1972). USDA Soil Conservation Service, Spokane State Office. 1:250,000 scale GRASS digital data layer.

- Watershed Boundary
- Streams and Rivers
- General Soil Boundaries
- Umatilla National Forest Boundary
- Open Water



- WA003 LICKSKILLET-SCHUELKE-BOLICKER: Shallow to very deep, well drained, gently sloping to very steep soils in the 12-to-15 inch precipitation zone; on canyon walls, foot slopes, slump blocks, and shoulder slopes.
- WA004 LAUFER-THIESSEN-MATHENY: Shallow to very deep, well drained, strongly sloping to very steep soils in the 15-to-18 inch precipitation zone; on canyon walls, slump blocks, and foot slopes.
- WA005 GWINLY-MALLORY-LAWYER: Shallow to very deep, well drained, gently sloping to very steep soils in the 18-to-25 inch precipitation zone; on canyon walls and shoulder slopes.
- WA006 NIMS-WEISSENFELLS-OLICAL: Moderately deep and very deep, well drained and moderately well drained, gently sloping to moderately steep soils in the 12-to-15 inch precipitation zone; on plateaus and hillslopes.
- WA007 STEMBER-PATAHA-NEISSENBERG: Moderately deep, well drained and moderately well drained, gently sloping to strongly sloping soils in the 15-to-18 inch precipitation zone; on plateaus and hillslopes.
- WA008 PEOLA-NEISSENBERG-CATHEEN: Moderately deep and very deep, well drained and moderately well drained, gently sloping to steep soils in the 15-to-18 inch precipitation zone; on plateaus and hillslopes.
- WA009 SWEITBERG-SNELL-SWEITBERG VARIANT: Moderately deep and deep, well drained, gently sloping to strongly sloping in the 20-to-22 inch precipitation zone; on plateaus.
- WA010 CLOVERLAND-SWEITING-TOLO: Moderately deep and very deep, well drained and moderately well drained, gently sloping to steep soils; on mountain plateaus, benches, and hillslopes.
- WA011 HARLOW-GETAWAY-SNELL: shallow to deep, well drained, gently sloping to very steep soils on mountainsides, mountain plateaus, canyon walls, shoulder slopes, benches, and ridgetops.
- WA019 NECONDA-FERDINAND-POWWAHKEE: Moderately deep and very deep, well drained, gently sloping to moderately steep soils in the 17-to-20 inch precipitation zone; on plateaus and hillslopes.
- WA068 KLICKER-GWIN-TOLO ASSOCIATION: Deep and very deep, strongly sloping to steep silt loams and shallow, moderately steep to very steep, extremely stony soils; 20-to-30 inches annual precipitation.
- WA122 TOLO-HIGHHORN: Deep and very deep, well drained, gently sloping to very steep soils on mountainsides, mountain plateaus, canyon walls, shoulder slopes, benches, and ridgetops.
- WA125 ANGELPEAK-EAGLECAP-HELTER: deep and very deep, well drained, gently sloping to very steep soils on mountainsides, mountain plateaus, canyon walls, shoulder slopes, benches, and ridgetops.



USDA Soil Conservation Service January 1994

Washington State Office, Spokane
in cooperation with the
Asotin County Conservation District

Map Constructed Using SCS GRASS 4.0-MAPGEN Interface

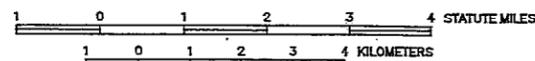
The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (braille, large print, audiotape, etc.) should contact the USDA Office of Communications at (202)720-5881 (voice) or (202)720-1127 (TDD).

To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, D.C., 20250, or call (202)720-7327 (voice) or (202)720-1127 (TDD).
USDA is an equal employment opportunity employer.

NOTE: This map is meant for general planning purposes rather than decisions on the use of specific tracts of land. Boundaries are approximate.

The information shown on this map was compiled using SCS GRASS and USFS MOSS GIS data layers.

SCALE 1:140,000



UNIVERSAL TRANSVERSE MERCATOR PROJECTION
ZONE 11

ASOTIN CREEK MODEL WATERSHED

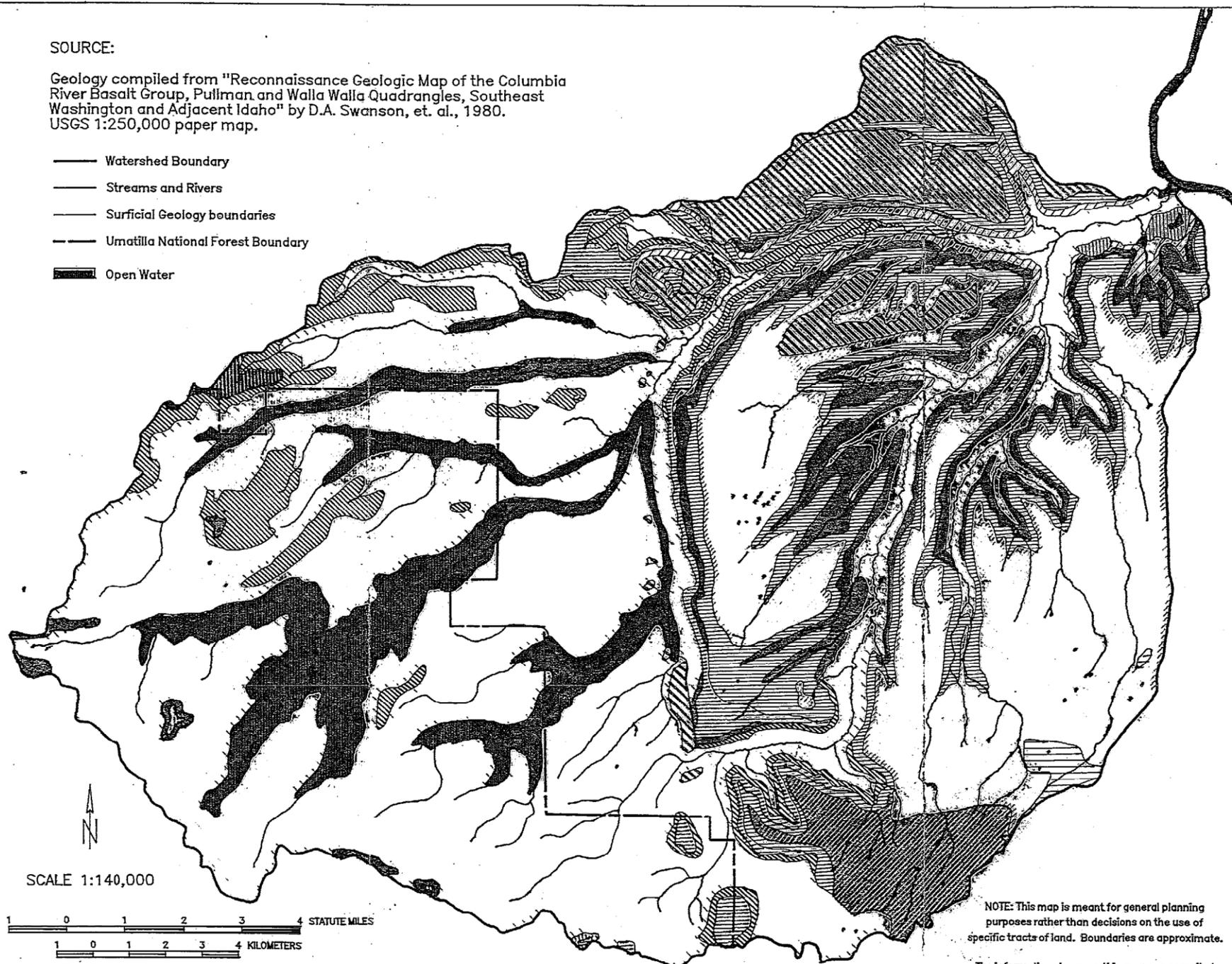
Asotin and Garfield Counties, Washington

SURFICIAL GEOLOGY MAP

SOURCE:

Geology compiled from "Reconnaissance Geologic Map of the Columbia River Basalt Group, Pullman and Walla Walla Quadrangles, Southeast Washington and Adjacent Idaho" by D.A. Swanson, et. al., 1980. USGS 1:250,000 paper map.

- Watershed Boundary
- Streams and Rivers
- Surficial Geology boundaries
- Umatilla National Forest Boundary
- Open Water



- ▨ Tsg – Gravel
- Tl – Saddle Mountains Basalt
- ▨ Tb – Buford Member Basalt Flow
- ▨ Tem – Elephant Mountain Member Basalt Flow and Dike
- ▨ Tws – Slippery Creek Basalt
- ▨ Twl – Lewiston Orchards Basalt
- ▨ Ta – Asotin Member and Sedimentary Rocks
- ▨ Tu – Umatilla Member Basalt Flows
- ▨ Twu – Wilbur Creek and Umatilla Members, Undivided
- ▨ Tpr – Priest Rapids Member Basalt Flows and Dikes
- ▨ Tr – Roza Member Basalt Flows, Tephra, and Dikes
- ▨ Tes – Shumaker Creek Basalt
- ▨ Ted – Dodge Basalt
- ▨ Tfd – Frenchman Springs Member Basalt Flows
- ▨ Tgn2 – Upper Flows Grande Ronde Basalt, Normal Polarity
- ▨ Tgr2 – Upper Flows Grande Ronde Basalt, Reversed Polarity
- ▨ Tgn1 – Upper Flows Grande Ronde Basalt, Normal Polarity



USDA Soil Conservation Service January 1994
 Washington State Office, Spokane
 in cooperation with the
 Asotin County Conservation District
 Map Constructed Using SCS GRASS4.0-MAPGEN Interface

The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (braille, large print, audiotape, etc.) should contact the USDA Office of Communications at (202)720-5881 (voice) or (202)720-1127 (TDD).

To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, D.C., 20250, or call (202)720-7327 (voice) or (202)720-1127 (TDD).
 USDA is an equal employment opportunity employer.

NOTE: This map is meant for general planning purposes rather than decisions on the use of specific tracts of land. Boundaries are approximate.

The information shown on this map was compiled using SCS GRASS and USFS MOSS GIS data layers.

SCALE 1:140,000

1 0 1 2 3 4 STATUTE MILES

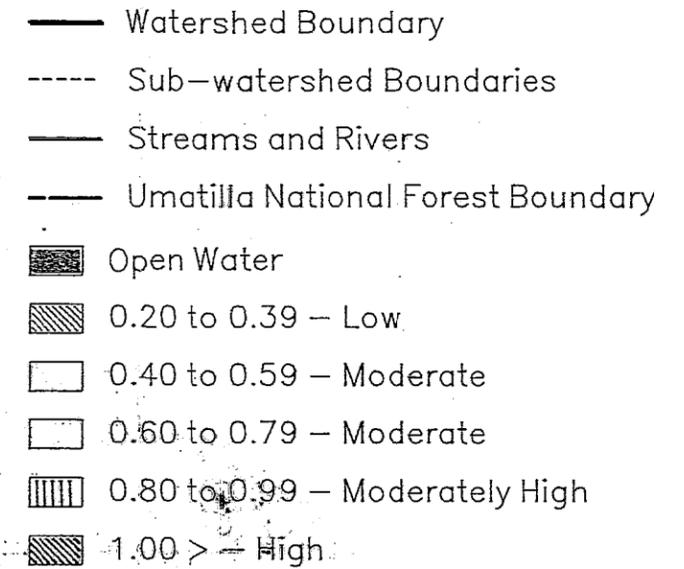
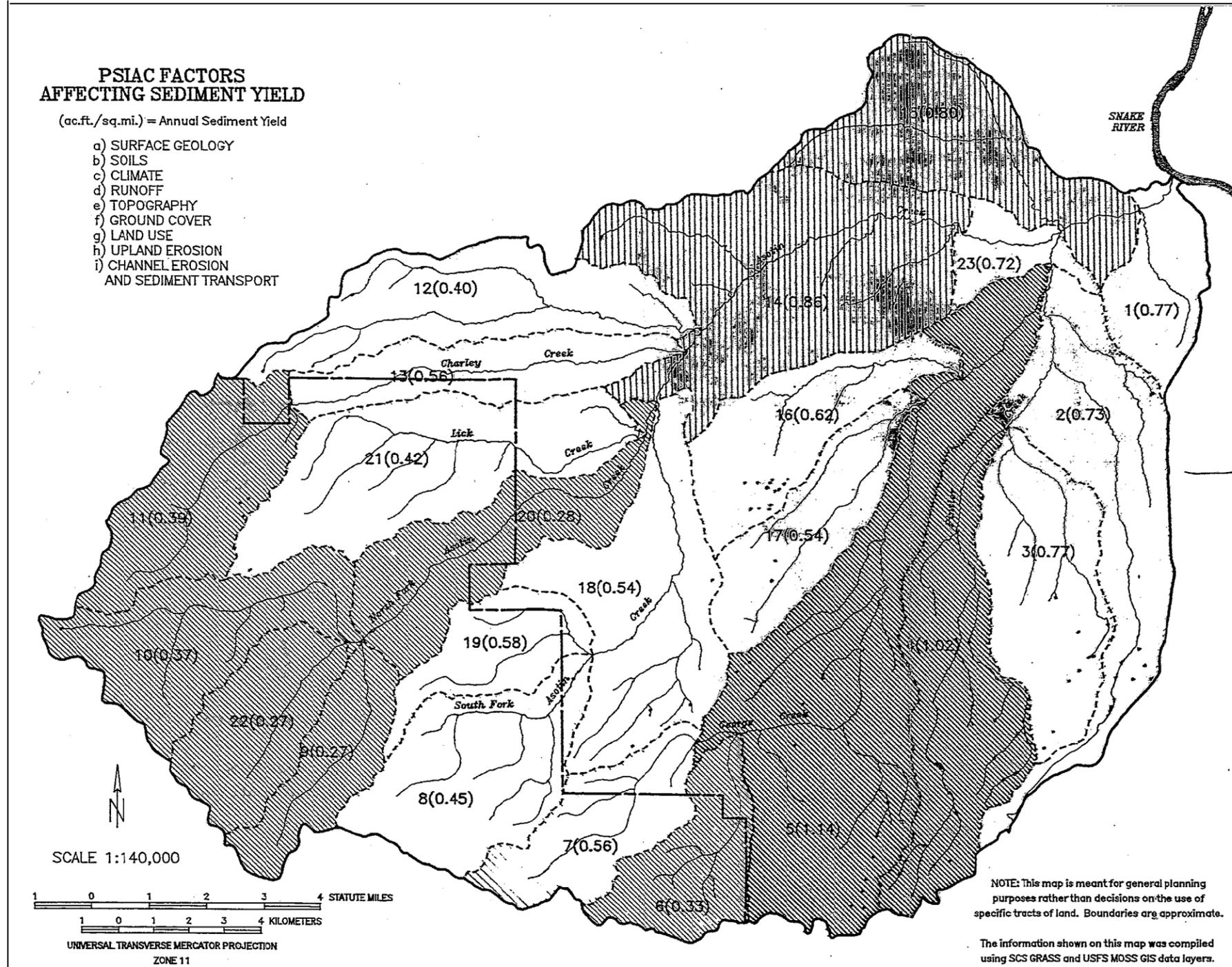
1 0 1 2 3 4 KILOMETERS

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
ZONE 11

ASOTIN CREEK MODEL WATERSHED

Asotin and Garfield Counties, Washington

PACIFIC SOUTHWEST INTER-AGENCY COMMITTEE (PSIAC) SEDIMENT YIELD RATINGS MAP



(ac.ft./sq.mi.) = Annual Sediment Yield

ASOTIN CREEK SUB-WATERSHEDS

- 1 - Asotin Town Subshed
- 2 - Ayers Gulch
- 3 - Kelly Gulch
- 4 - Pinfiler Creek
- 5 - George Creek
- 6 - Coombs Canyon
- 7 - Upper Segment of George Creek
- 8 - Hogback/Park Ridge
- 9 - South Fork of North Fork
- 10 - North Section, Upper Reach North Fork
- 11 - Upper Reach Charlie Creek
- 12 - Blankenship Gulch
- 13 - Charley creek
- 14 - Asotin Creek Main Stem
- 15 - Maguire Gulch
- 16 - Rockpile Creek
- 17 - Long, Stringtown Gulch
- 18 - Lower Reach, South Fork Asotin Creek
- 19 - Dark/Cooper Canyons
- 20 - North Fork Asotin Creek, Main Stem
- 21 - Lick Creek
- 22 - Middle Branch, South Fork
- 23 - Jerry



USDA Soil Conservation Service January 1994

Washington State Office, Spokane

in cooperation with the

Asotin County Conservation District

Map Constructed Using SCS GRASS4.0-MAPGEN Interface

The United States Department of Agriculture (USDA) prohibits discrimination in its program on the basis of race, color, national origin, sex, religion, age, disability, political beliefs and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (braille, large print, audiotape, etc.) should contact the USDA Office of Communications at (202)720-5881 (voice) or (202)720-1127 (TDD).

To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, D.C., 20250, or call (202)720-7327 (voice) or (202)720-1127 (TDD). USDA is an equal employment opportunity employer.

NOTE: This map is meant for general planning purposes rather than decisions on the use of specific tracts of land. Boundaries are approximate.

The information shown on this map was compiled using SCS GRASS and USFS MOSS GIS data layers.

ASOTIN CREEK MODEL WATERSHED

Asotin and Garfield Counties, Washington

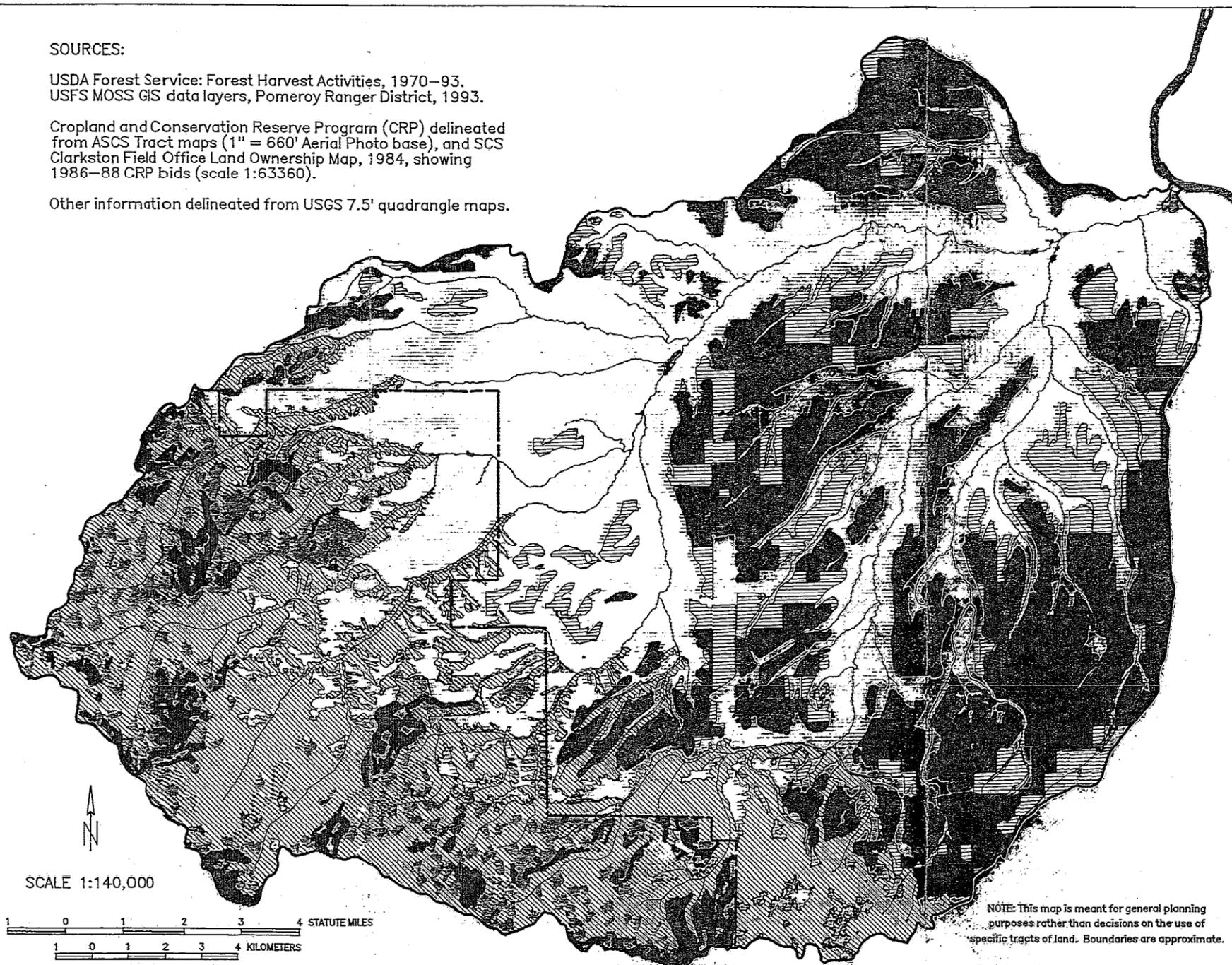
LANDUSE MAP

SOURCES:

USDA Forest Service: Forest Harvest Activities, 1970-93.
USFS MOSS GIS data layers, Pomeroy Ranger District, 1993.

Cropland and Conservation Reserve Program (CRP) delineated from ASCS Tract maps (1" = 660' Aerial Photo base), and SCS Clarkston Field Office Land Ownership Map, 1984, showing 1986-88 CRP bids (scale 1:63360).

Other information delineated from USGS 7.5' quadrangle maps.



- Watershed Boundary
- Streams and Rivers
- - - Umatilla National Forest Boundary
- ▬ Open Water
- ▩ Urban/Farmsteads
- ▨ Conservation Reserve Program (CRP)
- Dry Cropland
- ▧ Irrigated Cropland
- ▤ Rangeland and Pastureland
- ▦ Forest: No Harvest Activity
- ▥ Forest: Even Age Management, 1970-93
- ▧ Forest: Uneven Age Management, 1970-93
- ▨ Forest: Woodland Improvements, 1970-93



USDA Soil Conservation Service January 1994
 Washington State Office, Spokane
 in cooperation with the
 Asotin County Conservation District

Map Constructed Using SCS GRASS4.0-MAPGEN Interface

The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (braille, large print, audiotape, etc.) should contact the USDA Office of Communications at (202)720-5881 (voice) or (202)720-1127 (TDD).

To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, D.C., 20250, or call (202)720-7327 (voice) or (202)720-1127 (TDD).
 USDA is an equal employment opportunity employer.

SCALE 1:140,000

1 0 1 2 3 4 STATUTE MILES

1 0 1 2 3 4 KILOMETERS

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
 ZONE 11

NOTE: This map is meant for general planning purposes rather than decisions on the use of specific tracts of land. Boundaries are approximate.

The information shown on this map was compiled using SCS GRASS and USFS MOSS GIS data layers.

ASOTIN CREEK MODEL WATERSHED

Asotin and Garfield Counties, Washington

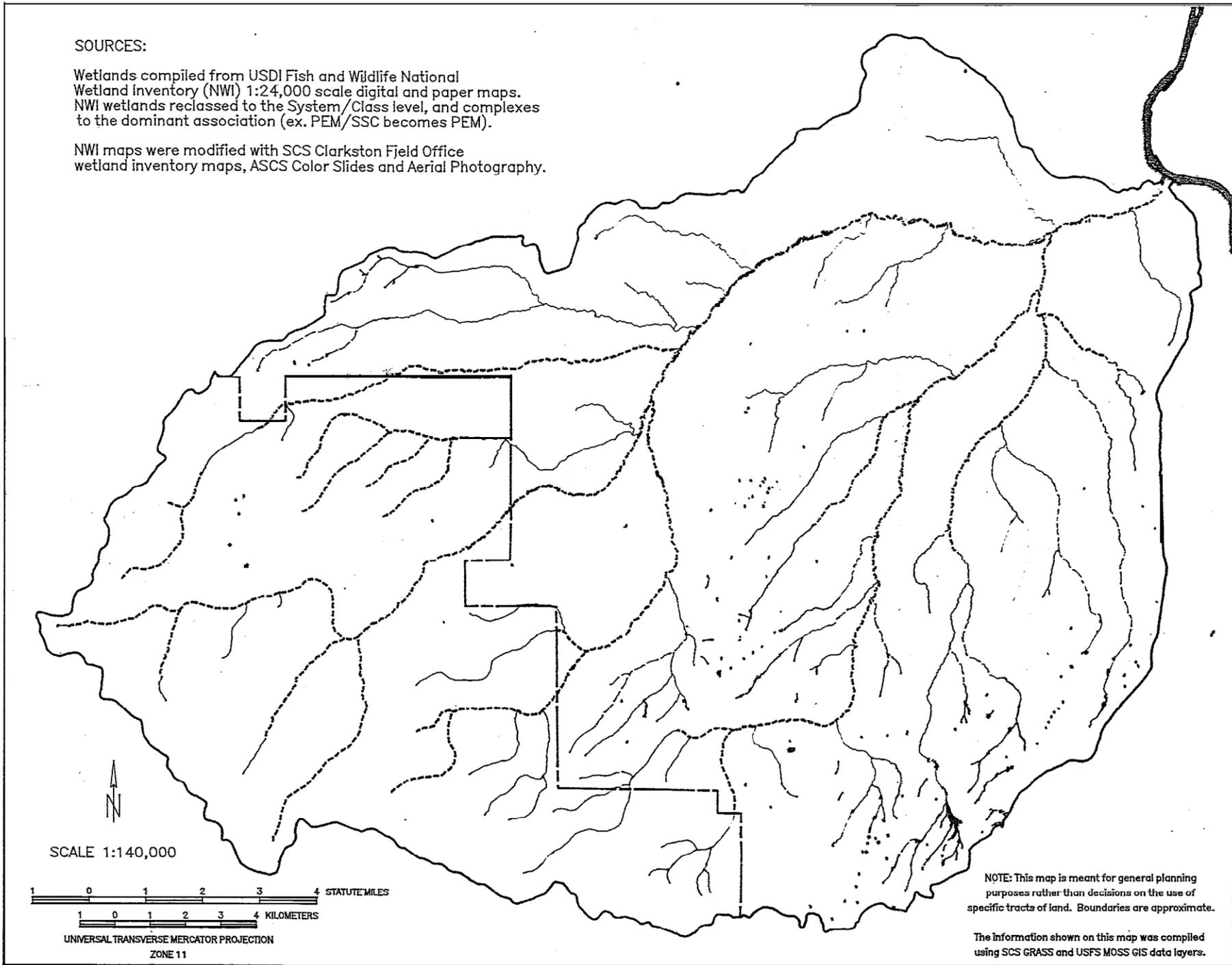
GENERAL WETLANDS MAP

SOURCES:

Wetlands compiled from USDI Fish and Wildlife National Wetland Inventory (NWI) 1:24,000 scale digital and paper maps. NWI wetlands reclassified to the System/Class level, and complexes to the dominant association (ex. PEM/SSC becomes PEM).

NWI maps were modified with SCS Clarkston Field Office wetland inventory maps, ASCS Color Slides and Aerial Photography.

- Watershed Boundary
- - - Umatilla National Forest Boundary
- PEM – Palustrine Emergent
- PFO – Palustrine Forested
- PSS – Palustrine Scrub/Shrub
- - - POW – Palustrine Open Water
- - - R3OW – Riverine Upper Perennial Open Water
- R4SB – Riverine Intermittent Streambed
- Uplands
- ▨ PEM – Palustrine Emergent
- ▨ PFO – Palustrine Forested
- ▨ PSS – Palustrine Scrub/Shrub
- ▨ PAB – Palustrine Aquatic Bed
- ▨ PUB – Palustrine Unconsolidated Bottom
- PUS – Palustrine Unconsolidated Shore
- ▨ POW – Palustrine Open Water
- ▨ L1OW – Lacustrine Limnetic Open Water
- ▨ R3RSA – Riverine Upper Perennial Rocky Shore (temp)
- ▨ Open Water



NOTE: This map is meant for general planning purposes rather than decisions on the use of specific tracts of land. Boundaries are approximate.

The information shown on this map was compiled using SCS GRASS and USFS MOSS GIS data layers.



USDA Soil Conservation Service January 1994
Washington State Office, Spokane
in cooperation with the
Asotin County Conservation District

Map Constructed Using SCS GRASS4.0-MAPGEN Interface

The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (braille, large print, audiotape, etc.) should contact the USDA Office of Communications at (202)720-5881 (voice) or (202)720-1127 (TDD).

To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, D.C., 20250, or call (202)720-7327 (voice) or (202)720-1127 (TDD).
USDA is an equal employment opportunity employer.

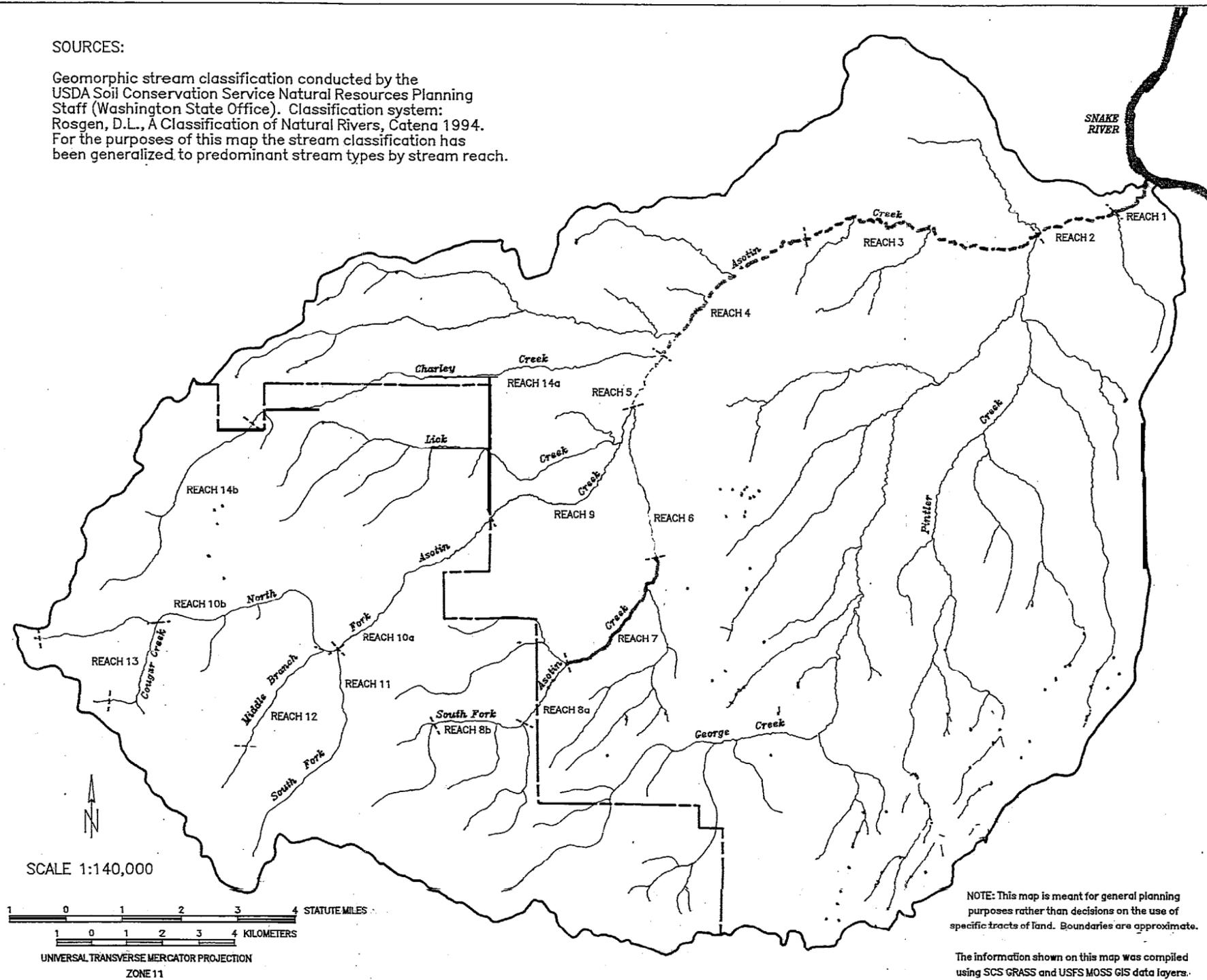
ASOTIN CREEK MODEL WATERSHED

Asotin and Garfield Counties, Washington

STREAM CLASSIFICATION MAP

SOURCES:

Geomorphic stream classification conducted by the USDA Soil Conservation Service Natural Resources Planning Staff (Washington State Office). Classification system: Rosgen, D.L., A Classification of Natural Rivers, Catena 1994. For the purposes of this map the stream classification has been generalized to predominant stream types by stream reach.



- Watershed Boundary
- Umatilla National Forest Boundary
- - - - - Stream Reach Limits
- Non-surveyed Streams
- F3/F4
- - - - - B3c/F3
- - - - - B4c/F3/B3c
- - - - - B4c/F4
- B4c/B3
- B4c/F4/D4
- Open Water

GEOMORPHIC STREAM TYPES

- B3 – Moderate Entrenchment, Boulder, 2 to 4% Slope, Moderate Width/Depth Ratio
- B3c – Moderate Entrenchment, Cobble, <2% Slope, Moderate Width/Depth Ratio
- B4c – Moderate Entrenchment, Gravel, <2% Slope, Moderate Width/Depth Ratio
- D4 – Braided Channel, Gravel, <2% Slope, High Width/Depth Ratio
- F3 – Entrenched, Cobble, <2% Slope, High Width/Depth Ratio
- F4 – Entrenched, Gravel, <2% Slope, High Width/Depth Ratio



USDA Soil Conservation Service January 1994
 Washington State Office, Spokane
 in cooperation with the
 Asotin County Conservation District
 Map Constructed Using SCS GRASS4.0—MAPGEN Interface

The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (braille, large print, audiotape, etc.) should contact the USDA Office of Communications at (202)720-5881 (voice) or (202)720-1127 (TDD).

To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, D.C., 20250, or call (202)720-7327 (voice) or (202)720-1127 (TDD).
 USDA is an equal employment opportunity employer.

NOTE: This map is meant for general planning purposes rather than decisions on the use of specific tracts of land. Boundaries are approximate.

The information shown on this map was compiled using SCS GRASS and USFS MOSS GIS data layers.

SCALE 1:140,000
 1 0 1 2 3 4 STATUTE MILES
 1 0 1 2 3 4 KILOMETERS
 UNIVERSAL TRANSVERSE MERCATOR PROJECTION
 ZONE 11

ASOTIN CREEK MODEL WATERSHED

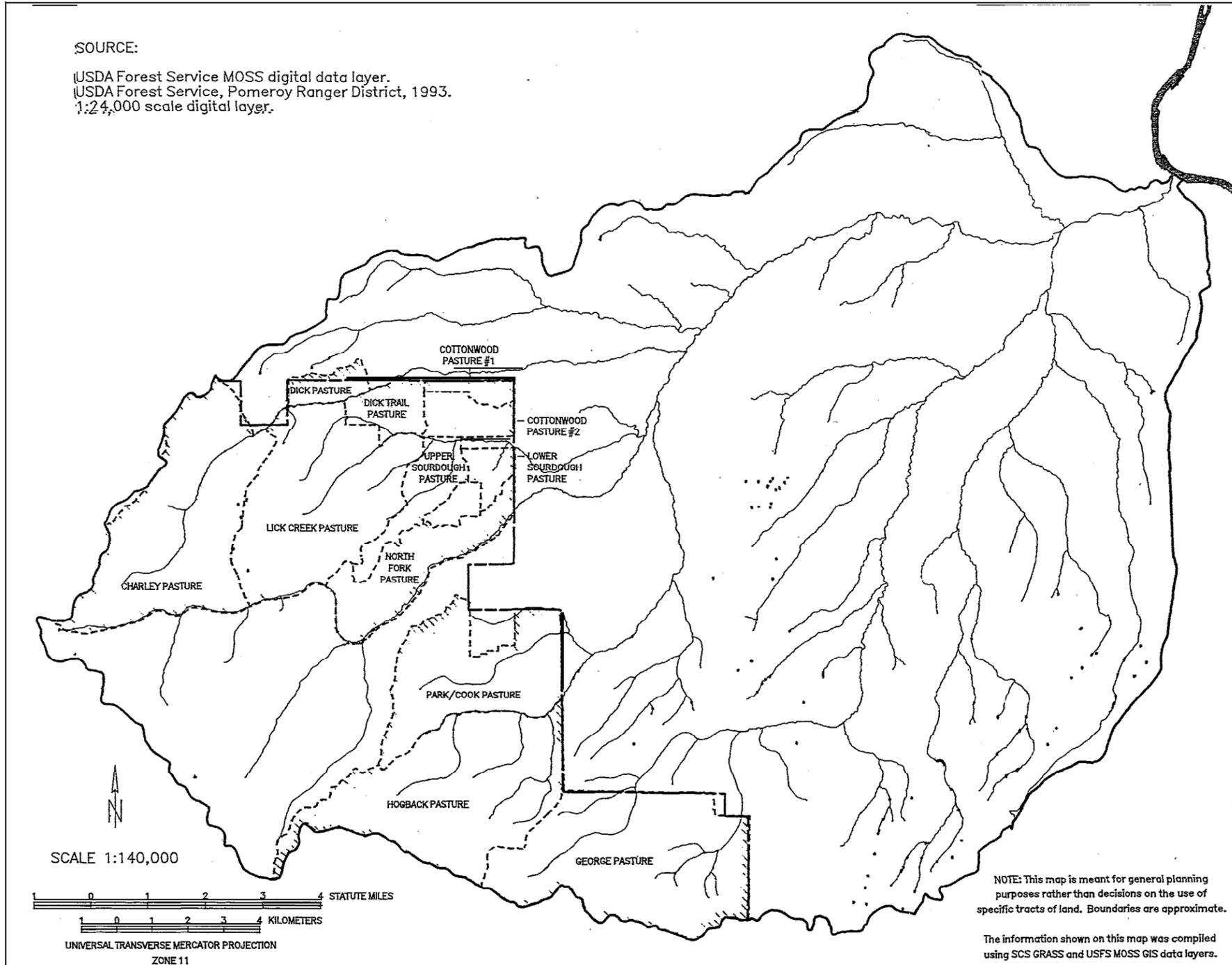
Asotin and Garfield Counties, Washington

RANGE ALLOTMENT MAP

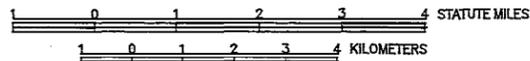
SOURCE:

USDA Forest Service MOSS digital data layer.
USDA Forest Service, Pomeroy Ranger District, 1993.
1:24,000 scale digital layer.

- Watershed Boundary
- Streams and Rivers
- - - Range Allotment Boundaries
- - - Umatilla National Forest Boundary
- ▭ Forest Service Range Allotments
- ▬ Open Water



SCALE 1:140,000



UNIVERSAL TRANSVERSE MERCATOR PROJECTION
ZONE 11

NOTE: This map is meant for general planning purposes rather than decisions on the use of specific tracts of land. Boundaries are approximate.

The information shown on this map was compiled using SCS GRASS and USFS MOSS GIS data layers.



USDA Soil Conservation Service April 1994

Washington State Office, Spokane
in cooperation with the
Asotin County Conservation District

Map Constructed Using SCS GRASS4.0-MAPGEN Interface

The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (braille, large print, audiotape, etc.) should contact the USDA Office of Communications at (202)720-5881 (voice) or (202)720-1127 (TDD).

To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, D.C., 20250, or call (202)720-7327 (voice) or (202)720-1127 (TDD).
USDA is an equal employment opportunity employer.

ASOTIN CREEK MODEL WATERSHED

Asotin and Garfield Counties, Washington

STREAMS WITH SEASONALLY ELEVATED WATER TEMPERATURES MAP

SOURCES:

US Forest Service thermograph sites from "Summary of 1992 Stream Temperature Data Collected on the Umatilla National Forest" location descriptions.

US Forest Service Hankin and Reeves Stream Survey, August 13-16, 1992.

Water Quality Monitoring sites from "Asotin Creek Water Quality Monitoring Project: First Year Progress" by Barry C. Moore (Clearwater Co.), November 6, 1991.

LEGEND

- Watershed Boundary
- Umatilla National Forest Boundary
- - - - Stream Reach Limits
- Streams
- Streams: Seasonally Elevated Water Temperatures
- Open Water
- ▨ Headgate County and Asotin City Parks



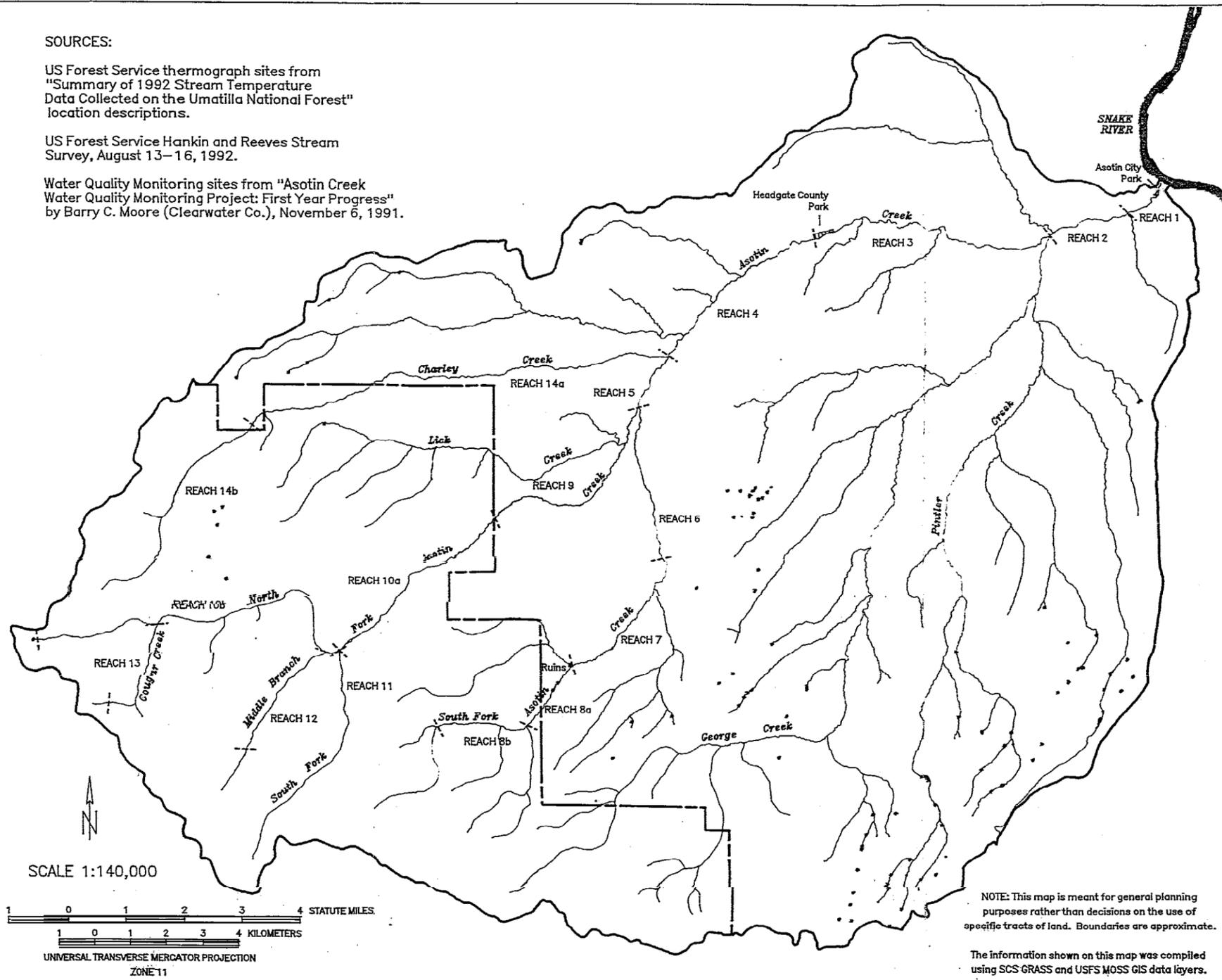
USDA Soil Conservation Service, July 1994

Washington State Office, Spokane
in cooperation with the
Asotin County Conservation District

Map Constructed Using SCS GRASS4.0-MAPGEN Interface

The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (braille, large print, audiotape, etc.) should contact the USDA Office of Communications at (202)720-5881 (voice) or (202)720-1127 (TDD).

To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, D.C., 20250, or call (202)720-7327 (voice) or (202)720-1127 (TDD). USDA is an equal employment opportunity employer.



SCALE 1:140,000

0 1 2 3 4 STATUTE MILES

0 1 2 3 4 KILOMETERS

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
ZONE 11

NOTE: This map is meant for general planning purposes rather than decisions on the use of specific tracts of land. Boundaries are approximate.

The information shown on this map was compiled using SCS GRASS and USFS MOSS GIS data layers.

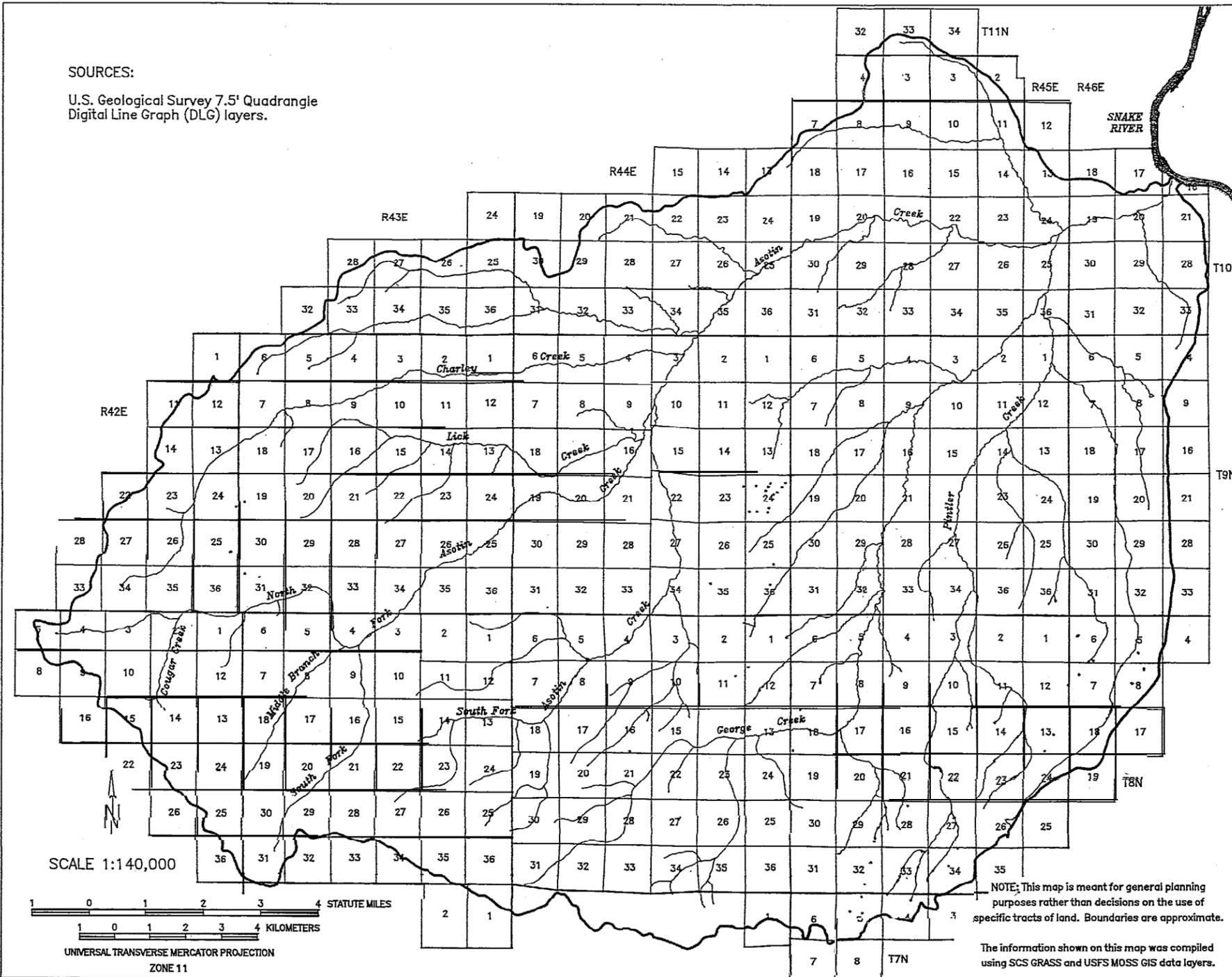
ASOTIN CREEK MODEL WATERSHED

Asotin and Garfield Counties, Washington

PUBLIC LAND SURVEY SECTION MAP

SOURCES:

U.S. Geological Survey 7.5' Quadrangle
Digital Line Graph (DLG) layers.



LEGEND

- Watershed Boundary
- Public Land Survey Township Boundaries
- Public Land Survey Section Boundaries
- Streams
- Open Water



USDA Soil Conservation Service, July 1994

Washington State Office, Spokane

in cooperation with the

Asotin County Conservation District

Map Constructed Using SCS GRASS4.0-MAPGEN Interface

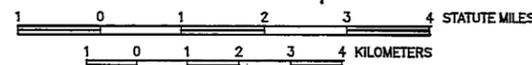
The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (braille, large print, audiotape, etc.) should contact the USDA Office of Communications at (202)720-5881 (voice) or (202)720-1127 (TDD).

To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, D.C., 20250, or call (202)720-7327 (voice) or (202)720-1127 (TDD).
USDA is an equal employment opportunity employer.

NOTE: This map is meant for general planning purposes rather than decisions on the use of specific tracts of land. Boundaries are approximate.

The information shown on this map was compiled using SCS GRASS and USFS MOSS GIS data layers.

SCALE 1:140,000



UNIVERSAL TRANSVERSE MERCATOR PROJECTION
ZONE 11

APPENDIX B: PROPOSED INSTREAM
IMPROVEMENTS ATLAS

ASOTIN CREEK MODEL WATERSHED

Asotin and Garfield Counties, Washington

INDEX TO ATLAS SHEETS

Fig. B-1: ATLAS INDEX	1 OF 9
Fig. B-2: ATLAS SHEET #1	2 OF 9
Fig. B-3: ATLAS SHEET #2	3 OF 9
Fig. B-4: ATLAS SHEET #3	4 OF 9
Fig. B-5: ATLAS SHEET #4	5 OF 9
Fig. B-6: ATLAS SHEET #5	6 OF 9
Fig. B-7: ATLAS SHEET #6	7 OF 9
Fig. B-8: ATLAS SHEET #7	8 OF 9
Fig. B-9: ATLAS SHEET #8	9 OF 9

SOURCES:

U.S. Geological Survey 7.5' Quadrangle Maps.
Digitized at 1:24,000 scale.

LEGEND

- Watershed Boundary
- - - - Umatilla National Forest Boundary
- - - - Boundaries of Atlas Sheets #1 - #8
- - - - Stream Reach Limits
- Streams
-  Open Water
-  Headgate County and Asotin City Parks

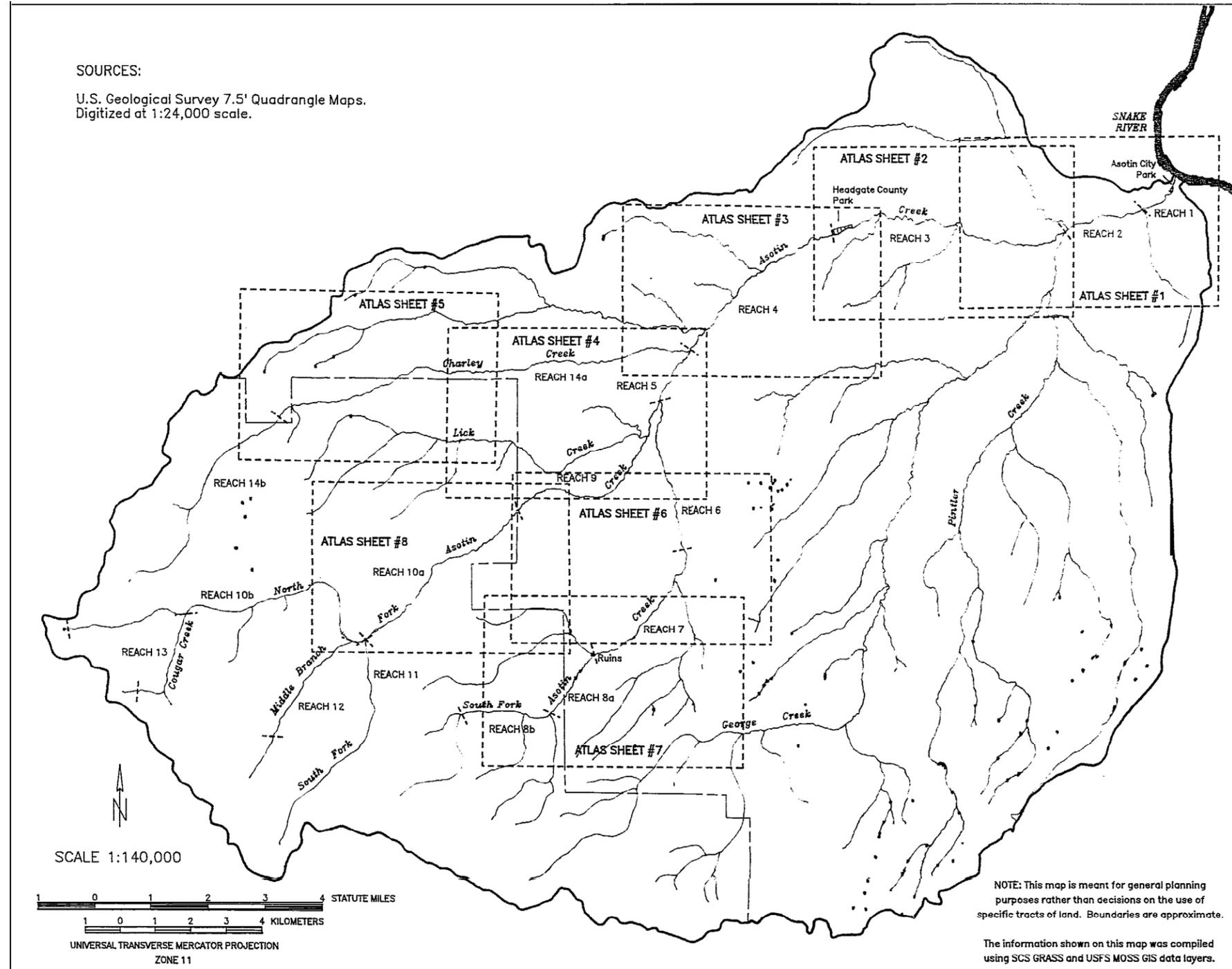


USDA Soil Conservation Service, July 1994
 Washington State Office, Spokane
 in cooperation with the
 Asotin County Conservation District

Map Constructed Using SCS GRASS4.0-MAPGEN Interface

The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (braille, large print, audiotape, etc.) should contact the USDA Office of Communications at (202)720-5881 (voice) or (202)720-1127 (TDD).

To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, D.C., 20250, or call (202)720-7327 (voice) or (202)720-1127 (TDD).
 USDA is an equal employment opportunity employer.



NOTE: This map is meant for general planning purposes rather than decisions on the use of specific tracts of land. Boundaries are approximate.

The information shown on this map was compiled using SCS GRASS and USFS MOSS GIS data layers.

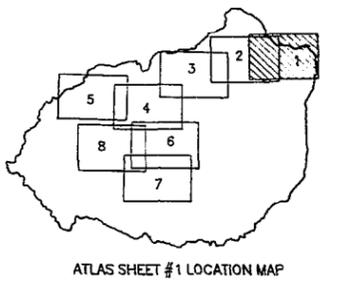
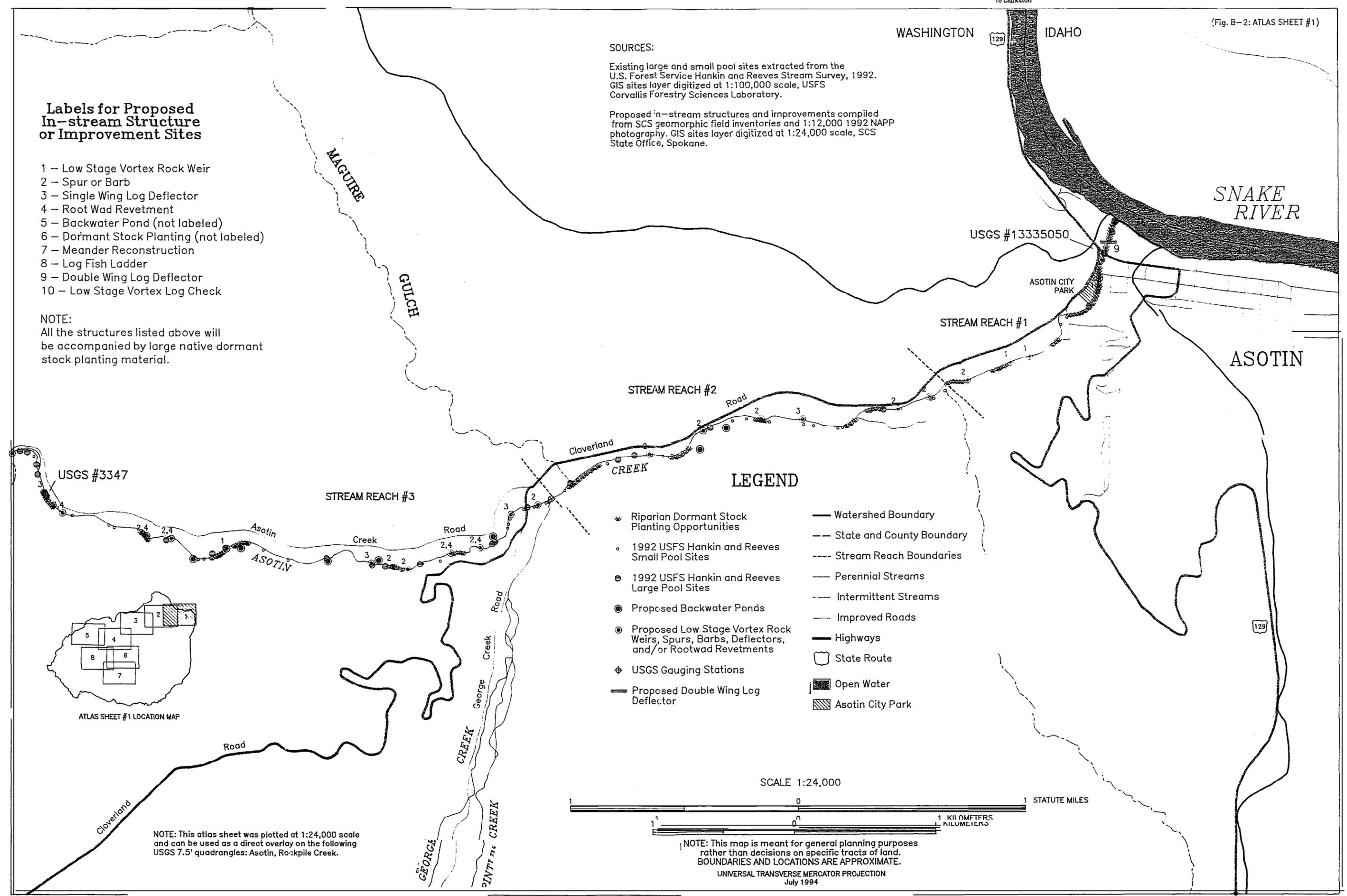
WASHINGTON IDAHO

SOURCES:
 Existing large and small pool sites extracted from the U.S. Forest Service Hankin and Reeves Stream Survey, 1992. GIS sites layer digitized at 1:100,000 scale, USFS Corvallis Forestry Sciences Laboratory.
 Proposed in-stream structures and improvements compiled from SCS geomorphic field inventories and 1:12,000 1992 NAPP photography. GIS sites layer digitized at 1:24,000 scale, SCS State Office, Spokane.

Labels for Proposed In-stream Structure or Improvement Sites

- 1 - Low Stage Vortex Rock Weir
- 2 - Spur or Barb
- 3 - Single Wing Log Deflector
- 4 - Root Wad Revetment
- 5 - Backwater Pond (not labeled)
- 6 - Dormant Stock Planting (not labeled)
- 7 - Meander Reconstruction
- 8 - Log Fish Ladder
- 9 - Double Wing Log Deflector
- 10 - Low Stage Vortex Log Check

NOTE:
 All the structures listed above will be accompanied by large native dormant stock planting material.



LEGEND

- ▼ Riparian Dormant Stock Planting Opportunities
- 1992 USFS Hankin and Reeves Small Pool Sites
- 1992 USFS Hankin and Reeves Large Pool Sites
- ⊙ Proposed Backwater Ponds
- ⊙ Proposed Low Stage Vortex Rock Weirs, Spurs, Barb, Deflectors, and/or Rootwad Revetments
- ⊕ USGS Gauging Stations
- Proposed Double Wing Log Deflector
- Watershed Boundary
- - - State and County Boundary
- - - Stream Reach Boundaries
- Perennial Streams
- - - Intermittent Streams
- Improved Roads
- Highways
- State Route
- Open Water
- ▨ Asotin City Park

SCALE 1:24,000



NOTE: This atlas sheet was plotted at 1:24,000 scale and can be used as a direct overlay on the following USGS 7.5' quadrangles: Asotin, Rockpile Creek.

NOTE: This map is meant for general planning purposes rather than decisions on specific tracts of land. BOUNDARIES AND LOCATIONS ARE APPROXIMATE.

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
 July 1994

Labels for Proposed In-stream Structure or Improvement Sites

- 1 - Low Stage Vortex Rock Weir
- 2 - Spur or Barb
- 3 - Single Wing Log Deflector
- 4 - Root Wad Revetment
- 5 - Backwater Pond (not labeled)
- 6 - Dormant Stock Planting (not labeled)
- 7 - Meander Reconstruction
- 8 - Log Fish Ladder
- 9 - Double Wing Log Deflector
- 10 - Low Stage Vortex Log Check

NOTE:
All the structures listed above will be accompanied by large native dormant stock planting material.

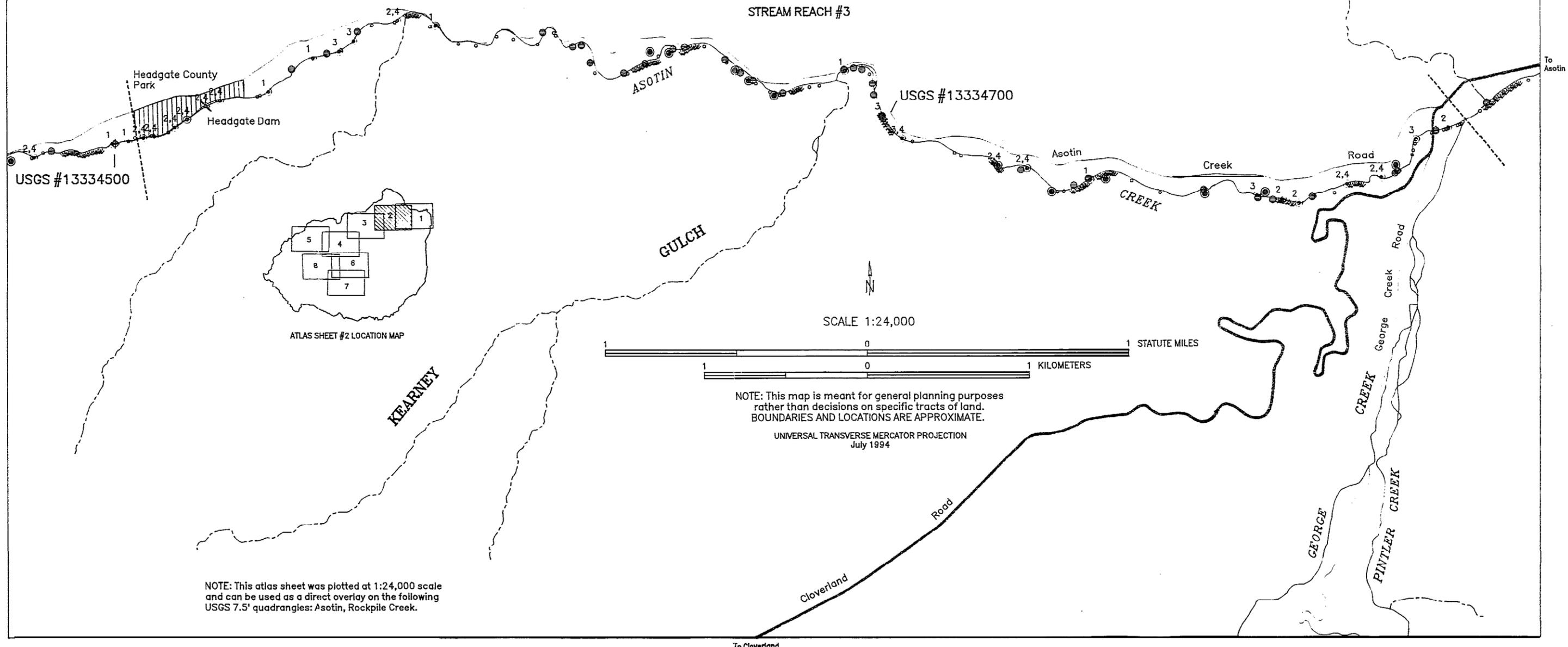
LEGEND

- ☛ Riparian Dormant Stock Planting Opportunities
- 1992 USFS Hankin and Reeves Small Pool Sites
- 1992 USFS Hankin and Reeves Large Pool Sites
- ⊙ Proposed Backwater Ponds
- ⊕ Proposed Low Stage Vortex Rock Weirs, Spurs, Barbs, Deflectors, and/or Rootwad Revetments
- ⊕ USGS Gauges #13334700 and #13334500
- Watershed Boundary
- - - Stream Reach Boundaries
- Perennial Streams
- - - Intermittent Streams
- Improved Roads
- Highways
- ▨ Headgate County Park

SOURCES:

Existing large and small pool sites extracted from the U.S. Forest Service Hankin and Reeves Stream Survey, 1992. GIS sites layer digitized at 1:100,000 scale, USFS Corvallis Forestry Sciences Laboratory.

Proposed in-stream structures and improvements compiled from SCS geomorphic field inventories and 1:12,000 1992 NAPP photography. GIS sites layer digitized at 1:24,000 scale, SCS State Office, Spokane.



NOTE: This map is meant for general planning purposes rather than decisions on specific tracts of land. BOUNDARIES AND LOCATIONS ARE APPROXIMATE.

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
July 1994

NOTE: This atlas sheet was plotted at 1:24,000 scale and can be used as a direct overlay on the following USGS 7.5' quadrangles: Asotin, Rockpile Creek.

LEGEND

- Riparian Dormant Stock Planting Opportunities
- 1992 USFS Hankin and Reeves Small Pool Sites
- 1992 USFS Hankin and Reeves Large Pool Sites
- Proposed Backwater Ponds
- Proposed Low Stage Vortex Rock Weirs, Spurs, Barbs, Deflectors, and/or Rootwad Revetments
- USGS Gauge #13334500
- Watershed Boundary
- Perennial Streams
- - - Intermittent Streams
- == Highways
- - - Improved Roads
- - - USFS Unimproved (High Clearance) Roads
- State Route
- ▨ Headgate County Park

Labels for Proposed In-stream Structure or Improvement Sites

- 1 - Low Stage Vortex Rock Weir
- 2 - Spur or Barb
- 3 - Single Wing Log Deflector
- 4 - Root Wad Revetment
- 5 - Backwater Pond (not labeled)
- 6 - Dormant Stock Planting (not labeled)
- 7 - Meander Reconstruction
- 8 - Log Fish Ladder
- 9 - Double Wing Log Deflector
- 10 - Low Stage Vortex Log Check

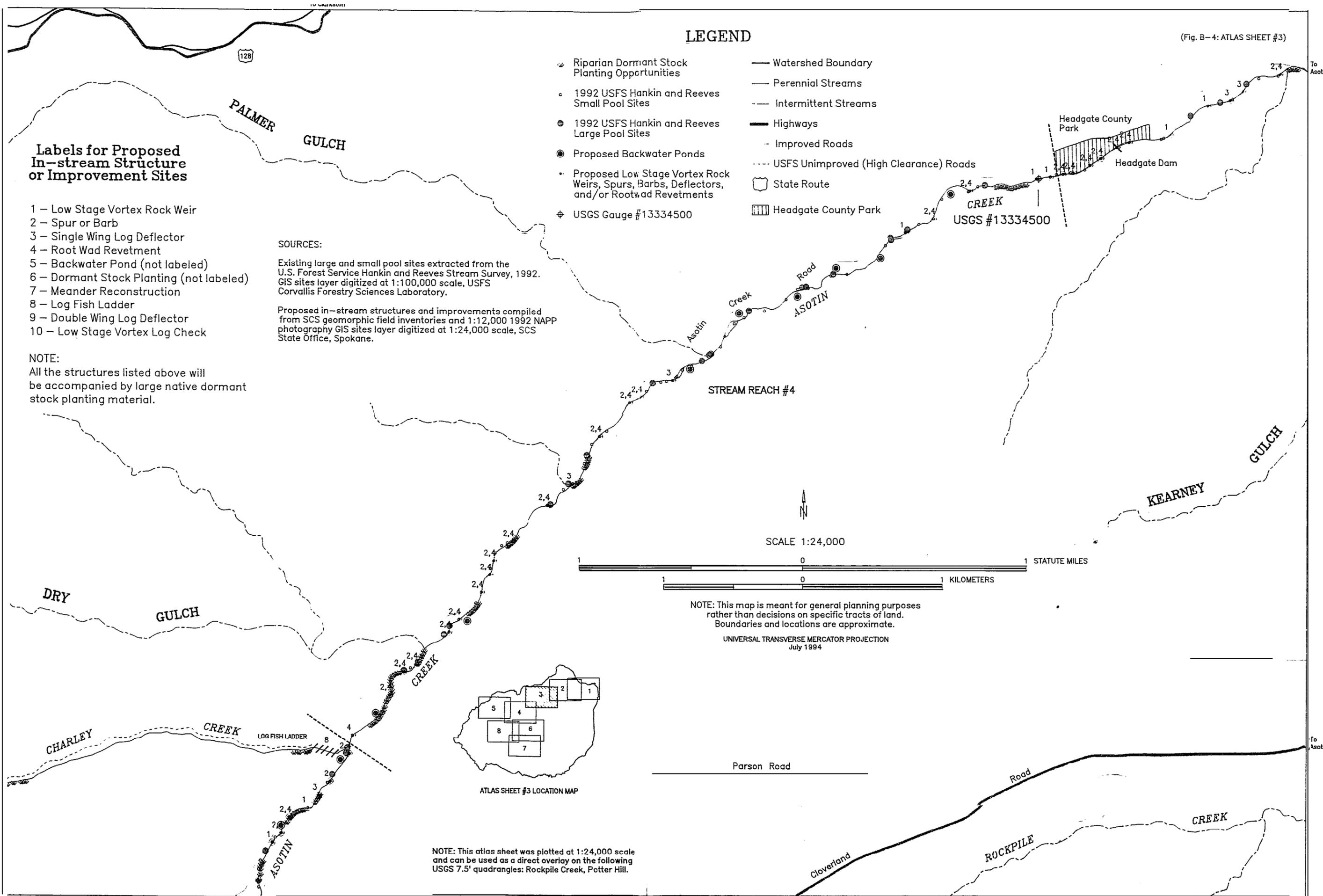
SOURCES:

Existing large and small pool sites extracted from the U.S. Forest Service Hankin and Reeves Stream Survey, 1992. GIS sites layer digitized at 1:100,000 scale, USFS Corvallis Forestry Sciences Laboratory.

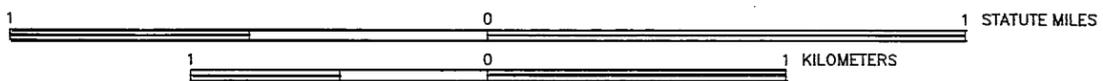
Proposed in-stream structures and improvements compiled from SCS geomorphic field inventories and 1:12,000 1992 NAPP photography GIS sites layer digitized at 1:24,000 scale, SCS State Office, Spokane.

NOTE:

All the structures listed above will be accompanied by large native dormant stock planting material.

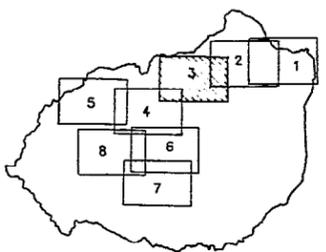


SCALE 1:24,000



NOTE: This map is meant for general planning purposes rather than decisions on specific tracts of land. Boundaries and locations are approximate.

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
July 1994



NOTE: This atlas sheet was plotted at 1:24,000 scale and can be used as a direct overlay on the following USGS 7.5' quadrangles: Rockpile Creek, Potter Hill.

SOURCES:

Existing large and small pool sites extracted from the U.S. Forest Service Hankin and Reeves Stream Survey, 1992. GIS sites layer digitized at 1:100,000 scale, USFS Corvallis Forestry Sciences Laboratory.

Proposed in-stream structures and improvements compiled from SCS geomorphic field inventories and 1:12,000 1992 NAPP photography. GIS sites layer digitized at 1:24,000 scale, SCS State Office, Spokane.

(Fig. B-5: ATLAS SHEET #4)

Labels for Proposed In-stream Structure or Improvement Sites

- 1 - Low Stage Vortex Rock Weir
- 2 - Spur or Barb
- 3 - Single Wing Log Deflector
- 4 - Root Wad Revetment
- 5 - Backwater Pond (not labeled)
- 6 - Dormant Stock Planting (not labeled)
- 7 - Meander Reconstruction
- 8 - Log Fish Ladder
- 9 - Double Wing Log Deflector
- 10 - Low Stage Vortex Log Check

NOTE:
All the structures listed above will be accompanied by large native dormant stock planting material.

LEGEND

- ♣ Riparian Dormant Stock Planting Opportunities
- 1992 USFS Hankin and Reeves Small Pool Sites
- 1992 USFS Hankin and Reeves Large Pool Sites
- ⊙ Proposed Backwater Ponds
- ⊕ Proposed Low Stage Vortex Rock Weirs, Spurs, Barbs, Deflectors, and/or Rootwad Revetments
- ⊘ Proposed Meander Reconstruction
- Umatilla National Forest Boundary
- Perennial Streams
- - - Intermittent Streams
- Improved Roads
- - - USFS Improved Light Duty Road
- ⋯ USFS Unimproved (High Clearance) Roads

SCALE 1:24,000

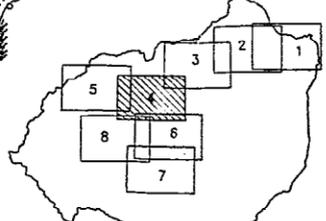
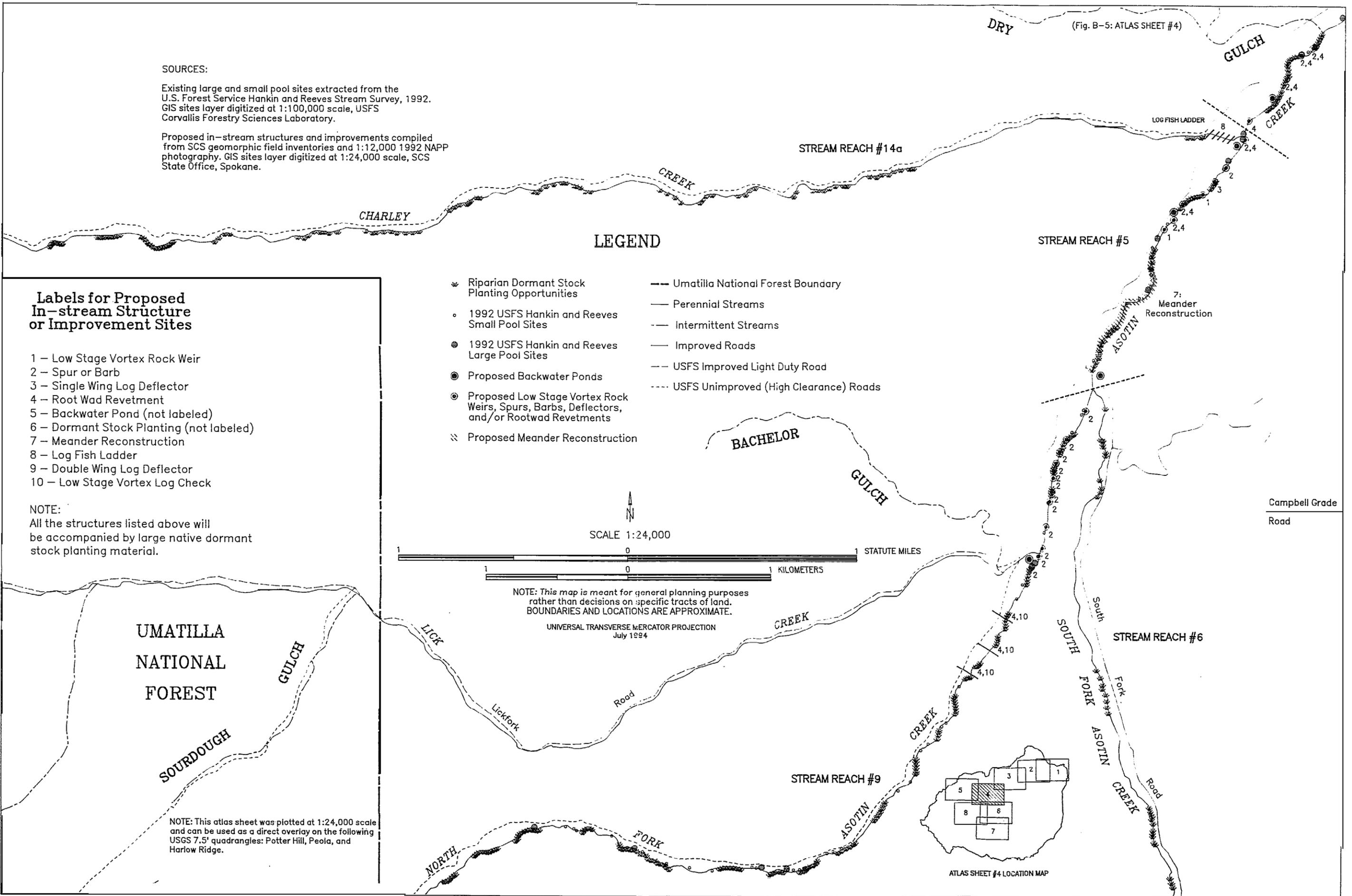


NOTE: This map is meant for general planning purposes rather than decisions on specific tracts of land. BOUNDARIES AND LOCATIONS ARE APPROXIMATE.

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
July 1994

UMATILLA NATIONAL FOREST

NOTE: This atlas sheet was plotted at 1:24,000 scale and can be used as a direct overlay on the following USGS 7.5' quadrangles: Potter Hill, Peola, and Harlow Ridge.



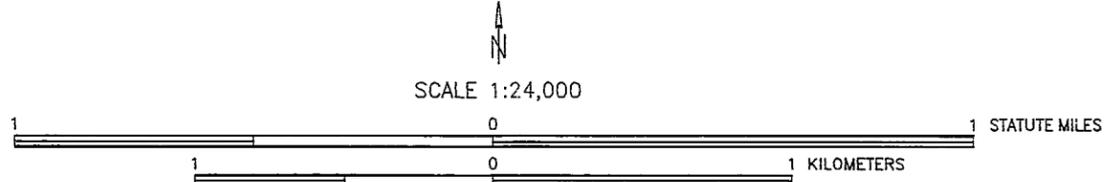
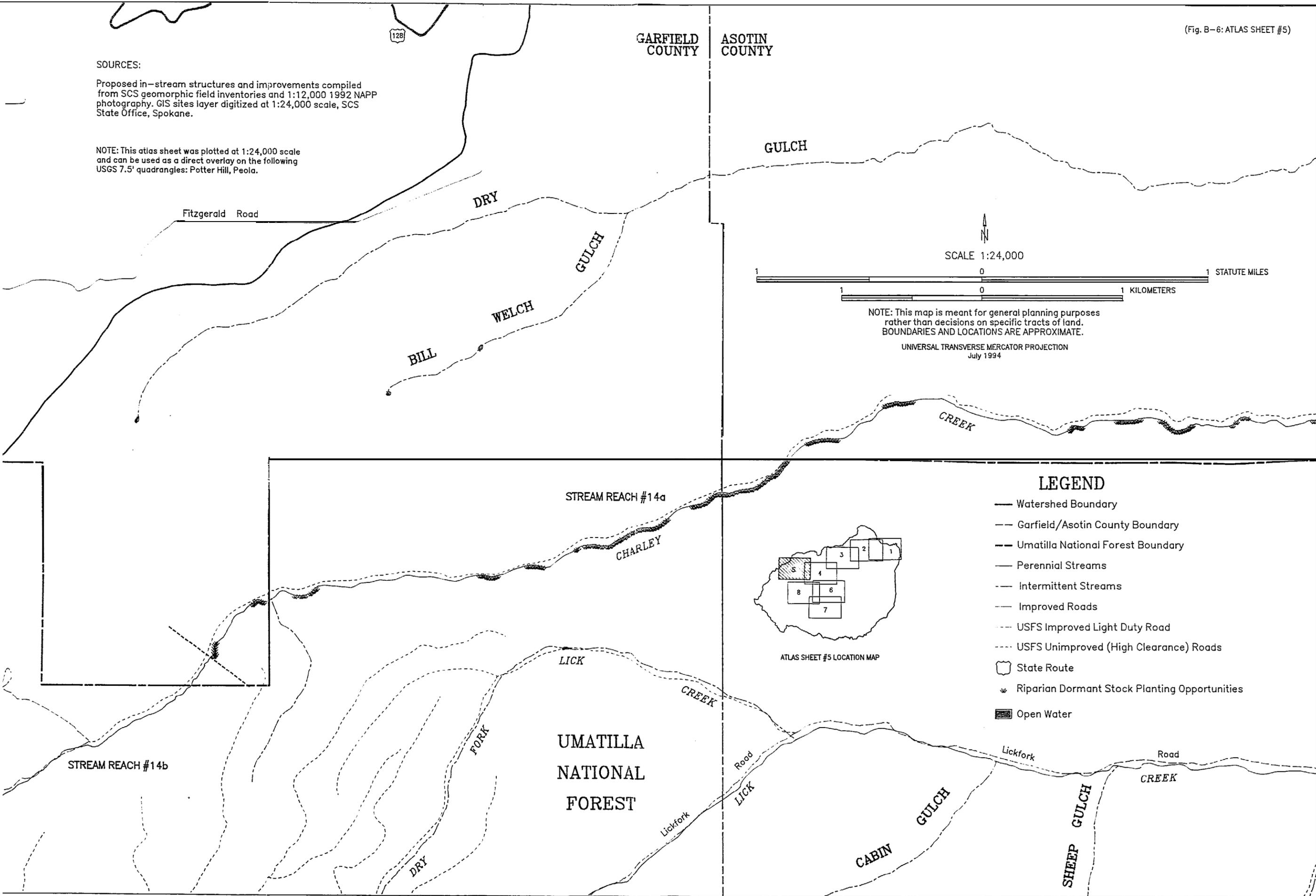
Campbell Grade Road

SOURCES:

Proposed in-stream structures and improvements compiled from SCS geomorphic field inventories and 1:12,000 1992 NAPP photography. GIS sites layer digitized at 1:24,000 scale, SCS State Office, Spokane.

NOTE: This atlas sheet was plotted at 1:24,000 scale and can be used as a direct overlay on the following USGS 7.5' quadrangles: Potter Hill, Peola.

GARFIELD COUNTY ASOTIN COUNTY

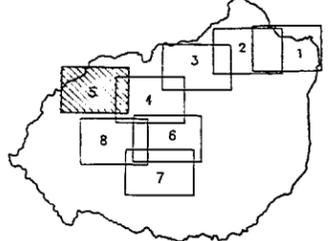


NOTE: This map is meant for general planning purposes rather than decisions on specific tracts of land. BOUNDARIES AND LOCATIONS ARE APPROXIMATE.

UNIVERSAL TRANSVERSE MERCATOR PROJECTION July 1994

LEGEND

- Watershed Boundary
- - - Garfield/Asotin County Boundary
- - - Umatilla National Forest Boundary
- Perennial Streams
- - - Intermittent Streams
- Improved Roads
- - - USFS Improved Light Duty Road
- - - USFS Unimproved (High Clearance) Roads
- ⬡ State Route
- ♣ Riparian Dormant Stock Planting Opportunities
- ▨ Open Water



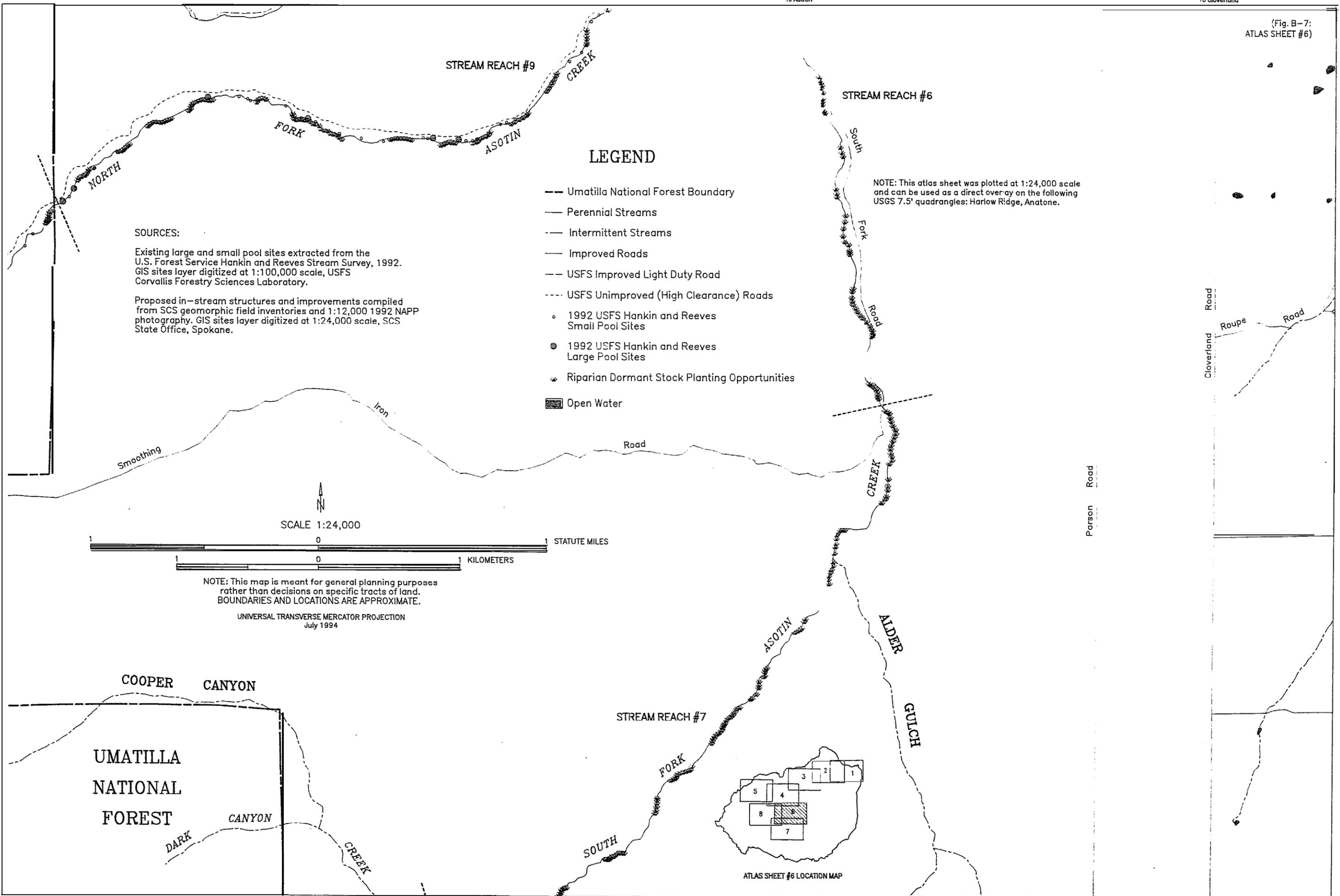
ATLAS SHEET #5 LOCATION MAP

STREAM REACH #14a

STREAM REACH #14b

UMATILLA NATIONAL FOREST

(Fig. B-7: ATLAS SHEET #6)



SOURCES:

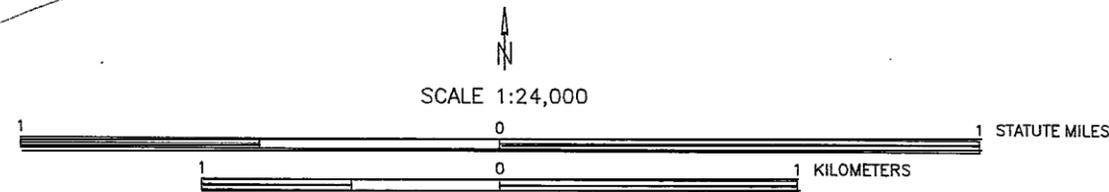
Existing large and small pool sites extracted from the U.S. Forest Service Hankin and Reeves Stream Survey, 1992. GIS sites layer digitized at 1:100,000 scale, USFS Corvallis Forestry Sciences Laboratory.

Proposed in-stream structures and improvements compiled from SCS geomorphic field inventories and 1:12,000 1992 NAPP photography. GIS sites layer digitized at 1:24,000 scale, SCS State Office, Spokane.

LEGEND

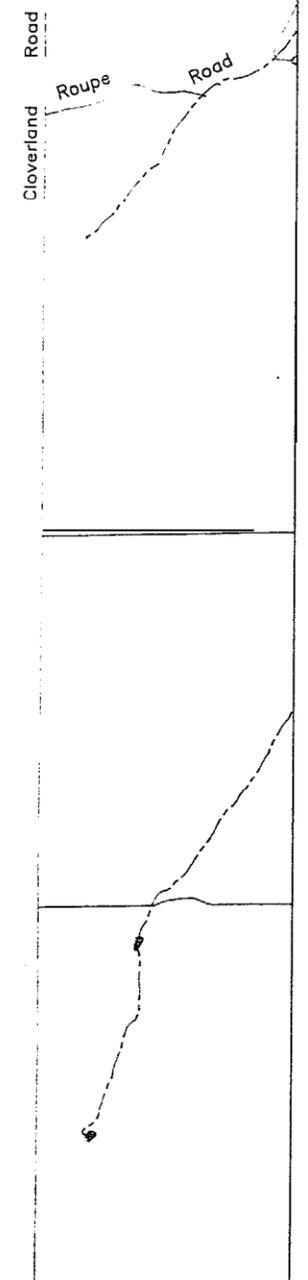
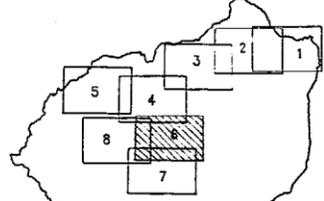
- Umatilla National Forest Boundary
- Perennial Streams
- - - Intermittent Streams
- Improved Roads
- - - USFS Improved Light Duty Road
- - - USFS Unimproved (High Clearance) Roads
- 1992 USFS Hankin and Reeves Small Pool Sites
- 1992 USFS Hankin and Reeves Large Pool Sites
- ↘ Riparian Dormant Stock Planting Opportunities
- ▨ Open Water

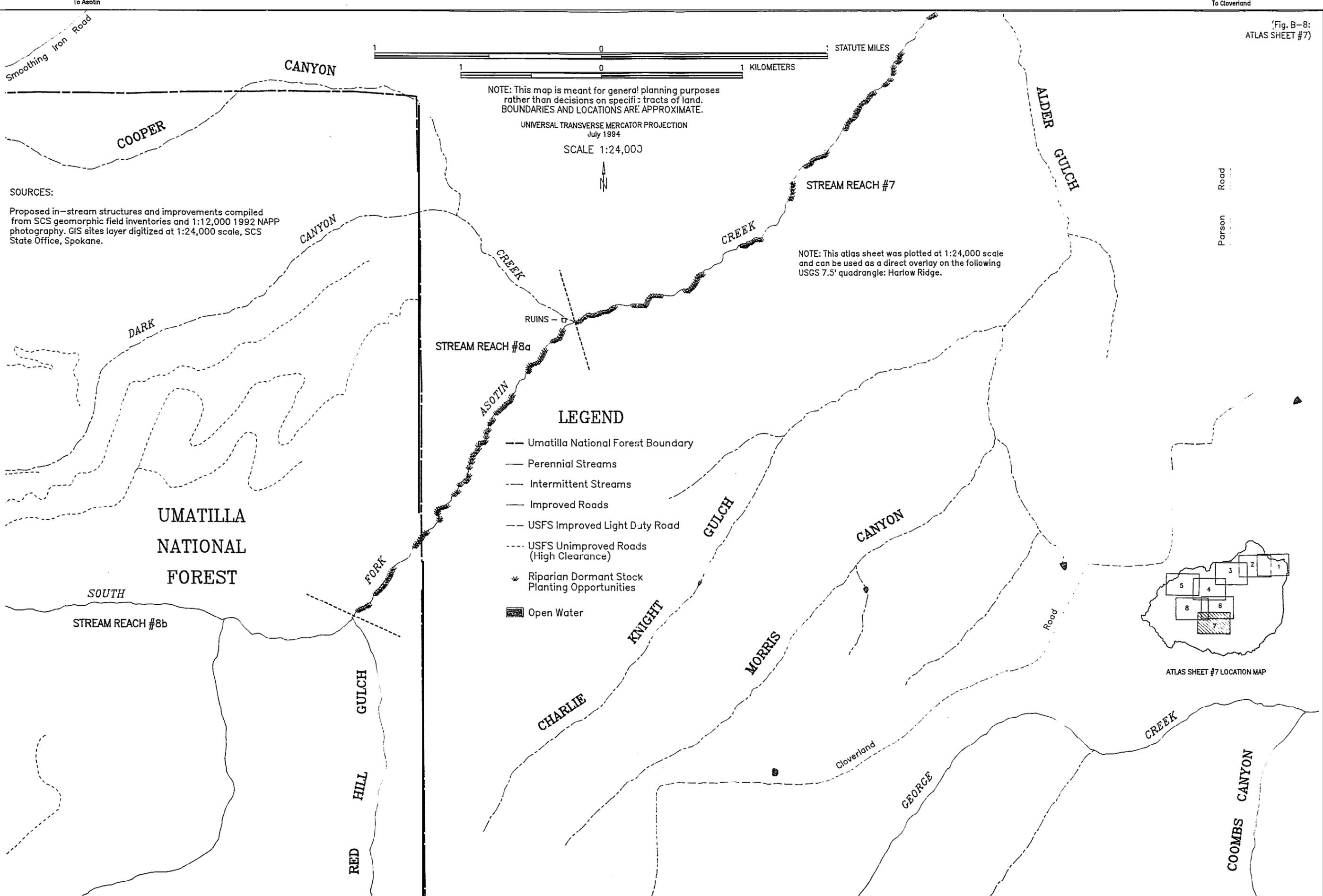
NOTE: This atlas sheet was plotted at 1:24,000 scale and can be used as a direct overlay on the following USGS 7.5' quadrangles: Harlow Ridge, Anatone.



NOTE: This map is meant for general planning purposes rather than decisions on specific tracts of land. BOUNDARIES AND LOCATIONS ARE APPROXIMATE.

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
July 1994





SOURCES:
Proposed in-stream structures and improvements compiled from SCS geomorphic field inventories and 1:12,000 1992 NAPP photography. GIS sites layer digitized at 1:24,000 scale, SCS State Office, Spokane.

NOTE: This map is meant for general planning purposes rather than decisions on specific tracts of land. BOUNDARIES AND LOCATIONS ARE APPROXIMATE.

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
July 1994

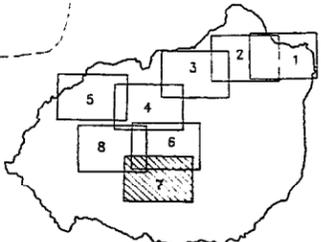
SCALE 1:24,000



LEGEND

- Umatilla National Forest Boundary
- Perennial Streams
- - - Intermittent Streams
- Improved Roads
- - - USFS Improved Light Duty Road
- - - USFS Unimproved Roads (High Clearance)
- * Riparian Dormant Stock Planting Opportunities
- Open Water

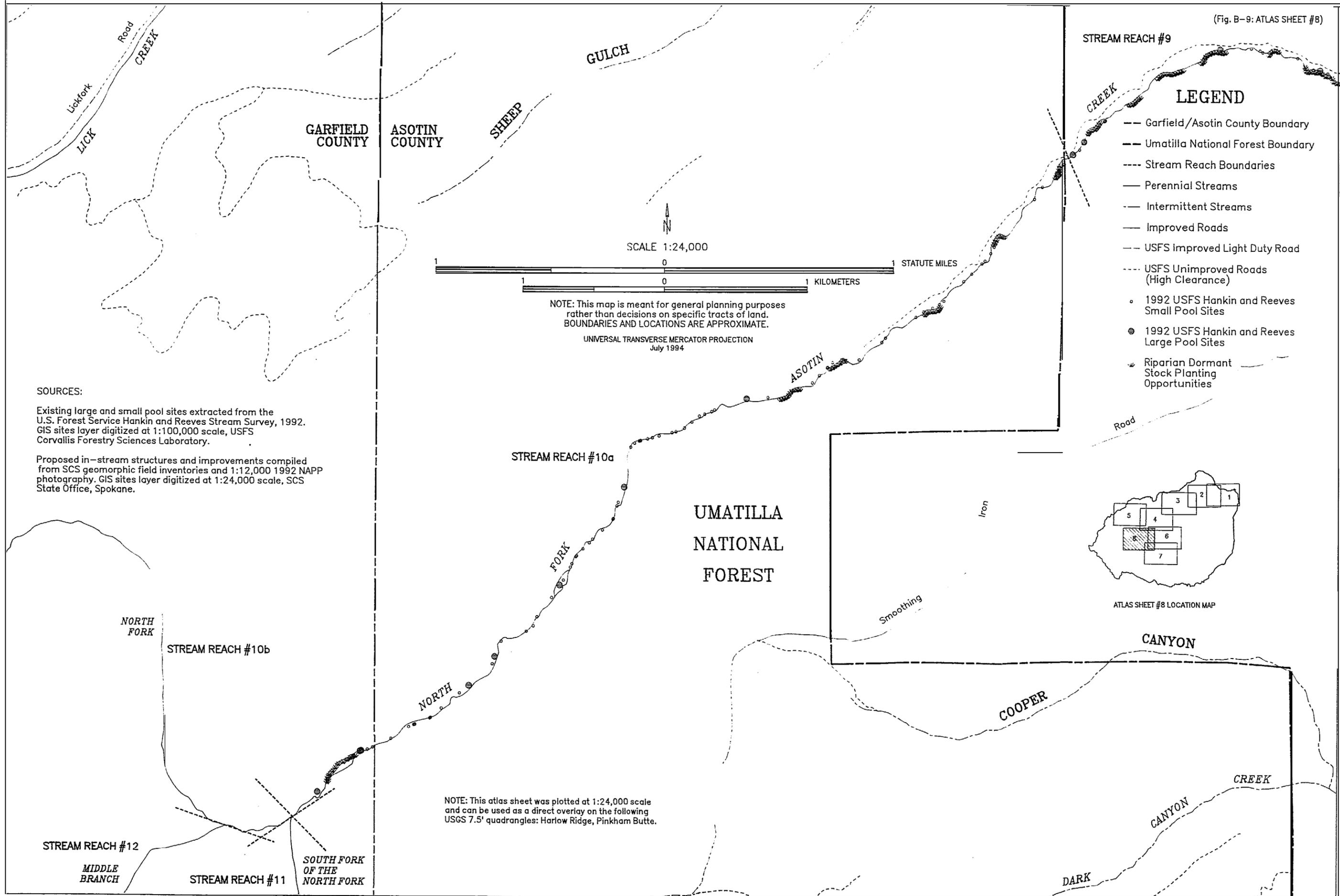
NOTE: This atlas sheet was plotted at 1:24,000 scale and can be used as a direct overlay on the following USGS 7.5' quadrangle: Harlow Ridge.



ATLAS SHEET #7 LOCATION MAP

Road
Parson

o
Cloverland



SOURCES:

Existing large and small pool sites extracted from the U.S. Forest Service Hankin and Reeves Stream Survey, 1992. GIS sites layer digitized at 1:100,000 scale, USFS Corvallis Forestry Sciences Laboratory.

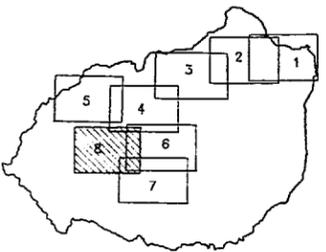
Proposed in-stream structures and improvements compiled from SCS geomorphic field inventories and 1:12,000 1992 NAPP photography. GIS sites layer digitized at 1:24,000 scale, SCS State Office, Spokane.

NOTE: This map is meant for general planning purposes rather than decisions on specific tracts of land. BOUNDARIES AND LOCATIONS ARE APPROXIMATE.

UNIVERSAL TRANSVERSE MERCATOR PROJECTION July 1994

LEGEND

- Garfield/Asotin County Boundary
- Umatilla National Forest Boundary
- Stream Reach Boundaries
- Perennial Streams
- Intermittent Streams
- Improved Roads
- USFS Improved Light Duty Road
- USFS Unimproved Roads (High Clearance)
- 1992 USFS Hankin and Reeves Small Pool Sites
- 1992 USFS Hankin and Reeves Large Pool Sites
- ✦ Riparian Dormant Stock Planting Opportunities



ATLAS SHEET #8 LOCATION MAP

NOTE: This atlas sheet was plotted at 1:24,000 scale and can be used as a direct overlay on the following USGS 7.5' quadrangles: Harlow Ridge, Pinkham Butte.

To Asotin

APPENDIX C: LISTED PLANT AND ANIMAL
SPECIES IN OR NEAR
ASOTIN CREEK WATERSHED

APPENDIX C: PRIORITY PLANT AND ANIMAL SPECIES THAT MAY OCCUR
IN OR NEAR THE ASOTIN CREEK WATERSHED.

The Priority Habitat and Species (PHS) Division of WDFW maintains a list of Priority Species that includes all *animals* presently listed in the Federal Register as *endangered, threatened, sensitive, or candidate*. It also includes Washington animals which WDFW feels are vulnerable to future listing (*monitor* species) or important for recreation (*game* species). WDFW also developed a list of Priority Habitats which support either a unique wildlife species or a wide diversity of species. A Washington plant list is kept by the Washington Natural Heritage Program. Federal determinations are made by National Marine Fisheries Service for anadromous fish and by U.S. Fish and Wildlife Service for all other ~~plant and animal~~ species.

1. Federal Threatened or Endangered Species:

A. Birds

Bald eagle (*Haliaeetus leucocephalus*)
Peregrine falcon (*Falco peregrinus*)

B. Anadromous Fish

Snake River sockeye salmon (*Oncorhynchus nerka*)
Snake River spring/summer and fall chinook salmon
(*Oncorhynchus tshawytscha*)

2. Federal Candidate Species:

A. Plants

Cusick's lupine (*Lupinus cusickii*)
Desert parsley (*Lomatium serpentinum*)
Spalding's silene (*Silene spaldingii*)

B. Fish

Bull trout (*Salvelinus confluentus*)

C. Birds

Black tern (*Chlidonias niger*)
Ferruginous hawk (*Buteo regalis*)
Harlequin duck (*Histrionicus histrionicus*)
Loggerhead shrike (*Lanius ludovicianus*)
Long-billed curlew (*Numenius americanus*)
Northern goshawk (*Accipiter gentilis*)
Sage grouse (*Centrocercus urophasianus*)
Sharp-tailed grouse (*Tympanuchus phasianellus*)

D. Mammals

Califor bighorn sheep (*Ovis canadensis californiana*)
California wolverine (*Gulo gulo luteus*)
Preble's shrew (*Sorex preblei*)
Pygmy rabbit (*Brachylagus idahoensis*)

E. Amphibians

Spotted frog (*Rana pretiosa*)

F. Insects

Columbia River tiger beetle (*Cicindela columbica*)

G. Molluscs

California floater (*Anodonia californiensis*)
Giant Columbia River limpet (*Fisherola nuttali*)
Great Col River spire snail (*Fluminicola columbiana*)

3. State Threatened and Endangered Species:

A. Plants

Arthur's milk-vetch	(<i>Astragalus arthuri</i>)
Bolandra	(<i>Bolandra oregana</i>)
Cross-haired rockcress	(<i>Arabis crucisetosa</i>)
Cusick's milk-vetch	(<i>Astragalus cusickii</i>)
Cusick's desert-parsley	(<i>Lomatium cusickii</i>)
Idaho gooseberry	(<i>Ribes Oxyacanthoides</i>)
Porcupine sedge	(<i>Carex Hystericina</i>)
Prairie lupine	(<i>Lupinus cusickii</i>)
Rollins' desert-parsley	(<i>Lomatium Rollinsii</i>)
Shining flatsedge	(<i>Cyperus Rivularis</i>)
Snake Canyon desert-parsley	(<i>Lomatium serpentinum</i>)
Squaw current	(<i>Ribes cereum</i>)

B. Birds

American white pelican	(<i>Pelecanus erythrorhynchos</i>)
Sandhill crane	(<i>Grus canadensis</i>)

4. State Candidate Species:

A. Reptiles

Striped whipsnake	(<i>Masticophis taeniatus</i>)
-------------------	----------------------------------

B. Birds

Burrowing owl	(<i>Athene cunicularia</i>)
Common loon	(<i>Gavia immer</i>)
Flammulated owl	(<i>Otus flammeolus</i>)
Golden eagle	(<i>Aquila chrysaetos</i>)
Lewis' woodpecker	(<i>Asyndesmus lewis</i>)
Pileated woodpecker	(<i>Dryocopus pileatus</i>)
Sage sparrow	(<i>Amphispiza belli</i>)
Sage thrasher	(<i>Oreoscopies montanus</i>)
Swainson's hawk	(<i>Buteo swainsoni</i>)
Vaux's swift	(<i>Chaetura vauxi</i>)
Western bluebird	(<i>Sialia mexicana</i>)
White-headed woodpecker	(<i>Dendrocopus albolarvatus</i>)
Yellow-billed cuckoo	(<i>Coccyzus americanus</i>)

C. Butterflies

Basin hairstreak	(<i>Mitoura barryi</i>)
Shepard's parnassian	(<i>Parnassius clodius sherpardi</i>)

6. State Monitor Species:

A. Birds

Black-backed woodpecker	(<i>Picoides articus</i>)
Black-crowned night heron	(<i>Nycticorax nycticorax</i>)
Great blue heron	(<i>Ardea herodias</i>)
Osprey	(<i>Pandion haliaetus</i>)
Prairie falcon	(<i>Falco mexicanus</i>)

B. Mammals

Ord's kangaroo rat	(<i>Dipodomys ordii</i>)
Washington ground squirrel	(<i>Citellus washingtoni</i>)

State Game Species:

A. Mammals

Marten (Martes americana)
Rocky Mtn bighorn sheep (Ovis canadensis canadensis)
Rocky Mountain elk (Cervus elaphus nelsoni)
Rocky Mtn mule deer (Odocoileus hemionus hemionus)
White-tailed deer (Odocoileus virginianus)
White-tailed jack rabbit (Lepus townsendii)

B. Birds

Blue grouse (Dendragapus obscurus)
Chukar (Alectoris chukar)
Hooded merganser (Lophodyter cucullatus)
Mountain quail (C. reortyx pictus)
Ring-necked pheasant (Phasianus colchicus)
Wood duck (Aix sponsa)

C. Fish

Channel catfish (Ictalurus punctatus)
Smallmouth bass (Micropterus dolomieu)
Steelhead/Rainbow trout (Oncorhynchus mykiss)

The following Priority Habitats can be found in the Asotin Creek watershed and should be protected as much as possible:

Aspen stands
Caves
Cliffs
Freshwater wetlands
Grasslands, meadows
Old growth/mature forests
Riparian
Shrub-steppe, large blocks
Shrub-steppe, small blocks
Snags
Talus slopes

NOTE: Many of the above animals have not been documented as living in the Asotin watershed in recent years. They have, however, been listed as living within the WDFW management area known as Region 1, which includes the Asotin watershed. Since Region 1 includes the entire far east portion of the state, from Oregon to Canada, several texts were used to eliminate those animals which live only in other parts of the Region, such as moose and golden-eye ducks. The texts which were used are:

A Field Guide to the Mammals. 1976. Burt, W. and R. Grossenheider. Third Edition.

A Guide to Field Identification of North American Birds. 1983. Robbins, C., B. Bruun, H. Zim, and A. Singer.

Inland Fishes of Washington. 1979. Wydoski, R. and R. Whitney.

Priority Habitat and Species. 1993. November. WDW/Habitat Division. Curt Smitch, Director. (Now WDFW, Bob Turner, Director).

APPENDIX D: WASHINGTON STATE FISH ADMINISTRATION
HISTORY

APPENDIX D: HISTORY OF FISH ADMINISTRATION IN WASHINGTON

I. Early History

The following information is an excerpt from The Origin and History of the Trout Brood Stocks of the Washinston Department of Game, by Bruce Crawford (1979):

In 1889 Washington achieved statehood and the Department of Fisheries and Game was established. In 1890 James Crawford was appointed The first Fish Commissioner of the State, and between 1890 and 1898 had three deputies to assist in regulating a statewide industry. Between 1897 and 1913, A.C. Little (1899-1902), T.R. Kershaw (1902-1905) and John L. Riseland (1906-1913) were appointed Fish Commissioner.

During this time numerous salmon hatcheries, oyster reserves and a few trout hatcheries were provided. Shortly after the Department of Fisheries and Game was created (1903) a county system of Game Commissions was established with each county having a game warden appointed by the Commission. Money received from county licenses went into the county game fund. However, in 1913 the new Game and Game-Fish Codes Provided for a chief Game Warden for the State. This code was enacted because the sportsmen and conservationists were displeased with the Fish Commissioners who gave little attention to the game and game fish of the State (WDFG, 1916, 1st Annual Report, Chief Game Warden).

In order to prohibit a separation of the food fisheries and game and game fish interests, Governor Lister appointed L.H. Darwin in 1913 as both Fish Commissioner and Chief Game Warden. Governor Lister believed that the control of game and fish should remain under one department. Darwin remained the unifying factor until 1921 when a new Civil Administration Code provided for a Director of the Department of Fisheries and Game and within this Department, the creation of the Division of Fisheries and Division of Game and Game Fish.

The Division of Game and Game Fish was administered by the Supervisor of Game and Game Fish who was appointed by the Director. The Division of Game and Game Fish also had a five member Advisory Board who were elected by the State Association of Game Commissioners and Wardens, and who met annually with the Supervisor to formulate policies. The Division of Game and Game Fish, unlike the Division of Fisheries, received no money from the state general fund, but were self supporting, relying upon hunting and fishing licenses (WDFG, Division of Game and Game Fish, 1923). This organization remained until 1932.

Due to the lack of central control found in having both county game commissions and a state game and game fish department, and to further divorce the interests of sportsmen and conservationists from those of the commercial fisheries, the legislature created in 1932 the separate Department of Fisheries and Department of Game. The Department of Game was to be headed by a Director who was appointed by a State Game Commission consisting of six members from various parts of the State. Game Commissioners were to be appointed by the Governor. The old county game commissions were disbanded and many of their assets were obtained by the new Department of Game. Funding remained on a self supported basis through the use of license fees and fines collected from game violations. This form of operation has persisted to the present [actually, to 1988]. It has worked well in that it has reflected the needs and desires of the sportsmen and conservationists of the State.

II. Recent History

By the 1960's the native Columbia and Snake River salmon runs were noticeably smaller than during the early 1900's. By the early 1970's much of this production was from hatcheries, which caused less emphasis to be put toward management of salmon habitat. Between then and 1985 fish habitat in the Snake and Columbia Rivers, and their tributaries (such as Asotin Creek), was managed primarily by the Washington Department of Game.

In June 1988 the Washington Department of Game (WDG) was renamed the Washington Department of Wildlife (WDW), with a Director appointed by the Governor and with access to money from the state general fund. In March 1994 these two agencies were combined into a single agency named the Washington Department of Fish and Wildlife (WDFW). The Director is still appointed by the Governor and the new agency is still funded with both license revenues and general fund money.

NOTE: Gathering information for the Asotin Model Watershed Plan began in early 1993, when there were the two agencies of WDF and WDW. The Final Rough Draft of this plan was issued in November 1994, after these two agencies became WDFW. To avoid confusion when reviewing the literature associated with Washington State salmon and trout, this plan refers to "WDG" (pre-June 1988), "WDW" (post-June 1988), and "WDF" (pre-1994) throughout the body of the text. The "WDFW" acronym is used only when referring to that agency's involvement since March 1994.

APPENDIX E: LIST OF ABBREVIATIONS
AND ACRONYMS

APPENDIX E: ABBREVIATIONS AND ACRONYMS

ACCD	Asotin County Conservation District
AC FT	Acre Feet
ASCS	Agricultural Stabilization and Conservation Service (now CFSA)
AUM	Animal Unit Month
BFD	Bankfull Discharge
BLM	Bureau of Land Management
BPA	Bonneville Power Administration
CFS	Cubic Feet per Second
CFSA	Consolidated Farm Services Agency (formerly ASCS)
COE	Corps of Engineers [U S Army]
CRM	Coordinated Resource Management Plan
CRP	Conservation Reserve Program
DNR	Department of Natural Resources [Washington State]
ESA	Endangered Species Act
FEMAT	Forest Ecosystem Management Assessment Team
FSA	Food Security Act
HEL	Highly Erodible Land
IFIM	Instream Flow Incremental Method
LWD	Large Woody Debris
NMFS	National Marine Fisheries Service [U.S.]
NRCS	Natural Resources Conservation Service [U.S.D.A.] (formerly SCS)
NWPPC	Northwest Power Planning Council
ODFW	Oregon Department of Fish and Wildlife
PACFISH	Pacific Fish
PHS	Priority Habitat and Species

PSIAC	Pacific Southwest Interagency Committee
RM	River Mile
scs	Soil Conservation Service [U.S.D.A.] (now NRCS)
USDA	United States Department of Agriculture
USFS	United States Forest Service [USDA]
USFW	United States Fish and Wildlife Service [U.S.]
USGS	United States Geologic Service
USLE	Universal Soil Loss Equation
WDF	Washington Department of Fisheries
WDG	Washington Department of Game
WDOE	Washington Department of Ecology
WDW	Washington Department of Wildlife (formerly WDG)
WDFW	Washington Department of Fish and Wildlife (union of WDW and WDF)

APPENDIX F: WETLAND TYPE DESCRIPTIONS

APPENDIXf

WETLAND TYPE DESCRIPTION&

WETLAND TYPE		DESCRIPTION	AREA ACRES)
PEM	Palustrine	emergent	112
PFO		forested	113
PSS		scrub/shrub	46
PAB		aquatic bed	9
PUB		unconsolidated bottom	6
PUS	"	shore	6
POW		open water	40
LLOW	Lacustrine	limnetic open water	2
R30W	Riverine	upper perennial open water	44
R4SB		intermittent streambed	25
R3RSA		upper perennial rocky shore (temp. 1	3
TOTAL			406

a/ From the National Wetlands Inventory, Cowardin et al, 1979.

APPENDIX G: RIPARIAN VEGETATION SPECIES LIST

APPENDIX G

RIPARIAN VEGETATION SPECIES LIST^{a/}

SCIENTIFIC NAME	COMMON NAME
<i>Populus trichocarpa</i>	black cottonwood
<i>Salix lutea</i>	yellow willow
<i>Salix exigua</i>	coyote willow
<i>Alnus rhombifolia</i>	white alder
<i>Swainsona salsula</i>	black locust
<i>Salix lasiandra</i> var. <i>caudata</i>	whiplash willow
<i>Rubus leucodermis</i> A	blackberry
<i>Prunus virginiana</i>	blue elderberry
<i>Phalaris arundinacea</i>	reed canarygrass
<i>Juglans nigra</i>	black walnut
<i>Equisetum</i> spp.	horsetail
<i>Clematis ligusticifolia</i>	western clematis
<i>Rosa nutkana</i> var. <i>hispida</i>	rose
<i>Pinus ponderosa</i>	ponderosa pine
<i>Scirpus acutus</i>	hardstem bullrush
<i>Glyceria</i> spp.	mannagrass
<i>Betula occidentalis</i> var. <i>occidentalis</i>	water birch
<i>Pseudotsuga menziesii</i> var. <i>glauca</i>	Douglas Fir
<i>Alnus incana</i>	mountain alder
<i>Acer glabrum</i>	rocky mt. alder
<i>Cornus sericea</i> var. <i>occidentalis</i>	red-osier dogwood
<i>Rhus trilobata</i>	skunkbush sumac
<i>Crataegus douglasii</i> var. <i>douglasii</i>	hawthorne
<i>Abies grandis</i>	grand fir
<i>Abies lasiocarpa</i>	subalpine fir
<i>Taxus brevifolia</i>	pacific yew

^{a/} From Hitchcock and Cronquist 1981.

APPENDIX H: STREAM INVENTORY, ANALYSIS,
AND ALTERNATIVE GENERATION
(GEOMORPHIC AND FISH)

FIGURE 1

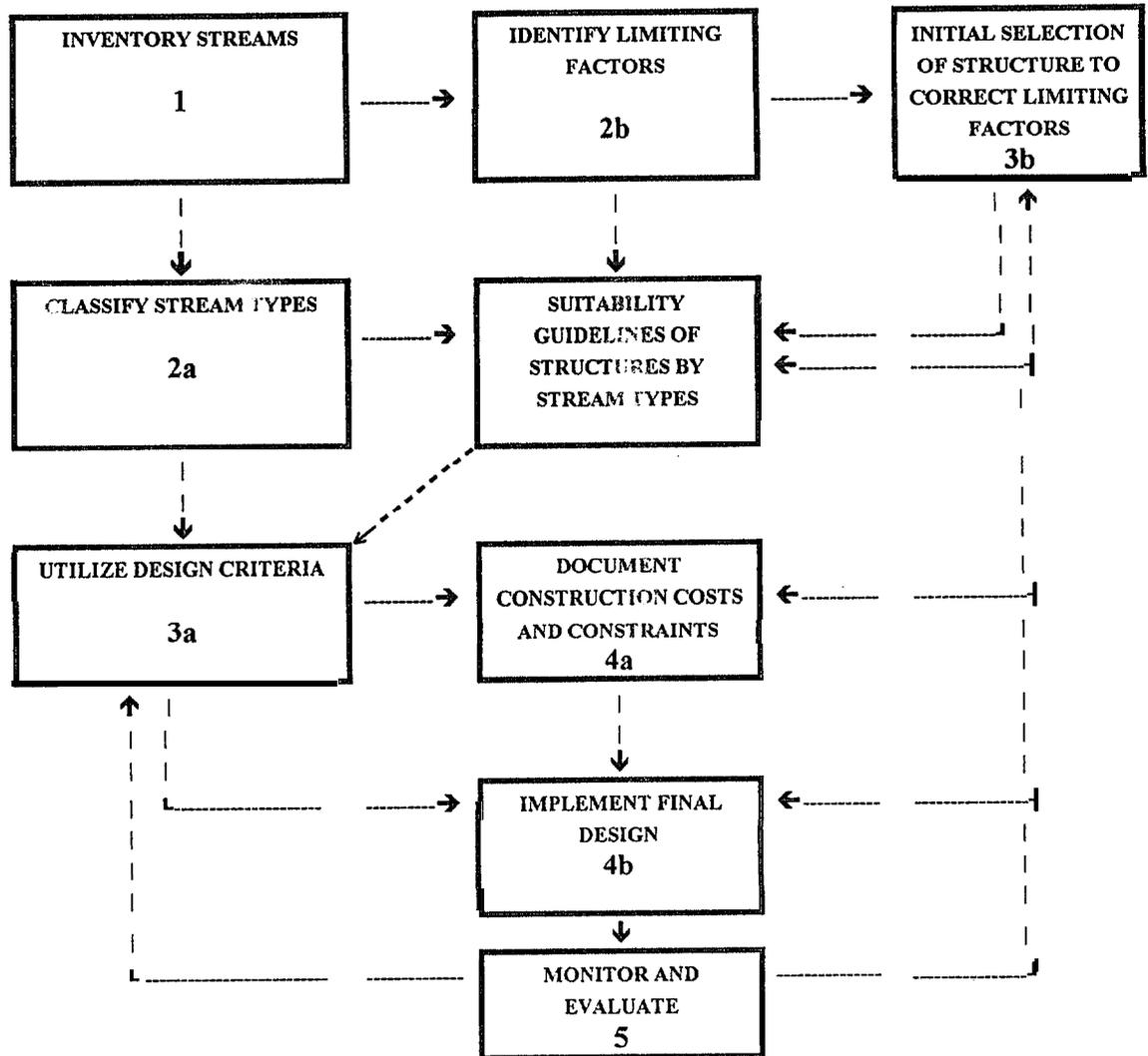


TABLE A

WATERSHED RESTORATION PLAN **ALTERNATIVE**
(Up to River Mile 16.1)

Stream Location	Practice	Units
Reaches 1 & 2 Combined (1993) same as Hankin and Reeves 1935 Highway Bridge at Asotin to Jerry Bridge. Station 2.	1. Vortex Rock Weirs	4
	2. Spur or Barb Logs	7
	3. Single Wing Log Deflector	1
	4. Root Wad Revetments	
	5. Backwater Ponds	2
	6. Dormant Stock Planting	840 feet
	7. Meander Reconstruction	
	8. Log Fish Ladder	
	9. Double Wing Log Deflector	1
	10. Low Stage Vortex Log Check	
Reach 3 (1993) same as Hankin and Reeves 1935 Station 2 to Station 3	1. Vortex Rock Weirs	5
	2. Spur or Barb Logs	14
	3. Single Wing Log Deflector	5
	4. Root Wad Revetment	12
	5. Backwater Ponds	10
	6. Dormant Stock Planting	2400 feet
	7. Meander Reconstruction	
	8. Log Fish Ladder	
	9. Double Wing Log Deflector	
	10. Low Stage Vortex Log Check	
Reaches 4 & 5 (1993) Headgate Park to Asotin Creek Road Bridge. Same as Hankin and Reeves 1935 Station 3 to Station 4	1. Vortex Rock Weirs	5
	2. Spur or Barb Logs	19
	3. Single Wing Log Deflector	3
	4. Root Wad Revetment	19
	5. Backwater Ponds	1 1
	6. Dormant Stock Planting	3000 feet
	7. Meander Reconstruction	2640 feet
	8. Log Fish Ladder	5
	9. Double Wing Log Deflector	
	10. Low Stage Vortex Log Check	
Reach 9 (1993) (Partial) Asotin Creek Road Bridge to 7500' upstream.	1. Vortex Rock Weirs	
	2. Spur or Barb Logs	12
	3. Single Wing Log Deflector	
	4. Root Wad Revetment	3
	5. Backwater Ponds	1
	6. Dormant Stock Planting	900 feet
	7. Meander Reconstruction	
	8. Log Fish Ladder	
	9. Double Wing Log Deflector	
	10. Low Stage Vortex Log Check	3
Reach 14a (1993) (Partial) Confluence of Asotin and Charlie Creeks	8. Log Fish Ladder	5
Total In-stream Structures		142
2640 feet of Geomorphic Restoration		1
7140 feet of Dormant Stock Planting		1

Refer to map Figures B-2, B-3, B-4, & B-5 for structure and planting locations.

TABLE B

Asotin Creek Mainstem Pool Riffle Ratio (Up to River Mile 16.1)

	1935 U.S. Fish & Wildlife	1992 Hankin and Reeves (Present)	Planned Action Alternative	Historical Geomorphic C4* (5 to 7 times Bfdw)**
Average Large Pools per mile	8.3	5.0	9.4	22
Pools	134	81	151	354
Large Pool loss		-39%		

* C4 stream type is described in Rosgen D.L. (1994) titled "A classification of Natural Rivers".

** A discussion of frequency of pools and their relationship to bankfull discharge width is in Leopold (1994) "View of a River". An average value of 6 was used.

DIAGRAM 1 - VORTEX ROCK WEIRS

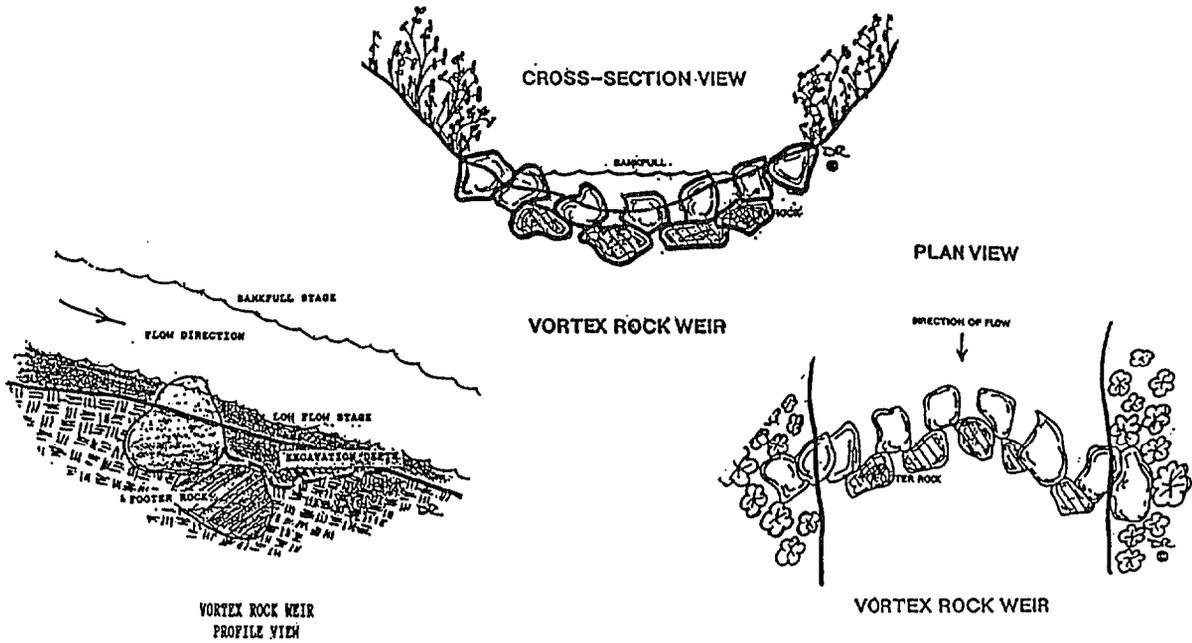


DIAGRAM 2 - DORMANT STOCK PLANTING

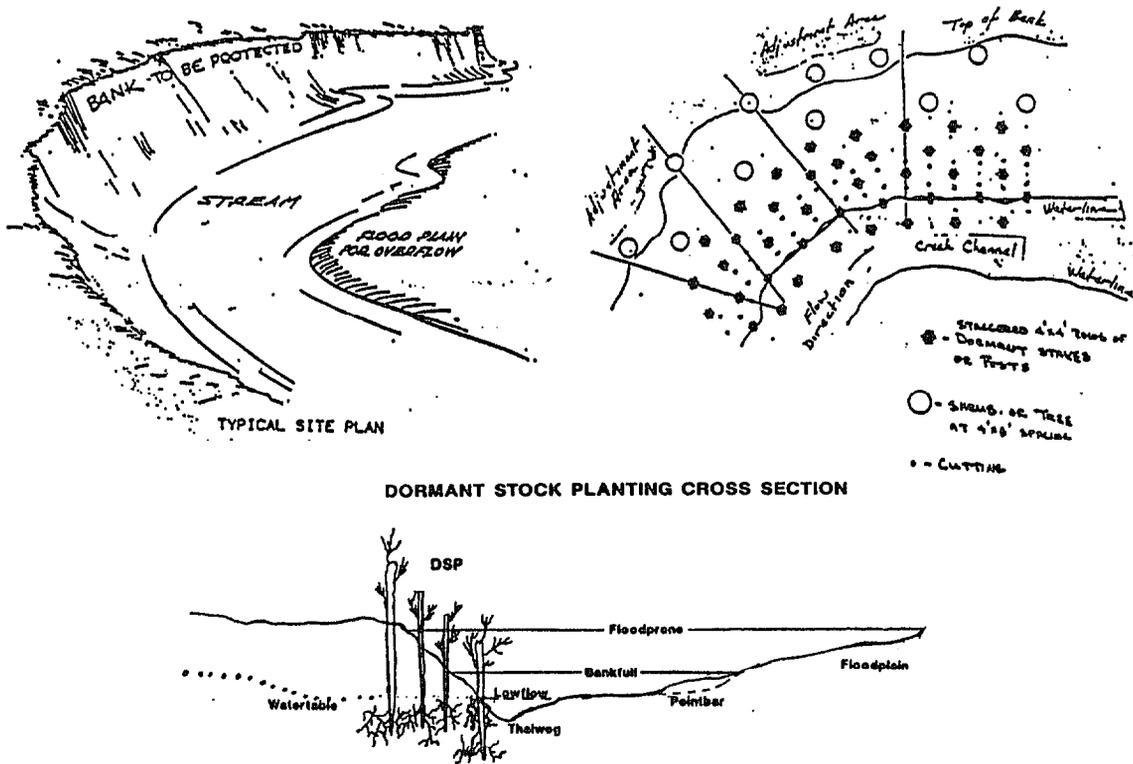


DIAGRAM 3

LOG SPUR

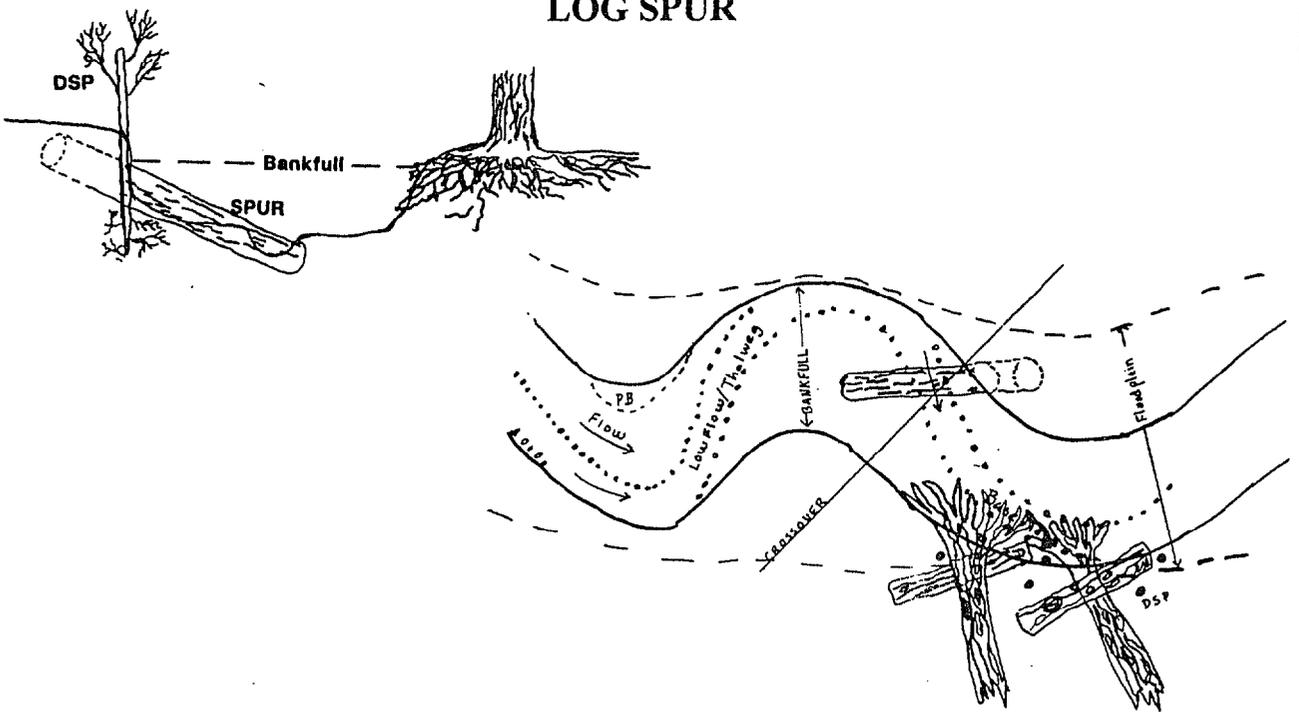


DIAGRAM 4

LOG BARB

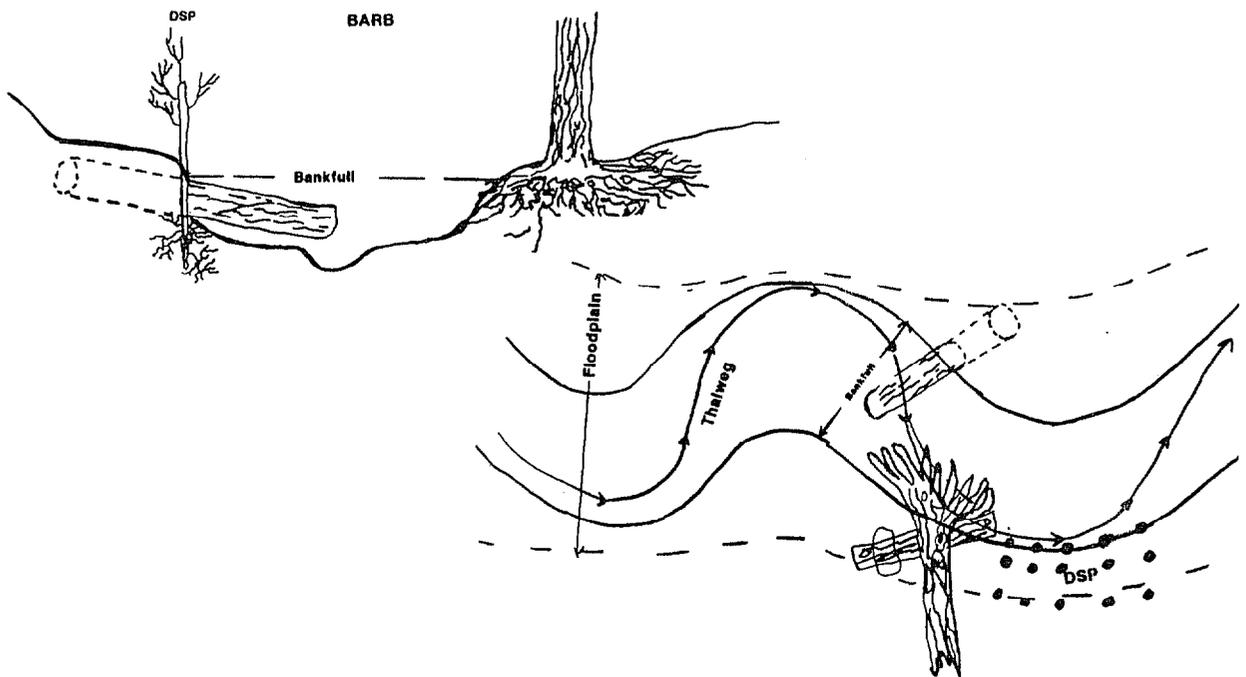
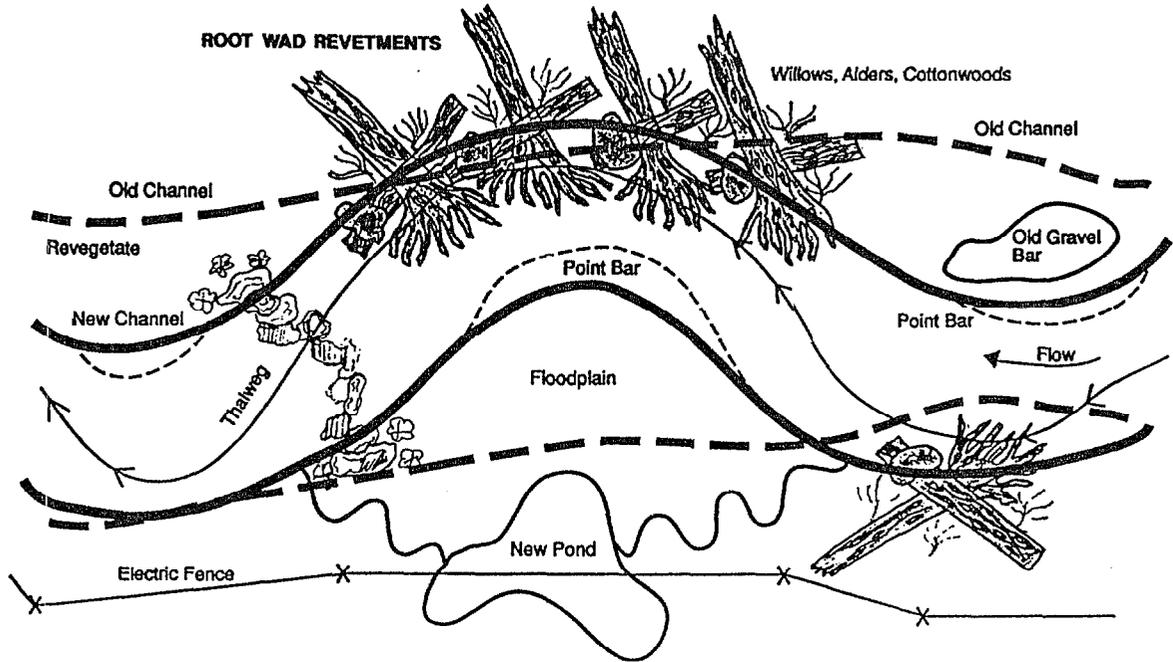


DIAGRAM 5 - ROOTWAD REVETMENTS

ROOT WAD REVETMENTS ARE EFFECTIVE STREAMBANK PROTECTION WHEN RE-ESTABLISHING MEANDER PATHS OR PROTECTING DOWN STREAM SCOUR AREAS INDUCED BY PROPOSED POOLS



ROOT WAD REVETMENT CROSS SECTION

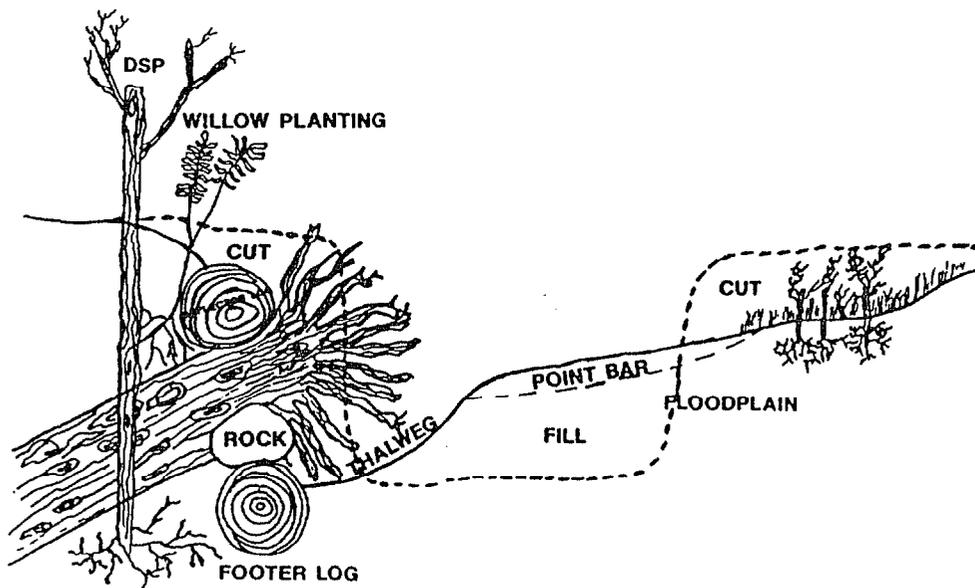


DIAGRAM 6 - SINGLE WING LOG DEFLECTOR

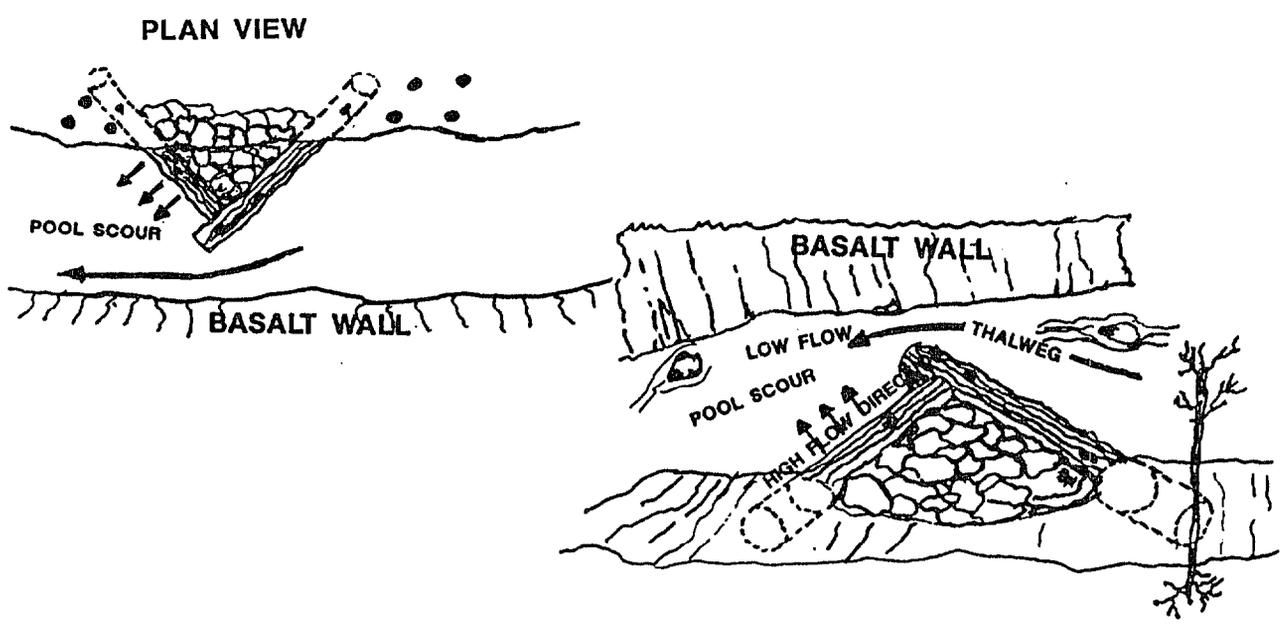
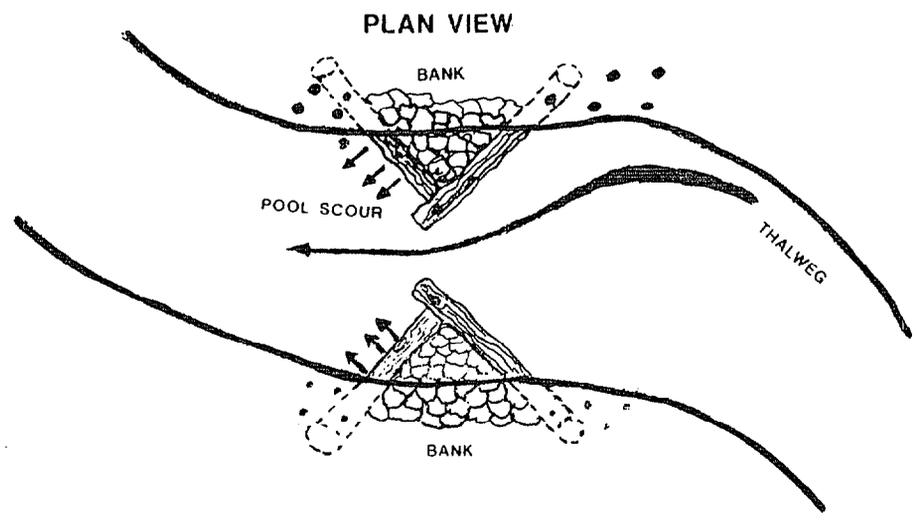


DIAGRAM 7 - DOUBLE WING LOG DEFLECTOR



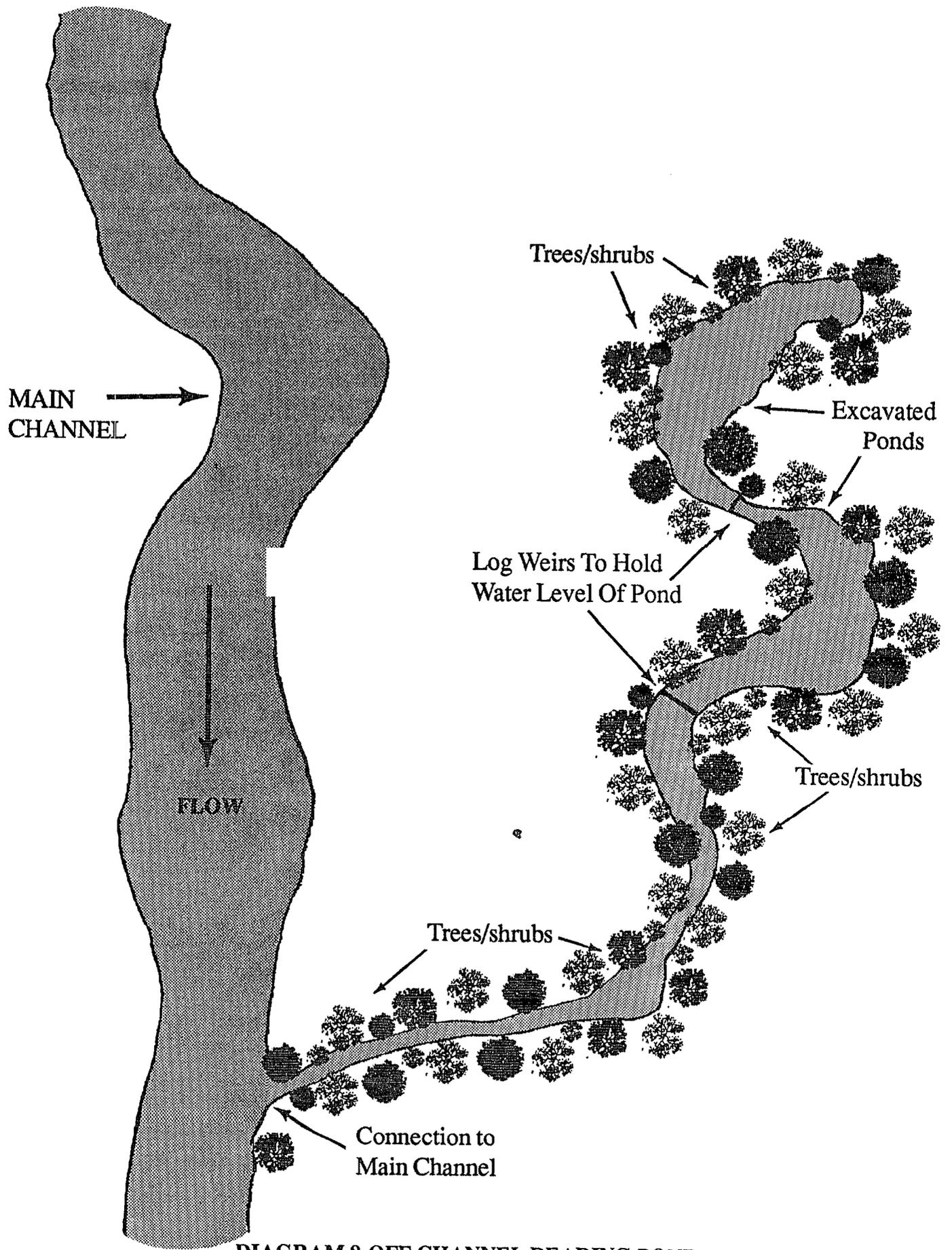


DIAGRAM 8-OFF CHANNEL REARING POND

APPENDIX I: ASOTIN BASIN COBBLE EMBEDDEDNESS

APPENDIX I
ASOTIN BASIN COBBLE EMBEDDEDNESS

STREAM NAME	SUBWATERSHED	HOOP METHOD		REACH	STREAM NAME/ DATE SURVEYED	SUBWATERSHED	HANKIN & REEVES	
		COBBLE EMBEDDEDNESS					COBBLE EMBEDDEDNESS %	REACH
North Fork Asotin	2D		13.8	I	North Fork Asotin-- 1992*	2D	Average Embedd.= 20.0	I
			9.6			2E	Average Embedd.= 20.0	II
		off forest	15.8				Average Embedd.= 35.0	III
		off forest	17.2					
		Average Embedd.=	14.1		Middle Branch N.F.--1993*	2F	Average Embedd.= 20.0	I
		2E	2.6	II	S.F. of N.F.-- 1993	2G	Average Embedd.= 35.6	I
			10.5	II				
			3.0	II				
			32.0	II	Charley Creek-- 1993	2A	Average Embedd.= 56.1	I
			11.0	III		2B	Average Embedd.= 55.6	II
			15.0	III			Average Embedd.= 40.8	III
		Average Embedd.=	10.17					
Middle Branch N.F.	2F		NO DATA	George-- 1993	1B	Average Embedd.= 38.9	I	
				S. Fork Asotin-- 1993	1D	Average Embedd.= 31.2	I	
Charley Creek	2A		30.2	II				
			9.1	II	Coombs-- 1993	1A	Average Embedd.= 29.3	
		Average Embedd.=	19.65				Average Embedd.= 11.0	II
		2B	18.0	II				
			34.4	II	Cougar-- 1992*	2E	Average Embedd.= 35.0	
			24.96	II				
		private	6.86	II				
		private	8.8	II				
	Average Embedd.=	20.60						
George	1B		NO DATA					
S. Fork Asotin	1D		NO DATA					
		1E private	11.7					
		private	35.7					
		private	25.4					
		private	7.99					
		private	15.65					
	Average Embedd.=	19.29						
Coombs	1A		NO DATA					
Cougar	2E		31.0					
			22.0					
		Average Embedd.=	26.5					

* DATA WERE BASED ON WHETHER SITE WAS GREATER OR LESS THAN 35%.

APPENDIX J: WASHINGTON STATE STANDARD FOR
SURFACE WATER - QUALITY CLASS A AND AA

Incremental temperature increases resulting from point source activities shall not, at any time, exceed $t = 28 / (T + 7)$ (freshwater) or $t = 1.5T - 21$ (marine water). Incremental temperature increases resulting from nonpoint source activities shall not exceed **2.8°C**.

For purposes hereof, "t" represents the maximum permissible temperature increase measured at a mixing zone boundary; and "T" represents the background temperature as measured at a point or points unaffected by the discharge and representative of the highest ambient water temperature in the vicinity of the discharge.

(v) pH shall be within the range of 6.5 to 8.5 (freshwater) or 7.0 to 8.5 (marine water) with a human-caused variation within a range of less than 0.5 units.

(vi) Turbidity shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.

(vii) Toxic, radioactive, or deleterious material concentrations shall be below those which have the potential either singularly or cumulatively to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health, as determined by the department (see WAC 173-201A-040 and 173-201A-050).

(viii) Aesthetic values shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste.

(V) pH shall be within the range of 6.5 to 8.5 (freshwater) or 7.0 to 8.5 (marine water) with a human-caused variation within a range of less than 0.2 units.

(v II Turbidity shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.

I vii) Toxic, radioactive, or deleterious material concentrations shall be below those which have the potential either singularly or cumulatively to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health, as determined by the department (see WAC 173-20 1 A-040 and 173-20 1 A-050).

(viii) Aesthetic values shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste.

(2) Class A (excellent).

(a) General characteristic. Water quality of this class shall meet or exceed the requirements for all or substantially all uses.

(b) Characteristic uses. Characteristic uses shall include, but not be limited to, the following:

(i) Water supply (domestic, industrial, agricultural).

(ii) Stock watering.

(iii) Fish and shellfish:

Salmonid migration, rearing, spawning, and harvesting.

Other fish migration, rearing, spawning, and harvesting.

Clam, oyster, and mussel, rearing, spawning, and harvesting.

Crustaceans and other shellfish. (crabs, shrimp, crayfish, scallops, etc.) rearing, spawning, and harvesting.

(iv) Wildlife habitat.

(v) Recreation (primary contact recreation, sport fishing, boating, and aesthetic enjoyment)

(vi j Commerce and navigation.

(c) Water quality criteria:

(i) j Fecal coliform organisms:

(A) Freshwater fecal coliform organism levels shall both not exceed a geometric mean value of 100 colonies/100 mL, and not have more than 10 percent of all samples obtained for calculating the geometric mean value exceeding 200 colonies/100 mL.

- (B) Marine water - fecal coliform organism levels shall both not exceed a geometric mean value of 14 colonies/100 mL, and not have more than 10 percent of all samples obtained for calculating the geometric mean value exceeding 43 colonies/100 mL.

(ii) Dissolved oxygen:

(A) Freshwater - dissolved oxygen shall exceed 8.0 mg/L.

(B) Marine water - dissolved oxygen shall exceed 6.0 mg/L. When natural conditions, such as upwelling, occur, causing the dissolved oxygen to be depressed near or below 6.0 mg/L, natural dissolved oxygen levels may be degraded by up to 0.2 mg/L by human-caused activities.

(iii) Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection.

(iv) Temperature shall not exceed **18.0°C** (freshwater) or **16.0°C** (marine water) due to human activities. When natural conditions exceed **18.0°C** (freshwater) and **16.0°C** (marine water), no temperature increases will be allowed which will raise the receiving water temperature by greater than **0.3°C**.

WAC 173-201A-030 General water use and criteria classes. The following criteria shall apply to the various classes of surface waters in the state of Washington:

(1) Class AA (extraordinary).

(a) General characteristic. Water quality of this class shall markedly and uniformly exceed the requirements for all or substantially all uses.

(b) Characteristic uses. Characteristic uses shall include but not be limited to, the following:

(i) Water supply (domestic, industrial, agricultural).

(ii) Stock watering.

(iii) Fish and shellfish:

Salmonid migration, rearing, spawning, and harvesting.

Other **fish** migration, rearing, spawning, and harvesting.

Clam, oyster, and mussel rearing, spawning, and harvesting.

Crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing, spawning, and harvesting.

(iv) Wildlife habitat.

(v) Recreation (primary contact recreation, sport fishing, boating, and aesthetic enjoyment).

(vi) Commerce and navigation.

(c) Water quality criteria:

(i) Fecal **coliform** organisms:

(A) Freshwater - **fecal coliform** organism levels shall both not exceed a geometric mean value of 50 colonies/ 100 mL and not have more than 10 percent of ail samples obtained for calculating the geometric mean value exceeding 100 colonies/ 100 mL.

(B) Marine water **total coliform** organism levels shall both not exceed a geometric mean value of 14 colonies/ 100 mL, and not have more than 10 percent of all samples obtained for **calculating** the geometric mean value exceeding 43 colonies/ 100 mL.

(ii) Dissolved oxygen:

(A) Freshwater - dissolved oxygen shall exceed 9.5 mg/L.

(B) Marine water - dissolved oxygen shall exceed 7.0 mg/L. When natural conditions, such as **upwelling**, occur, causing the dissolved oxygen to be depressed near or below 7.0 mg/L, natural dissolved oxygen levels may be degraded by up to 0.2 mg/L by human-caused activities.

(iii) Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection.

(iv) Temperature shall not exceed 16.0°C (freshwater) or 13.0°C (marine water) due to human activities. When natural conditions exceed 16.0°C (freshwater) and 13.0°C (marine water), no temperature increases will be allowed which will raise the receiving water temperature by greater than 0.3°C.

Incremental temperature increases resulting from point source activities shall not, at any time, exceed $t = 1.5$ (freshwater) or $t = 8 / (T - 4)$ (marine water). Incremental temperature increases resulting from nonpoint source activities shall not exceed 2.8°C.

For purposes hereof, "t" represents the maximum permissible temperature increase measured at a mixing zone boundary; and "T" represents the background temperature as measured at a point or points **unaffected by** the discharge and representative of the highest ambient water temperature in the vicinity of the discharge.

WATER QUALITY STANDARDS-SURFACE WATERS CLASS A AND AA

APPENDIX K: PRACTICES: DEFINITION AND PURPOSE

APPENDIX K - SELECTED PRACTICES FROM THE NRC8 FIELD OFFICE
TECHNICAL GUIDE.

Channel Vegetation

Definition: Establishing and maintaining adequate plants on channel banks, berms, spoil piles, and associated areas.

Purpose: To stabilize channel banks and adjacent areas and reduce erosion and sedimentation. To maintain or enhance the quality of the environment, including visual aspects and fish and wildlife habitat.

Conservation Cover

Definition: Establishing and maintaining perennial vegetative cover to protect soil and water resources on land retired from agricultural production.

Purpose: To reduce soil erosion and sedimentation, improve water quality, and create or enhance wildlife habitat.

Critical Area Planting

Definition: Planting vegetation, such as trees, shrubs, vines, grasses, or legumes, on highly erodible or critically eroding areas (does not include tree planting mainly for wood products).

Purpose: To stabilize the soil, reduce damage from sediment and runoff to downstream areas, and improve wildlife habitat and visual resources.

Fencing

Definition: Enclosing or dividing an area of land with a suitable permanent structure that acts as a barrier to livestock, big game, or people (does not include temporary fences).

Purpose: (1) Exclude livestock or big game from areas that should be protected from grazing, (2) confine livestock or big game to a given area, (3) control domestic livestock while permitting wildlife movement, (4) subdivide grazing land to permit use of grazing systems, (5) protect new seedlings and plantings from grazing, and (6) regulate access to areas by people or prevent trespassing.

Filter Strip

Definition: A strip or area of vegetation planted in a designated area outside the perimeter of a localized area of potential surface pollution.

Purpose: To remove sediment and other pollutants from runoff or waste water by filtration, deposition, infiltration, absorption, decomposition, and volatilization, thereby keeping it from entering surface waters.

Fish Stream Improvement

Definition: Improving a stream channel to make new fish habitat or to improve existing habitat.

Purpose: To increase the production of desired species of fish.

Grassed Waterway

Definition: A natural or constructed channel that is shaped or graded to require dimensions and established in suitable vegetation for the stable conveyance of runoff.

Purpose: (1) Convey runoff from terraces, diversions, or other water concentrations without causing erosion or flooding and (2) improve water quality.

Pasture and Hayland Management

Definition: Proper treatment and use of pastureland or hayland.

Purpose: (1) Prolong the life of desirable forage species, (2) maintain or improve the quality and quantity of forage, and (3) protect the soil and reduce water loss.

Pond

Definition: A water impoundment made by constructing a dam or an embankment or by excavating a pit or dugout.

Purpose: To provide water for livestock, fish and wildlife, recreation, fire control, crop and orchard spraying, and other related uses, and to maintain or improve water quality.

Prescribed Grazing

Definition: The controlled harvest of vegetation with grazing or browsing animals, managed with the intent to achieve a specified objective.

Purpose: This practice may be applied as part of a conservation management system to accomplish one or more of the following:

1.) Improve or maintain the health and vigor of selected plant(s) and to maintain a stable and desired plant community.

2.) Provide or maintain food, cover and shelter for animals of concern.

3.) Improve or maintain animal health and productivity.

4.) Maintain or improve water quality and quantity

5.) Reduce accelerated soil erosion and maintain or improve soil condition for sustainability of the resource.

Sediment Basin

Definition: A basin constructed to collect and store debris or sediment.

Purpose: (1) Preserve the capacity of reservoirs, ditches, canals, diversions, waterways, and streams, and (2) prevent undesirable deposition on bottom lands.

Spring Development

Definition: Improving springs and seeps by excavating, cleaning, capping, or providing collection and storage facilities.

Purpose: Mainly to improve the distribution of water or to increase the quantity of water for livestock or wildlife. Also to obtain water for irrigation if water is available in a suitable quantity and quality.

Stock Trails and Walkways

Definition: A livestock trail or walkway constructed to improve grazing distribution and access to forage and water.

Purpose: (1) Provide or improve access to forage and water, (2) reduce livestock concentrations, (3) control livestock to permit proper grazing use in planned grazing systems, and (4) improve grazing efficiency.

Streambank and Shoreline Protection

Definition: Using vegetation or structures to stabilize and protect banks of streams, lakes, estuaries, or excavated channels against scour and erosion.

Purpose: To stabilize or protect banks of streams, lakes, estuaries, or excavated channels for one or more of the following reasons:

1. Prevent loss of land or damage to utilities, roads, buildings, or other facilities adjacent to the banks.
2. Maintain the capacity of the channel.
3. Control channel meander that would adversely affect downstream facilities.
4. Reduce sediment loads causing downstream damages and pollution.
5. Improve the stream or lake for recreation or as habitat for fish and wildlife.

Stripcropping, Field

Definition: Growing crops in a systematic arrangement of strips or bands across the general slope (not on the contour) to reduce water erosion. The crops are arranged so that a strip of grass or a close-growing crop is alternated with clean-tilled crop or fallow.

Purpose: To help control erosion and runoff on sloping cropland where contour stripcropping is not practical.

Terrace

Definition: An earth embankment, a channel, or a combination ridge and channel constructed across the slope.

Purpose: (1) reduce slope length, (2) reduce erosion, (3) reduce sediment content in runoff water, (4) improve water quality, (5) intercept and conduct surface runoff at a nonerosive velocity to a stable outlet, (6) retain runoff or conserve moisture, (7) prevent gully development, (8) reform the land surface, (9) improve farmability, or (10) reduce flooding.

APPENDIX L: FISH HABITAT STRUCTURES VS STREAM
TYPE

TABLE 1

ANADROMOUS FISH HABITAT IMPROVEMENTS FOR ASOTIN STREAM TYPES

Stream type	Low Stage Checks	Medium Stage Checks	Vortex Rock Weirs	Boulder Placement	Bank Placement Boulder	Single Wing Deflector	Double Wing Deflector	Channel Constrictor	Bank Cover	Half Log Cover	Migration Barrier	Gravel Trap "V" Shaped	Gravel Trap Log Sill	Gravel Placement	Vegetation stabilization Ex. Dor. Stock Plant.
B2	Exc.	Good	Good	Exc	Exc	Exc	Exc	Exc	Exc	Exc	Exc	Good	Good	Good	Fair
B3	Exc	Good	Exc	Exc	Exc	Exc.	Exc.	Exc.	Exc.	Exc.	Good	Good	Good	Good	Fair
B3c	Good	Fair	Good	Good	Exc.	Good	Good	Fair	Good	Good	Poor	Fair	Good	Fair	Good
B4c	Fair	Poor	Good	Poor	Good	Fair	Fair	Fair	Good	Fair	Poor	Poor	Poor	N/A	Good
C4	Fair	Poor	Good	Poor	Good	Fair	Fair	Fair	Good	Fair	Poor	Poor	Poor	N/A	Exc
F2b	Good	Fair	Exc	Fair	Good	Fair	Fair	Fair	Good	Good	Poor	Poor	Poor	Fair	Fair
F3b	Fair	Poor	Exc	Fair*	Good	Fair	Fair	Fair	Good	Good	Poor	Poor	Poor	Fair	Exc
F3	Good	Fair	Good	Fair	Good	Fair	Fair	Fair	Good	Good	Poor	Poor	Poor	Fair	Good
F4	Fair	Poor	Good	Poor	Good	Fair	Fair	Fair	Good	Fair	Poor	Poor	Poor	Fair	Good
G3c	Good	Fair	Good	Poor	Fair	N/A	N/A	N/A	N/A	N/A	Poor	Poor	Poor	Poor	Fair
G4c	Fair	Poor	Good	Poor	Fair	N/A	N/A	N/A	N/A	N/A	Poor	Poor	Poor	Poor	Fair
D4	Fair	Poor	Poor	Poor	Poor	Fair	Fair	Fair	Poor	Poor	Poor	N/A	Poor	Poor	Good

- e Excellent - Little or no limitation to location of structures or special modification. (with exception of meander reconstruction).
- 0 Good - Under most conditions, very effective. Minor modifications of design or placement required.
- a Fair - Serious limitations which can be overcome by placement location, design modification, or stabilization techniques. Generally not recommended due to difficulty of offsetting potential adverse consequences and high probability of reduced effectiveness

- e Poor - Not recommended
- 8 Most of these practices must be completed with corresponding streambank protection. Example - A single wing log deflector must be accompanied by streambank vegetation because the opposing bank will scour as water deflects.
- 0 Utih, table 4 in "Fish Habitat Structures. A Field Manual for Stream Classification" Dave Rosgen and Brenda L. Futante. Convert 1985 classification types to 1992.

APPENDIX M: LIST OF TROUT PLANTS 19354980

Record of Plantings

F. No. 4185-A-12-40-5C. 20783.

Date of Planting	Species	Size	Number	Source of Fish
June 30, 1942	Rain	3"-3 1/2"	26,380	Walla Walla Hatch.
July 31, 1942	"	1 1/2"	55,365	" "
Aug. 31, 1942	Rain	3"	22,985	" "
May 31, 1945	"	4"-6"	12,500	" "
" " "	"	6"-10"	2,500	" "
Aug 31, 1943	"	4 1/8"	24,425	" "
" " "	"	4 1/8"	24,605	" "
April 21, 1944	"	4"	10,205	" "
April 24, 1944	"	6"	2,320	" "
July 12, 1944	"	3 1/2"	10,494	" "
July 14, 1944	"	3 1/2"	9,899	" "
Apry 30, 1945	"	4 1/2"	8,750	" "
Apry 30, 1945	"	4 1/2"	5,245	" "
July 13, 1945	"	3 1/2"	13,193	" "
" 15, 1945	"	3-3/4"	12,475	" "
" 18, 1945	"	3-3/4"	12,978	" "
Apr. 17, 1946	"	5"	5,997	" "
Apr. 20, 1946	"	5"	5,513	" "
July 9, 1946	"	3 1/2"	13,641	" "
April 10, 1947	Rainbow	5"	4,200	Walla Walla Hatch.
" 11, 1947	"	5"	8,399	" "
June 26, 1947	"	4"	12,300	" "
" 28, 1947	"	4"	6,300	" "
April 3, 1948	"	"	7,320	" "
June 11, 1948	"	6"	3,500	" "
April 25, 1949	Rainbow	7"	3,942	Walla Walla Hatchery
" 26, "	"	7"	2,785	" "
" 26, "	"	"	2,506	" "
ROADSIDE PLANTINGS				
May 4, 1950	Rainbow	6 1/2"	3,200	Walla Walla Hatch.
" 6, "	"	6 1/2"	3,200	" "
May 3, 1951	Rainbow	6/#	624	Tucannon Hatchery
" 4, "	"	10/#	1,380	" "
" 4, "	"	6/#	1,044	" "
" 5, "	"	10/#	1,040	" "
" 5, "	"	6/#	1,362	" "
Jun. 15, "	"	11/#	5,610	" "
May 5-12, 1952	Rainbow	7/#	5,250	Tucannon
" 7, "	"	3/#	1,200	" "
" 7, "	"	6 1/2/#	2,275	" "

Card # 2
County ASOTIN

Name of Stream ASOTIN CREEK

Meandered

Tributary of Snake River

Source

Barriers

Diversions

Pollutions

Tributaries

307
521
828,000

Type of stream

Type of Shore Line: Gravelly
Muddy
Vegetated

Type of Bed: Boulders
Gravelly
Muddy

Type of water: Clear
Brackish
Glacial Silt

Character of Watershed: Mountains, rolling, flat, swampy, wooded, open

Fish native to this stream

Transplanted species

In species thrive best

3/8,000

Value for fishing and degree fished

Accessible by

Distance from highway

Record of Plantings

S . 4185-A-1-40-1M. 2053A.

Date of Planting	Species	No./lb.		Number	Source of Fish
		Size			
Jun. 12, 1952	Rainbow	8 1/2		2,591	Tucannon
Apr. 16-17, 1953	Rainbow	4 1/2		3,600	Tucannon
" 16, "	"	7 1/2		3,000	"
Apr. 26, 1954	Rainbow	5		3,100	Tucannon
May 25, "	"	11.5		2,990	"
Apr. 11-12, 1955	Stealhead	9		6,066	W.A. Report found
" 12, "	"	11		4,312	Walla Walla
" 15, "	Rainbow	6		1,980	Tucannon
" 26, "	"	5		1,750	"
May 7, "	"	5		1,625	"
June 4-12, "	"	10		5,370	"
Oct. 3-4, 1955	Stealhead	10		9,830	Asotin Cr. Stock
" 5-27, "	"	7		14,350	Tucannon
May 18, 1956	Rainbow	9		2,070	Tucannon
" 18, "	"	7		3,010	"
June 23, "	"	5		5,475	"
May 2, 1957	Rainbow	6		4,000	Tucannon
June 5, 1957	"	6		2,490	Tucannon
" 5, 1957	"	11		2,158	"
" 19, 1957	"	7.5		3,005	"
May 9, 1958	Rainbow	4.5		2,712	Tucannon
July 11, 1958	"	5		4,300	"
June 9, 1958	Rain.	7.5		2,250	Tucannon
April 8, 1959	Sthd.	9		10,248	Asotin Cr. Stock Naches
April 23, 1959	Rain.	5 1/2		3,979	Tucannon
May 10, 1959	rainbow	6		5,148	"
April 20, 1960	Sthd	8 1/2		4,948	W. Naches to Trace
April 22, 1960	"	"		4,721	"

County Asotin Name of STREAM Asotin Creek (3)

Meandered _____ Tributary of _____

Source _____ Barriers _____

Diversions _____ Pollutions _____

Tributaries _____

Type of stream _____

Type of Shore Line: Gravelly _____ Type of Bed: Boulders _____ Type of water: Clear _____
 Muddy _____ Gravelly _____ Brackish _____
 Vegetated _____ Muddy _____ Glacial Silt _____

Character of Watershed: Mountains, rolling, flat, swampy, wooded, open _____

Fish native to this stream _____

Planted species _____

Which species thrive best _____

Value for fishing and degree fished _____

Accessible by _____ Distance from highway _____

Record of Plantings

S. F. No. 4185-A-3-57-5C. 48507.

out. 11 1963

Date of Planting	Species	No./lb.	Number	Source of Fish
May 16, 1960	Rainbow	5	3,491	Tucannon
May 16, 1960	"	5	3,994	"
May 20, 1960	"	5	2,200	"
May 21, 1960	"	52	1,980	"
May 5, 1961	Rainbow	5.5	7,025	Tucannon
May 3-4, 1961	Sthd	9 1/2	10,450	Forest Rapids Sta Grant County
June 30, 1961	Rainbow	6	2,400	Tucannon
May 12&15, '62	Rainbow	5-5.5/#	9,496	Tucannon
June 1962	Rainbow	4.2/#	1,257	Tucannon
May 23, 1963	Rainbow	4.7/#	6,004	Tucannon
July 17, 1963	"	5.0	3,997	"
May 1964	"	5-5.8	5,304	"
May 1964	"	5	1,000	"
June 1964	"	5.2	3,640	"
July 1964	"	4.7	3,008	"
"	"	6.0	2,502	"
May 1965	"	6.2	4,005	"
June 1965	Rainbow	7.8	3,510	Tucannon
August 5, 1965	"	7.5	4,004	Tucannon
August 23, 1965	"	7	5,005	Col. Basin
June, 1966	"	4.3	3,438	Tucannon
July 1966	"	4.5	2,585	"
May 1967	"	5.6	3,024	"
July 1967	"	6	5,010	"
May 1977	Rbw.	4.3	3,741	Tucannon

County: Asotin Name of STREAM: Asotin Creek (L)

Meandered: _____ Tributary of: _____

Source: _____ Barriers: _____

Diversions: _____ Pollutions: _____

Tributaries: _____

Type of Stream: _____

Type of Shore Line: Gravelly Type of Bed: Boulders Type of water: Clear
Muddy Gravelly Brackish
Vegetated Muddy Glacial Silt

Character of Watershed: Mountains, rolling, flat, swampy, wooded, open

Fish native to this stream: _____

Transplanted species: _____

Which species thrive best: _____

fishing and degree fished: _____

Accessible by: _____ Distance from highway: _____

Record of Plantings

F. No. 4183-A-3-57-5C. 48507.

Date of Planting	Species	No./lb.	Number	Source of Fish
May 13, 1968	Rbw	3.5-6	3507	Tucannon
May 1968	"	4.5	1,980	Entiat NFH
July 16	Rain	5.5/#	500	FORD
June 1969	Rbw	3	9,300	Tucannon
*June 1970	Rbw	3-3.5	4,875	Tucannon
**June 23, 1970	Rbw	3	2250	Tucannon
*July 1970	Rbw	3	5,400	Tucannon
**May 1971	Rbw	4.5	3,275	Tucannon
*May 1971	Rbw	4.2	2,016	Tucannon
**June 1971	Rbw	4	2600	Tucannon
*July 1971	Rbw	3.5	2,012	Tucannon
May 1972	Rbw.	3.2	6,384	Tucannon
June 1972	Rbw	3.2	3,248	Tucannon
May, 1973	Rbw.	3.9	8,077	Tucannon
June, 1973	Rbw.	3.8	4,006	Tucannon
May, 1974	Rbw.	4.2	2,520	Tucannon
June, 1974	Rbw.	4.1	2,583	Tucannon
May, 1975	Rbw.	5.5	4,015	Tucannon
June, 1975	Rbw	4.6	1,035	Tucannon
May, 1976	Rbw	4.5	4,050	Tucannon
June 1977	Rbw	3.4	3,196	Tucannon
May, 1978	Rbw.	4.4	4,488	Tucannon
June, 1978	Rbw	4.0	4,720	Tucannon
May, 1979	Rbw.	4.4	3,432	"
June, 1979	Rbw.	4.0	3,740	"
May 1980	Rbw.	5.0	3,925	Tucannon
June, 1980	Rbw.	4.6	2,760	"

Asotin County Name of STREAM Asotin Creek (5)

Meandered Tributary of Snake River

Source Barriers

Diversions Pollutions

Tributaries

Type of Stream.

Type of Shore Line: Gravelly, Muddy, Vegetated
 Type of Bed: Boulders, Gravelly, Muddy
 Type of water: Clear, Brackish, Glacial Silt

Character of Watershed: Mountains, rolling, flat, swampy, wooded, open

Fish native to this stream

Transplanted species

species thrive best

Value for fishing and degree fished

Accessible by Distance from highway

APPENDIX N: W-DOE DRAFT MEMO REGARDING RIPARIAN
STOCKWATER

PRO-1025 WATER RESOURCES PROGRAM PROCEDURE

Resource Contact: Policy and Technical Support
Section

EffectiveDate: 6/30/94
Revised: NEW

References: Chapters 90.03 and 90.22 RCW

PROCEDURE FOR STOCKWATER USES WHEN STREAMS ARE FENCED

Purpose: To provide a simple, consistent response to water right related issues when fencing stock out of streams.

Application: This policy does not apply to stockwatering relating to feedlots and other activities which are not related to normal stockgrazing land uses.

1. WHEN MOVING STOCK OUT OF STREAMS FOR WATER QUALITY PURPOSES NORMAL WATER RIGHT PERMITTING PROCEDURES ARE NOT REQUIRED.

Water users shall notify the program by a letter to the Water Resources Section Supervisor at the appropriate regional office of an intent to exclude stock from a water source and transport small quantities of water from the source. Proper notice shall include the description of the place of stock confinement; the number of stock maintained on the property; the period of the year that stock are present; the name of the water source; and the method, distribution system, including point of diversion and rate which will be used to deliver water to the place of confinement.

2. THE PROGRAM SHALL REVIEW AND FILE THE NOTICE.

The Program shall respond within 45 days to the notice if there is disagreement with the proposal, such as disagreement with the underlying water right or the method of diversion.

The notification and response shall be retained within files, organized by Township, Range, and Section and separated by WRIA, established specifically for this purpose.

CarolFleskes
Program Manager
Water Resources Program