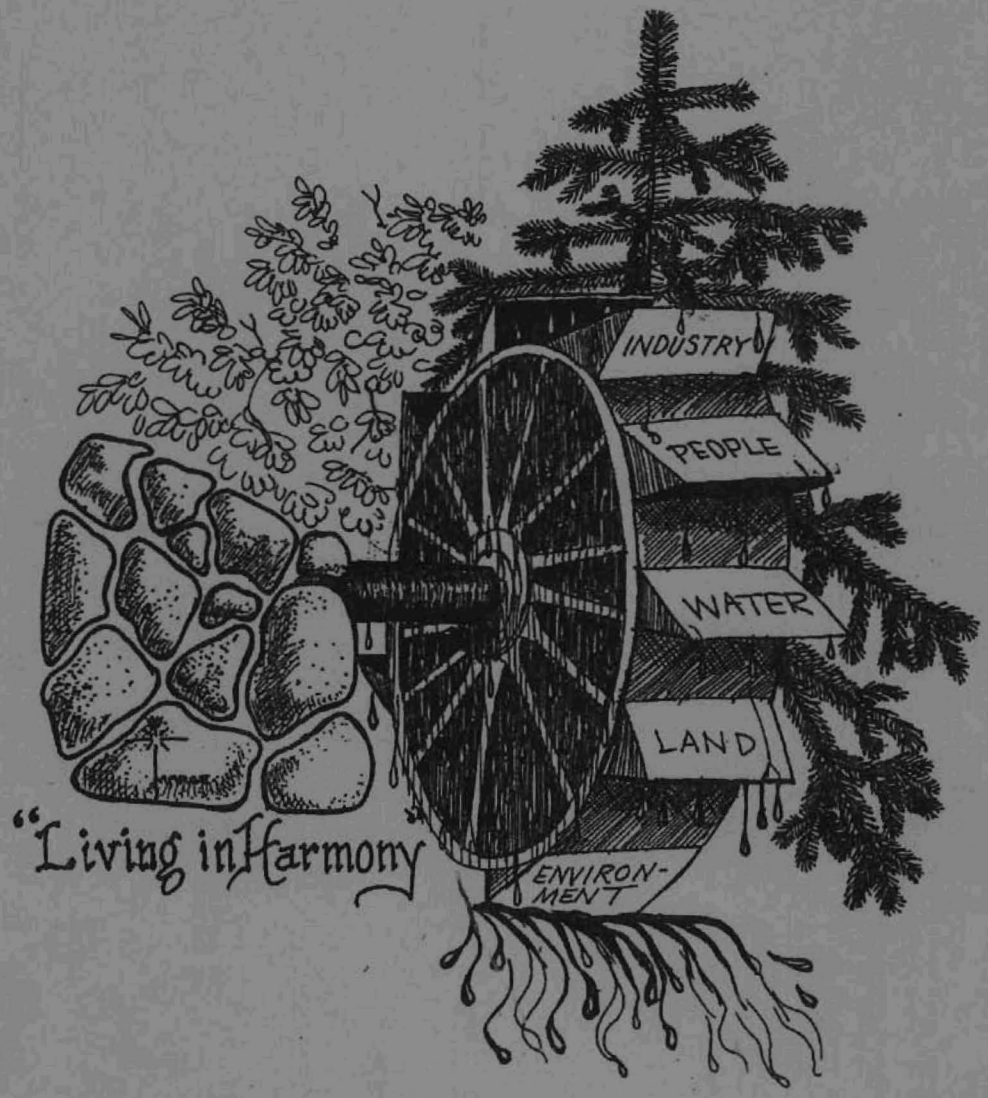
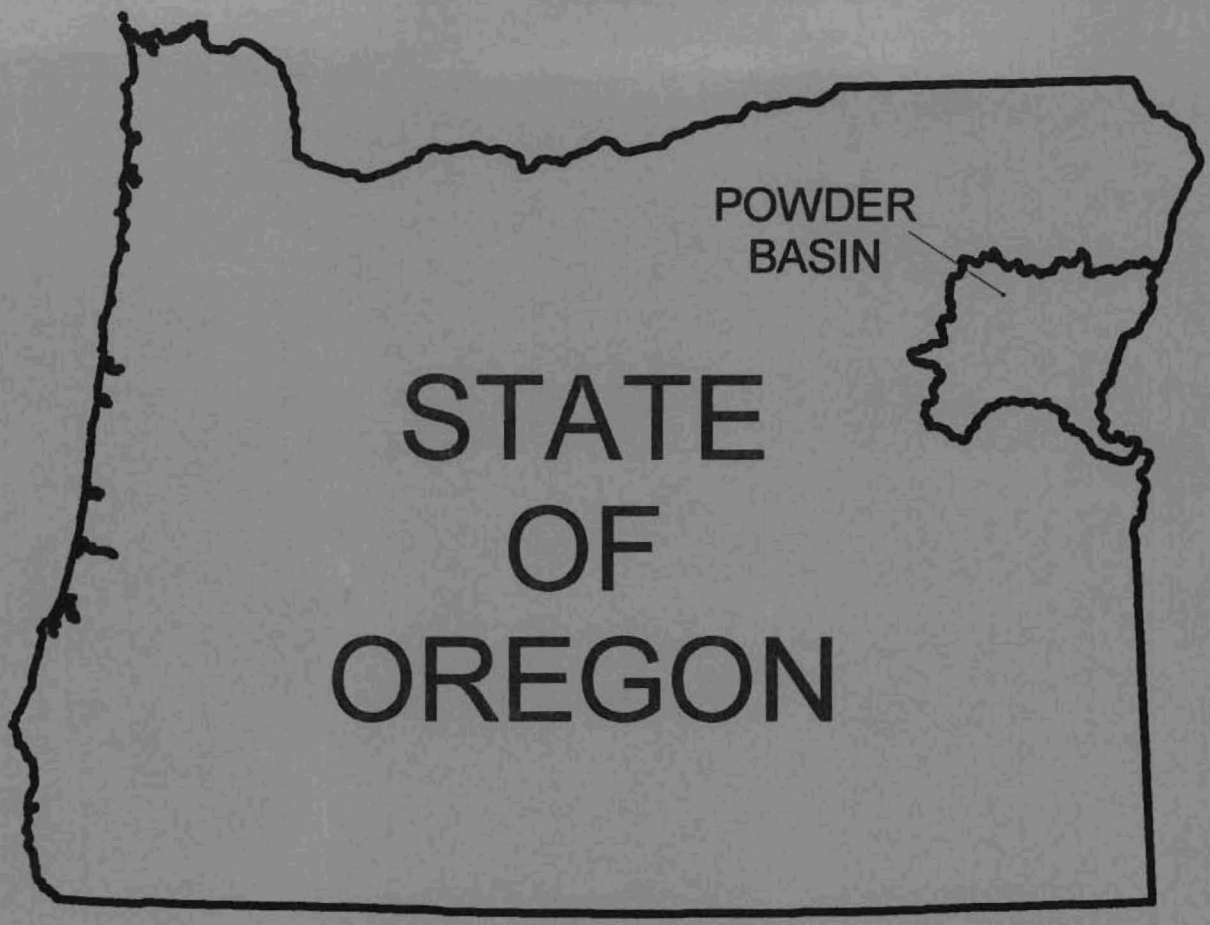
UPPER POWDER RIVER WATERSHED ASSESSMENT

OREGON

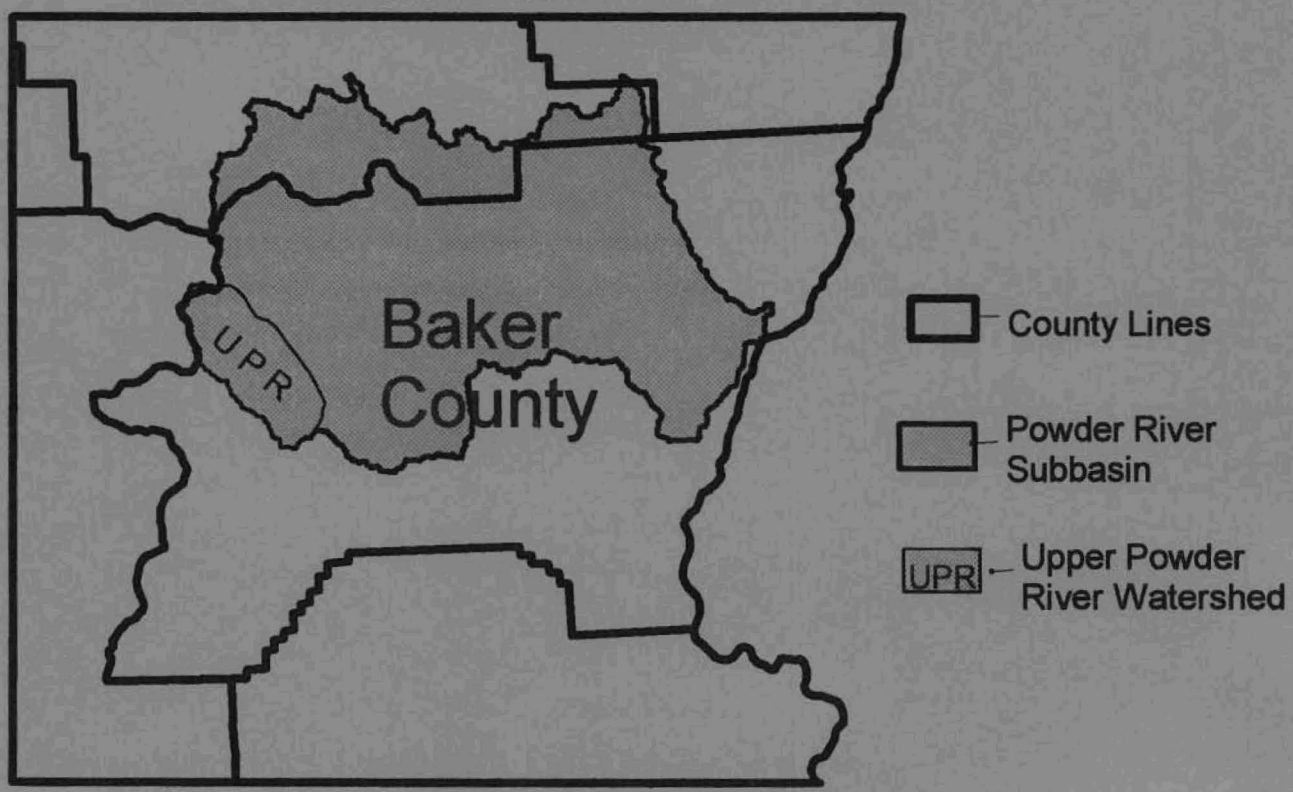


Prepared for the
Powder Basin Watershed Council
Baker City, Oregon

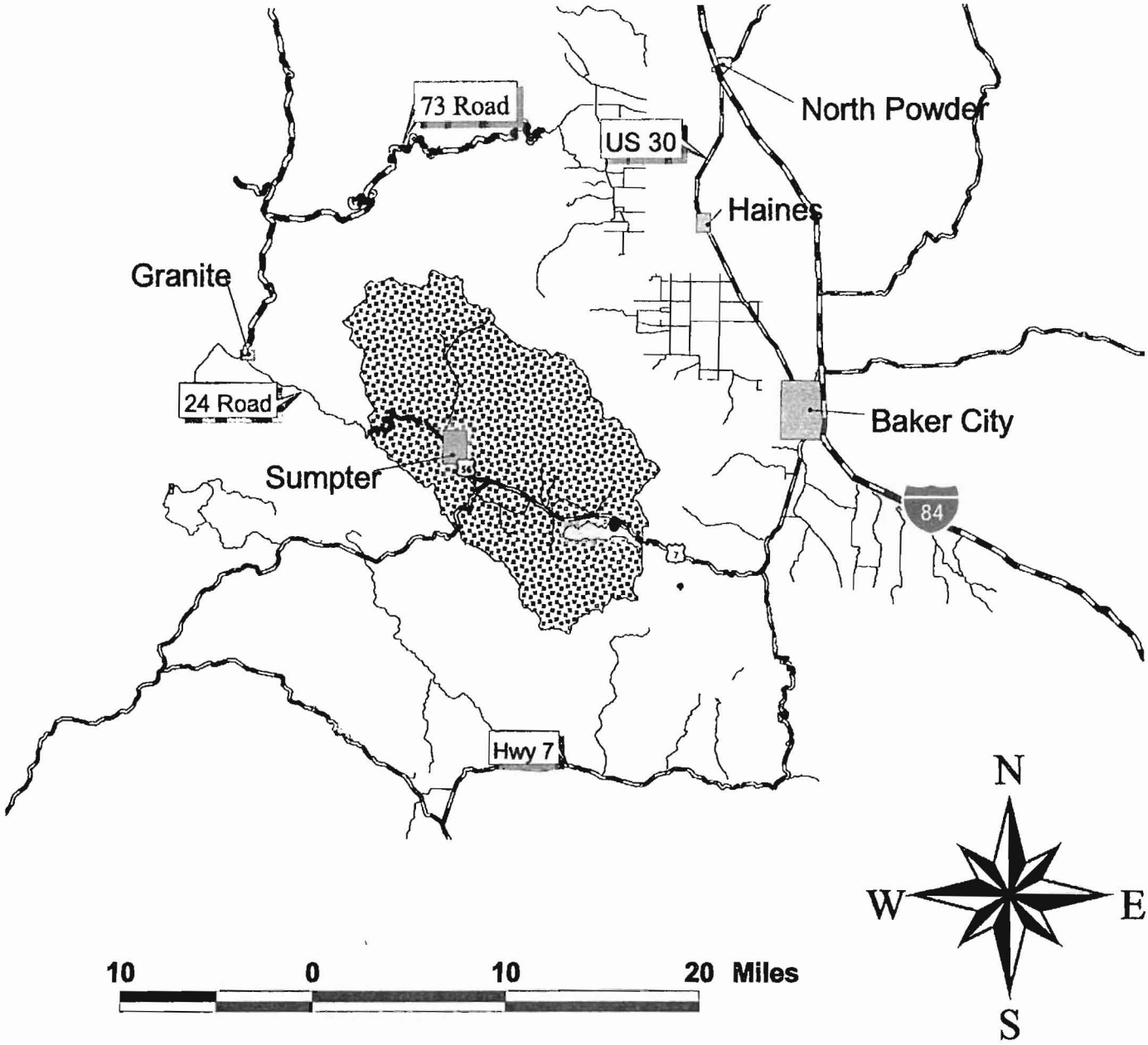
September 2001



LOCATION MAP



UPPER POWDER RIVER WATERSHED
VICINITY MAP



Upper Powder River

Roads

4 - MODERATE DEGREE OF USER COMFORT

5 - HIGH DEGREE OF USER COMFORT

Highways

Phillips Lake

Upper Powder River Watershed

mapped

ACRONYMS AND ABBREVIATIONS

AUM	Animal Unit Month
BLM	United States Bureau of Land Management
BMP	Best Management Practices
BO	Biological Opinion
CAFO	Confined Animal Feed Lot Operation
cfs	cubic feet per second
Council	Powder Basin Watershed Council
DOG	Designated Old Growth
EA	Environmental Assessment
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FPF	Forest Practice Foresters
FAR	Functioning at Risk
gpm	gallons per minute
GPS	Geographic Positioning System
HU	Hydrologic Unit
HUC	Hydrologic Unit Code
ICBEMB	Interior Columbia Basin Ecosystem Management Project
INFISH	Inland Native Fish Strategy
msl	mean sea level
mmbf	million board feet
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Dishcharge Elimination System
NRA	National Recreation Area
NRCS	Natural Resources Conservation Service
OAR	Oregon Administrative Rules
ODA	Oregon Department of Agriculture
ODEQ	Oregon Department of Environmental Quality
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
ORGAMI	Oregon Geological and Mining Institute
ORS	Oregon Revised Statutes
OSAC	Oregon State Agriculture College
OSU	Oregon State University
OWEB	Oregon Watershed Enhancement Board
OWRC	Oregon Water Resource Commission
OWRD	Oregon Water Resources Department
PETS	Proposed, Threatened, Endangered, and/or Sensitive Plant Species
PFC	Proper Functioning Condition
RHCA	Riparian Habitat Conservation Area
RMO	Riparian Management Objectives
SAF	Society of American Foresters
SWCD	Soil and Water Conservation District
SWS	Subwatersheds (as labeled A through N)
TES	Threatened and Endangered Species

TMDL	Total Maximum Daily Load
U/D/M EA	Union/Deer/Miners Creeks Timber Sale Environmental Assessment
UPR	Upper Powder River
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USFS	United States Forest Service
USGS	United States Geological Survey
WAA	Water Availability Analysis
WAB	Water Availability Basins
WPCF	Water Pollution Control Facility
WQLW	Water Quality Limited Waterbodies
WQMP	Water Quality Management Plan
WWNF	Wallowa-Whitman National Forest

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SUMMARY

Upper Powder River Watershed Assessment

The goal of the Powder Basin Watershed Council (Council) is to assist local stakeholders in the watershed(s) to develop a watershed action plan from this assessment. Prior to the development of that action plan, local stakeholders should use this assessment to help them to evaluate and prioritize the watershed health issues in the Upper Powder River watershed.

The Council has a Vision Statement and a list of Watershed Health Concerns for the Powder Basin (see appendix A) that they use as a guiding premise for their work with local stakeholders.

Watershed Health Issues

A preliminary list of issues was identified by the Council and the Wallowa-Whitman National Forest (WWNF). The Assessment Committee reviewed and edited the preliminary list of issues and selected the following list of issues for the UPR watershed. Additions to the list of issues were made from comments received at public meetings and from discussions with agency representatives. Below is how the more detailed breakdown of the particular issues and additions appeared after the scoping process. Issues in **bold** type are subjects treated as subtitles in the narrative text in the third section, ISSUES. The organizations following the issue in parenthesis are those agencies and groups having responsibility or vested interest in the subject and are often the source of the reported information.

Issues Identified by Council, Assessment Committee, and Assessment Author (Specific issues are bullet statements)

I. **Water-related Issues**

A. **Sumpter Municipal Watershed: Cracker & McCully Creeks** (Source: city of Sumpter, ODEQ, ODFW, WWNF, Council)

- City water system improvement and maintenance needs, especially at diversions in McCully and O'Farrel Creeks.
- Potential impacts of Forest Service forest, fire and fuel management policies and plans.

- Potential impacts of new and expanded recreational site development, and related transportation infrastructure, especially in Cracker Creek.

B. **Riparian Area (Ecosystem) Health and Function** (Source: ICBEMP, WWNF)
- Loss and degradation of riparian/wetland habitat and function due to past and current land use and land management practices, especially due to mining, roads and grazing.
- Loss and degradation of floodplains and floodplain function due to past and current land use and land management practices, especially due to mining and roads.
- Effects of alteration of hydrologic function (i.e., changes in quantity, timing, and duration of water flow) on stream channels, riparian wetlands, floodplains, aquatic life and wildlife.
- Grazing conflicts

C. **Water Quality** (Source: ODEQ, EPA, OWEB, WWNF, Council)
- Local validation of stream segments and parameters on ODEQ 1998 303(d) list: temperature listings for Dean and Silver Creeks.
- ODEQ data needs for evaluation of other stream segments and parameters on 1998 303(d) List Decision Matrix: Buck Creek (Gulch), Clear Creek, Cracker Creek, Dean Creek, Deer Creek, McCully Fork, Powder River, Sawmill Creek.
- Water quality monitoring needs in SB1010 Plan being developed by ODA in 2001.
- Water quality monitoring needed to prepare for development of Total Maximum Daily Loads (TMDL) and Powder Subbasin Water Quality Management Plan by ODEQ in 2005, which will include the SB1010 Plan.
- Natural water quality potential versus state water quality standards.
- Point and nonpoint sources of pollution in the watershed.

D. **Fish Species** (Source: ODFW, WWNF, USFWS, Council)
- Potential impacts of USFWS bull trout recovery plan (threatened species) on Federal and private land management under Sections 7 and 10 of the Endangered Species Act (ESA).
- Status of redband trout (sensitive species).
- Impacts of nonnative warmwater species on other aquatic life in and adjacent to Phillips Reservoir.

E. **Fish Passage** (Source: ODFW, WWNF, Council)
- Some water impoundments, water diversions, and stream crossing structures (e.g., culverts) are not providing adequate fish passage (Summary).

F. **Fish Screens** (Source: ODFW, WWNF, Council)

- Municipal diversions on McCully and O'Farrel Creeks and many irrigation diversions do not have fish screens.

G. **Water Rights** (Source: ODFW, OWRD, WWNF, Council)

- OWRD water availability data indicates some streams are over-appropriated during the summer based on 50 percent and 80 percent exceedence standards.
- ODFW instream water rights appropriated summer stream flows not appropriated by 1991, which limits certain future economic development opportunities.
- Streamflow does not fully support desired aquatic resources in several streams, especially during the summer months.
- Potential exceedence of rate and duty limitations due to lack of regulated water measurement devices on diversions and limited OWRD enforcement reviews.

II. **Other Issues**

A. **Mining** (Source: EOMA, ODMG, EPA, USFWS, WWNF)

- Lack of water rights for many operations (see **Water Rights**).
- Cumulative effects of past and current mining on streams, riparian wetlands, floodplains, fish, wildlife, landscapes, etc. (see **Riparian Area Health and Function**).

B. **Noxious Weeds** (Source: Tri-County Weeds Manager, WWNF)

- Environmental impacts of noxious weeds on riparian and upland ecosystems are expected to worsen over the longterm, including impacts to pasture, rangelands, and forested rangelands used by livestock and wildlife.
- Economic impacts of noxious weeds are expected to worsen over the longterm: increased annual control costs; land value depreciation.

C. **Forest Health and Management** (Source: WWNF, ODF, ICBEMP, SAF Blue Mtn Chapter)

- Cumulative effects of detrimental soil conditions in forest lands on long-term soil productivity.
- Extent of disease and insect damage; need for management remedies.
- Effects of management requirements for sensitive, threatened, and endangered plant and animal species.

D. **Fire Hazard in the Rural/Urban Interface** (Source: WWNF, ODF, City of Sumpter)

- The number of homes in fire-prone forest lands is increasing in the Bourne, Sumpter, and McEwen areas.

- Forest lands are overstocked and fine fuels have been accumulating to levels believed to exceed historic range of variability; wildfires are difficult to control in these stands.
- Adequacy of current WWNF and ODF fuels reduction programs, especially with little or no treatment planned in 600 feet-wide riparian conservation areas on National Forest land.

E. **Roads and ATV Trails** (Source: WWNF, Public Meetings, User Groups)

- ATV use, especially during hunting and mushrooming seasons, is causing erosion problems on Red Mountain, in the Sumpter Municipal Watershed, and adjacent to the Baker City Municipal Watershed.
- Many unsurfaced roads have drainage problems that result in rutting and erosion of road surfaces, and sedimentation in streams.
- High road density in some areas impacts wildlife and water quality.
- Some roads were located in floodplains, resulting in floodplain confinement or isolation (see **Riparian Area Health and Function)**.
- Culverts in some roads do not provide adequate fish passage (see **Fish Passage**).

F. **Barriers to Outreach Efforts for the Assessment** (Source: Council)

- Some landowners may mistrust, fear, or reject efforts by the Council to assess watershed conditions on private lands since the Council is a public entity.

Information Needs

- Water rights summary of groundwater cfs, surface water cfs, and reservoir acre feet as well as acres served would be useful to compare to flows. The watermaster is in the process of making an electronic record of this information.

- Abandoned groundwater wells in the watershed should be identified because they are potential entrances for pollutants into groundwater. There are 193 known unregistered well sites. Identification of underground fuel-storage tanks is also needed for the same reason.

- A list of irrigation ditches with OWRD approved measuring devices and fish screens.

- Fish blockages need to be evaluated and prioritized for changes.

- An intensive survey in the study area is needed to identify culverts, diversions, and other barriers that do not provide for fish passage (see Key Findings for discussion of one site and opportunity for action).

- Location and mapping of irrigation diversions and/or dams and whether they are screened for fish is needed to determine priorities for potential screening and passage improvements.
- Need to know if flood flows have damaged irrigation diversions and canals to plan for future repairs or redesign.

- The WWNF has reported a need to survey and resurvey some streams. Any method used should be applied universally and consistently to both public and private lands.

- Critical habitat for bull trout needs to be designated by the USFWS.

- Water quality information for drainages where information is minimal or nonexistent is needed to know if action is needed to meet federal and state water quality standards.

- More temperature data is needed to correlate with bull trout life histories, persistence, and survival.

- Determine the influence of Phillips Reservoir and its operations on bull trout in upstream tributaries.

- A list of potentially legally over-appropriated streams in the basin would be helpful to prioritize funding for projects that would have most positive impact on fish and/or water quality.

- An estimate of subsurface flows and recharge values would give a more complete analysis of the water cycle and water balance.

- A more complete picture of the magnitude and extent mining has played in influencing the landscape and the local economy is needed. The WWNF has developed a better picture of activities on public lands. Activity on private lands is not quantified.

- Whether the historical dredge tailings provide interlocking ponds and waterways functioning as wetlands habitat for waterfowl is not

known. The acreage has not been counted nor classified officially as "wetlands."

- Fire Locations—An analysis of year by year data with burn locations would help determine areas of higher risk that may affect the watershed. ODF is currently working on a comprehensive software program that will display this data and may be expected in 2 to 3 years.

- Longterm counts are needed to establish status and trends for bull trout subpopulations. Techniques to conduct these counts need to be developed, evaluated and implemented for each identified subpopulation.

- Information about grazing practices on private land and grazing impact on water quality is needed.

- Identify Confined Animal Feed Lot Operation (CAFO) sites in the basin or feed lots not covered by CAFO which may be in direct proximity to running streams.

- Identify and map the miles of roads within the watershed by condition and type and within 200 feet of a stream. The type of road: dirt, gravel, paved, etc., is important because each type impacts the watershed differently.

- Opportunities to provide more late summer streamflow through improved water use efficiency, diversion management, storage, etc.

- Acres of agricultural ground that could be productive crop land with additional irrigation.

- There is a need to calculate the water requirements of mining operations and compare that to the adjudicated amounts to justly allocate legal rights that allow and recognize the consumptive and nonconsumptive uses.

- Opportunities for reintroducing beaver into the watershed needs to be investigated.

- The impacts of timber harvest and forest restoration on watershed health would help in the planning process.

Key Findings

A. Mason Dam (Phillips Reservoir) is a significant attribute in the watershed, providing water storage, recreational opportunities, and habitat. Some of these benefits are realized basinwide.

B. Water temperatures of several stream reaches are above the thresholds established by ODEQ for certain fish species, including bull trout, during the warmer time of the year.

C. Fish passage or bypass is lacking on many streams where irrigation diversion structures that hinder fish passage are in use. Bypass is prevented by stream dewatering and/or physical barriers. Some dams are seasonal or year-long barriers to fish passage. Long term bull trout recovery will require fish passage improvements if it is found that bull trout habitat needs extend below diversion dams. Fish screens are lacking on most irrigation diversions.

D. The city of Sumpter is in the process of improving its water facilities. Partners include the WWNF and regional economic development agencies. During the Council's public meeting in Sumpter (February 7, 2001) discussion about the town's planned reconstruction of their water conveyance system led to identification of the fish passage problem at their present intake site in McCully Creek. Mayor Jack Colton and District Ranger Chuck Ernst led the discussion. With participation by Council members and agency representatives, it was agreed it would be desirable to modify the intake structure to make it more fish-friendly and that some of the other agencies would help find the technical and financial assistance.

E. Bull Trout

1. The WWNF monitors each project they start and report to the USFWS annually. Several ongoing or proposed projects in the watershed on National Forest lands and their effects are considered in the WWNF documents. Disturbances and project classifications are summarized in this Watershed Assessment.

2. Summer bull trout distribution and some spawning distribution is documented. The USFWS has not yet designated *critical habitat* for bull trout through consultation with the WWNF and state agencies.

F. Noxious weeds are spreading in the watershed and are a serious environmental and potential economic threat, especially in rangelands. Weeds of greatest concern are knapweeds (spotted and diffuse), dalmation toadflax, and Dyer's woad. Sites most affected are the dredge tailings and Highway 7. Current level of monitoring and treatment is not preventing spread of noxious weeds. Also funding at all levels of government is not adequate for preventing spread of noxious weeds.

G. In many of the streams, the instream water rights are so junior that they would be ineffective at protecting streamflow for instream values.

H. Forest insects and disease are having a significant impact on forest health.

I. The potential for future stand replacement fires will likely increase as fuel loading continues to build across the watershed. Such fires could significantly affect short- and longterm water quality.

J. Siltation of streams caused by past and current land use activities has affected fish spawning and rearing capabilities of streams. Some mine tailings that wash directly into stream ways contribute to sedimentation.

K. Sediment discharge is a natural and beneficial function of streams, providing for channel maintenance and floodplain productivity. On-channel reservoirs disrupt these processes.

L. County roads and the Oregon Transportation Department roads have constrained stream channels in the watershed. An example is Cracker Creek. These constraints resulted in down cutting; thus affecting natural floodplain function and water quality.

M. Irrigated agriculture has economically benefitted the watershed. Hay crops and pasture use tend to assure an almost constant ground cover except where livestock have been allowed to concentrate.

N. The last decade has seen a shift from timber harvests on public lands to timber harvest on private holdings. This is caused, in part, by the WWNF's marked reduction in offerings. Other factors include landowner's fears that there will be the time when they will not be allowed to harvest their trees, and that insect and disease

infections would reduce or eliminate the value of their trees. The potential changes in the Forest Practices Act has also encouraged more intensive liquidation of timber assets by some owners.

O. The Eastern Oregon Mining Association has voiced a concern as to how the Forest Service has changed their management style in administering operations on public lands.

P. Hydrologic function of many streams and associated floodplains and wetland has been altered by placer mining, grazing, roads, culverts, bridges, dams, reservoirs, water diversion structures, irrigation of uplands and channel straightening. Many stream channels, floodplains and wetlands have been placer mined, resulting in entrenched channels that eliminate historic floodplains and disconnect wetlands. Overgrazing of uplands, primarily on federal lands, resulted in gullying of many stream channels. Roads have been constructed in floodplains. Culverts and bridges confine steam channels and increase water velocities. Dams and water diversion structures trap sediment and build floodplains and wetlands, while reservoirs inundate floodplains and wetlands. Irrigation of uplands creates new springs and wetlands and increases streamflow in some areas throughout the summer. Channel straightening results in channel downcutting and disconnects floodplains and wetlands from the stream channel. *Note: Hydrologic function is defined as the behavioral characteristics of a watershed described in terms of ability to sustain favorable conditions of water flow. Favorable conditions of water flow are defined in terms of water quality, quantity, and timing.*(P & Q from FSM R6 SUPP 2500-98-1)

Q. Soil function has been highly altered in many areas by the same activities that have affected hydrologic function. In addition, soil function in uplands has been altered primarily by roads, logging (landings and skid trails) and wildfires. *Note: Soil function is defined as the characteristic physical, chemical and biological activity of soils that influences productivity, capability and resiliency.*(P & Q from FSM R6 SUPP 2500-98-1)

Next Step — Action Plan

The Assessment Committee offers the following suggestions:

A. Develop a Watershed Action Plan following the guidelines outlined in *Guidelines for Watershed Councils,* Vol. 2, Final Report to the Legislature, Oregon Watershed Health Program, 1995. (Particular attention to guideline numbers 6, 7, and 10.)

B. Use a collaborative planning process that solicits input from all major landowners and all interested residents.

C. Objectively study and evaluate the watershed health issues, key findings, and information needs described in this assessment. Ask the Assessment Committee to explain anything that is unclear.

D. Prioritize major information needs, and set goals, and time lines for obtaining critical information needed for the planning process.

E. Prioritize the issues, consider funding opportunities, goals, and time lines of state and Federal regulatory agencies, including OWRD, ODFW, ODEQ, and USFWS. USFWS may have earlier deadlines for accomplishing actions needed to protect bull trout and other listed plant and animal species. The Council may want to help coordinate project development and financing within these structured guidelines. Funding could be obtained through the Oregon Watershed Enhancement Board (OWEB) grants, other grants, land owner, local entity, and/or agency (local, state, and Federal) cost share.

F. Develop potential actions or responses for all issues. Consider focusing the plan on one or more issues with a high probability of implementation in the first few years after the plan is completed. Deferred action and no action may be appropriate for some issues, depending on risk and responsible agency or private interests. Action plans are best designed by segment, community, or subwatershed which allows for addressing the issues on a site specific basis.

G. If landowners do not begin development of a Watershed Action Plan within 6 months of Council approval of this assessment or complete the Action Plan within 12 months of Council approval of this assessment, the Council, in cooperation with the appropriate SWCD, should begin developing a "draft" Action Plan. The plan should include as a minimum all potential Council actions, such as planning for and securing funding for additional assessment or monitoring work identified in the "Information Needs" section, or new individual or cooperative projects to be sponsored by Council members or interested parties.

Assessment Committee

This document was made possible by funding from the Oregon Watershed Enhancement Board and through inkind services by Assessment Committee participants representing various entities or as private citizens.

The Upper Powder Watershed Assessment was accomplished by the Assessment Committee at the request of the Council. The Assessment Committee members are:

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Vickie Valenzuela	Transportation Advocate for Baker County
Joel Waldo	WWNF
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INTRODUCTION

Powder Basin Watershed Council

The Powder Basin Watershed Council (Council) began in 1991 as the Baker County Water Advisory Board. The board's main function was to advise the Baker County Commission on water issues particularly relevant to the county. The board advised the County Commission on many water-related issues, including needs for water storage, water management, fish screens, fish bypasses, groundwater problem areas, and watershed improvements.

In 1995, the advisory board was reorganized into a Watershed Council under provisions of Oregon House Bill 2215 (1993). Under HB 2215 and its subsequent successor, HB 3441 (that further defined the structure and functions of watershed councils), the State of Oregon authorized the formation of watershed councils as experimental attempts to include grassroots knowledge and cooperation in addressing Oregon's environmental issues. The Baker County Commission has recognized this Council as empowered to advise county officials regarding retaining, restoring, and enhancing the health of Baker County's watersheds.

The focus of the Council has been to develop a sustainable organization capable of dealing with the issues of local watershed health. These issues include:

- Assessment of the watershed's natural and human resources
- Prioritization of environmental needs
- Development of an Action Plan addressing those environmental needs

Recent Activities

In 1996, the Council completed a preliminary assessment of basinwide watershed interests and concerns represented by Council members. The Council completed its first assessment, Pine Creek, in 2000. Residents in the Halfway area are currently using this assessment to develop community-based action plans.

The Upper Powder River is an important watershed within the Powder Basin. Its headwaters are the origins for the river system. The landscape has incurred very evident disturbances. The construction of Mason Dam was a landmark event with Phillips Reservoir providing irrigation water storage, flood control and recreation. Bull trout are present in some of the headwaters such as Silver Creek. The city of Sumpter and the state Park Service are in the process of improving and expanding recreation. The WWNF has completed a watershed analysis and a biological assessment on this watershed and is in progress on an analysis for the McCully Creek subwatershed. An accelerated fuels hazard (build up of combustible material) reduction plan is underway.

In 1998 ODEQ completed a statewide Unified Watershed Assessment that prioritized watersheds for restoration, including eligibility for funding under the Federal Clean Water Action Plan. This Upper Powder River Watershed Assessment helps to give priority for funding to projects proposed in this watershed.

Following completion of the preliminary assessment for the Powder Basin drainage, the Assessment Committee subdivided the Powder Basin into 10 watersheds, and prioritized these watersheds for assessment. These watersheds listed in order of priority are: Pine Creek, North Powder River, Upper Powder River, Middle Powder River (Baker Valley), Eagle Creek, Lower Powder River, North Fork Burnt River, West and South Forks Burnt River, Burnt River, and Snake River.

The Assessment Committee recommends that this assessment be viewed as a *working* document that will be periodically updated to meet Council and local community needs. The content of this assessment requires review and approval by the Council before the Council and the landowners in the watershed begin developing an action plan.

OVERVIEW OF THE UPPER POWDER RIVER WATERSHED

Location

The Upper Powder River watershed includes the upper reaches of the Powder River and its tributaries upstream from the Mason Dam site. The watershed contains 105,345 acres, almost entirely inside Baker County. Elevation ranges from 3900 feet to 9039 feet. About 79 percent of the watershed is public land administered by the WWNF. Private lands account for 21 percent of the area. Sumpter is the only incorporated city in this watershed. The town site contains a concentration of deeded properties with a population of 175 (1998). Incorporated in 1901, Sumpter rests at elevation 4444 feet. There are dozens of rural residents sparsely scattered throughout the watershed at the lower elevations. Except for a few large landowners, most residences exist as small in-holdings across the forested landscape such as at Bourne, Spaulding Ridge, and Bear Gulch.

The Upper Powder River drains the southwest slopes of the Elkhorn Mountains with headwaters at elevations of 6000 to 9000 feet. The northern boundary of the watershed follows the breaks of the Elkhorn Mountains along the southwest slope. Cracker and Deer Creeks drain the southern slopes of the Elkhorn Range of the Blue Mountains where the most dependable summer flows originate. McCully Fork has its headwaters on Mount Ireland, Grays Peak, and Spaulding Ridge along the Blue Mountain divide. Most of the lower elevation tributaries have intermittent flows. The southern boundary of the watershed is a range of hills dominated by Huckleberry Mountain. The basin formed between the mountains and hills is locally called Sumpter Valley. Benchlands on the north and south sides of the Sumpter Valley are used for irrigated agriculture involving numerous irrigation diversions. The Powder River begins at the confluence of Cracker Creek and McCully Fork at the city of Sumpter. It flows in a southeasterly direction through Sumpter Valley to Phillips Reservoir. Deer Creek enters the reservoir from the north. The Sumpter Valley floor has large areas of gravel and river rock piled as a result of past gold dredging operations. The valley is partly bordered on the north and south by old gravelly terraces that graduate into the mountainous foothills.

Subbasins and Watersheds

The OWRD Powder Basin includes three subbasins or 4th code watersheds shown on the 1974 U.S. Water Resources Council Hydrologic Unit Map for the State of Oregon. The Upper Powder River is a 5th-code watershed that is located within the Powder Subbasin (17050203) or 4th code watershed of the Middle Snake River Basin (170502). The Upper Powder River Watershed is assigned the HUC number of 1705020320; the new HUC number under a new national protocol will be 1705020301.

Identifying Watersheds

Hydrologic Unit (HU). An area of land upstream from a specific point on a stream (designated as the mouth or outlet) that is defined by a hydrologic boundary that includes all of the source area that could contribute surface water runoff directly or indirectly to the designated outlet point. The HU may also contain associated surface areas such as unconsolidated, noncontributing diversions associated with the certain designated outlet point. It may also have one or more of the same level hydrologic units completely contained with the upstream drainage area.

Earlier versions of the watershed and subwatershed delineations may have utilized administrative boundaries such as state and county or project lines to define HUs. The HU boundaries must be determined solely upon hydrologic principles to obtain a homogeneous national seamless digital data layer.

Hydrologic Unit Code. The identifier of a specific HU. It is determined by an established system of assigning numbers and alpha characters in a specified order and in different levels of detail or size.

Subwatershed. A delineated HU depicting the location of a drainage area that is typically 10,000 to 40,000 acres in size. The 6th division level of the nation's drainage, represented by extending the 10-digit HUC to 12-digits.

Watershed. The 5th level of HU delineation. The typical size is 40,000 to 250,000 acres.

Subwatersheds

Fourteen subwatersheds (SWS) ranging in size from about 2,270 to 11,590 acres make up the Upper Powder River watershed (1705020320). Each subwatershed is given an alphabetic designation that identifies it. The UPR is hydrologic segment 1705020320, and each subwatershed is A, B, C, etc. Major tributaries in the subwatersheds include Deer Creek, Cracker Creek, Phillips Reservoir, McCully Creek, Dean Creek, Clear Creek, Silver Creek, Union Creek, and Bridge Creek. Table 1 displays the individual SWS acreages and the percent of the total watershed they make up. An interagency Federal/state task group has mapped 5th-code hydrologic units in Oregon.

Several subwatersheds on this map do not comply with new national watershed mapping standards. Some problems include the need to change subwatershed coding, to remove Phillips Reservoir as a separate subwatershed and to map the Deer Creek subwatershed to its legacy confluence with the Powder River. Appendix B contains a map of new subwatersheds developed by an interagency task group. Also shown is a table showing the crosswalk between the old subwatersheds used in this assessment and the new subwatersheds. The OWRD utilizes

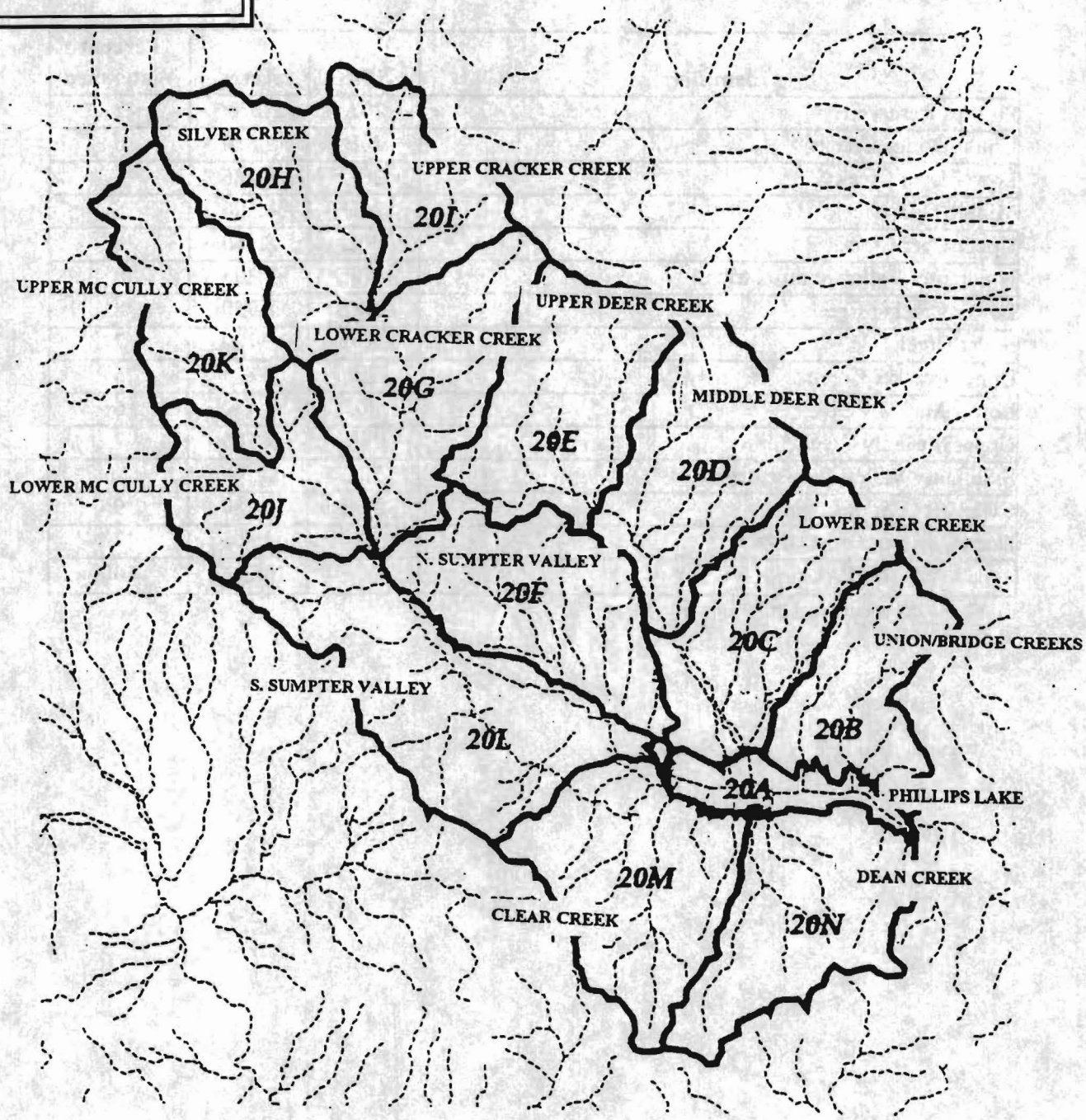
a different mapping and coding system. The OWRD subwatersheds are grouped in larger acreages with different boundaries.

Table 1. SWS Acreages and Percent of UPR Watershed
(acres are approximate, not inclusive of all named drainages)

Identifier	SWS	Acres	Percent Watershed
Phillips Reservoir	20A	2,270*	2
Union/Bridge Creeks	20B	5,810	6
Lower Deer Creek	20C	8,225	8
Middle Deer Creek	20D	8,500	8
Upper Deer Creek	20E	8,360	8
N.Sumpter Valley & misc. tribs.	20F	8,495	8
Lower Cracker Creek	20G	8,730	8
Silver Creek	20H	8,100	7
Upper Cracker Creek	20I	4,835	5
Lower McCully Creek	20J	6,180	6
Upper McCully Creek	20K	7,105	7
S.Sumpter Valley & misc. tribs.	20L	11,590	11
Clear Creek & misc. tribs.	20M	9,280	9
Dean Creek and misc. tribs.	20N	7,865	7
TOTAL		**105,345**	**100**

* high water level of Phillips Reservoir

UPPER POWDER RIVER WATERSHED
1705020320
SUBWATERSHEDS



SWS Descriptions

Phillips Lake (20A) Phillips Reservoir is the uppermost impoundment for the Powder River. The lake is a major attraction for the area and is the center of much of the recreational activity. This is an important area for raptors, waterfowl and shorebirds (nesting and migrants), spotted frog breeding sites, and is a noted Oregon bird watching spot. Redband trout and other fish are in the lake; historically there may have been bull trout in the river before Mason Dam was constructed. Dredge mining of the river and riverine areas took place in two concentrated efforts between 1913 and 1954. Mason Dam and the Phillips Lake right-of-way are withdrawn from mineral entry. This SWS has undergone a total change in riparian morphology because of Phillips Reservoir.

Because of the presence of the lake, there is a very low fire risk, mainly from campfires along the beach. There are possibilities for waterfowl grazing the tender new grasses along the west end of Phillips Reservoir in the adjacent grass and willow habitat. The lake is a major recreation attraction for the area.

Union/Bridge Creeks (20B) Union Creek Campground, historical Chinese mining site, Elkhorn Drive Scenic Byway (Hwy 7), and Indian Rock Trail are some of the recreational attractions. The SVRR (Sumpter Valley Railroad) is proposing a railway expansion to the campground. This SWS has a low urban/wildland interface in comparison to others SWSs. This SWS is important transitory habitat for elk moving to and from the State winter feeding site (Auburn). The lower portion is important deer winter range. There are unique wildlife habitats throughout. There are no designated old-growth blocks (DOGs) on federal lands. The SWS provides wildlife corridors/linkages into the next watershed and to the Baker City watershed along the north boundary. The WWNF has done some waterfowl habitat improvement projects. Redband trout are present. It is in the Sumpter mining district, with historic Chinese mining remnants.

This SWS is rated a high fire risk based on fuel models, consequence, and occurrence. There is also high human-caused fire occurrence in and around Union Creek campground. The majority of the SWS below 6000 feet elevation is second-growth ponderosa pine. Recent studies have shown that these stands had a very short fire return interval historically, as short as 5 to 7 years. The current stands resulted from the railroad logging in the area in the early 1900s. In the last 25 years, the area has seen an active thinning program, and much of it was underburned in the early 1980s. Most of these stands are well above the optimum trees per acre for ponderosa pine stands.

Lower Deer (20C) Elkhorn Drive Scenic Byway, railroad expansion proposal; 39 percent private land. This SWS provides important corridor habitat into Baker City watershed along the northern boundary. There is 1 DOG, with potential old-growth (POG) areas. There are important habitat corridors associated with Bridge, Smith, Miner, and Stovepipe drainages. The WWNF has completed a waterfowl habitat improvement project (burning). There is no known bull trout presence although they do occur upstream in the Deer Creek drainage. The SWS is in the Sumpter mining district; many of the streams were historically mined. Today there are no active lode mines; there is some placer mining with mechanized equipment. History of over-grazing has influenced productivity.

This SWS has a low/mod fire risk, based on low fire occurrence. Bar-C-Bar Ranch occupies most of the low-elevation land. Fuels on Bar-C-Bar have been effectively treated in the last 2 to 3 years. Elkhorn Estates subdivision is on lower Deer Creek and contains around 20 residences; about half of them are occupied year-round. The upper end of the SWS adjoins Baker City watershed, but light patchy fuels reduce the risk of a fire reaching the crest. The area above the Bar-C-Bar and below 6000 feet is mostly second-growth ponderosa pine, and matches the description in Union/Bridge Creeks.

Middle Deer (20D) Marble Pass; Blue Mtn. Lime Quarry (Baboon Lime; restorations in 1995-1996) began in 1960 as an open pit near Baboon Creek, operating just a few years. There are 5 DOGs. This SWS provides habitat for bull trout (presence in Lake Creek) and redband trout throughout. There is potential for important corridor habitat into Baker City watershed along the northern boundary. There are mountain goats in the Marble Pass area. The SWS is in Sumpter mining district; historic hydraulic mining. Placer mining takes place today, as well as recreational gold panning and suction dredging adjacent to Deer Creek CG. History of over-grazing has influenced productivity.

Fire risk is high to moderate based on high lightning fire occurrence. This SWS has significant acreages of existing thinning slash. The rest of the description is similar to Union/Bridge Creeks.

Upper Deer (20E) About 40 percent backcountry. There are 3 DOGs and 2 potential old-growth areas. There are important potential habitat corridors to the Upper North Powder watershed. There is a travel corridor down Deer Creek to Lower Deer POG. Redband trout are present, and there are no known bull trout. The SWS is in Sumpter mining district; no active lode mines; many active suction dredges in Deer Creek and pick and shovel operators and mechanized equipment at work today. History of over-grazing has influenced productivity.

This SWS is rated a low fire risk, due to low fire occurrence and lack of any private property, keeping the fire consequence low. This area is mostly lower elevation ponderosa pine stands, similar to 20B, so is not a critical problem. This SWS contains a larger percentage of fir-dominated stands, both at upper elevations and in the drainages, than SWSs B-D. These long fire return interval stands contain much heavier fuel loading. This SWS has significant acreages of thinning slash.

North Sumpter Valley (20F) Part of the city of Sumpter, with associated heavy use (tourism); 62 percent private land; network of undesignated ATV trails leads onto the Forest. There are important travel corridors for wildlife and 1 POG, but no DOGs; no late/old habitat. Powder River was dredged; tailings dominate valley bottom. No known fish presence. This SWS provides important bitterbrush and mountain mahogany habitat. Sumpter mining district. No active lode mining, but there is active placer mining. History of overgrazing has influenced productivity.

Fire risk is moderate, but consequence is high. The majority of this SWS is in private land ownership, mostly in the south half. Bear Gulch and Deer Creek subdivisions, and the townsite of McEwen are showing an increase in residences and residents. National Forest System lands are similar to the description for Union/Bridge Creeks.

Lower Cracker Creek (20G) City of Sumpter, with associated heavy use (tourism); Dredge State Park (expansion plans). The city's municipal water intake is on private land; other parts of the water system are under special use permit in McCully Fork and O'Farrel Gulch. There are 2 DOGs and important linkages to Upper North Powder watershed. Sumpter and Cracker mining districts; historic hydraulic mining; Cracker Creek to Wind Creek was gold dredged and the channel morphology is dominated by tailings; currently many active placer mines. Redband trout are present.

Fire risk is moderate. This SWS has an increased percentage of the long fire return interval stand types. Also has significant acreages of thinning slash. The Spaulding fire burned in this SWS around 1960. Many of the south-facing slopes provide opportunities for underburning, that may help to isolate the fir-dominated stands and reduce the risk of a large fire. The upper elevation dominated with DF/WF/LPP stands, with long fire return intervals.

Silver (20H) About 50 percent backcountry; patented land bisects this SWS. There are 4 DOGs. Habitat is fragmented. Bull trout are present in Silver Creek. Silver Creek is on the 303(d) list. Cracker mining district; much early activity (some of the first gold mining in Oregon), but development was curtailed by lack of access.

This SWS is at high fire risk, based on fuel models and a high occurrence of lightning fires. This SWS has poor access for fire suppression or management activities. There

is private property throughout the SWS, most of which has been extensively logged in recent years, and has high slash loads. There are several seasonal cabins. The upper elevations are characterized by long fire return intervals, heavy fuel loadings, and large, stand-replacing fires. There are few opportunities for underburning.

Upper Cracker (20I) About 31 percent private land; patented land bisects the SWS. This SWS has 2 DOGs. Habitat is severely fragmented. Bull and redband trout are present. Cabins at Bourne; access to Elkhorn Crest-Summit Lake. Contains an important mineral vein; most of the mineral area is patented.

High fire risk, similar to Silver (heavy harvesting on private land). Large areas of nonforest occupy the upper end.

Lower McCully (20J) There are no DOGs present in this SWS. This SWS receives heavy recreation winter use. Sumpter mining district; known for placer mining historically and currently. Recreational gold panning in McCully Forks CG is no longer allowed because of the bull trout listing; small scale placer and suction dredging on McCully Creek. Largest number of acres of noxious weeds of all the SWSs in UPR (mostly knapweeds).

Fire risk is moderate. Very similar to Lower Cracker Creek. There are extensive acreages of thinning slash. There are some limited opportunities for underburning in the warm/dry stands.

Upper McCully (20K) McCully Campground; Mt. Ireland Lookout sits at the head of this SWS; 25 percent backcountry; city of Sumpter watershed diversions on O'Farrel and McCully (fish barriers); patented land. There is 1 DOG; habitat is fragmented. No bull trout known to be present; redbands present. Sumpter and Cracker mining districts. Private lands were logged 1999-2000. One of the two largest noxious weed infestations is in this SWS.

Fire risk is high, due in part to high consequence of hot fire. There is poor access, high acreages of fir-dominated stands, and limited opportunities for underburning. There are approximately 400 acres containing thinning slash. The Sumpter municipal watershed lies within this SWS.

South Sumpter Valley (20L) About 41 percent private land/County ownership. Heavy recreation use; Sumpter Railroad expansion. A portion of the Dredge State Park is in this SWS. The SVRR and depot are included here. There is 1 DOG. McEwen Ditch diversions. Redband trout are present in the subwatershed. Heavy historic bucketline dredging (barge) and tailings and creation of ponds by the dredges.

Fire risk is moderate. This SWS shows an equal split between lightning and human-caused fires. The majority of the stands here are within the short fire return interval stand types, dominated by ponderosa pine. These stands show a higher percentage of Douglas-fir than the stands at similar elevations across the watershed on the north side of the Powder River. The Huckleberry Fire crossed over the ridge into this SWS in 1986 (approximately 3,800 acres, including private land).

Clear Creek (20M) About 47 percent private land; Lakeshore Trail; Millers Lane and South Shore Campgrounds. McEwen and Farmers Ditches. There is moderate to heavy recreation use, both developed and dispersed. There is 1 DOG. There is a good amount of bitterbrush and mountain mahogany habitat; no late/old habitat. Redband trout present. Waterfowl habitat improvement project (burning) was completed. No current minerals activity. Hudspeth House, a WWNF administrative facility, is occupied by seasonal employees in the summer when funded for fire suppression.

High fire risk. The lower half of this SWS is in private ownership, with other parcels of private land scattered throughout. Very similar to South Sumpter Valley.

Dean Creek (20N) There is 1 DOG. Good amount of bitterbrush and mountain mahogany habitat. Important big game transitory habitat. Redband trout present. Dean Creek is on the 303(d) list. Riparian restoration projects have been implemented. The area was rested from grazing for 2 years. Lower Montane Sale, closed 1997. No current minerals activity.

Moderate fire risk (500+ acres of this SWS were prescribed burned in 1997). Only one small piece of private ownership (5 acres). Excellent opportunities for underburning. Very similar to South Sumpter Valley.

Climate

The climate of the watershed is continental with very dry summers and low annual precipitation. Average annual precipitation is about 28.9 inches with an average growing season of about 65 days in the arable lands. Winters are severe and summers are warm. Temperatures range across the board at all times of the year and are influenced by the mountains. Snowstorms are not uncommon in the summer, and warming, melting trends can occur in the middle of the winter. Cold, dry, "open" winters result in less snowfall. About 26 percent of the watershed is above 6000 feet elevation, where most of the snowpack occurs. Almost 71 percent of the area is above 5000 feet, giving the reader an idea of the areas topographic relief and snow frequency.

Based on data for the McCully Creek drainage, the Mean Minimum Air Temperature for the winter months is 21.7 °F and the Mean Maximum Temperature for the summer months is 66 °F with several days reaching real (diurnal highs) temperatures into the 90s. Two thirds of the annual precipitation falls as winter snowfall from November through April. (*Characteristics for Watershed 72183*, OWRD website) Most of the precipitation falls as snow and enters the drainage network during spring runoff. The watershed commonly has rain-on-snow events that remove or reduce the snow pack at sites below elevation 5000 feet. The 1997 New Year's Day event is the largest in that category recently, but both 1995 and 1996 experienced warm rains in January or February that were substantial enough to cause road damage. Intense summer storms are frequent, localized events.

Two weather stations collect precipitation data in the watershed. The Bourne Snowtel site has been operated by the NRCS (Natural Resource Conservation Service) since 1978. It is located in Upper Cracker Creek at elevation 6000 feet near Little Cracker Creek. The Mason Dam weather station has been operated by the Baker Valley Irrigation District since 1969 and is located at the dam, elevation 4000 feet. Comparison of yearly data shows that the higher elevation site receives about twice the precipitation that the dam site receives. The average precipitation at these stations is 16 inches/year at Mason Dam and near 35 inches/year at the Bourne station.

Table 2. Austin Temperature, Precipitation, and Water Balance Data

Austin or Austin 3s *Long. 118°30' West*
Grant County *Lat. 44°35' North to 44°36' North* *Elev. 4200 to 4333 feet*

Calendar Period	Temperature data (°F)*			Precipitation and Water Balance Data (in)*					
	Avg. Max.	Avg. Min.	Avg.	Avg. P	Avg. PE	Surplus P-PE	Deficit PE-P	Cum. Surplus	Cum. Deficit
Jan.	33.8	7.3	20.6	2.6	0.0	2.6		7.7	
Feb.	39.3	12.0	25.7	2.1	0.0	2.1		9.8	
Mar.	46.5	17.6	32.1	1.8	0.0	1.8		11.6	
Apr.	57.6	25.0	41.3	1.1	1.3		0.2		0.2
May	66.7	30.3	48.6	1.3	2.7		1.4		1.6
June	73.7	35.3	54.5	1.6	3.5		1.9		3.5
July	85.2	40.2	62.7	0.5	4.7		4.2		7.7
Aug.	83.3	37.0	60.1	0.5	4.0		3.5		11.2
Sept.	75.0	31.7	53.3	0.6	2.8		2.2		13.4
Oct.	62.7	25.5	44.0	1.5	1.4	0.1		0.1	
Nov.	45.3	17.4	31.4	2.2	0.0	2.2		2.3	
Dec.	36.6	13.6	25.1	2.8	0.0	2.8		5.1	
Annual	58.8	24.4	41.6	18.6	20.4			11.6	13.4
Record Period	18 yrs	19 yrs	18 yrs	1931-1955**					

Ave FFS (32°)* PE of FFS (32°) PE = Potential Evaporation FFS = frost free days.
Ave FFS (28°)* PE of FFS (28°) Max = Maximum Min = Minimum
Cum = Cumulative P = Precipitaion

Notes:
**All other temperature and precipiation data shown in the table was copied from the 1963 OSU Publication and was for the 1941 to 1952 period of record.
Water balance data in the table was based on the Thornthwaite-Mather equation

Geology

The earliest geologic event to shape the landscape of the UPR watershed was the docking of an island arc on the edge of an earlier continent, leaving masses of metavolcanic and metasedimentary rocks about 250 million years ago. Argillites dominate these rocks, though metagabbros are also present. These exotic terrains were precursors of the Elkhorn Mountains, exposed to several million years of weathering processes.

About 120 million years ago the granitic Bald Mountain batholith was intruded below the argillites. While this did not immediately alter the shape, it resulted in gold deposits that would influence the landscape later.

In the last 12 to 40 million years, a variety of volcanic deposits were laid down on the south side of the watershed. The basalts and andesitic tuffs of this period were the last major addition of parent materials to the landscape. A smaller but significant addition since those volcanic flows was the 6,700 year-old Mount Mazama eruption that left about 1.5 feet of silty volcanic ash.

Block faulting was the largest force in the last 20 million years to shape the Elkhorn Mountains. The uplifting of the Elkhorn Mountains exposed the argillites and granitic rocks to water, and eventually ice erosion that are considered contemporary land sculpting processes. A basin the southern half formed by a down-dropped block filled with water first, then with silty and clayey lake bed sediments. The ancestral Powder River found an exit from the basin near where the Mason Dam is presently located, gravelly alluvial deposits were laid down on top of the old lake bed sediments.

Soils

This watershed is geologically very stable. An examination of the aerial photos of the area did not find any mass failure activities within the watershed (Upper Powder Watershed Analysis). Because this scale of photography cannot delineate mass failures of less than 1-2 acres, an analysis was done by the WWNF that identified materials and settings that may be prone to failure and assigned a mass failure hazard rating.

The highest, coldest landscapes where glacial and periglacial processes dominate lie in an arc across the north and part way down the east side of the watershed. In the warm/dry basin in the south central section bordering private lands, stream deposition is the dominant process. The cool to cold intermediate elevations covering most of the remaining parts are dominated by water erosion.

The high alpine and glaciated erosional areas have mostly shallow soils with rock outcrops and a large amount of surface runoff. These areas are steep. They comprise 2 percent of the watershed in Middle Deer Creek, Silver Creek, Upper Cracker Creek and Upper McCully Creek. The glacial deposition has accumulated on many upper valley floors, downslope from glacial scour areas. These are cool and cold soils in the south central part of the watershed and comprise 7 percent of the watershed in Upper McCully Creek, Upper Cracker Creek and Lower McCully Creek. Glacial till in Silver Creek, Upper Cracker Creek and Upper McCully Creek are generally stable but can easily be moved by overland flow on steep slopes. Moderate to high mass failure hazard has been assigned where these moraines lie below high runoff zones (glacial scoured). About 450 acres were identified as having this risk. These high elevation areas have no proposed management activities. Patented mining lands, historic and current mining, and roading for historic mining and current private logging may occur on these areas.

The intermediate slopes of the basin are dominated by water-eroded slopes and comprise about 70 percent of the watershed. On cool to cold moist sites (about 35 percent of the watershed) there are significant amounts of Mazama ash and productivity is limited by cold temperatures. The lower elevations are cool/dry sites (this soils group corresponds closely with the vegetative warm/dry sites) that comprise about 30 percent of the watershed. These lower elevation sites are more susceptible to sheet and rill erosion than the higher elevation cool to cool moist sites, due to lower vegetative density. These categories are found in most of the SWSs of the watershed. Andesitic tuffs of the Clarno formation are associated with the southern parts of the watershed. These have weathered to form very deep and clayey soils. A moderate to high mass failure hazard is possible for the steep (30 to 60 percent) soil map units if moisture is present These types of situations occur naturally where seeps and springs are present and are not common. Thirty-four acres are assigned to this risk rating in Clear and Dean Creeks and their tributaries.

Granitic soils occupy approximately 5.5 percent of the watershed. On steep mountain side slopes they support cold subalpine fir associations. These areas account for 3 percent of the watershed, occurring in Middle Deer Creek, Silver Creek,Upper and Lower McCully Creek and Dean Creek. At lower elevations and less steep slopes, granitic soils support dry grand fir and ponderosa pine plant associations. These sites account for about 2.5 percent of the watershed, occurring primarily in South Sumpter Valley and Clear Creek.

The higher elevation granitic soils support dense vegetation and are relatively stable regarding sheet and rill erosion. Lower elevation sites may have significant sheet and rill erosion concerns due to low vegetative density. Concerns for granitic soils center on surface erosion rather than mass wasting. Activities that disturb vegetation and/or concentrate surface runoff may accelerate sheet and rill erosion. Road location in these areas is the primary focus of concern for accelerated erosion. Water depositional sites are of two ages. The old, Tertiary deposits occur as benches around the edges of the valley floor, generally above the Phillips Lake reservoir. Stream dissection has exposed clays that can be an engineering problem. About 3.4 percent of the watershed is composed of these soils. North of Phillips Lake, in Union/Bridge Creeks and Lower Deer Creek, a low to moderate mass failure hazard was given to some map units with inclusions of clay. This is a small area.

The young alluvium occur along most streams and are not extensive on National Forest System lands. The most significant aspect of stream alluvium in this drainage is that it is gold-bearing. Gold miners used dredges to disturb a larger surface area looking for gold than all the glaciers in the drainage affected during the ice age. The volumes of material moved are comparable in scale to a geologic event like the ice age even though the material did not move as far.

Water Resources

Hydrology and Water Budget

The reservoir, Phillips Lake, has active (usable) storage capacity of 90,500 acre-feet of water. Mason Dam is a rolled-earth and rockfill structure 173 feet in height with a crest length of 895 feet. Phillips Lake, impounded behind the dam, covers 2,235 acres. Total storage capacity of the reservoir is 95,500 acre-feet In addition, there is a minimum pool (below the outlet) of 5,000 acre-feet; 17,000 acre-feet are exclusively reserved for flood control. The maximum water storage occurred in 1983, with 86,337 acre-feet stored. The reservoir was high again in May 1997, with 84,164 acre-feet. Minimum storage occurred in 1988, when the reservoir was drawn down to 428 acre-feet of usable storage. The Baker Valley Irrigation District utilizes the storage for irrigation. There are 21,000 acre-feet allocated for joint use for irrigation and flood control. Another 52,500 acre-feet are allocated for irrigation.

Phillips Lake provides irrigation water, flood control, recreational opportunities, and habitat supporting fish and wildlife. A total of 5,038 acres in the Phillips Lake area are available for recreational use. The 2,235 surface acres at normal elevation (4070 feet) have a shoreline that stretches almost 13 miles. Recreation facilities for camping, picnicking, swimming, and boating have been constructed and are administered by the Forest Service. Boat launches and moorings are provided. The reservoir is stocked annually with rainbow trout. Many waterfowl rest at the reservoir during migration, most noted are Canadian geese.

Under an agreement with ODFW, the Baker Valley Irrigation District releases water to meet a 10 cfs (cubic feet per second) minimum instream fish flow at Smith Dam, about five miles below Mason Dam. At times when storage is depleted, the Baker Valley Irrigation District, in cooperation with ODFW, may reduce the release in order to maintain a flow of water in the Powder River over the length of the season.

The irrigation season begins by decree on March 1 and ends November 1. In practice the irrigation season begins about April 15 and ends about October 1. Releases are controlled to moderate the annual variations in stream flow. The actual release pattern depends on the available water and expected runoff for any year.

Two stream gauges are maintained near Phillips Lake. One is located on the Powder River at Hudspeth Lane. Actually two different gauges (13275105 at Hudspeth and 13275100 at McEwen) at different locations with different periods of record provide information for discharge values above Phillips Lake. The gauge on Deer Creek near Phillips Lake is located below Highway 7. The information from the Hudspeth and Deer Creek sites can produce a total of measured discharge into the reservoir but can not account for several unmeasured sources that contribute to the amount of available water. Both are currently operating but data has not been finalized since 1991. The provisional data is not shown due to site

characteristics at both stations that require data corrections that are not yet completed. There is another gauge below the dam on the main stem of the Powder River.

The existence of the the dam structure and the location of the gauges does not lend the data to be analized the same as would a more natural system. Streams for which cumulative discharge are not accounted are those streams flowing directly into Phillips Lake without being measured (e.g., Dean Creek). A watershed analysis could construct a more complete picture by estimating average water yields for these individual streams.

On the other hand, the fact that the dam provides for the storage and regulated release of accumulated streamflows allows for the reporting of storage levels and release. The gauge 1,200 feet below Mason Dam is a good indication of total regulated flow because it includes a minimum amount of natural flow from unmeasured tributaries.

Water leaves the watershed as evapotranspiration. Water is transpired by native vegetation growing in the watershed. Water evaporates from lakes,streams, soils, plants, and snowpacks. The amount of water cycling through this part of the hydrologic cycle varies from year to year based on timing, type, and amount of precipitation, length of growing season, changes in vegetation, and other factors. Data was not available to construct a water balance table inside the watershed. Data from Austin, Oregon is displayed as comparable information because of the similarities in elevations, soils, and moisture regimes. One major difference between the two geographic units is the large surface area of the reservoir. The information is still valuable in describing the water budget.

The Baker Ranger District has implemented hydrology and habitat improvement projects on National Forest System lands. Projects that have occurred or are planned for the Upper Powder watershed are described in the UPR Biological Assessment.

Water Quantity and Timing of Flows

Reductions in vegetative cover and density increase water yield due to the decrease in evapotranspiration. Changes in vegetative cover affect the distribution and melt rate of snow packs that may change the amount of water yield and its timing to the system. These effects may change peakflows. Currently there is no ability to predict the size or direction of this change. Increased peak flows may lead to channel destabilization, changing stream morphology, increasing sedimentation, and harming aquatic habitat. Decreased peak flows may lead to aggradation of the stream as sediment transport capabilities are decreased. Substrate embeddedness may increase as flushing flows decrease.

The USFS developed a method to evaluate the extent of vegetative manipulation in the subwatersheds of the Upper Powder River watershed. Based on recovery tables for differing ecotypes and stand basal area, the method reflects manipulations and natural events within the last 50 to 100 years. The most recent effects are attributed to harvest, wildfire, and insect

mortality. A complete explanation of this method is contained in the WWNF's UPR Watershed Analysis.

An index based on the basal area of live trees on a site represents canopy density and stocking. It is used to estimate vegetative use of water and snow melt characteristics. The calculated values can be viewed as a watershed disturbance factor with direct links to changes in canopy closure and conifer age distribution. Risk categories were assigned to values in "Determining the Risk of Cumulative Watershed Effects Resulting from Multiple Activities", USDA Forest Service, February 1993:

Table 3. Subwatershed Risk Rating

Name	SWS	Risk	Notes	Percent SWS Pvt
Phillips Lake	20A	N/A	Lake	0
Union/Bridge Creeks	20B	L		13
Lower Deer Creek	20C	M	0	39
Middle Deer Creek	20D	M		5
Upper Deer Creek	20E	M		0
North Sumpter Valley	20F	M	**	62
Lower Cracker Creek	20G	H		11
Silver Creek	20H	M	0	14
Upper Cracker Creek	20I	H	**	31
Lower McCully Creek	20J	H		9
Upper McCully creek	20K	M		7
South Sumpter Valley.	20L	M		29
Clear Creek	20M	H	**	47
Dean Creek	20N	M		<1

Table 3 was been edited by writer of this assessment from how it originally appeared in the Forest Service's Upper Powder River Watershed Analysis.

The Lower Cracker Creek, Upper Cracker Creek, Lower McCully Creek, and Clear Creek subwatersheds are in the high risk categories. The high ratings are linked to timber sales (private in the case of Upper Cracker Creek SWS) and to the 1986 Huckleberry Fire in the Clear Creek SWS. These subwatersheds have had extensive modification of the vegetative canopy and age distribution.

Table 4. Powder River Near Sumpter OR (13275300)

LOCATION – Lat 44° 40' 20" N, Long 117° 59' 40" W, NE¼ SW¼ Sec.25, T 10 S., R 38 E, W.M. located in Baker County, Hydrologic Unit 17050203, WWNF, on left bank 1,200 feet downstream from Mason Dam, ¼ miles upstream from California Gulch, 11.4 miles southeast of Sumpter, and at river mile 123.2.

DRAINAGE AREA – 168 square miles (mi^2), approximately.

PERIOD OF RECORD – April 1965 to 1987.

GAGE –Water-stage recorder. Datum of gage is 3898.47 feet above National Geodetic Vertical Datum of 1929 (BOR benchmark). Prior to July 29, 1967, nonrecording gage at datum 1.03 feet higher.

REMARKS – Flow completely regulated since October 31, 1967 by Phillips Reservoir, active capacity 90,540 acre feet. Many small diversions for irrigation upstream from dam.

AVERAGE DISCHARGE – 22 years, 115 cfs, 83,320 acre-feet/year, not adjusted for storage in Phillips Reservoir.

EXTREMES FOR PERIOD OF RECORD – Maximum discharge, 1,600 cfs, March 20, 1910, based on comparison with records for station downstream near Baker City.

Statistical Summaries for the Period 1968 – 1987

Source: USGS open file report 90-118, page 61

Monthly and annual statistics based on mean daily discharge, in cfs

Month	n	Minimum	(year)	Maximum	(year)	Mean	Standard Deviation	% annual runoff
October	20	2.6	1974	19	1981	11	4.7	0.8
November	20	0.5	1968	16	1985	9	4.3	0.6
December	20	0.5	1968	14	1984	8.2	3.9	0.6
January	20	0.4	1968	105	1984	15	26	1.1
February	20	0.8	1968	67	1984	18	19	1.2
March	20	1.1	1968	317	1982	64	91	4.6
April	20	11	1978	355	1984	147	117	10.1
May	20	157	1978	519	1975	324	101	23.1
June	20	135	1987	546	1983	308	137	21.3
July	20	85	1968	411	1984	214	69	15.3
August	20	56	1976	301	1974	216	63	15.4
September	20	21	1984	171	1974	86	37	6.0
Annual		60		186		119	39	100.0

n = number of values used to compute statistics

Table 4. Powder River Near Sumpter, OR (continued)

Flow Duration Statistics Based on Mean Daily Discharge																
Percent of time discharge equals or exceeds monthly discharge		95%	90%	85%	80%	75%	70%	60%	50%	40%	30%	25%	20%	15%	10%	5%
Month		**Monthly discharge in cubic feet per second (cfs)**														
October	20	3.8	5.2	5.2	7.2	7.9	8.5	9.1	10	12	14	15	16	17	19	21
November	20	1.2	2.6	3.1	4.9	6.2	7.0	8.2	8.8	9.6	11	12	13	15	16	17
December	20	0.7	2.7	3.1	3.1	4.6	5.3	8.1	9.1	9.7	11	12	12	13	14	15
January	20	0.3	1.5	2.9	2.9	4.8	5.3	7.2	7.7	9.2	11	12	12	13	15	96
February	20	1.2	1.4	3.7	4.5	5.6	6.2	8.0	8.6	10	11	12	14	16	41	103
March	20	1.5	2.2	5.5	6.4	7.7	8.3	11	13	14	50	85	118	164	210	345
April	20	6.4	9.4	12	13	14	16	56	94	154	204	238	291	343	398	463
May	20	122	156	181	207	227	245	283	317	360	401	429	457	478	500	536
June	20	102	127	147	167	186	202	234	275	329	427	452	475	498	528	563
July	20	89	115	128	141	150	160	183	206	226	248	259	270	285	309	396
August	20	55	98	130	148	165	179	201	221	242	268	278	289	299	321	349
September	20	6.5	9.3	15	18	23	31	54	79	102	124	136	149	164	178	199
Annual		3.0	5.2	6.9	8.1	9.2	10	13	23	117	181	213	247	290	343	447
n = number of values used to compute statistics																

Source: USGS open file report 90-118, page

Stream Channel Condition and Dynamics

Hydrologic Function

Several activities in the watershed have altered hydrologic function of streams. Summer streamflow in the lower reaches of larger streams is reduced by irrigation and mining water use withdrawals. ODEQ may need to evaluate the effects of these flow modifications using its section 303(d) listing criteria. Timing, duration, and quantity of peak and low streamflow may have also been affected by reduced ground cover due to wildfire, livestock grazing, timber harvest, insect and disease mortality, roads, and mining; by floodplain confinement from dikes, road fills, and gullies; and by extension of the drainage network by road ruts and ditches, irrigation and mining ditches, and rills and gullies. Quantitative changes in hydrologic function have not been modeled as part of this assessment process.

Wetted Width/Maximum Depth

The USFS Region 6 stream survey protocol (Hankin and Reeves) currently does not recognize the various pool types, or their causal factors, unless there is a unique feature associated with the pool habitat, such as a waterfall, chute, or dam. As a result, dammed pools that may flood several times the mean channel width, resulting in artificially high wetted width-maximum depth ratios (USFS 1997b) cannot be eliminated. For those streams within the UPR watershed that have been surveyed, wetted width to maximum depth ratios of all pools was calculated. The average width to maximum depth ratio for pools for every stream that was surveyed was less than 10. The assumption is that the UPR watershed is rated as **properly functioning** for this particular habitat indicator.

Streambank Condition

Streambank stability information has been collected in several ways in this watershed. Hankin and Reeves survey comments, PFC surveys, channel condition surveys, and personal observations were used to evaluate the streams of this watershed. In those watersheds where more than one stream is evaluated, the lowest bank condition was assigned to the watershed.

Historic mining, current mining, and grazing have been partially responsible for causing unstable streambank conditions in some reaches of Lower Deer Creek, Middle Deer Creek, North Sumpter, Lower Cracker Creek and Lower McCully SWSs. They are categorized as **functioning at unacceptable risk** for these reasons. There is little information for the Upper Cracker Creek SWS on private land. The Clear and Dean Creek SWSs have reaches that are recovering from down cutting. These last mentioned subwatersheds are categorized as **functioning at risk**. The remaining subwatersheds are categorized as **functioning appropriately**.

Floodplain Connectivity

Most of the channels in this watershed have high or moderate gradients with narrow (i.e., entrenchment <2.2 times bankfull width) floodplains. The subwatersheds were evaluated by the WWNF based on disturbance that has affected the ability of high flows to occupy stream adjacent areas to their natural extent.

Lower Cracker Creek and the lower part of Lower McCully Creek were dredged. Mine tailings occupy the floodplain and confine the channel. Connectivity to floodplains is lost and not self-repairing. In the Lower Cracker Creek SWS the road along Wind Creek is adjacent to the creek and confining the channel for a portion of its length. The county road confines Lower McCully Creek. These subwatersheds are categorized as **functioning at unacceptable risk.**

In the Upper Cracker Creek SWS the stream bottoms were patented and are privately owned. Little information is available for these channels. The Clear and Dean Creek SWSs have stream segments that are down cut, with loss of connectivity to the old floodplain. The down cutting is probably related to the disturbance that occurred during the railroad logging that took place at the turn of the century. About one-third of each of these stream channels is in this condition. These stream segments are recovering, but the floodplain that they use now are formed in the bottom of the down-cut channels. These subwatersheds are classified as **functioning at risk**

Roads exist in the near-channel area of many of the streams in this watershed, and in some cases confine lateral movement of the channel. However, with the exceptions noted above, high flows are generally able to access their historic floodplains. Ephemeral draws in several subwatersheds are down cut, generally relating to historic placer and hydraulic mining. Due to their limited flow regime they were not included in this analysis (by the Forest Service). Lower Deer Creek has some areas of localized down cutting amounting to less than 5 percent of its length. Other channels in this subwatershed are functioning appropriately. Silver Creek was placer mined for about 10 percent of its length, up to the confluence with Snell Hollow. Floodplain connectivity has been reduced but not eliminated in this segment. These subwatersheds and the remaining SWSs of the UPR watershed are classified as **functioning appropriately.**

Hydrology/Flow

Change in Peak/Base Flow

Due to limited stream flow data, there has not been an evaluation of changes in peak and base flows. Vegetative cover largely controls watershed response. Equivalent Clearcut Acre (ECA) method measures the amount of vegetative disturbance and can be taken as an

indication of the potential for changes in flow regime. This method is described in the Overview under **Water Resources**, Hydrology and Water Budget (Water Quantity and Timing of Flows) of this assessment. More detailed discussion is contained in the WWNFs UPR Watershed Analysis.

The Subwatershed Risk Rating (table 3) shows the Risk Ratings (High, Medium and Low) for each subwatershed. The Union/Bridge Creek SWS is classified as **functioning appropriately**. The remaining subwatersheds are categorized as **functioning at unacceptable risk**. Base flows would generally be higher as vegetative disturbance increases, due to the reduction in evapotranspiration. This could be offset by reductions in groundwater storage in riparian areas due to down cutting, compaction, and other disturbances that reduce storage. No comprehensive evaluation of these effects has been made.

Drainage Network Increase

Data regarding increases in the drainage network due to human-caused disturbances are not available. However, any increase in the drainage network is likely to be strongly correlated to the road density in the watershed. Due to the lack of specific data, watershed and subwatershed ratings for drainage network increase are identical to the road density and location ratings as described below. All subwatersheds were classified as **functioning at unacceptable risk.**

Historic mining, current mining, and grazing have contributed to unstable streambank conditions in some reaches of Lower Deer Creek, Middle Deer Creek, North Sumpter, Lower Cracker Creek and Lower McCully SWS. They are categorized as **functioning at unacceptable risk** for these reasons. There is little information for Upper Cracker Creek SWS on private land. The Clear and Dean Creek SWSs have reaches that are recovering from down cutting. Clear and Dean Creek SWSs are categorized as **functioning at risk.** Phillips Lake, Union/Bridge Creeks, Upper Deer Creek, Silver Creek, Upper McCully Creek and South Sumpter Valley SWSs are categorized as **functioning appropriately**.

Sediment in Streams

Little sediment data has been collected. Accelerated sediment deposition and turbidity in streams in the watershed is believed to be caused in part by altered hydrologic function due to past and current land use activities (roads, farming, mining, timber harvest, and grazing practices), and natural events such as fires and flooding. A forest channel condition survey has been conducted on several of the smaller streams of the watershed and estimates were made of surface fines. Hankin and Reeves embeddedness data exists for several other streams and is used as an indication of sedimentation. Embeddedness is defined in the next subsection, Fisheries. Streams for which there is no data are listed at risk. At this point in time, sedimentation and turbidity have not been shown to be serious enough to merit a listing

under section 303(d) of the Federal Clean Water Act (ODEQ 1998c), that is, there is not enough data to show impairment of beneficial uses.

Most cattle in the valley are confined to pastures. Erosion problems on private forest land road systems are related to surface water drainage, and historical road location. Sediment delivery into waters of the state occurs most often as a result of these problems.

Bridge Creek had an average rating of 10 percent surface fines. There is no sediment data on Union Creek. In the Lower Deer Creek SWS, Miners Creek and Smith Creek were found to have less than or equal to 12 percent surface fines, and Stovepipe Gulch was found to have 50 percent surface fines. These subwatersheds are listed as **functioning at risk**. In Middle Deer Creek the two reaches have about 70 percent of measured units with greater than 35 percent embeddedness. There is no data for Lake Creek. In Upper Deer Creek the two reaches have 22 percent and 40 percent of the measured habitat units with greater than 35 percent embeddedness. Crevice Creek has 29 percent of measured units with greater than 35 percent embeddedness. Lower Cracker Creek has 65 percent of habitat units greater than 35 percent embeddedness. McCully Forks has about 90 percent of measured habitat units with greater than 35 percent embeddedness. Clear and Dean Creeks had about 30 percent of measured units showing greater than 35 percent embeddedness. These subwatersheds are listed as **functioning at unacceptable risk**. There is no data for the other subwatersheds that are listed as **functioning at risk**.

Surface water drainage: Because of high recreational use during wet portions of the year (hunting season) traditional water barring of native surface mainline roads is often inadequate to provide sufficient drainage. This has prompted seasonal road use restrictions and construction of rolling dips, grade changes or other more permanent drainage structures such as ditching with cross drainage. In addition to being prudent activity, maintenance of forest roads on private lands is required by the Oregon Forest Practices Act. The Act states that "operators shall maintain active and inactive roads in a manner sufficient both to provide a stable running surface, and keep the drainage system operating as necessary to protect water quality". Several rules within the Act specifically address these concerns.

Historical road location: The common historical practice of locating roads in draw bottoms and/or near stream courses has, in site specific locations, led to various problems from occasional sedimentation into stream courses, to being unusable after being totally washed out. The gravel pit road above Deer Creek is such an example where it washes out some years.

Sumpter Municipal Watershed

The city of Sumpter is located in the lower portions of the Lower Cracker Creek, Silver Creek and Upper McCully Creek SWSs. The municipal water supply for Sumpter is composed of three intakes. An intake on McCully Creek above the confluence of O'Farrel

Gulch, and and another intake on O'Farrel Gulch at its confluence with McCully Creek are located in the Upper McCully Creek SWS on National Forest System lands. These intakes are in the lower reaches of this subwatershed. In addition there is an intake on Cracker Creek located in the tailings on private land low in the Lower Cracker Creek SWS.

The WWNF's Forest Plan recognizes that the watershed provides water for a municipal purpose; however, the city's watershed does not have Federal designation. There is currently no Memoradum of Understanding (MOU) between the USFS and the city of Sumpter regarding the city water supply. Forest Plan Standards and guidelines apply to this domestic supply watershed.

Sumpter municipal watershed includes all of Lower Cracker Creek SWS from the top to the point where O'Farrel Gulch joins McCully Fork. Specific to the McCully watershed, Road 7300900 (adjacent to McCully Creek) is closed to all but WWNF administrative use and city officials at a point past the campground. Mining claims with active operating plans exist on McCully Creek above the intakes. None of them are actively mining at this time. The watershed is open to public entry.

The McCully Creek intake is filtered through a sand filter located at the point of diversion. The other two intakes are unfiltered. Sumpter relies on the McCully intake for nearly all of its water, turning to O'Farrel Gulch and Cracker Creek only to deal with unusual circumstances, such as a fire in town, to clean the filter beds, or when an intake is blocked by debris. A chlorination house is located on the pipeline before it reaches Cracker Creek. Only McCully and O'Farrel can be chlorinated. The water reaching Sumpter is stored in a holding tank above the town. The filter and chlorination systems were installed in the early 1980s.

Sumpter has water rights to all these diversions in excess of their current use and also has water rights on Fruit Creek in the Silver Creek SWS. The estimated diversion at McCully is 5 cfs and the water rights are for 15 cfs at each intake. The city supplies approximately 140,000 gallons per day during the winter low-use period and approximately 200,000 gallons per day during the summer high-use period.

The city is under a remedial order to filter 100 percent of its water at all times. Currently, during maintenance of the filter beds and when water from Cracker Creek or O'Farrel Gulch are used, this criteria is not met. The city is in the process of studying its options to do this and to plan for future water needs. Various options exist, including enlargement of the sand filter at the McCully diversion, diverting O'Farrel Gulch into McCully above the sand filter, developing its water rights on Fruit Creek, and building a sand filter in Sumpter. The latter is the city's preferred alternative and plans are being developed. The WWNF is evaluating the proposals on National Forest System lands for environmental effects.

Diversion structures at the intakes on McCully Creek and O'Farrel Gulch appear to be barriers to fish passage and need to be evaluated. The diversion dams are in place except

during the spring runoff. Sand removed from the sand filter is currently being spread around the filter and its effect on McCully Creek needs to be evaluated.

Two hard rock mines, Bald Mountain and Grand Trunk, are located on patented land in the McCully subwatershed. Heavy metals from the adits associated with these mines have been detected through sampling at adits and below Bald Mountain on McCully Creek. Several are in excess of water quality standards (see the heavy metals discussion below). The city of Sumpter samples for heavy metals at its storage tank in town and these tests show that the water delivered meets all water quality standards for heavy metals.

Water Quality

Groundwater

There are 193 individual wells inside the watershed. Wells that were established prior to 1955 may not have been recorded. There are no known groundwater water quality problems. No critical groundwater areas have been identified in the Powder Basin by OWRD. Below is a table showing the number of well sites by use classification.

Number of Well Sites by Classification

Community	1
Domestic	148
Irrigation	43
Industrial	1
Total	193

Surface Water

Stream Conditions

(Source: WWNF UPR Biological Assessment)

Stream Gradients and Channel Type

The streams of the UPR watershed have variable gradients, steepest at the headwaters, with decreasing gradients downstream. On the north side of the watershed the high elevations of the Elkhorn Mountains are drained by long reaches where gradients are between 4 and 20 percent. These correspond to Rosgen A-type channels and have substrates ranging from bedrock to boulder/cobble and narrow V-shaped valleys. These steep streams flow into

larger systems (Silver, Deer, Lower McCully) that have gradients in the 2-4 percent range and are Rosgen B-type channels, with substrates ranging from large boulders to sand. These streams occupy valleys that are wider and have generally steep side slopes, floodplains, and other depositional features. These B-type channels have been heavily disturbed by placer and dredge mining.

Streams on the south side of the watershed drain from lower elevations over more gentle topography and are generally Rosgen B-type channels (2-4 percent gradients) over their whole length. Substrates are primarily sand and gravel.

The Powder River was a low gradient C-type channel that has been thoroughly disturbed by dredge mining and is currently confined by tailings mostly to B-type and F-type channels. In this watershed more than one-third of the length of the main Powder River Valley is covered by Phillips Reservoir, the impoundment behind Mason Dam.

Miles of Stream

Table 5 displays miles of stream, broken out by perennial fish-bearing and nonfish bearing, intermittent, and ephemeral classifications. Streams are classed based on Forest Service Manual direction. Corrections to the stream database are ongoing as ground-truthing reveals inaccuracies. In addition, an elevation range and miles of roads obliterated is given for each subwatershed. Obliteration information is incomplete at this time.

Heavy Metals

The watershed topography, streamflow distribution, water development and use practices, and historical land use practices have caused some water quality problems. Since 1993, many mine portals and streams below mines on the WWNF have been sampled for heavy metals. A review of the water quality analyses show low or no detection for most metals on most mines, and generally below concentrations of concern to fisheries and to the EPA. The water quality parameters analyzed were compared to State of Oregon water quality criteria for acute and chronic affects on fresh water aquatic life and for protection of human health (OAR, Chapter 340, Division 41, DEQ, table 20).

Samples were generally taken at mine adits. For some mines, downstream surface waters were sampled. A review of the data shows that high concentrations of metals at adits are often substantially reduced when the mine water mixed with streams. In other words, heavy metal concentrations were evident at portals but lower heavy metal concentrations were found in stream water. A review of the water qualities analyzed results is contained in the mining subsection under the discussion of issues in the third chapter of this assessment.

Some streams within the UPR watershed have not been surveyed using the Hankin and Reeves method. Some previously surveyed streams need to be resurveyed. The WWNF

Baker Ranger District is participating in a Forest-wide effort to prioritize necessary stream survey work.

Table 5. Elevation, Range, and Miles of Fish-Bearing, Nonfish-Bearing, Other Perennial, and Intermittent/Ephemeral Streams

SWS	Elevation (feet)	Perennial		Stream Miles	
		Fish-Bearing	Nonfish-Bearing	Intermittent	Ephemeral
Phillips Lake	4067-4090	N/A	N/A	N/A	-----
Union/Bridge Creeks	4070-7084	5.4	12.9	2.1	45.1
Lower Deer Creek	4070-7911	8.3	24.5	6.7	49.8
Middle Deer Creek	4254-8888	21.9	7.2	0.9	70.4
Upper Deer Creek	4595-9039	10.8	23.2	3.7	64.4
North Sumpter	4080-5638	1.1	N/A	3.8	86.9
Lower Cracker Creek	4368-8076	11.5	19.5	11.1	65.1
Silver Creek	4988-8065	17.0	8.3	7.4	75.1
Upper Cracker Creek	4975-8459	7.6	10.5	5.2	34.2
Lower McCully Creek	4368-6806	8.5	14.3	7.4	59.2
Upper McCully Creek	4529-8236	17.8	10.9	1.7	94.3
South Sumpter Valley	4080-5913	9.5	23.8	45.3	56.5
Clear Creek	4070-5854	1.9	19.4	13.9	80.3
Dean Creek	4070-6638	6.4	14.5	4.8	66.0
TOTALS		**127.7**	**189.0**	**114.0**	**847.3**

* Elevations are listed from lowest point to highest within the subwatershed.

ODEQ 303(d) List

Oregon's Department of Environmental Quality has published a list of "water-quality-limited" streams under section 303(d) of the Clean Water Act. Two stream segments in the UPR watershed (20) are listed due to summer water temperatures. The 1998 list was published March 1998. There were no changes for this watershed from the 1994/1996 list.

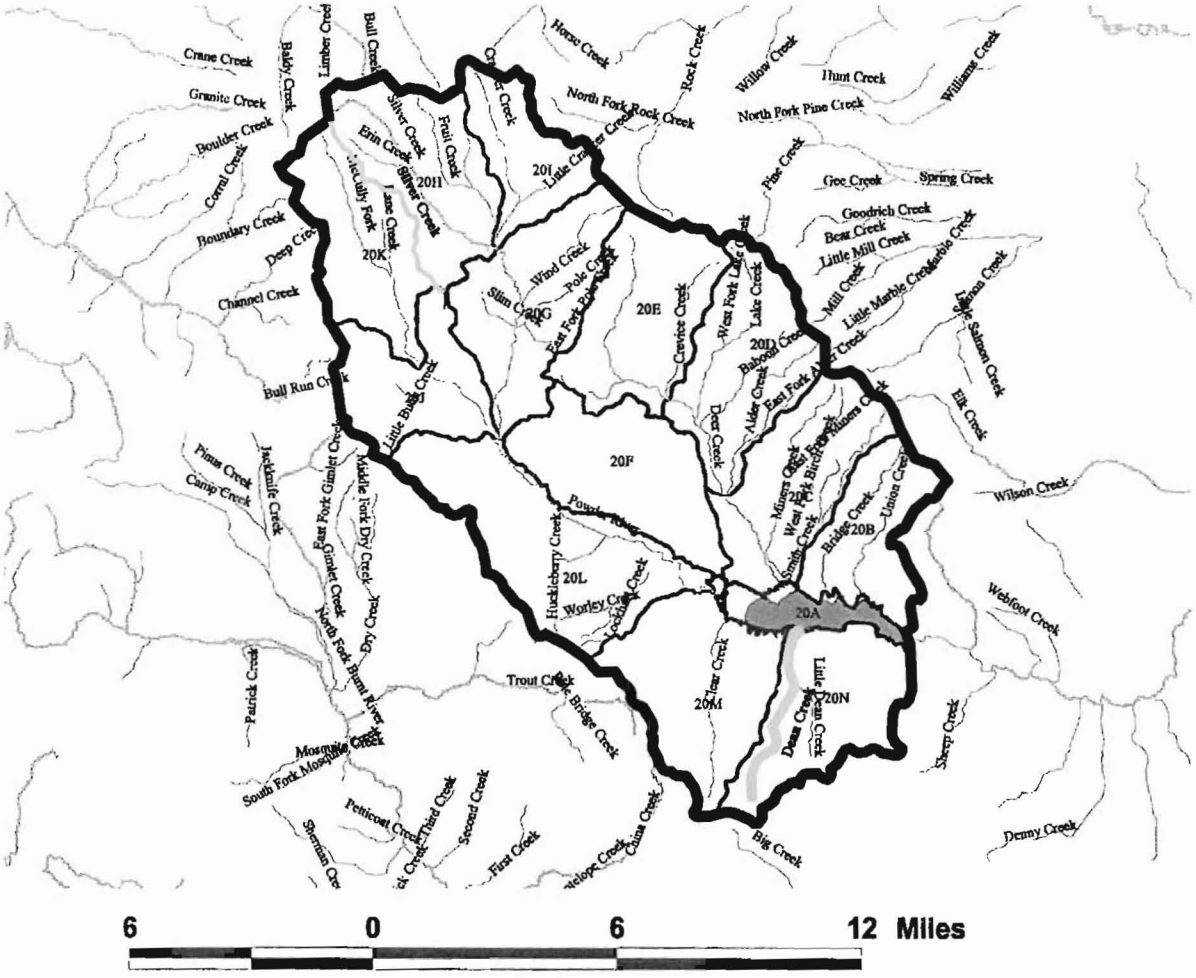
Silver Creek, mouth to headwaters, temperature. Because Silver Creek has bull trout, the State standard for water temperature is 50 °F. Five years of temperature monitoring, just above the mouth of Cracker Creek, found the 7-day maximum average exceeded 50 °F in every year. Bull trout are first found in the summer over a mile above this point. Single sample temperatures taken upstream of the monitoring site indicate that Silver Creek is cooler in those reaches. Additional temperature monitoring is needed to establish the

longitudinal temperature regime of the creek and to determine if a temperature barrier is confining the bull trout.

Dean Creek, mouth to headwaters. This stream was monitored 1992 through 1994 using max-min thermometers that were read twice per week. The temperatures recorded represent Insert Upper Powder River Watershed 303(d) figure a 3- or 4-day period. In all years the site lowest on the stream was above State standards. One year of data from Dean Creek above the Little Dean confluence and from Little Dean (1994) Creek shows Dean substantially cooler with only one 4-day period above standards and Little Dean meeting standards. In the reach below the Little Dean confluence, Dean Creek is well vegetated with hardwoods. The reach above this confluence is deficient in hardwoods and shade for much of its length and Road 1160 is adjacent to the creek, reducing potential for riparian shading. Many years of restoration projects have focused on this stream, and within the last three years a new grazing management plan as well as two years of rest have contributed to significant improvement in the channel. The upper reach is still very deficient in shade, but several thousand hardwoods have been planted and survival has been good. Temperature data is 8 years old and the one year of data from the upper reach and Little Dean Creek is anomalous. This stream should receive more temperature monitoring.

These are the only streams currently listed on the 303(d) list. Data on several other streams shows them to be above state standards for water temperature: Lake Creek (Middle Deer Creek SWS), bull trout population; Lower Deer Creek (Middle Deer Creek SWS); Lower Cracker Creek (Lower Cracker Creek SWS); Huckleberry Creek (South Sumpter Valley SWS) with one year meeting and one year exceeding; Clear Creek (Clear Creek SWS) with one year of max-min data.

UPPER POWDER RIVER WATERSHED
303d LISTED STREAMS



Need For More Water Quality Monitoring

Watershed specialists are involved with ongoing monitoring of baseline conditions and of project implementation. Baseline monitoring consists primarily of water temperature monitoring. Projects are monitored at several phases; project planning to include protective measures in project design, contract preparation, project implementation for implementation of BMPs and mitigation, and follows up visits to monitor the effectiveness of protective measures.

State standards allow no increases in water temperature of greater than 0.5 °F from any activity, and no increase when water temperature is 64 °F, or in bull trout habitat, 50 °F. WWNF data on several streams shows water temperatures to be above state standards: Lake Creek, (bull trout population); Lower Deer Creek; Lower Cracker Creek; Huckleberry Creek (one year meeting and one year exceeding); Clear Creek (one year of max-min data). The data has been evaluated against State of Oregon water quality criteria in the setting of activities that have the potential to affect water temperature. The following temperature data summary by subwatershed includes comments on channel morphology and condition.

Phillips Lake

There is no water temperature data for Phillips Lake.

Union/Bridge Creeks

Union Creek has been monitored. Its water temperature meets state standards for redband and rainbow trout. Recovery from historic mining and grazing and current grazing management has allowed substantial riparian vegetation to be maintained. The stream was evaluated in 1997 and found to be in proper functioning condition (PFC).

Lower Deer Creek

The Lower Deer Creek subwatershed has no temperature data. Its main streams are Stovepipe Gulch, Miners Creek, Birch Creek, and Smith Creek. These streams are very small; those with perennial flows have a low flow of less than 1 cfs. Historic placer mining throughout this SWS and hydraulic mining on two forks of Birch Creek has severely disturbed the channels of this subwatershed. The ephemeral draws of the area have been heavily mined and thoroughly disturbed. These draws are severely down cut and do not have the subsurface water storage that existed prior to mining, especially Birch and Miners Creek. Active mining is ongoing, preventing recovery on these streams. Restoration and reclamation are needed in these areas. Stovepipe Gulch below Rd 120 is deficient in hardwoods and shade. Grazing and camping are preventing recovery. Stovepipe, Miners, and Birch are fish-bearing below the Forest and a short way onto the Forest. Road crossings

need to be evaluated for fish passage. The potential for fish habitat (very small streams) is a necessary part of this evaluation.

Middle and Upper Deer Creek

These streams drains a large area from the crest of the Elkhorns (elevation 8000 feet) to Phillips Lake (elevation 4000 feet). This stream will be discussed from its headwaters down. Upper Deer Creek carries a very large bedload of gravel, especially below Crevice Creek. Because of this large bedload, there is very little pool formation or habitat, in spite of a sufficient supply of large wood. Within this subwatershed, Deer Creek meets state standards for water temperature. The lower reach of Middle Deer Creek was evaluated in 1997 and found to be in PFC.

Lake Creek, a tributary to Deer Creek, has a short reach with a bull trout population. Water temperature data on this stream is in the mid-60 °F range that exceeds state standards for bull trout streams. Temperature monitoring has been near the confluence of Deer Creek. Additional monitoring is needed to evaluate the limited distribution of bull trout. Brook trout are found above the bull trout up to and including Twin Lakes in the headwaters. Three temperature sites on Deer Creek in this subwatershed show mixed results. Above Lake Creek and near the Forest boundary water temperatures exceed 64 °F. One year of data indicates that a site below Lake Creek meets standards. Data from Lake Creek does not suggest that it could cool Deer Creek to this extent.

Deer Creek below Lake Creek was historically placer mined and there are two areas of known historic hydraulic mining. This historic activity and ongoing mining from the Deer Creek Campground to the Forest boundary are affecting the vegetative potential of the riparian area. Until very recently top soil was not protected during mining, and as a consequence much of the top soil is gone in the riparian area of this stretch of Deer Creek. The vegetative potential has been severely reduced due to this loss. Grazing on this section of Deer Creek needs to be more tightly controlled due to the sensitivity of the area. Ongoing mining is destabilizing some portions of the channel. The width-to-depth ratio is too large due to the unstable banks, the lack of streamside vegetation, and the extreme amount of gravel in the system. Middle Deer Creek was evaluated in 1997 and found to be "Functioning at Risk" due to these factors. The ability to correct these problems is limited by the ongoing mining, the large amount of gravel in the system, and the reduced vegetative potential. Crevice Creek needs to be evaluated to determine the source of the gravel it is putting into Deer Creek. It heads above tree line in the actively eroding crest of the Elkhorns. There are no records of placer or hydraulic mining, however this drainage was heavily harvested for timber in the 1980s.

North Sumpter

This subwatershed has no perennial water and no temperature data. Bear Gulch was historically placer mined and is currently being mined. Restoration and reclamation are needed. Because grazing pressure had damaged Hawley Gulch, it was recently enclosed above Rd 7240150 to prevent grazing, and willows were planted in 1997.

Cracker Creek

The Cracker Creek drainage encompasses Upper and Lower Cracker Creeks and Silver Creek. These subwatersheds have many hard rock mines dating from the late 1800s. Much of this subwatershed and all of its drainages have been patented and are on private land. For this reason there is no water temperature or stream survey data for this portion of Cracker Creek and Little Cracker Creek. ODFW found bull trout in Little Cracker Creek. The private lands have been heavily logged in the last 5 years.

Silver Creek has a population of bull trout. Water temperatures are in the high 50 °F range and do not meet the state standard for bull trout streams. This stream has been listed as "water quality impaired" by the State of Oregon (303d) due to water temperature. The upper and lower ends of the creek are private patented mining claims. Hard rock mining began in the late 1880s. Silver Creek below Snell Hollow was placer mined historically. This has affected its channel morphology, leaving berms of rock and an isolated floodplain. The riparian areas are well vegetated with conifers and riparian hardwoods. Horse Creek and Fruit Creek have no temperature data.

Lower Cracker Creek has data from two temperature sites, both of which exceed the state standard of 64 °F. This channel was dredged up to near its confluence with Wind Creek. The width of the floodplain was overturned and large amounts of fines were washed downstream. The channel is confined by tailings that are of a size, quantity, and height above the stream that flood flows of the current regime of the creek are unable to work them. Channel geomorphic processes are confined and depositional features are rare. The geomorphic and vegetative potential has been severely reduced.

Tributaries to lower Cracker Creek include Wind Creek, Pole Creek, and Spaulding Gulch. There is no temperature data for these streams. Wind Creek is a high gradient, flashy stream that moves large wood and rock. Forest Road 5540075 was reconstructed and rocked in the North Wind Timber Sale in 1991 and 1992. Twice since that time portions of the road have washed out. The road confines the channel, reduces the vegetative potential of the riparian area, and in portions is at or near the level of high flow events. Pole Creek has been identified as adversely affected by grazing in its lower reaches. The January 1997 rain-on-snow event plugged a culvert, causing about 1,000 cubic yards of material to enter Pole Creek. This has probably affected the width-to-depth ratio for at least the short term. Spaulding Gulch, an intermittent stream, is flooded with gravel. The source of the gravels is

unknown. Periodic intense thunderstorms have moved this gravel at a rate that has buried an exclosure several times. The fence was removed in 1997. The channel is down cut in the lower reaches on National Forest system lands. Headcuts were repaired in 1997.

Upper and Lower McCully Creek

Upper McCully Creek meets the state standards for temperature. Lode mining occurred historically and is currently occurring in the headwaters of the drainage. There are several active placer claims in the lower reaches. There is no grazing in this SWS due to the location of intakes for the city of Sumpter municipal water supply on McCully and O'Farrel Gulch. O'Farrel Gulch has active placer mining.

Lower McCully Creek has no temperature data. It has been severely affected by historic mining. McCully Creek was dredged up to its confluence with Buck Gulch. Forest Road 73 confines the channel in this SWS. Buck Gulch was heavily placer mined historically and is currently being mined. Restoration and reclamation is needed in these areas. Historic hydraulic mining occurred along McCully Creek and in the private land area of the confluence of McCully and Cracker Creeks.

South Sumpter, Clear Creek and Dean Creek

Huckleberry Creek, Clear Creek and Dean Creek drain the south side of the Powder River and Phillips Lake watershed. These streams drain from an elevation of 5700-5900 feet. All three of these streams are fish-bearing and exceed state standards (64 °F) for water temperature. There was very little (if any) mining on this side of the basin. These streams have very small drainage areas and though they are perennial, their low flows are much less than 1 cfs. All of the basins were railroad logged in the late 1800s and rail grades were constructed up each of the channels. All of these streams have segments where down cutting, although not continuous, is apparent. Clear Creek and Dean Creek remain unstable in those areas. Until recently grazing has prevented the recovery of riparian hardwoods on Clear Creek and Dean Creek. Recent changes in the number of cow/calf pairs and in grazing season timing have allowed the rate of recovery of these streams to increase.

Huckleberry Creek is well shaded in its forested sections. It flows through several meadows. These reaches should be evaluated for width-to-depth ratio. There are two years of data (max/min) on this stream. One year meets the state standard and one year exceeds it. Huckleberry Creek is totally diverted by the McEwen Ditch.

Clear Creek is well shaded in its lower reach, down-cut above Road 1170, and in a meadow on the private land. A cattle exclosure was built in the mid 1980s on the down-cut portion of the channel. Recovery has been slow. Some riparian planting has taken place recently. The Rusty Bull Timber Sale EA proposed and evaluated restoration activities on this stream.

Dean Creek has been listed by the State of Oregon as a "water quality impaired" stream (303d) due to its high water temperature in the summer. Dean Creek has had many years of restoration projects. In the 1980s structures were placed to raise the bed of the stream, and this has largely succeeded in the upper reaches. Riparian planting in the middle reaches has reintroduced hardwood seedlings. Survival has been very good after 3 years. These shrubs are young and do not yet provide shade. Headcuts were repaired in the upper reach in 1995. Forest Road 1160 is adjacent to the stream and in some areas confines the stream and limits vegetative potential of the streamside area. Dean Creek was evaluated using the PFC method in 1995. The stream was divided into two reaches. Reach 1, between Forest Roads 220 and the first stream crossing of Road 1160 at the junction with spur 040, was at PFC. Reach 2, from the junction of Forest Road 1160 and 040, was functioning at risk due to a down-cut channel, a stream-adjacent road, and lack of stream shade.

Little Dean, a tributary to Dean Creek, meets state standards. A large portion of the stream has a narrow valley bottom and steep side slopes that prevented road location from occurring here.

Table 6 summarizes water temperatures in the subwatersheds in relation to state standards.

Table 6. Water Temperature Summary

SWS	State Water Temperature Standard
Phillips Lake	NA
Union/Bridge Creeks	Meets
Lower Deer Creek	NA
Middle Deer Creek	Exceeds; Lake >50 °F; Deer >64 °F
Upper Deer Creek	Meets
North Sumpter	NA
Lower Cracker Creek	Exceeds; Cracker >64 °F
Silver Creek	303(d); Silver >50 °F
Upper Cracker Creek	NA
Lower McCully Creek	NA
Upper McCully Creek	Meets
South Sumpter Valley	Exceeds; Huckleberry >64 °F
Clear Creek	Exceeds; Clear >64 °F
Dean Creek	303(d); Dean >64 °F

Vegetation

The UPR watershed drains over 105,000 acres or approximately 164 square miles. The length of UPR from the Cracker Creek/McCully Fork confluence to Mason Dam is approximately 12 miles. Elevation in the UPR watershed ranges from a high of 9039 feet

(Elkhorn Mountains) to a low of 4070 feet, the lowest potential surface level of Phillips Reservoir. Because of the elevation range, the landscape changes from rocky faces and sagebrush meadows with fringes of subalpine fir, to mid-slope and lower elevation forests of ponderosa pine and Douglas-fir intermixed with western larch, grand fir, and lodgepole pine, to lower elevations of open ponderosa pine stands blending into grassy meadows on private land and around the lake.

There are many different plant communities in the watershed. The southern and eastern parts of the watershed are mostly rangeland and shrubland communities; the rest of the watershed is mostly forest land. Most of the plant communities in the watershed occur on drier sites referred to as uplands. A small but important group of plant communities, referred to as wetlands or riparian areas, occur mostly along streams and around lakes.

The distribution of plant series (such as the ponderosa pine or big sagebrush series) and plant communities (such as grand fir/pinegrass) in the watershed are influenced by several factors, including climate (i.e., precipitation, temperature), elevation, aspect, depth to groundwater, floodplain characteristics, soil type, noxious weed invasions, and past land, water, and vegetation management practices.

High elevation stands in the northwest corner of the watershed are dominated by cool/cold (G1-G3) biophysical environments. The majority of the watershed is dominated by warm/dry environments; both late/old grand fir and ponderosa/Douglas-fir climax stands are present. Mid-age (80 years) understory reinitiation warm/dry stands dominate much of the lower elevation areas such as those surrounding Phillips Reservoir. (*WWNF UPR Watershed Analysis 1997*)

Riparian Vegetation and Wetlands

The vegetation in riparian areas varies with elevation, floodplain characteristics, soil types, aspect, ownership, past management activities, and other physical and biological characteristics. There are numerous perennial streams, wet meadows, bogs, springs, ponds, lakes, reservoirs, and ditches within UPR watershed, all of which support riparian vegetation. Generally speaking, the lower reaches of the streams are primarily private land. Segments of the main Powder River, located in the valley bottom, are owned by Baker County. On most of either the County or private lands, native vegetation has been removed and replaced with hay fields or mining dredge tailings. Residual stands of hardwoods (i.e., cottonwood, aspen, alder, and willow), along with some conifers, can be found on private land. Moving up into the National Forest, riparian vegetation varies with elevation and aspect. The riparian areas within the National Forest tend to be dominated by conifers. Residual stands of aspen and cottonwood can be found in almost every drainage. The most common riparian hardwoods are red osier dogwood, thin leaf alder, mountain alder, willow species, and currant.

Meadow environments tend to be small in size (less than one acre) and randomly distributed within riparian areas. The largest meadows are located adjacent to Phillips Reservoir and the valley bottom.

Wetlands are defined as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support and normally do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include marshes, shallow swamps, lakeshores, peatlands, wet meadows, and riparian areas. There are two general settings for wetlands in the watershed. Wetlands located along streams and lakeshores are referred to as "lotic" or "riparian" wetlands. Marshes, swamps, peatlands, and wet meadows are referred to as "lentic" wetlands. Most wetlands in the watershed are stream-associated riparian wetlands.

The dredge tailings above Phillips Reservoir provide habitat for water fowl and other aquatic fauna. Although the series of ponds may not be officially classified as "wetlands", personnel with NRCS and ODFW who are responsible for evaluating wetlands concur that the tailings are functioning as such. The tailings account for over 1,400 acres of which one-fourth to one-third has been estimated to hold surface water and riparian vegetation.

Upland Vegetation

Nonforested

The UPR watershed supports a variety of nonforested vegetation types. The following is a list of the nonforested vegetation types:

cold, wet riparian
warm, wet riparian*
agriculture
cold, moist grassland*
cold, dry grassland
warm, moist grassland/shrubland*
hot, dry grassland*
nonvegetated*
cold, dry shrubland*
warm, moist shrubland*
hot, moist shrubland*
hot, dry shrubland*
hot, moist woodland
hot, dry woodland
water*

*nonforested vegetation within these types occupy more than 200 acres

Generally, the nonforested vegetation types are concentrated in two areas. One area is associated with Phillips Reservoir and the other area is along the Elkhorn Mountains crest, from Alder Creek north to Deer Creek. The majority of open grasslands occur at the lowest elevations surrounding Phillips Reservoir and are in private ownership. Grazing takes place on the bulk of private land as well as on suitable areas within National Forest administration. Grazing is discussed in the ISSUES section.

Forested

The general trend throughout this watershed is for timbered stands to be ponderosa-pine-dominated. These trees are less than 100 years old, due to the heavy harvesting at the turn of the century. These stands range from 4400 to 6000 feet, changing to mixed conifer and fir-dominated stands at higher elevations and draw bottoms. The upper elevations of the area (6400 feet and above) are patchy, open, sage-, grass-, and forb-dominated stands with some scattered trees, timbered stringers, and areas with little or no vegetation. The northwest corner of the watershed is dominated by cool/cold environments composed of subalpine fir, lodgepole pine, and Engelmann spruce. The majority of.the watershed is dominated by warm/dry environments; both late/old grand fir and ponderosa/Douglas-fir climax stands are present. Mid-age (80 years) understory reinitiation warm/dry stands dominate much of the lower elevation areas such as those surrounding Phillips Reservoir.

Low elevation stands (elevation 4400-5500 feet, Sumpter Valley)

The flatter or south-facing areas regenerated (following railroad logging) to a fairly uniform age class of ponderosa pine/Douglas-fir and western larch. The plant associations fall into the warm/dry biophysical category (ponderosa pine/pinegrass, Douglas-fir/pinegrass, Douglas-fir/snowberry). Historically these sites were dominated by fairly open stands of relatively large diameter ponderosa pine, Douglas-fir, and western larch that were maintained by frequent low-intensity fire. Some of these areas had overstory removals of scattered old growth pine that were not harvested during the railroad logging era. During the early 1970s most of these pine-dominated stands were precommercially thinned when they were 40-50 years old.

These same stands sustained damage/mortality due to the mountain pine beetle attacks in the 1970s. The beetles killed individual trees, small pockets, and entire stands. During the early 1980s many of the pine stands were underburned. This helped create the existing matrix of 70-80 year-old pine stands with a clumped understory of 15-year-old ponderosa pine in the small openings created by mountain pine beetles or fire. Stocking levels in many of the stands exceed 120 square feet of basal area at 12-14 inches dbh. The stands have closed in and the growth has slowed to the point that the trees are now susceptible to mountain pine beetle damage. There is a low to moderate amount of mistletoe infection in the pine, Douglas-fir, and western larch.

Remnant aspen clones exist in some of the riparian areas. Because of the past disturbances (railroad grades/mining/grazing) the extent of these clones is probably less now than what occurred in presettlement/ pre-European conditions. On the other hand, many of these clones are old and decadent due to competition from conifers, damage from cattle and deer/elk, and lack of rejuvenating disturbance such as fire and beaver.

Many of the north-facing stands in this area fall into the Douglas-fir or grand fir plant association and are dominated by grand fir, Douglas-fir, and larch, along with some lodgepole pine. Most of these sites are classified as warm/dry biophysical environments, with the exception of the cooler drainages dominated by lodgepole and grouse huckleberry that fall into the cold/dry group. These sites had varying degrees of partial overstory removals of the early seral pine and larch component. Many of these stands are now multi-layered and fir-dominated, as opposed to historic conditions that would probably show a greater dominance by pine and larch along with a more open, clumpy structure. These stands have sustained past damage from logging, spruce budworm defoliation, and mistletoe. The stands are currently below potential for tree growth due to smaller diameters, fire suppression, presence of damaged trees, and the fir-dominated nature of the stands. The stands are currently functioning as thermal and/or hiding cover for big game.

Mid elevation stands (elevation 4800-6400 feet)

This area had a small amount of partial harvest logging in the 1960s. Large scale overstory removals of the ponderosa pine occurred in the 1970s at about the same time as a major infestation of mountain pine beetle was occurring. Much of the harvest occurred in the upper Deer, Wahoo, and Crevice Creek drainages. Many of these stands are in the warm/dry biophysical group (grand fir/pinegrass-elk sedge) with moderate to frequent historic fire return intervals. Many of these stands have slopes ranging from 30-50 percent. Cable logging was used below the road system and downhill skidding used above the roads. These stands are now stocked with a scattered overstory of old growth ponderosa pine and an understory of 15-20 year-old ponderosa pine, Douglas-fir, and grand fir. Many of these areas were precommercially thinned in the early 1990s.

Higher elevation stands (mixed conifer, elevation 6000-6400 feet)

Most of this area is an unharvested mixed conifer band of grand fir, Douglas-fir, and larch. Stands are generally steep, multistory, larger diameter, and classified as at or near late successional. Areas fall into the warm/dry grand fir/pine grass classification. North-facing areas are cool/dry grand fir/twin flower sites.

High elevation stands (subalpine, elevation 6400 feet and above)

This area is dominated by steep, unroaded stands with no past harvest. Vegetation types are a mix of grand fir, subalpine fir, and whitebark pine interspersed with high elevation bunch grass/sage openings. The forested sites fall into the cold/dry and cool/dry classifications.

Other conditions that exist in scattered areas across the watershed include conifer encroachment on aspen stands and into meadow associations. The high elevation whitebark pine communities are in decline due to white pine blister rust, 1970s mountain pine beetle mortality, and subalpine fir encroachment.

Vegetation Maps and Data Tables

Major plant communities are grouped into ecoclasses that are based on potential vegetation at climax. Ecoclasses are further stratified into biophysical environments using temperature/ moisture information; and each biophysical environment was further broken down into structural stages. Maps graphically display the current conditions. Percentages of the historic range for each structural stage within the temperature/moisture group for the various ecoclasses were developed. These ranges are then compared with the current condition. It is important to understand that the purpose of the comparisons is to identify trends.

The estimated historic ranges within each structural stage reflect normal fluctuations of vegetative patterns prior to fire exclusion and timber harvest. Stand structures outside the range of natural variability cannot be sustained naturally and would require intensive management activities to maintain them outside their range. The risk of catastrophic events, such as large wildfires or insect and disease outbreaks, is high for those young and old stands outside the natural range of variability. Since these events could unravel some key ecosystem processes, it is logical to try and manage within the natural range. Therefore, one objective of ecosystem management is to bring forested stand elements (structure, species composition) within their natural range of variability.

Forested stands were classified into the following Structural Size Classes:

- Stem Exclusion Open Canopy (SEOC)
- Stem Exclusion Closed Canopy (SECC)
- Understory Re-initiation (UR)
- Multi-Stratum Without Large Trees (MSLTU)
- Multi-Stratum With Large Trees (MSLTC)
- Single-Stratum With Large Trees (SSLTC)

Historic and Current Structural Stages by Ecoclass, compares historic ranges and existing conditions for each ecoclass in the UPR watershed. Biophysical Environment Groups:

G1 whitebark pine/subalpine fir cold/dry
G2 alpine fir cool/moist
G3 grand fir cold/dry
G4 grand fir cool/moist-dry
G5 grand fir warm/dry
G6 Douglas-fir warm/moist
G7 ponderosa pine/Douglas-fir warm/dry
G8 ponderosa pine hot/dry
G9 juniper hot/dry

Natural disturbances and human management activities have created a landscape that is different than the estimated historic conditions. Large diameter, old-growth types of stands are much less abundant than estimated historic levels. The watershed is now dominated by mid-age, multi-layered stands created by a combination of insect epidemics, early century

railroad logging, and fire prevention. The table on the next page displays these changes, calculated for National Forest System lands only.

The maps on the pages following the table display the biophysical environments and structural stages of the forested areas for which data is present. Forested stands were classified into structural size classes based on Oliver-Larson (USFS 1997b) and modified through the screening process and work completed at Walla Walla for the Interior Columbia EIS project.

ODF has a vegetation inventory for private lands that includes data for percent of acres in each of the different plant categories (vegetation cover types); stand characteristics (structural stages) such as crown closure, species composition, size class, riparian areas, wet mix, dry mix, etc. Although comparable, the state and federal classification systems are different.