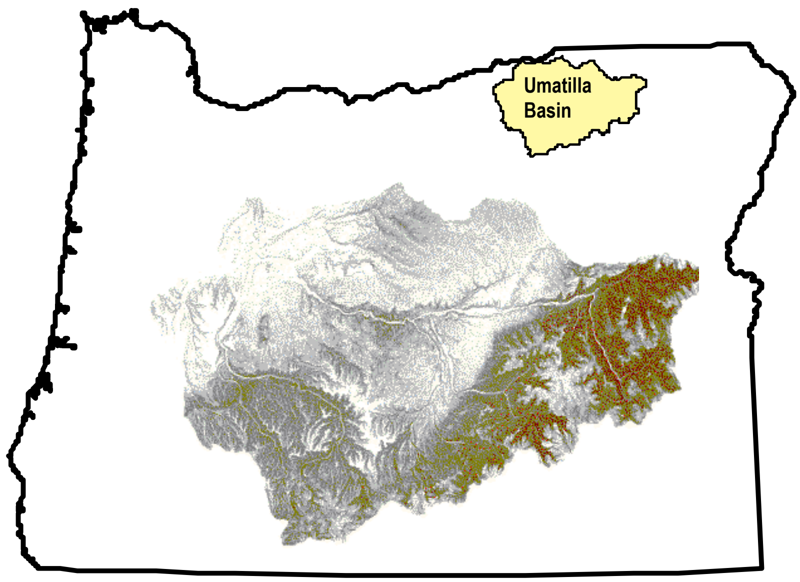
# UMATILLA RIVER BASIN TOTAL MAXIMUM DAILY LOAD (TMDL) AND WATER QUALITY MANAGEMENT PLAN (WQMP)




***Prepared by:*** **Oregon Department of Environmental Quality in Partnership with the Umatilla Basin Watershed Council and The Confederated Tribes of the Umatilla Indian Reservation**

State of Oregon
**Department of Environmental Quality**

MARCH 2001

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# ACKNOWLEDGEMENTS

The watershed evaluation and goals herein are products of extensive labor, dedication and cooperation of citizens, stakeholders, tribes, state and federal agencies, cities, counties, businesses, industries and interest groups. Through this committed participation and teamwork, Basin-wide watershed outreach and education is becoming a reality and watershed improvement is underway. This process has taken just under 5 years, and lays the foundation for substantial improvement through the decades ahead. The abundance of volunteer effort attests to the commitment and stewardship that Umatilla Basin citizens maintain toward their land, water and quality of living.

The Umatilla TMDL Stakeholders Committee provided policy recommendations while the Umatilla TMDL Technical Committee, an inter-agency workgroup, formed the technical basis for the watershed goals (TMDL - Total Maximum Daily Load). All meetings were public meetings. These two principal committees were sponsored by a core partnership: the Umatilla Basin Watershed Council, the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and the Oregon Department of Environmental Quality (ODEQ). Additional land use expertise and representation were recruited to form four management plan workgroups linked to the Stakeholders Committee: 1) forestry, 2) urban/industrial, 3) transportation and 4) water quantity. A related group prepared a management plan for agriculture through the Oregon Senate Bill 1010 process.

For their participation in the TMDL development process, appreciation and gratitude is extended to the following groups:

- Citizens of the Umatilla Basin
- Umatilla Basin landowners
- Umatilla Basin land managers
- Cities and Towns of the Umatilla Basin
- Umatilla SWCD
- Natural Resource Conservation Service
- Umatilla Basin Watershed Council
- Con. Tribes of the Umatilla Indian Res.
- Department of Environmental Quality
- Oregon Department of Agriculture
- Oregon Department of Forestry
- Oregon Department of Fish and Wildlife
- Oregon Water Resources Department
- Umatilla Basin Industries and Businesses
- Agricultural Research Service
- Umatilla and Morrow Counties
- Oregon State University
- Blue Mountain Community College
- The Oregon Water Coalition
- The Eastern Oregonian
- Trout Unlimited
- Umatilla National Forest
- US Environmental Protection Agency
- US Geological Survey
- Bonneville Power Administration
- US Army Corps of Engineers
- US Bureau of Reclamation
- Oregon Watershed Enhanc. Board

Special thanks are due to members of the Umatilla TMDL Stakeholders and Technical Committees and management plan workgroups, for their extensive participation and insightful input. The members listed below were active through the last year of the process. Numerous others made valuable contributions in prior years. In addition, particular recognition is due to early contributors whose vision and hard work launched and gave legacy that guided the Umatilla TMDL process: Bruce Hammon, Luise Langheinrich, Michael Purser and Christine Kelly. Subsequent core partnership representatives provided guidance, coordination, resources and technical editing: Tracy Bosen, Rick George, Don Butcher.

**Stakeholders Committee**: Co-Chair Antone Minthorn, Co-Chair Don Wysocki; Jeff Blackwood, Bill Burke, Jayne Clarke, Ron Deutz, Alanna Nanegos, Bob Hoeffel, Carter Kerns, Karen King, Jeff Lyon, Shauna Mosgrove, Robert Ramig, Phil Reeves, Gary Rhinhart and Phil Walchli.

**Technical Committee**: Tracy Bosen - Facilitator; Bob Adelman, Tim Bailey, Joe Bernert, Don Butcher, Matt Boyd, Jerry Cheek, Caty Clifton, Ray Denny, Aletha Eastwood, Brian Kasper, Kate Ely, Robin Harris, Bob Hoeffel, Karen King, Mike Ladd, Sue Lawrence, Peter Leinenbach, Jim Loiland, Larry Marxer, Doug Nelson, Scott O'Daniel, Stacy Platt, Ron Rickman, Sara Simrell, Brent Spencer, Tom Straughan, Jack Turner, Jim Webster, John Williams and Mike Wiltsey.

**Management Plan Workgroups**: Citizen and agency representatives are acknowledged in the Water Quality Management Plan, Chapter Three of this document, in each land use section (Sections 3.3 & 3.4).

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The Umatilla TMDL Stakeholders Committee is a TMDL Citizens Advisory Committee, sponsored by the Oregon Department of Environmental Quality, the Umatilla Basin Watershed Council and the Confederated Tribes of the Umatilla Indian Reservation. The Committee's Mission Statement is:

***"To equitably improve the health of the Umatilla Basin's water in an effort to meet recognized water quality standards for it's economy and inhabitants, human and non-human, now and in the future."***

# ADVISORY COMMITTEE COMMENT

## CO-CHAIR ANTONE MINTHORN:

Good things take a long time to develop. It took seventy years to partially restore stream flows to the Umatilla River and to reintroduce salmon into our River. We now have both – salmon and minimal instream flows. Now we have spent nearly five years developing the Umatilla TMDL – to restore water quality to the water we all worked so hard to leave in the River. It is with honor that I have served the basin and worked along side Co-Chairman Don Wysocki. I have been most impressed with the commitment of the citizens of this watershed. The humor, interest and dedication brought to this monumental effort will shape the future of our River. Ron Deutz, Carter Kerns, Shauna Mosgrove, Phil Reeves, Phil Walchi, Gary Rhinhart, Jayne Clarke and Bob Hoeffel – your energy and enthusiasm will continue far beyond the life of our paperwork. It is with our eyes on the next seven generations that directs Tribal efforts – I am thankful we have all had a common vision.

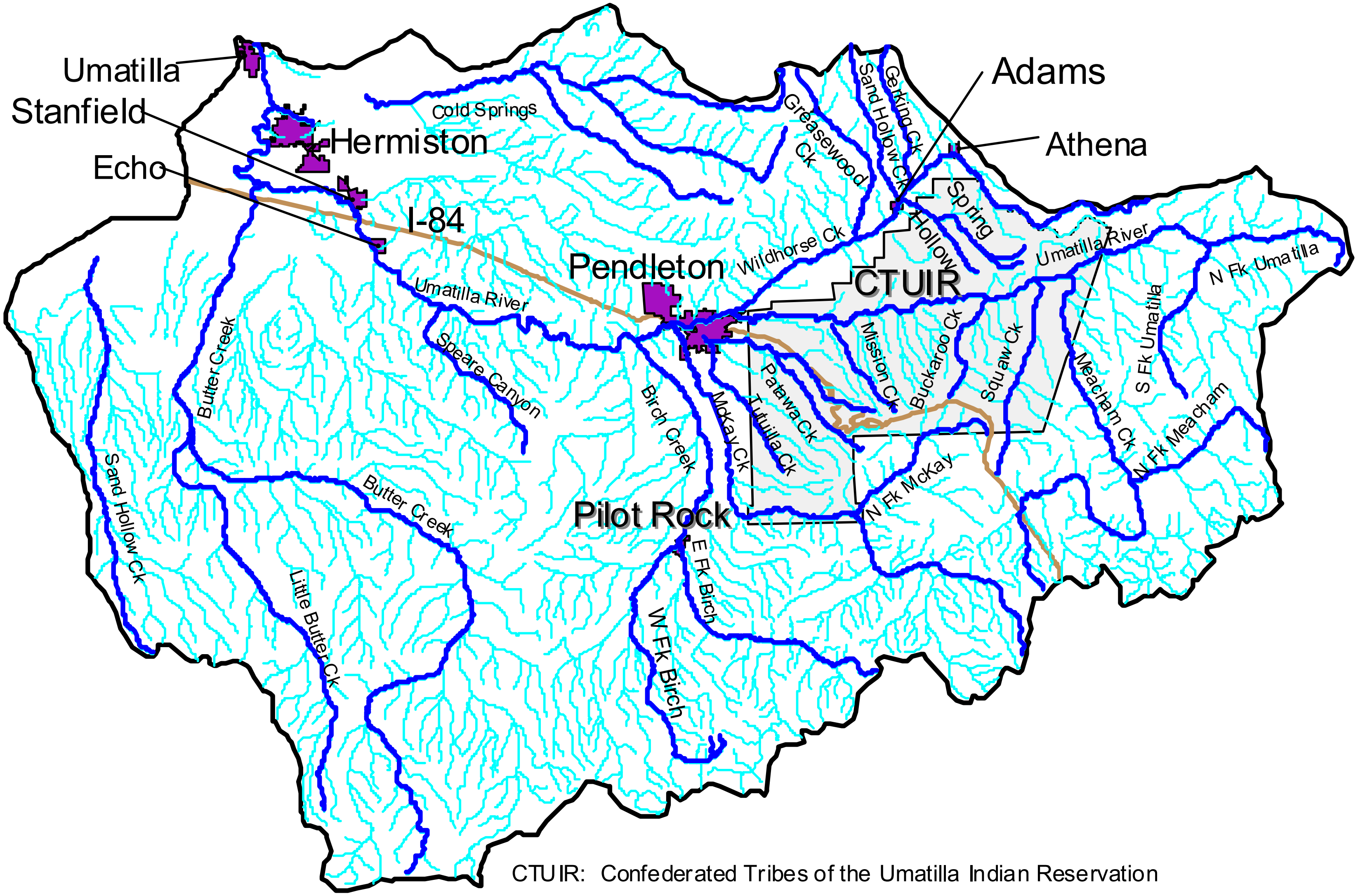
Out of this process leadership was provided and leaders rose up from our group. Ron Deutz, Karen King, Alanna Nanegos and Shauna Mosgrove each provided the committee with vision. Their strength and courage was demonstrated individually and served to lead us over the course of nearly three years to fulfilling our mission. I recognize each of these people as community leaders and thank them.

People working together seems like old hat in the Umatilla. I am appreciative of the efforts made by the State of Oregon and the U.S. Environmental Protection Agency to collaborate about our future. The Umatilla model of citizen cooperation has infiltrated even our bureaucracies – a true signal of hope and confidence that we can continue to achieve what is now in our sights. Clean water, children playing in the Umatilla River without concern about pollution, robust salmon and eel runs, strong economies and respectful people.

Finally, I want to thank the staff of the Confederated Umatilla Tribes whose expertise has enabled the Tribal Government to participate in this TMDL as recognized leaders and push the envelope to see farther than we could have otherwise.

Now it is time for us as a community to step back from our work and ask those in other places to pick it up, fund it and help us make it happen. I call upon our congressional delegation, and especially Sen. Gordon Smith to take the challenge and help us in Congress to fund our projects and achieve our vision. I call upon state government and the Governor to assist us in cleaning up the Umatilla River and working in partnership to finally arrive at a clean river with bountiful salmon and eels. And I ask for the continued commitment of our citizens to watch over these efforts and to contribute when needed to make our plan work.

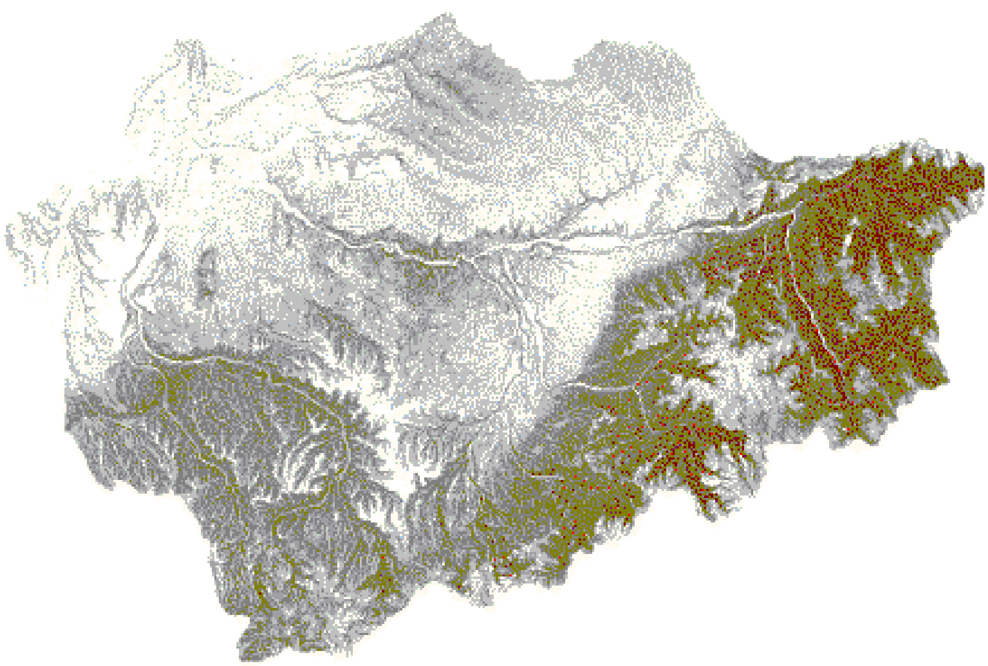
# MAP OF MAJOR STREAMS OF THE UMATILLA BASIN




CTUIR: Confederated Tribes of the Umatilla Indian Reservation

# CHAPTER ONE:

# OVERVIEW & BACKGROUND



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# 1.1 INTRODUCTION

The following summary (**Section 1.1.1**) serves to introduce the Umatilla Basin, discuss the purpose of this document and describe the goals and plans established within.

Total Maximum Daily Loads (TMDLs) of pollutants are set at levels that are protective of streams and other waterbodies, designed to support beneficial uses of waters of the state. The Umatilla Basin beneficial uses that are currently limited are: drinking water, water contact recreation and uses related to salmon and trout populations. The most widespread concerns in the Basin are temperature, and excess soil erosion which leads to turbidity and impaired salmonid spawning areas. This TMDL is based on surface water protection and develops surface water goals. In certain instances, groundwater improvement will be essential to attaining stream water quality goals and should be accounted for in response to this TMDL.

Abbreviations and terms used in this document are defined in **Appendix 2**.

## 1.1.1 DOCUMENT & ALLOCATION SUMMARY

This document establishes water quality goals for streams of the Umatilla Basin. It also lays out steps toward meeting these goals. The goals are intended to reinforce and add to existing and historic stream restoration implemented by agencies, tribes and citizens. Numerous Basin streams do not meet Oregon water quality standards. Observation, history and research clearly indicate that riparian areas of the Umatilla Basin have been considerably modified through vegetation removal, stream straightening, diking, land re-surfacing and constriction due to management and structures. Flow levels in the lower Basin are highly managed through irrigation withdrawal and reservoir management - summer flow improvement is key to needed temperature reduction. Nutrient and chemical application to fields occurs through much of the Basin. All of these actions can decrease water quality. **Chapter Two** evaluates impairments and establishes numeric goals based on attainment of water quality standards.

This effort is formally conducted through Oregon's TMDL process. TMDL is 'total maximum daily load' defined by State and Federal law. The Federal Clean Water Act requires that TMDLs be established for certain waterbodies that do not meet water quality standards and that the State conducts a continuous planning process to implement TMDLs. This document is prepared and organized accordingly. **Chapter One** describes the Basin and the TMDL process, **Chapter Two** develops the TMDLs and **Chapter Three** is a water quality management plan (WQMP) designed to implement the TMDLs. TMDLs in Oregon are basin-specific. The TMDL process is further described in **Section 1.3**.

**Chapter One Summary:**

The Umatilla Basin has several noteworthy distinctions:

- Policy and technical recommendations for the TMDL are community-based
- More than 80 percent of the Basin area is in private ownership
- The Confederated Tribes of the Umatilla Indian Reservation is located within the Basin
- Cooperative flow restoration and salmon re-introduction have returned flow levels and fish species absent from the Basin for 75 years
- The largest area of land use is agricultural
- The TMDL committee process was tri-sponsored through the Umatilla Basin Watershed Council, The Confederated Tribes of the Umatilla Indian Reservation and the Oregon Department of Environmental Quality
- The water quality concerns are predominately landscape based; not discrete point source pollution
- The Basin is among the 5 largest of Oregon's 91 sub-basins
- The Basin is a high priority for Oregon, and will be the 3rd sub-Basin TMDL completed in the State

The Umatilla Basin is home to productive agricultural and forestlands and contains streams with historically viable and returning salmonid populations. Topography, geology, land use, climate, demographics, and flow and salmon restoration are described in this Chapter. The applicability of this TMDL, the TMDL general process and the Basin TMDL committee process are described as well. The TMDL strategy for addressing all identified water quality impairments is defined here. Tribal involvement, interests and contributions are recognized.

**Chapter Two (TMDL) Summary**

**Chapter Two** develops TMDLs for temperature, sediment, algae & pH, nutrients, bacteria; and other goals for streambed and habitat concerns. **Tables 1** and **2** summarize the TMDLs. **Table 1** relates the TMDL text to the Clean Water Act. The reader is encouraged to review **Table 2** and the figures and tables referenced by it, for a succinct statement of the goals allocated via the TMDLs. To understand the tables discussion of two terms is needed (the terms are further defined in **Section 1.3** and the glossary appendix): 'load allocations' apply to pollutants derived from the landscape, whereas 'wasteload allocations' are TMDLs that apply to permitted "point" sources such as a sewage treatment plant. TMDLs are the maximum amount of pollutant that can be present in a stream while meeting water quality standards.

Management goals for habitat and streambed grain size distribution are described in **Section 2.2**.

**Chapter Three (WQMP) Summary**

The water quality management plan (the entirety of **Chapter 3**) has been developed for forest, agricultural, urban and transportation sources of water quality impairment. The plans apply to non-point sources. A water quantity plan, prepared to address flow concerns, is included in this chapter. Point source waste load allocations are established in **Chapter Two** and will be incorporated into permits administered by ODEQ.

The TMDL and WQMP build upon the following land management programs in the Umatilla Basin:

- ✓ *Oregon's Forest Practices Act (state and private forest lands)*
- ✓ *Senate Bill 1010 (agricultural lands)*
- ✓ *Oregon Plan (all lands)*
- ✓ *Many other programs (USFS, ODOT, Cities & County, NPDES, etc.)*

**Chapter Three** includes (1) schedules for evaluating and producing programs, rules or policy to implement TMDLs, (2) recommendations of best management practices to improve water quality, (3) discussion of costs, areas and impairments of emphasis, long-term monitoring, public involvement and maintenance of effort over time. The primary authors were workgroups appointed to represent the specific land uses, providing stakeholder representation as well as technical and policy expertise. Key steps for all land use sectors are summarized in **Section 3.5.8**.

| **Table 1.** Umatilla Basin TMDL Components, TMDL Nomenclature | |
|---|---|
| State/Tribe: Oregon<br>Waterbody Name(s): streams within the 4th field HUC (hydrologic unit code) 17070103. | |
| POINT SOURCE TMDL: X NON-POINT SOURCE TMDL: X (CHECK ONE OR BOTH)<br>Date: March 2001 | |
| ***Component*** | ***Comments*** |
| **Pollutant Identification** | ♦ Temperature: Anthropogenic increase in solar radiation loading, and warm water discharge to surface waters<br>♦ Sediment: turbidity<br>♦ Aquatic Weeds and Algae: temperature, light<br>♦ Nitrate, Ammonia, Bacteria |
| **Target Identification**<br>***CWA §303(d)(1)***<br>***40 CFR 130.2(f)*** | ***Applicable Water Quality Standards***: see Appendix A-7<br>***Loading Capacities:***<br>♦ Temperature: no increases in radiant energy above site potentials (fig 35)<br>♦ Sediment: watershed specific TSS targets (table 26)<br>♦ Nitrate: flow-based nitrate mass load (table 41 & 42)<br>♦ Ammonia: flow-based ammonia mass load, unspecified (section 2.1.5.5)<br>♦ Bacteria: 406 counts/100 ml |
| **Existing Sources**<br>***CWA §303(d)(1)*** | Forestry, Agriculture, Transportation, Rural Residential, Urban, Industrial Discharge, Waste Water Treatment Facilities |
| **Seasonal Variation**<br>***CWA §303(d)(1)*** | Temperature: Peak temperatures occur throughout late July and early August<br>Sediment: Highest turbidity and suspended sediments occur December through April, load allocations are based on winter/spring design storm<br>Nitrate: seasonal trend not apparent, TMDL applies all year<br>Ammonia: seasonal trend not apparent, TMDL applies all year<br>Bacteria: based on 90th percentile design storm during critical season - April to October, except McKay Creek watershed was addressed all year |
| **TMDL Allocations**<br>***40 CFR 130.2(g)***<br>***40 CFR 130.2(h)*** | Refer to **Table 2** summary of load and waste load allocations |
| **Margins of Safety**<br>***CWA §303(d)(1)*** | Temperature: implicit (section 2.1.1.7)<br>Sediment: implicit (section 2.1.2.7)<br>Nitrate: explicit (section 2.1.4.7)<br>Ammonia: implicit (section 2.1.5.8)<br>Bacteria: implicit (section 2.1.6.10) |
| **Water Quality Standard Attainment Analysis**<br>***CWA §303(d)(1)*** | • Analytical modeling demonstrates that allocated loads will attain water quality standards<br>• In areas where numeric criteria are not met, analytical assessments demonstrate that allocated loads represent a pollutant loading condition where anthropogenic contributions are minimized to the extent possible.<br>• A Water Quality Management Plan (WQMP) is developed to implement measures that attain load / wasteload allocations. |
| **Public Notice**<br>***40 CFR 25*** | Prior to October 16, 2000 to December 15, 2000 public comment period |

**Table 1 & 2 Notes:**

- *Umatilla Basin* in this document is the geographic area draining into the Umatilla River - 4th field Hydrologic Unit Code
- *Agriculture* refers to farming and ranching, range land and cropland and animal feeding operations
- *Urban* includes incorporated areas and unincorporated residential, commercial, industrial
- WWTP - Waste Water Treatment Plant

**Table 2.** Description of Load Allocations and Waste Load Allocations (developed in Chapter Two)

| | Load Allocations | | | | Waste Load Allocations | | | |
|---|---|---|---|---|---|---|---|---|
| **Water Quality Limitation** | **Quantity** | **Geographic Areas** | **Season** | **Responsibility** | **Quantity** | **Point of Compliance** | **Season** | **Facility** |
| Temperature | ♦ Daily max. radiant energy<br>♦ % effective shade (fig 37)<br>♦ Channel width and shade (figs 31, 38, 39, 40)<br>♦ Channel max. width/depth (table 15) | Perennial streams of the Umatilla Basin | July to August annual peak temperatures | Land uses:<br>♦ Agriculture<br>♦ Forestry<br>♦ Urban<br>♦ Transportation | percent reduction in discharge temperature during critical period (table 18) | end of pipe | April 15 to November 1 | Municipal WWTP: Pendleton, Hermiston, Athena, Stanfield, Echo (map - fig 7) |
| Sediment | ♦ % Upland erosion reduction<br>♦ % Streambank erosion reduction<br>(both in fig 47) | All streams of the Umatilla Basin | Design storm (winter/spring) | Land uses:<br>♦ Agriculture<br>♦ Forestry<br>♦ Urban<br>♦ Transportation | 80 mg/l total suspended solids (daily max., sect. 2.1.2.9) | end of pipe | all year | listed above |
| Aquatic Weeds and Algae | (addressed through temperature TMDL) | | | | (addressed through temperature TMDL) | | | |
| Nitrate | Flow-based daily instream limits in lbs/day of nitrate (tables 41, 42) | Wildhorse Creek watershed | Throughout year | Land use:<br>♦ Agriculture | 11 lb/day nitrate-N maximum load (table 41) | end of pipe | all year | City of Athena WWTP |
| Ammonia | (addressed through point source) | | | | 0.12 lb/day (variable) ammonia-N | edge of mixing zone | all year | City of Hermiston WWTP |
| Bacteria | Number of *E. Coli* organisms entering streams per design storm runoff (Tables 49 to 54) | 8 Major Watersheds (figs 80 to 87) | Design storm<br>♦ McKay Ck (all year)<br>♦ Others (April to October) | Land use:<br>♦ Agriculture<br>♦ Urban | *E. Coli* and total coliform maximum concentration (tables 47-51) | end of pipe | all year | Municipal WWTP: Pendleton, Hermiston, Stanfield |

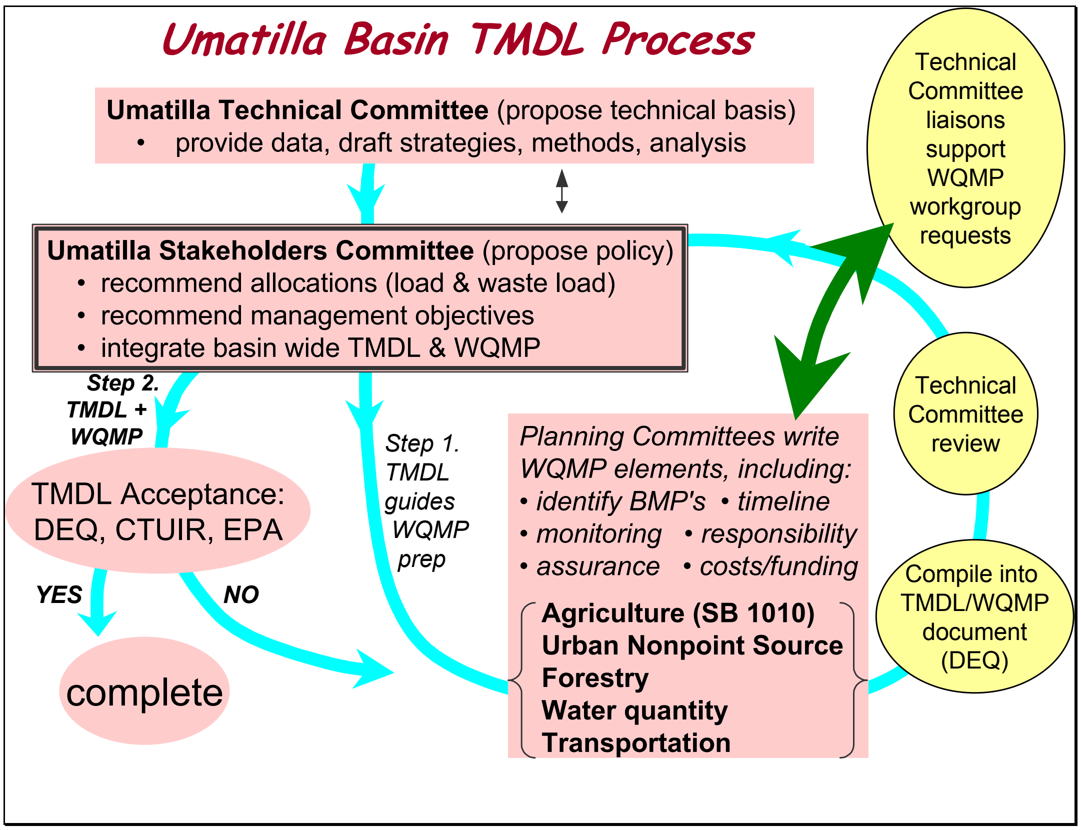
## 1.1.2 COMMITTEE PROCESS

The mission statement of the Citizen's Advisory Committee (Umatilla TMDL Stakeholders Committee) is:

*"To equitably improve the health of the Umatilla Basin's water in an effort to meet recognized water quality standards for it's economy and inhabitants, human and non-human, now and in the future."*

The flowchart below was prepared to guide the TMDL committee process.

**Figure 1.** Umatilla Basin TMDL Committee Process




A core partnership was formed between the Umatilla Basin Watershed Council (UBWC), the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and the Oregon Department of Environmental Quality (ODEQ). The partnership sponsored two primary committees to make TMDL recommendations: the Umatilla Basin TMDL Technical Committee first convened in January, 1996 and the Umatilla TMDL Stakeholders Committee was established January, 1998. All meetings were open to the public and advertised. The Watershed Council facilitated the Technical Committee. The Stakeholders Committee was co-chaired by Antone Minthorn (CTUIR Board of Trustees Chair) and Don Wysocki (soil scientist at the Agricultural Research Service). Chuck Norris, previous Oregon State Representative, also provided early leadership. The citizen and agency members are listed in the acknowledgements.

The above chart illustrates the document development process. The Technical Committee (including ODEQ) conducted watershed assessment and recommended the TMDL technical basis and reviewed all sections. The draft TDML components were then submitted to the Stakeholders Committee for review. The Stakeholders Committee, representing the public, led the process. During TMDL development, Stakeholders Committee members appointed citizen/agency workgroups representing four selected land use categories (agriculture, transportation, forestry, urban) and flow restoration. These workgroups developed the core components of the **Chapter Three** WQMP. Both the Technical Committee and the Stakeholders Committee then reviewed the compiled TMDL and WQMP document herein and, with the concurrence of ODEQ and CTUIR, recommend it as the Umatilla Basin TMDL and WQMP. ODEQ was participant and provided guidance throughout document preparation. All essential TMDL data and modeling were verified by ODEQ. The bulk of the TMDL modeling and data evaluation was implemented by ODEQ with advisory group guidance.

The agricultural WQMP was prepared through the SB1010 process prior to the appointment of the Stakeholders workgroups. The two processes are closely related and were linked through liaisons including ODA, ODEQ and the agricultural committee Chair.

Representatives of various land uses and resources formed the Umatilla Basin TMDL Technical Committee (refer to acknowledgements). Valuable contributions include method development, extensive data collection, data evaluation and study of the interaction between land use and water quality. The knowledge derived from these data collection efforts and discussion, some of which is presented in this document, has been used to design the enclosed protective and enhancement strategies that address water quality issues.

Much credit is due to the Basin community and agencies for exceptionally dedicated cooperation and contribution. **The Watershed Council provided Basin-wide coordination, outreach, facilitation and forums that greatly enhanced the process, generated widespread public input and awareness and assured broad representation in the development of this TMDL and WQMP**.

# 1.1.3 CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION

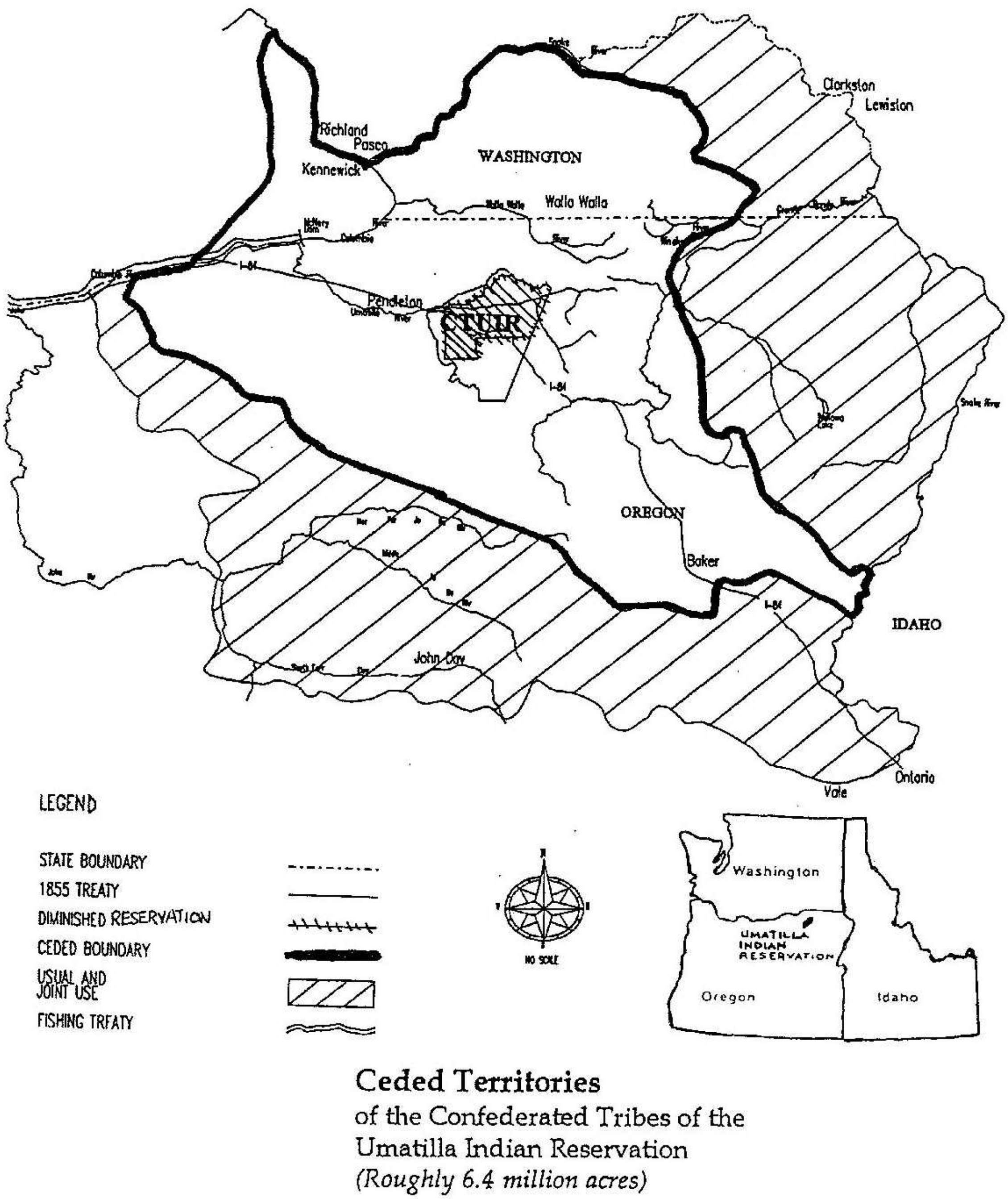
This section has four purposes: (1) recognize the contributions of the CTUIR to Basin-wide watershed restoration and specifically to this TMDL/WQMP preparation, (2) recognize tribal rights and interests throughout the Basin, (3) specify that this TMDL does not apply within the reservation boundary, and (4) discuss the relationship between this TMDL and the anticipated Reservation TMDL.

(1) The CTUIR natural resource department staff contributed expertise in hydrology, ecology, aquatic biology, monitoring and policy. The CTUIR provided committee support, guidance and ongoing input to the core partnership and committees. The leadership provided by tribal Co-Chair Antone Minthorn, in teamwork with the non-tribal Co-Chair Don Wysocki, maintained the group on track and focused on common goals. The CTUIR provided automated sampling equipment, expertise in stream morphology inventories and conducted stream-monitoring basin-wide. A key data source for the Temperature TMDL is the aerial infrared data contracted by the CTUIR. Another important data set are the habitat surveys conducted by CTUIR, ODFW and USFS. The CTUIR maintains the most extensive geographic information system database for the Basin, and provided key GIS resources in dispersing this data. This is an abbreviated list of CTUIR contributions that were unfailingly maintained for 5 years of TMDL development. In addition, the CTUIR facilitated the Basin project, the benefits of which are inestimable in terms of fisheries and flow restoration.

(2) The CTUIR have treaty rights and interests in their traditional homeland, including those relating to natural resources and water quality, such as fishing and subsistence activities. The map below shows these lands, which entirely encompasses the Umatilla Basin. Also, upstream conditions affect Reservation water quality just as Reservation lands can influence lower- and mid-Basin water quality. Rights recognition, mutual interests and common values of support and cooperation have prevailed throughout TMDL development.

**Figure 2.** Map of Ceded and Joint Use Territories
*Note: this map shows the lands, waters and resources traditionally under the direct management influence of the Confederated Tribes of the Umatilla Indian Reservation, and which are now subject to influence by their right to protect treaty-reserved resources and interests for Tribal members.*

**CTUIR CEDED AND JOINT USE TERRITORIES MAP**



(3) This document does not apply within the Reservation Boundary. This is discussed with the scope and applicability of this TMDL in **Section 1.3**.

(4) A TMDL is currently being prepared for Reservation land by the CTUIR. The State of Oregon and the CTUIR have worked together closely in Basin-wide TMDL development. Mutual assessment of streams has occurred throughout the Basin. The core partnership between the CTUIR, the Watershed Council and the ODEQ, and five years of cooperation between this partnership and the other Basin natural resource organizations, has laid the foundation for TMDL development within and outside of the Reservation that is mutually supportive and consistent. It is envisioned that the two sets of TMDLs will target similar water quality standards, and hence provide similar levels of water quality protection.

# 1.2 THE UMATILLA BASIN

The Umatilla River Basin is located in the northeastern part of Oregon, in the Middle Columbia Basin, occupying approximately 2,500 square miles. The Umatilla River originates in the conifer forests of the Blue Mountains at over 6,000 feet elevation and flows west and then northwest through the semi-arid shrub steppe of the Deschutes-Umatilla plateau, entering the Columbia river at an elevation of 270 feet above sea level. This confluence occurs at the town of Umatilla, Oregon, about 300 miles upstream from the Pacific Ocean. The hydrologic unit code for the Umatilla Basin, classified accordingly as a 'Sub-Basin' or 4th level watershed, is 17070103 (USGS Hydrologic Unit Code, 1989). Basin topography is depicted in **Figure 3.** Most of the Basin area, including the Blue Mountain uplands, is gently sloping. Expansive plateaus, steppes and rolling hills are incised by the narrow and steep-walled valleys of the Umatilla River drainage. Note that a map of major streams is enclosed on **Page xviii**.

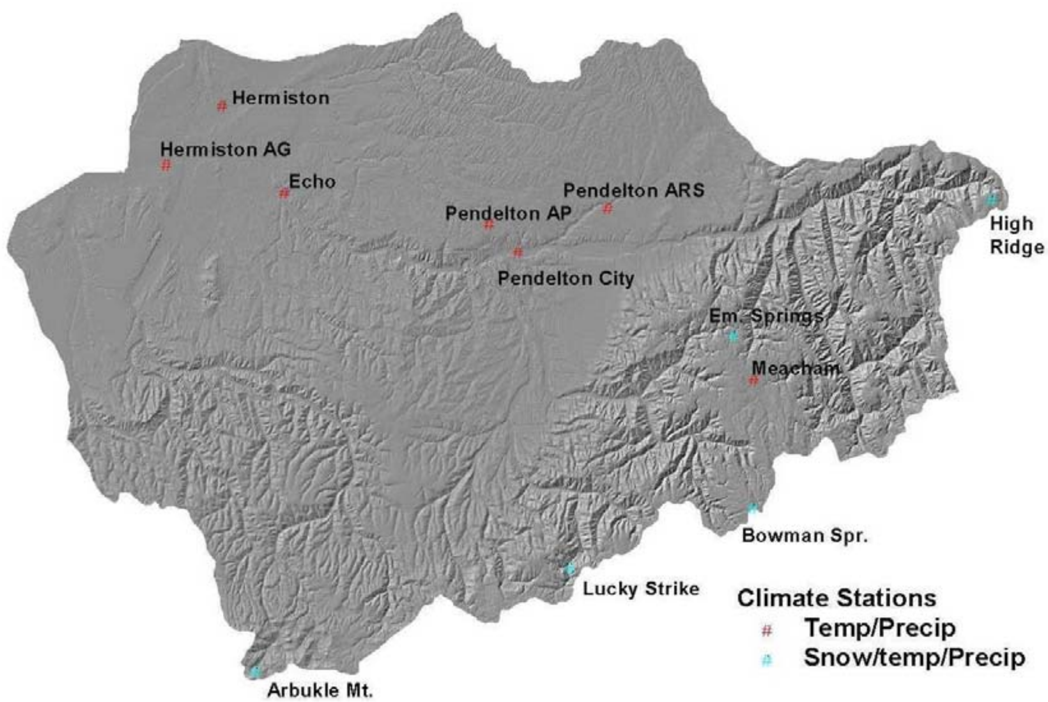



**Figure 3.** Illustration of Basin Topography

The Umatilla River main stem begins at the confluence of its North and South Forks, 90 miles from the mouth. It has eight major tributaries: The North and South Forks of the Umatilla River and Meacham Creek in the upper Basin; Wildhorse, Tutuilla, McKay and Birch Creeks in the mid Basin; and Butter Creek in the lower Basin. Much of the mainstem and major tributaries have been straightened and or levied.

## 1.2.1 GEOLOGY

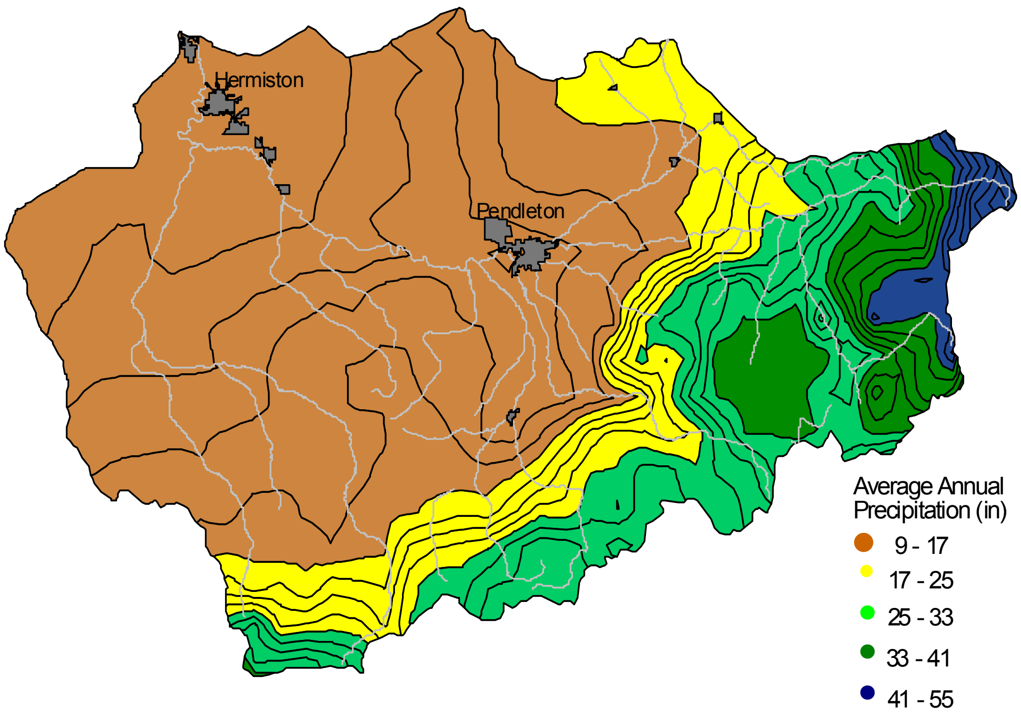
The Miocene Columbia River Basalt group (14-17 million years old) comprises the dominant bedrock throughout the Basin. Flexure and faulting have created the major structural features - the Blue Mountain uplift of the upper Basin and the subtle northeast trending arch that the Umatilla River traverses, mid-Basin, between the towns of Pendleton and Echo. These resistant highlands act as hydraulic controls that inhibit deepening and widening of valleys and are slow to transmit groundwater recharge (Walker and McLeod, 1991). A relatively thin layer of sedimentary deposits covers the basalt in much of the Basin. Alluvium deposited by modern rivers is common in valleys and floodplains. Coarse Pleistocene glacial-riverine deposits occur in the lower Basin below the town of Echo, related to the Pleistocene Missoula floods. Pleistocene and Holocene glacial and wind-blown silt and fine sand blanket much of the Basin, often to a depth of 20 feet, such as in the Wildhorse Creek watershed, thinning southward.

Soil scientists have mapped 75 different soil types in Umatilla County. The lower elevation soils of the Columbia Basin formed in old alluvial deposits that have been reworked by wind. Their elevation ranges from 250 feet to about 1,500 feet. The soils of the Columbia Plateau are on hills, in gently sloping areas on terraces and on steep hill slopes that are mantled by windblown silt. These soils range in elevation from 500 to 3,100 feet. The soils of the Blue Mountain foothills are in gently sloping areas on ridge-tops and in very steep areas on hill slopes. Elevation ranges from 1,500 to 4,500 feet. The soils of the Blue Mountains are in gently sloping areas on plateaus and ridge-tops and in very steep areas on hill slopes. Ash deposited during past volcanic activity in the Cascades has accumulated in some areas. Blue Mountain soil elevations range from 3,000 to 5,200 feet (USDA, 1988).

## 1.2.2 CLIMATE

The Rocky Mountains partly shield the Umatilla Basin from strong arctic winds, so winters generally are not severe, though cold. In summer, the Cascade Range inhibits winds from over the Pacific Ocean to the west. Days are hot, but nights are fairly cool. Annual average temperatures in the lower Basin range from 50 to 55 °F (10 to 13 °C). In winter the average temperatures at Hermiston, Pendleton and Meacham are 35, 36 and 29 °F (1.6, 2.2, -1.6 °C), respectively. In summer the average temperature is 60 °F at Meacham and 71 °F at both Hermiston and Pendleton (16 and 22 °C; USDA, 1988).

**Figure 4.** Basin Precipitation (Oregon SSCGIS)
[precipitation contours in 2-inch intervals]




Annual precipitation is illustrated in **Figure 4.** Precipitation is scant in the summer except in mountainous areas. Total annual precipitation is 9 inches at Hermiston, 12 inches at Pendleton and 33 inches at Meacham. Of this, 30 percent usually falls in April through September (USDA, 1988). Mean annual precipitation ranges from 10 inches per year at Umatilla to 50 inches per year in the headwaters (Taylor, 1993). Climate stations are shown in **Figure 3**.

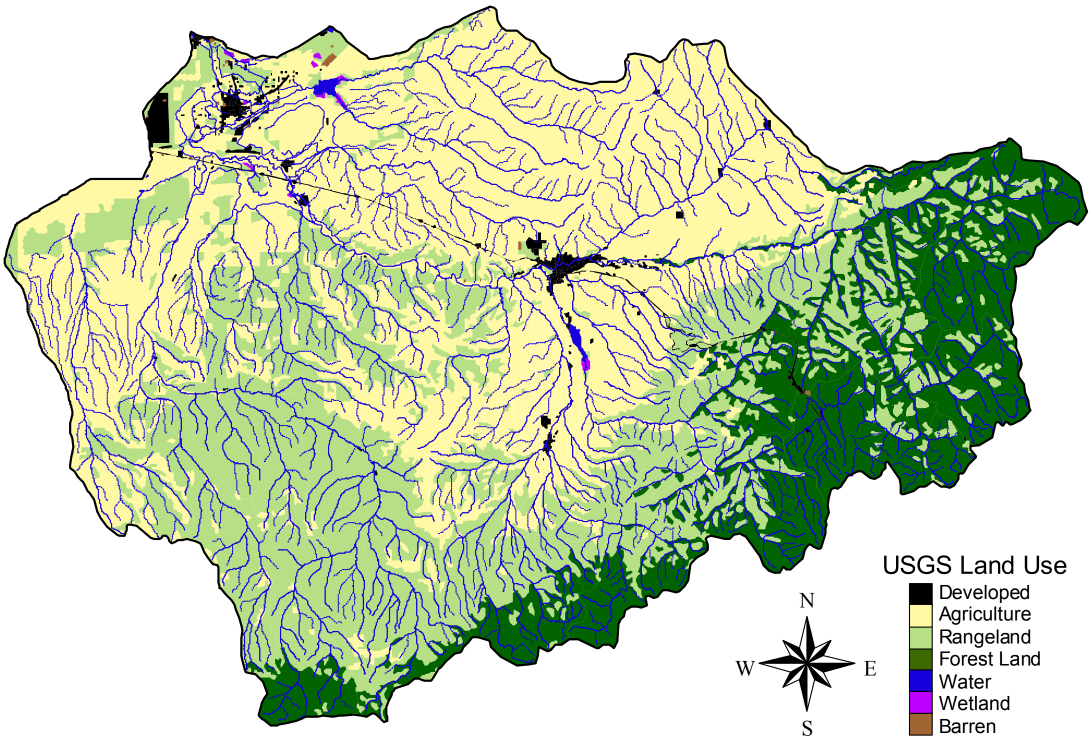
Average seasonal snowfall is 11 inches at Hermiston, 18 inches at Pendleton and 146 inches at Meacham (USDA, 1988). Maximum winter snow pack in the Blue Mountains typically ranges from two to six feet in depth in the area of greatest accumulation, which is above the North Fork of the Umatilla.

The average relative humidity in the afternoon is about 55 percent in mid-afternoon and 70 percent at dawn. The prevailing wind is from the southwest. Average wind speed is highest, 11 miles per hour, in the spring (USDA, 1988). The most dramatic runoff events are associated with rain on frozen ground in the upper- and mid- Basin.

# 1.2.3 LAND USE AND OWNERSHIP

Private ownership is predominant in the Umatilla Basin, covering roughly 80 percent of the Basin land area (1,456,000 acres). The US Forest Service manages about 13 percent (**Section 3.3.3**) of the land area while approximately 12 percent (CTUIR, 1999), lies within the boundaries of the Confederated Tribes of the Umatilla Indian Reservation. Land use area is illustrated in **Figure 5.**

**Figure 5.** Land Use Spatial Distribution




Agricultural and rangelands comprise more than 80 percent of the Basin area and the remainder consists of roughly 15 percent forest and 3 percent urban and developed area. The following summary is from the Umatilla River Basin Agricultural Water Quality Management Area Plan.

> *"The early settlers (1843-1880) pursued an agrarian lifestyle, primarily raising livestock and with limited crop production. Heavy livestock grazing during the last half of the 1800's and early part of this century, along with expanding cultivation, modified much of the native vegetation. Less desirable drought-tolerant species moved in converting thousands of acres of perennial grasses to sagebrush, rabbitbrush and antelope bitterbrush. Intensive tillage began during the 1880's to 1910's, causing large amounts of native grasslands to be converted to dry cropland. Mechanization and government policy (WW II horse slaughter) reduced the number of horses and the need for large area of pasture and hay production by the late 1940's or early 1950's. Irrigation water rights date to the 1860's for flood irrigating in creek valleys. Several Bureau of Reclamation projects, beginning shortly after the turn of the century, developed arid areas in the lower Basins. Since the advent of modern irrigation systems, thousands of acres of land in the lower Basin have been developed for crop production."*
>
> (ODA & Umatilla County SWCD, 1999)

Private, state and federal forest harvest and management take place in the forested fringe of the Umatilla Basin to the south and east. Urbanized areas are located in river valleys.

Pre-settlement land use was tribal. The tribes' homeland once encompassed 6.4 million acres in northeast Oregon and southeast Washington. As a result of the 1855 Treaty with the US Government and subsequent federal legislation, the present day reservation of the CTUIR consists of 172,000 acres, entirely within the Umatilla River Basin (**Section 1.1.3**).

**Table 3** was used by the Umatilla TMDL Stakeholders Committee to guide the land management plan workgroups in delineating responsibilities for the various land uses.

**Table 3.** Umatilla Basin Water Quality Management Plan Responsibilities

| Land & Water Use | Agency or Authority Responsible for WQMP Implementation |
|---|---|
| **Forestry** | |
| State/Private | OR Dept. Forestry (FPA) |
| National Forest | US Forest Service |
| Agriculture | SWCD authorized by ODA |
| **Transportation** | |
| Interstate | OR Dept. Transportation |
| State roads | OR Dept. Transportation |
| County roads | County |
| City roads | City |
| CTUIR roads | CTUIR |
| Railroads | Federal, others |
| Utility corridors | County, others |
| **Urban/Industrial (Including Non-Incorporated Development)** | |
| Cities | Cities |
| Point Sources | Points Sources (permits) |
| Non-incorporated (e.g., residential, golf courses, resorts) | County |
| Reservation point and nonpoint sources | CTUIR |
| **Water quantity management** | OWRD, |
| Water rights/divert/dams | US BOR, US ACE, Irrigation Districts |
| Upland/floodplain restore | All land holders |

**Table 4** data is from Watersheds of the Umatilla Basin (Rickman, 1998) based on the 1971 USGS land use map for the Umatilla Basin, reproduced in **Figure 5**. This serves as an approximate indication of land use distribution.

**Table 4.** General Land Use In Watersheds of the Umatilla River

| Watershed Name | Percent of Watershed Area in General Land Uses: Forested | Rangeland | Cropland/ Pasture | Urban/ Industrial |
|---|---|---|---|---|
| Forks | 79 | 20 | 1 | 0 |
| Meacham | 76 | 22 | 0 | 1 |
| McKay | 37 | 44 | 16 | 1 |
| Tributaries | 18 | 44 | 36 | 1 |
| Birch | 22 | 42 | 35 | 1 |
| Butter | 7 | 72 | 20 | 1 |
| Wildhorse | 3 | 2 | 94 | 1 |
| Tutuilla | 0 | 17 | 78 | 4 |
| Pendleton | 0 | 11 | 57 | 32 |
| Canyons | 0 | 48 | 51 | 1 |
| Stage | 0 | 2 | 96 | 2 |
| Irrigated | 0 | 20 | 69 | 10 |

## 1.2.4 STREAM FLOW CHARACTERISTICS AND THE UMATILLA BASIN PROJECT

Stream flow in the Basin is characterized by episodic hydrographs (graph of flow against time), with high flow regularly occurring during rainstorms and melt conditions. Steep-sided canyons, relatively impervious basalt bedrock, and diminished vegetation contribute to poor ground water recharge and rapid runoff (CTUIR, 1996). Oregon Trail diaries indicate that during drought years (1852, 1853) the Umatilla River was dry in parts of the lower Basin (Nagle, 1988). Flow was sufficient to support salmon fisheries and the needs of developing towns along the lower mainstem. Summer steelhead, chinook and coho salmon were abundant in the Umatilla River prior to the 1900's. The extreme flows were less pronounced in the near pristine North Fork Umatilla Wilderness Area, apparently because of the lack of human disturbance, higher elevation headwaters, developed soils, large woody debris and climax plant communities (CTUIR, 1996).

Several irrigation projects were completed in the early part of the century, which provided water for some 12,000 acres of arid sandy soils in the west part of Umatilla County (USDA, 1988). Two major reservoirs store water in the Basin, McKay Reservoir has a design capacity of 73,800 acre-feet and Cold Springs Reservoir is 50,000 acre-feet. Currently six major Bureau of Reclamation project irrigation diversions are located in the lower Basin. Irrigation acreage has expanded substantially since the early diversions. These projects and other water usage and impediments rendered flow insufficient for fish passage, often drying up the river completely in reaches below the town of Echo. Strategic releases from the Reservoirs partly restore in-stream flow during times of irrigation diversion.

> **McKay Reservoir Note**: *As of May 1993, at reservoir elevation (feet) 1322.0, the surface area was 1,283 acres, and the total capacity was 71,534 acre-feet. Since the reservoir's initial filling in December 1927, it is estimated that 1,909 acre-feet of sediment have been trapped in McKay Reservoir, resulting in a 2.6 percent loss in reservoir capacity. The average annual rate of sediment accumulation since 1927 is 29.1 acre-feet (USBR communication, April 2000).*

The Pacific Northwest Power Planning and Conservation Act (PL 96-051, 1980) mandated work to protect and restore anadromous fish in the Columbia River System. Subsequent improvements in the Basin began in 1983 with the development of fish rearing facilities and in-stream planting of juvenile fish by the State of Oregon and the CTUIR. In 1986 a low flow fish passage channel was excavated by the Army

Corps of Engineers below Three Mile Falls Diversion Dam ('Three Mile Dam' on Umatilla River, river mile 3). In 1986/1987 the Bureau of Reclamation constructed fish ladders and traps at Three Mile Dam.

In the 1980's the Bureau of Reclamation conducted studies leading to the Umatilla Basin Project Act of 1988, which authorized a phased implementation approach to flow restoration. Phase I and II included construction of facilities and operations to improve stream flows for anadromous fish primarily through water exchange. Phase I of the project includes pumping of water from the Columbia River into the West Extension Irrigation District system, to offset diversion of Umatilla River water. Its capacity is 140 cubic feet per second. This improved flows below the diversion point at Three Mile Dam (USBR, 1998).

Phase II similarly improves flow by Columbia River exchange. Phase II pumping and conveyance exchanges Umatilla River for Columbia River water for Stanfield and Hermiston Irrigation Districts. The capacity of Phase II is 240 cubic feet per second. The Stanfield Irrigation District historically diverted live flow and McKay Reservoir releases, which are now retained in-stream as needed to meet stream target flows for fish passage (USBR, 1998). Phase II can offset diversion from the Umatilla River that would have occurred at and downstream from the Stanfield Dam at river mile 32.

Phase I & II meet some but not all of the in-stream flow needs for anadromous fish (USBR, 1999). A Phase III is being considered. The Phase III feasibility study was initiated in 1997 to evaluate the further potential for improving fish and salmon habitat through a water exchange with Westland Irrigation District (USBR, 1999). The Westland Main Canal diverts up to 220 cubic feet per second from the Umatilla River water at approximately river mile 28.

Umatilla River target flows, water availability and water rights guide the strategy for reservoir releases and amounts diverted. Flow goals are adjusted annually and seasonally in consultation with Basin fish managers. The river is emptied entirely at times, typically near the town of Stanfield, during the summer when flow augmentation is not occurring from McKay Reservoir. During 1998, a relatively rainy year with substantial winter snow pack, Basin-wide TMDL monitoring was implemented (last week of August). It was noted that water was not present in Wildhorse Creek from river mile 18 to 25, Meacham Creek from river mile 10 to 15, little Butter Creek entirely, and West Fork of Birch Creek near the mouth. Upper Meacham Creek held standing water only.

To attain the flows in the lower Umatilla River that are supportive of water quality and habitat needs, ODEQ advocates the use of the Umatilla temperature TMDL and further modeling as needed to assist developing flow goals for a Phase III of the Umatilla Basin Project.

# 1.2.5 POPULATION

Population data for the cities and towns in the Umatilla Basin are listed in **Figure 6**. A map showing urban locations and point sources of pollution is displayed as **Figure 7**. Small rural residential areas with populations of a few hundred or less are low in number and are not listed (e.g., Reith, Pine City, Meacham). The Reservation Boundary is shown in **Figure 8**. The major population centers are located along the Umatilla River mainstem. Other Basin communities, between 200 and 2,000 in population, are located adjacent to Birch and Wildhorse Creeks.

**Figure 6.** Umatilla Basin Urban Population
(Oregon Blue Book, Office of the Oregon Secretary of State, 1999-2000 edition, http://www.sos.state.or.us/BlueBook/1999_2000/)

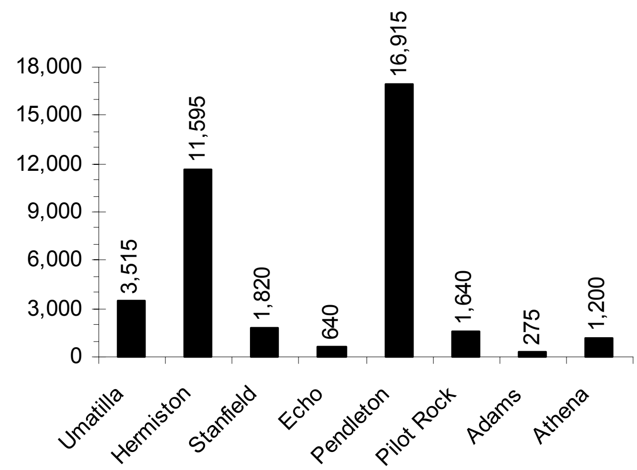



**Figure 7.** Map of Umatilla Basin Towns and Cities
[Including Point Sources of Pollution with Facility NPDES Permits]

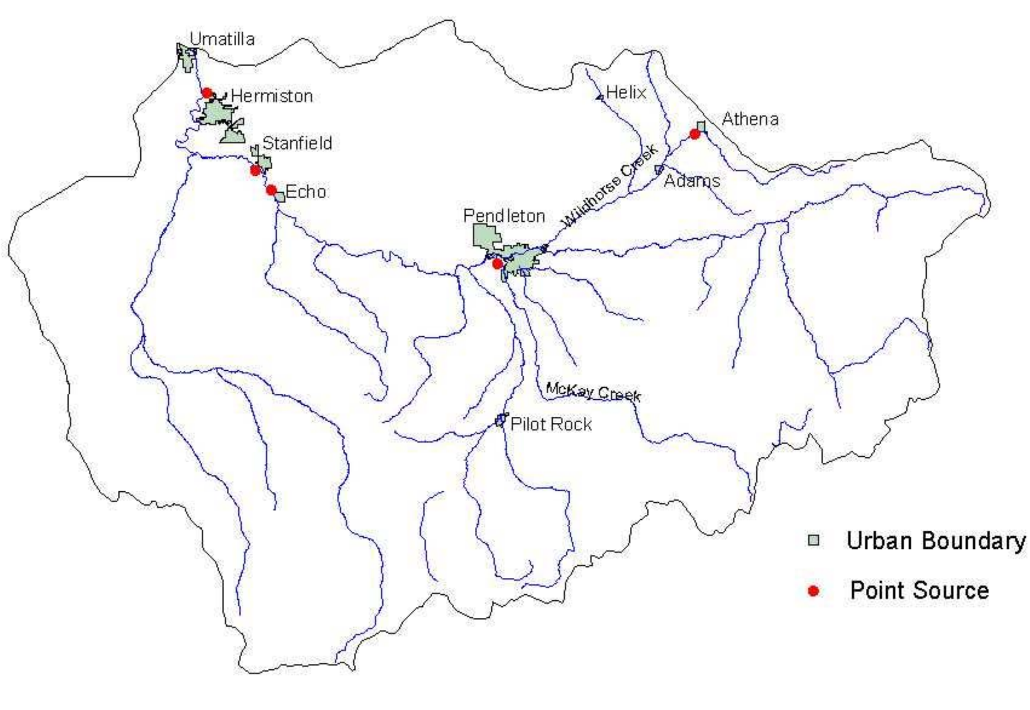
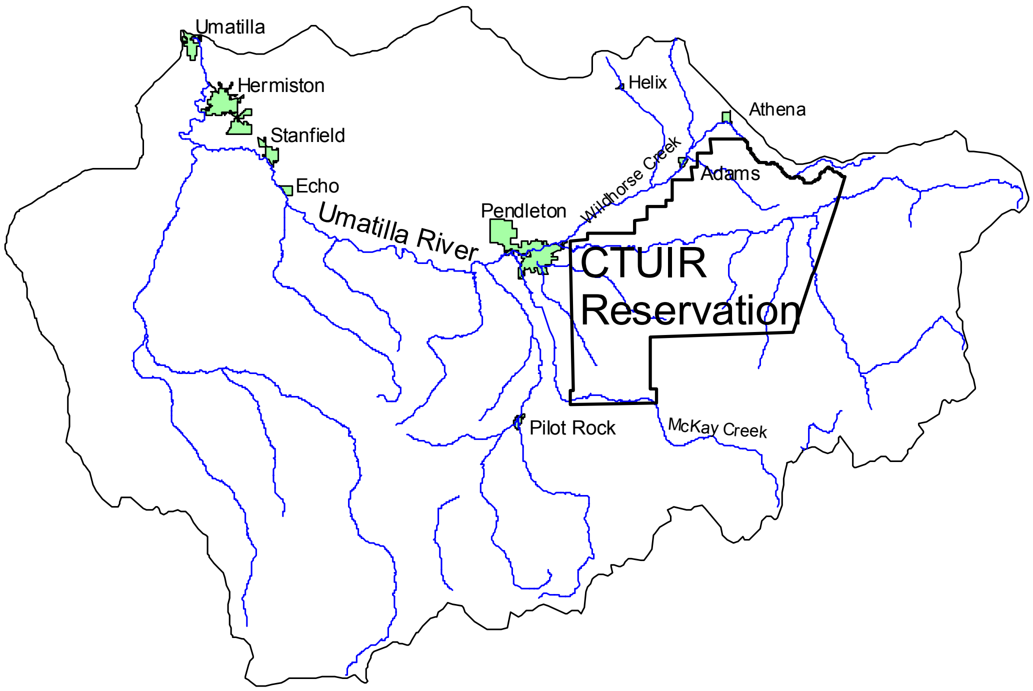


**Figure 8.** Map of the Umatilla Basin Illustrating Approximate Boundary of the CTUIR



# 1.2.6 POINT SOURCES

There are five point sources in the Umatilla Basin that discharge directly to surface waters under individual facility permits. The locations of these facilities are mapped in **Figure 7**. Current permit requirements are summarized in **Section 2.1.2.9**.

Discharge to waters of the state is regulated through National Pollutant Elimination System Discharge (NPDES) permits. Under the NPDES program, individual (facility specific) permits and general permits are administered. General permits address certain types of facilities categorically with statewide standards. Both types of permits are issued for a term of 5 years. Both general and individual permits are reevaluated prior to renewal. Once a TMDL for a Basin such as the Umatilla is completed, effluent limitations and conditions that meet TMDL goals will be incorporated into all individual permits when they are revised. This is scheduled for completion in 2001 for individual permits and 2005 for general permits.

A *Waste Load Allocation* (WLA) is the amount of pollutant that a ***point source*** can contribute to the stream without violating water quality standards. The point sources in the Umatilla Basin for which WLAs have been determined are the municipal wastewater treatment plants.

For the purposes of this TMDL, stormwater is treated as a non-point source. Other than stormwater permitted facilities (state-wide general permits), there is one facility with an assigned ODEQ General NPDES permit that currently allows discharge to waters of the state in the Umatilla Basin - #109448/A (Gen13) (oil water separator at truck washing facility). General Permit 13 has language designed to prevent violation of water quality standards:

> *"Notwithstanding the effluent limitations established in this permit, no wastes shall be discharged and no activities shall be conducted which will violate Water Quality Standards as adopted in OAR Chapter 340 Division 41 except in the following defined mixing zone..."*

This facility will be further evaluated for its potential to degrade water quality, during the upcoming Umatilla Basin permit review cycle of 2005. Note that the discharge is through a 1-inch diameter pipe onto a gravel grade for 20 minutes approximately once each two weeks, and the point of discharge is approximately 500 feet from nearest stream, which is intermittent. Site configuration and discharge amounts are such that surface effluent is very unlikely to flow to Meacham Creek.

# 1.3 TMDL PROCESS AND SCOPE

Section 303(d) of the Clean Water Act (CWA) requires that a list be developed of all impaired or threatened waters within the State (often referred to as the "303(d) List"). The principal agency responsible for monitoring the quality of Oregon's streams, lakes, estuaries and groundwater is the Department of Environmental Quality (DEQ). Accordingly, stream-monitoring information is collected by ODEQ, as well as other agencies, and used to determine whether water quality standards are being met. Water quality standards are based on the protection of *beneficial uses* of waterbodies. *Beneficial uses* include fisheries, aquatic life, drinking water, recreation, irrigation and others (**Table 5**). Applicable State and Federal law and regulation include the *Federal Clean Water Act of 1972* and the associated regulations in *40 Code of Federal Regulations 130 & 131*, the *Oregon Revised Statute* (ORS Chapter 468) and the *Oregon Administrative Rules* (OAR Chapter 340, Division 41).

The Umatilla Basin §303(d) listings are described in **Section 1.3.4**.

**TMDL and WQMP.** The State must establish a *Total Maximum Daily Load* (*TMDL)* for any waterbody designated as *water quality limited* (with a few exceptions, such as in cases where exceedance is due to natural causes). The term *water quality limited* is applied to streams and lakes where State water quality standards are not met, as reflected in the State's §303(d) list. A TMDL defines the maximum amount of pollutant that can be present in a waterbody without causing departure from water quality standards. An essential part of TMDL documentation is a discharge permit and/or a water quality management plan (WQMP) designed to implement TMDLs. The WQMP serves Oregon's continuous planning process to implement TMDLs [CWA, 303(e)].

The total allowable pollutant load can be allocated to point, non-point, background, and future sources of pollution. *Wasteload Allocations* are portions of the total allowable pollutant load that are allocated to point sources of pollution, such as wastewater treatment plants or industries. They are used to establish effluent limits in discharge permits. *Load allocations* are portions of the total allowable pollutant load that are allocated to non-point sources, such as agriculture or forestry activities, and natural background sources. Allocations can also be set aside in reserve for future uses. Simply stated, *allocations* are quantified measures that assure water quality standard compliance. The *TMDL* is the integration of all developed *allocations*.

Some TMDLs are expressed as *surrogates*. An example would be *percent effective shade* targets design to fulfill needed reduction in daily solar energy loading. The surrogate and the daily load of pollutant both serve as TMDL allocations in the Umatilla Basin TMDL. The surrogate is provided as a translation of the "daily load" for increased understanding and to provide clear management outcomes.

The essential elements of TMDLs stem from the Clean Water Act and are identified in a Memorandum of Agreement (MOA) between the US EPA and the ODEQ, as follows:

1. A description of the geographic area to which the TMDL applies;
2. Specification of the applicable water quality standards;
3. An assessment of the problem including the extent of deviation from water quality standards;
4. Development of a loading capacity including those based on surrogate measures and, including flow assumptions used in developing the TMDL;
5. Identification of point and non-point sources;
6. Development of Waste Load Allocations for point sources and Load Allocations for non-point sources;
7. Development of a margin of safety;
8. Evaluation of seasonal variations.

For clarity, the section headings of **Section 2.1.1** are annotated with references to the Clean Water Act and Oregon Administrative Rules. The MOA lays out a committee and agency process for developing the TMDL in which ODEQ ultimately takes the lead in the determination of components such as loading capacity and margin of safety. The Umatilla Basin falls into the category of "combination TMDL" in that both point and non-point sources are contributing sources.

**Geographic Area.** The area covered by the Umatilla Basin TMDL corresponds to the fourth field (sub-basin classification) hydrologic unit code (HUC) 17070103, which includes all lands that drain to the Umatilla River. The Umatilla Basin in northeastern Oregon drains approximately 2,290 square miles (above the USGS gage in Umatilla).

The Umatilla Basin TMDL and WQMP are applicable throughout the Umatilla Basin, including all land and water that ultimately drains into the Umatilla River, except in those areas within the exterior boundaries of the Confederated Tribes of the Umatilla Indian Reservation (**Figure 8**) as stated in **Section 1.1.3**. The boundary of the Basin is illustrated in **Figures 3, 4, 5,** etc. Various figures and computations throughout this document do not attempt to delineate the Reservation Boundary. This should not be interpreted as an application of State load allocations within the Reservation Boundary. Any load allocation identified in this document that overlaps the Reservation Boundary is only applicable outside of the Reservation, unless Tribal authority indicates otherwise.

This document establishes TMDL allocations and other goals for streams within the Umatilla Basin that are not currently on the Oregon 1998 303(d) list. This is consistent with State and Federal TMDL implementation law and policy. Un-listed streams are addressed where upstream improvements are needed to sufficiently decrease downstream water quality impairment or where impairment leading to water quality standards violations are found. Various causes of excess heat and fine sediment are observed throughout the Basin (unstable streambanks, channelization, contriction, bank and upland vegetation disturbance, rill and gully erosion).

**Umatilla Basin Land Use Workgroups.** Four workgroups were appointed through ODEQ and with additional sponsorship from the Umatilla Basin Watershed Council and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR). These workgroups identified water quality management practices in key land use sectors (forestry, urban/industrial and transportation). A related group prepared an agricultural plan through Oregon's SB1010 process. A group was appointed to address water quantity. These groups prepared the core sections of the Umatilla Basin WQMP - **Sections 3.3 and 3.4**. The committee process is described in **Section 1.1**.

## 1.3.1 BENEFICIAL USES

The beneficial uses of the Umatilla Basin waters are multi-fold. For the purposes of maintaining and protecting water quality, beneficial uses have been designated in the Oregon Administrative Rules. These uses are listed in **Table 5.**

**Table 5.** Umatilla Basin Designated Beneficial Uses (OAR 340-41, Table 11)

| | |
|---|---|
| Public Domestic Water Supply | Anadromous Fish Passage |
| Private Domestic Water Supply | Salmonid Fish Rearing |
| Industrial Water Supply | Salmonid Fish Spawning |
| Irrigation | Resident Fish & Aquatic Life |
| Livestock Watering | Wildlife and Hunting |
| Boating | Fishing |
| Aesthetic Quality | Water Contact Recreation |
| | Hydropower |

Beneficial uses and the associated water quality standards are generally applicable Basin-wide. Some uses require further delineation. At a minimum, uses are considered attainable wherever feasible or wherever attained historically. In applying standards and restoration, it is important to know where existing salmonid spawning locations are and where they are potentially attainable. The TMDL process addresses existing beneficial uses as defined in 40 CFR 131.3: "those uses actually attained in the water body on or after November 28, 1975..." Salmonid spawning and the quality of the spawning grounds are particularly sensitive to water quality and streambed conditions. **Figure 9** identifies the locations and seasons in which salmonids are known to spawn, and where there is potential to expand the areas of spawning habitat. The other most sensitive beneficial uses, drinking water and contact recreation, are applicable throughout the Basin.

**Figure 9.** Area and Timing of Salmonid Spawning and Residence

Figure 9a. Salmonid Spawning Areas and Seasons Based on Known Occurrence. [The August 1 - June 30 spawning period was extended downstream to Mission Creek approximately 15 miles from actual to account for potential expansion by Spring Chinook (prepared by Umatilla Sub-Basin fisheries managers - ODFW, CTUIR and USFS). The salmonid spawning numeric criteria of the temperature standard applies in these locations of existing and potential beneficial use. Note: colors in this figure are based primarily on species as follows: green for spring chinook, blue for fall chinook/coho, red for redband trout].

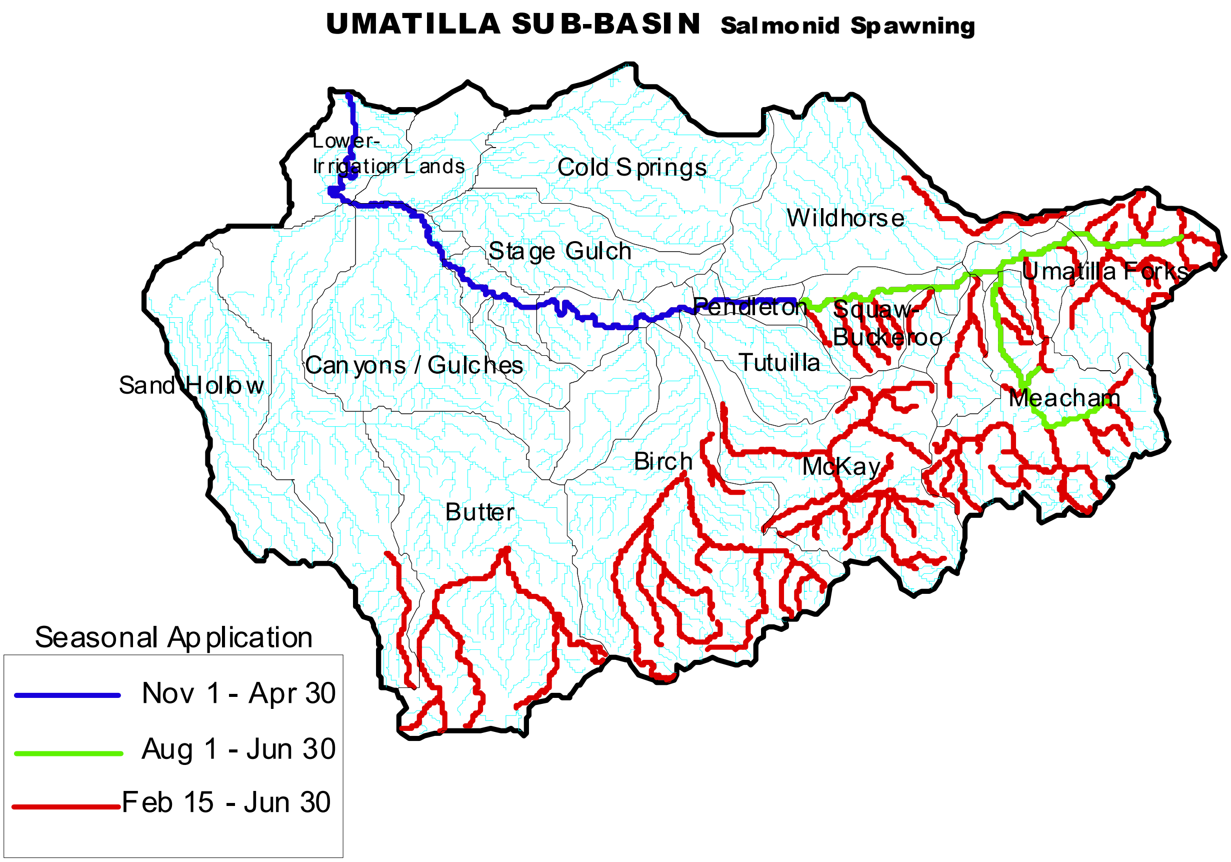
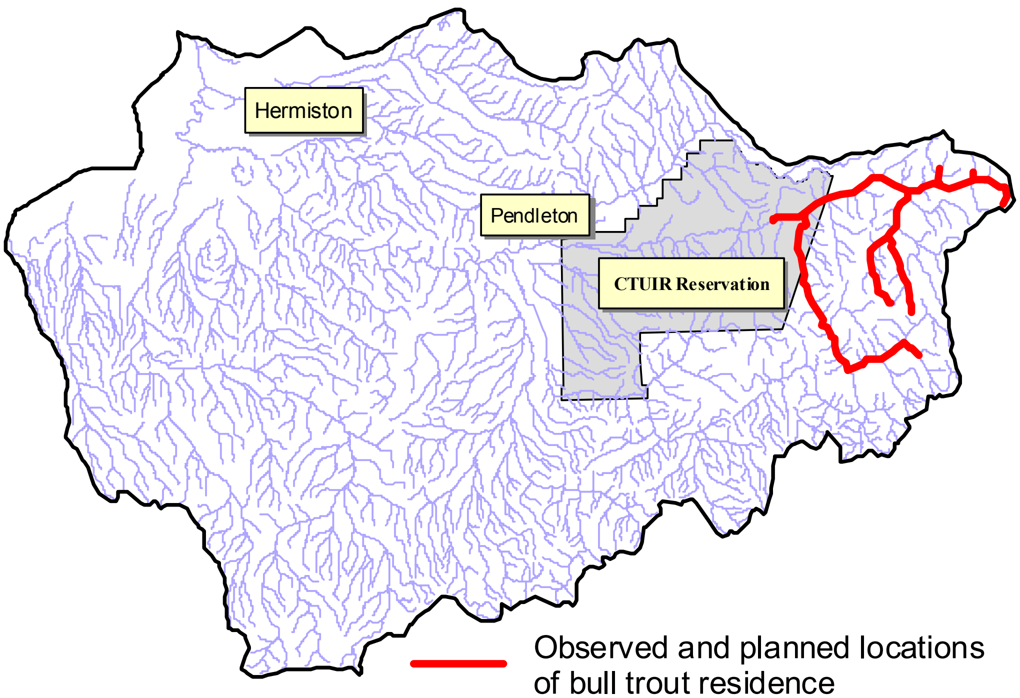


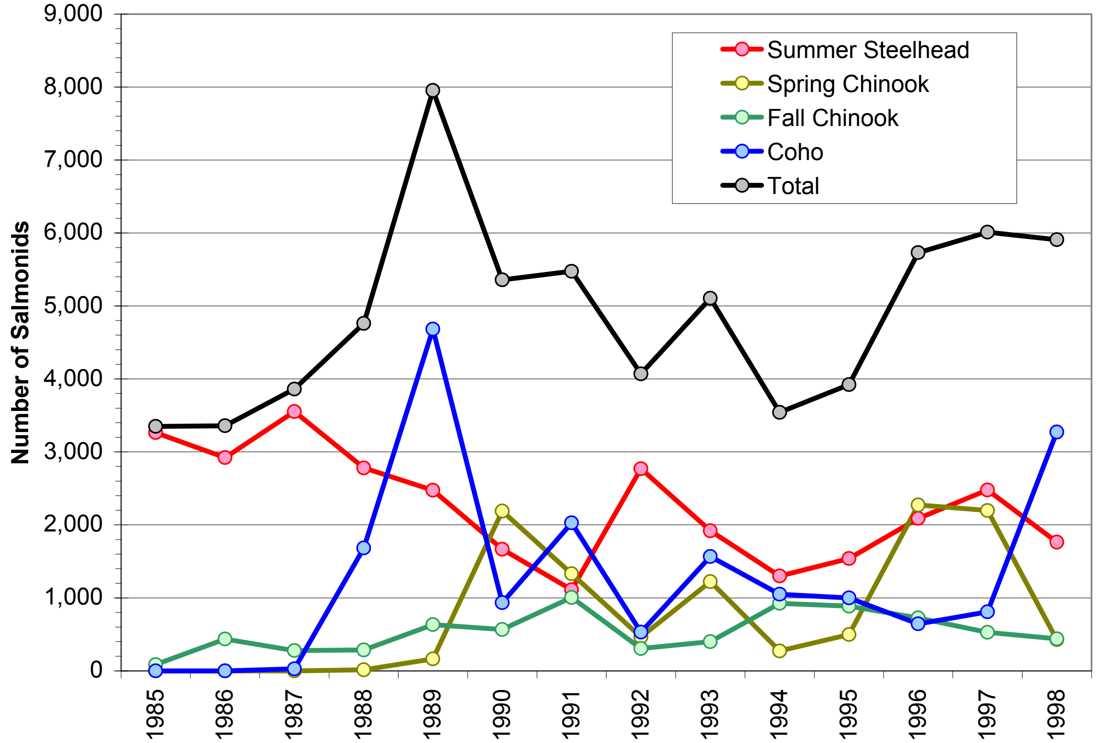
Figure 9b. Observed and planned locations of bull trout residence in the Umatilla Basin are shown in red. [prepared by the Basin fish managers (ODFW, CTUIR, USFS). This figure represents assessment of known locations where bull trout have been observed in residence (primarily the North Forks of the Umatilla River and Meacham Creek) and areas that could link metapopulations or expand viable habitat to increase resiliency. Note: the Umatilla River mainstem is a bull trout migratory corridor. The bull trout numeric criteria of the temperature standard applies in these locations of existing and potential beneficial use.]




Salmonids are cold water fish and are very sensitive to heat and low dissolved oxygen levels. Umatilla Basin salmonids are generally anadromous (ocean going) with the exception of the redband trout that spawn in much of the upper Basin. The anadromous fish that occurred historically and exist currently in the Basin are bull trout, coho, steelhead and spring and fall chinook. Steelhead, coho and chinook were extirpated due to passage and flow impediments from irrigation projects, beginning in the early 1900's. Following an absence of approximately 75 years, re-introduction, flow augmentation and re-engineering of diversion structures have resulted in incipient restoration of these species. **Figure 10** is a graph of the number of salmonids returning to the Basin through the Three Mile Dam fish ladder since just prior to re-introduction (CTUIR data).

Warm water fish and eels, frogs and many other aquatic organisms are also present in the Umatilla Basin. Catfish, lamprey, squawfish, suckers, sunfish, bluegill, small- and large-mouth bass and crappie reside in the Basin (Oregon State Game Commission, 1973).

**Figure 10.** Salmonid returns to the Umatilla Basin at Three Mile Dam
(The data are actual counts of fish that returned to the Umatilla Basin, after having hatched in the Basin and traveled to the Pacific Ocean. All fish passing Three Mile Dam are counted.)



# 1.3.2 WATER QUALITY STANDARDS

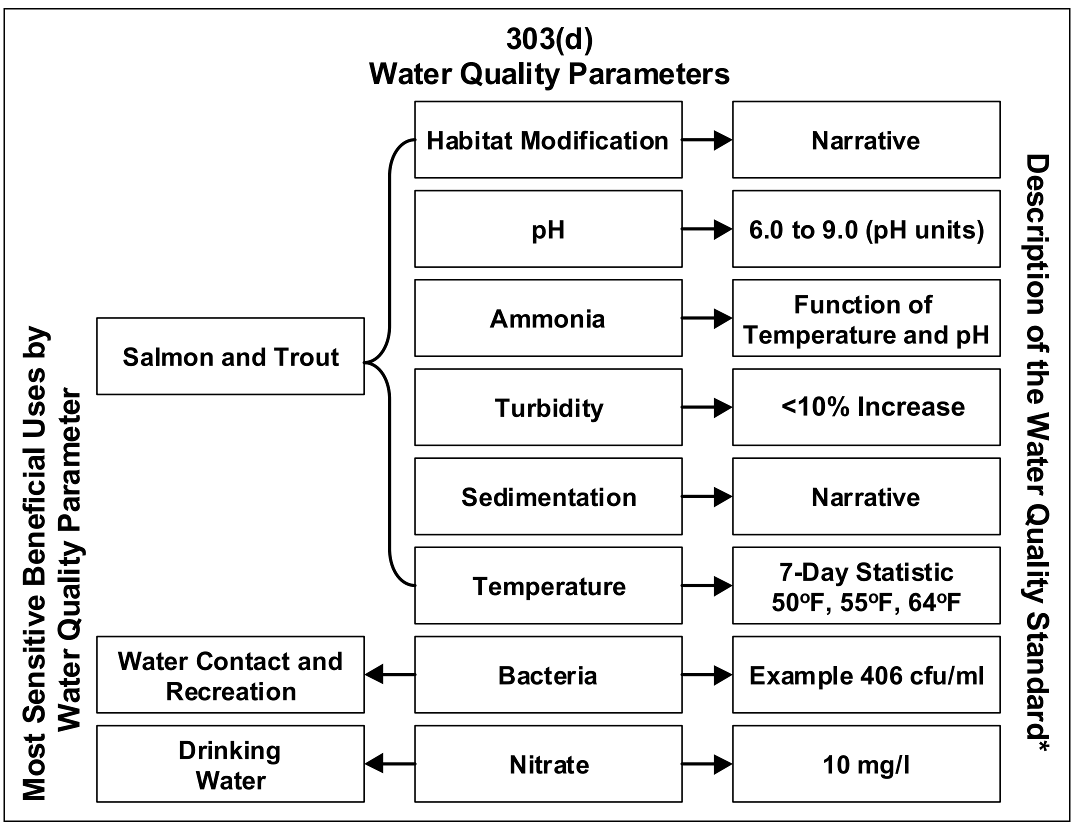
Water quality standards are based on beneficial uses of waters of the state. Uses are evaluated collectively for each type of potential water quality indicator or impairment. The most sensitive use is selected and the water quality standard is developed for this use, thus protecting it and all the others. For instance, elevated bacteria concentrations typically don't affect boating or hydropower, but can cause illness in swimmers. Hence bacteria toxicity to humans through contact recreation is evaluated for needed level of protection and the water quality standard is established accordingly.

**Table 6** identifies the beneficial uses that the standards of concern are based on. Note that human toxicity related to drinking water is of concern for nitrate and not for bacteria. This is because drinking water is treated as needed for bacteria, but generally the much more difficult treatment needed to remove nitrate is not nearly as feasible.

Water quality standards for temperature, sediment, bacteria, pH & algae, nitrate and ammonia, are discussed in the sections of **Chapter Two** that address goals for those variables. Relevant Oregon water quality standards are included here as **Appendix A-7**.

**Table 6.** Linkage Between Water Quality Standards and Beneficial Uses

(for Various Water Quality Concerns Identified in the Umatilla Basin)



# 1.3.3 BENEFICIAL USE IMPAIRMENT

Streams of the Umatilla Basin have been artificially straightened and re-located beginning prior to the 1900's. Approximately 70 percent of the Umatilla River has been levied or channeled in some fashion (observation, aerial photography, CTUIR survey). Extensive vegetation removal and disturbance along the streams and in the uplands has occurred and still occurs. This is associated with urban development, cultivation, forestry, transportation corridors, flood control and navigation. Habitat surveys conducted through ODFW, CTUIR, and the Umatilla National Forest indicate excessive streambank erosion, and low quality of habitat such as: infrequent woody debris, few pools, absence of overhanging banks and high concentrations of silt and sand on streambeds (e.g., CTUIR, 1996; Crabtree, 1996). Beavers were virtually eradicated by the early 1900's. One of the most sensitive aquatic species, Bull Trout, has been relegated to spawning only in the North Fork of the Umatilla and the North Fork of Meacham Creek. Bull Trout is a threatened species under the Endangered Species Act. Recent surveys for Bull Trout in the North Fork of Meacham Creek have not revealed the presence of Bull Trout. Summer Steelhead are also listed as threatened.

Water quality monitoring results will be discussed in the sections of this document specific to each type of impairment: temperature, sediment, nutrients, etc. Primary concerns are elevated temperature, turbidity and sedimentation throughout the Basin. Toxic (human drinking) levels of nitrate occur in the Wildhorse Creek watershed. Toxic (fish) levels of ammonia have been found in the lower Umatilla River in the Hermiston area. Bacteria concentrations in the Umatilla River near Echo exceed water quality standards. The mid-Basin Umatilla River exceeds the pH water quality standard. Note that habitat modification and sedimentation, though identified as concerns primarily in the mid- and upper-Basin where habitat surveys were conducted on a priority basis, are probable adverse conditions Basin-wide. Further discussion of impairment or indications of impairment follow in **Section 1.3.4** discussing the Clean Water Act Section 303(d) list.

What were the conditions like before settlement or prior to any human impact? Little is known. Land uses more than one hundred years ago are now known to have adverse effects, some dramatic. These practices included splash dams, eradication of beaver, stream re-location, over-grazing, etc. One of the early known accounting of temperature is as follows:

> "The Umatilla River was examined August 23 near its mouth, and on August 12 [in the year 1892] near Pendleton, Oregon. At Pendleton it had an average width of 25 feet, depth of 14 inches, and a velocity of 1 foot. Temperature at 11:00 a. m. [was] 70$^{o}$F. The bottom was of coarse gravel covered with algae, and the water was clear."
>
> - Bulletin of the United States Fish Commission, 1894

## 1.3.4 303(d) LISTINGS

As discussed above, Section 303(d) of the Clean Water Act (1972) requires that states develop a list of water quality-limited water bodies. The 303(d) list is updated in approximately 2-year intervals. The most recent edition of the list was compiled in 1998.

The 1998 303(d) Umatilla Basin listings are summarized below (for more information refer to the ODEQ website containing Oregon's 303(d) list at http://waterquality.deq.state.or.us/wq/). In the following text, values other than State water quality standards are referenced. This is because some standards are narrative rather than numeric, necessitating additional numeric targets to fulfill or evaluate attainment of water quality standards.

- Temperature: Entire Umatilla River mainstem and tributaries in the mid- and upper-Basin (this listing is based on exceedance of the numeric temperature criteria of the Oregon water quality standard)
- pH: Umatilla River from Speare Canyon to North & South Forks confluence and lower McKay and Butter Creeks (this listing is based on exceedance of numeric pH criteria of the Oregon water quality standard)
- Aquatic Weeds and Algae: Follows pH listing on Umatilla River from Spear Canyon to North & South Forks confluence (this listing is related to pH)
- Sedimentation: 17 stream segments including the Umatilla River from Pendleton to the N-S Forks confluence (this listing is based on ODFW benchmarks for streambed particle distribution)
- Turbidity: Umatilla River from mouth to the town of Mission (Wildhorse and other tributaries cause turbidity to increase in the Umatilla River by more than 10 percent. The Oregon water quality standard is 10 percent maximum increase over background)
- Habitat: 21 stream segments including the Umatilla River from Pendleton to the N-S Forks confluence (this listing is based on low pool frequency and minimal large woody debris occurrence, relative to ODFW benchmarks)
- Ammonia (Toxics): North Hermiston Drain and the Umatilla River lower 5 miles (this listing is based on exceedance of the EPA Goldbook criteria 0.1 mg/l, EPA, 1986)
- Nitrate (Toxics): Wildhorse Creek, Spring Hollow Creek (Wildhorse tributary) (this listing is based on the toxicity criteria of 10 mg/l an Oregon water quality standard)
- Bacteria: Umatilla River from mouth to Speare Canyon, McKay Creek below reservoir (this listing is based on numeric toxicity criteria of the Oregon water quality standard)
- Flow Modification: Umatilla River below Pendleton (this listing is based on in-stream water rights not being met)

## 1.3.5 ADDRESSING ALL 303(d) LISTED CONCERNS

The intent of this document is to address each of the 10 categories of impairments for which Basin streams are listed, wherever they occur. It is important to be aware that improvement is required upstream from listed reaches as well as within the reach, in order for a listed segment to achieve water quality goals. For instance, high main-stem water temperatures can not generally be lessened sufficiently without reductions in tributary stream temperatures. The method for addressing each listing is outlined below. All Umatilla Basin 1998 303(d) listings are addressed in this document.

- Temperature - TMDL allocations are established in this document.
- pH - Water quality modeling indicates that temperature and light are the controlling variables for excess aquatic plant growth. Photosynthesis from aquatic weeds and algae result in mid-day pH increases. Modeling demonstrates that the temperature and light reduction achieved through implementation of the temperature TMDL allocations will result in pH standard attainment. No additional allocations are established.
- Aquatic Weeds or Algae - Aquatic plant life is accounted for in the temperature reduction achieved through temperature TMDL allocation implementation. No additional allocations are established.
- Turbidity - Turbidity has been related to suspended solids. TMDL allocations have been established in this document for suspended solids reduction from uplands and streambanks. This is referred to herein as the "sediment TMDL."
- Sedimentation - Measures or targets to improve streambed particle size distributions are not allocated as TMDLs . Sediment TMDL allocations based on turbidity are established in this document. The associated erosion reduction is generally expected to reduce deposition of substrate fines as well. Management goals are established to evaluate progress in reducing substrate fines (**Section 2.2**).
- Habitat - As with sedimentation, management goals established in the document serve as measures of progress (**Section 2.2**).
- Ammonia - a TMDL wasteload allocation is established in this document.
- Nitrate - TMDL allocations are established in this document.
- Bacteria - TMDL allocations are established in this document.
- Flow Modification - A water quantity management plan is included in this document.

In summary, TMDL allocations for point and non-point sources will be established for temperature, sediment (turbidity), nitrate, ammonia and bacteria. Reference management goals are included for habitat, streambed sediment and percent eroding streambanks. A management plan is included to address flow. Aquatic weeds, algae, and pH are addressed through temperature reduction.

## 1.3.6 IMPLEMENTATION AND ADAPTIVE MANAGEMENT ISSUES

The following text describes ODEQ's TMDL implementation policy.

a) The goal of the Clean Water Act and associated Oregon Administrative Rules is that water quality standards shall be met or that all feasible steps will be taken towards achieving the highest quality water attainable. This is a long-term goal in many watersheds, particularly where nonpoint sources are the main concern. To achieve this goal, implementation must commence as soon as possible.

b) Total Maximum Daily Loads (TMDLs) are numerical loadings that are set to limit pollutant levels such that in-stream water quality standards are met. ODEQ recognizes that TMDLs are values calculated from mathematical models and other analytical techniques designed to simulate and/or predict very complex physical, chemical and biological processes. Models and techniques are simplifications of these complex processes and, as such, are unlikely to produce an exact prediction of how streams and other waterbodies will respond to the application of various management measures. It is for this reason that TMDLs are established with a margin of safety.

c) Water Quality Management Plans (WQMPs) are plans designed to reduce pollutant loads from nonpoint sources to meet TMDLs. ODEQ recognizes that it may take some period of time—from several years to several decades-- after full implementation before management practices identified in a WQMP become fully effective in reducing and controlling non point source pollution. In addition, ODEQ recognizes that technology for controlling nonpoint source pollution is, in many cases, in the developmental stages. It will likely take one or more iterations to develop the most effective techniques. It is possible that after application of all reasonable best management practices, some TMDLs or their associated surrogates cannot be achieved as originally established.

d) DEQ also recognizes that, despite the best and most sincere of efforts, natural events beyond the control of humans may interfere with or delay attainment of the TMDL and/or its associated surrogates. Such events could be, but are not limited to, floods, fire, insect infestations, and drought. That said, it is important to recognize that a more naturally functioning stream system is relatively resilient to natural disturbance.

The purpose of the TMDLs and associated surrogates is not to bar or eliminate human access or activity in the basin or its riparian areas. It is the expectation, however, that WQMPs will address how human activities will be managed to achieve these allocations. It is also recognized that full attainment of TMDL allocations (site potential vegetation, for example) at all locations may not be feasible due to physical, legal or other regulatory constraints. To the extent possible, WQMPs should identify potential constraints, but should also provide the ability to mitigate those constraints should the opportunity arise. For instance, at this time, the existing location of a road or highway may preclude attainment of vegetation potential due to safety considerations. In the future, however, should the road be expanded or upgraded, consideration should be given to designs that support TMDL load allocations and pollutant surrogates such as 'site potential vegetation.'

e) If a non-point source that is covered by this TMDL complies with its WQMP or applicable forest practice rules, it will be considered in compliance with the TMDL.

f) DEQ intends to regularly review progress of WQMPs to achieve TMDLs. If and when ODEQ determines that WQMP have been fully implemented, that all feasible management practices have reached maximum expected effectiveness and a TMDL or its interim targets have not been achieved, ODEQ shall reopen the TMDL and adjust it or its interim targets and its associated water quality standard(s) as necessary.

g) The implementation of TMDLs and the associated management plans is generally enforceable by the Department, other state agencies and local government. However, it is envisioned that sufficient initiative exists to achieve water quality goals with minimal enforcement. Should the need for additional effort emerge, it is expected that the responsible agency will work with land managers to overcome impediments to progress through education, technical support or enforcement. Enforcement may be necessary in instances of insufficient action towards progress. This could occur first through direct intervention from land management agencies (e.g. ODF, ODA, counties and cities), and secondarily through ODEQ. The latter may be based in departmental orders to implement management goals leading to water quality standards.

h) A zero load allocation for non-point sources (i.e. achieving system potential vegetation) does not necessarily mean that a point source is prohibited from discharging any wastes to the stream in question. A source may be permitted by the Department under certain circumstances to discharge if the permit holder can adequately demonstrate that the discharge will not cause a measurable decrease in water quality over that achieved by a zero load allocation and immediately upstream of the point of discharge. For instance, a permit applicant may be able to demonstrate that a proposed thermal discharge would not have a measurable increase on projected stream temperatures when site temperature is achieved. Or, in the case where a TMDL is set based upon attainment of a specific pollutant concentration, a source could be permitted to discharge at that concentration.

i) In employing an adaptive management approach to this TMDL and WQMP, ODEQ has the following expectations and intentions:

1. Subject to available resources, on a five-year basis, the Department intends to review the progress of the TMDL and the WQMP.

2. In conducting this review, the Department will evaluate the progress towards achieving the TMDL (and water quality standards) and the success of implementing the WQMP.

3. The Department expects that each management agency will also monitor and document its progress in implementing the provisions of its component of the WQMP. This information will be provided to ODEQ for reviewing the TMDL.

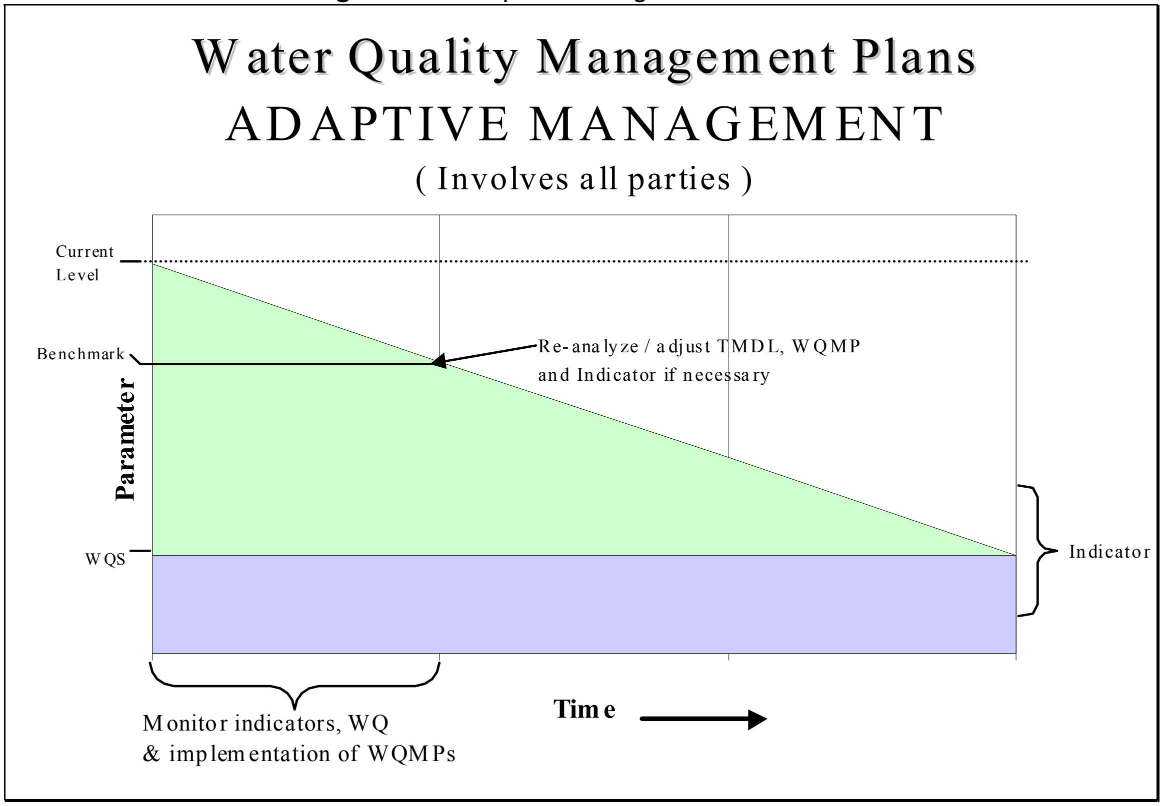
4. As implementation of the WQMP proceeds, ODEQ expects that management agencies will develop benchmarks for attainment of TMDL surrogates which can then be used to measure progress.

5. Where implementation of the WQMP or effectiveness of management techniques are found to be inadequate, ODEQ expects management agencies to revise the components of the WQMP to address these deficiencies.

6. When ODEQ, in consultation with the management agencies, concludes that all feasible steps have been taken to meet the TMDL and its associated surrogates and attainment of water quality standards, the TMDL, or the associated surrogates is not practicable, it will reopen the TMDL and revise it as appropriate. ODEQ would also consider reopening the TMDL should new information become available indicating that the TMDL or its associated surrogates should be modified.

**Figure 11** illustrates the adaptive management process, referred to in 'i' above.

**Figure 11.** Adaptive Management Illustration



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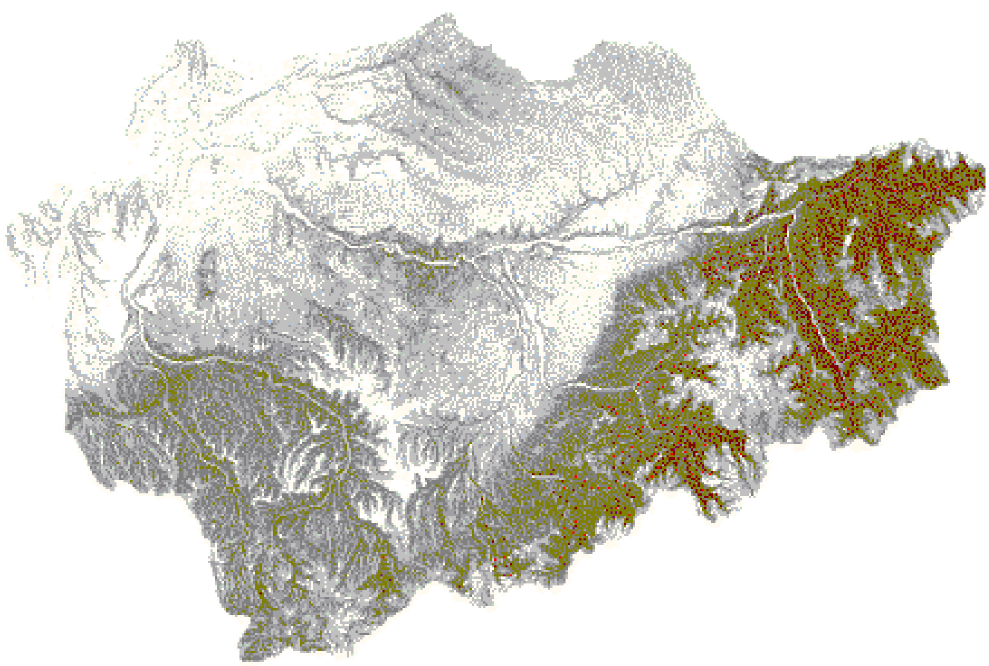
# CHAPTER TWO:

# TOTAL MAXIMUM DAILY LOADS



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# 2.1 LOAD AND WASTE LOAD ALLOCATIONS

*What is a Total Maximum Daily Load?*

The water quality of Oregon's streams, lakes, estuaries and groundwater is monitored by the Oregon Department of Environmental Quality (DEQ) and other agencies. This information is used to determine whether water quality standards are being met and, consequently, whether the *beneficial uses* of the waters are *impaired*. *Beneficial uses* include fisheries, aquatic life, drinking water, recreation and irrigation and others. State and Federal law and regulation require evaluation and improvement of water quality. These include the *Federal Clean Water Act of 1972* and the associated regulations in *40 Code of Federal Regulations 130 & 131*, the *Oregon Revised Statute* (ORS Chapter 468) and the *Oregon Administrative Rules* (OAR Chapter 340).

The term *water quality limited* is applied to streams and lakes where required treatment processes are being applied, but State water quality standards are not met. With few exceptions, such as in cases where violations are due to natural causes, the State must establish *a Total Maximum Daily Load* or *TMDL* for any waterbody designated as *water quality limited*. A *TMDL* is the total amount of a pollutant (from all sources) that can be present in a specific waterbody and still meet water quality standards.

The TMDL is allocated to point, non-point, background and/or future sources of pollution. *Wasteload Allocations* are portions of the TMDL that are allotted to *point sources* of pollution, such as sewage treatment plants that pipe wastewater to streams. The *Wasteload Allocations* are used to establish effluent limits in discharge permits. *Load Allocations* are portions of the TMDL that are attributed to *non-point* sources - landscape derived pollution such as field runoff or solar heat resulting from vegetative-shade removal. Non-point sources are typically natural "background" or sources such as urban, agriculture or forestry activities. *Allocations* can also be set aside in reserve for future uses. Simply stated, TMDL *allocations* are quantified measures designed to achieve water quality standard compliance, accounting for point and non-point sources.

*Information relevant to this chapter is provided in Chapter One: Basin physiography, demographics, point sources & hydrology background; beneficial uses discussion, water quality concerns, and the strategy for addressing all 303(d) listings.*

*A summary of TMDL allocations is provided in the Chapter One document summary and geographic area, point of compliance and allocation responsibility are specified (Table 2).*

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# 2.1.1 TEMPERATURE TMDL

**Pollutant Identification:**

Human caused increases in solar radiation loading, and warm water discharge to surface waters.

Water temperature change is an expression of heat energy exchange per unit volume:

$$\Delta\text{Temperature} \propto (\Delta\text{Heat Energy}) \div \text{Volume}$$

Anthropogenic increase in heat energy is derived from solar radiation as increased levels of sunlight reach the stream surface and raise water temperature. The pollutants targeted in this TMDL are (1) human caused increases in solar radiation loading to the stream network and (2) warm water discharges of human origin.

**Summary of TMDL Development and Approach**

*Applying Oregon's Temperature Standard*

The reduction in thermal loading needed to meet the water quality standard (**Section 2.1.1.1.3**) is evaluated using a variety of data (ground level, GIS and remote sensing) and analytical modeling. Attainment of the temperature standard relies on the simulating the thermal effects of "system potential" riparian, channel morphology and hydrologic conditions that reduce thermal patterns to those that minimize human caused increases in stream temperatures. In areas where the numeric criteria are being exceeded, the department considers attainment of system potential conditions to serve as compliance with the temperature standard. This is obtained through restoration/protection of riparian vegetation, channel morphology, and hydrologic processes.

*Development of System Potential Conditions*

System potential conditions are comprised of riparian, channel morphology and hydrology parameters. The Umatilla TMDL Technical Committee assessed potential vegetation with field measurements and literature regarding existing vegetation. Channel morphology was assessed with Rosgen level II stream classifications and application of hydrologic principles. Flows were evaluated with flow measurements and gage data. A current condition flow profile was derived, from which "natural river flows" and "maximum potential flows" were estimated. ODEQ calculated the thermal effects associated with achieving both riparian, channel morphology and hydrologic system potential conditions. Other factors, such as groundwater/stream interactions and floodplain/stream connection, are more difficult to quantitatively assess are indirectly addressed through the riparian, channel morphology and hydrology TMDL targets.

*Temperature TMDL Overview*

Stream temperature pollutants are identified as human-caused increases in solar radiation and warm water discharge. The resultant TMDL loading capacities are expressed as pollutant loading limits for both non-point and point sources of pollution. Allocations of the pollutant load are provided to all sources of pollution in the Umatilla Sub-Basin. Surrogate measures are also provided to non-point sources of pollution to help translate the loading capacity and to provide a clear list of site specific targets for management and implementation considerations.

## 2.1.1.1 TARGET IDENTIFICATION – CWA §303(d)(1)

### 2.1.1.1.1 Temperature Related to Aquatic Life

Salmonids are sensitive to warm temperatures. Temperatures greater than 70°F are considered incipient lethal (salmonid mortality occurs rapidly – hours to days). Temperatures between 64°F and 74°F are sub-lethal (salmonid mortality occurs more slowly and indirectly – weeks to months)

Salmonids, often referred to as cold water fish, and some amphibians appear to be highly sensitive to temperature. In particular, Chinook salmon (*Oncorhynchus tshawytscha*) and bull trout (*Salvelinus confluentus*) are among the most temperature sensitive of the cold water fish species. Oregon's water temperature standard employs logic that relies on using these *indicator species,* which are the most sensitive. If temperatures are protective of *these indicator species*, other species are protected as well.

If stream temperatures become too hot, fish die almost instantaneously due to denaturing of critical enzyme systems in their bodies (Hogan, 1970). The ultimate *instantaneous lethal limit* occurs in high temperature ranges (upper-90°F). Such warm temperature extremes are rare in the Umatilla Basin.

More common and widespread observed within the Umatilla Basin, however, is the occurrence of temperatures in the mid- to high- 70°F range (mid- to high-20°C range). These temperatures cause death of cold-water fish species during exposure times lasting a few hours to a day. The exact temperature at which a cold water fish succumbs to such a thermal stress depends on the temperature that the fish is acclimated and on particular development life-stages. This cause of mortality, termed the *incipient lethal limit*, results from breakdown of physiological regulation of vital processes such as respiration and circulation (Heath and Hughes, 1973).

The most common and widespread cause of thermally induced fish mortality is attributed to interactive effects of decreased or lack of metabolic energy for feeding, growth or reproductive behavior, increased exposure to pathogens (viruses, bacteria and fungus), decreased food supply (impaired macroinvertebrate populations) and increased competition from warm water tolerant species. This mode of thermally induced mortality, termed indirect or *sub-lethal*, is more delayed and occurs weeks to months after the onset of elevated temperatures (mid-60°F to low-70°F). **Table 7** summarizes the modes of cold water fish mortality.

**Table 7.** Modes of Thermally Induced Cold Water Fish Mortality (Brett, 1952; Bell, 1986, Hokanson et al., 1977)

| *Modes of Thermally Induced Fish Mortality* | *Temperature Range* | *Time to Death* |
|---|---|---|
| *Instantaneous Lethal Limit* – Denaturing of bodily enzyme systems | > 90°F<br>> 32°C | Instantaneous |
| *Incipient Lethal Limit* – Breakdown of physiological regulation of vital bodily processes, namely: respiration and circulation | 70°F to 77°F<br>21°C to 25°C | Hours to Days |
| *Sub-Lethal Limit* – Conditions that cause decreased or lack of metabolic energy for feeding, growth or reproductive behavior, encourage increased exposure to pathogens, decreased food supply and increased competition from warm water tolerant species | 64°F to 74°F<br>20°C to 23°C | Weeks to Months |

# 2.1.1.1.2 Sensitive Beneficial Use Identification

Temperature sensitive beneficial uses are anadromous fish passage, salmonid fish spawning (see **Figure 9** for seasonal spawning areas and periods), salmonid fish rearing and resident fish and aquatic life.

Oregon Administration Rules (OAR Chapter 340, Division 41, Table 11) lists the designated beneficial uses for which water is to be protected in the Umatilla Basin. Designated beneficial uses are presented in **Tables 5 & 8** (Table 8 is a copy of Table 5 with temperature-sensitive beneficial uses marked in gray shading). Numeric and narrative water quality standards are designed to protect the most sensitive *beneficial uses*. In the Umatilla Basin, resident fish and aquatic life, salmonid spawning, rearing and migration (i.e., anadromous fish passage) are the most sensitive *beneficial uses*, with regard to temperature.

**Table 8.** Designated Beneficial Uses Occurring in the Umatilla Basin *(OAR 340-41-642)*
*Temperature-sensitive beneficial uses are marked in gray*

| Beneficial Use | Occurring | Beneficial Use | Occurring |
|---|---|---|---|
| Public Domestic Water Supply | ✓ | Anadromous Fish Passage | ✓ |
| Private Domestic Water Supply | ✓ | Salmonid Fish Spawning | ✓ |
| Industrial Water Supply | ✓ | Salmonid Fish Rearing | ✓ |
| Irrigation | ✓ | Resident Fish and Aquatic Life | ✓ |
| Livestock Watering | ✓ | Wildlife and Hunting | ✓ |
| Boating | ✓ | Fishing | ✓ |
| Aesthetic Quality | ✓ | Water Contact Recreation | ✓ |
| Commercial Navigation & Trans. | | Hydro Power | ✓ |

# 2.1.1.1.3 Water Quality Standard Identification

The temperature standard applicable in the Umatilla River Basin specifies that "***no measurable surface water temperature increase resulting from anthropogenic (human induced) activities is allowed"*** unless specifically allowed under a ODEQ-approved management plan, when trigger temperatures are exceeded (see temperature standard below - i through viii).

A seven-day moving average of daily maximums (7-day statistic) was adopted as the statistical measure of the stream temperature standard. Absolute numeric criteria are deemed action levels and indicators of water quality standard compliance. Unless specifically allowed under a ODEQ-approved surface water temperature management plan as required under (OAR 340-041-0026(3)(a)(D)), no measurable surface water temperature increase resulting from anthropogenic activities is allowed in State of Oregon Waters determined out of compliance with the temperature standard. The numeric criteria adopted in Oregon's water temperature is presented in **Table 9**. **Figure 9** contains maps of the areas of applicability of the 'salmonid spawning, egg incubation and fry emergence' and bull trout numeric criteria. The salmonid rearing criteria applies in all other Umatilla Basin streams and lakes. A much more extensive analysis of water temperature related to aquatic life and supporting documentation for the temperature standard can be found in the *1992-1994 Water Quality Standards Review Final Issue Papers (DEQ, 1995)*.

It is important to understand the State of Oregon's temperature standard and that there is more to it than just a 64$^{o}$F criterion. Specifics for the Umatilla Basin temperature standard can be found in OAR 340-041-645(2)(b)(A).

**Umatilla Basin Temperature Standard - OAR 340-041-645(2)(b)(A)**

To accomplish the goals identified in OAR 340-041-120(11), unless specifically allowed under a ODEQ-approved surface water temperature management plan as required under OAR 340-041-026(3)(a)(D), no measurable surface water temperature increase resulting from anthropogenic activities is allowed:

(i) In a basin for which salmonid fish rearing is a designated beneficial use, and in which surface water temperatures exceed 64.0°F (17.8°C);

(ii) In the Columbia River or its associated sloughs and channels from the mouth to river mile 309 when surface waters exceed 68.0°F (20.0°C);

(iii) In waters and periods of the year determined by ODEQ to support native salmonid spawning, egg incubation, and fry emergence from the egg and from the gravels in a basin which exceeds 55.0°F (12.8°C);

(iv) In waters determined by ODEQ to support or to be necessary to maintain the viability of native Oregon bull trout, when surface water temperatures exceed 50.0°F (10.0°C);

(v) In waters determined by ODEQ to be ecologically significant cold-water refugia;

(vi) In stream segments containing federally listed Threatened and Endangered species if the increase would impair the biological integrity of the Threatened and Endangered population;

(vii) In Oregon waters when the dissolved oxygen (DO) levels are within 0.5 mg/l or 10 percent saturation of the water column or intergravel DO criterion for a given stream reach or Basin; and

(viii) In natural lakes.

## 2.1.1.2 DEVIATION FROM WATER QUALITY STANDARD

| |
|---|
| Many reaches of the Umatilla River and tributaries are designated as temperature limited on Oregon's 1998 303(d) list. In total, 287 stream miles are temperature limited (triggers for the standard (see temperature standard - i through viii) are exceeded and/or occur). |

Monitoring has shown that water temperatures in the Umatilla Basin often exceed numeric criteria of the State water quality standard. There are approximately 287 miles of stream segments within the Umatilla Basin on the 1998 §303(d) list for exceeding numeric temperature criteria (refer to **Table 9** and **Figure 12**). During the summer of 1998, temperature monitoring instruments recorded hourly stream temperatures at various locations throughout the Umatilla River Basin. **Figure 13** displays the locations and corresponding 7-day temperature statistic ranges. The only stream segments that had a 7-day maximum below 64$^{o}$F were located in the upper portion of the Basin (For further discussion regarding current condition stream temperatures, refer to **Appendix A-4**).

**Figure 12.** Segments on the 1998 §303(d) List for Temperature

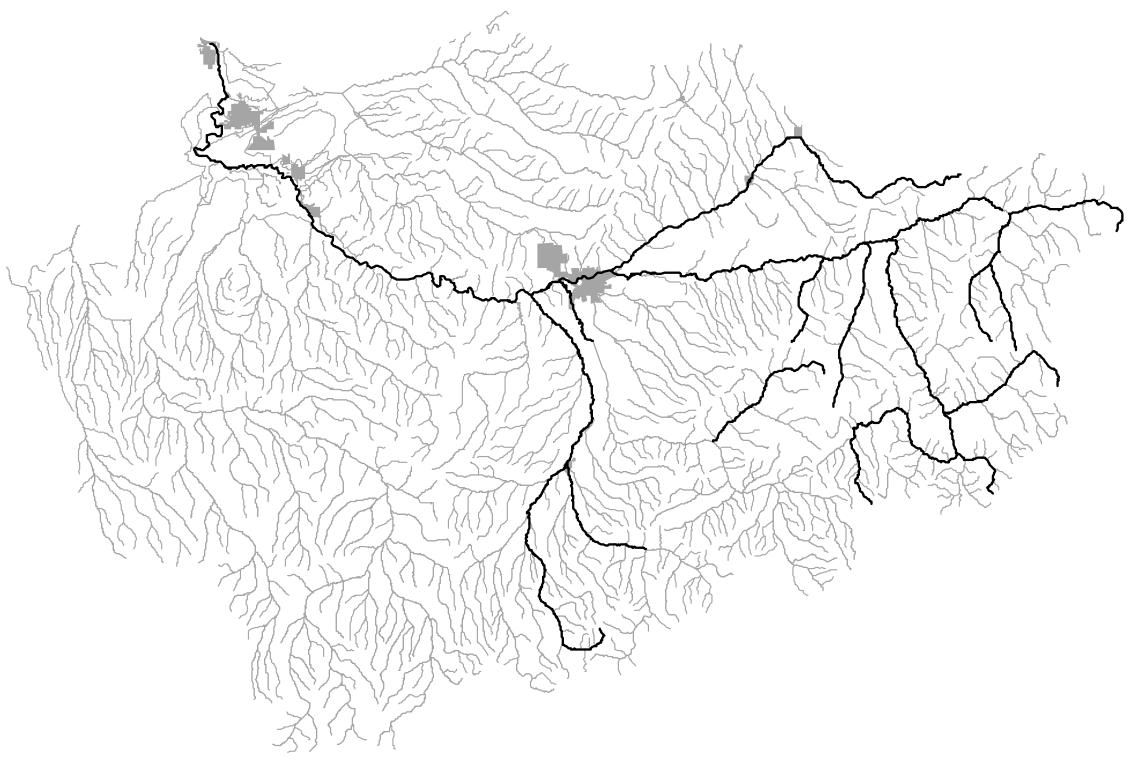


**Figure 13.** Continuous Temperature Monitoring Sites and 7-Day Statistic Ranges (greatest 7-day running average of daily maxima,1998 season)

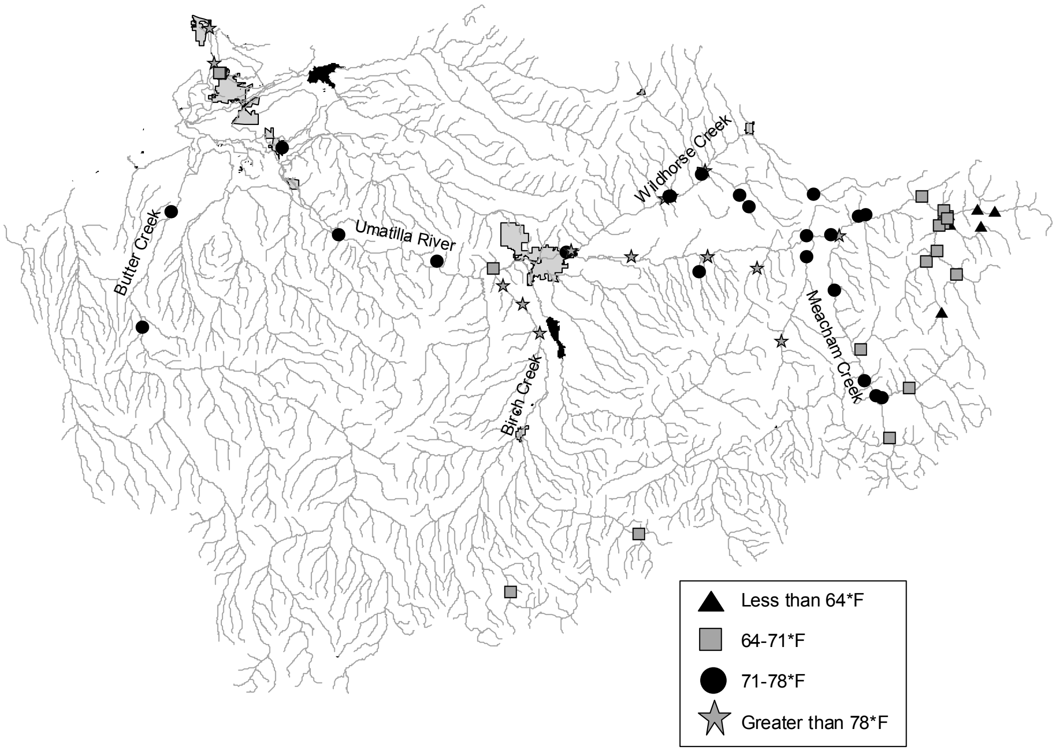



**Table 9.** 1998 §303(d) Temperature-Listed Segments and Applicable Numeric Criterion

*OAR 340-41-645(2)(b)(A)*

*Supporting Data:* Refer to the §303(d) list as document of record

| *Stream* | *Segment* | *Criterion* |
|---|---|---|
| Birch Creek | Mouth to Headwaters | Rearing 64°F (17.8°C) |
| Buckaroo Creek | Mouth to Headwaters | Rearing 64°F (17.8°C) |
| East Birch Creek | Mouth to Pearson Creek | Rearing 64°F (17.8°C) |
| EF Meacham Creek | Mouth to Headwaters | Rearing 64°F (17.8°C) |
| McKay Creek | Mouth to McKay Reservoir | Rearing 64°F (17.8°C) |
| Meacham Creek | Mouth to Headwaters | Rearing 64°F (17.8°C) |
| North Fork McKay Creek | Mouth to Headwaters | Rearing 64°F (17.8°C) |
| NF Meacham Creek | Mouth to Headwaters | Oregon Bull Trout 50°F (10°C) |
| North Fork Umatilla | Mouth to Headwaters | Oregon Bull Trout 50°F (10°C) |
| Shimmiehorn Creek | Mouth to Headwaters | Oregon Bull Trout 50°F (10°C) |
| South Fork Umatilla | Mouth to Headwaters | Oregon Bull Trout 50°F (10°C) |
| Squaw Creek | Mouth to Headwaters | Rearing 64°F (17.8°C) |
| Umatilla River | Mouth to Lick Creek | Rearing 64°F (17.8°C) |
| West Birch Creek | Mouth to Headwaters | Rearing 64°F (17.8°C) |
| Westgate Canyon | Mouth to Headwaters | Rearing 64°F (17.8°C) |
| Wildhorse Creek | Mouth to Headwaters | Rearing 64°F (17.8°C) |

## 2.1.1.3 EXISTING SOURCES - CWA §303(d)(1)

### 2.1.1.3.1 Non-point Sources of Pollution

Elevated summertime stream temperatures attributed to non-point sources in the Umatilla River Basin result from riparian vegetation disturbance (reduced stream-surface shade), summertime diminution of flow (reduced assimilative capacities) and channel widening (increased stream surface area exposed to solar radiation).

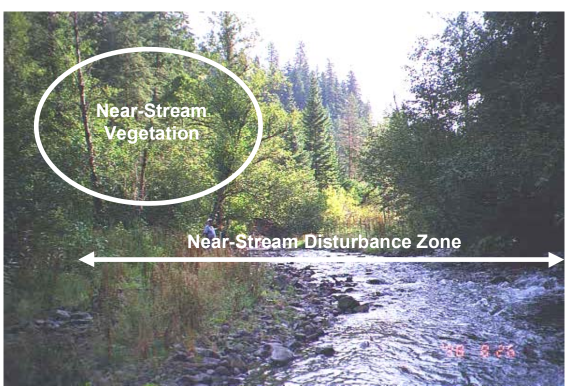
Riparian vegetation, stream morphology, hydrology, climate, and geographic location influence stream temperature. While climate and geographic location are outside of human control, riparian condition, channel morphology and hydrology are affected by land use activities. Human activities that contribute to degraded water quality conditions in the Umatilla Basin are associated with agriculture, forestry, roads, urban development and rural residential related riparian disturbance. The relationships that exist between factors that impact stream temperature are discussed in detail within **Appendix A-4**.

Specifically, the elevated summertime stream temperatures attributed to anthropogenic sources in the Umatilla Basin result from the items listed (1 through 3) below:

1. *Near stream vegetation disturbance/removal reduces stream surface shading via decreased riparian vegetation height, width and/or density, thus increasing the amount of solar radiation reaching the stream surface (shade is commonly measured as percent effective shade or open sky percentage). Riparian vegetation also plays an important role in shaping the channel morphology, resisting erosive high flows and maintaining floodplain roughness.*
2. *Channel widening (increased width to depth ratios) increases the stream surface area exposed to energy processes, namely solar radiation. Near-Stream Disturbance Zone (NSDZ)[*] widening decreases potential shading effectiveness of shade-producing near-stream vegetation.*
3. *Reduced summertime base flow results from stream withdrawals.*

Umatilla Basin groundwater influences on stream temperatures are being assessed by the CTUIR. This study (hyporheic potential) may provide basis for modification of TMDL allocations in potential future iterations of Umatilla Basin TMDLs.

[*] *Near-Stream Disturbance Zone (NSDZ) is defined for purposes of the TMDL as the width between shade-producing near-stream vegetation. This dimension was measured from Digital Orthophoto Quad (DOQ) images and where near-stream vegetation was absent, the near-stream boundary was used, defined as armored stream banks or where the near-stream zone is unsuitable for vegetation growth due to external factors (i.e., roads, railways, buildings, etc.).*



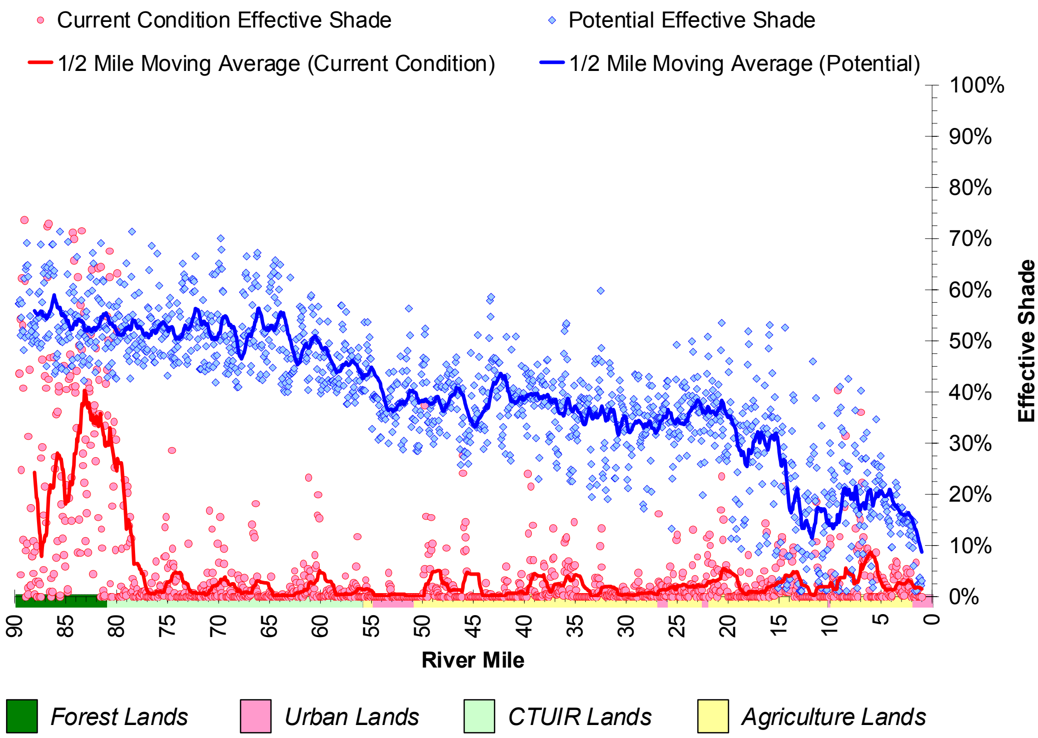

## NON-POINT SOURCES OF THERMAL POLLUTION #1

**Near stream vegetation disturbance and removal increases solar radiation loading (decreases shade) and causes channel instability that leads to channel widening (decreased resistance to flow velocity).**

*Near stream vegetation disturbance/removal reduces stream surface shading via decreased riparian vegetation height, width and/or density, thus increasing the amount of solar radiation reaching the stream surface (shade is commonly measured as percent effective shade).*

**Figure 14** displays the current and potential effective shade profile for the Umatilla River. Current near stream vegetation type, height, density and width were sampled from GIS[1] at 100 feet longitudinal intervals and 30-foot transverse intervals (up to 250 feet away from the stream edge). Potential near stream vegetation type was derived from field survey, literature and professional judgement. Average height and density were estimated based on the vegetation types, assuming mature healthy vegetation. These near stream vegetation targets were used (with morphology, aspect, etc.) to generate the Umatilla River potential effective shade profile. **Figures 22** through **25** display the current and potential near stream vegetation height.

**Figure 14.** Umatilla River Effective Shade - Current and Potential
98% of the stream segments are below the effective shade target
2% of the stream segments are above the effective shade target




[1] *Landsat Imagery and digital othrophoto quads were used to map and sample near stream vegetation (Appendix A-4).*

## (1A) NEAR STREAM VEGETATION - CURRENT CONDITIONS

The current condition of the near stream vegetation varies considerably in the Umatilla Basin. The majority of the upper tributary riparian vegetation is composed of narrow bands of hardwood and conifer species, including some National Forest lands. Galleries of large mature cottonwoods exist in some areas of CTUIR land. Lower mainstem and tributary reaches have riparian vegetation types primarily composed of shrubs, crops and grasses, with some scattered deciduous trees (i.e., ash, cottonwood, and alder). Much of the lower mainstem is diked, and trees are actively prevented from growing on the dikes.

Undisturbed riparian areas in the Umatilla Basin generally progress towards late seral woody vegetation communities. Few, if any, riparian areas in the Umatilla Basin are unable to support either late seral woody vegetation or tall growing herbaceous vegetation. A recent report regarding wildlife habitats in the Umatilla and Willow Creek Basins examines the differences between current and pre-settlement vegetation coverages (Kagan, 1999). The following quote from that report exemplifies the drastic changes that have occurred in the riparian landscape since European settlement:

> *"The most notable difference between the landscape in the study area now and in the 1850s is the conversion of native prairie to farmland. The large, forested riparian areas along the Umatilla River have largely disappeared. However, the most interesting change is the current lack of water in many areas where the original General Land Office (GLO) surveyors reported abundant springs and small creeks. These were recorded on a township basis and the differences are striking…"*
>
> *"The greatest percentage losses are in the riparian communities. These bottomland hardwood and willow communities show losses of 87%, and are clearly underestimated. Only the largest riparian bottomland areas were reported by the GLO surveyors* [are] *included in the map. Many thousands of acres dominated by willows with scattered alder and cottonwood were not reported, and therefore the 87% loss indication has been significantly underestimated. Actual losses are probably greater than 95%."*

### Umatilla River LandSat Vegetation Height Classification

Existing vegetation heights were determined from infrared satellite data (LandSat) that was classified into dominant species type, canopy density, and stand size (Pacific Meridian, 1997). Pacific Meridian used ground truthing and aerial photograph analysis during LandSat vegetation classification. Additionally, the Oregon ODEQ collected riparian species, size, and density data at several sites in the Umatilla River Sub-basin during the summer of 1999. ODEQ then used that data to further verify the LandSat accuracy. Every LandSat near-stream vegetation code was also quality checked against aerial photographs (digital orthophoto quads) by ODEQ.

The LandSat vegetation data is comprised of 25-meter pixels, each coded for species type, canopy density, and size/structure. Species type is coded according to the dominant existing over-story species. Canopy density is presented as the percentage of ground that is covered by over-story vegetation when viewed from directly above. LandSat size/structure classes are divided by diameter at breast height (dbh) of woody trees. Additionally, the LandSat size/structure class denotes whether the stand is single or multiple story. Shown below are the size/structure codes from the LandSat data (Pacific Meridian, 1997).

| | | |
|---|---|---|
| Non-Forested: | | |
| 1) | Water | |
| 2) | Rock, Sparsely Vegetated | |
| 3) | Snow | |
| 4) | Herbaceous/Grass | |
| 5) | Agriculture | |
| 6) | Developed | |
| 7) | Shrub | |
| Single Story: | | Seedling Sapling = 0-4.9" dbh |
| 8) | Seed-Sap | Pole = 5.0-9.9" dbh |
| 9) | Pole | Small = 10.0-14.9" dbh |
| 10) | Small | Medium = 15.0-19.9" dbh |
| 11) | Medium | Large = 20-29.9" dbh |
| 12) | Large | X-Large = 30" + dbh |
| 13) | X-Large | |
| Multi-Storied: | | |
| 14) | Pole/MS | |
| 15) | Small/MS | |
| 16) | Medium/MS | |
| 17) | Large/MS | |
| 18) | X-Large/MS | |

Non Forest – If the total tree crown closure is ≤ 10%, then the site is labeled with the appropriate Non Forest class.

Canopy Layer – If over 85% of the total tree crown closure is present in one canopy layer, then it is single-story, else it is Multi-Storied.

*Conversion of DBH to Tree Height*

Existing tree heights were calculated from the specified LandSat DBH using species-specific growth curves (Hann, 1997 and Richards 1959). LandSat presents the DBH in ranges, so ODEQ applied the middle (average) value of the range for each size/structure class. Below is the Chapman-Richards Asymptotic Nonlinear Regression Module equation that is used to determine heights based on known DBH values (Richards, 1959).

$$H = 1.37 + \left(b_o\left[1 - \exp\left(b_1 \cdot DBH\right)\right]^{b_2}\right)$$

*Where,*

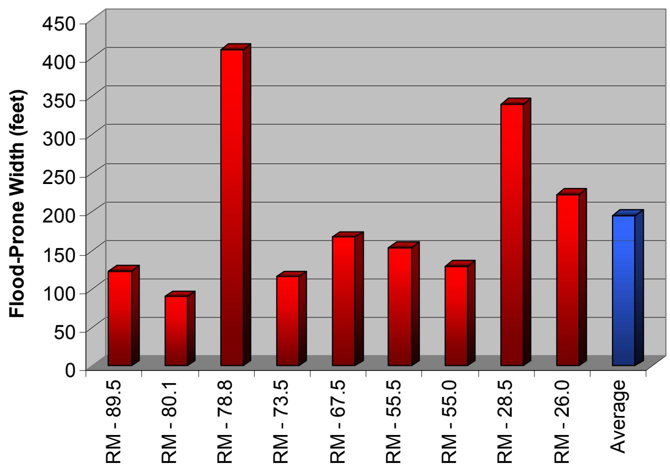
*H = Height of Tree*
*$b_0$ = regression variable*
*$b_1$ = regression variable*
*$b_2$ = regression variable*
*DBH = Diameter at Breast Height*

As previously mentioned, the calculated existing tree heights were confirmed through comparison with aerial photograph (digital orthophoto quad) and ground-truth data.

## (1B) NEAR STREAM VEGETATION – POTENTIAL CONDITIONS

The estimated potential riparian width, unless specified in the figures, is assumed to extend at least to the edge the flood prone area. For healthy riparian conditions, a vegetation buffer width equal to the flood-prone width is often a desirable minimum. The flood-prone width is defined (Rosgen, 1996) as the cross-sectional valley or floodplain width (perpendicular to the channel) at twice the bankfull height. These have been estimated as presented in **Figure 15**. The term *entrenchment* describes the condition where the floodprone and bankfull widths are similar. In reaches that are relatively entrenched the flood prone width is not sufficient as a guide for minimum buffer width.

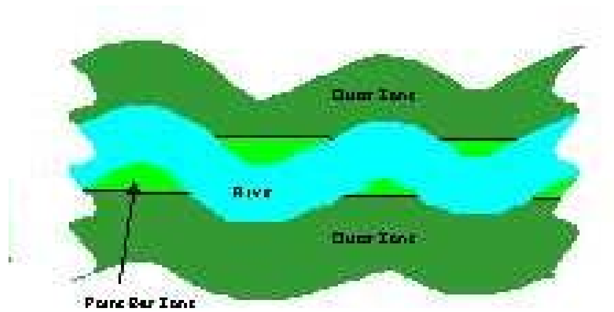
**Figure 15.** Estimated Flood-Prone Widths




The 'system potential' or 'site potential' (these terms are often used interchangeably in this text) vegetation and channel characteristics were estimated by the Umatilla Basin TMDL Technical Committee. This characterization is discussed below and included as **Appendix A-3**. It should be recognized that this characterization is used for model input conditions to predict potential future temperatures, and as the best estimate available of attainable conditions that lead to improved water quality. Not all attributes are allocated. The TMDL allocations and model simulation are based on this characterization, but floodprone width, channel cross-sectional area, point bar zones, etc. are not allocated in the TMDL process. Refer to **Section 2.1.1.6** for the definition of the temperature TMDL allocations and associated surrogates. The Department recognizes that site potential condition characterization should be re-evaluated as more information is available and as progress is achieved.

In characterizing potential riparian vegetation, the Umatilla TMDL Technical Committee considered two zones along the stream - the point bar and outer zones. These are illustrated in **Figure 16**. The inner width (point bar zone) is an average width applied along 50 percent of the length of each bank. The outer zone contacts the bank along the other 50 percent of its length. That is, both banks are full-length vegetated, but along each bank the zone in contact with the stream alternates as shown in **Figure 16**. On each bank, one half of the stream-length is occupied by the point bar zone vegetation and the other half is occupied by the outer zone vegetation. The outer zone is ever present, but only abuts a bank for half of the stream-length. The potential width of the point bar zone, specified in the figures below, is a mean width measured perpendicular to the channel.

**Figure 16.** Map of Predicted Riparian Configuration




The near stream vegetation width was simulated in temperature modeling as comprised of these two zones. For the purpose of the simulation, the maximum near stream vegetation width accounted for is 150 feet. Data input for simulation required simplification of the Committee's characterization of potential vegetation, as follows:

- Point Bar Zone - 50 feet from bankfull edge, 50 feet tall vegetation, zone is continuous along stream length
- Outer Zone – 100 feet from Point Bar Zone edge

The site potential riparian vegetation density is assumed to be 80 percent. Estimated potential riparian vegetation density for modeling purposes can be defined as the percent area of ground surface visible on aerial photographs or the percent open sky measured by an instrument such as a densiometer, within stream-side vegetated areas. An overall average density value was assumed due to the characteristic variability and complexity of riparian density and the inherent difficulty in extrapolation into the future. The 80 percent values is based on professional judgement extrapolated from:

- Umatilla Basin aerial photography interpretation of mature stands;
- Satellite-based interpretation (canopy density for existing stands) reported by Pacific Meridian, CTUIR and ODF for the upper Basin, and;
- Knowledge of typical measured values, e.g., cottonwood Galleries are normally 100 percent, pine forests 70-90 percent, etc.

Tree heights were selected from the literature and measured along the Umatilla River. The listed potential vegetation either occurs or is likely to have occurred historically along the Umatilla River. Further monitoring is encouraged to refine this estimate of site potential vegetation height, width and density. Note that the intent is not to specify desired or required tree types but rather to characterize the potential riparian buffer dimensions. In instances where planting is recommended, riparian species that support stream habitat and stream surface shade production should be considered. In the future, TMDL load allocations can be re-assessed to include alternative determinations of healthy riparian species.

**Height Values for Potential Vegetation Communities (USDA 1974, maximum heights)**

- Coyote Willow - 10 feet
- Bebb Willow - 15 feet
- Pacific Willow - 60 feet (expected in healthy eastern Oregon riparian zones at lower elevations such as downstream from Pendleton)
- Mixed Willow - 30 feet (average of the three above)
- Thinleaf Alder - 30 feet
- White Alder - 80 feet (used 70 feet, measured below Pendleton)
- Black Cottonwoods - 200 feet, but average large Cottonwood local measurements are applied here: 112 feet above Pendleton, 100 feet in and below Pendleton
- Choke Cherry - 30 feet
- Red Osier Dogwood - 8 feet

*Other species, particularly in the upper Basin, including Englemann Spruce, Larch, Quaking Aspen, mixed Willow and various Firs, Pines and Alders are reported in Crowe and Clausnitzer, 1997 and Audubon Society, 1988, Field Guide to North American Trees. Mature heights (mid-range or average height) for shade producing species in this citation include:*

- Quaking Aspen - 75 feet
- Grand Fir - 135 feet
- Douglas Fir - 75 feet
- Mountain Alder - 35 feet
- Ponderosa Pine - 95 feet (60-130 feet in height, Audubon, 1988; 125-180 feet, Bever, 1981)

Within each zone identified in **Table 10,** the mature heights of characteristic species within the zone are averaged, each with equal weight.

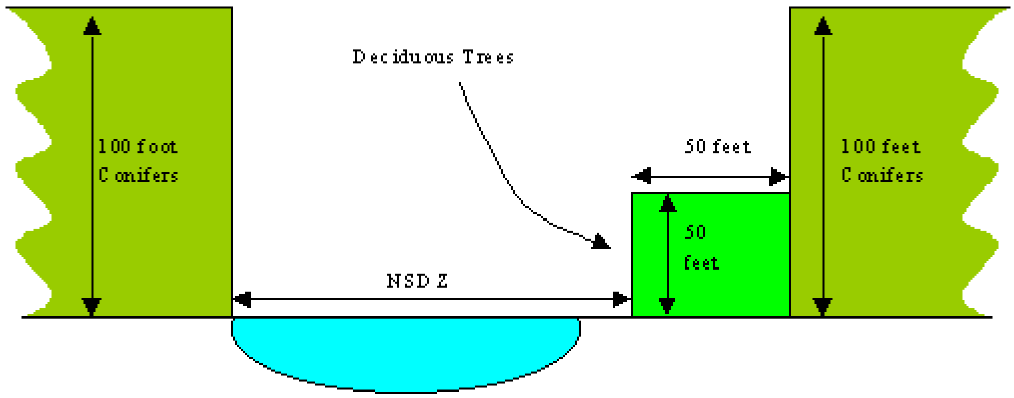
**Table 10.** Potential Near Stream Vegetation Types and Heights
(average mature heights, sorted by reaches)

| Reaches | Point Bar Zone (50% of stream length) | | Outer Zone (50% of stream length) | |
|---|---|---|---|---|
| | Shade Producing Vegetation Types | Average Mature Height | Shade Producing Vegetation Types | Average Mature Height |
| Mainstem - Above Meacham Creek (N/S Forks to river mile 78.8) | **Deciduous** - Quaking Aspen, Black Cottonwood, Mountain Alder, mixed Willow, Red Osier Dogwood | 50 feet | **Conifer** - Grand Fir, Douglas Fir (Ponderosa Pine increasing downstream) | 100 feet |
| Mainstem - Meacham Creek to Pendleton (river mile 78.8-55.5) | Coyote Willow, Bebb Willow, Pacific Willow, Thinleaf Alder, White Alder, Cottonwood, Ponderosa Pine | 55 feet | Cottonwood Stands | 112 feet |
| Mainstem - Pendleton (Hwy 11 to McKay Creek, river mile 51.0-55.5) | Coyote Willow, Bebb Willow, Pacific Willow, Thinleaf Alder, White Alder, interspersed Cottonwood | 50 feet | Cottonwood Stands | 100 feet |
| Mainstem - Below McKay Creek to Butter Creek (river mile 15.0-51.0) | Coyote Willow, Bebb Willow, Pacific Willow, Thinleaf Alder, White Alder, interspersed Cottonwood | 50 feet | Cottonwood Stands | 100 feet |
| Mainstem - Butter Creek to mouth (river mile 0.0-15.0) | Coyote Willow, Bebb Willow, Pacific Willow, Thinleaf Alder, White Alder, interspersed Cottonwood | 50 feet | Same as Point Bar Zone | 50 feet |
| Tributary – Forested Lands (identified in USGS land use mapping) | **Deciduous** - Quaking Aspen, Black Cottonwood, Mountain Alder, mixed Willow, Red Osier Dogwood | 50 feet | **Conifer** - Grand Fir, Douglas Fir (Ponderosa Pine increasing downstream) | 100 feet |
| Tributary – Butter Creek Upstream from RM 20 to Forested Lands (identified in USGS land use mapping) | Coyote Willow, Bebb Willow, Pacific Willow, Thinleaf Alder, White Alder, interspersed Cottonwood | 50 feet | Same as Point Bar Zone | 50 feet |
| Tributary – Non-Forested Lands (identified in USGS land use mapping) | Coyote Willow, Bebb Willow, Pacific Willow, Thinleaf Alder, White Alder, interspersed Cottonwood | 50 feet | Cottonwood Stands | 100 feet |

**Upstream from Meacham Creek**

The vegetation dimensions illustrated below are estimated as system potential for the Umatilla Mainstem reaches upstream from Meacham Creek. The longitudinal distribution for each bank is 50% the right-bank geometry and 50% the left, as described previously in this section. In this section and much of the river below, it is recognized that the level of natural disturbance and moisture availability in the point bar zone argues for an alternating band riparian assemblage as indicated in the figure below and in the map view of **Figure 16**.

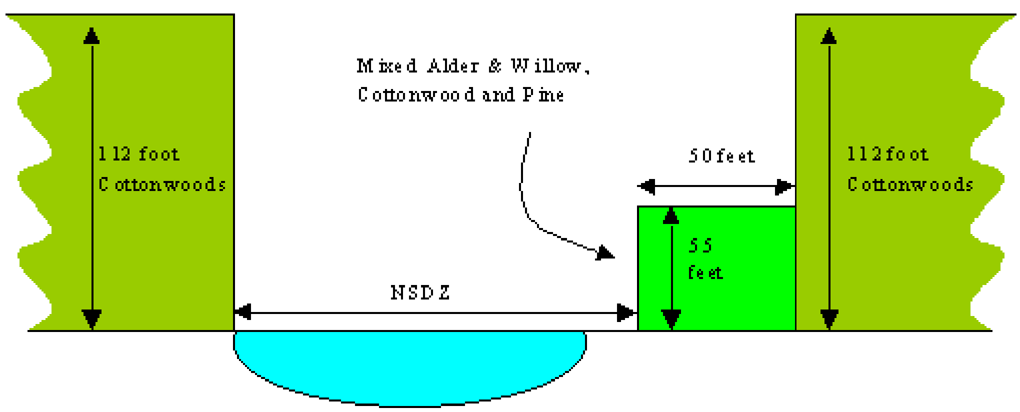
**Figure 17.** Potential Mainstem Vegetation Cross-Section, Upstream from Meacham Creek




**Meacham Creek to Pendleton**

The vegetation dimensions illustrated below are estimated as system potential for the Umatilla Mainstem reaches from Meacham Creek to Pendleton. The longitudinal distribution for each bank is 50% the right-bank geometry and 50% the left, as described previously in this section. This zone has less tall conifers than the reaches above and in contrast with Pendleton is observed to support pine and taller Cottonwoods.

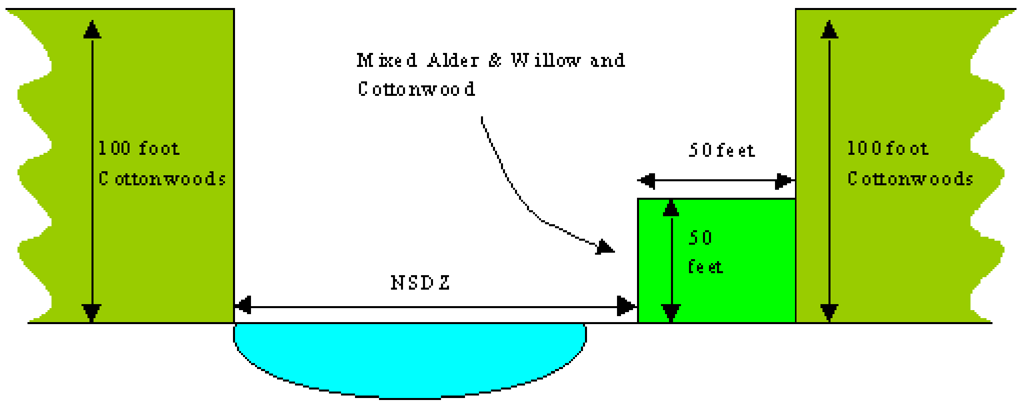
**Figure 18.** Potential Mainstem Vegetation Cross-Section, Meacham Creek to Pendleton



**In Pendleton**

The vegetation dimensions illustrated below are estimated as system potential for the Umatilla Mainstem reaches from the Highway 11 Bridge in Pendleton to McKay Creek. The longitudinal distribution for each bank is 50% the right-bank geometry and 50% the left as described previously in this section. Occasional Cottonwoods are observed up to the rivers edge, interspersed with alder, willow and other trees of similar height to the alder/willow.

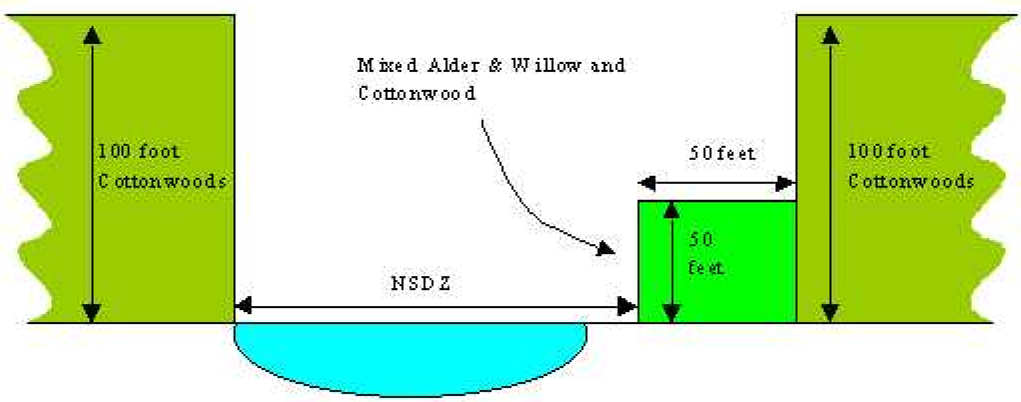
**Figure 19.** Potential Mainstem Vegetation Cross-Section, in Pendleton




**Between Pendleton and Butter Creek**

The geometry illustrated below is the estimated system potential for the Umatilla Mainstem reaches from immediately below McKay Creek to Butter Creek. The longitudinal distribution for each bank is 50% the right-bank geometry and 50% the left as described previously in this section. This section appears similar enough to Pendleton to be equivalently characterized. Width is probably less limited here.

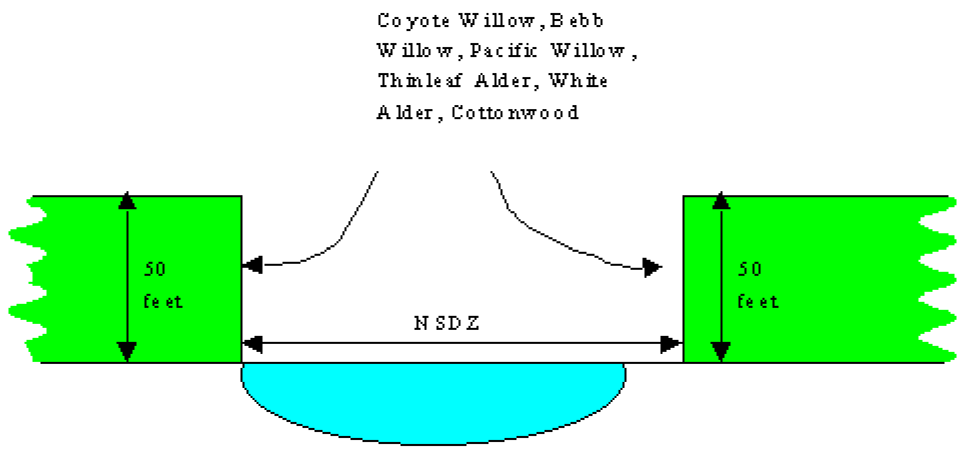
**Figure 20.** Potential Mainstem Vegetation Cross-Section, Pendleton to Butter Creek



**From Butter Creek to the mouth of the Umatilla River**

The vegetation dimensions illustrated below are estimated as system potential for the Umatilla Mainstem reaches below Butter Creek. Potential galleries of taller trees such as Cottonwoods would be scarce due to thin soils and relatively rocky banks and less groundwater availability though interspersed Cottonwoods and small stands are present currently, e.g., river mile 1.5, east bank.

**Figure 21.** Potential Mainstem Vegetation Cross-Section, Butter Creek to mouth




**Tributaries**

System potential vegetation goals are needed for the major tributaries and lower order streams. The vegetation geometry described for the Umatilla River upstream from Meacham Creek will be assumed for forested areas (using USGS land use map). The vegetation geometry described for the mainstem from Pendleton to Butter Creek will be applied elsewhere except for the thin soil on basalt area of Butter Creek between stream mile 20 and the forest. The lower mainstem vegetation geometry below river mile 15 is assumed for this specified area along Butter creek.

**Diagrams of mainstem vegetation**

**Figures 22** through **25** illustrate assessed-current and estimated-potential vegetation height and width, as simulated to evaluate river temperatures. Note that existing conditions were assessed up to 250 feet from the bank, whereas site potential was accounted for (in simulations for temperature predictions) within 150 feet of the bank. The greatest temperature influences occur adjacent to the channel, and the actual width needed for habitat, sediment filtration/trapping etc., is not addressed in the temperature TMDL. These assessed and simulated widths are not prescriptive; they provide information for model input. The TMDL allocation of percent effective shade (**Section 2.1.1.6**) can be obtained with varying buffer widths.

**Figure 22.** Umatilla River Near Stream Vegetation - Current Condition and Potential (RM 89.6 to RM 67.4)

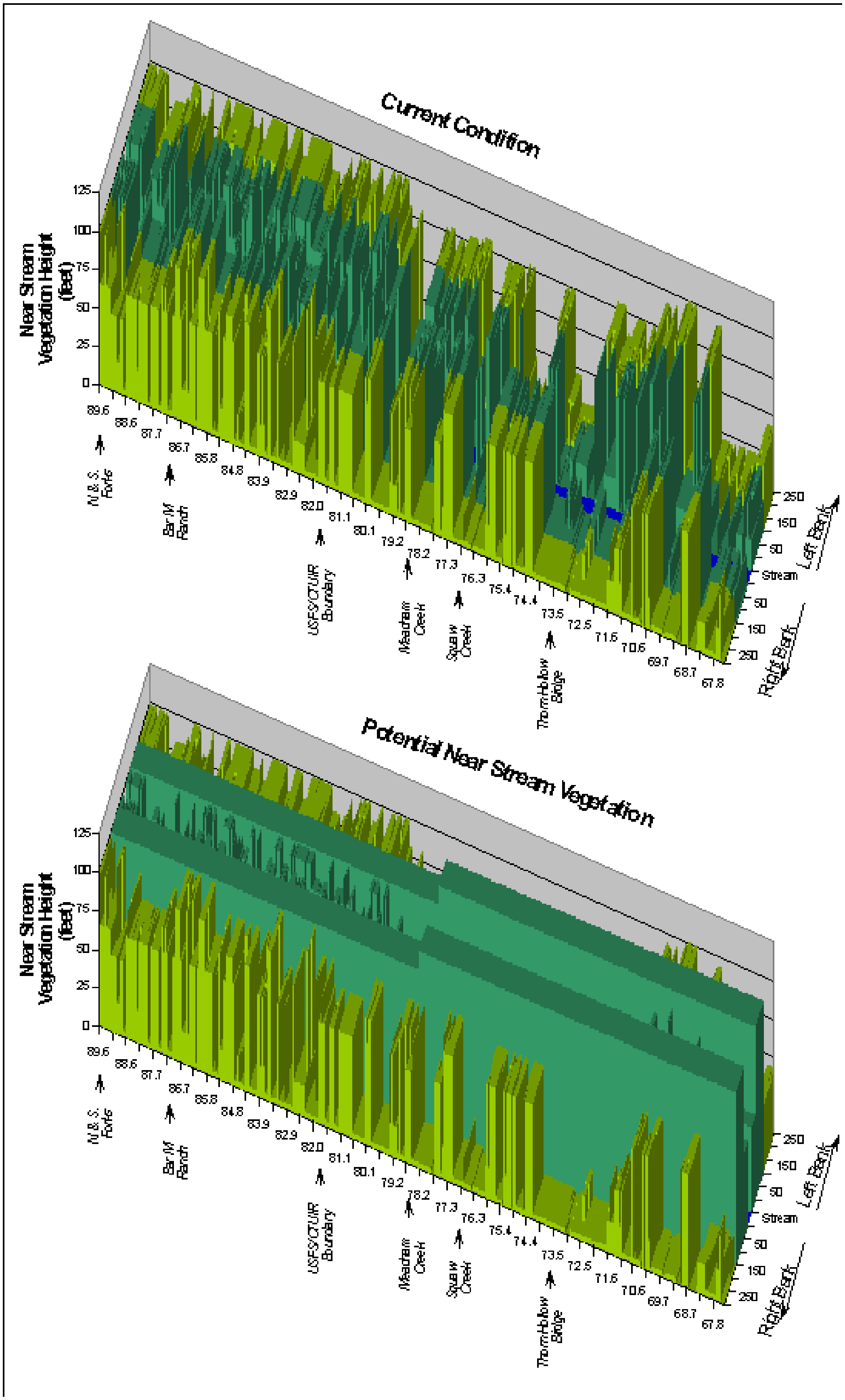

Current Condition
Near Stream Vegetation Height (feet)
125
100
75
50
25
0
89.6
88.6
87.7
86.7
85.8
84.8
83.9
82.9
82.0
81.1
80.1
79.2
78.2
77.3
76.3
75.4
74.4
73.5
72.5
71.6
70.6
69.7
68.7
67.8
N & S Forks
Bar M Ranch
USFS/CTUIR Boundary
Meacham Creek
Squaw Creek
Thorn Hollow Bridge
250
150
50
Stream
50
150
250
Left Bank
Right Bank
Potential Near Stream Vegetation
Near Stream Vegetation Height (feet)
125
100
75
50
25
0
89.6
88.6
87.7
86.7
85.8
84.8
83.9
82.9
82.0
81.1
80.1
79.2
78.2
77.3
76.3
75.4
74.4
73.5
72.5
71.6
70.6
69.7
68.7
67.8
N & S Forks
Bar M Ranch
USFS/CTUIR Boundary
Meacham Creek
Squaw Creek
Thorn Hollow Bridge
250
150
50
Stream
50
150
250
Left Bank
Right Bank

**Figure 23.** Umatilla River Near Stream Vegetation - Current Condition and Potential (RM 67.4 to RM 42.2)

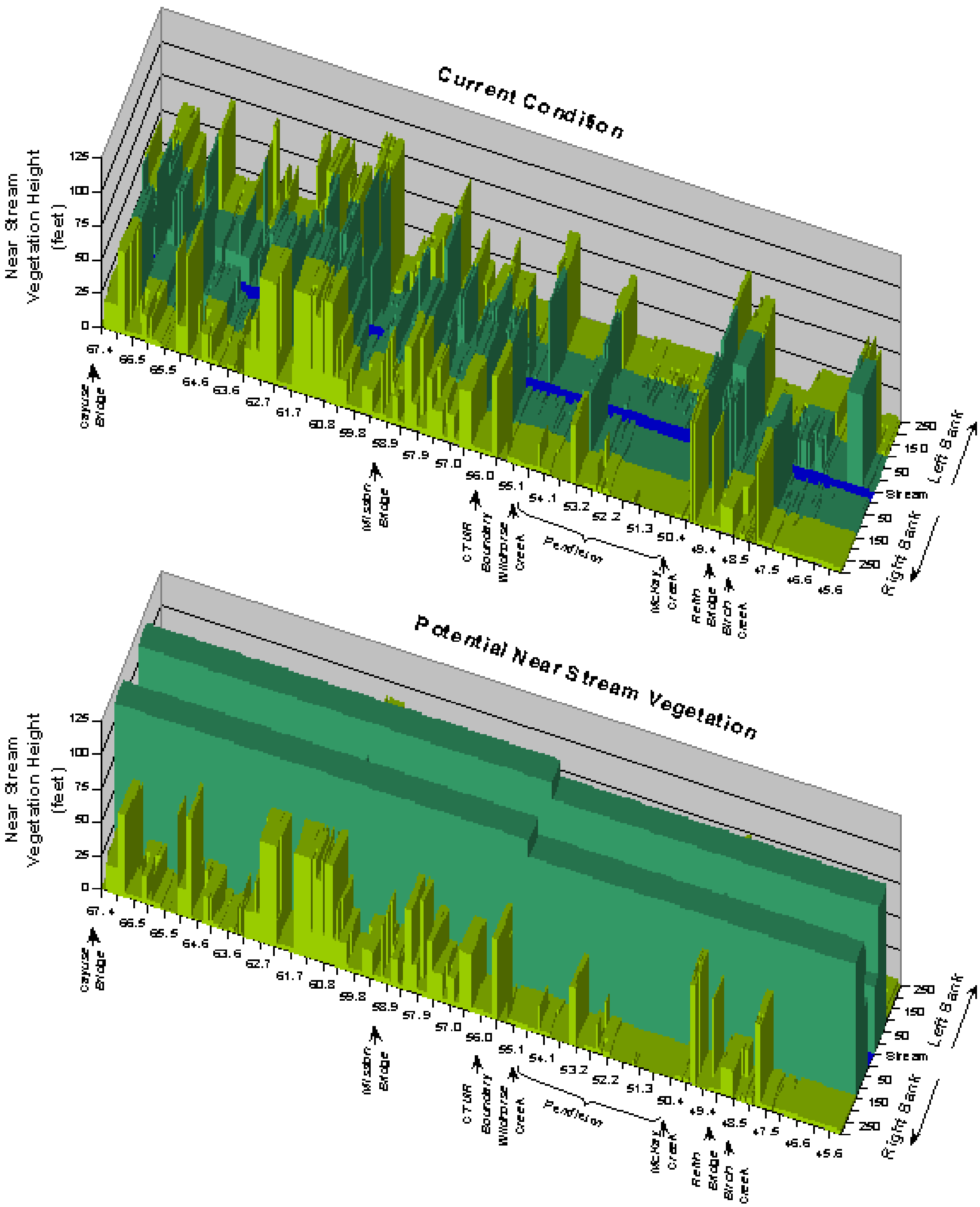


**Figure 24.** Umatilla River Near Stream Vegetation - Current Condition and Potential (RM 42.2 to RM 23.1)

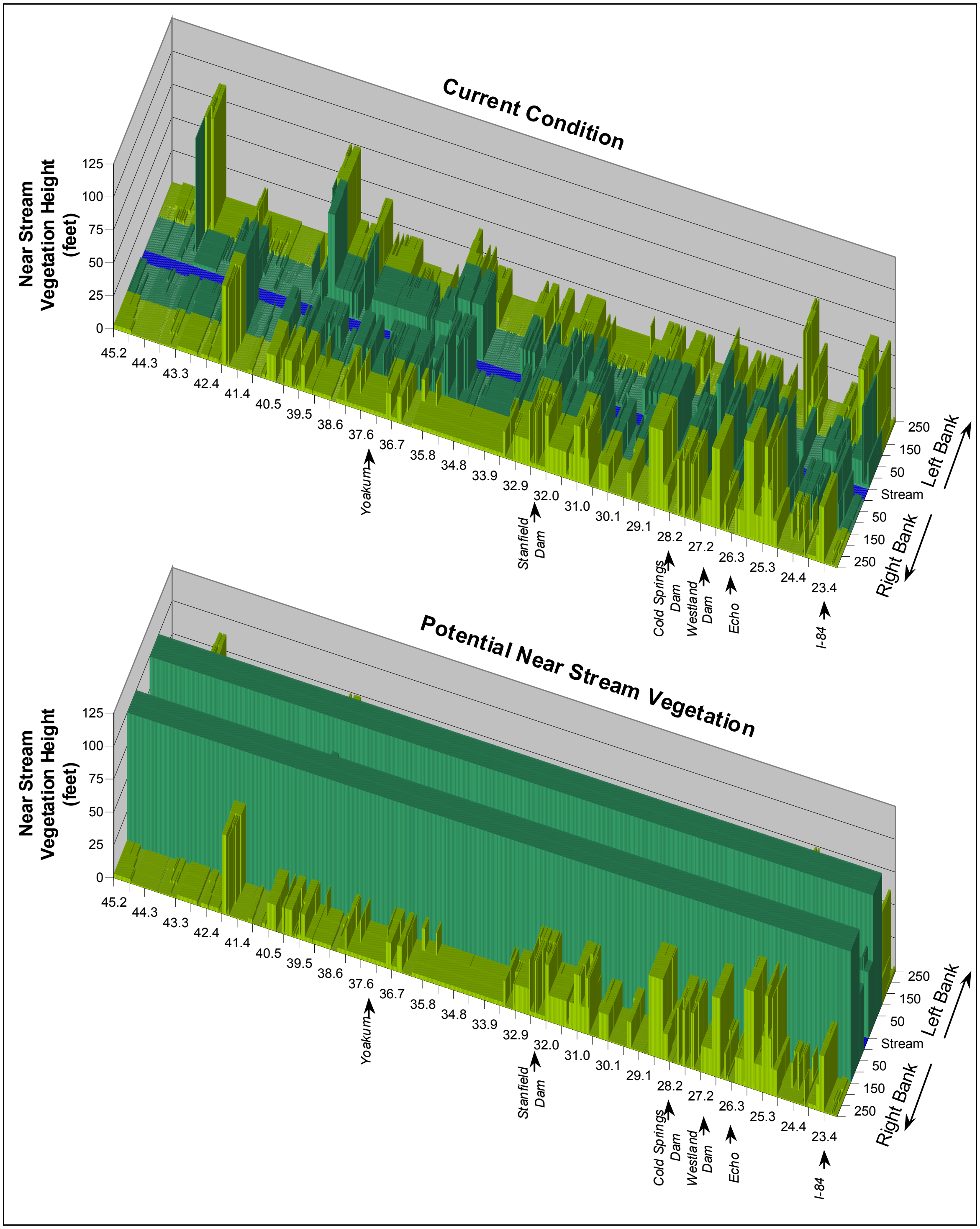
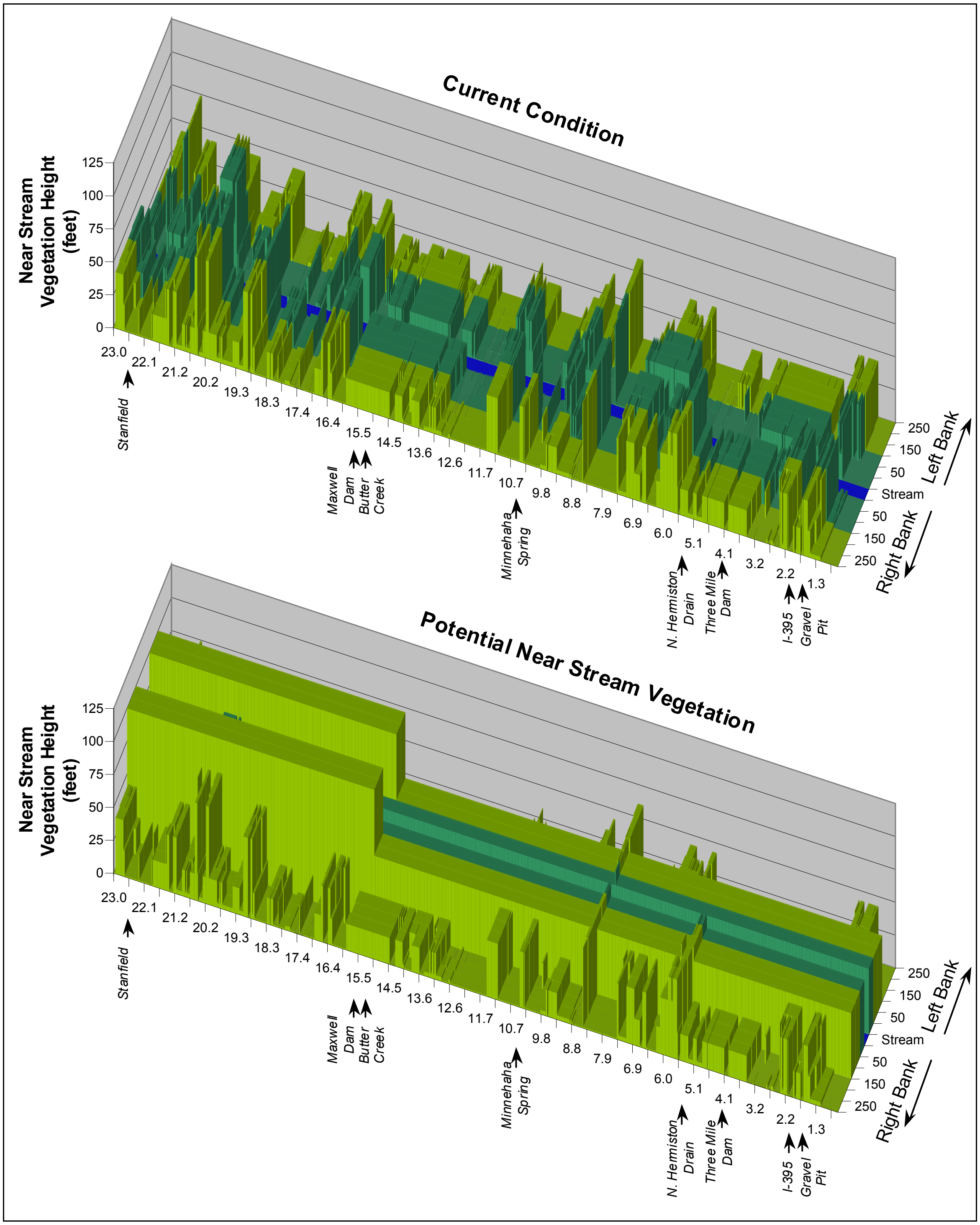


**Figure 25.** Umatilla River Near Stream Vegetation - Current Condition and Potential (RM 23.1 to RM 0.6)



## NON-POINT SOURCES OF THERMAL POLLUTION #2

**Channel widening has occurred in many Umatilla Basin stream segments. This widening is a result of channel and riparian disturbance. A wider channel compounds increased solar radiation loading (decreased shade) with an increased stream surface area exposed to solar radiation loading.**

*Stream width is largely a function of high flow volume magnitude and frequency, sediment supply and transportation, stream bed and bank materials and stability (Rosgen 1996 and Leopold et al. 1964). The Umatilla River has wide channels in many areas that result from channelization, disturbance/removal of riparian vegetation and changes to the sediment regime. Channel widening (increased near stream disturbance zone width, bankfull width and width to depth ratios) increases the stream surface area exposed to energy processes associated with solar radiation. Channel widening decreases potential shading effectiveness of shade-producing near-stream vegetation.*

## (2A) ROSGEN STREAM TYPE – LEVEL I

In 1998, members of the Umatilla TMDL Technical Committee used a field method, the Rosgen Level I & II Inventory, to classify stream channel types on the Umatilla River, as well as several tributaries. Level I Rosgen stream classifications break streams into groupings (letters A through G) that relate channel morphology to valley shape, and channel patterns, slope and cross-section. **Figure 26** displays Rosgen Level I stream types and sample locations. **Table 11** presents the general parameter ranges associated with Rosgen Level I classification. Detailed descriptions of Rosgen stream type classifications can be obtained from Rosgen (1994) and are summarized in **Figure 27**.

## (2B) ROSGEN STREAM TYPE – LEVEL II

Rosgen Level II morphologic classifications considers all of the Level I parameters as well as substrate particle size, entrenchment ratio, width to depth ratio and sinuosity. Level II classifications can provide insight as to reach-specific sediment supply, sensitivity to disturbance and the potential for natural recovery. Twenty-four Level II Rosgen classifications were performed for the Umatilla mainstem and selected tributaries during the summer of 1998 (Williams et al., 1998). Generalized characteristics can be associated with each of the Level II Rosgen stream classes that relate channel morphology to sensitivity to disturbance, recovery potentials, sediment supply, streambank erosion potential and vegetation controlling influence. Rosgen (1994) presents these characteristics to provide guidance to riparian and sediment management.

The level II Rosgen stream morphology classification system to describe existing and future potential stream type assessment is summarized in **Table 12**, based on 1997 and 1998 Rosgen Level II Inventories (Inventories) of nine Umatilla River mainstem reaches and best professional judgement.[2] Potential level II stream types are considered the highest ecological status attainable. Limiting factors in channel morphology restoration include influences of the riparian area, influences of channelization, levees, structures in floodplains, channel constriction (via roads, bridges, railroad), urbanization, management practices, historical and existing dams.

[2] Rosgen stream typing provides a widely accepted methodology for categorizing stream channel characteristics. Qualified staff from USFS, CTUIR, ARS and DEQ employed professional judgement for developing level II potential stream types. Further monitoring is recommended to expand the existing coverage and to support progress evaluation.

**Figure 26.** Umatilla Basin Morphologic Assessment – Rosgen Classifications

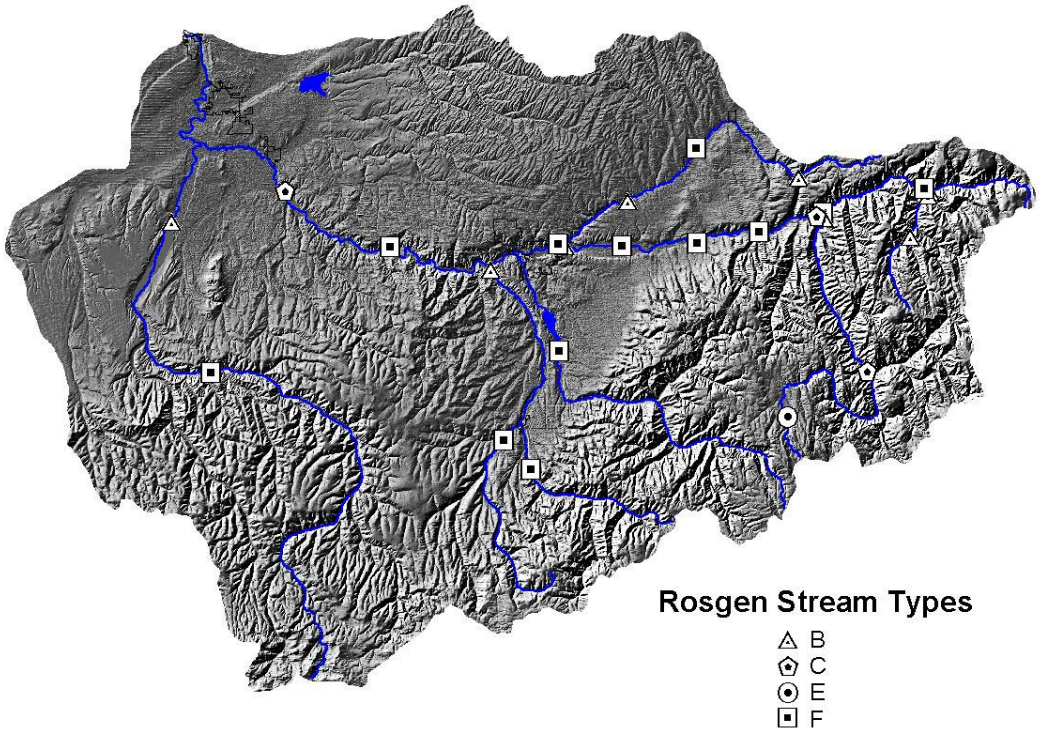



**Figure 27.** Slope Ranges, Cross-Sections and Plan Views of Level I Rosgen Stream Types
*(Image from Rosgen, 1996)*

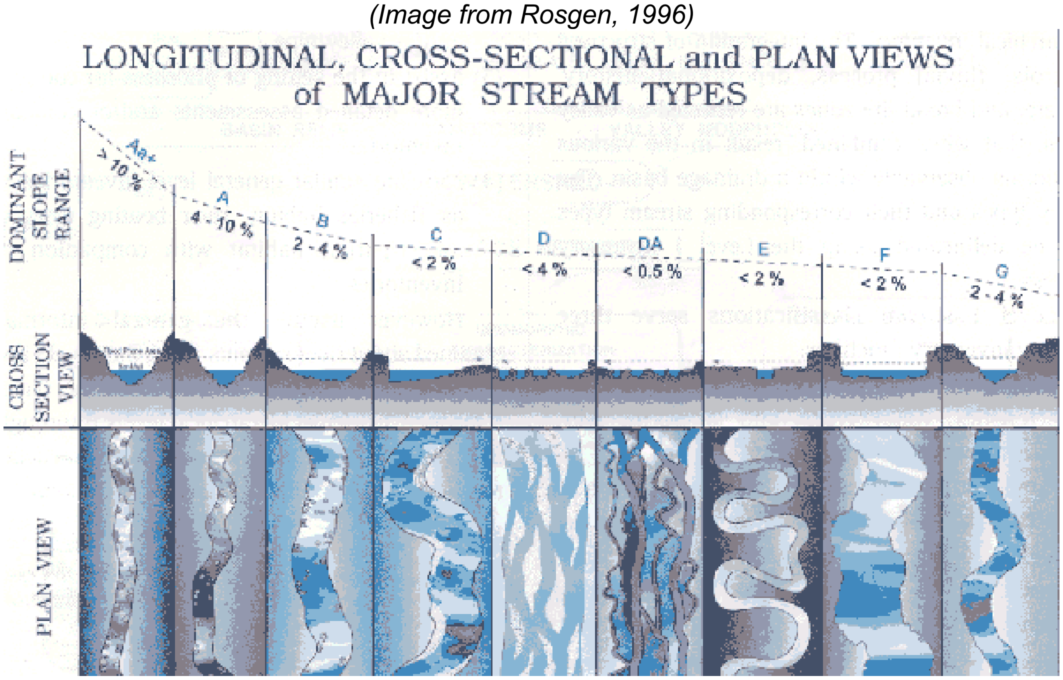


**Table 11.** Generalized Parameter Ranges for Level I Rosgen Stream Types
*(Data taken form Rosgen, 1996)*

| | Entrenchment | Sinuosity | Width to Depth | Stream Type |
|---|---|---|---|---|
| Single-Thread Channels | High (< 1.4) | Low (<1.2) | Low (<12) | A |
| | | Moderate (>1.2) | | G |
| | | | Moderate/High (>12) | F |
| | Moderate (1.4-2.2) | | Moderate (>12) | B |
| | Low (>2.2) | Very High (>1.5) | Very Low (<12) | E |
| | | High (>1.2) | Moderate/High (>12) | C |
| Multiple Channels | | Low (<1.2) | Very High (>40) | D |
| | | Low-High (1.2-1.5) | Low (<40) | $D_A$ |

**Table 12.** Rosgen Level II Stream Type Assessments

| Reach | Site Extent (River Miles) | Level II Type (1997) | Level II Type (1998) | Level II Type (potential) |
|---|---|---|---|---|
| Forks to Bear Creek | 90.0-87.0 | B4c | F4 | B4 |
| Bear to below Rock Creek | 87.0-86.3 | - | - | C4 |
| Below Rock Creek to Gray's property | 86.3-82.0 | - | F4 | B4 |
| Gray's to Meacham Creek | 82.0-78.8 | - | - | C4/B4 |
| Meacham Creek to Squaw Creek | 78.8-76.7 | C4 | C4 | C4 |
| Squaw Creek to Buckaroo Creek | 76.7-73.4 | - | F4 | C4 |
| Buckaroo Creek to Cayuse Bridge | 73.4-67.5 | - | F1/F4 | C4/F1 |
| Cayuse Bridge to above Mission Creek | 67.5-60.0 | - | - | C4 |
| Above Mission Creek to developed area | 60.0-57.0 | B1c | F1/F4 | C4 |
| Developed area to Hwy 11 | 57.0-55.5 | - | B1c/ B3c | C4 |
| Hwy 11 to Westgate Road (prison) | 55.5-51.5 | F1 | F4 | F4 |
| Westgate Road to McKay Creek | 51.5-51.0 | - | - | F4/B4c |
| McKay Creek to Birch Creek | 51.0-48.3 | - | - | C4/B4c |
| Birch Ck. To Yoakum Bridge | 48.3-37.0 | F4 | - | C4 |
| Yoakum Bridge to Stanfield Dam | 37.0-32.3 | | | C4 |
| Stanfield Dam to Westland Dam | 32.3-27.3 | - | - | B4c**/C4 |
| Westland Dam to Stage Gulch | 27.3-21.5 | F4 | C4 | C4 |
| Stage Gulch to Maxwell Dam | 21.5-15.0 | - | - | C4 |
| Maxwell Dam to below Hermiston WWTP | 15.0-5.0 | - | - | F4/C4 |
| Hermiston WWTP to Three Mile Dam | 5.0-3.0 | - | - | F1 |
| Three Mile Dam to mouth/slackwater | 3.0-0.0 | - | - | F1 |

## (2C) CHANNEL WIDTH – CURRENT CONDITION

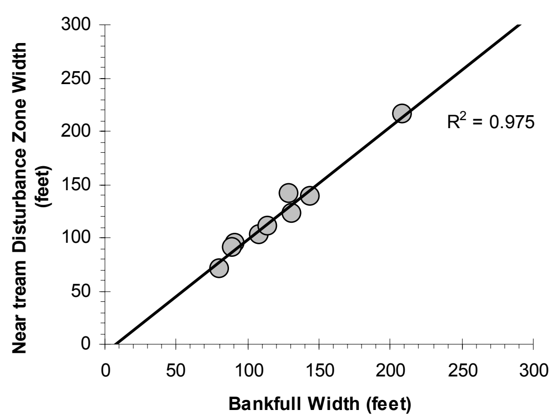
The bankfull width is defined (Rosgen, 1996) as the channel width (perpendicular to the channel) at the bankfull height. Bankfull channel widths often increase in the downstream direction and may occur in a step-wise manner as a function of discharge and stream type changes at a major confluence. The bankfull widths measured for Umatilla River level II Rosgen stream classifications are listed in **Table 13.**

The NSDZ is an approximate measurement of the channel width that is sampled from 1997 digital orthophoto quads (DOQs). This provides the widespread geographic coverage to compliment data from the ground level Rosgen Inventories. Digital orthophoto quads and remote sampling tools[3] were employed to determine the NSDZ width throughout the length the Umatilla River mainstem (for purposes of temperature modeling, the NSDZ was sampled at 100-foot intervals for the entire length of the Umatilla River). Bankfull widths are compared with the near stream disturbance zone width (NSDZ) widths in **Figure 28**. Comparisons between both measurements indicate that the near stream disturbance zone width is on average 5% greater than the measured bankfull width with a range of deviation from 9% to –13% (see **Figure 29**). Observed deviations are considered small and are likely a reflection of the resolution of the digital orthophoto quads. Further, the one year difference between the DOQ (1997) and Rosgen (1998) sampling directly following the extensive channel modifications caused during the 1996 flood, after which channel widening may have been more apparent in 1997 than 1998.

**Table 13.** Bankfull Widths Identified with Rosgen Level II

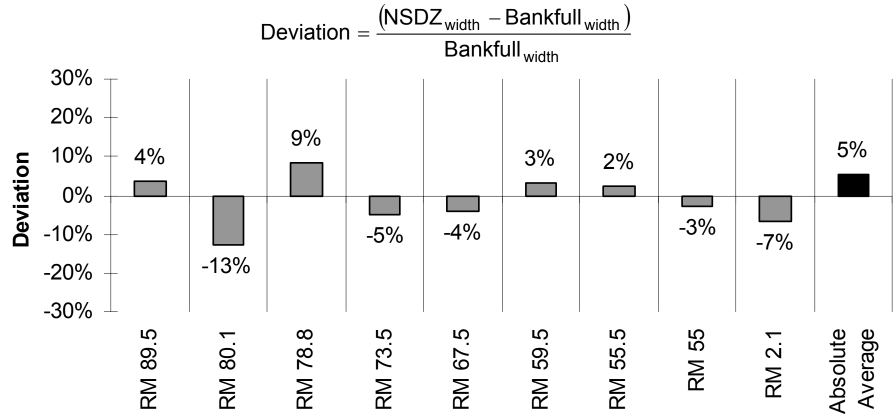
| Site Description | River Mile | Bankfull Width (feet) |
|---|---|---|
| Corporation | 89.5 | 91 |
| USGS gage upstream Meacham | 80.1 | 80 |
| Downstream from Meacham | 78.8 | 129 |
| Upstream from Thorn Hollow Bridge | 73.5 | 108 |
| Near Cayuse Bridge | 67.5 | 144 |
| Near Mission Bridge | 59.5 | 209 |
| Near Hwy 11 Bridge | 55.5 | 89 |
| Upstream from W. 10th St Bridge, Pendleton | 55.0 | 114 |

**Figure 28.** Near Stream Disturbance Zone Width and Bankfull Width Comparision




[3] Ttools is an Arcview extension developed by DEQ used to sample near stream disturbance zone at 100-foot intervals along the Umatilla River.

**Figure 29.** Deviation Between Near Stream Disturbance Zone and Bankfull Widths




## (2D) CHANNEL WIDTH – POTENTIAL CONDITION

Rosgen (1996) acknowledges the difficulty in developing future stable-channel width to depth ratio estimates. He recommends width to depth ratios from stable reference reaches, by stream type. Stable reference reaches of various stream types have not been identified in the Basin. The selected alternative was to utilize the mid-range of the dominant mode for US streams per stream type (data summarized in Rosgen, 1996). These width to depth ratios, along with bankfull width cross-sectional areas were then used to calculate the potential bankfull width (equation in **Table 14**, from Rosgen, 1996). **Table 14** lists existing cross-sectional areas from gage station measurements and the targeted width to depth ratios used in this analysis, and the corresponding potential bankfull width. The cross-sectional area at the 1.2-year recurrence interval was chosen because this stage height closely matches field measured bankfull height at key stations. The near stream disturbance zone width is assumed to be 5% greater than bankfull based on comparison between the two measurements. In order to provide channel width (potential) targets along the entire Umatilla River mainstem, a best-fit line for potential bankfull width vs. river mile was derived through regression (**Figure 30**). The equation of this line provides longitudinal target values for potential bank full width and increasing this by five percent produces the potential NSDZ width.

**Table 14.** Potential Bankfull Width Calculations

$$\text{Bankfull}_{\text{width}} = \left(\text{Area} \cdot \frac{w}{d}\right)^{\frac{1}{2}}$$ (Rosgen 1996)

$\text{Bankfull}_{\text{width}}$ = Site potential bankfull width
Area = Bankfull channel cross-sectional area at each mainstem gage or inventory station
$\frac{w}{d}$ = Targeted potential width/depth ratio of channel

| Station Description | River Mile | 1.2 Year Return Period High Flow (cfs) | Potential Stream Type | Targeted $w/d$ (feet) | Cross-Sectional Area (sq. feet) | Potential Bankfull width (feet) |
|---|---|---|---|---|---|---|
| USGS gage u/s Meacham | 80.1 | 1300 | C4/B4 | 21 | 210 | 66.4 |
| near Mission Brdg. | 59.5 | 3000 | C4 | 21 | 540 | 106.5 |
| u/s W. 10th St Brdg, Pdtn | 55.0 | 3100 | F4 | 21 | 590 | 111.3 |
| Yoakum Brdg. Gage | 37.0 | 3700 | C4 | 21 | 570 | 109.4 |
| near Echo Brdg. | 26.0 | 3700 (assumed) | C4 | 21 | 1040 | 147.8 |
| USGS gage below 3 Mile Dam | 2.1 | 3075 | F1 | 21 | 800 | 129.6 |

Table notes: U/s = upstream; d/s = downstream. 1.2 year recurrence interval flows are from CTUIR, 1999. Cross-sectional areas where calculated from flow vs. velocity regression, $R^2$=0.87 (from CTUIR analysis, unpublished).

**Figure 30.** Umatilla River Potential Channel Width Based on 1.2 Year High Flow

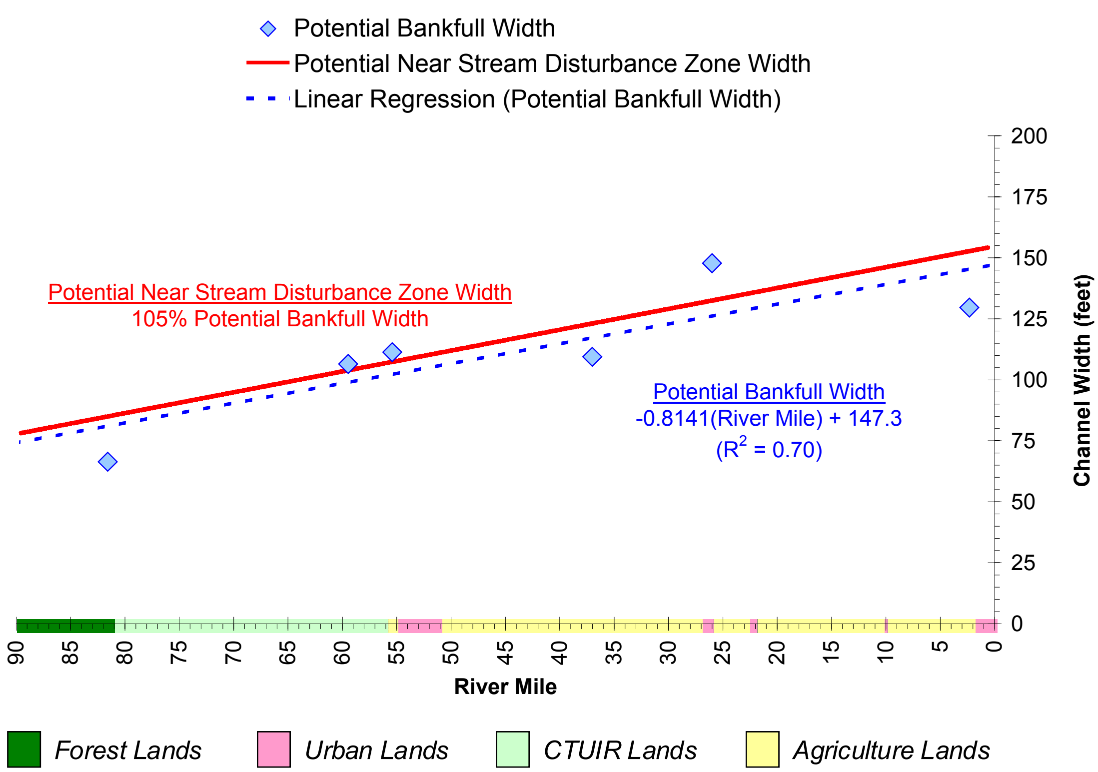
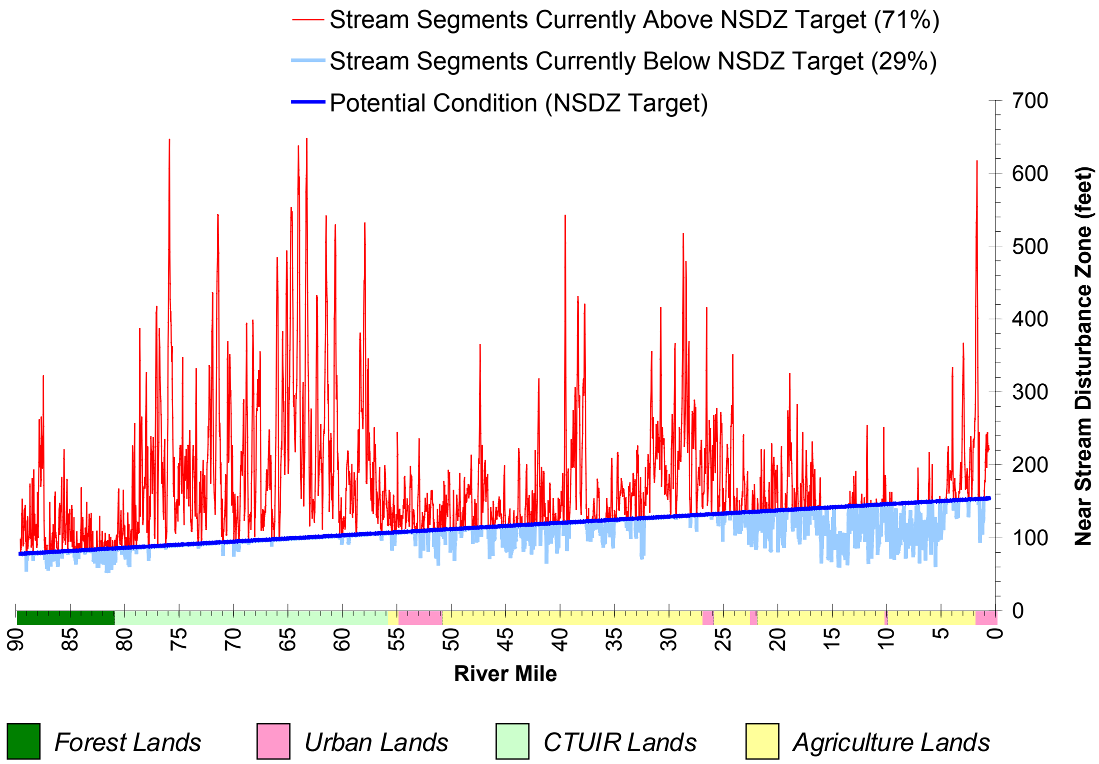


**Figure 31.** Umatilla River Near Stream Disturbance Zone Width Target




## (2E) TRIBUTARIES

The lack of available data limits estimation of potential bankfull widths on major tributaries and lower order streams. The Umatilla Basin TMDL Technical Committee recommended that bankfull width/depth, as a fundamental property of stream channels, be considered as a TMDL temperature surrogate. These are adopted as temperature load allocation surrogates in **Section 2.1.1.6**. Stream classification has not been done for much of the Basin but the basic Umatilla Basin types are fairly readily distinguishable based on gradient, profile and cross-section (Classification summary in **Figure 27**). Maximum mid-range width/depth reported in Rosgen (1996) for the dominant mode of various types is listed in **Table 15**.

**Table 15.** W/d Targets by Stream Type

(mid-range measured width/depth of streams across the US, from Rosgen, 1996)

| Stream Type | A | B | C | F |
|---|---|---|---|---|
| w/d Target | 7 | 17 | 24 | 29 |

## NON-POINT SOURCES OF THERMAL POLLUTION #3

**Low summertime flows decrease the thermal assimilative capacity of streams. Pollutant (solar radiation) loading causes larger temperature increases in stream segments where flows are reduced.**

*The Umatilla River is extensively utilized for crop irrigation during the summer months. Significant flow augmentation occurs from a large storage reservoir located on McKay Creek near Pendleton. However, during parts of the summer this flow augmentation is largely withdrawn from the Umatilla River before it reaches the Columbia River. Analysis presented in* ***Appendix A-4*** *demonstrates that when instream flows are depleted in several lower river reaches, temperatures in excess of 80°F are the lowest achievable.*

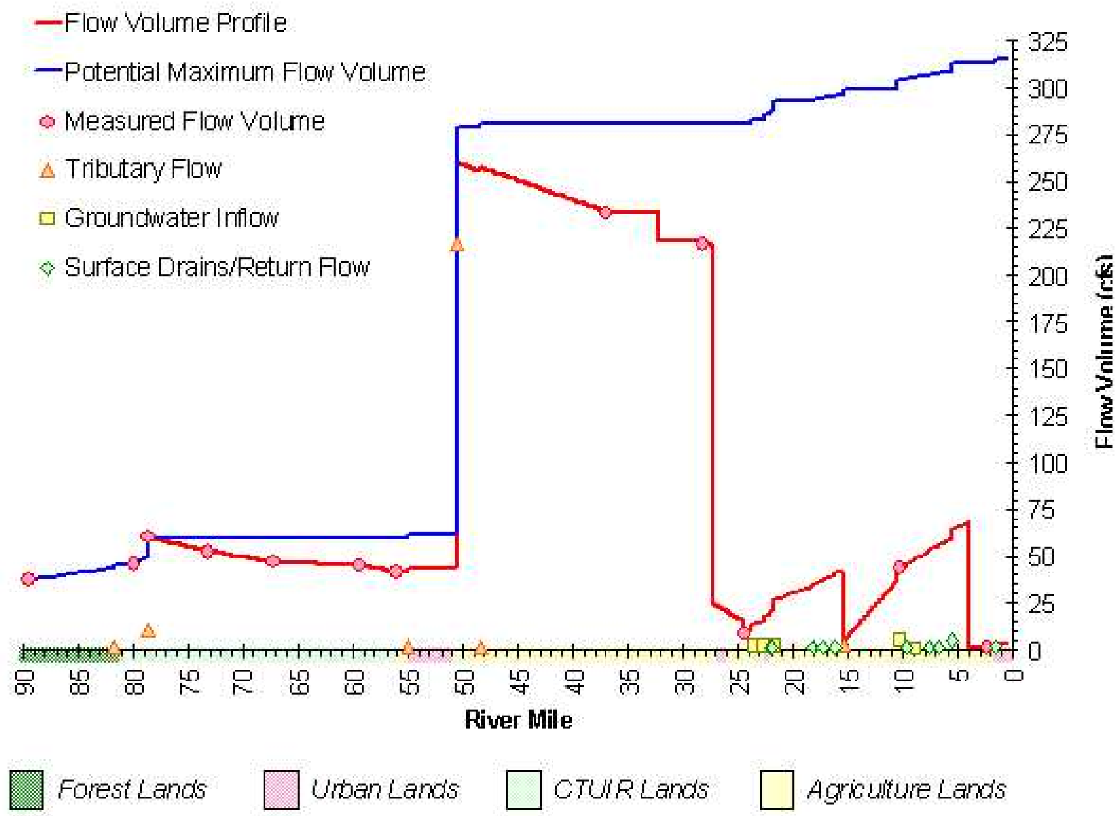
The summer low flow pattern in the Umatilla River mainstem reflects a highly managed flow condition. ODEQ staff calculated return periods for both high and low-flow conditions.[4] Flows were also measured throughout the Umatilla Basin over a four-day period during the summer of 1998. Observed flow conditions were below 10 cfs for all tributary streams. No flow (zero cfs) was observed at several tributary streams during this monitoring work. Observed mainstem flow increased dramatically downstream of the McKay Creek confluence, where nearly 200 cfs of McKay Reservoir water enters the Umatilla River. Umatilla River flows then decreased dramatically between river mile 26.3 (Umatilla River at the City of Echo) and river mile 8.7 (Umatilla River at Westland Road) due to irrigation diversions. Below river mile 26.3, there are areas where Umatilla River flows increase as a result of irrigation and urban drain and groundwater returns.

[4] Flow data has been collected in the Umatilla River Sub-Basin at numerous OWRD and USGS gages. Daily stream flow measurements have been collected at several of these gages since 1903. Flow statistics were performed using the Log Pearson Type III distribution. Results from this analysis are available in DEQ Umatilla River Basin Data Review (1998). The 7Q10 flow represents the lowest 7-day average flow that occurs on average once every 10 years. Therefore, the probability that this flow condition will occur during any year is 10%. The 7Q10 flow at selected sites is provided below.

| 7Q10 Low Flow Statistics (cfs) | | | | | |
|---|---|---|---|---|---|
| RM 79 | RM 68 | RM 55 | RM 51 | RM 24 | RM 2 |
| 36.2 | 37.7 | 21.6 | 16.2 | 36.5 | 0.1 |

**Figure 32** illustrates gage site and portable-meter measured flows collected August 24-28, 1998. This figure also depicts an estimated mainstem flow profile assuming instream flow conservation, thus arraying a wide range of potential flow. Management of McKay Reservoir (entering the mainstem at river mile 49.5) and irrigation diversions can greatly influence mainstem flow, causing volumes dramatically above or below that of pre-1900 hydrology.

**Figure 32.** Umatilla River Flow During Summer Minimum Flow - Current and Potential



## 2.1.1.3.2 Point Sources of Pollution

Elevated summertime stream temperatures attributed to five point sources in the Umatilla River Basin result in part from warm water discharge to surface waters. However, not all of these point sources discharge during the warm season.

The locations of the individual NPDES permitted point sources that discharge directly to surface waterbodies are mapped in **Figure 7** (recalled below). There are five such facilities within the Umatilla River Basin (**Table 16**). Two of these facilities, the Pendleton and Hermiston Waste Water Treatment Plants, are currently permitted to discharge during the warmer months. Discharge temperatures are generally in the low 70$^{o}$F range. Maximum design discharge rates are listed in **Table 16**. **Table 17** provides flow information and instream system potential temperatures.

Loading capacities for these facilities are described in **Section 2.1.1.5** and Wasteload allocations are established in **Section 2.1.1.6**. The system potential temperatures and WLA method are provided both for facilities that discharge during the critical season as well as those that do not, to guide future permit renewal.

Recall **Figure 7.** Map of Umatilla Basin Towns and Cities Including Point Sources of Pollution with Facility NPDES Permits.

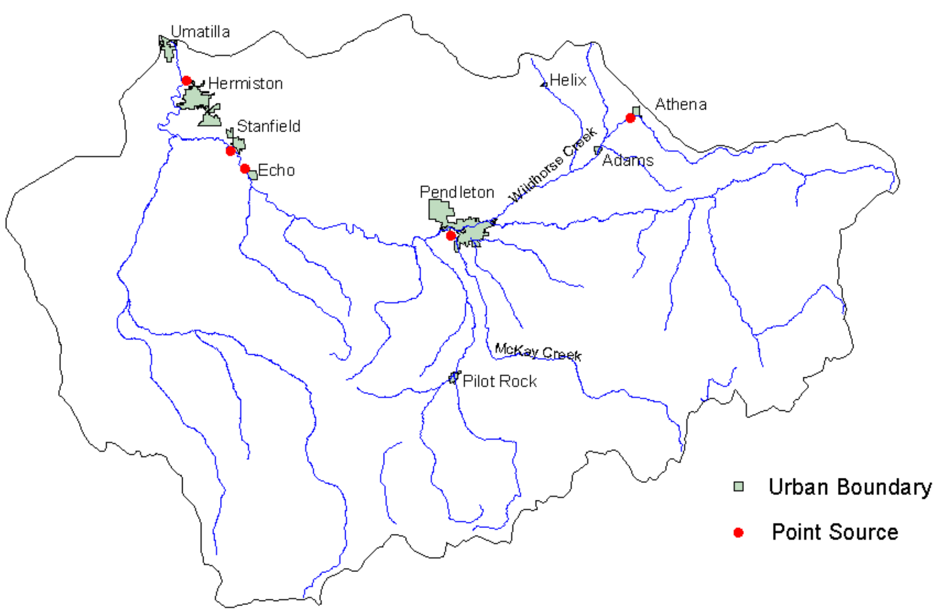


**Table 16.** NPDES Permitted Sources of Thermal Input

| City/ Facility Name[5] | Permit Discharge Period | Receiving Water | River Mile | Permit Type | Permit Expires[6] | Design Flow Rate | Average August Effluent Temp. |
|---|---|---|---|---|---|---|---|
| Athena WWTP | Nov 1 - Apr 30 | Wildhorse Cr. | 18.5 | NPDES | 5/31/96 | 0.19 cfs | 72°F (assumed) |
| Pendleton WWTP | all year | McKay Ck / Umatilla R. | 50.6 (Umatilla R.) | NPDES | 9/30/97 | 8.51 cfs | 72°F |
| Echo WWTP | Nov 1- Apr 30 | Umatilla R. | 25.0 | NPDES | 12/31/99 | 0.19 cfs | 72°F (assumed) |
| Stanfield WWTP | Nov 1- Apr 30 | Stage Gulch / Umatilla R. | 29.9 (Umatilla R.) | NPDES | 7/31/98 | 0.35 cfs | 72°F (assumed) |
| Hermiston WWTP | all year | Umatilla R. | 5.2 | NPDES | 5/31/00 | 4.55 cfs | 73°F |

gray shading identifies facilities that are not permitted to discharge during the warm season.

[5] Lists of permitted wastewater discharges in Oregon are available through the DEQ website at: http://waterquality.deq.state.or.us/SISData/FacilityHome.asp

[6] The existing permit remains in effect until DEQ acts on the renewal application. Permit renewals have been extended pending TMDL establishment.

## 2.1.1.4 SEASONAL VARIATION - CWA §303(D)(1)

The critical season is the period in which Umatilla River temperatures (in the warmest reach of the Basin) exceed the applicable numeric criteria of the temperature water quality standard. In the locations of NPDES individual-permit point sources in the Basin, this period is documented to occur (64 ºF criterion) from June through September. Salmonid spawning (55 ºF criterion) occurs in these locations during November 1 to April 30.

Section 303(d)(1) requires this TMDL to be "established at a level necessary to implement the applicable water quality standard with seasonal variations." Both stream temperature and flow vary seasonally. Water temperatures are coolest in winter and early spring months. Stream temperatures exceed State water quality standards in summer and early fall months (June, July, August and September). Warmest stream temperatures correspond to prolonged solar radiation exposure, directness of sunlight, warm air temperature, low flow conditions and decreased groundwater contribution. Seasonal variability of the daily maximum temperatures for the Umatilla River mainstem is presented in **Figures 33** and **34** and **in Appendix A-4**.

The warmest stream temperatures occur in late July and early August. Upper reaches of the Umatilla River warm rapidly in the downstream direction to *sub-lethal* (64°F to 74°F) and *incipient lethal* (74°F to 80°F) levels for salmonids (**Table 7**). Most tributaries where data was collected also have 7-day maximums within or near the sub-lethal and incipient lethal levels for salmonids.

**Figure 33.** Umatilla River Seasonal Variability in the 7-Day Temperature Statistic

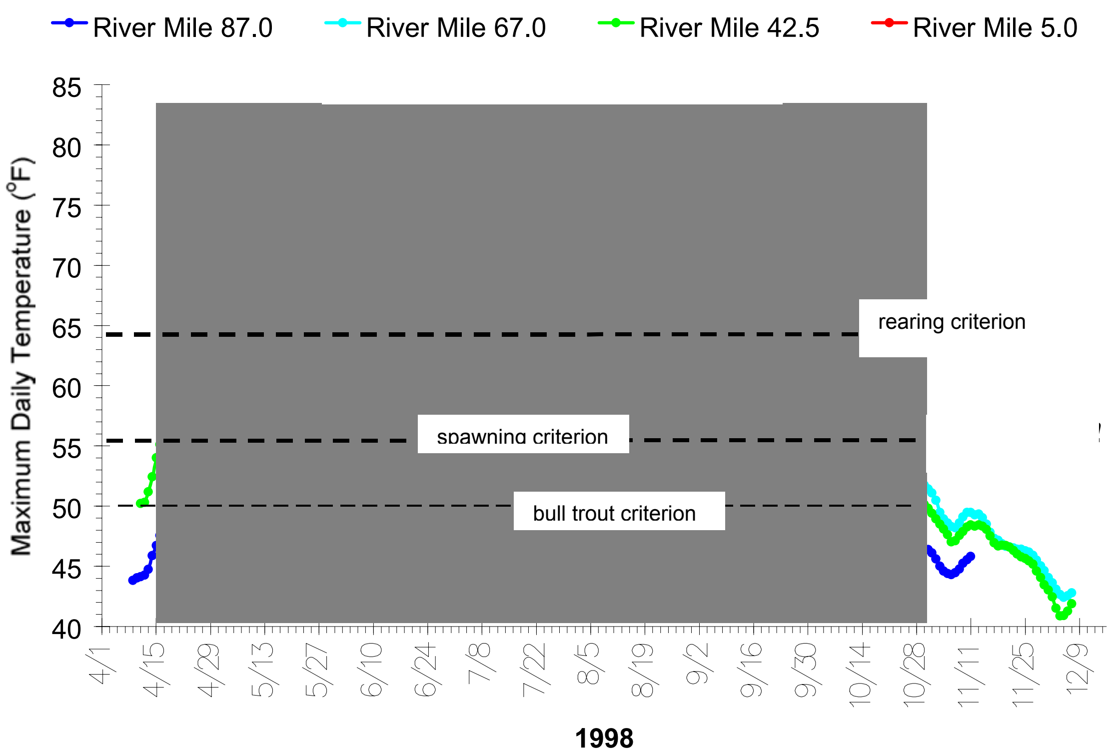
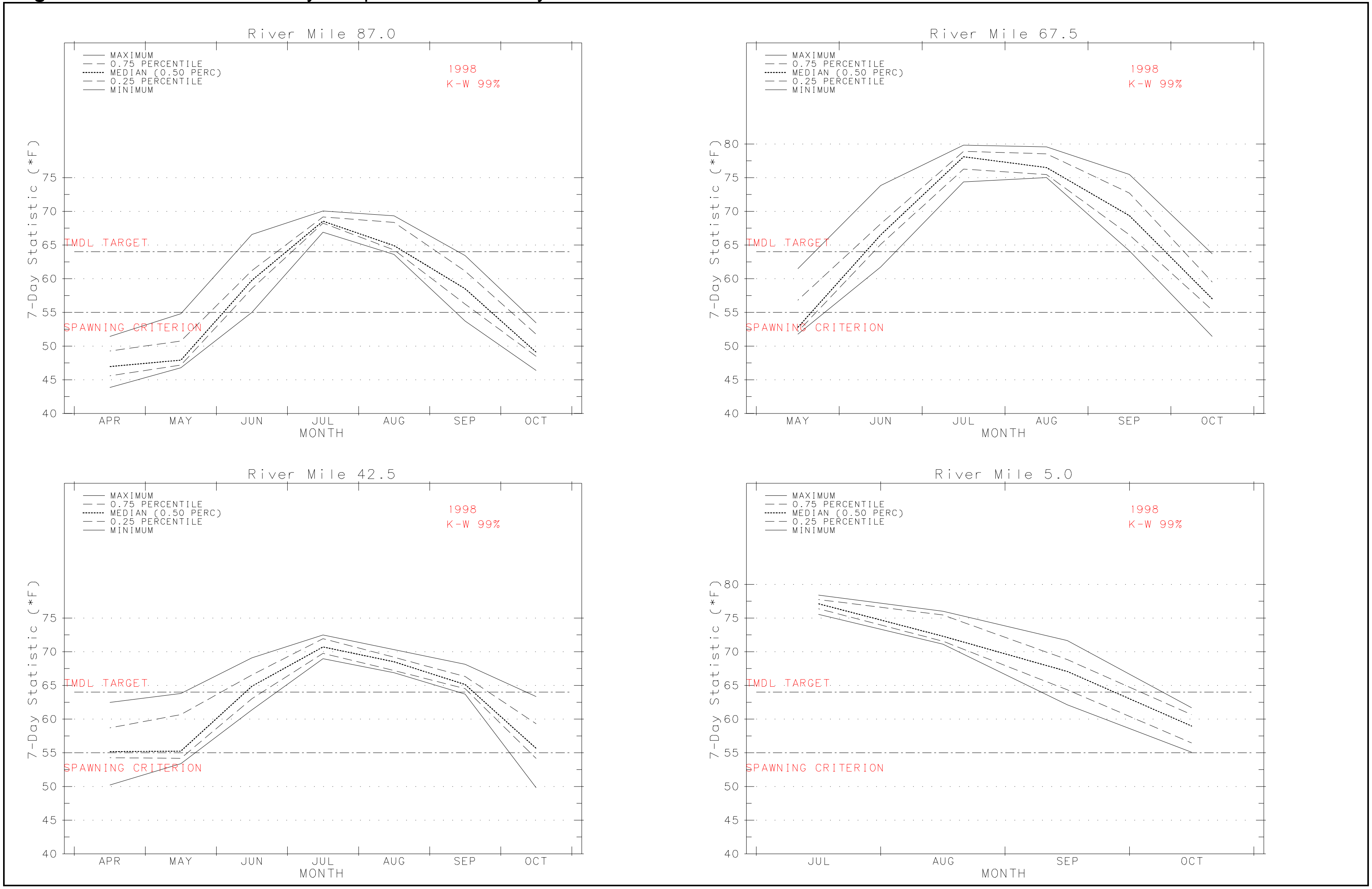



**Figure 34** illustrates warm season summary statistics for each month's 7-day average of daily maximums, with temperature targets shown. This was used to evaluate the critical season of exceedance duration with regard to the 64 ºF temperature criteria.

**Figure 34.** Umatilla River 7-Day Temperature Statistic by River Mile



# 2.1.1.5 LOADING CAPACITY – 40 CFR 130.2(F)

| |
|---|
| The Water Quality Standard (described in **Section 2.1.1.1.3**) calls for a loading capacity based on the condition that meets 'no measurable surface water temperature increase resulting from anthropogenic activities.' This condition is considered to be achieved when (1) non-point source solar radiation loading is representative of morphologic and riparian vegetation conditions without human disturbance and (2) point source discharges cause no measurable increases in surface water temperatures. |

The loading capacity provides a reference for calculating the amount of pollutant reduction needed to bring water into compliance with standards. EPA's current regulation defines loading capacity as "*the greatest amount of loading that a water can receive without violating water quality standards*" (40 CFR § 130.2(f)).

- The pollutants as identified in **Section 2.1.1.1** are anthropogenic increases in solar radiation loading (non-point sources) and warm water discharge (point sources).

## 2.1.1.5.1 Loading Capacity (Non-Point Sources)

The non-point source loading capacities consist of solar radiation loading profiles that reflect system potential. The non-point source loading capacities are derived by simulating the solar radiation loads that are received when morphology and riparian vegetation is restored to reflect undisturbed potential conditions in the Umatilla River Basin. Recall that system potential vegetation characteristics were described in **Section 2.1.1.3.1**.

**Figure 35** contrasts the longitudinal profile of the current radiant energy load with the longitudinal profile of the system potential radiant energy load. **The system potential radiant energy load is the loading capacity.** The percent solar loading reduction needed to meet the Umatilla River nonpoint source loading capacity is shown in **Figure 36**. The nonpoint source loading capacity for the tributaries is similarly shown as radiant energy loading and is translated into percent effective shade in **Figures 38-40**.

*Nonpoint Source loading capacities* in the Umatilla River Basin are heat energy from incoming solar radiation expressed as Langleys per day. Analysis/simulation of heat transfer processes indicate that water temperatures increase above natural daily fluctuations when the heat load from solar radiation is above those allowed by system potential riparian vegetation, channel morphology and hydrologic conditions. **Appendix A-4** describes the modeling results that lead to the loading capacities.

**Figure 35.** Non-point Source Solar Radiation Loading Capacity *(August 10, 1998)*

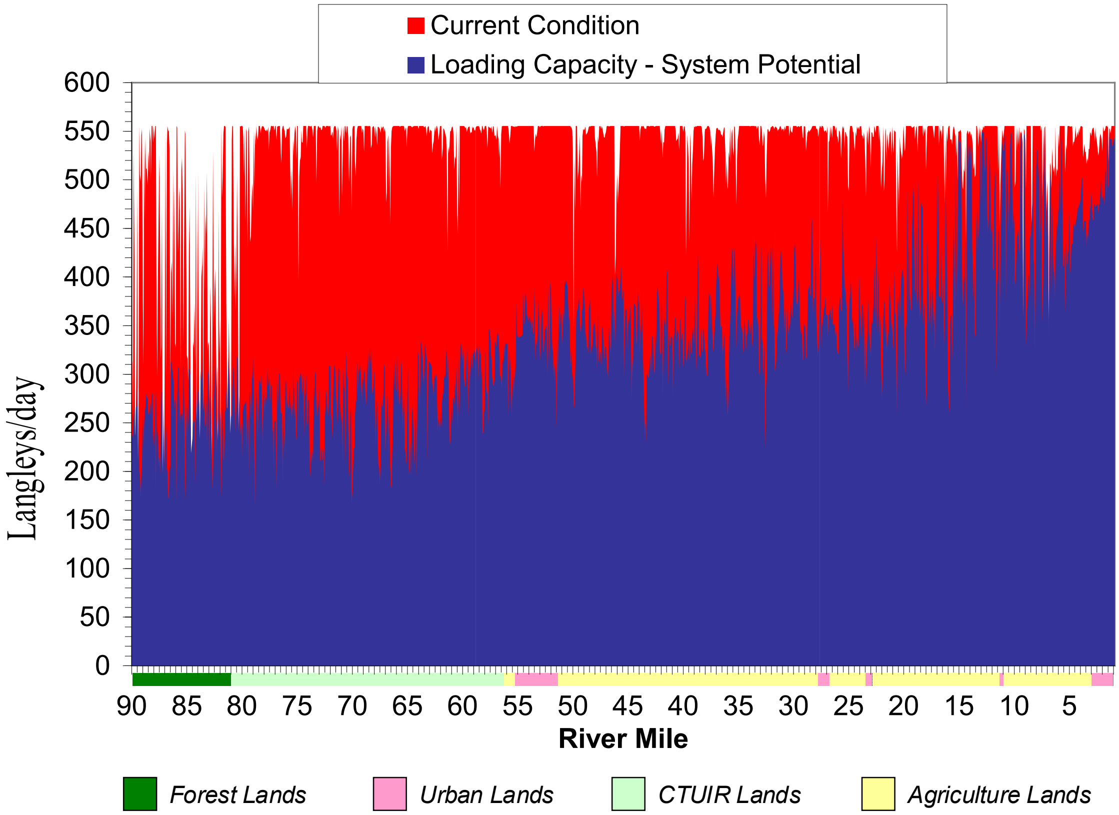
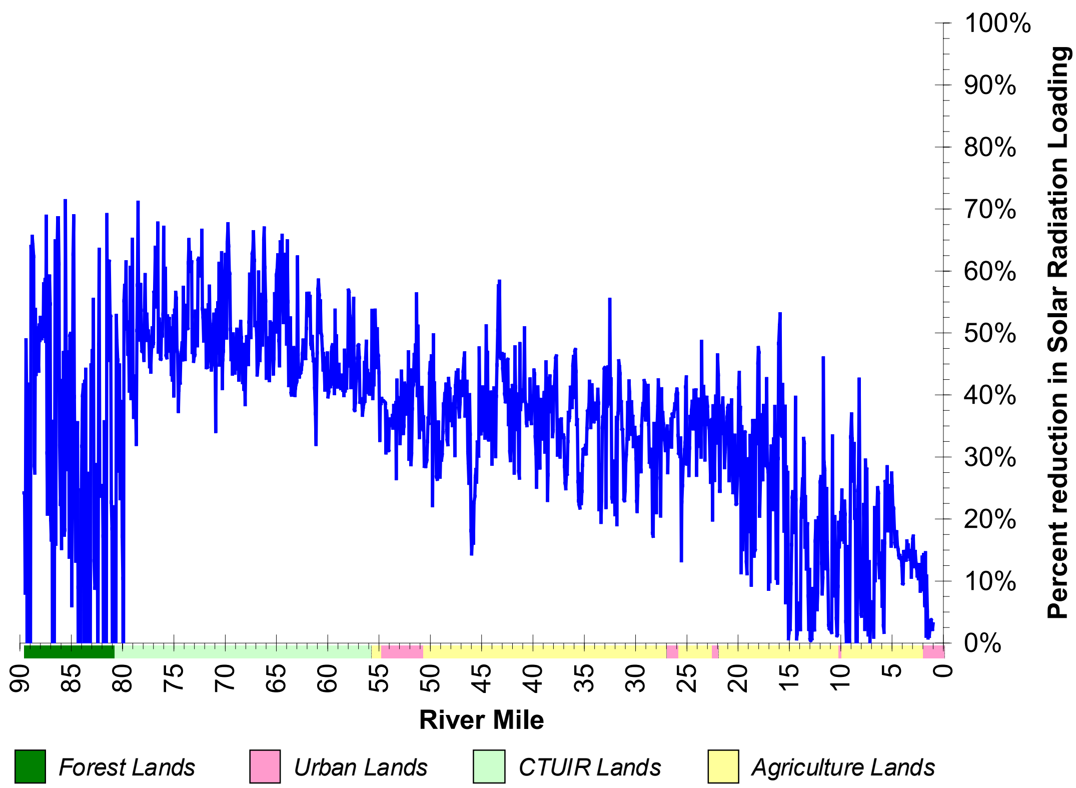



**Figure 36.** Non-point Source Solar Radiation Loading Reduction *(August 10, 1998)*



## 2.1.1.5.2 Loading Capacity (Point Sources)

The loading capacity for point sources is defined for the receiving water body; it is the lesser of (1) system potential temperatures that represent no measurable surface water temperature increase resulting from nonpoint source anthropogenic activities, and (2) background temperatures. System potential instream temperatures were derived for peak summer temperatures by applying the non-point source loading capacity throughout the Umatilla River Basin and removing all point source discharges. These system potential temperatures were developed using computer modeling (see **Appendix A-4**). These system potential temperatures and background temperatures were then used to assign wasteload allocations to the point sources.

**Table 17** lists flow statistics and the system potential temperatures. The receiving body was assumed to be the Umatilla River, except for Athena, where critical temperatures and flows were estimated for Wildhorse Creek. The Hermiston and Echo treatment plants discharge directly to the Umatilla River. The treatment plants at Athena, Pendleton and Stanfield discharge to Wildhorse Creek, McKay Creek and Stage Gulch, respectively.

**Table 17.** Instream System Potential Temperatures at NPDES Permitted Facilities

| City and Facility Name | Receiving Waterbody and River Mile | 7Q10 Low Flow | System Potential Temperature[7] | Current July/August Effluent Temperature | Allowable Temperature Change at Edge of Mixing Zone |
|---|---|---|---|---|---|
| Athena WWTP | Wildhorse Cr. RM 18.5 | 1.50 cfs (assumed) | 64.0 °F (assumed) | 72.0 °F (assumed) | 0.25 °F |
| Pendleton WWTP | Umatilla R. RM 50.6 | 20.0 cfs | 69.8 °F | 71.6 °F | 0.25 °F |
| Stanfield WWTP | Umatilla R. RM 29.9 | 10.0 cfs (assumed) | 69.3 °F | 72 °F (assumed) | 0.25 °F |
| Echo WWTP | Umatilla R. RM 25.0 | 10.0 cfs (assumed) | 69.0 °F | 72 °F (assumed) | 0.25 °F |
| Hermiston WWTP | Umatilla R. RM 5.2 | 58.2 cfs | 70.0 °F | 73.4 °F | 0.25 °F |

[7] System Potential Temperature is derived through simulating instream temperatures produced by non-point source loading capacities (assumed no point source discharge, **Figure 2-31**).

# 2.1.1.6 ALLOCATIONS – 40 CFR 130.2(G) AND 40 CFR 130.2(H)

**Load Allocations (Non-Point Sources)** – Since the nonpoint source Loading Capacity is based on system potential, and use of this target is based on the water quality standard (i.e., no measurable temperature increases from anthropogenic sources), the nonpoint source Loading Capacity is by definition 100% allocated to natural sources (**Table 18**).[8]

**Wasteload Allocations (Point Sources)** – The Umatilla Basin Wasteload Allocation is defined herein as the portion of loading capacity heat allocated to point sources given an allowable 0.25°F temperature increase in the zone of dilution. Outside of the designated mixing zone, surface water discharges into the Umatilla River Basin receiving waters should not cause measurable increases above the system potential temperatures listed in **Table 17**, or above background temperatures, whichever is less. Maximum allowable effluent temperatures are listed in **Tables 19 (Pendleton)** and **20** (Hermiston).

Point Source Note - that currently the Athena, Stanfield and Echo WWTP are not permitted to discharge during May 1 through October 31. Consequently there is no need to further evaluate compliance for these three facilities.

Nonpoint Source Note - This TMDL establishes goals for streams within the Umatilla Basin that are not currently on the Oregon 1998 303(d) list. This is consistent with State and Federal TMDL implementation law and policy. Un-listed streams are addressed because upstream improvements are needed to sufficiently decrease downstream temperatures. The causes of impairment are readily observed throughout the Basin (unstable streambanks, channelization, bank and upland vegetation disturbance).

[8] The Umatilla TMDL Stakeholders Committee requested explanatory text regarding zero allocations, as follows: A TMDL allocates allowable pollution levels within the limits set by State water quality standards. Because the standard's trigger temperatures are probably close to, or at times less than, natural background, there is no capacity for additional thermal loading. This is logical from a biologic standpoint - salmon in Oregon are near the southern and warmest edge of their range, and hence are challenged by relatively slight increases. The TMDL modeling shows that there is much opportunity, from a hydrologic and physics standpoint, to substantially decrease temperatures; and that summer 7-day average temperatures have been increased by human-related actions, typically by 3 to 15 °F. A zero allocation by no means indicates that land usages should be eliminated, in fact, the current custodians are to whom we appropriately rely on for progress toward fishable, drinkable, swimmable waters in the Umatilla Basin.

**Table 18** lists Umatilla Basin load allocations according to land use and wasteload allocations.

**Table 18.** Temperature Allocation Summary

| Load Allocations (Non-Point Sources) | |
|---|---|
| *Source* | *Distribution of Radiant Loading Capacity* |
| Natural | 100% |
| Agriculture | 0% |
| Forestry | 0% |
| Transportation Corridors | 0% |
| Urban | 0% |

**Wasteload Allocation (Point Sources)**

| *Source Facility & City* | *Current Effluent Temperature (July/August)* | *System Potential Temperature (°F)* | *Minimum Percent Reduction in Effluent Temperatures to attain Loading Capacity (late July - early August)* | *Wasteload Allocation maximum effluent temperatures* |
|---|---|---|---|---|
| Athena WWTP | 72.0 °F (assumed) | 64.0 °F (assumed) | 10.1% | * |
| Pendleton WWTP | 71.6 °F | 69.8 °F | 2.0% | Table 19 |
| Stanfield WWTP | 72 °F (assumed) | 69.3 °F | 3.8% | * |
| Echo WWTP | 72 °F (assumed) | 69.0 °F | 4.2% | * |
| Hermiston WWTP | 73.4 °F | 70.0 °F | 4.6% | Table 20 |

* Not discharging during critical season.

**Table 19.** Maximum Allowable Effluent Temperatures for Pendleton WWTP (7-Day Average of Daily Maximum, °F)

Subtable 19a. When River 7-Day Average Maximum Daily Temperature Exceeds 69.8° F:

| | Effluent Flow, MGD | | | |
|---|---|---|---|---|
| River Flow Range (cfs) | 2.0 to 2.99 | 3.0 to 3.99 | 4.0 to 4.99 | 5.0 to 5.99 |
| 10 to 19.9 | 70.25 | 70.18 | 70.15 | 70.13 |
| 20 to 39.9 | 70.45 | 70.32 | 70.25 | 70.21 |
| 40 to 59.9 | 70.86 | 70.59 | 70.45 | 70.37 |
| 60 to 100 | 71.26 | 70.86 | 70.66 | 70.53 |

Subtable 19b. When River 7-Day Average Maximum Daily Temperature is less than 69.8° F but exceeds 68° F:

| | Effluent Flow, MGD | | | |
|---|---|---|---|---|
| River Flow Range (cfs) | 2.0 to 2.99 | 3.0 to 3.99 | 4.0 to 4.99 | 5.0 to 5.99 |
| 10 to 19.9 | 68.45 | 68.38 | 68.35 | 68.33 |
| 20 to 39.9 | 68.65 | 68.52 | 68.45 | 68.41 |
| 40 to 59.9 | 69.06 | 68.79 | 68.65 | 68.57 |
| 60 to 100 | 69.46 | 69.06 | 68.86 | 68.73 |
| 100 to 200 | 70.27 | 69.60 | 69.26 | 69.06 |
| 200 to 300 | 72.29 | 70.94 | 70.27 | 69.87 |

| Subtable 19c. When River 7-Day Average Maximum Daily Temperature is less than 68° F but exceeds 66° F: | | | | |
|---|---|---|---|---|
| | Effluent Flow, MGD | | | |
| River Flow Range (cfs) | 2.0 to 2.99 | 3.0 to 3.99 | 4.0 to 4.99 | 5.0 to 5.99 |
| 10 to 19.9 | 66.45 | 66.38 | 66.35 | 66.33 |
| 20 to 39.9 | 66.65 | 66.52 | 66.45 | 66.41 |
| 40 to 59.9 | 67.06 | 66.79 | 66.65 | 66.57 |
| 60 to 100 | 67.46 | 67.06 | 66.86 | 66.73 |
| 100 to 200 | 68.27 | 67.60 | 67.26 | 67.06 |
| 200 to 300 | 70.29 | 68.94 | 68.27 | 67.87 |

| Subtable 19d. When River 7-Day Average Maximum Daily Temperature is less than 66° F but exceeds 64° F: | | | | |
|---|---|---|---|---|
| | Effluent Flow, MGD | | | |
| River Flow Range (cfs) | 2.0 to 2.99 | 3.0 to 3.99 | 4.0 to 4.99 | 5.0 to 5.99 |
| 10 to 19.9 | 64.45 | 64.38 | 64.35 | 64.33 |
| 20 to 39.9 | 64.65 | 64.52 | 64.45 | 64.41 |
| 40 to 59.9 | 65.06 | 64.79 | 64.65 | 64.57 |
| 60 to 100 | 65.46 | 65.06 | 64.86 | 64.73 |
| 100 to 200 | 66.27 | 65.60 | 65.26 | 65.06 |
| 200 to 300 | 68.29 | 66.94 | 66.27 | 65.87 |

| Subtable 19e. When River 7-Day Average Maximum Daily Temperature is less than 64° F but exceeds 63° F: | | | | |
|---|---|---|---|---|
| | Effluent Flow, MGD | | | |
| River Flow Range (cfs) | 2.0 to 2.99 | 3.0 to 3.99 | 4.0 to 4.99 | 5.0 to 5.99 |
| 10 to 19.9 | 63.45 | 63.38 | 63.35 | 63.33 |
| 20 to 39.9 | 63.65 | 63.52 | 63.45 | 63.41 |
| 40 to 59.9 | 64.06 | 63.79 | 63.65 | 63.57 |
| 60 to 100 | 64.46 | 64.06 | 63.86 | 63.73 |
| 100 to 200 | 65.27 | 64.60 | 64.26 | 64.06 |
| 200 to 300 | 67.29 | 65.94 | 65.27 | 64.87 |

| Subtable 19f. When River 7-Day Average Maximum Daily Temperature is less than 63° F but exceeds 54° F and spawning criteria applies: | | | | |
|---|---|---|---|---|
| | Effluent Flow, MGD | | | |
| River Flow Range (cfs) | 2.0 to 2.99 | 3.0 to 3.99 | 4.0 to 4.99 | 5.0 to 5.99 |
| 10 to 19.9 | 54.45 | 54.38 | 54.35 | 54.33 |
| 20 to 39.9 | 54.65 | 54.52 | 54.45 | 54.41 |
| 40 to 59.9 | 55.06 | 54.79 | 54.65 | 54.57 |
| 60 to 100 | 55.46 | 55.06 | 54.86 | 54.73 |
| 100 to 200 | 56.27 | 55.60 | 55.26 | 55.06 |
| 200 to 300 | 58.29 | 56.94 | 56.27 | 55.87 |

**Table 20.** Maximum Allowable Effluent Temperatures for Hermiston WWTP
(7-Day Average of Daily Maximum, °F)

| Subtable 20a. When River 7-Day Average Maximum Daily Temperature Exceeds 70° F: | | | | |
|---|---|---|---|---|
| | Effluent Flow, MGD | | | |
| River Flow Range (cfs) | 2.0 to 2.99 | 3.0 to 3.99 | 4.0 to 4.99 | 5.0 to 5.99 |
| 10 to 19.9 | 70.45 | 70.38 | 70.35 | 70.33 |
| 20 to 39.9 | 70.65 | 70.52 | 70.45 | 70.41 |
| 40 to 59.9 | 71.06 | 70.79 | 70.65 | 70.57 |
| 60 to 100 | 71.46 | 71.06 | 70.86 | 70.73 |

| Subtable 20b. When River 7-Day Average Maximum Daily Temperature is less than 70° F but exceeds 68° F: | | | | |
|---|---|---|---|---|
| | Effluent Flow, MGD | | | |
| River Flow Range (cfs) | 2.0 to 2.99 | 3.0 to 3.99 | 4.0 to 4.99 | 5.0 to 5.99 |
| 10 to 19.9 | 68.45 | 68.38 | 68.35 | 68.33 |
| 20 to 39.9 | 68.65 | 68.52 | 68.45 | 68.41 |
| 40 to 59.9 | 69.06 | 68.79 | 68.65 | 68.57 |
| 60 to 100 | 69.46 | 69.06 | 68.86 | 68.73 |
| 100 to 200 | 70.27 | 69.60 | 69.26 | 69.06 |
| 200 to 300 | 72.29 | 70.94 | 70.27 | 69.87 |

| Subtable 20c. When River 7-Day Average Maximum Daily Temperature is less than 68° F but exceeds 66° F: | | | | |
|---|---|---|---|---|
| | Effluent Flow, MGD | | | |
| River Flow Range (cfs) | 2.0 to 2.99 | 3.0 to 3.99 | 4.0 to 4.99 | 5.0 to 5.99 |
| 10 to 19.9 | 66.45 | 66.38 | 66.35 | 66.33 |
| 20 to 39.9 | 66.65 | 66.52 | 66.45 | 66.41 |
| 40 to 59.9 | 67.06 | 66.79 | 66.65 | 66.57 |
| 60 to 100 | 67.46 | 67.06 | 66.86 | 66.73 |
| 100 to 200 | 68.27 | 67.60 | 67.26 | 67.06 |
| 200 to 300 | 70.29 | 68.94 | 68.27 | 67.87 |

| Subtable 20d. When River 7-Day Average Maximum Daily Temperature is less than 66° F but exceeds 64° F: | | | | |
|---|---|---|---|---|
| | Effluent Flow, MGD | | | |
| River Flow Range (cfs) | 2.0 to 2.99 | 3.0 to 3.99 | 4.0 to 4.99 | 5.0 to 5.99 |
| 10 to 19.9 | 64.45 | 64.38 | 64.35 | 64.33 |
| 20 to 39.9 | 64.65 | 64.52 | 64.45 | 64.41 |
| 40 to 59.9 | 65.06 | 64.79 | 64.65 | 64.57 |
| 60 to 100 | 65.46 | 65.06 | 64.86 | 64.73 |
| 100 to 200 | 66.27 | 65.60 | 65.26 | 65.06 |
| 200 to 300 | 68.29 | 66.94 | 66.27 | 65.87 |

| Subtable 20e. When River 7-Day Average Maximum Daily Temperature is less than 64° F but exceeds 63° F: | | | | |
|---|---|---|---|---|
| | Effluent Flow, MGD | | | |
| River Flow Range (cfs) | 2.0 to 2.99 | 3.0 to 3.99 | 4.0 to 4.99 | 5.0 to 5.99 |
| 10 to 19.9 | 63.45 | 63.38 | 63.35 | 63.33 |
| 20 to 39.9 | 63.65 | 63.52 | 63.45 | 63.41 |
| 40 to 59.9 | 64.06 | 63.79 | 63.65 | 63.57 |
| 60 to 100 | 64.46 | 64.06 | 63.86 | 63.73 |
| 100 to 200 | 65.27 | 64.60 | 64.26 | 64.06 |
| 200 to 300 | 67.29 | 65.94 | 65.27 | 64.87 |

| Subtable 20f. When River 7-Day Average Maximum Daily Temperature is less than 63° F but exceeds 54° F and spawning criteria applies: | | | | |
|---|---|---|---|---|
| | Effluent Flow, MGD | | | |
| River Flow Range (cfs) | 2.0 to 2.99 | 3.0 to 3.99 | 4.0 to 4.99 | 5.0 to 5.99 |
| 10 to 19.9 | 54.45 | 54.38 | 54.35 | 54.33 |
| 20 to 39.9 | 54.65 | 54.52 | 54.45 | 54.41 |
| 40 to 59.9 | 55.06 | 54.79 | 54.65 | 54.57 |
| 60 to 100 | 55.46 | 55.06 | 54.86 | 54.73 |
| 100 to 200 | 56.27 | 55.60 | 55.26 | 55.06 |
| 200 to 300 | 58.29 | 56.94 | 56.27 | 55.87 |

**Wasteload Allocation (Tables 19 and 20) Explanation**

The water quality standard for temperature requires that there shall be no increase in temperature due to anthropogenic causes when stream temperatures are above certain criteria. To this end, waste load allocations for point sources will ensure no measurable increase (0.25 ° F) during the critical season. In the Umatilla basin, the applicable criteria will be 64 ° F. [Note: Salmonid spawning and bull trout, except possibly during migration, are not present below any of the point sources that are permitted to discharge during the critical season and, therefore, neither spawning nor the bull trout criteria are applicable to the determination of point source waste load allocations.]

Using a computer model, system potential in-stream temperatures were derived by DEQ for days of peak summer temperatures by applying the non-point source loading capacity throughout the Umatilla River Basin and removing all point source discharges. Essentially, system potential temperatures are the lowest expected stream temperatures that can be achieved when nonpoint sources achieve their respective load allocations, or, in other words, upon removal of all nonpoint sources of heating due to anthropogenic causes. The site potential condition as calculated represents the warmest time of year.

The warmest time of year, while often the worst case for the river, does not necessarily produce the most stringent discharge condition for a point source discharger. The more stringent condition will occur at cooler stream temperatures, but when the appropriate criteria (64 ° F, in this case) is still exceeded downstream. This can be demonstrated by applying the following equation which is a temperature mass balance equation reconfigured to calculate temperature increase:

$$\Delta T = Q_E \times \left( \frac{T_E - T_R}{Q_E + Q_R} \right)$$

Where $\Delta T$ is the change in stream temperature,
$Q_E$ is effluent flow,
$Q_R$ is river flow,
$T_E$ is effluent temperature, and
$T_R$ is river temperature.

Assuming $T_E$, $Q_E$ and $Q_R$ all remain constant, as $T_R$ is reduced, $\Delta T$ will increase. Therefore, in order to maintain no measurable increase (or less than 0.25 ° F) either $T_E$ and/or $Q_E$ will have to be reduced or $Q_R$ will have to be increased.

This means that early and/or late during the warmest months, during periods of relatively cool river temperature, thermal discharge limits will have to be less than during the peak summer temperatures in order to comply with the temperature standard.

For the WWTPs serving Pendleton and Hermiston, wasteload allocation tables have been derived to indicate effluent temperature requirements for different effluent discharge rates and river flow rates (**Tables 19 and 20**). [Note: since Stanfield, Echo and Athena will not discharge during the critical season, their thermal waste load allocations for this period are zero.] The values in these tables were calculated using a variation of the above equation:

$$T_E = 0.25 \times \left\{ \frac{0.25 \times Q_R}{Q_E} + 1 \right\} + T_R$$

Where $T_E$ is effluent temperature needed to produce ¼ °F increase,
$Q_E$ is effluent flow,
$Q_R$ is river flow, and
$T_R$ is river temperature.

Because the temperature standard is based upon the 7-day average of the daily maximum temperatures, the parameters above should also be applied as the 7-day average of the daily maximum values. Note that the river flow $Q_R$ is divided by four (4). The Department believes that any single thermal discharge should not consume more than one quarter of the available assimilative capacity.

The river and effluent ranges selected for the tables are arbitrary. In arriving at permit limits, permit writers should expand **Tables 19 and/or 20** as needed, using the above equation.

The wasteload allocations in the tables are intended to apply only during the critical season (**Section 2.1.1.4**). It should be understood, however, that during the non-critical season, effluent thermal discharges must still not violate water quality standards.

It is likely that the Cities of Pendleton and Hermiston will not have sufficient data to evaluate their options for complying with the waste load allocations in the tables. The permits revised to implement the waste load allocations should provide a year or two to collect sufficient flow and temperature data upon which to make decisions about feasible alternatives.

**Waste Load Allocation Permit Preparation**

NPDES permits provide for waste load allocation implementation. Permits should be prepared with effluent limitations so that the loading capacity is met at the edge of the mixing zone during the critical season: no measurable increase above site potential and background temperatures during the critical season. The following information is provided to assist permit preparation:

- Background, critical season and effluent temperatures can be assessed as the 7-day running average of the daily maximums.
- Background temperatures: the temperature of the receiving body of water at any given time, normally measured just upstream of the mixing zone. In the event of multi-stream influence, such as McKay Creek and the Umatilla River, background can be calculated from a thermal balance of the two input flows.
- The percent reductions in **Table 18** are provided as a general guideline for the amount of reduction needed to attain the load capacity. Additional reduction may be needed to prevent measurable increases in the Umatilla River above background temperatures, particularly early and late in the critical season.

# Surrogate Measures – 40 CFR 130.2(i)

The Umatilla River Basin TMDL incorporates measures other than "*daily loads*" to fulfill requirements of §303(d). Although a loading capacity for heat energy is derived [e.g. Langleys per day], it is of limited value in guiding management activities needed to solve identified water quality problems. In addition to heat energy loads, the Umatilla River Basin TMDL allocates "*other appropriate measures*" (or surrogates measures) as provided under EPA regulations [40 CFR 130.2(i)].

The *Report of Federal Advisory Committee on the Total Maximum Daily Load (TMDL) Program"* (FACA Report, July 1998) offers a discussion on the use of surrogate measures for TMDL development. The FACA Report indicates:

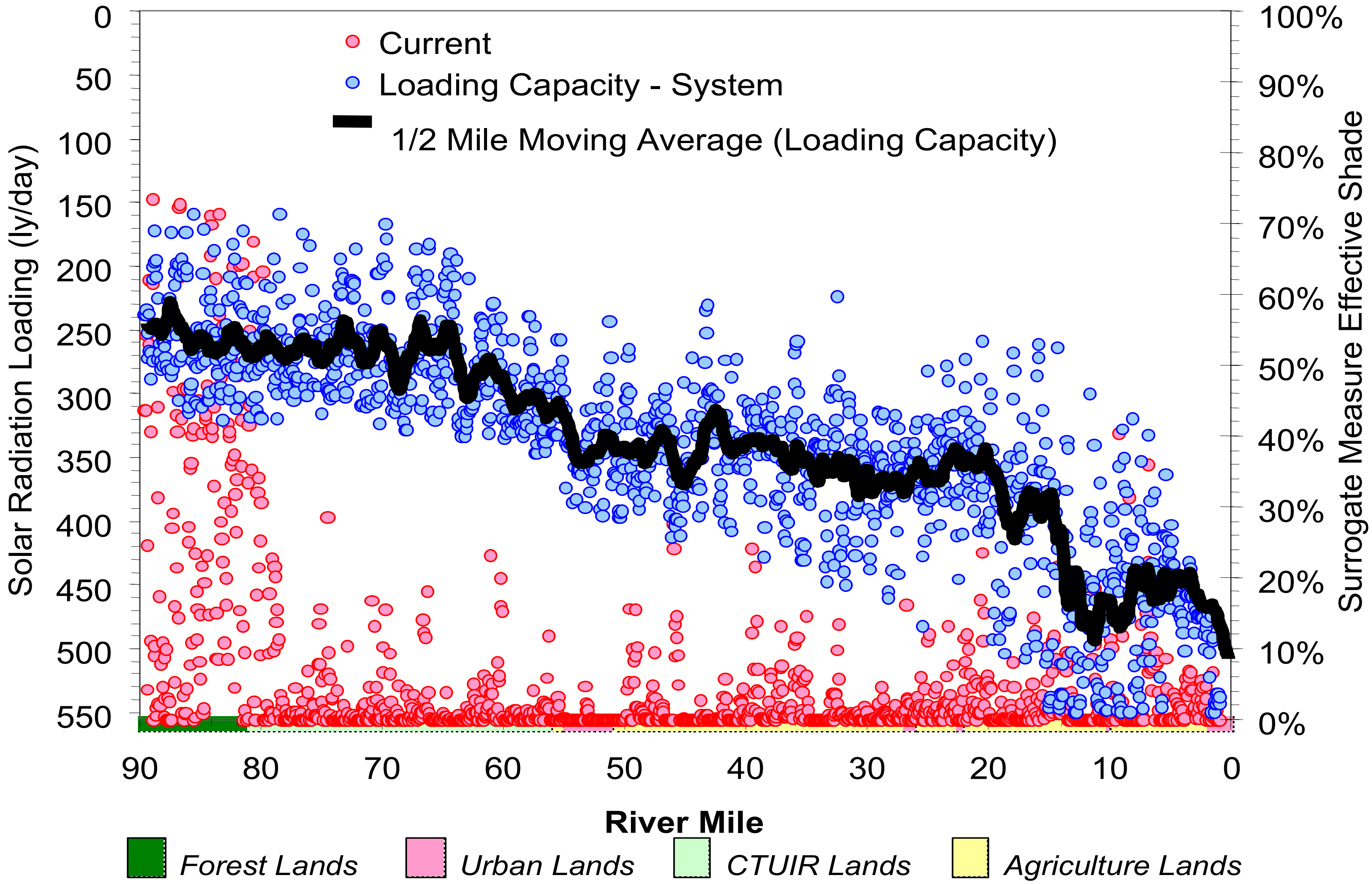
> *"When the impairment is tied to a pollutant for which a numeric criterion is not possible, or where the impairment is identified but cannot be attributed to a single traditional "pollutant," the state should try to identify another (surrogate) environmental indicator that can be used to develop a quantified TMDL, using numeric analytical techniques where they are available, and best professional judgment (BPJ) where they are not. The criterion must be designed to meet water quality standards, including the waterbody's designated uses. The use of BPJ does not imply lack of rigor; it should make use of the "best" scientific information available, and should be conducted by "professionals." When BPJ is used, care should be taken to document all assumptions, and BPJ-based decisions should be clearly explained to the public at the earliest possible stage.*
>
> *If they are used, surrogate environmental indicators should be clearly related to the water quality standard that the TMDL is designed to achieve. Use of a surrogate environmental parameter should require additional post-implementation verification that attainment of the surrogate parameter results in elimination of the impairment. If not, a procedure should be in place to modify the surrogate parameter or to select a different or additional surrogate parameter and to impose additional remedial measures to eliminate the impairment."*

The following surrogates, as well as the load capacities, are largely dependent on determination of system potential vegetation. It is acknowledged that a wider range of potential conditions than considered in this TMDL (due to limited information) is probable. If the definition of potential vegetation herein is ecologically inappropriate, site-specific potential should be rigorously evaluated to minimize past and present human impacts. Such determinations should be approved by the land use authority and ultimately by ODEQ, as the State water pollution control authority.

<u>Surrogate Measure #1:</u> Along the Umatilla River mainstem attain the potential effective shade levels specified in **Figure 37** between the North and South Fork confluence and the Columbia pool.

> As mentioned above, a loading capacity of Langleys per day is not very useful in guiding non-point source management practices. Percent effective shade is a surrogate measure that can be calculated directly from the loading capacity. Additionally, percent effective shade is simple to quantify in the field or through mathematical calculations. **Figure 37** displays the mainstem percent effective shade values that correspond to the current condition and the loading capacity (i.e., system potential).

**Figure 37.** Mainstem Percent Effective Shade Surrogate Measure



As discussed, water temperature warms as a result of increased solar radiation loads. A loading capacity for radiant heat energy (i.e., incoming solar radiation) is used to define a reduction target that forms the basis for identifying a surrogate. The specific surrogate used is percent effective shade (expressed as the percent reduction in potential solar radiation load delivered to the water surface). The solar radiation loading capacity is translated directly (linearly) by effective solar loading. The definition of effective shade allows direct measurement of the solar loading capacity.

Because factors that affect water temperature are interrelated, the surrogate measure (percent effective shade) relies on restoring/protecting riparian vegetation to increase stream surface shade levels, reducing stream bank erosion, stabilizing channels, reducing the near-stream disturbance zone width and reducing the surface area of the stream exposed to radiant processes. Effective shade screens the water's surface from direct rays of the sun. Highly shaded streams often experience cooler stream temperatures due to reduced input of solar energy (Brown 1969, Beschta et al 1987, Holaday 1992, Li et al 1994).

Over the years, the term shade has been used in several contexts, including its components such as shade angle or shade density. For purposes of this TMDL, shade is defined as *the percent reduction of potential solar radiation load delivered to the water surface* (illustrated in **Figure A-22, Appendix A-4**). Thus, the role of effective shade in this TMDL is to prevent or reduce heating by solar radiation and serve as a linear translator to the solar loading capacities.

<u>*Surrogate Measure #2*</u>: Along the tributaries attain both the potential effective shade levels specified in **Figure 38** through **40** for the appropriate physiographic/political unit (displayed in **Figure 5**) and NSDZ.

**Figures 38** through **40** are graphs of effective shade vs. NSDZ. The correlative solar loading reduction is shown as well. For a given channel width (NSDZ width) the amount of effective shade is a function of stream direction and vegetation height, width and density. The figure graphs are from this calculation, assuming the system potential vegetation characteristics described in **Section 2.1.1.3.1**. To apply this surrogate, compare the actual NSDZ with the graph NSDZ axis. If shade is less than indicated by the appropriate curve for the stream aspect, vegetation/trees and bank stability should be promoted. As vegetation matures and the channel stabilizes, the channel width should reduce, concomitant with increased effective shade, approaching or following the curve.

**Recall Figure 5**. USGS Identified Land Use

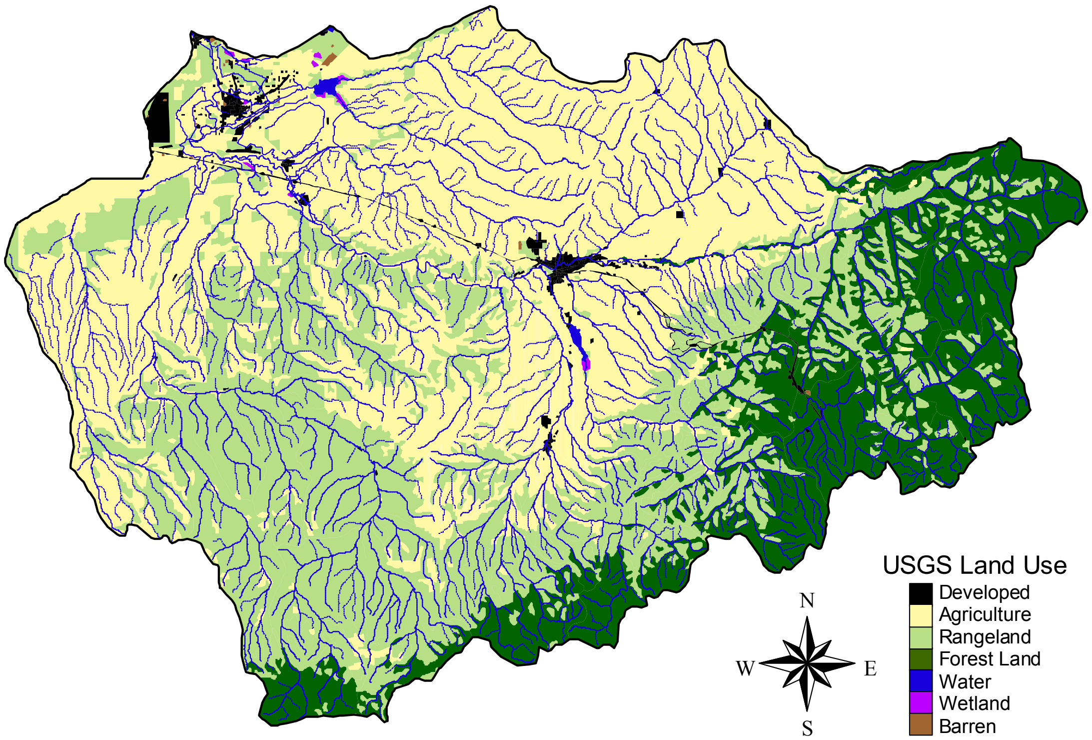



**Figure 38.** Surrogate Measure #2 Shade Curve – For Tributaries in Forested Lands (forested Lands are identified by USGS (**Figure 5**, recalled above)

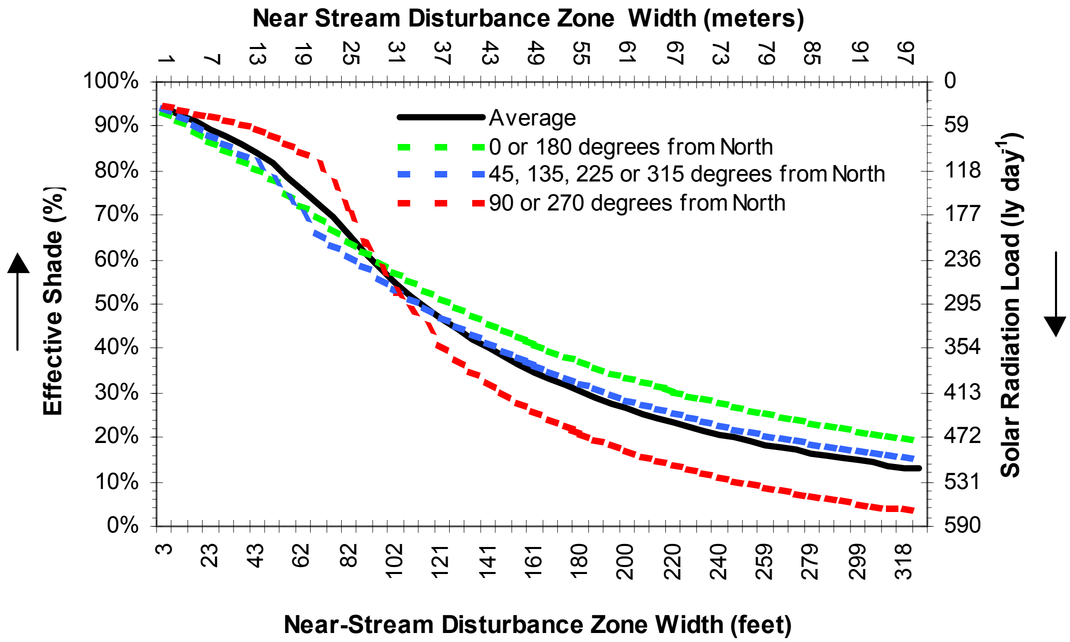


**Figure 39.** Surrogate Measure #2 Shade Curve - Butter Creek, River Mile 20 to Forest (forested Lands are identified by USGS (**Figure 5**, recalled above)

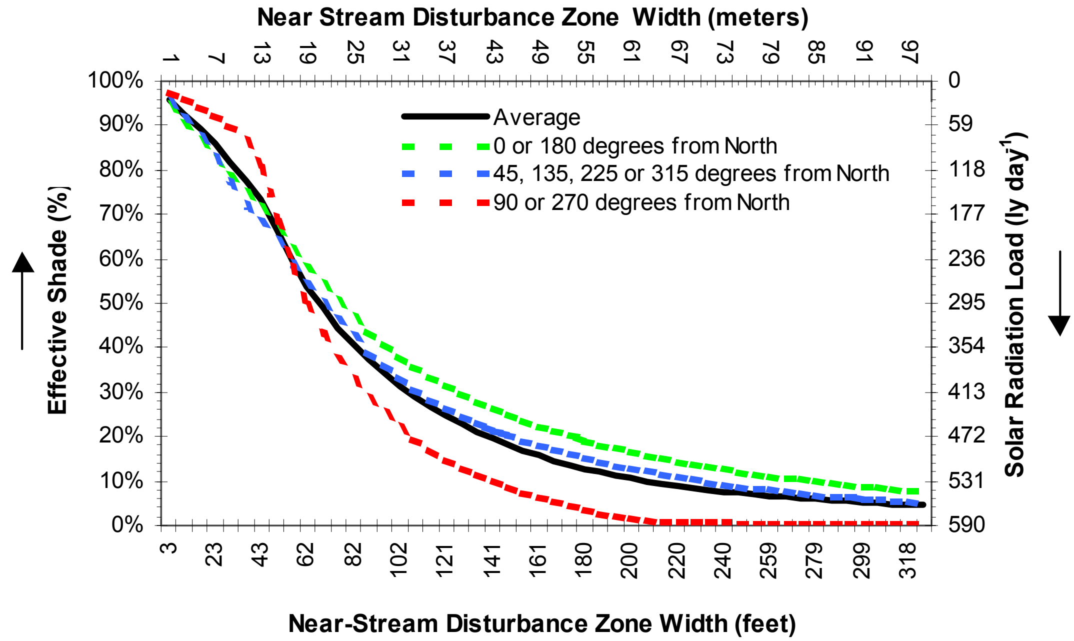
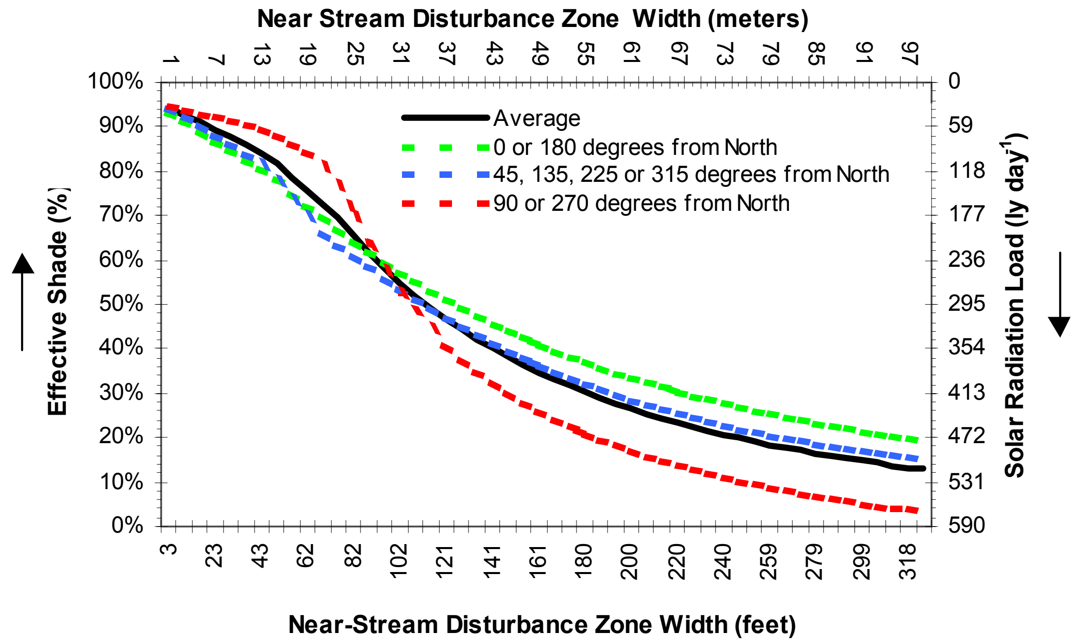
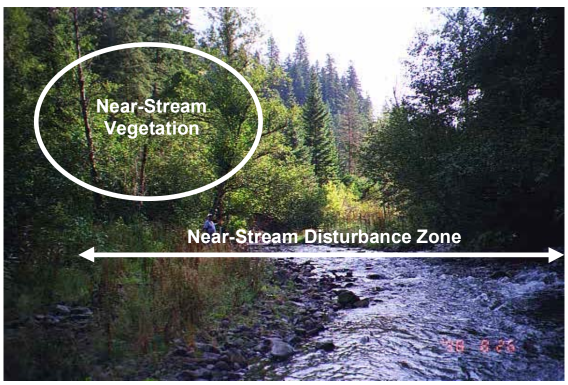


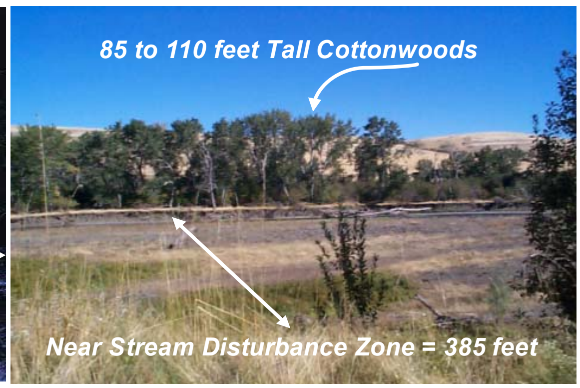

**Figure 40.** Surrogate Measure #2 Shade Curve – For Tributaries in Non-Forested Lands[11]



Surrogate Measure #3: Umatilla River near-stream disturbance zones should be reduced to the levels presented in **Figure 31**. These near stream disturbance zone (NSDZ) reductions should be achieved primarily via restoration that accompanies healthy riparian vegetation, stable stream banks, fine sedimentation reductions and improved flow management. Active stream channel restoration should consider this target by reducing channel constriction and stream bank armoring (dikes, road/railroad grades, and artificially hardened stream banks). Existing NSDZ widths should not be allowed to increase even if widths are less than shown in **Figure 31,** unless greater widths are required for stream stability, and can be shown to not adversely effect water quality, or lead to water quality degradation.

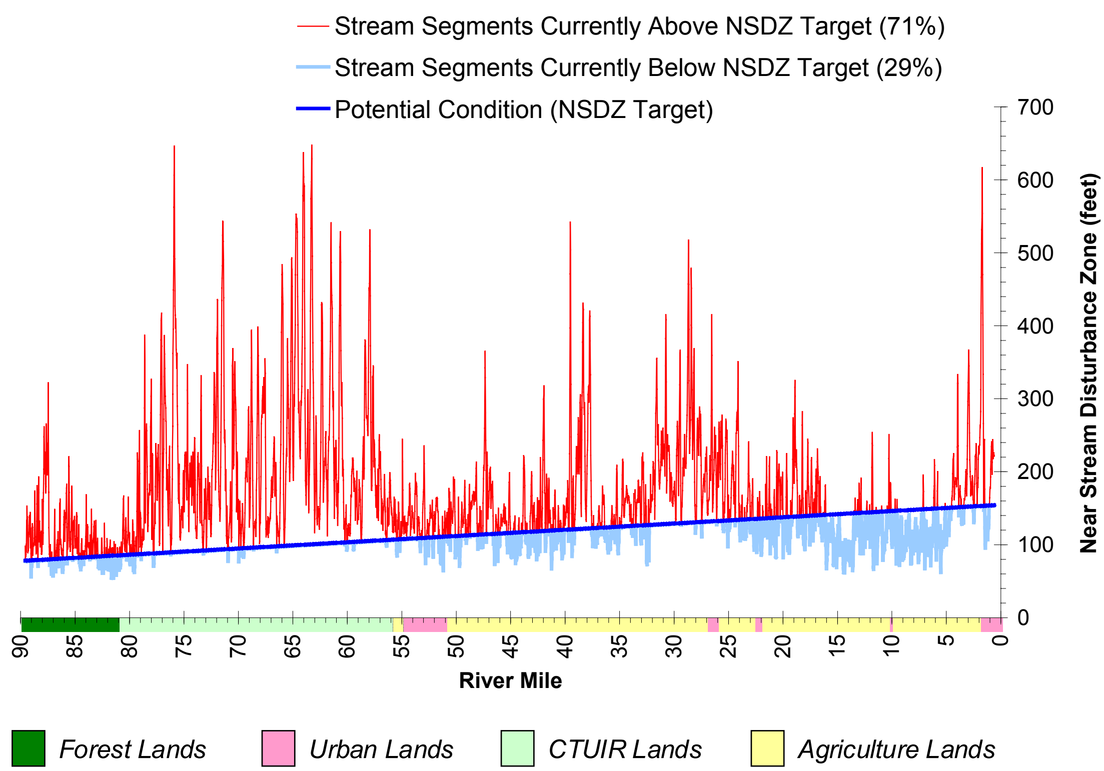
Near-Stream Disturbance Zone (NSDZ) is defined for purposes of the TMDL as the width between shade-producing near-stream vegetation. This dimension was measured from Digital Orthophoto Quad (DOQ) images and where near-stream vegetation was absent, the near-stream boundary was used, as defined as armored stream banks or where the near-stream zone is unsuitable for vegetation growth due to external factors (i.e., roads, railways, buildings, etc.).




The current condition NSDZ is characterized by 4,699 measurements taken at a 100-foot interval between the Umatilla forks and the Columbia pool (89.6 river miles). Recall that system potential NSDZ values were described in **Section 2.1.1.3.1**.

**Recall Figure 31.** Umatilla River Near Stream Disturbance Zone Width Target




*Surrogate Measure #4*: Width to depth ratios (W:D) throughout the Basin should be reduced to targets listed in **Table 15** or less. These reductions should be achieved primarily via restoration that accompanies healthy riparian vegetation, stable stream banks, fine sedimentation reductions and improved flow management. Active stream channel restoration should consider this target by reducing channel constriction and stream bank armoring (dikes, road/railroad grades, and artificially hardened stream banks).

**Recall Table 15.** Rosgen w/d Targets by Stream Type

| Stream Type | A | B | C | F |
|---|---|---|---|---|
| w/d Target | 7 | 17 | 24 | 29 |

*Surrogate Measure #5*: Where feasible and attainable, instream flows should be maintained or increased during the critical season (at a minimum, June to September) by limiting water withdrawals, improved flow management, and/or flow augmentation.

## 2.1.1.7 MARGINS OF SAFETY – CWA §303(d)(1)

The Clean Water Act requires that each TMDL be established with a margin of safety (MOS). The statutory requirement that TMDLs incorporate a margin of safety is intended to account for uncertainty in available data or in the actual effect controls will have on loading reductions and receiving water quality. A margin of safety is expressed as unallocated assimilative capacity or conservative analytical assumptions used in establishing the TMDL (e.g., derivation of numeric targets, modeling assumptions or effectiveness of proposed management actions).

The margin of safety may be implicit, as in conservative assumptions used in calculating the loading capacity, WLAs, and LAs. The margin of safety may also be explicitly stated as an added, separate quantity in the TMDL calculation. In any case, assumptions should be stated and the basis behind the margin of safety documented. The margin of safety is not meant to compensate for a failure to consider known sources. **Table 21** presents six approaches for incorporating a margin of safety into TMDLs.

**Table 21.** Approaches for Incorporating a Margin of Safety into a TMDL

| *Type of Margin of Safety* | *Available Approaches* |
|---|---|
| ***Explicit*** | 1. Set numeric targets at more conservative levels than analytical results indicate.<br>2. Add a safety factor to pollutant loading estimates.<br>3. Do not allocate a portion of available loading capacity; reserve for MOS. |
| ***Implicit*** | 1. Conservative assumptions in derivation of numeric targets.<br>2. Conservative assumptions when developing numeric model applications.<br>3. Conservative assumptions when analyzing prospective feasibility of practices and restoration activities. |

The following factors may be considered in evaluating and deriving an appropriate margin of safety:

- ✓ *The analysis and techniques used in evaluating the components of the TMDL process and deriving an allocation scheme.*
- ✓ *Characterization and estimates of source loading (e.g., confidence regarding data limitation, analysis limitation or assumptions).*
- ✓ *Analysis of relationships between the source loading and instream impact.*
- ✓ *Prediction of response of receiving waters under various allocation scenarios (e.g., the predictive capability of the analysis, simplifications in the selected techniques).*
- ✓ *The implications of the MOS on the overall load reductions identified in terms of reduction feasibility and implementation time frames.*

A TMDL and associated margin of safety (MOS), which results in an overall allocation, represents the best estimate of how standards can be achieved. The selection of the MOS should clarify the implications for monitoring and implementation planning in refining the estimate if necessary (adaptive management). The TMDL process accommodates the ability to track and ultimately refine assumptions within the TMDL implementation-planning component.

## Implicit Margins of Safety

Description of the margin of safety for the Umatilla Basin Temperature TMDL begins with a statement of assumptions. A margin of safety has been incorporated into the temperature assessment methodology. Conservative estimates for groundwater inflow and wind speed were used in the stream temperature simulations. Specifically, unless measured, groundwater inflow was assumed to be zero. In addition, wind speed was also assumed to be at the lower end of recorded levels for the day of sampling. Recall that groundwater directly cools stream temperatures via mass transfer/mixing. Wind speed is a controlling factor for evaporation, a cooling heat energy process. Further, cooler microclimates and channel morphology changes associated with late seral conifer riparian zones were not accounted for in the simulation methodology.

Calculating a numeric margin of safety is not easily performed with the methodology presented in this document. In fact, the basis for the loading capacities and allocations is the definition of system potential conditions. It is illogical to presume that anything more than system potential riparian conditions are possible, feasible or reasonable.

## 2.1.1.8 WATER QUALITY STANDARD ATTAINMENT ANALYSIS – CWA §303(d)(1)

Maximum daily mainstem temperatures (displayed in **Figure 44**) represent the system potential when ***no measurable surface water temperature increase resulting from anthropogenic activities*** occurs.

Simulations were performed to calculate the mainstem temperatures that result with the allocated measures that form the basis for the system potential condition with no measurable surface water temperature increase resulting from anthropogenic activities. The resulting simulated temperatures represent the attainment of system potential, and therefore, attainment of the temperature standard.

During the August 10, 1998 simulation period, 0.8% of the sampled Umatilla River length (89.6 river miles from the Umatilla Forks to the Columbia pool) was under 64$^{o}$F. The remaining 99.2% of the Umatilla River length was above 64$^{o}$F. 44.8% of the river length is above 72$^{o}$F which is a thermal condition considered to be 'incipient lethal' for salmon. **Figures 41** through **43** graphically illustrate current condition and modeled potential temperatures of the Umatilla mainstem, based on August 19, 1998 assessment.

**Figure 44** compares the current Umatilla River mainstem temperatures with river temperatures that result at system potential conditions as a result of the implementation of Surrogate Measures #1 through #4. The upper graph of **Figure 44** is a "box and whisker" plot (refer to appended glossary for explanation of this graph type) illustrating the system potential temperatures of the large number of reaches simulated, for the various flow scenarios described below. The lower graph also portrays system potential temperatures. The lower graph illustrates the proportion of river length within specified temperature ranges, again according to flow scenario. The system potential river temperatures directly correlate to the loading capacity (i.e., they are the temperatures that result when the loading capacity is met). Specifically, the temperatures displayed in **Figure 44** as system potential are temperatures that exist when no measurable surface water temperature increase resulting from anthropogenic activities occurs (with the exception of improved flow management – Surrogate Measure #5).

“Current Flows” occur when flow conditions are those that were measured during August 10, 1998. **Figure 41** displays the system potential temperatures during this “Current Flow” condition. When the system potential is reached (Surrogate Measures #1 through #4) 40% of the river length is below 64°F. The extent of incipient lethal temperatures (> 73°F) is reduced to 4% of the river length. This reduction in temperature represents a 91% reduction (or 35.0 river miles) in terms of the extent of incipient lethal temperatures.

"Natural Flows" occur when there is no flow augmentation from McKay Reservoir, no water withdrawals and no irrigation return flows. **Figure 42** displays the system potential temperatures during this "Natural Flow" condition. The percentage of the Umatilla River below 64°F in the system potential "Natural Flow" condition is 22%. However, temperatures do not exceed 73°F throughout the entire mainstem.

"Flow Augmentation" occurs when there is flow augmentation from McKay Reservoir, no water withdrawals and no irrigation return flows. **Figure 43** displays the system potential temperatures during this "Flow Augmentation" condition. The extent of temperatures below 64°F in the system potential with "Flow Augmentation" condition is 61%. An additional 35% of the Umatilla River was between 64°F and 68.5°F. Temperatures do not exceed 73°F throughout the entire Umatilla River. *[NOTE: the term 'flow augmentation' is used generally to address releases from McKay reservoir that are greater than un-impounded streamflow - this Chapter does not employ a contractual or project-based definition of the term]*

Spatial distributions of the predicted temperatures for the various flow conditions are presented in **Figure 44**. System potential (Surrogate Measures #1 through #4) with maximum potential flows achieve the greatest temperature reductions. In all scenarios, the distribution of incipient lethal temperatures is dramatically reduced from the current condition.

**Figure 41.** Attainment of Surrogate Measures 1-4 with Current Flow Conditions (8-10-98)

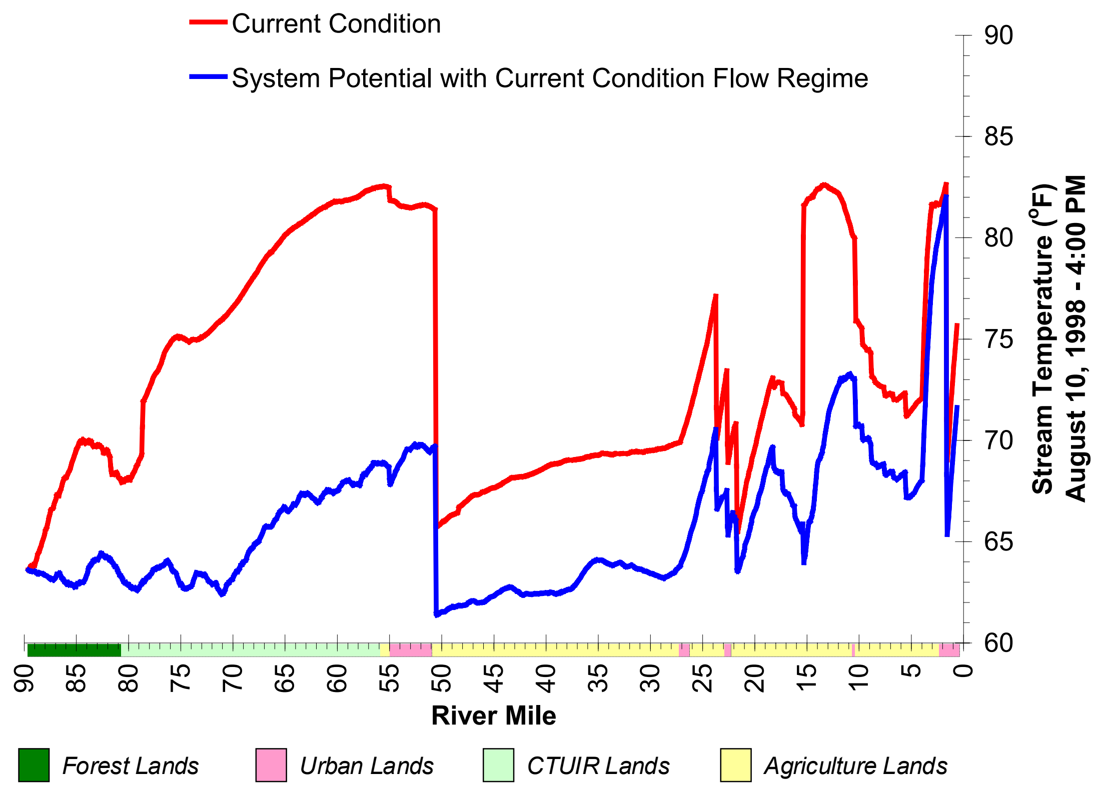
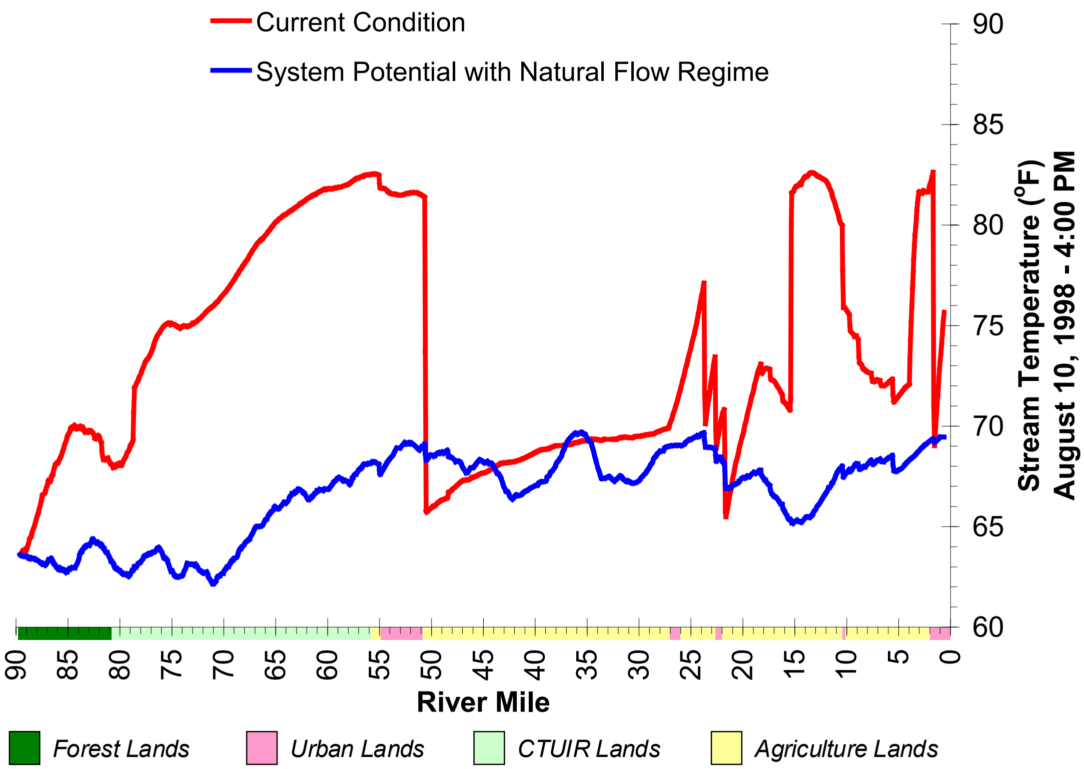


**Figure 42.** Attainment of Surrogate Measures 1-5 with Natural Flow Conditions (8-10-98)



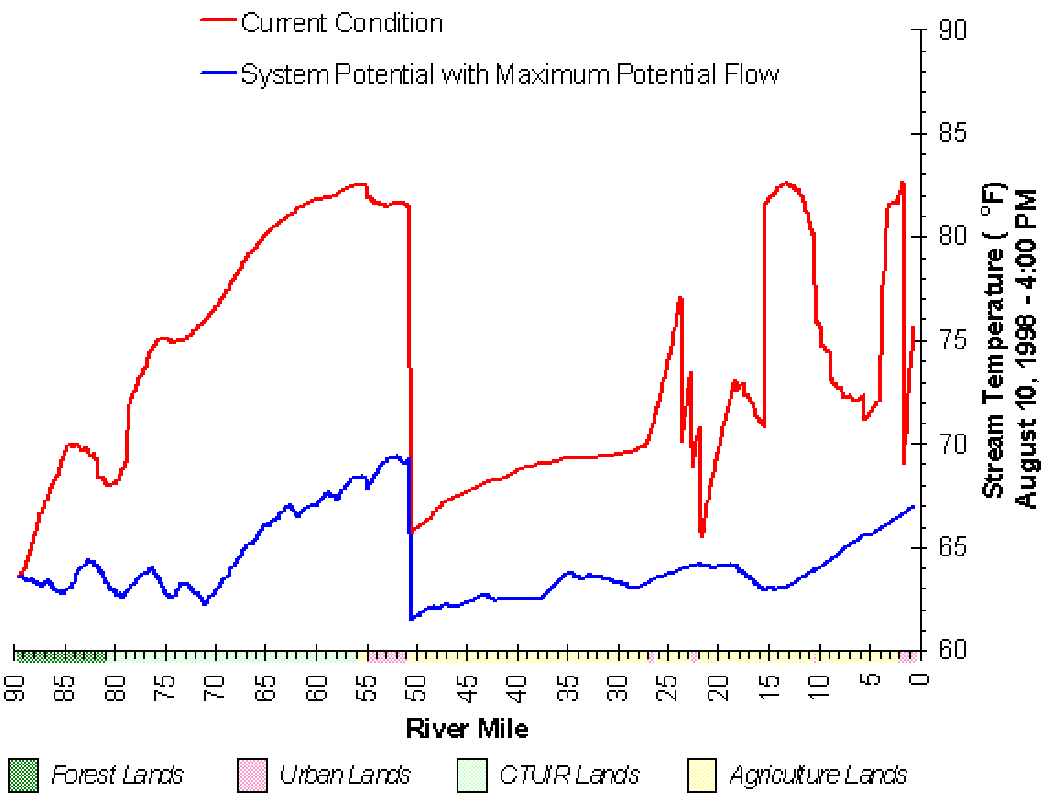
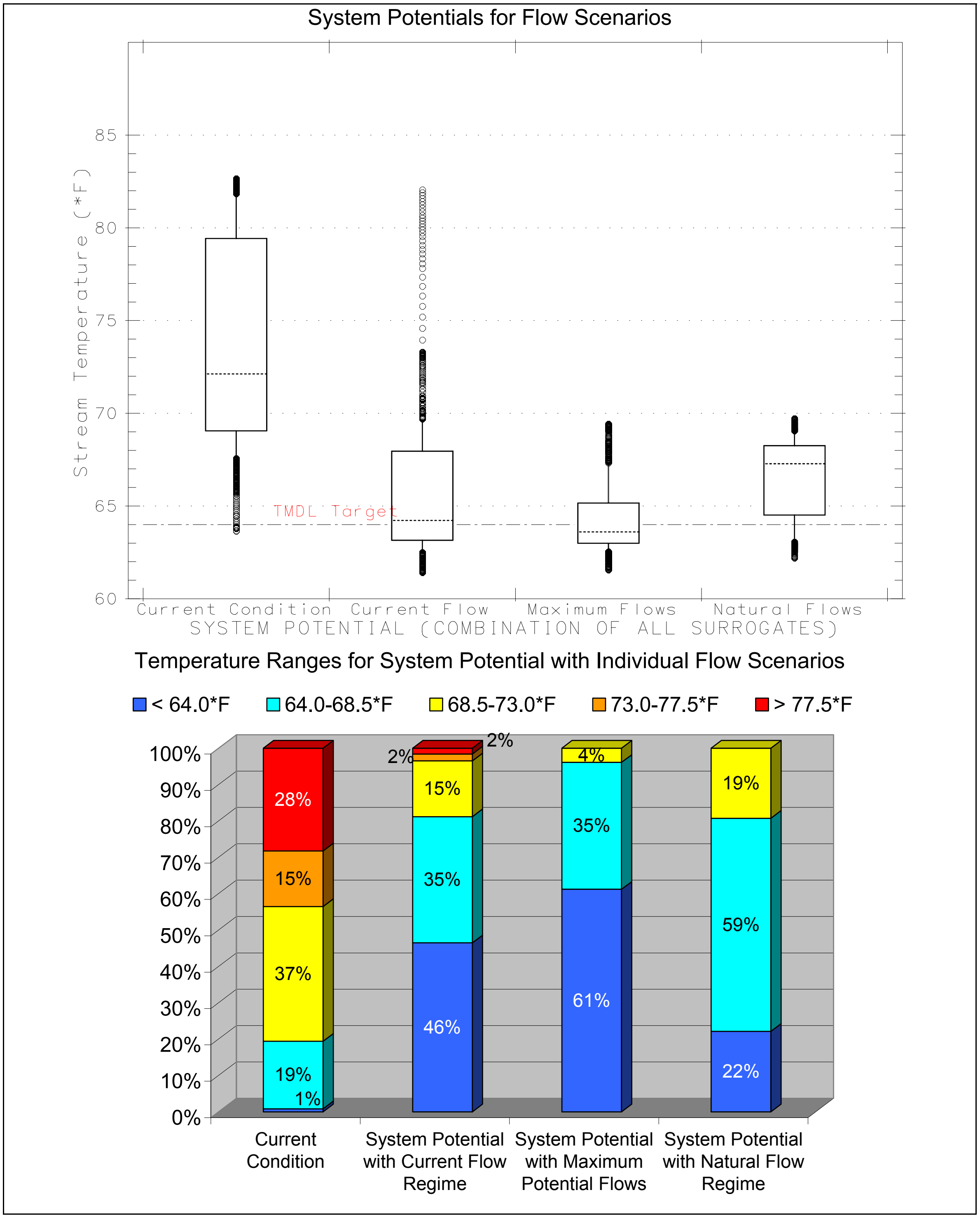




**Figure 43.** Attainment of Surrogate Measures 1-5 with Flow Augmentation (8-10-98)

**Figure 44.** Umatilla River Mainstem Simulated System Potential[9] Temperatures
Three Flow Regimes (89.6 River Miles) *4:00 PM August 10, 1998*




[9] System potential is the combination of all the surrogate measures (near stream vegetation restoration, near stream disturbance zone width reductions and width to depth ratio reductions).

# 2.1.2 SEDIMENT TMDL

This sediment TMDL specifies an amount of suspended-pollutant load reduction calculated to achieve turbidity levels that are protective of salmonid feeding and respiration. This TMDL is designed to implement the turbidity water quality standard by explicitly targeting turbidity and the sedimentation standard by reducing the amount of suspended material available for settling. It allocates pollutant loads among sources in the watershed, and provides a basis for implementing land management practices needed to restore water quality.

## 2.1.2.1 TARGET IDENTIFICATION

This section identifies the target that the sediment TMDL is based on. A numeric target for turbidity is established in this section, providing a quantitative endpoint for TMDL establishment. A quantitative measure of sedimentation (the impairment is excess deposition of fine sediment in the streambed) is discussed in **Section 2.2.**

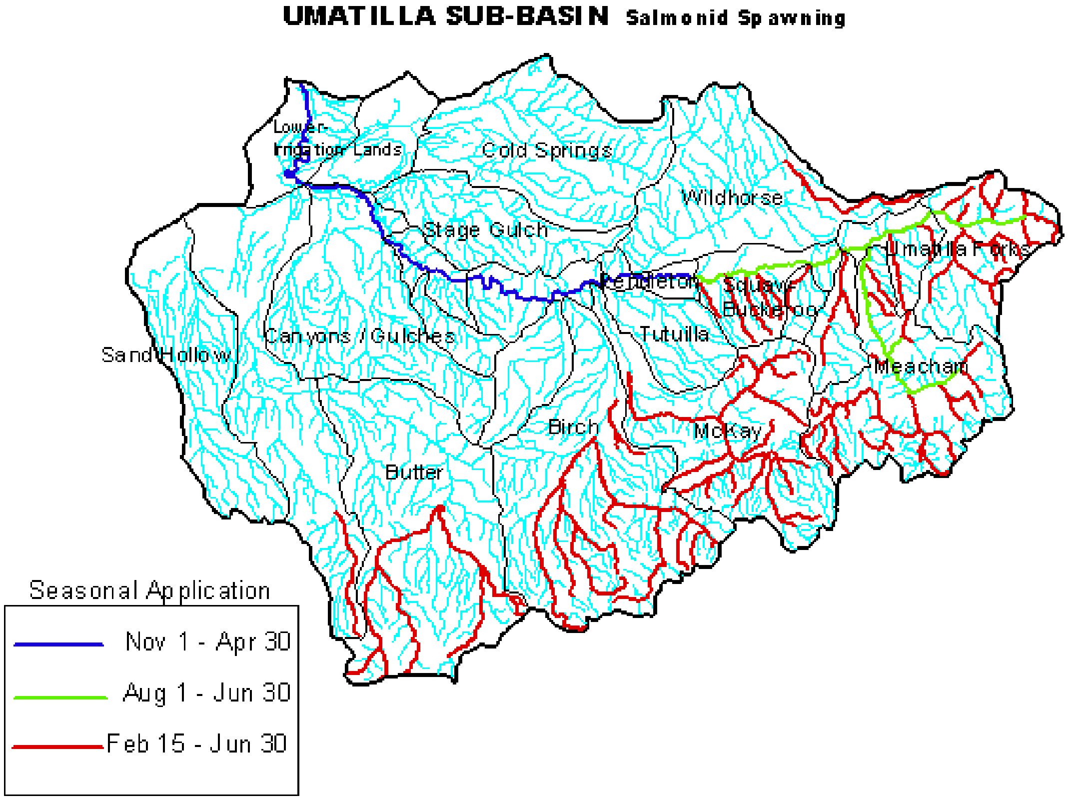
### 2.1.2.1.1 Sediment Related to Aquatic Life

Excessive suspended material and sedimentation threatens the survival of fish and other aquatic animals. The effects of turbidity and suspended solids include: respiratory and feeding impairment, social disorganization. Excessive fine sedimentation in spawning grounds limits available oxygen and removal of metabolic toxins near eggs and physically renders spawning sites less suitable. Literature and effects are discussed in **Section 2.2** and **Appendix A-5**.

### 2.1.2.1.2 Sensitive Beneficial Use Identification

Oregon Administrative Rule (OAR) 340-41-642 states: “Water quality in the Umatilla River Basin shall be managed to protect the recognized beneficial uses as identified in Table 11 of the OAR.” These designated beneficial uses are listed in **Section 1.3.1**. Salmonid spawning is generally the most sensitive use relevant to sediment, and has been identified as a beneficial use from the Umatilla River at Mission (Rivermile 61.5) to the mouth from November 1 through April 30 and in the middle and upper Basin August 1 through June 30 (see **Figure 9**).

**Recall Figure 9a.** Umatilla Basin Salmonid Spawning Areas and Timeframes




The map of attainable spawning areas illustrates the areas and seasons in which salmonid spawning is considered attainable in the Umatilla Basin, as determined by fish biologists from the Oregon Department of Fish and Wildlife, The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and the U.S. Forest Service (Umatilla National Forest).

## 2.1.2.1.3 Water Quality Standard Identification

**Table 22** lists the State of Oregon water quality standards for sediment and turbidity:

| **Table 22.** Applicable Sedimentation, Turbidity and Biological Criteria Standards |
|---|
| *Sedimentation (OAR 340-41-645(2)(j)* – "The formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry shall not be allowed." |
| *Biological criteria (OAR 340-41-027)* - "Waters of the State shall be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities." |
| *Turbidity (OAR 340-41-645(2)(c))* - "No more than a ten percent cumulative increase in natural stream turbidities shall be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity." |

## 2.1.2.1.4 IDENTIFICATION OF WATER COLUMN ENDPOINTS

The Environmental Protection Agency (EPA) and the State of Oregon do not have numeric water quality standards for suspended solids or streambed fines. The applicable standards (previous section) are relative or narrative.

The sediment-related water quality impairments were identified (Clean Water Act Section 303(d) list) based on streambed surface area percent fines and greater than ten percent increase in mainstem turbidity caused by mid-basin tributaries. While numeric data and professional judgement (Umatilla Basin TMDL fishery managers & Technical Committee) indicate the need for sediment reduction, these data do not lend themselves to load calculations. An endpoint that could be related to sediment loading and evaluated with available data was sought.

The Umatilla Basin fisheries managers determined through basin-specific knowledge and literature review that 30 nephelometric turbidity units (NTU) instream turbidity (not to exceed a 48-hour duration) is protective of aquatic species and will not be detrimental to residential biological communities. **Appendix A-5** includes a basin fish managers report which supports this conclusion. This target is applicable basin-wide and year-round. *To visualize water quality impairment resulting from 30 NTU turbidity, imagine looking through a six-inch column of water and seeing lines of newsprint but not being able to read the words*.

It should be noted that there are inherent difficulties in linking turbidity and TSS to physical and biological processes and in measuring these variables and their effects. Upland erosion, deposition and delivery to the stream as well as instream sediment erosion, transport and deposition are highly variable processes.

In order to express the water column sediment TMDL in terms of mass load, regressions were calculated to evaluate the association between total suspended solids (TSS, described in the next section) and turbidity. The TMDL applies to the 14 watersheds comprising the Umatilla Basin. The regression analyses were done for all watersheds where data was available. The TSS correlative to 30 NTU turbidity was calculated as the TMDL target concentration for those watersheds. Where data was not collected, a Basin-wide mean calculated from all of the TSS and turbidity data collected in the Umatilla Basin was utilized as the watershed target. The following table lists the watersheds with their associated TSS target concentration:

**Table 23.** Watershed Target Concentrations/Loading Capacities

| *Watershed* | *TSS Target (mg/L) @ 30 NTU Turbidity* |
|---|---|
| Upper Umatilla River | 76 |
| Meacham Creek | 60 |
| Squaw/Buckaroo | 99 |
| Pendleton | 80* |
| Wildhorse | 86 |
| Tutuilla | 70 |
| McKay | 72 |
| Birch | 110 |
| Butter | 110 |
| Gulches and Canyons | 80* |
| Stage Gulch | 80* |
| Sand Hollow | 80* |
| Cold Springs | 80* |
| Lower Umatilla River | 77 |

* Basin-wide mean of 80 mg/l

## 2.1.2.2 DEVIATION FROM WATER QUALITY STANDARDS (SEDIMENTATION AND TURBIDITY STANDARDS)

**Tables 24** and **25** summarize the stream segments on the 1998 §303(d) list for sedimentation and turbidity, and **Figures 45 and 46** map these segments. Oregon's §303(d) list and its supporting data references can be publicly accessed through the Oregon Department of Environmental Quality web page at the following URL: http://www.deq.state.or.us. Relevant Oregon State water quality standards are printed in **Appendix A-7**.

**Table 24.** Segments on the 1998 §303(d) List for Sedimentation

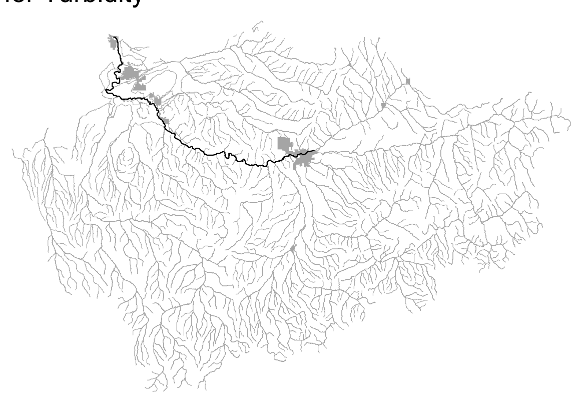
| *Waterbody Name* | *Boundaries* |
|---|---|
| Beaver Creek | Mouth to Headwaters |
| Birch Creek, West Fork | Mouth to Headwaters |
| Boston Canyon Creek | Mouth to Headwaters |
| Coonskin Creek | Mouth to Headwaters |
| Cottonwood Creek | Mouth to Headwaters |
| Line Creek | Mouth to Headwaters |
| Little Beaver Creek | Mouth to Headwaters |
| Lost Pin Creek | Mouth to Headwaters |
| McKay Creek, North Fork | Mouth to headwaters |
| Meacham Creek | East Meacham Creek to Headwaters |
| Mill Creek | Mouth to Headwaters |
| Mission Creek | Mouth to Headwaters |
| Moonshine Creek | Mouth to Headwaters |
| Rail Creek | Mouth to Headwaters |
| Sheep Creek | Mouth to Headwaters |
| Twomile Creek | Mouth to Headwaters |
| Umatilla River | Wildhorse Creek to Forks |

**Table 25.** Segments on the 1998 §303(d) List for Turbidity

| *Waterbody Name* | *Boundaries* |
|---|---|
| Umatilla River | Mouth to Mission Creek |

**Figure 45.** Segments on the 1998 §303(d) List for Sedimentation

**Figure 46.** Segments on the 1998 §303(d) List for Turbidity



## 2.1.2.3 POLLUTANT

Turbidity is the pollutant that the sediment TMDL is based on. Turbidity was then related to TSS, producing a concentration based endpoint for the TMDL.

Turbidity and TSS provide an indication of upstream sedimentation processes through observing the amount of suspended material in the water column through gravimetric (TSS and TS – e.g. mg/L) and visual (turbidity – e.g. NTU (nephelometric turbidity units)) methods. Turbidity is a direct measurement of the relative level that suspended matter interferes with the passage of light through water. However, because the TMDL is best expressed as a mass load, total suspended solids (TSS) is the constituent used as a surrogate for turbidity in this TMDL. TSS and turbidity are variously correlated for Umatilla Basin streams (typically correlation coefficients were greater in the 1998-1999 winter, see regression analyses in **Appendix A-6**).

Samples for TSS are well mixed and filtered through a 0.45-micron standard glass fiber filter and the residue is dried to a constant weight in an oven held at $103^oC$ - $105^oC$. The increase in weight over that of the filter represents the total suspended solids (Standard Methods, $18^{th}$ Edition). The TSS represents the fraction of total solids suspended in the water column.

Turbidity is a measure of cloudiness in water. In streams, turbidity is usually associated with suspended particles, but can also be caused by the presence of organic matter. The analytical method (Standard Methods, $18^{th}$ Edition) is based on a comparison of the intensity of light scattered by the sample under defined conditions to the intensity of light scattered by a standard reference suspension under the same conditions. Readings, in Nephelometric Turbidity Units (NTU's), are made on a Nephelometer designed according to standard specifications. Turbidity was measured to provide a simple indirect measure of suspended sediments in streams. Stream turbidity is often closely related to TSS, however the specific relationship varies, depending on several factors including the solids type and size. Because of these interrelationships, the impact of suspended solids and turbidity on aquatic life are often evaluated together.

In addition to these water column effects, many streams of the Umatilla Basin have unusually fine-grained streambeds. Fine-grained streambeds are a result of the dominant grain size produced from weathered basalt and unconsolidated loess deposits, the dominant geology in the Basin. Land uses can accelerate production of stream fines. Sources include streambank erosion and uplands that resulted in the sedimentation 303(d) listing. An increased amount of fine-grained sediment comprising the streambed can impair salmonid spawning through reduction of dissolved oxygen adjacent to eggs, reduction of pore-space circulation needed to remove metabolic wastes associated with redds, and reduction of the gravel armoring needed for protection during emergence. It is not feasible at the sub-Basin scale to predict the reduction in the amount of erosion necessary to quantitatively improve the streambed grain-size distribution. However, reduction of fine sediment entering the stream is expected to improve the condition and long-term monitoring will support evaluation of the needed reduction. A method (Wolman pebble counts) and goals for evaluation of streambed fines are discussed in **Section 2.2**. This sediment TMDL, though calculated based on suspended material, supports improvement to the streambed as well.

### 2.1.2.4 LOADING CAPACITY

Identification of the instream sediment loading capacity is the first step for the development of TMDLs. The loading capacity is defined as the greatest amount of a pollutant that water can receive without exceeding water quality standards.

**Section 2.1.2.1** states that instream target concentrations for TSS, necessary to protect beneficial uses, were calculated for 14 Umatilla Basin watersheds. The loading capacities for the individual watersheds are the target concentrations and are included in **Tables 23** and **26.**

### 2.1.2.5 LOAD ALLOCATION DEVELOPMENT AND APPLICATION

A *Load Allocation* (LA) is the maximum amount of pollutant that ***natural and non-point*** sources can contribute to a stream in compliance with State water quality standards. The sediment erosion load allocations for the Umatilla Basin are expressed as percent reductions for the individual watersheds. **Figure 47** illustrates the percent of the total erosion reductions necessary to achieve the TSS target concentrations from upland runoff and streambank sources for each of the watersheds. Upland refers to land area outside of stream channels and banks. Streambank contributions to the total load result from unstable banks. The allocations apply to urban (including rural and unincorporated residential, commercial and industrial), agriculture (farming and ranching including range and cropland), and transportation land uses. Each land use authority is responsible for the watershed percent reduction throughout the land area where their land use predominates.

This TMDL establishes goals for streams within the Umatilla Basin that are not currently on the Oregon 1998 303(d) list. This is consistent with State and Federal TMDL implementation law and policy. Un-listed streams are addressed because upstream improvements are needed to lessen mid-lower Umatilla River mainstem turbidity and sedimentation. Various causes of impairment are readily observed throughout the Basin (turbid waters, excess streambed fines, unstable streambanks, rill and gully erosion; channelization, bank and upland disturbance). Un-listed areas are lacking in-stream data, and were characterized by comparison with adjacent watersheds.

#### 2.1.2.5.1 Load Allocations

**Figure 47** presents the load allocations for upland and streambank erosion.

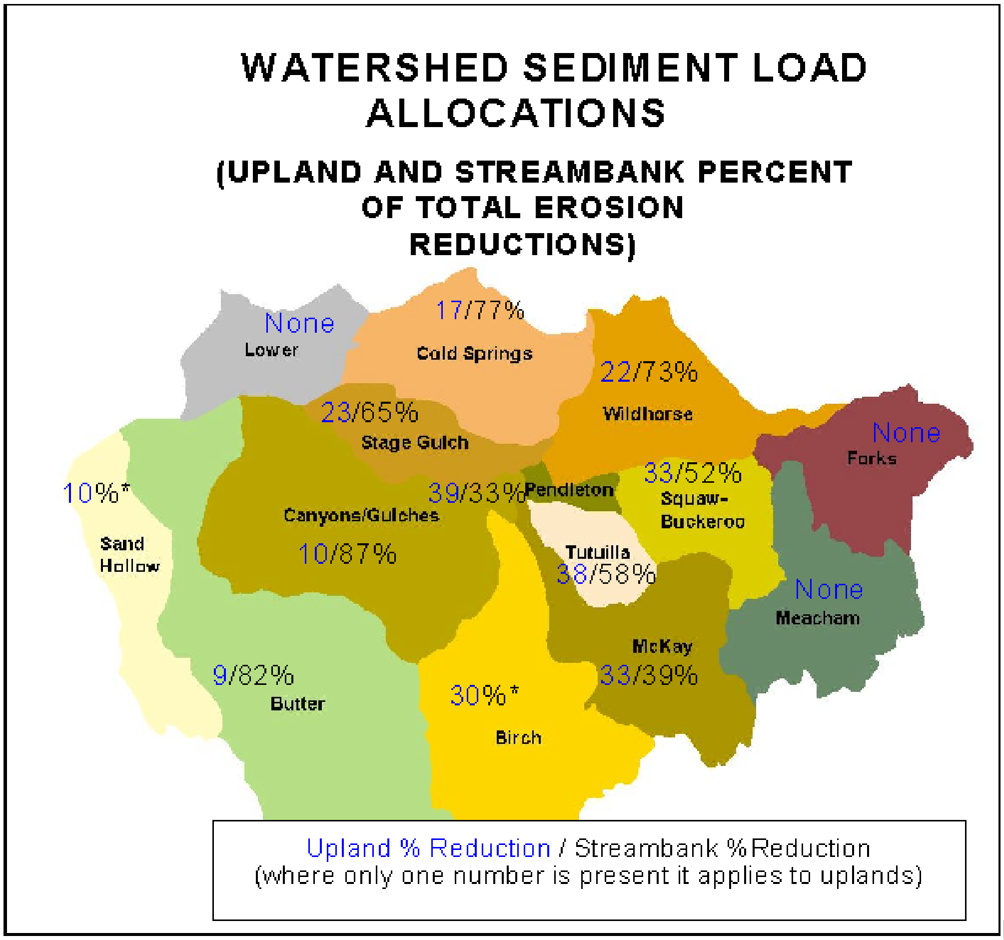
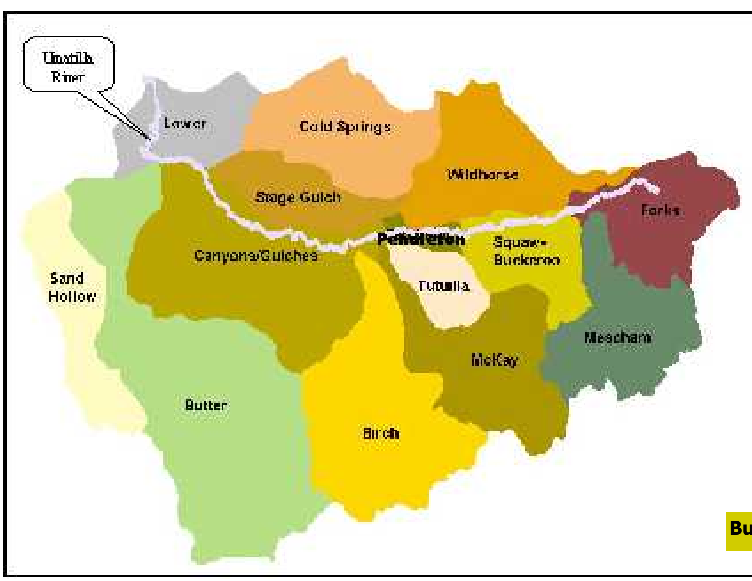



**Figure 47.** Erosion Percent Reductions During Design Storm Event




Buckaroo

* refer to **Table 26** footnote



Buckaroo

**Figure 47** illustrates the upland and streambank percentages of the total erosion reduction necessary to meet the instream target concentrations. The allocations are based upon modeled conditions and used rainfall and stream gage data collected during a storm that occurred in late December, 1998. The model simulates streamflow and surface runoff coinciding with this precipitation event, throughout the Basin. This is important because stream gage and runoff data are limited in spatial extent. As a model basis, this event is referred to as a *design storm*. This storm increased Umatilla River flow to approximately 1.5 times its bankfull discharge below Pendleton. The percentage reductions in loading were calculated using design storm event-mean instream TSS concentration model output.

Sediment sources can be placed into three general categories: Sediment derived from fields and slopes (referred to here as upland erosion), streambanks, and mass wasting. The first two are addressed via the load allocations (**Figure 47, Table 26**). Mass wasting, including landslides and debris flows, is considered to be a lesser source of sediment and is not assigned a load allocation (assessed in **Section 2.1.2.8.3**). Two other important quantities that are reflected in the load allocation analysis are the sediment transported to streams and the load carried in streams. Upland erosion and the amount delivered to the stream are not the same due to factors such as downslope storage, but the two are related via a watershed-specific delivery ratio. Upland erosion is characterized by the Modified Universal Soil Loss Equation (MUSLE, described below). This calculation is refined by calibration to measured in-stream TSS at the mouth of each watershed where both streamflow and TSS data were collected. The streambank contribution is a separate calculation utilizing empirical relationships of model output hydrology and TSS and non-forested watershed area.

Another category of sediment position is in-channel storage and release. In-channel sediment is partly an outcome of the balance between deposition and re-suspension, broadly accounted for by the model calibration of soil loss to in-stream total suspended solids. It is assumed in the allocation that in-channel sediment is not generally a significant anthropogenic source of sediment or that it will be sufficiently controlled by attainment of the load allocations.

# 2.1.2.5.2 Load Allocation Determination Summary

Outlined below are the steps used for determining the load allocations:

- Current upland erosion (mass per area) was calculated using the MUSLE and calibration to streamflow and instream TSS measurements from two consecutive winter monitoring surveys, 1997-1998 and 1998-1999 (conversion to TSS is based on a delivery ratio and mass balance). This calibration provided the basis for simulating specific storm events and predicting sediment loss in the basins lacking sufficient data to otherwise account for.
- The design storm condition (December, 1998 – approximating 1.5 bankfull flow) was modeled providing upland erosion and instream TSS outputs.
- Design storm instream TSS (mg/L) was compared to instream target concentrations.
- Total erosion reductions necessary to achieve instream target concentrations were calculated for the 14 watersheds (TSS reduction needed to achieve target).
- Streambank contribution was evaluated using MUSLE calibration hydrology and TSS trends and non-forested rivermiles (method below).

The total erosion reduction percentages, percentage of total erosion reduction for the upland and streambank erosion components, and storm event mean TSS concentrations are detailed in **Table 26** (additional detail on the load allocation calculations is included in the following sections).

**Table 26.** Water Column Sediment TMDL Summary

| Watershed | Modeled Event Mean TSS (mg/L) | TSS Loading Capacity (mg/L) | Design Storm Total Erosion Percent Reduction | Upland Component Percent of Total Reduction | Streambank Component Percent of Total Reduction |
|---|---|---|---|---|---|
| Upper Umatilla | 14 | 76 | None | None | None |
| Meacham | 34 | 60 | None | None | None |
| Squaw / Buckaroo | 652 | 99 | 85 | 33 | 52 |
| Pendleton | 279 | 80 | 72 | 39 | 33 |
| Wildhorse | 1694 | 86 | 95 | 22 | 73 |
| Tutuilla | 1599 | 70 | 96 | 38 | 58 |
| McKay | 251 | 72 | 72 | 33 | 39 |
| Birch | 376 | 110 | 71* | * | * |
| Butter | 1186 | 110 | 91 | 9 | 82 |
| Gulches / Canyons | 2560 | 80 | 97 | 10 | 87 |
| Stage Gulch | 656 | 80 | 88 | 23 | 65 |
| Sand Hollow | 1115 | 80 | 93* | * | * |
| Cold Springs | 1295 | 80 | 94 | 17 | 77 |
| Lower Umatilla | 36 | 77 | None | None | None |

## 2.1.2.5.2.1 DESIGN EVENT MAGNITUDE

The load allocations are based on a storm of specified intensity, referred to as a design storm. The total percent reductions illustrated above were calculated for a design storm that exceeded Umatilla River bankfull flow. For example, 1.5 times the bankfull flow of the Umatilla River near Umatilla gage (rivermile 2.1) is 4710 cfs, with an average recurrence interval of 1.25 years, and the design storm flow peaked at 4780 cfs. This design condition was chosen because the bankfull stage is defined as the incipient elevation of flooding; the elevation of the water just before it begins to spread out onto the floodplain.

* Streambank and upland erosion are not separately accounted for in these watersheds. Model characterization of streambank erosion in these watersheds was limited by local low flow associated with the design storm. In order to simulate real conditions as closely as possible, the design storm was based on an actual event as discussed in the text. Storm intensity and runoff varies significantly across the land, particularly over large regions with complex topography such as the Umatilla Basin. As in all of the Umatilla Basin watersheds, the eroding streambank management goal (**Section 2.1.2.6.1.1**) serves as a streambank goal. The upland component can be estimated by averaging adjacent watershed reduction values. This leads to upland erosion reduction goals of approximately 10% and 30% for Sand Hollow and Birch Creek, respectively.

Thus the TMDL considers flood effects. Modeling of significantly larger flows would result in increasing uncertainty and dramatic masking of surface runoff by bank sources.

## 2.1.2.5.2.2 MODEL DESCRIPTION

A GIS-based Modified Universal Soil Loss Equation (MUSLE) model was used to determine the load allocation reductions by estimating the spatial distribution of sediment loads across the entire Umatilla River Basin. The model provided quantitative estimates of 1) hydrology, 2) sediment transport, and 3) an estimate of the sediment (TSS) yield necessary to meet the basin-specific instream targets.

The model estimates a hydrologic budget (SCS method and Rational Formula) and applies the MUSLE to estimate upland erosion. A delivery ratio, which is a function of watershed area, is used to calculate the sediment delivered to streams.

The model is applied to the winter to evaluate the dominant precipitation and snowmelt events. MUSLE characterizes an event that causes increases in overland flow resulting in upland erosion that delivers sediment to the stream. A simplified streambank erosion factor was developed to account for stream bank erosion during major storm events.

The Umatilla Sediment Model code was written in ArcInfo Arc Macro Language (AML) to run using GRID (ESRI, 1990). The input databases include:

- Watershed delineation
- Land Cover
- Soils (Slope, Hydrologic Soil Group, Soil Erodibility [K])
- Hydrography (used for creating buffer zones)
- Snow deposition patterns

Daily data (approximately 120 days in 1998 and 110 days in 1999) for rainfall and temperature was used in the model.

The spatial resolution of the data is 984.1 square meters and there are over 120,000 cells in the Umatilla River Basin. The GIS processing was performed with ArcInfo version 7.2.1 on an NT 4.0 workstation with 384 MB of RAM and 50 GB of local disk storage.

## 2.1.2.5.2.3 MODEL CALIBRATION, ASSUMPTIONS AND LIMITATIONS

Uncertainty exists in all modeling activities and needs to be evaluated and assessed during the modeling process. Simulations of varying precipitation and air temperature were conducted to assess the model sensitivity to climate. The Umatilla sediment model was calibrated to measured sediment loads and concentrations for eight watersheds in the Basin. The model was calibrated to fit this data set (8 watersheds) so that the model could be used in areas where data had not been collected.

This model does not address several specific sediment mechanisms including bedload transport and mass wasting. There is also variability in the precision and accuracy of the TSS data used for model calibration. The ODEQ Laboratory data precision goal for TSS and turbidity is plus or minus 10%. The data accuracy goal is 1.0 mg/L for TSS and 1.0 NTU for the turbidity analysis.

It is recognized that there is a lag-time between upland soil loss and delivery to streams. The calculation herein relates current upland soil loss to current instream suspended sediment load. After practices are changed, substantial time may elapse prior to instream load reduction, due to ongoing contributions from legacy sediment at bases of slopes, floodplains and channel banks. Re-evaluation of needed levels of erosion reduction through time may be needed.

*Hydrology Model: Peak Flow – Rational Method*

One of the most widely used methods for estimating peak flow in un-gaged watersheds is the Rational Method (Pilgrim and Cordery, 1993; Gray, 1990). The form of the equation is:

$$Qp = CIA$$

Where,
Qp = peak flow in cfs
C = runoff coefficient
A = area in acres
I = rainfall intensity in inches/hour

*Hydrology Model: Flow Volume – SCS Method*

The upland runoff volume was estimated using the Soil Conservation Services (SCS) runoff depth estimation (USDA, 1973; Maidment, 1993):

$$Q = (P-0.2S)^2 / (P+0.8S)$$

Where,
Q = runoff depth in inches
P = rainfall in inches
S = storage parameters = 1000/CN - 10
CN = curve number which is a function of land use (see McCuen, 1998 for Curve Numbers)

*Hydrology Model: Snow Melt – Temperature Index*

Snow melt was estimated with a temperature based index. The equation used for the Basin is:

$$SM = M\,T \text{, if } T > 38\ ^{o}F$$

Where,
SM = snow melt in inches
T = temperature in degrees Celsius
M = melt factor coefficient (approximately 2 degrees Celsius)

The snow melt model was tested at the SNOTEL sites and had high correlations ($r^2 > 0.90$ for 5 sites; df > 110).

*Hydrology Model: Runoff - Flow Movement*

The travel time of water was estimated by kinematic wave routing (Henderson and Wooding, 1963; Novotny and Chesters, 1981). Travel time (or time of concentration):

$$Tc = 6.9\,[(d\,n^{0.6})/(i^{0.4}\,S^{0.3})]$$

Where,
Tc = overland flow travel time in hours
n = manning overland flow coefficient
S = Slope in percent
i = rainfall intensity in mm/hour
d = distance of overland flow in meters

The distance of the overland flow path was estimated based on buffer zones away from the hydrography. Water that had travel times greater than 24-hour increments were partitioned into future days. No re-freezing processes were incorporated into the model. Travel times greater than 168 hours (> 7 days) were assumed to be recharging the deep aquifers.

*<u>Erosion Model</u>: Slope – Length Estimates*

Slope-length was estimated from slope, using the equation proposed by Moore and Burch (1986):

$$LS = (area/22.13)^{0.4} (\sin(S)/0.0896)$$

Where,
LS = length of slope
area = polygon area in hectares
S = slope in percent

Novotny and Chesters (1981) also provide nomographs for verifying the LS parameters,

*<u>Erosion Model</u>: Modified Universal Soil Loss Equation*

Estimates of erosion were generated using the Modified Universal Soil Loss Equation (Williams and Berndt, 1977;Shen and Julien, 1993). This is an event based modified version of the Universal Soil Loss Equation (USLE) originally formulated by Wischmeier and Smith (1965). The general form of the MUSLE model is:

$$Y = 11.8(Qp\ Q)^{0.56}\ K\ LS\ CP$$

Where,
Y = event soil loss (tons/hectare)
Qp = peak runoff ($m^3$/sec)
Q =event runoff volume ($m^3$)
K = soil erodibility
LS = slope – length
CP = a cropping/erosion factor (used in calibration)

Data for the soil erodibility (K was obtained from the detailed soil data surveys from Umatilla and Morrow County (SSURGO Digital Data Bases, USDA)).

*<u>Erosion Model</u>: Sediment Delivery*

The amount of total suspended solids transported in a stream is not necessarily the same as the upland erosion due to the contribution of stream bank erosion and hill-slope storage of upland sediment. The delivery ratio is a percentage of upland sediment reaching the stream. Roehl (1962; Novotny and Olem, 1994; Fraiser, et al 1996) has demonstrated that the fraction of sediment delivered is inversely related to the drainage area with the following formula:

$$Y_{DR} = 2.04\ A^{-0.25}$$

Where,
$Y_{DR}$ = delivery ratio
A = area (square miles)

<u>Erosion Model</u>: Streambank Contributions

Streambank erosion in the Umatilla Basin is a significant source of sediment. This is apparent in agency habitat surveys, monitoring observations, and is reflected in flow and TSS data patterns. Streambank sources are typically difficult to incorporate in non-point source models due to the scale of the data required and the stochastic nature of the stream bank erosion process. Therefore, an empirical analytical approach was chosen to characterize the relative sediment input from streambanks.

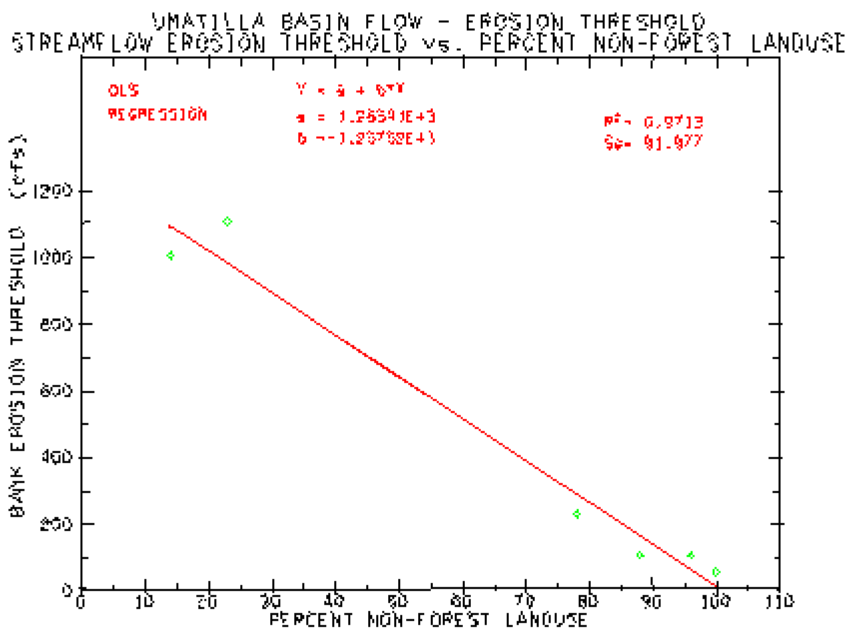
Relatively high streamflow causing streambank erosion was determined to be a function of watershed area. Plots of measured instream TSS data and flow over time using the winter 1997-1998 and 1998-1999 data were visually inspected to estimate the flow magnitude at which streambank erosion contributions begin to occur (flow levels above which TSS/flow ratio abruptly increases). These flows were plotted against non-forested watershed area. Forested areas exhibit dramatically lower concentrations of TSS, generally less than the levels of concern. The statistical relationship between observed flows causing bank erosion and non-forested watershed area (expressed as percentage of total watershed) had a strong statistical relationship ($r^2$=0.97; S.E. = 91.98, **Figure 48**):

Bcfs = 1265-12.6NF

Where,

Bcfs = discharge when stream bank erosion occurs
NF = Non-forested watershed / total watershed area (in percent)

**Figure 48.** Bank Erosion Threshold vs. Non-forest Land use



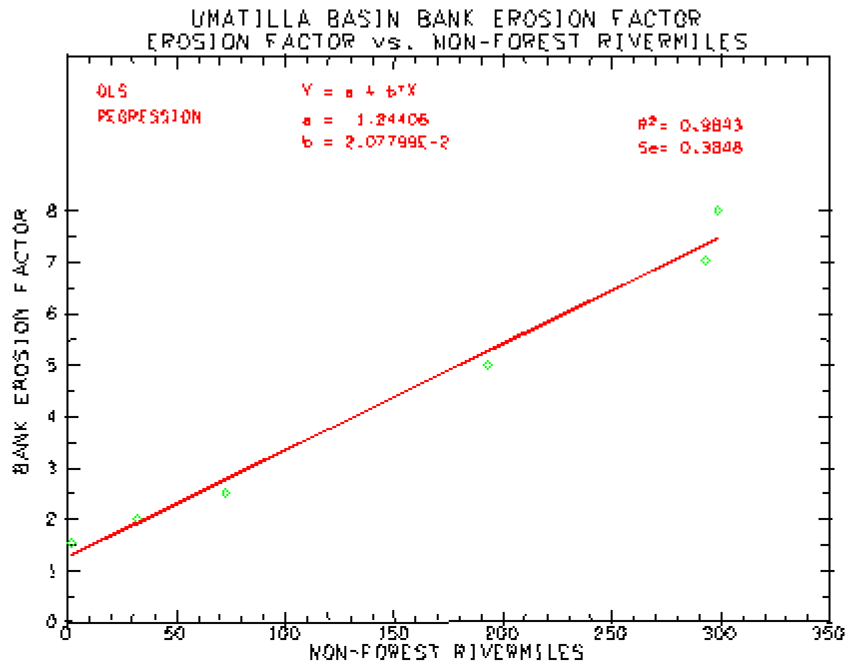

Plots of measured instream TSS and flow over time using the winter 1997-1998 and 1998-1999 data were visually inspected to estimate a streambank erosion factor; the multiplier used to account for the TSS contributed by streambank erosion (Y axis in **Figure 49**). A linear estimation of severity of TSS increase above the 'Bcfs' described above was assigned. This bank erosion factor as a function of non-forested rivermiles was estimated by a regression analysis (**Figure 49**) ($r^2$=0.98; S.E.= 0.38):

$EF_{rm}$ = 1.24+0.0208RM

Where,

$EF_{rm}$ = stream bank erosion factor as a function of non-forested rivermiles
RM = river miles in non-forested areas

**Figure 49.** Bank Erosion Factor vs. Non-forest Rivermiles




To obtain the streambank portion of the load allocation, the modeled sediment yield to the stream from upland erosion was multiplied by the stream bank erosion factor ($EF_{rm}$) during periods when the bank erosion initiating discharge (Bcfs) occur.

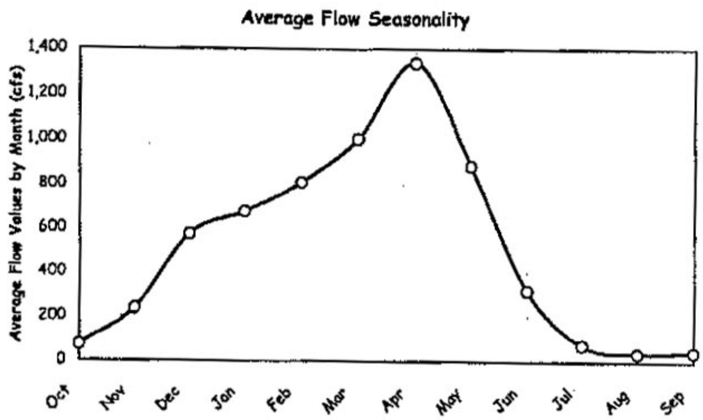
## 2.1.2.5.3 Seasonal Variation

The annual Umatilla River monthly discharge is uni-modal, dramatically peaking in April (enclosure below). Average monthly flows in excess of 500 cubic feet per second occur December through May. The TMDL design storm runoff has a high probability of occurring in this time frame. Seasonable variability is accounted for by basing the load allocation on an event that is seasonally dependent. It is important to recognize that erosion control requires measures that are implemented throughout the year, e.g., restoration of riparian vegetation.

**Enclosure**. Umatilla River flow statistics for Pendleton
(from *Umatilla River Basin Data Review*, ODEQ, 1998)

**Umatilla River (@ Pendleton)**
USGS #14021000
Drainage Area: 637 sq. miles
Period of Record: 1934 to 1989

| Average Flows by Month | (cfs) |
|---|---|
| Oct | 74 |
| Nov | 235 |
| Dec | 574 |
| Jan | 675 |
| Feb | 809 |
| Mar | 1,001 |
| Apr | 1,339 |
| May | 882 |
| Jun | 318 |
| Jul | 74 |
| Aug | 37 |
| Sep | 44 |




| | | *Low Flow Statistics (CFS)* | | | *High Flow Statistics (CFS)* | | |
|---|---|---|---|---|---|---|---|
| *Return Period (years)* | *Yearly Probability* | *1 Day Flow* | *7 Day Flow* | *14 Day Flow* | *1 Day Flow* | *7 Day Flow* | *14 Day Flow* |
| 1 | 100.0% | 64.4 | 69.2 | 72.5 | 1,590 | 1,152 | 825 |
| 2 | 50.0% | 25.7 | 28.8 | 30.8 | 4,228 | 2,614 | 2,140 |
| 5 | 20.0% | 20.7 | 23.5 | 24.9 | 6,500 | 3,696 | 2,888 |
| 10 | 10.0% | 18.9 | 21.6 | 22.6 | 8,262 | 4,471 | 3,342 |
| 25 | 4.0% | 17.4 | 20.1 | 20.6 | 10,797 | 5,517 | 3,876 |
| 50 | 2.0% | 16.5 | 19.2 | 19.4 | 12,913 | 6,345 | 4,253 |
| 100 | 1.0% | N/A | N/A | N/A | N/A | N/A | N/A |

## 2.1.2.6 APPLYING AND LINKING LOAD ALLOCATIONS

# 2.1.2.6.1 Streambank Stability Goal

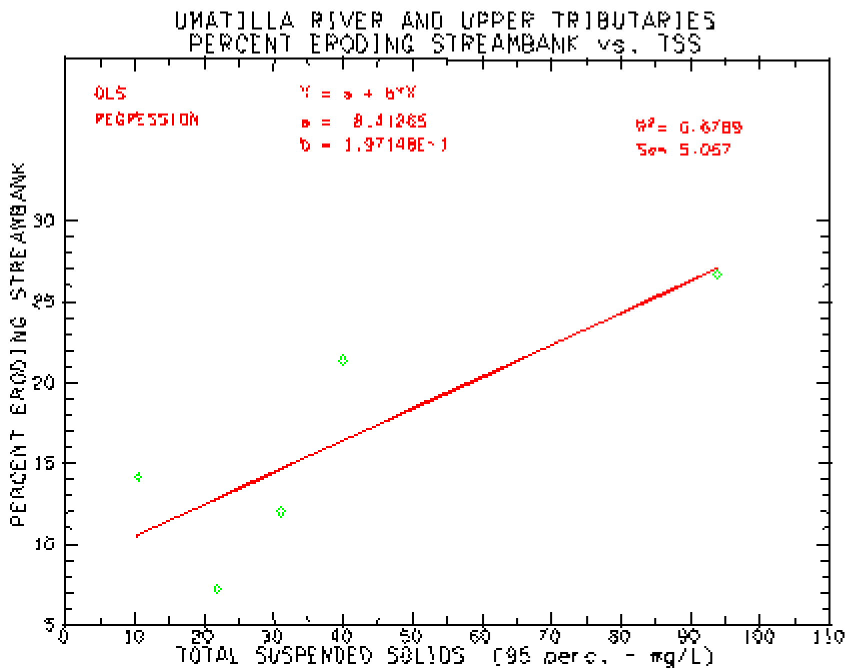
**A management planning goal of 25 percent eroding streambank**... is expected to fulfill the streambank component of the sediment load allocations.

A regression analysis was performed using available data comparing 95th percentile TSS and reach-averaged percent eroding streambank. The data was collected from sites on the Umatilla River, Buckaroo Creek and Mission Creek. The regression model predicts that the basin-average 80 mg/L TSS target would be achieved at a percent eroding streambank goal of approximately 25 percent. This indicates that a management planning goal of 25 percent eroding streambank is desirable (**Figure 50**). The percent eroding streambank data used in this analysis are an average of many data points for each stream reach.

**Figure 50.** Percent Eroding Streambank versus TSS

## 2.1.2.6.2 Upland Load Allocation

A large variety of potential upland sediment reduction measures are available; most are difficult to quantify in terms of achieving load allocations. Best judgement, best science and long term monitoring must be employed to assess attainment of upland load allocations. Implementation goals should be developed by land managers (e.g., road density, maximum gully cross-section, and percent ground cover).




## 2.1.2.6.3 Delineating Upland and Streambank Load Allocations

Sediment streambank load allocations apply to both perennial and non-perennial streams. Non-perennial streams are included because sediment delivery predominates during the winter and spring runoff season. Ephemeral streams (less than 30 days of flow) can be managed under either the upland runoff load allocation or through practices such as re-vegetation that meet the sediment streambank load allocation.

The upland allocation applies across the landscape outside of stream channels. Both upland and streambank load allocations must be implemented in order to meet water quality goals.

#### 2.1.2.6.4 Linking Sediment and Temperature Load Allocations

Non-point source improvements that reduce temperature generally also reduce erosion. Near-stream load allocations can be related as follows, for streams where the temperature load allocations apply (perennial streams):

- Surrogate Measures #1 and #2 in the Temperature TMDL promote riparian conditions that will increase near-stream (stream bank) area resistance to erosive energy (shear stress) and may reduce local shear stress levels. Specifically, the restoration/protection of riparian areas called for in the temperature TMDL will serve to reduce stream bank erosion by increasing stream bank stability via rooting strength and near-stream roughness.

- Surrogate Measures #2 and #3 in the Temperature TMDL targets a decrease in the near-stream disturbance zone dimension that relies primarily on passive stream narrowing via decreased stream bank erosion and increased naturally occurring stream bank building processes.

- Surrogate Measure #4 in the temperature TMDL targets decreased channel width to depth ratio. Specifically, increased pool frequency is an important component of stream habitat and healthy channel morphology, and promotes reduced stream temperatures. And, reduced stream bank erosion and increased stream bank building processes are necessary to promote this condition. Further, erosion reduction via the sediment TMDL leads to reduced sedimentation (the accumulation of sediments in the stream channel) that will assist pool development and maintenance.

Both the sediment TMDL allocation of reduced streambank erosion and the channel/stream width reduction surrogates of the temperature TMDL are outcomes that, through much of the basin, will be met by implementing the effective shade goals of the temperature TMDL (surrogates 1 & 2). It is important to recognize that implementation of these surrogates both requires and leads to width reduction. It is also important to recognize that similar work on non-intermittent streams is needed for implementation of the sediment TMDL and the associated sedimentation reduction will support downstream morphology needed for achievement and maintenance of decreased temperature. The temperature and sediment TMDLs can be entirely achieved through increased riparian vegetation (including canopy vegetation), increased space for sinuosity/channel stability, floodplain reconnection where feasible; and increased upland groundcover.

### 2.1.2.7 MARGIN OF SAFETY

The Clean Water Act margin of safety requirement and eligible approaches are described in **Section 2.1.1.7**.

The MOS for this TMDL is implicit.

- spatially overlapping allocations are set for multiple parameters (temperature, sediment, bacteria, nutrients) that will are simultaneously addressed with similar management measures
- sediment parameters are addressed in the long-term monitoring plan (**Section 3.5.4**)
- best professional judgement (Umatilla Basin TMDL Technical Committee) indicates that the sediment TMDL, in watersheds with large upland reduction load allocations, will be challenging in terms of feasibility

The MOS used for the point source WLAs is inherent in the effluent target concentration. The effluent target concentrations are set so that no dilution/mixing zone is required to meet the instream concentration (**Section 2.1.2.9**). This is a conservative approach because the river flow normally provides a significant amount dilution for the effluent.

Sources of instream sediment considered in the development of the Umatilla Basin TMDL include uplands, roads, streambank and the channel bed. Due to the lack of information on sediment delivery from roads and instream bedload, it is recommended that monitoring provisions be established to determine the relative magnitude of the source(s).

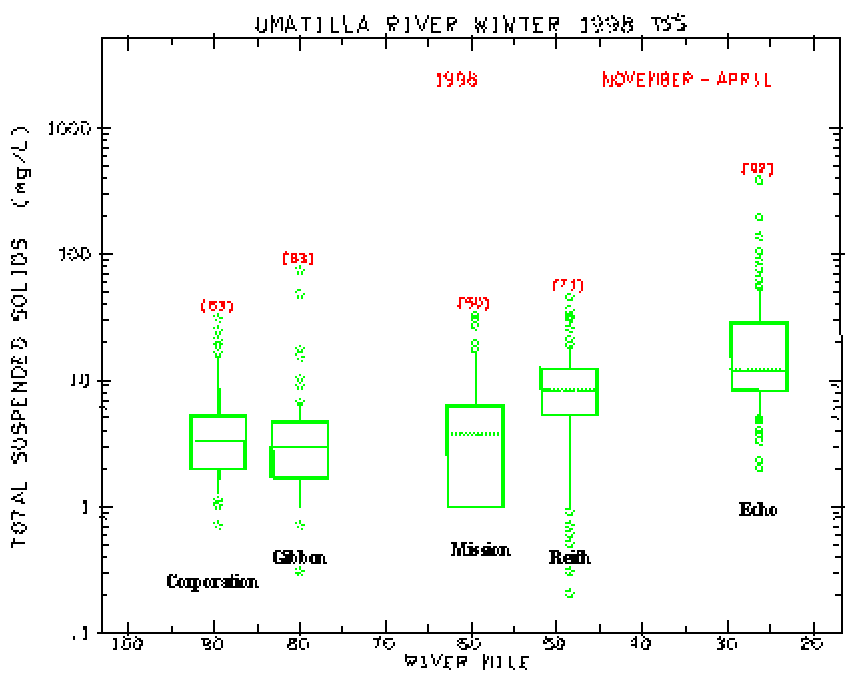
## 2.1.2.8 EXISTING SOURCES

### 2.1.2.8.1 Composite TSS Data Review

Data presented in the following longitudinal box plots plot (refer to glossary for explanation of "box and whisker" graphs) were collected during a sediment survey that was planned and conducted by the Umatilla TMDL Technical Committee. The data were collected from December 1997 to May 1999, at several key monitoring sites on the mainstem Umatilla River and tributaries. The composite samples were collected with fixed-tube automated samplers programmed to combine four sub-samples each 24-hour period, collected at six-hour intervals, January through April or greater duration. Sample tube inlets were approximately six inches above the streambed.

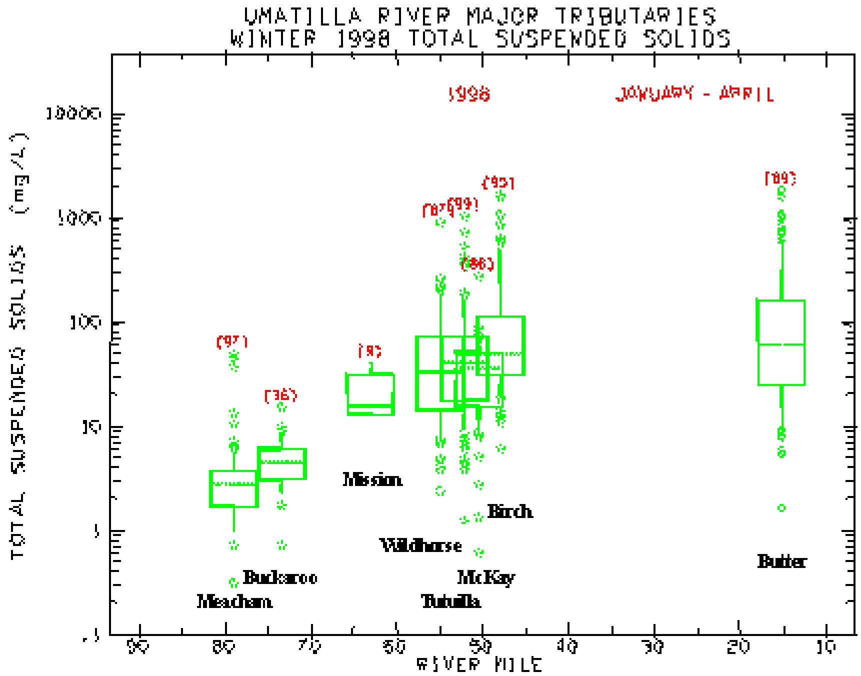
The daily composite TSS data presented in **Figures 51** and **52** were collected during the winter/early spring of 1997-1998. That period had little or no rain on snow/ice so the TSS data may not be indicative of concentrations that would be seen during a more typical winter/early spring. The observed Umatilla River TSS indicates a significant increase in concentrations below the Mission site (Rivermile 61.5, **Figure 51**).

**Figure 51.** Longitudinal TSS - Mainstem Umatilla River




The 90$^{th}$ percentile TSS value for Wildhorse, Tutuilla, Birch, and Butter Creeks exceeds the 80 mg/L TSS basin-average target concentration (**Figure 52**). This is an important observation that indicates the tributaries are significant sources of TSS load to the Umatilla River.

**Figure 52.** Longitudinal TSS – Tributaries




**Figures 53** through **56** are selected plots of the daily composite turbidity measurements gathered from Umatilla River sites during surveys of winter 1997-1998 and 1998-1999. It should be noted that winter 1997-1998 had less than average precipitation and runoff due to snow melt so the data do not represent worst-case conditions. Larger runoff events occurred in 1998-1999. A line is drawn at 30 NTU turbidity on the plots to indicate the TMDL target. **Figures 53** and **54** represent 1997-1998 data. **Figures 55** and **56** represent 1998-1999 data. The figures present mainstem data first followed by tributary data. Note that where maximums exceeded 100 NTU the turbidity axis is logarithmic.

These graphs illustrate the observed spatial and temporal extend of turbidity exceedances of the 30 NTU target.

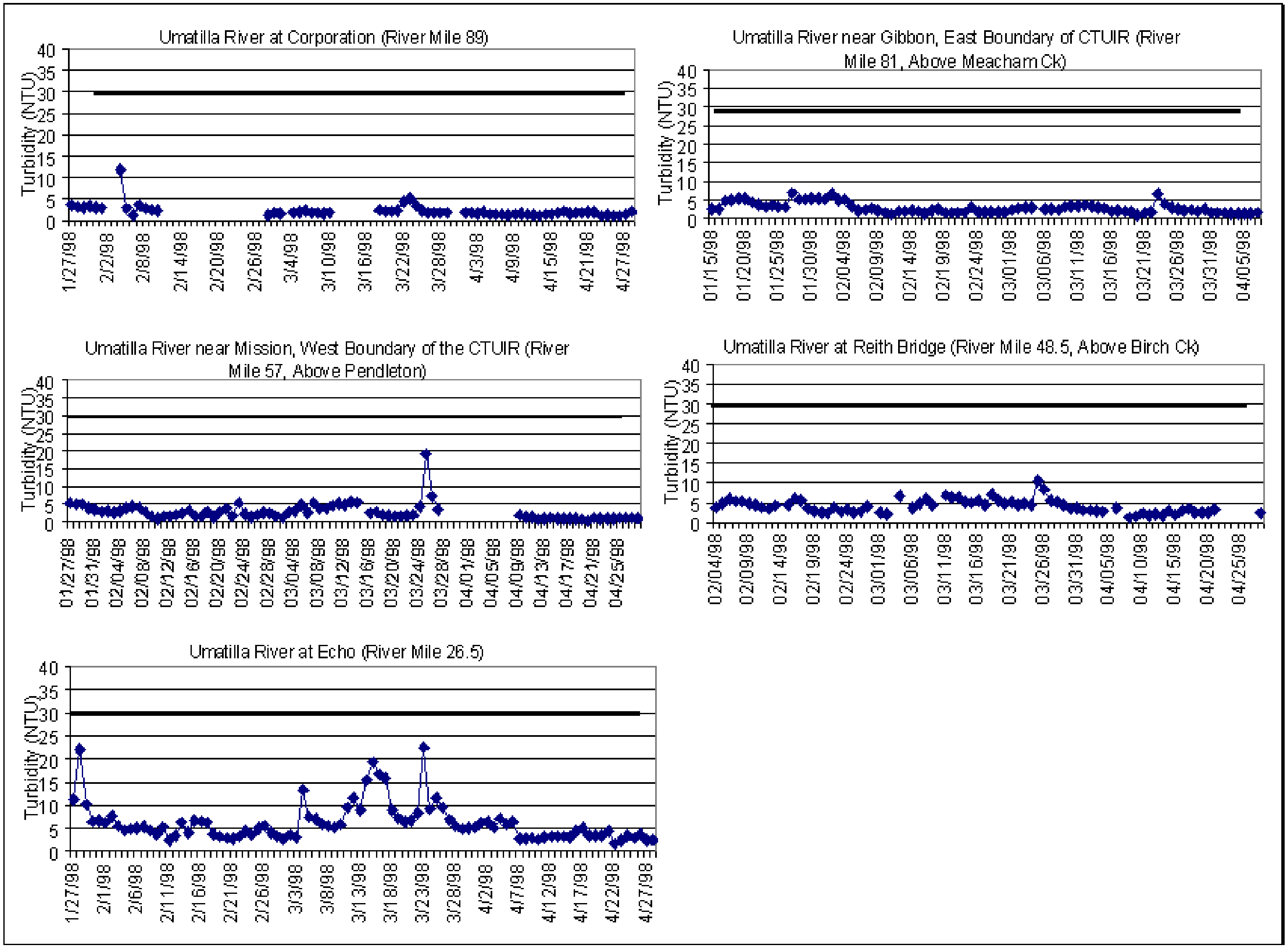



**Figure 53.** Turbidity vs. Time, Umatilla River Daily Composite Samples (Winter 1997-1998 )

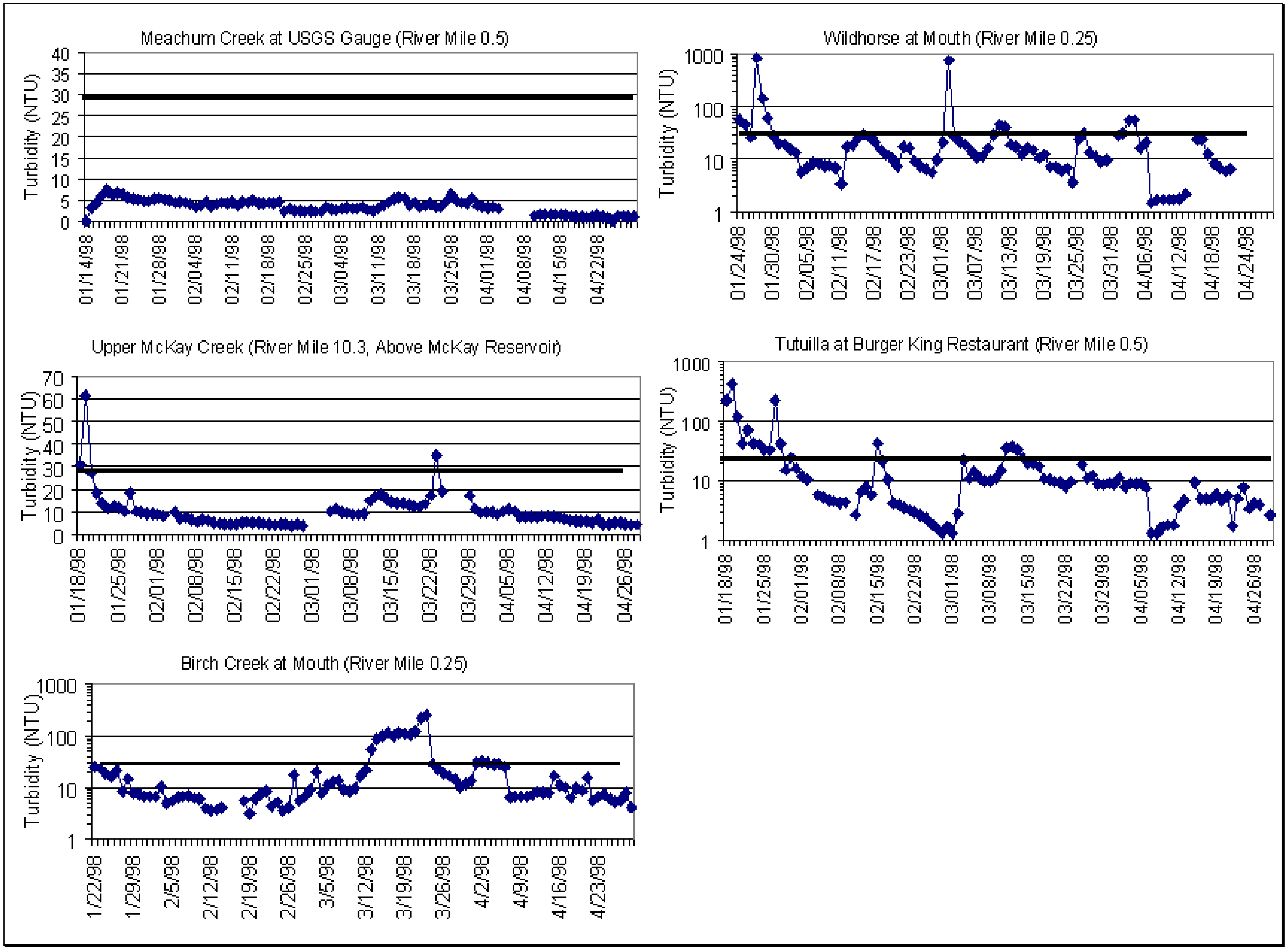



**Figure 54.** Turbidity vs. Time, Basin Tributaries Daily Composite Samples (Winter 1997-1998 )

**Figure 55.** Turbidity vs. Time, Umatilla River Daily Composite Samples (Winter 1998-1999 )

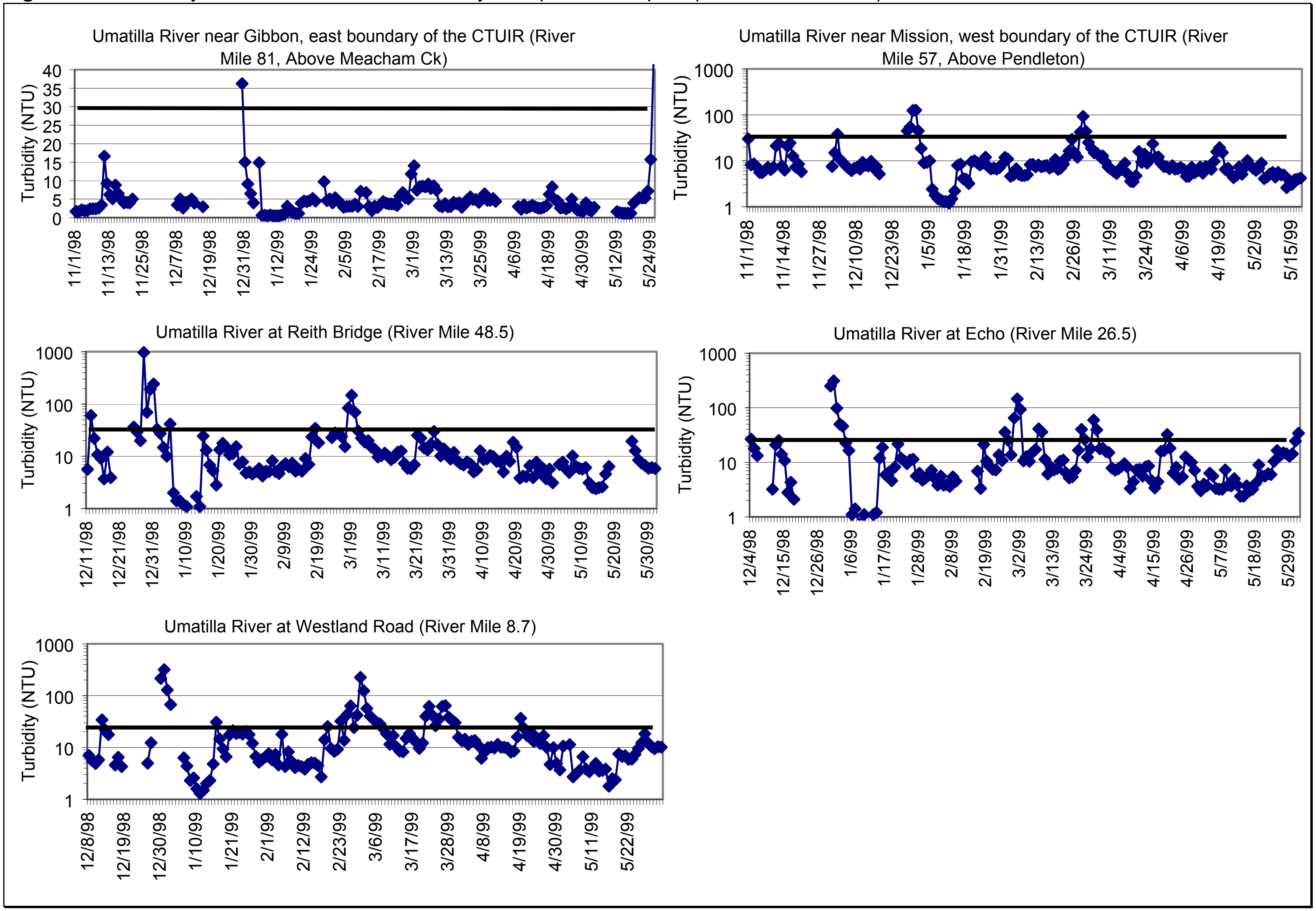
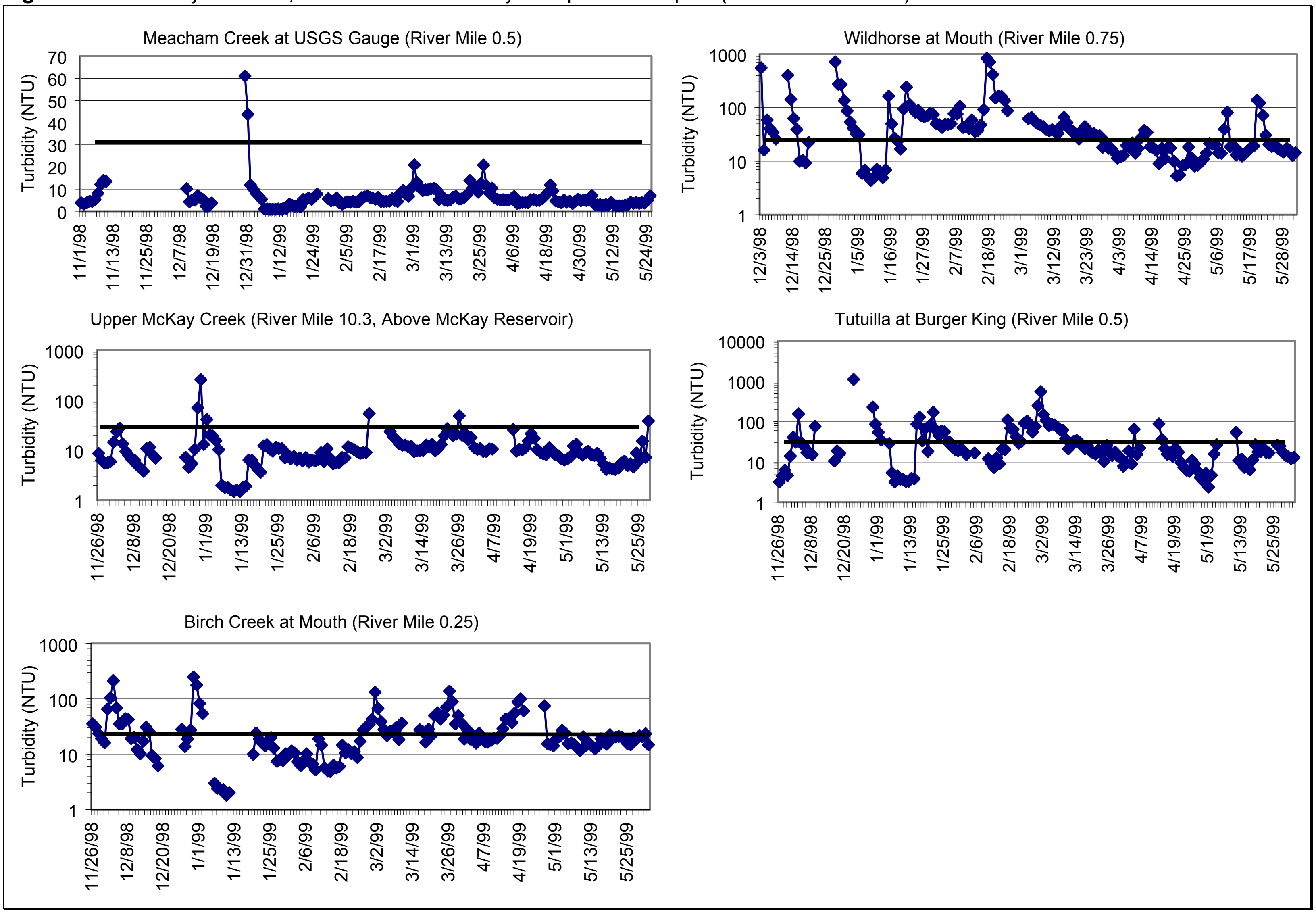


**Figure 56.** Turbidity vs. Time, Basin Tributaries Daily Composite Samples (Winter 1998-1999 )



# 2.1.2.8.2 Erosion Source Assessment

Sources of instream sediment include upland runoff, streambank erosion, and mass wasting. Upland runoff is addressed in this TMDL through the load allocations determined from the MUSLE model. The streambank component of TSS loading to the stream was estimated using an empirical analytical approach. Mass wasting potential was assessed using a geomorphic risk assessment, discussed in the next section.

One approach to consider for future source assessment work in the Umatilla Basin is a *sediment budget*, which accounts for the source and fate of sediment as it travels through the watershed (Reid and Dunne, 1996). The sediment budget identifies soil loss rates, delivery to stream channels and overall sediment yields. Although the TMDL is most concerned with sediment delivered to stream channels because of impacts to beneficial uses, soil loss rates are a concern because of soil productivity, and sediment delivery is also a concern because of reservoir sedimentation.

The Umatilla Basin TMDL Technical Advisory Committee have assessed river morphology at 24 locations on the Umatilla River and tributaries (Williams, et al, 1998). This information can be used by land managers to better characterize the source and disposition of sediment sources in the Umatilla Basin.

Mass wasting is considered a relatively subordinate sediment source or delivery process in the Umatilla Basin, based on the analysis described in this section. Mass wasting is a general term for dislodgment and gravitational transport of soil and rock not carried within another medium such as air or water. Mass wasting includes slow displacements, such as the slumping of hillsides or soil creep, and rapid movements such as rock fall, landslides and debris flows (Bates and Jackson, eds., 1987).

Landslide processes offer significant sediment delivery mechanisms to streams. It is important to note that both natural and human-caused processes cause landslides. Mass failures are the dominant process controlling the rate of sediment production in the Northwest (Swanson et al 1987). Mass failures also affect the geometry and disturbance regimes of channels and riparian areas. Earth flow may affect the channel width, complexity, slope, and riparian vegetation (Swanson et al 1987). The type, amount, and timing of sediment input will determine influence on channel morphology (Sullivan et al 1987).

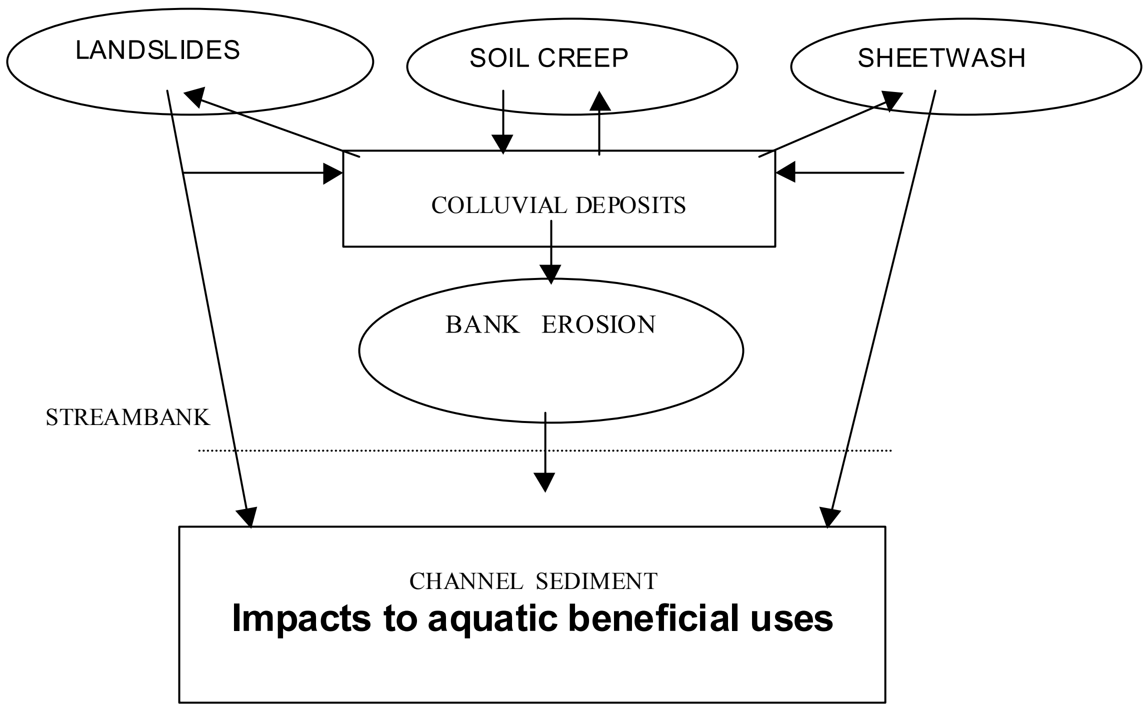
Hartman (1996) found that impacts from increased sediment production from hillsides increased stream bank erosion and transport of sediment and bedload when stream bank stability is decreased. Reduced streambed stability and channel diversity may be initiated decades after changes in land management practices (*legacy* conditions) and likely are related to storm events. Such sedimentation problems are likely to persist for several decades.

Mass wasting is not a dominant process in the Blue Mountains and Umatilla Plateau. The United States Forest Service mapped 9 landslide features in the Upper Umatilla River (Forks) watershed after the 1996 storms. The dominant feature type was flows, most of which entered small tributaries, and several intercepted roads and plugged culverts. Mass wasting was one of the sources of accelerated sediment during these unusual flood events. Other sources included sheetwash erosion from hill-slopes, road erosion, and channel and floodplain erosion.

This chapter does not directly address in-channel storage of sediment and the lag-time between upland soil loss and delivery of sediment to streams, as discussed in earlier sections. Further work is encouraged, to evaluate the role of these sinks with regard to impacts to water quality and time-frames to decrease sediment loading in Basin streams.

In general, the dominant erosion process across the Umatilla Basin, including foothills and mountains, is surface erosion by sheetwash, rills, and gullies; and bank erosion. **Figure 57** shows the general processes of erosion and sedimentation. Overall, erosion and sediment transport rates are extremely variable, both spatially and temporally, and depend on a wide range of factors from storm conditions to channel hydraulics (Bunte and MacDonald, 1998).

**Figure 57.** Conceptual Diagram of Sediment Sources and Transport Processes (after Reid and Dunne, 1996)




## 2.1.2.8.3 Geomorphic Risk Assessment

A slope stability analysis was performed based on slope, stability, and curvature of land within the Umatilla Basin (**Figure 58**). Data was derived from a digital elevation model and processed in ArcInfo/Grid using the methodology outlined in Shaw and Johnson, 1995. The analysis identifies areas that are susceptible to mass wasting.

The potentially highly unstable areas identified by the analysis are Bingham Springs and Upper Meacham Creek.

**Figure 58.** Umatilla Basin Slope Stability Analyses

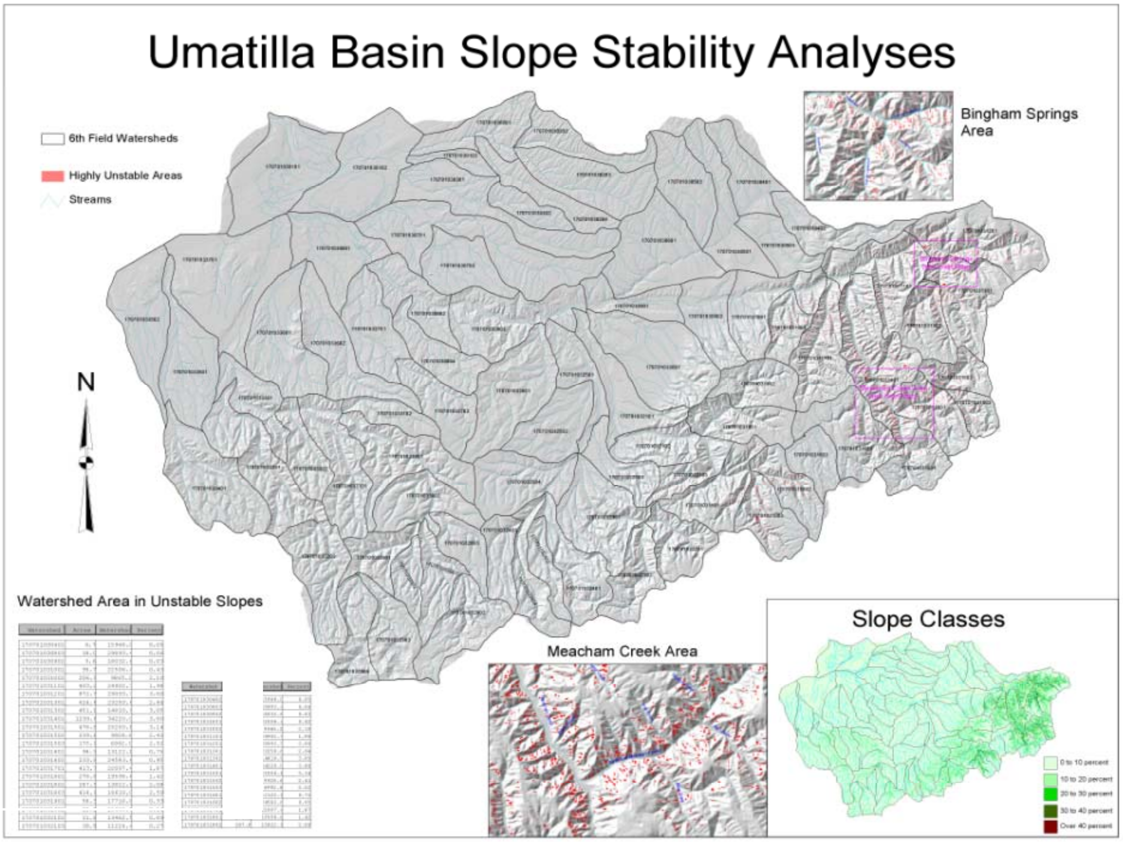
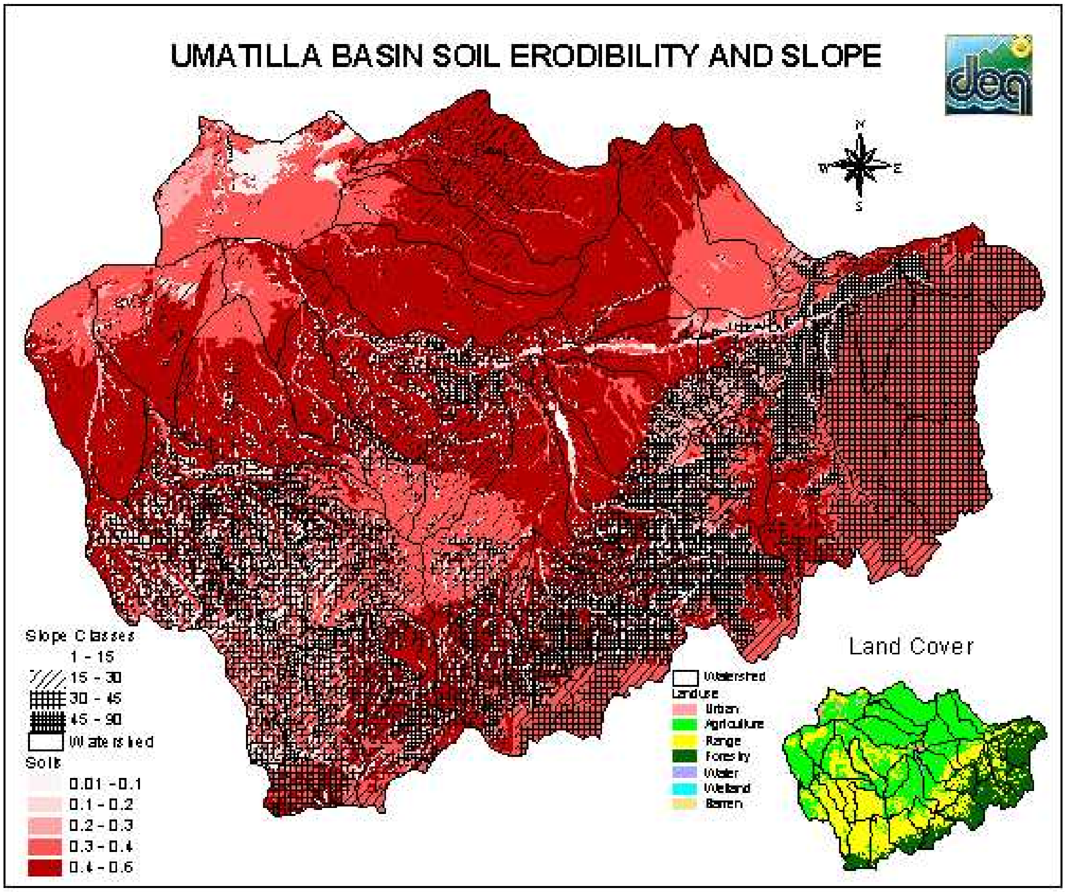



**Figure 59** is a map with slope overlaid on soil erodibility. Land use is inset in the lower right. The areas with the darkest red and most dense cross-hatching are critical areas for sediment delivery potential.

The slope stability and soils erodibility analyses provide land managers with potentially critical areas to prioritize for erosion reduction efforts. These analyses are intended as a flagging tool which should be supported by field data for making management decisions for reducing erosion.

**Figure 59.** Umatilla Basin Potential Soil Erodibility and Slope



## 2.1.2.9 WASTE LOAD ALLOCATIONS

A *Waste Load Allocation* (WLA) is the amount of pollutant that a ***point source*** can contribute to the stream without violating water quality standards. The point sources in the Umatilla Basin for which WLAs have been determined are the municipal wastewater treatment plants. **The WLA for each facility is 80 mg/L TSS at the end of pipe.**

## 2.1.2.9.1 Current NPDES Permit Requirements

Umatilla Basin point sources that discharge directly to surface waters and have individual facility NPDES permits are:

**Table 27.** NPDES Permitted Sources and Expiration Dates

| Facility* | Permit Expiration Date** |
|---|---|
| Athena waste water treatment plant | 5/31/96 |
| Pendleton waste water treatment plant | 9/30/97 |
| Echo waste water treatment plant | 12/31/99 |
| Stanfield waste water treatment plant | 7/31/98 |
| Hermiston waste water treatment plant | 5/31/00 |

Current wastewater treatment plant (WWTP) effluent limitations (end of pipe) for NPDES individual permits in the Umatilla Basin are included in **Tables 28 through 34**.

**Table 28.** City of Hermiston WWTP Effluent Limits

May 1-October 31:

| | Limitations | | | | |
|---|---|---|---|---|---|
| | Average Effluent Concentrations | | Mass Loading | | |
| **Parameters** | Monthly | Weekly | Monthly Average #/day | Weekly Average #/day | Daily Maximum #s |
| BOD5 | 20 mg/l | 30 mg/l | 490 | 740 | 980 |
| TSS | 20 mg/L | 30 mg/L | 490 | 740 | 980 |
| pH | 6.0-9.0 | | | | |
| BOD and TSS Removal Efficiency | Shall not be less than 85% based on the average monthly concentration | | | | |
| Fecal coliform | Shall not exceed 200/100 ml monthly geometric mean, and 400/100 weekly geometric mean. | | | | |
| Total residual chlorine | 0.03 mg/L daily avg | | | | |

* Lists of permitted wastewater discharges in Oregon are available through the ODEQ website at: http://waterquality.deq.state.or.us/SISData/FacilityHome.asp

** The existing permit remains in effect until DEQ acts on the renewal application. Permit renewals have been extended pending TMDL establishment.

**Table 29.** City of Hermiston WWTP Effluent Limits (continued)

November 1-April 30:

| Parameters | Limitations | | | | |
|---|---|---|---|---|---|
| | Average Effluent Concentrations | | Mass Loading | | |
| | Monthly | Weekly | Monthly Average #/day | Weekly Average #/day | Daily Maximum #s |
| BOD5 | 30 mg/l | 45 mg/l | 740 | 1110 | 1480 |
| TSS | 30 mg/L | 45 mg/L | 740 | 1110 | 1480 |
| pH | 6.0-9.0 | | | | |
| BOD and TSS Removal Efficiency | Shall not be less than 85% based on the average monthly concentration | | | | |
| Fecal coliform | Shall not exceed 200/100 ml monthly geometric mean, and 400/100 weekly geometric mean. | | | | |
| Total residual chlorine | 0.03 mg/L daily avg | | | | |

**Table 30.** City of Pendleton WWTP Effluent Limits

May 1-October 31:

| Parameters | **Limitations** | | | | |
|---|---|---|---|---|---|
| | Average Effluent Concentrations | | Mass Loading | | |
| | Monthly | Weekly | Monthly Average #/day | Weekly Average #/day | Daily Maximum #s |
| BOD5 | 20 mg/l | 30 mg/l | 920 | 1400 | 1800 |
| TSS | 20 mg/L | 30 mg/L | 920 | 1400 | 1800 |
| pH | 6.0-9.0 | | | | |
| BOD and TSS Removal Efficiency | Shall not be less than 85% based on the average monthly concentration | | | | |
| Fecal coliform | Shall not exceed 200/100 ml monthly geometric mean, and 400/100 weekly geometric mean. | | | | |
| Total residual chlorine | 0.03 mg/L daily avg | | | | |

**Table 31.** City of Pendleton WWTP Effluent Limits (continued)

November 1-April 30:

| Parameters | Limitations | | | | |
|---|---|---|---|---|---|
| | Average Effluent Concentrations | | Mass Loading | | |
| | Monthly | Weekly | Monthly Average #/day | Weekly Average #/day | Daily Maximum #s |
| BOD5 | 30 mg/l | 45 mg/l | 1400 | 2100 | 2800 |
| TSS | 30 mg/L | 45 mg/L | 1400 | 2100 | 2800 |
| PH | 6.0-9.0 | | | | |
| BOD and TSS Removal Efficiency | Shall not be less than 85% based on the average monthly concentration | | | | |
| Fecal coliform | Shall not exceed 200/100 ml monthly geometric mean, and 400/100 weekly geometric mean. | | | | |
| Total residual chlorine | 0.03 mg/L daily avg | | | | |

**Table 32.** City of Stanfield WWTP Effluent Limits

May 1-October 31: No discharge
November 1-April 30:

| Parameters | Limitations | | | | |
|---|---|---|---|---|---|
| | Average Effluent Concentrations | | Mass Loading | | |
| | Monthly | Weekly | Monthly Average #/day | Weekly Average #/day | Daily Maximum #s |
| BOD5 | 30 mg/l | 45 mg/l | 56 | 84 | 110 |
| TSS | 45 mg/L | 65 mg/L | 84 | 130 | 170 |
| pH | 6.0-9.0 | | | | |
| BOD Removal Efficiency | Shall not be less than 85% based on the average monthly concentration | | | | |
| TSS Removal Efficiency | Shall not be less than 65% based on the average monthly concentration | | | | |
| Total coliform | 7-day median <23/100mL with no 2 consecutive samples exceeding 240/100/mL. | | | | |
| Total residual chlorine | .03 mg/L monthly avg<br>.06 daily avg. | | | | |

**Table 33.** City of Athena WWTP Effluent Limits

May 1-October 31: No discharge
November 1-April 30:

| Parameters | Limitations | | | | |
|---|---|---|---|---|---|
| | Average Effluent Concentrations | | Mass Loading | | |
| | Monthly | Weekly | Monthly Average #/day | Weekly Average #/day | Daily Maximum #s |
| $BOD_5$ | 30 | 45 | 78 | 117 | 156 |
| TSS | 30 | 45 | 78 | 117 | 156 |
| | | | | | |
| Other Parameters | Limitations (cont.) | | | | |
| pH | Shall be within the range of 6.0 - 9.0. | | | | |
| $BOD_5$ and TSS percent removal efficiency | Shall not be less than 65% monthly average on a concentration basis. | | | | |
| Total Residual Chlorine | Monthly average shall not exceed the minimum level of detection, which is defined as 0.1 mg/l. | | | | |
| Escherichia coli (E. coli) bacteria | Shall not exceed a 30 day log mean of 126 organisms per 100 ml. No single sample shall exceed 406 organisms per 100 ml. | | | | |

**Table 34.** City of Echo WWTP Effluent Limits

May 1-October 31: No discharge
November 1-April 30:

| Parameters | Limitations | | | | |
|---|---|---|---|---|---|
| | Average Effluent Concentrations | | Mass Loading | | |
| | Monthly | Weekly | Monthly Average #/day | Weekly Average #/day | Daily Maximum #s |
| $BOD_5$ | 30 | 45 | 30 | 45 | 60 |
| TSS | 85 | 140 | 85 | 128 | 170 |
| | | | | | |
| Other Parameters | Limitations (cont.) | | | | |
| pH | Shall be within the range of 6.0 - 9.0. | | | | |
| Escherichia coli (E. coli) bacteria | Shall not exceed a 30 day log mean of 126 organisms per 100 ml. No single sample shall exceed 406 organisms per 100 ml. | | | | |
| $BOD_5$ percent removal efficiency | Shall not be less than 85% monthly average on a concentration basis. | | | | |
| TSS percent removal efficiency | Shall not be less than 65% monthly average on a concentration basis. | | | | |

## 2.1.2.9.2 TMDL-Based Conditions

The limits listed in this section constitute point source waste load allocations, which can be expressed as mass per time or other appropriate measure according to EPA guidance. Mass loads were not established because the impairment of concern is concentration-based and some facilities are planning or considering expansions for population growth and TMDL implementation - design flows have not yet been established. It is clear from the data evaluation in the Umatilla Basin discussed in this text that non-point sources far outweigh point sources in their potential for sediment-related water quality impairment, and generally diminish TSS concentrations rather than intensify them. Due to the importance of flow for sensitive beneficial uses, primarily fisheries, limitations on beneficial flow can be detrimental.

The TMDLs are basin goals that add to or modify existing permit conditions. Most existing permit-specific conditions will remain, such as: more stringent seasonal concentrations, state and federal standards and acute toxicity prohibition outside the zone of immediate dilution. The following effluent limitations are applicable at the end of pipe:

> **November 1 – April 30:** Total suspended solids (TSS) - not to exceed a daily maximum of 80 mg/L (basin average TSS associated with 30 NTU). Concentration limits will be converted to mass load using the appropriate effluent design flow, and included as effluent permit limitations. Dischargers have the alternative of demonstrating that their effluent does not exceed 30 NTU.

# 2.1.3 AQUATIC WEEDS, ALGAE & PH TMDL

## 2.1.3.1 TARGET IDENTIFICATION

### 2.1.3.1.2 Aquatic Weeds and PH Related to Aquatic Life

There is increasing periphyton (algae attached to the river substrate) growth during the summer in the Upper Umatilla River as it flows from the North and South Fork (forks) of the Umatilla to the Highway 11 Bridge at rivermile 57.1. The water in the forks is generally high quality, with relatively cool instream temperatures and without excessive periphyton growth and pH problems. However, the Umatilla River warms to temperatures conducive to algae growth as it flows from the forks to the Highway 11 Bridge site, where excessive periphyton growth seasonally occurs.

Algae production is the principle cause of wide pH fluctuations in the Umatilla River at Highway 11 Bridge (RM 57.1) and Yoakum Bridge (RM 37.2). The algae of concern in the Umatilla River is periphyton. As periphyton obtains carbon dioxide for cell growth the bicarbonate present in the water is decreased. Removal of the bicarbonate from the water will generally increase the pH. High pH is stressful to fish. This daily increase in pH is associated with algal photosynthesis, which is maximized by mid-day light and warmth. The pH standard is exceeded during the warmest part of the day.

### 2.1.3.1.2 Sensitive Beneficial Use Identification

Excessive algae growth can increase pH in the river to levels that are stressful to fish. Nuisance algae growth can also adversely affect aesthetic quality of the Umatilla River and, as mentioned above, can cause taste and odor problems.

Beneficial uses affected by aquatic weeds, algae and pH include water contact recreation, aesthetics, and fish-related uses.

#### 2.1.3.1.3 Water Quality Standard Identification

The following is the State of Oregon standard that is applicable to aquatic weeds or algae, in the Umatilla Basin (OAR 340-41-645(2)(h):

> The development of fungi or other growths having a deleterious effect on stream bottoms, fish or other aquatic life, or which are injurious to health, recreation, or industry, shall not be allowed.

The following is the State of Oregon standard that is applicable to pH, in the Umatilla Basin (OAR 340-41-645(2)(d):

> pH values shall not fall outside the ranges... 6.5 to 9.0. When greater than 25 percent of ambient measurements taken between June and September are greater than pH 8.7, and as resources are available according to priorities set by the Department, the Department shall determine whether the values higher than 8.7 are anthropogenic or natural in origin.

### 2.1.3.2 DEVIATION FROM WATER QUALITY STANDARDS

**Table 35** summarizes the stream segments on the 1998 §303(d) list for aquatic weeds or algae and **Figure 60** maps these segments. In addition, Butter Creek is listed as water quality limited (also 1998 §303(d) list) for pH, from the mouth to its confluence with Little Butter Creek. Oregon's §303(d) list and its supporting data references can be publicly accessed through the Oregon Department of Environmental Quality web page at the following URL: http://www.deq.state.or.us. The language of the relevant standards is provided in **Appendix A-7**.

**Table 35.** Segments on the 1998 §303(d) List for Aquatic Weeds or Algae

| *Waterbody Name* | *Boundaries* |
|---|---|
| Umatilla River | Speare Canyon to Wildhorse Creek |
| Umatilla River | Wildhorse Creek to Forks |

**Figure 60.** Segments on the 1998 §303(d) List for Aquatic Weeds or Algae

## 2.1.3.3 DATA REVIEW

Observed total and orthophosphorus, pH, and temperature data, all factors that influence periphyton growth, are reviewed below.

### 2.1.3.3.1 Phosphorus

The review of phosphorus is done to determine whether the instream concentrations are at levels that will support periphyton growth, and to see if there is the potential to reduce phosphorus to low enough levels to reduce periphyton growth. Both total and orthophosphorus (OP) data were collected during sampling surveys conducted during the months of March through October, 1993 to 1997. Total phosphorus (TP) includes both the particulate and water-soluble phosphorus. OP is the soluble form that is readily available for the periphyton to utilize for growth.

The monitoring locations included in the data review are listed in **Table 36**.

**Table 36.** Upper Umatilla Basin Monitoring Stations

| Site | Rivermile |
|---|---|
| North Fork Umatilla River | 0.1 |
| South Fork Umatilla River | 0.5 |
| Umatilla River at Corporation | 89.5 |
| Umatilla River upstream of Gibbon | 81.7 |
| Umatilla River east of Gibbon | 80.0 |
| Umatilla River at Cayuse Bridge | 69.4 |
| Umatilla River at Mission Bridge | 61.5 |
| Umatilla River at Highway 11 | 57.1 |
| Umatilla River at Reith | 49.0 |
| Umatilla River at Yoakum Bridge | 37.2 |

**Figure 61** displays observed TP by rivermile and includes the North and South Forks of the Umatilla River, and main stem Umatilla River sites down to Yoakum Bridge at rivermile 37.2 (note the Y axis is a logarithmic scale).

The TP concentrations do not change noticeably from the forks down to the Umatilla River at Highway 11 site (RM 57.1), where pH violations, resulting from increased periphyton growth, are first measured.

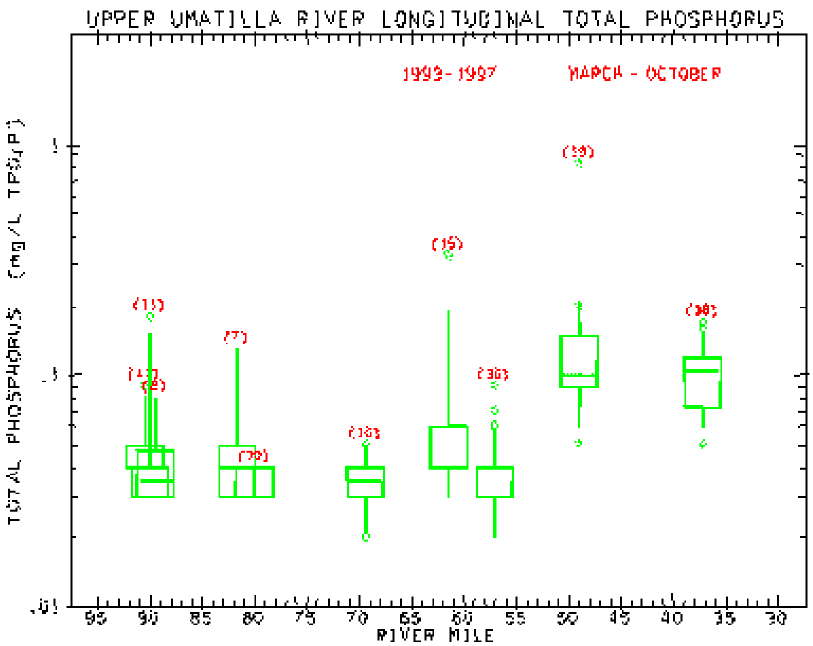



**Figure 61.** Total Phosphorus by Rivermile

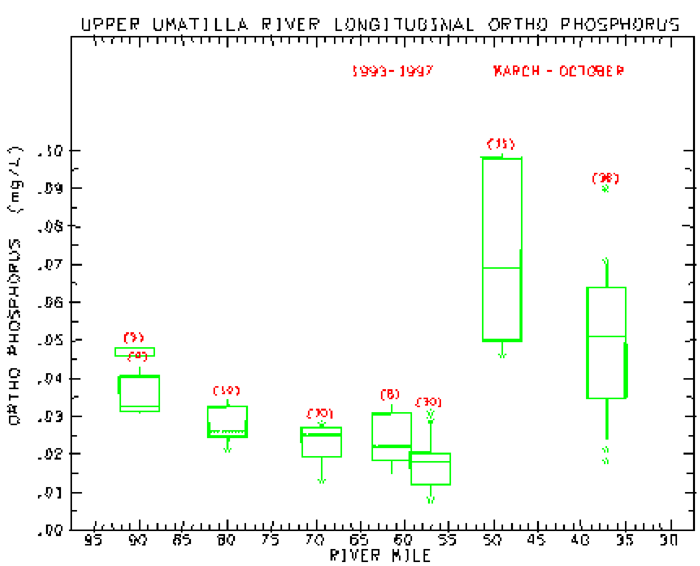



**Figure 62.** Orthophosphorus in the Forks and Upper Umatilla River

**Figure 62** represents the OP in the forks and the Umatilla River down to Yoakum Bridge (RM 37.2). OP amounts to about half of the TP, and as mentioned above, is the most readily available form utilized for periphyton growth.

As can readily be seen in **Figure 62**, the OP steadily decreases from the forks downstream to Highway 11. This is evidence that there is periphyton uptake of OP which is decreasing the concentration as the periphyton grow. In order to limit the growth of periphyton, it is recommended in the literature that one of the nutrients be limited to the half-saturation constants. Literature values for phosphorus half-saturation constants range from 0.004 to 0.008 mg/L (EPA, 1985). This will result in a periphyton productivity rate that is no greater than 50 percent of the maximum rate. Based on the work done by Michaelis-Menton on uptake kinetics of organisms, it would be unlikely for there to be significant algal growth limitation with OP concentrations observed in the forks of 6 to 9 times the high end of this range, or 0.03 to 0.045 mg/L. Data suggest that there is sufficient instream OP in the forks to support periphyton growth downstream to the Highway 11 Bridge, where pH violations occur.

**Figure 63** is a plot of longitudinal total inorganic nitrogen (TIN). In addition to phosphorus, TIN also has the potential to limit periphyton growth. The TIN concentrations remain relatively low from the forks to Highway 11, where excessive periphyton growth and pH violations occur. The TIN in the forks to Highway 11 Bridge is above a limiting concentration of 0.035 mg/L (TIN corresponding stoichiometrically to approximate 0.005 mg/L TP).

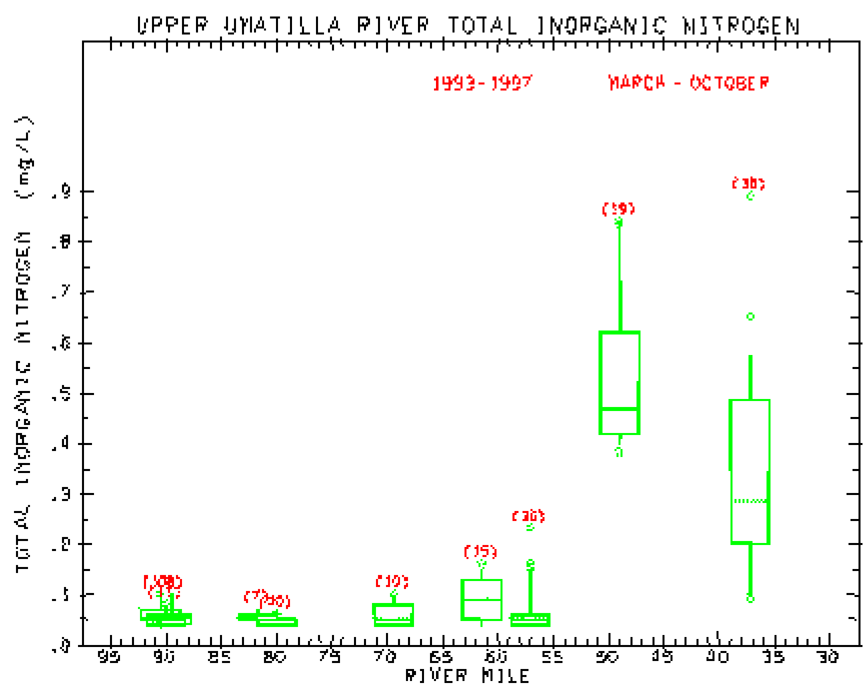



**Figure 63.** Upper Umatilla River Total Inorganic Nitrogen

Available information indicate that there is minimal, if any, human-caused contribution of OP or TIN load to the North and South Forks of the Umatilla River. The Umatilla Basin TMDL Technical Committee discussions with NRCS, ARS, CTUIR and SWCD and ODA indicate that phosphorus is rarely applied as a crop nutrient throughout the Umatilla Basin above Pendleton because there is sufficient geologic source. The USFS has indicated that nitrogen fertilizer generally has not been applied in the Umatilla

National Forest. Nutrient sources such as grazing and animal feedlots are potential and nitrogen crop fertilizers are applied throughout much of the agricultural areas of the basin. Data evaluation suggests that nitrogen is not a limiting factor and that the expected temperature reductions should control periphyton. There is little opportunity to control periphyton growth by reducing phosphorus to limiting concentrations in the river from the forks to Highway 11.

Nutrient concentrations increase significantly between the Highway 11 Bridge site and Reith Bridge at rivermile 49.0. However, the pH decreases at Reith Bridge as the instream temperature decreases due to the cool flow augmentation released from McKay Reservoir during the summer months. As the data review and modeling demonstrate in the following sections, it appears that elevated periphyton growth and pH would be best addressed by reducing the instream temperature in the Upper Umatilla River.

# 2.1.3.3.2 pH

The observed pH data appear to indicate that the progressively increasing instream temperature from the forks to Highway 11 results in increasing periphyton growth and elevated pH. Approximately half of the observed pH data exceed the water quality standard at the Umatilla River at Highway 11 and Yoakum Bridge (RM 37.1) sampling sites (**Figure 64**). However, at the Reith Bridge site at rivermile 49.0, the median pH decreases to about 7.9 SU as the stream temperature decreases due to the McKay Reservoir flow augmentation. The river then warms from Reith Bridge to Yoakum Bridge (RM 37.2) and the pH again begins to routinely exceed the water quality standard.

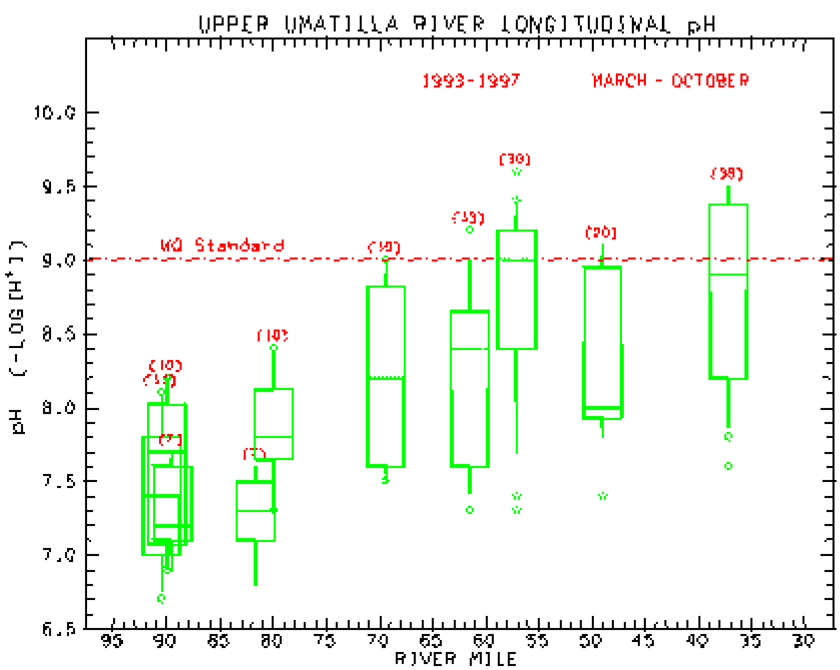



**Figure 64.** Upper Umatilla River Longitudinal pH

# 2.1.3.3.3 Temperature

The observed summertime temperature data show about a 6 degrees Celsius (11 °F) median increase in temperature from the Umatilla River at Corporation (RM 89.5) to Highway 11 (RM 57.1). **Figure 65** displays stream temperature data by rivermile.

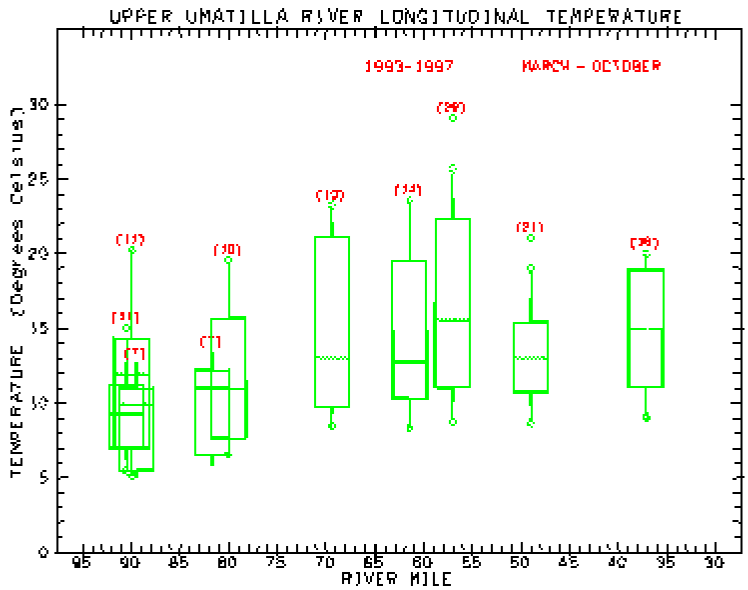



**Figure 65.** Upper Umatilla River Longitudinal Stream Temperature

The increase in Umatilla River temperature coincides with the increase in periphyton growth and pH. It appears from this data review that the key to reducing periphyton growth and meeting the goal of instream pH below 9.0 SU is to reduce instream temperature.

**Figure 66** represents the theoretical relationship between instream temperature and algal growth. The algal growth rate increases significantly as the instream temperature increases.

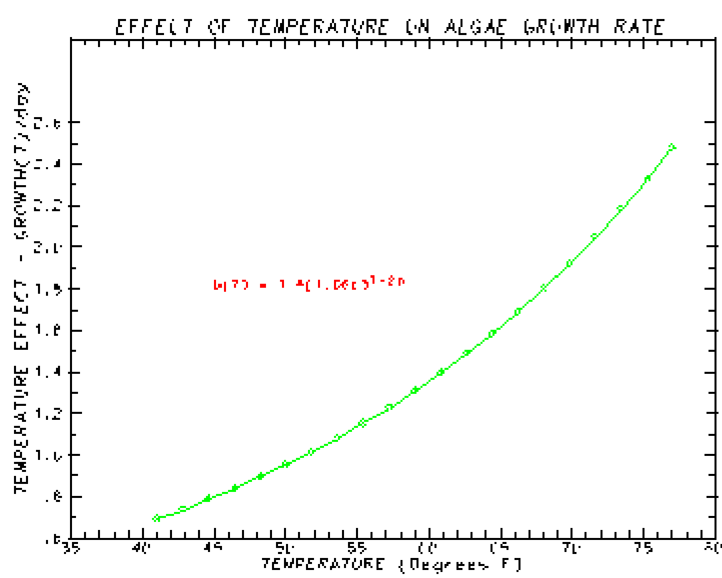



**Figure 66.** The Theoretical Relationship between Instream Temperature and Algal Growth

A regression analysis of pH and stream temperature, using historical data collected by ODEQ, illustrates that the pH at the Umatilla River Highway 11 (RM 57.1) increases as the instream temperature increases (**Figure 67**). The regression analysis ignores other factors, such as the effect that nutrients and light have on algal growth, and subsequently pH. Nonetheless, it illustrates an association between pH and instream temperature.

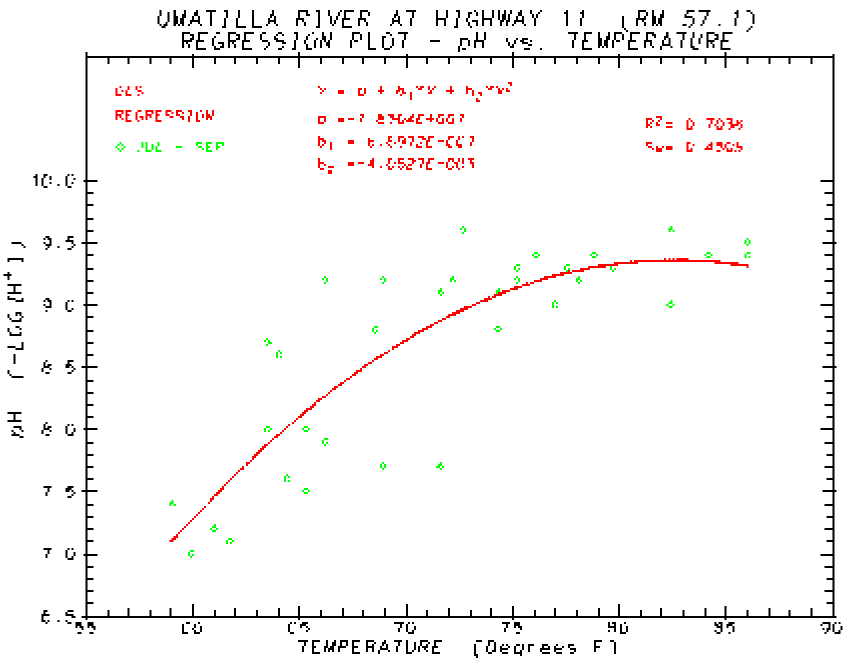



**Figure 67.** Regression Analysis of pH and Stream Temperature at Highway 11

## 2.1.3.4 POLLUTANT

Nutrient, pH and temperature data indicate that reducing instream temperature is the key to reducing excessive periphyton growth and pH fluctuations in the river. Since nitrogen and phosphorus are above limiting concentrations from the forks to the Umatilla River at Highway 11 sampling site, reducing nutrient loads to the Umatilla River would not have a significant impact on either periphyton growth or pH.

A model (discussed below) was developed to further investigate the relationship between temperature and pH. The model corroborates the association seen in the pH and temperature data at the Highway 11 Bridge site. The model predicts that the pH standard will be achieved through the implementation of the site-potential temperature TMDL allocations. The narrative algal growth component of the water quality standard should be met as well, through temperature TMDL implementation.

Instream temperature is the pollutant that is the focus of this algae and pH TMDL.

## 2.1.3.5 LOADING CAPACITY

As discussed in the data review, a water quality concern in the Umatilla River from Highway 11 (RM 57.1) to Yoakum Bridge (RM 37.2) is pH exceeding the State of Oregon water quality standard (greater than 9.0 standard pH units (SU)). The presence of instream aquatic plants can have a profound effect on the variability of pH throughout a day and from day to day. In the Umatilla River the emphasis is on attached algae which clings to rocks and other surfaces (periphyton).

Nitrogen, phosphorus, light availability, and instream temperature are all parameters necessary for supporting periphyton growth. The data review indicates that there is little reason to believe that nutrients can be reduced to concentrations needed to limit algal growth at Highway 11.

The rate of periphyton growth is limited by the **availability of light**, **nutrients**, **and water temperature. In a situation where the available light for periphyton growth is at an optimum level and nutrients are plentiful, then the growth of periphyton will be dependent on the temperature effect** (Thomann and Mueller, 1987).

The data review also indicates that the increase in pH is correlated with the increase in instream temperature between the confluence of the forks and the Umatilla River at Highway 11. Both the regression analysis of pH versus temperature and a pH model of the Upper Umatilla River (rivermile 80.0 to 57.1) predict that the instream pH will be maintained below the standard (9.0 SU) when system potential temperature TMDL allocations and the resulting instream cooling are achieved.

The temperature model of the Upper Umatilla River (**Section 2.1.1**) predicts site potential temperatures at Highway 11 is 69 °F. The pH/temperature regression and the pH model predict that the maximum instream pH at Highway 11 will be 8.5 SU with the river achieving system potential temperatures. Site potential temperature at the Umatilla River at Yoakum Bridge site, the lowest site on the river where pH criteria exceedances have been recorded, is 63 °F. **The loading capacities for this TMDL are the system potential instream temperatures as predicted in Section 2.1.1.**

The following sections discuss the theory and application of the pH model used to determine the periphyton loading capacities.

## 2.1.3.5.1 Photosynthesis and the Carbonate Buffering System

Periphyton is important because of its ability to photosynthesize. The essence of the photosynthetic process centers about chlorophyll containing plants which can utilize radiant energy from the sun, convert water and carbon dioxide into glucose, and release oxygen. The photosynthesis reaction can be written as (Thomann and Mueller, 1987):

$$6\,CO_2 + 6H_20 \xrightarrow{\text{photosynthesis}} C_6H_{12}O_6 + 6\,O_2$$

Equation 1

Periphyton obtains energy from the sun for this daytime process. Instream dissolved oxygen is produced by the removal of hydrogen atoms from the water. The photosynthesis process consumes dissolved forms of carbon during the production of plant cells. Periphyton requires oxygen for respiration, which can be considered to proceed throughout the day and night (Thomann and Mueller, 1987). Carbon dioxide ($CO_2$) is produced during the respiration process as represented by the following equation:

$$6\,CO_2 + 6H_20 \xleftarrow{\text{Respiration}} C_6H_{12}O_6 + 6\,O_2$$

Equation 2

The consumption of $CO_2$ during photosynthesis and $CO_2$ production during respiration has no direct influence on alkalinity. Since alkalinity is associated with a charge balance, changes in $CO_2$

concentrations result in a shift of the carbon equilibrium proton balance and the pH of the solution. (The pH of a solution is defined as an expression of hydrogen-ion concentration in terms of its negative logarithm (Sawyer and McCarty, 1978.)) However, it can be shown that photosynthesis would result in limited alkalinity changes through the uptake of charge ions, such as orthophosphorus ($PO4^-$), nitrate ($NO_3^-$), and ammonia ($NH3^+$).

Carbon dioxide is very soluble in water, some 200 times greater than oxygen, and obeys normal solubility laws within the conditions of temperatures and pressures encountered in fresh water ecosystems (Wetzel, 1983). Dissolved $CO_2$ hydrates to yield carbonic acid ($CO_2 + H_20 \Leftrightarrow H_2CO_3$). The concentration of hydrated carbon dioxide ($CO_{2(aq)}$) predominates over carbonic acid in natural waters and it is assumed that carbonic acid is largely equivalent to hydrated carbon dioxide (e.g. $[H_2CO_3^*] \cong [CO_{2(aq)}]$) (Snoeyink and Jenkins, 1980).

Carbonic acid dissociates rapidly relative to the hydration reaction to form bicarbonate ($H_2CO_3^* \Leftrightarrow H^+ + HCO_3^-$). In addition, bicarbonate dissociates to form carbonate ions ($HCO_3^- \Leftrightarrow H^+ + CO_3^{2-}$). The various components of the carbonate equilibria are interrelated by temperature dependent constants (i.e. $pK_{a1}$ and $pK_{a2}$, respectively) which establishes an equilibrium between $H_2CO_3^*$, $HCO_3^-$, and $CO_3^{2-}$:

$$HCO_3^- + H_20 \Leftrightarrow H_2CO_3^* + OH^-$$
$$CO_3^{2-} + H_20 \Leftrightarrow HCO_3^- + OH^-$$
$$H_2CO_3^* \Leftrightarrow H_20 + CO_2$$

Equation 3

From these dissociation relationships, the proportions of $H_2CO_3^*$, $HCO_3^-$, and $CO_3^{2-}$ at various pH values indicate that $H_2CO_3^*$ dominates in waters at pH 5 and below. Above pH of 9.5 $CO_3^{2-}$ is quantitatively significant. Between a pH of 7 and 9.5 $HCO_3^-$ predominates (Wetzel, 1983).

Alkalinity is defined as a measure of the capacity of a water solution to neutralize a strong acid (Snoeyink and Jenkins, 1980). In natural water this capacity is attributable to bases associated with the carbonate buffering system ($HCO_3^-$, $CO_3^{2-}$ and $OH^-$). The carbonate equilibria reactions given above result in solution buffering. Any solution will resist change in pH as long as these equilibria are operational.

Photosynthesis and respiration are the two major biologically mediated processes that influence the amount of available $CO_{2(aq)}$ in fresh water systems. Accordingly, the pH of the solution will fluctuate diurnally and seasonally in accordance with a change of charge balance resulting from the production and/or consumption of $CO_{2(aq)}$ during these respective processes. Thus, an estimation of $CO_{2(aq)}$ will provide a method to determine pH levels in relation to the carbonate equilibrium proton balance within the solution. The concentration of $CO_{2(aq)}$ (e.g. $H_2CO_3^*$) in solution can be determined as:

$$[H_2CO_3^*] = \alpha_0 C_{tCO3}$$

Equation 4

where $\propto_0$ is mathematically defined as (Chapra, 1997):

$$\alpha_0 = \frac{[H^+]^2}{[H^+]^2 + [H^+]Ka1 + Ka1Ka2}$$

Equation 5

where $K_{a1}$ and $K_{a2}$ are equilibrium constants for carbonic acid and bicarbonate ions, respectively, and where the amount of total inorganic carbon ($C_{tCO3}$) in natural waters is defined as:

$$C_{tCO3} = \frac{Alkalinity - \frac{Kw}{[H^+]} + [H^+]}{(\alpha_1 + 2\alpha_2)}$$

Equation 6

The “Alkalinity” component of Equation 6 is expressed in milliequivalents (meq). The “Kw” term is a temperature dependent equilibrium constant for water and can be defined as:

$$K_w = [H^+][OH^-]$$

Equation 7

The“$\propto_1$” and “$\propto_2$” terms in Equation 6 are mathematical definitions of ionization fractions (Chapra, 1997):

$$\alpha_1 = \frac{[H^+]k_{a1}}{[H^+]^2 + [H^+]K_{a1} + K_{a1}K_{a2}}$$

Equation 8

$$\alpha_2 = \frac{K_{a1}K_{a2}}{[H^+]^2 + [H^+]K_{a1} + K_{a1}K_{a2}}$$

Equation 9

An increase in instream $CO_2$ results in a lower pH. Conversely, a decrease in $CO_2$ results in a higher pH. The consumption of $CO_2$ during periphyton photosynthesis causes elevated pH levels between the Umatilla River at Highway 11 and Yoakum Bridge monitoring sites.

### 2.1.3.5.1.1 PH MODEL

The impact of algal production on pH can be determined by a mass balance of the carbonate species. Assuming that the consumption of carbon is consistent along the river bottom, the change in total carbonate species can be estimated as the amount of $CO_{2\,(aq)}$ plus the amount brought in by aeration and production, minus the amount of carbon dioxide consumed over time:

$$C_{CO2(aq)T} = C_{CO2(aq)E} - (\{[C_{CO2(aq)E} - C_{CO2(aq)T}]e^{-ka_{CO2}T}\} + \{[1 - e^{-ka_{CO2}T}][\frac{P_{aCO2}}{K_{aCO2}}]\})$$

Equation 10

where:

| | | |
|---|---|---|
| $C_{CO2(aq)}$ | = | Dissolved $CO_2$ (e.g. $[CO_{2(aq)}] \approx [H_2CO_3^*]$) (mmoles/l); and |
| E | = | Equilibrium Condition @ Time = 0; |
| T | = | Time (day); |
| $K_{aCO2}$ | = | Inorganic carbon gas transfer rate from the atmosphere ($day^{-1}$); |
| $P_{aCO2}$ | = | Periphyton consumption of $CO_2$ (mmoles $CO_2$/mg $O_2$/l * day). |

Periphyton oxygen production is developed through an analytical formula developed by Di Torro (1981) that relates the observed range of diurnal dissolved oxygen ($\Delta_{DO}$), depth (H), and aeration coefficient ($Ka_{O2}$) to a measure of maximum potential benthic oxygen production ($P_{aO2}$):

$$P_{aO2} = (\frac{0.5Ka_{O2}[1 - e^{-KaO2}]}{[1 - e^{(-0.5Ka_{O2})}]^2})(\Delta_{DO})(H)$$

Equation 11

Equation 11 is a method to calculate the amount of oxygen produced by periphyton per bottom area normalized by depth (mg/l-day). The stoichiometric equivalent of carbon consumed during the photosynthetic process was determined by a simple mass balance relationship which defines the amount of oxygen produced during photosynthesis to the amount of carbon consumed (Equation 1). Specifically, $P_{aO2}$ (Equation 11) was converted to carbon consumed during the photosynthetic process (Chapra, 1997) and incorporated into the model:

$$\text{Oxygen to Carbon Coversion} = \frac{6 \text{ mmole } CO_2}{6 \text{ x } 32 \text{ mg}O_2} = 0.03125 \frac{\text{mmole } CO_2}{\text{mg}O_2}$$

Equation 12

Equation 10 is analogous to classical dissolved oxygen balances, with the exception that only the free carbon ($[CO_{2(aq)}] \approx [H_2CO_3^*]$) portion of the total carbonate concentration is involved in the aeration equilibrium calculations. Neglecting the influence of buffers other than the carbonate system, and assuming that total alkalinity does not change, the pH can then be estimated from the application of these equations. Changes in free carbon (e.g. $[CO_{2(aq)}] \approx [H_2CO_3^*]$) and total carbonate species (e.g. $[C_tCO_3]$) due to photosynthesis and respiration were calculated through the application of Equation 10. At the range of pH found in the Umatilla River (6.5-9.5), it can be assumed that most of the carbonate buffers are in the form of bicarbonate $HCO_3^-$ (e.g. $C_tCO_3 \approx HCO_3^-$). The temperature dependent equilibrium constant for bicarbonate ($K_{a1}$) is defined as:

$$K_{a1} = \frac{[H^+][HCO_3^-]}{[H_2CO_3^*]}$$

Equation 13

Through substitution and rearrangement, pH can be defined as the negative logarithm of $[H^+]$:

$$[H^+] = \frac{K_{A1}[CO_{2(aq)}]}{[C_tCO_3]}$$

Equation 14

where $[C_tCO_3]$ and $[CO_{2(aq)}]$ are determined through the application of Equation 10.

The carbon balance presented in Equation 10 is expressed in terms of a deficit, and is defined as the difference between saturation and existing concentrations. The carbon deficit will increase due to carbon uptake from periphyton and decrease from gas exchange (Chapra, 1997). The carbon equilibrium level in water is defined as saturation, at which point no net diffusion exchange of carbon between air and the water will occur. The carbon exchange rate between air and water depends on both the differences between existing carbon concentrations and saturation, as well as water turbulence. For example, carbon diffusion rates will increase at a greater carbon deficit and water turbulence levels. This process is similar to re-aeration in streams.

It is assumed that the dominant carbon balance processes are photosynthetic uptake (i.e. periphyton uptake) and carbon re-aeration (i.e. gas exchange). By assuming that the uptake of carbon and equilibrium reactions occur at a greater rate than replacement of carbon through aeration, the response of pH to reduced carbon concentration can be modeled. Accordingly, the carbon balance accounts for the current deficit, the amount of carbon brought in through aeration due to that deficit, the amount of carbon lost due to photosynthesis and the amount of carbon brought in through aeration due to the increase deficit resulting from photosynthesis.

The impact of algal production on pH was determined by solving the inorganic carbon mass balance up to a pH of 9.5. Above 9.5, the solution was assumed to be simply greater than 9.5 in order to simplify the calculations (e.g. available inorganic carbon is significantly curtailed at pH values equal or above 9.5.).

## 2.1.3.5.1.2 APPLICATION OF THE MODEL

Model Time Step

A simple steady state analysis does not provide information on how effective nutrient control may be downstream of the nutrient source because uptake from benthic algae reduces the available nutrient supply. Accordingly, a time dependent solution of the inorganic carbon balance was used to assess the potential influence of diurnal pattern of photosynthetic activity. A time dependent determination of total carbonate ($C_tCO_3$) and hydrated carbon dioxide ($CO_{2(aq)}$) provided a method to estimate in-stream pH levels resulting from increased periphyton production rates downstream of a source of pollution. The time step was modeled at a ten-minute interval.

$CO_2$ and $O_2$ Aeration Rate

The carbon mass balance equations in this model are extremely sensitive to the estimated, or assumed, ratios between aeration ($Ka_{O2}$) and production ($P_a$) rates. It can be shown that a decreased gas transfer or increased benthic consumption rate would increase the rate which the $CO_{2(aq)}$ deficit develops, and therefore result in an increase in-stream pH. In addition, increased depths would decrease the relative impact from periphyton production rates ($P_a$). The distance or the time required to exceed water quality standards is dependent on the availability of inorganic carbon concentrations of the water entering the section of the river, or from other sources such as tributaries, groundwater, or atmospheric aeration of $CO_2$.

Aeration rates ($K_{aO2}$) were estimated through the use of the Tsivoglou and Wallace (1972) formula. The formula was developed using a database of direct measurement of re-aeration:

$$K_{aO2} = 0.88US$$

Equation 15

Where $K_{aO2}$ is in day$^{-1}$ at 20*C, $S$ is the slope in feet/mile, and $U$ is the velocity in feet per second. More recent comparisons by Grant and Skavroneck (1980) indicated that this expression is most accurate for small shallow streams (Thomann and Mueller, 1987).

There is little literature describing aeration rates for inorganic carbon ($Ka_{CO2}$). Tsivoglou (1967) found during a series of laboratory tests that the mean ratio for dissolved oxygen ($Ka_{O2}$) and inorganic carbon aeration rates ($Ka_{CO2}$) to be 0.894 with a range of 0.845 to 0.940 and a standard deviation of 0.034. Simonsen and Harremoest (1978) determined aeration rates in a river using a twin curve method for both carbon and oxygen and found that the $Ka_{CO2}$ averaged 0.57 $Ka_{O2}$. It was assumed that the aeration rates for inorganic carbon followed the relationship presented by Simonsen and Harremoest (1978).

Periphyton Growth

The rate of periphyton growth is limited by the **availability of light**, **nutrients**, **and water temperature. In a situation where the available light for periphyton growth is at an optimum level and nutrients are plentiful, then the growth of periphyton will be dependent on the temperature effect** (Thomann and Mueller, 1987). If all of these are available in excess (i.e. non limiting condition), then dense mats of periphyton will grow and the algal mass will then be regulated by grazing by macro-invertebrates, grazer predation, substrate characteristics, and hydraulic sloughing.

Potential periphyton growth was assumed to occur proportional to the calculated growth rate from light availability ($G_L$) and the calculated growth rate from nutrient ($G_N$) concentration, whichever rate is lowest. It was assumed that the calculated production rate of oxygen ($P_{AO2}$) (see Equation 11) was proportionately reduced by these periphyton growth rate functions:

$$\text{Potential Periphyton Growth} = \text{Minimum}(G_N \text{ or } G_L) * P_{AO2}$$

Equation 16

In addition, a component to estimate periphyton growth response to changes in stream temperature ($G_T$) was used to estimate the instream pH at the Umatilla River at Highway 11 monitoring site given instream temperatures ranging from 19 to 25 degrees C.

*Algal Growth Factor - Availability of Light ($G_L$)*

Increased Solar Radiation has been shown to increase pH by encouraging photosynthetic chemical reactions associated with primary production (DeNicola et al., 1992). Increased algal productivity in response to increased solar exposure has been well documented (Gregory et al., 1987; DeNicola et al, 1992). In addition, it has been shown that photosynthesis of benthic algal communities in streams reaches a maximum at low light intensities (Gregory et al., 1987; Powell, 1996).

The effect of solar radiation on periphyton productivity ($G_L$) was added to model calculations, and was assumed to follow a sinusoidal curve described by Simonsen and Harremoest (1978):

$$G_L = \cos\frac{2\pi}{\alpha}t$$

Equation 17

where alpha is the length of day (assumed 16 hours/day) and t is the time of day and is represented in **Figure 68**.

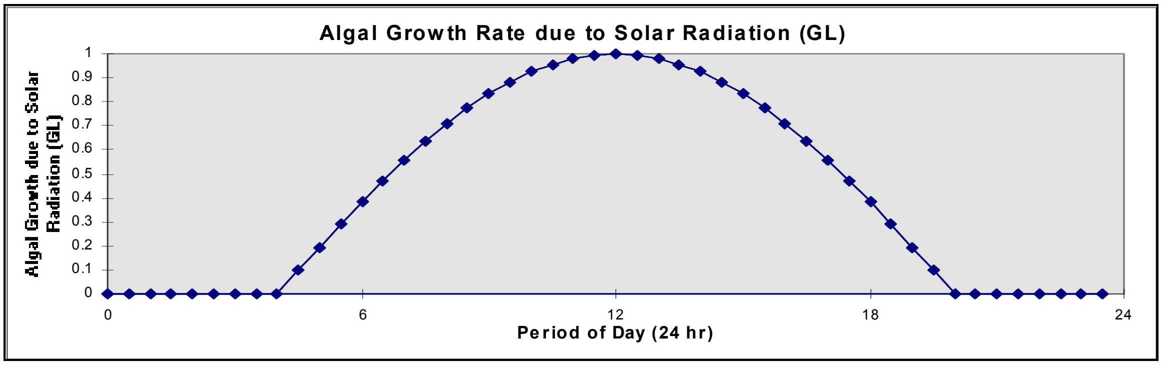



**Figure 68.** Algal Growth Rate due to Solar Radiation ($G_L$)

*Algal Growth Factor - Nutrients ($G_N$)*

Algae (periphyton) production due to phosphorus concentrations, as well as periphyton nutrient uptake, was assumed to follow the Michaelis-Menton model of enzyme kinetics: Algae production and nutrient uptake due to available nutrients ($G_N$) was assumed to be
relative to the availability of in-stream dissolved orthophosphorus (**Figure 69**).

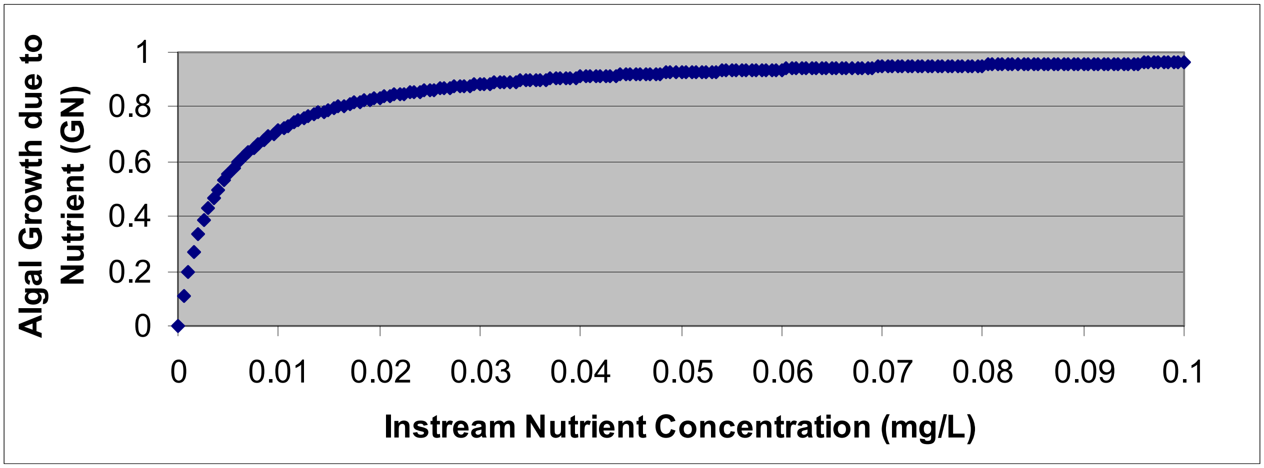



**Figure 69.** Algal Growth rate due to instream nutrient concentration ($G_N$)

A conservative 0.004 mg/l Michaelis-Menton half saturation constant ($K_S$) was used in the model to calculate $G_N$. This value corresponds to an algal growth rate which is one half (0.5) the maximum rate. Typical phosphorus half saturation constants found in literature for benthic algae range from 0.004 to 0.008 mg/l.

If a nutrient control program is initiated, but the reduction in input load only reduces the nutrient concentration to a level of about two to three times the Michaelis constant, then there will be no effect on the algal growth. This is equivalent to the notion of the limiting nutrient. Removing a nutrient that is in excess will not have any effect on growth until lower concentrations are reached. The treatment program may then be ineffective. The nutrient effect on algal growth, therefore, is a marked contrast to other types of water quality problems where reductions in input load (as in biochemical oxygen demand reduction) can generally be considered as being advantageous (Thomann and Meuller, 1987).

Horner et al. (1990), conducting research in laboratory streams, observed that nutrient uptake by filamentous algae increased most dramatically as Soluble Reactive Phosphorus (SRP) concentrations increased up to 0.015 mg/l, and decreased beyond 0.025 mg/l. The author noted that this information corroborates results presented in Horner et al. (1983): Working with the attached filamentous green algae *Mougeotia* sp., Horner et al. (1983) reported that algal accrual increased in proportion to increased SRP up to about 0.025 mg/l, but further increases were not as pronounced above that concentration, presumably due to a saturation of uptake rates.

Bothwell (1989) reported that maximum algal growth occurred at orthophosphorus concentration of 0.028 mg/l. However, this author reported that there appears to be differences between saturation growth rates and biomass accrual rates, with algal cellular requirements saturated at ambient phosphorus levels between 0.003 - 0.004 mg/l (Bothwell, 1992). However, many researchers have found that much higher levels of phosphorus are required to produce algal bloom problems in streams and rivers (Horner et al., 1990; Horner et al., 1983; Welch et al., 1989). Discrepancies may arise because of species differences, differing physical factors, the influences of algal mat thickness and community nutrient requirements, and the dynamics of nutrient spiraling. Accordingly, it was assumed that the algal growth, and subsequently the phosphorus uptake rate, was saturated at in-stream concentrations greater than 0.025 mg/l.

It is important to note that Bothwell (1985) observed that additions of multiple nutrients have a greater stimulatory effect on periphyton than estimated from single nutrients as assumed in this modeling work. Accordingly, pH modeling simulations may underestimate the actual production rates resulting from nutrient additions ($G_N$) that would be observed in the river.

*Algal Growth Factor - Temperature ($G_T$)*

The assimilative capacity of a water body is often proportional to temperature because of its influence on equilibrium conditions and several biological and chemical reaction rates. In a review of laboratory studies, field studies and mathematical models, O'Connor (1998) demonstrated that the gas transfer rate between the water surface and overlying atmosphere, rather than the carbonate equilibrium reaction rate, was the controlling mechanism for pH change resulting from temperature changes. Therefore the analysis of assimilative capacity at different temperatures focuses on factors influencing $CO_2$ exchange and not the carbonate equilibrium reaction.

Specific temperature dependent functions affecting $CO_2$ exchange include in this model are: 1) $CO_2$ saturation; 2) maximum algal growth rate (expressed as the photosynthetic demand of carbon); and 3) $CO_2$ aeration. Temperature influences were estimated by multiplying the ratio between the estimated rate at predicted temperatures and the calculated rate at initial conditions, which was calibrated using observed field temperature data.

The saturation level of carbon dioxide is related to temperature through Henry's law and is calculated as a function of temperature and altitude according to USEPA (1986); and as expressed by Caupp et al. (1997):

$$CO_2\ Saturation = 10^{-\left(\frac{-2385.73}{Temp}+14.01884-0.0152642*Temp\right)} * 3.162*10^{-4} * e^{\frac{(-0.03418\ *\ Elivation)}{(288.0\ -\ 0.006496\ *\ Elivation)}} * 44000$$

Equation 18

where Temp is water temperature in Kelvin, and Elevation is elevation in meters.

The influence of temperature on the $CO_2$ aeration rate is modified using the Arrhenius relationship with a standard reference to 20 $^OC$. The USEPA Document (1985) identified a typical range of theta values between 1.022 and 1.024, with a reported range of 1.008 to 1.047. This range was developed for the simulation of dissolved oxygen. A theta value of 1.02 identified by O'Connor (1998) for $CO_2$ was used:

$$K_t = K_{20}\ \theta^{(Temperate\ (^oC)\ -\ 20\ ^oC)}$$

Equation 19

where $K_t$ is the $CO_2$ aeration rate at temperature (t), and $K_{20}$ is the $CO_2$ aeration rate at 20 $^OC$.

Temperature effects on the algal growth rate were related directly to maximum production rate ($P_{AO2}$) (Equation 11). Algal growth rate, expressed as photosynthetic demand of carbon, was adjusted for temperature using the equations presented by the USEPA (1986):

$$Algal\ Growth_{\ (Temperature)} = \theta^{(Temperature\ (C)\ -\ 20\ (C))}$$

Equation 20

Typical theta values were reported by USEPA to range between 1.01 and 1.2. Epply (1972) reported a theta of 1.066. This value was used in the model.

# 2.1.3.5.2 Initial Buffering Capacity

Initial alkalinity, pH and temperature influences resulting from the mixing of Meacham Creek with the river were included in the carbon balance calculations in the model.

Algal Biomass Accrual

Results obtained from the application of this model do not simulate algal biomass accrual, but it provides a method to calculate an assumed diel production (≈ growth) pattern. A simple procedure proposed by Horner et al. (1983) and discussed by Welch et al. (1989) provides a steady state kinetic prediction of the potential periphyton biomass accrual based on physical and chemical characteristics of the river and their influence on algae growth rates and accumulation. The model was originally calibrated against the growth of filamentous green algae in artificial channels over a range of velocities and phosphorus concentrations. Application of the model with site specific data from the Spokane River, Washington (Welch et al., 1989) and the Coast Fork Willamette River, Oregon (DEQ 1995-b) indicated that the rate of biomass accumulation reduced proportionally to that of in-stream limiting nutrient concentrations, and that the rate of bioaccumulation was expected to decrease downstream as uptake removed the limiting nutrient. In addition, it was also hypothesized that periphyton biomass will eventually approach maximum levels even at low in-stream nutrient concentrations following a sufficiently long growing season.

Invertebrate Grazing

The pH model described above does not estimate the potential effects of grazing by macroinvertebrate on the standing crops and net production of the periphyton community. Grazing may influence not only standing crop, but also nutrient uptake and recycle rates, as well as species distribution within the benthic algal mat. Grazing generally results in lower periphyton biomass (Lamberti et al., 1987 and; Welch et al., 1989), a simplified algal community, lower rates of carbon production, and a constraint nutrient cycling (Mulholland et al., 1991). Reduced production rates anticipated under a nutrient control strategy would likely increase the relative influence of grazing as a controlling mechanism on periphyton. Hence, periphyton biomass accrual rates in the Umatilla River may be lower than predicted by the model as a result of a relative increased invertebrate grazing pressure at the anticipated reduced periphyton growth rates.

# 2.1.3.5.3 Model Calibration

The model was calibrated using continuous pH data collected during the summer of 1996. As can be seen in **Figure 70** below, the model calculated pH was very close to the observed pH.

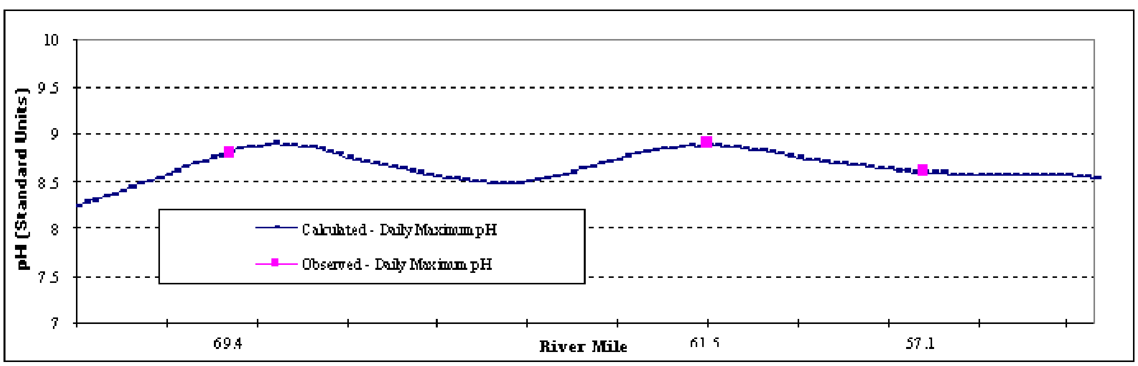
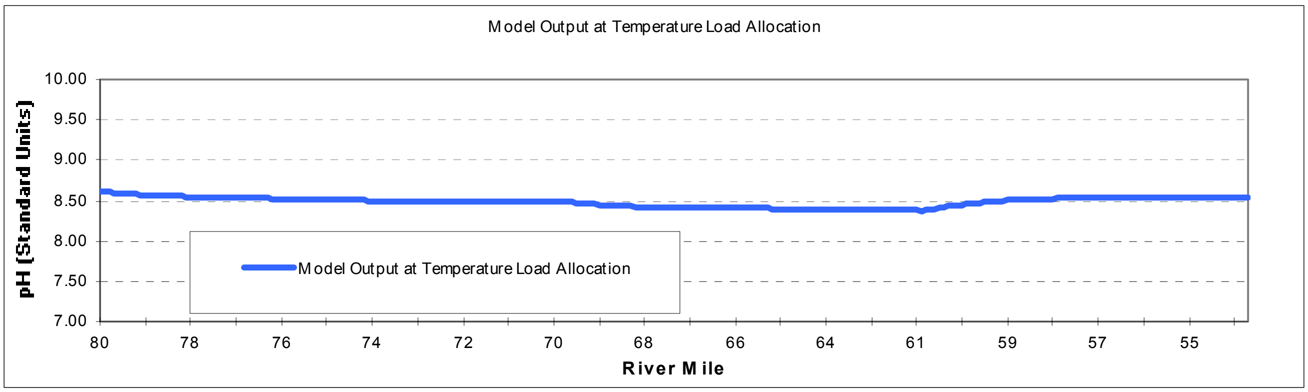



**Figure 70.** pH Model Calibration Plot

The temperature model of the Upper Umatilla River predicts site potential maximum (7-day stat) temperatures at Highway 11 of 69 degrees F. The pH/temperature regression and the pH model predict that the maximum instream pH at Highway 11 will be 8.5 SU with the river achieving system potential temperatures (**see model output in Figure 71**). Site potential temperature at the Umatilla River at Yoakum Bridge site, the lowest site on the river where pH standard exceedances have been recorded, is 63 degrees F. The pH model was could not be extended to include the Yoakum Bridge site due to insufficient data. The assumption is made that the pH and periphyton standards will be achieved at the Yoakum Bridge site through the implementation of the temperature TMDL because the site potential temperature is 6 degrees F cooler than at the Highway 11 site. **The loading capacities for periphyton are the site potential instream temperatures discussed above.**

**Figure 71.** pH Model Output at Site Potential Temperatures



### 2.1.3.6 LOAD ALLOCATIONS/WASTELOAD ALLOCATIONS

It was determined by the above pH modeling of the Upper Umatilla River that achieving the load allocations and wasteload allocations established for temperature will reduce periphyton growth and lead to the attainment of the water quality standards for pH and aquatic weeds and algae. Refer to **Section 2.1.1.6** of the temperature TMDL for allocations.

Algae and pH modeling was not conducted for Butter Creek and McKay watersheds due to insufficient data. Both are water quality limited [§303(d) listed] for pH. During the development of this TMDL, US EPA and ODEQ agreed that pending ongoing monitoring results, the application of the temperature TMDL surrogate allocations in these watersheds will be assumed to effect sufficient pH moderation.

The temperature TMDL allocations established in **Section 2.1.1.6** are the allocations for this TMDL.

### 2.1.3.7 MARGINS OF SAFETY

The following are margins of safety implicit in the determination of the periphyton/pH TMDL:

- A conservative half-saturation constant was used in the model (0.004) which is at the lower end of the range in the literature for algae (EPA, 1985).
- The pH model does not estimate the potential effects of grazing by macroinvertebrates on the periphyton crop. Grazing may influence not only the standing crop, but also nutrient uptake and recycle rates, as well as species distribution within the benthic algal mat. Grazing generally results in lower periphyton biomass (Lamberti, et al., 1987 and Welch, et al., 1989), a simplified algal community, lower rates of carbon production, and constrained nutrient cycling (Mulholland, et al., 1991). Reduced algal production rates under the temperature management strategy will likely increase the relative influence of grazing as a controlling mechanism on periphyton.
- Because photosynthesis responds quantitatively to changes in light, environmental variation in its quantity and quality potentially accounts for much of the variation in the physiology, population growth, and community structure of benthic algae (Stevenson, Bothwell, and Lowe, 1996). In addition to reducing periphyton growth through cooling the river, the additional shading of the river resulting from the implementation of the temperature TMDL will help reduce light availability, which may help the river shift from a dominance of nuisance filamentous green algae species (i.e. *Cladophora*) to single cell species (i.e. diatoms).

The sediment TMDL will decrease suspended sediment, which will increase light availability in the river. However, this increase in light availability should occur as sediment load to the river is reduced during the winter critical season, which is not the season of concern for periphyton growth.

- Many of the margins of safety in the temperature TMDL apply to the periphyton TMDL, as well. The margins of safety for the Umatilla Basin Temperature TMDL begin with a statement of assumptions. A margin of safety has been incorporated into the temperature assessment methodology. Conservative estimates for groundwater inflow and wind speed were used in the stream temperature simulations. Specifically, unless measured, groundwater inflow was assumed to be zero. In addition, wind speed was also assumed to be at the lower end of recorded levels for the day of sampling. Groundwater directly cools stream temperatures via mass transfer/mixing. Wind speed is a controlling factor for evaporation, a cooling heat energy process. Further, cooler microclimates and channel morphology changes associated with late seral conifer riparian zones were not accounted for in the simulation methodology.

## 2.1.3.8 SECTION REFERENCES

**Bothwell, M. L. (1985).** *Phosphorus Limitation of Lotic Periphyton Growth Rates: An Intersite Comparison Using Continuous Flow Troughs (Thompson River System, British Columbia.* Limnol. Ocean. 30(3)

**Bothwell, M. L. (1989).** *Phosphorus-Limited Growth Dynamics of Lotic Periphyton Diaton Communities: Areal Biomass and Cellular Growth Rate Response.* Can. J. Fish. Aquatic. Sci. 46: pp. 1291-1301.

**Bothwell, M. L. (1992).** *Eutrophication of Rivers by Nutrients in Treated Kraft Pulp Mill Effluent.* Water Poll Res J Canada., V27 No. 3, pp. 447-472.

**Chapra, S.C. (1997).** *Surface Water-Quality Modeling.* WCB McGraw-Hill, pp. 884.

**DeNicola, D.M. (1996).** *Algal Ecology – Freshwater Benthic Ecosystems. Edited by Stevenson, R.J., M.L. Bothwell, R.L. Lowe.* Academic Press Inc., pp. 150-176.

**Di Torro, D. M. (1981).** *Algae and Dissolved Oxygen.* Summer Institute in Water Pollution Control, Manhattan College, pp. 3-99.

**Eppley, r.w. (1972).** *Temperature and Phytoplankton Growth in the Sea.* Fish Bull. 70. Pp. 1063-1085. (As reported in USEPA Document, 1986).

**Gregory, S.V., G.A. Lambaerti, D.C. Erman, K.V. Koski, M.L. Murphy and J.R. Sedell (1987).** *Influences of forest practices on aquatic production.* In: E.O. Salo and T.W. Cundy (eds), Streamside Management: Forestry and Fishery Interactions. University of Washington, Institute of Forest Resources, Contribution.

**Horner, R.R., E.B. Welch and R.B. Veenstra (1983).** *Development of nuisance periphytic algae in laboratory streams in relation to enrichment and velocity.* Periphyton of Freshwater Ecosystems, Wetzel, R.G. (ed.), Dr W. Junk Publishers, The Hague

**Lamberti, G. A., L. R. Ashkenas, and S. V. Gregory (1987).** *Effects of three herbivors on periphyton communities in laboratory streams.* Journal of North American Benthology Society. 6(2), pp. 92-104.

**Mulholland , P. J., A. D. Steinman, A. V. Palumbo, J. W. Elwood, and D. B. Kirschtel (1991).** *Role of Nutrient Cycling and Herbivory in Regulating Periphyton Communities in Laboratory Streams.* Ecology 72(3), pp. 966-982.

**Mulholland , P. J., A. D. Steinman, and J. W. Elwood (1991).** *Measures of Phosphorus Uptake Length in Streams: Comparison of Radiotracer and Stable PO4 Releases.* Can. J. Fish. Aquatic. Sci. 47: pp. 2351-2357.

**O'Connor (1998).** *Chemical Reactions and Gas Transfer in Natural Waters.* Journal of Environmental Engineering. Feb, pp. 85-93.

**Powell, M. (1996).** Streamboat Creek water quality study, 1996. Colliding Rivers Research, Inc.

**Sawyer, C. N. and P. L McCarty (1978).** *Chemistry For Environmental Engineering.* McGraw-Hill Publishing Company, 3rd Edition.

**Simonsen, J. F. and P. Harremoest (1978).** *Oxygen and pH fluctuations in Rivers.* Water Research Vol. 12, pp. 477-489.

**Snoeyink V. L. and D. Jenkins (1980).** *Water Chemistry.* John Wiley & Sons, Inc. New York.

**Stevenson, R.J., M.L. Bothwell, R.L. Lowe (1996).** *Algal Ecology, Freshwater Benthic Ecosystems.* Academic Press, Inc.

**Thomann R. V., and J. A. Mueller (1987).** *Principles of Surface Water Quality Modeling and Control.* Harper and Row, Inc., New York.

**Tsivoglou, E. C. (1967).** *Tracer measurement of stream reaeration:* U.S. Department of the Interior, Federal Water Pollution Control Administration, Washington, D. C., p.86.

**United States Environmental Protection Agency document - EPA/404/5-85-001 (1985).** *Ambient Water Quality Criteria for Ammonia.*

**United States Environmental Protection Agency document - EPA/600/3-85/040 (1986).** *Rates, Constants, and Kinetics Formulations in Surface Water Quality Modeling (Second Edition).*

**Welch E. B., R.R. Horner, and C.R. Patmont (1989**). *Prediction of Nuisance Biomass: A Management Approach*. Wat. Res. 4: pp. 401-405.

**Wetzel, R.G. (1983).** *Limnology*. Saunders College Publishing. 2nd edition.

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# 2.1.4 NITRATE TMDL

Wildhorse and Spring Hollow Creeks are listed on the 303(d) list as being water quality limited year-round for nitrate nitrogen (nitrate). Nitrate TMDLs are determined herein for the listed streams.

## 2.1.4.1 TARGET IDENTIFICATION

The target identification is discussed below. The nitrate ion is expressed in a variety of terms in this section. When concentrations are referred to, they are expressed as the mass of nitrogen in a particular form, per water volume. Though this is a standard expression for nitrate, it differs from the typical method of expressing inorganic or organic compound concentrations.

Another potential source of confusion is that the available analyses are typically of combined nitrate and nitrite. This analysis is considered representative of the nitrate quantity because nitrite is unstable in normal stream pH and oxidation environments and occurs in slight concentrations that are considered insignificant for the purpose of this TMDL.

## 2.1.4.1.1 Nitrate related to Drinking Water

**TECHNICAL BULLETIN**

HEALTH EFFECTS INFORMATION

Prepared by:
Oregon Health Division
Environmental Toxicology Section
August 1990

**NITRATE**

Nitrate is a compound formed when nitrogen combines with oxygen. This combination occurs in nature when nitrogen in the air reacts with oxygen or ozone. Amounts produced in this way however, are generally very small. It is produced by plants and animals, and is an ingredient in smoke and exhaust.

**OCCURRENCE AND SOURCES OF NITRATE IN WATER SUPPLIES**

Naturally occurring levels of nitrate in surface and groundwater do not generally exceed 2 milligrams per liter (mg/l). Water with less than 10-mg/l nitrate as nitrogen ($NO_3$ -N) is generally safe for use in foods and beverages. Sources of elevated nitrate levels include fertilizers, septic systems, animal feedlots, industrial wastes, and food processing waste. It can also be naturally occurring in certain geological settings, and can result from decaying organic matter. Elevated levels of nitrate found in well water are often used as indicators of improper well construction or location, overuse of chemical fertilizers or improper disposal of human and animal waste.

**HEALTH EFFECTS OF DRINKING NITRATE CONTAMINATED WATER**

The United States Environmental Protection Agency (USEPA) has set a maximum contaminate level (MCL) of 10 mg/l for nitrate ($NO_3$ -N) in public water supplies. Nitrate levels above 10 mg/l may represent a serious health concern for infants and pregnant or nursing women. Adults receive more nitrate exposure from food. Infants, however, receive the greatest exposure from drinking water because most of their food is in liquid form. Nitrate can interfere with the ability of the blood to carry oxygen to vital tissues of the body in infants of six months old or younger. The result is called methemoglobinemia, or "blue baby syndrome". Pregnant women may be less able to tolerate nitrate, and nitrate in the milk of nursing mothers may affect infants directly. These persons should not consume water containing more than 10-mg/l nitrate directly, added to food products, or beverages (especially in baby formula). Other domestic use of this water supply is acceptable, including washing and bathing.

The 10-mg/l standard for $NO_3$ -N in public drinking water supplies has been devised to protect a select group of sensitive persons (infants, and pregnant and nursing women). Available health information suggests that non-sensitive persons, including healthy adults and children older than six months in age, can consume water containing up to 20 mg/l nitrate without experiencing adverse health effects. At nitrate levels above 20 mg/l the Oregon State Health Division recommends that alternate water supplies be used by all persons. It has been suggested in preliminary studies that excessive nitrate ingestion may be linked to gastric cancer. This link, however, has not been firmly established and current exposure levels do not appear to put the population at risk.

## 2.1.4.1.2 Sensitive Beneficial Use Identification

The sensitive beneficial use impacted by nitrate toxicity is drinking water.

## 2.1.4.1.3 Water Quality Standard Identification

Water quality standards pertaining to nitrate are both narrative and numeric:

> OAR 340-41-645(2)(p)(A): Toxic substances shall not be introduced above natural background levels in the waters of the state in amounts, concentrations, or combinations which may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect public health, safety, or welfare; aquatic life; wildlife; or other designated beneficial uses;
>
> OAR 340-41-645(2)(p)(B): Levels of toxic substances shall not exceed the criteria listed in *Table 20* (of the regulation) which were based on criteria established by EPA and published in Quality Criteria for Water (1986), unless otherwise noted.

The *Table 20* criteria for nitrate is 10 mg/L, which will be the instream goal of this TMDL.

## 2.1.4.2 DEVIATION FROM WATER QUALITY STANDARD

**Table 37** summarizes the stream segments on the 1998 §303(d) list for nitrate and **Figures 72** is a map of these segments. Oregon's §303(d) list and its supporting data references can be publicly accessed through the Oregon Department of Environmental Quality web page at the following URL: http://www.deq.state.or.us. The language of the relevant standards is provided in **Appendix A-7**.

**Table 37.** Segments on the 1998 §303(d) List for Nitrate

| *Waterbody Name* | *Boundaries* |
|---|---|
| Spring Hollow Creek | Mouth to Headwaters |
| Wildhorse Creek | Mouth to Headwaters |

**Figure 72.** Segments on the 1998 §303(d) List for Toxics
(the nitrate listings are in the Wildhorse Creek watershed)

## 2.1.4.3 EXISTING SOURCES

Typical localized sources of nitrogen in Oregon waterbodies include municipal and industrial wastewaters, septic tanks, and feed lot dischargers. Diffuse sources of nitrogen include farm fertilizer and animal wastes, lawn fertilizer, and leachate from waste disposal in sanitary landfills. The likelihood of contamination varies depending on site-specific factors such as hydrogeologic vulnerability, type of operation, and management practices.

Nitrate concentrations in the Wildhorse watershed are unusually high for the Umatilla Basin. Basin-wide data is available in the Umatilla River Basin Data Review (DEQ 1998). No other watersheds in the Basin exhibited exceedances of the water quality standard for nitrate toxicity. The cause of this distinction, relative to other Basin watersheds, is not clear. The source evaluation discussion here is focused within the Wildhorse Creek watershed.

The following table lists the historical nitrate data collected near the mouth of Wildhorse Creek. Water quality standard exceedances are included in bold.

**Table 38.** Wildhorse Creek Nitrate

| **Wildhorse Creek Near Mouth (Rivermiles 0.25 and 0.75)** | |
|---|---|
| **Date** | **Nitrogen ($NO_3$+$NO_2$ - mg/L)** |
| 93/06/22 | 5.00 |
| 93/08/31 | 4.50 |
| 96/04/30 | 6.60 |
| 96/05/01 | 7.00 |
| 96/05/02 | 7.20 |
| 96/08/06 | 6.30 |
| 96/08/07 | 6.40 |
| 96/08/08 | 6.30 |
| 96/10/22 | 7.90 |
| 96/10/23 | 7.70 |
| 97/03/27 | 7.90 |
| 97/04/09 | **12.00*** |
| 97/04/23 | 2.80 |
| 97/05/07 | 8.90 |
| 97/05/21 | **11.00*** |
| 97/06/04 | **11.00*** |
| 97/06/18 | 10.00 |
| 97/12/15 | 9.40 |
| 97/12/22 | 8.40 |
| 97/12/29 | 9.40 |
| 98/01/05 | 7.40 |
| 98/01/20 | 3.80 |
| 98/01/27 | 4.10 |
| 98/02/10 | 7.50 |
| 98/02/17 | 5.10 |
| 98/02/24 | 6.10 |
| 98/03/03 | 3.80 |
| 98/03/10 | 5.10 |
| 98/03/17 | 5.40 |
| 98/03/23 | 6.10 |
| 98/03/31 | 5.40 |
| 98/04/06 | 6.00 |
| 98/04/14 | 3.00 |
| 98/04/14 | 6.00 |
| 98/04/14 | 6.00 |
| 98/08/26 | 2.80 |

* Water Quality Standard Exceedance

**Figure 73** shows the nitrate monitoring locations sampled during a 1999 special survey conducted by the Umatilla Basin TMDL Technical Committee. Monthly samples were collected during May through December, as flow levels allowed.

**Figure 73.** Wildhorse Creek Watershed Nitrate Monitoring Locations

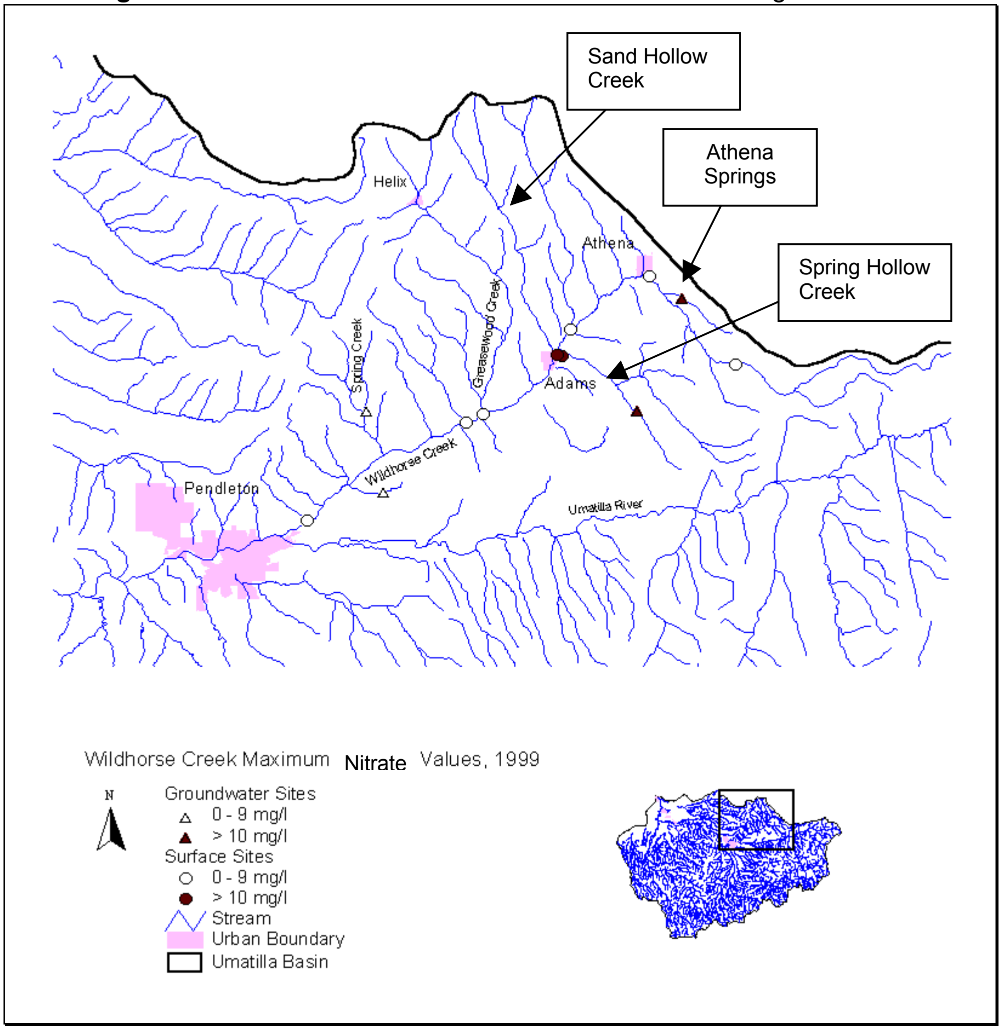



**Table 39** lists summary statistics for the 1999 survey. One of the 1999 survey samples exceeded the 10 mg/L nitrate standard at the mouth of Sand Hollow Creek. Although it is not currently listed on the 303(d) list for nitrate, loading capacity and load allocations are determined for Sand Hollow Creek due to the measured exceedance of the water quality standard during TMDL development. Three samples collected from Spring Hollow Creek in 1997 had nitrate concentrations of 19.0 mg/L.

Surface water exceedances identified in the 1999 survey were uncommon: two at Spring Hollow, one at Sand Hollow.

**Table 39.** Summary Statistics for 1999 Nitrate Stream Data

| Stream Sample Location | mean nitrate+nitrite nitrogen (mg/l) | standard deviation (mg/l) | number of samples (1999) |
|---|---|---|---|
| Wildhorse Creek above Athena, river mile 24.3 | 0.43 | 0.25 | 7 |
| Wildhorse Creek at Athena, above Waste Water Treatment Plant, river mile 18.5 | 0.82 | 0.7 | 6 |
| Wildhorse Creek, Helix Hwy Bridge, river mile 7.3 | 3.97 | 0.86 | 7 |
| Wildhorse Creek near mouth, OWRD gage, river mile 0.75 | 3.72 | 1.05 | 7 |
| Mouth of Gerking Creek | 5.09 | 2.48 | 4 |
| Mouth of Spring Hollow Creek | 7.41 | 6.17 | 3 |
| Mouth of Sand Hollow Creek | 4.75 | 5.06 | 5 |
| Mouth of Greasewood Creek | 5.72 | 0.76 | 4 |

**Wildhorse Creek Watershed Groundwater**

Groundwater nitrate concentrations exceeding 10 mg/l were measured at Athena Springs and in a spring-tank in the Spring Hollow watershed in a 1999 survey conducted monthly by the Umatilla Basin TMDL Technical Committee. Athena Springs, an abandoned municipal drinking water source, is a spring converted to a shallow well with laterals (less than 30-foot depth) located near Wildhorse Creek approximately 2 miles upstream from the City of Athena. Seven samples were collected from Athena Springs; the mean concentration is 15 mg/l.

Six samples were collected from the spring tank near Spring Hollow Creek; the mean concentration is 16.8 mg/l. The tank serves as a very shallow well, and may not be representative of a broad area.

The following are historical data collected from Athena Springs (Oregon Health Division Pendleton Files):

7/15/87 - 15 mg/l
3/1/88 - 11.2 mg/l
9/14/88 - 12.9 mg/l

Land use in the Athena Springs and Spring Hollow Creek watersheds is entirely agricultural, with infrequent rural residences.

Reported mean nitrate concentrations from 2 wells (old construction, 250-400 foot depth) at the Agricultural Research Station (Highway 11, 6 miles northeast of Pendleton) is 14.5 mg/l (n=8). The data were collected between 1965 and 1997. Also, nitrate concentrations above drinking water standards have been reported for wells in the Helix area.

The shallow groundwater in most of the Wildhorse Creek watershed resides in silts and fine sands (loess) overlying dense basalt. The loess typically ranges up to 25 feet in depth. Summer rainfall is slight and Wildhorse Creek is entirely dry in various sections above Athena; ground water is the source of summer flow in Wildhorse Creek. Variously elevated nitrate concentrations occur in the Creek throughout the year. Consequently, groundwater is a potential source for surface water contamination. Further discussion of pollutant sources is provided in following text.

**Discussion of sources**

TMDLs are allocated appropriately to point and - point source in Wildhorse watershed, the Athena Wastewater Treatment Plant. Load Allocations for non-point sources are allocated to agriculture, in accordance with the reasoning outlined in the next several paragraphs.

As discussed previously, potential non-point sources of nitrate include: sewage, fertilizer, plant and animal waste and decay. For the TMDL, the Umatilla Basin has been roughly divided into 4 aggregate land use categories: urban, agriculture (livestock management and cropland), forest and transportation corridors such as road and rail. Another source category is natural background.

Forestry. Of these categories of potential sources of nitrate, forest sources are considered insignificant. Nitrate concentrations are consistently low in forested watersheds in the Umatilla Basin (refer to natural background discussion in this section). At the approximate forest/agricultural boundary (river mile 24.3 of Wildhorse Creek), the 1999 survey mean concentration was 0.43 mg/l nitrate+nitrite as N. This is substantially less than downstream concentrations in the Wildhorse watershed, all in non-forested areas (**Table 39**).

Transportation. Transportation corridors are likely to influence transport and distribution of nitrate by controlling runoff, but are considered an unlikely source.

Urban. Urban runoff includes sources such as pet waste, yard chemicals. No local data is known to be available and literature values for runoff are scarce. Reported event mean concentrations in Quezner (1998) are 0.23 mg/l Nitrate-N for non-point runoff from urban areas in Texas. This level of input is small, relative to the 10 mg/l goal and. Another potential urban or residential source is septic systems. To evaluate this potential screening calculations were conducted (below). It is likely that these calculations overestimate loading by assuming no attenuation of nitrogen between septic tanks and streams, and by conservatively over-estimating the population using septic systems in the Wildhorse basin. This potential septic load screening range of 14-31 pounds per day nitrate-N can be compared to the desired maximum load at the mouth of Wildhorse Creek, at relatively low flow time of year, e.g., at 10 cfs: 552 pounds of nitrate-N per day. In the unlikely event that the actual loading approached this screening level, septic loading would be slight when compared to the LA, except at very low flow. While encouraged to reduce non-point pollution, urban sources are not assigned a non-point source LA.

**Screening estimate for urban nitrate loading for Wildhorse Creek watershed**

L=Q*P*C = **31 pounds per day,** where:
L = pounds per day potential nitrate N loading in Wildhorse watershed from septic systems,
Q = 48 gallons per day is average septic tank effluent discharge per person (Bounds, 1997),
P = 900 persons utilizing home septic systems (This is likely an over-estimate - the bulk of the population lives in Athena, population 1,200, which has a central sewer system. Adams, population 275, is entirely on septic)
C = 85-mg/l organic and inorganic nitrogen: upper end of measured concentration range for septic effluent (Bounds, 1997; Townsend, 1997)

or

L=M*P = **14 pounds per day**, where:
L and P are defined as above,
M = estimated 5.8 pounds per person each year from septic effluent (Black, 1999; similar to Shaw, 1992)

These screening calculations are based on the following conservative assumptions:

- No plant uptake occurs, no denitrification occurs
- All effluent ultimately enters the stream
- All nitrogen compounds convert to nitrate
- No ammonia is lost through evaporation
- Removal of diluted nitrogen during storm events is not accounted for

Natural Background. Another potential non-point source is natural background. Natural background from a geologic source is unlikely. Soils in the basin evolve from Pleistocene glacial-derived loess and Columbia River basalt. Both of these mineral sources have minimal nitrogen content, and associated large quantities of organic material are not expected or in evidence in the watershed. Background concentrations are sampled in several other watershed of the Umatilla Basin (DEQ 1998). At the mouth of Meacham Creek samples (n=19) were less than or equal to 0.03 mg/l nitrate+nitrite N from 1993-1997. At river mile 4.2 on East Birch Creek samples in this time frame had a maximum of 0.23 mg/l (n=9). Other than the Wildhorse watershed, the Umatilla Basin maximum concentrations range from 0.3-7.1 mg/l for 1993-1997 data, with a maximum of 0.21 mg/l for the Umatilla Basin watershed upstream from Wildhorse (DEQ 1998). In this same time period maximum values in the Wildhorse watershed were 12.0 mg/l at the mouth and 9.4 mg/l at Athena.

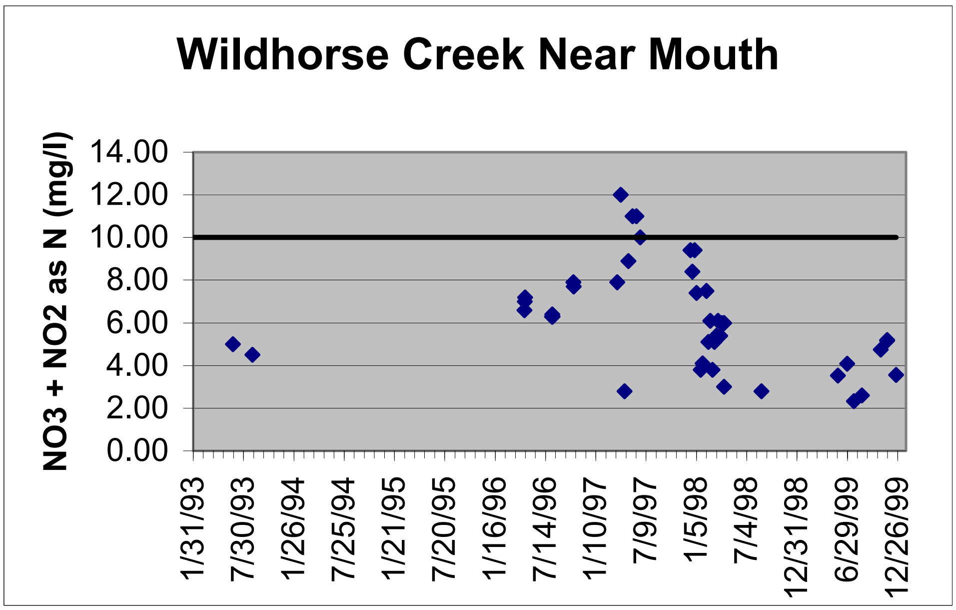
Agriculture (94% of land area). It is generally accepted that fertilizers can result in groundwater contamination in vulnerable hydrogeologic settings (Follet, Keeney, and Cruse, 1991). Nitrogen fertilizers are applied through much of the Wildhorse watershed for crop production. Typical nitrogen fertilizer application rates are 75 pounds nitrogen per acre/year or greater (ARS use 30 lbs/acre in long-term plot studies). The Wildhorse Creek watershed is approximately 120,000 acres. Estimating that a minimum of 50 percent of the basin undergoes nutrient application annually (the Technical Committee accounted for fallow, roads, etc.), this amounts to a loading rate of approximately 12,400 pounds per day of nitrogen as fertilizer. As much as 75% of this is taken up by planting and harvest (personal communication with ARS). This results in a daily nitrogen load for the watershed of greater than 3,000 pounds. The magnitude of this loading places it in the forefront of human influence to the watershed. Also in the category of agriculture, in some locations livestock feeding operations are located near streams. Additional information is needed to evaluate this potential source of nitrate input. For purposes of the load allocation, agricultural sources, whether livestock or crop-based, are not discriminated. The load allocations are assigned generally to agricultural land uses because of the large potential for non-point source nitrogen, based on land area and application, and the lack of potential from other land uses. For this TMDL, 'agriculture' does not include forestry.

Additional indication that agriculture is the primary source of elevated nitrate in the Wildhorse watershed is found in data from Athena Springs and Spring Hollow. These Wildhorse watersheds have no urban or forest influence, and have unusually high surface and ground water concentrations (**Table 39** and groundwater discussion above).

Nitrate is highly water soluble and mobile. In a soil environment it will tend to reside in soil moisture or ground water, rather than adsorbing to soil particles. Nitrate concentrations in the Wildhorse watershed generally do not exhibit a discernable seasonal pattern (**Figure 74**). Nitrate transport to streams, during seasons of high runoff, is expected to be lessened in part by sediment TMDL implementation (upland allocation measures control runoff). Near stream livestock operations should be considered as potential sources. Other nitrate fates include vadose zone storage and transport by rainfall/infiltration to the shallow perched loess aquifer overlying the area basalt bedrock. In the summer and fall infiltration and groundwater transport are the primary vector for soil nitrate delivery to streams. Implementation of measures to attain the State groundwater action level for nitrate nitrogen (7.0 mg/l) should sufficiently minimize subsurface nitrate input to streams.

Regarding the surface water, the 1999 data meets the TMDL load capacity and it is not known whether this is part of an improving trend.

**Figure 74.** Nitrate vs. time, Wildhorse Creek near Mouth




## 2.1.4.4 POLLUTANT

The pollutant addressed by this TMDL is nitrate nitrogen (nitrate). The State of Oregon water quality standard for nitrate is 10 mg/L, which is the instream goal of the TMDL.

# 2.1.4.5 LOADING CAPACITY

For purposes of determining this nitrate TMDL, an instream target for Spring Hollow, Sand Hollow, and Wildhorse Creeks is established at 10-mg/L nitrate nitrogen, the State water quality standard.

The loading capacity is streamflow dependent (listed in **Tables 41** and **42**). Spring Hollow and Wildhorse Creeks are listed for nitrate year-round. Descriptive statistics for Wildhorse Creek streamflow for water years 1999-2000 are provided in **Table 40**. The range of flows is approximately 1 to 200 cubic feet per second.

The equation for determining the loading capacities of the creeks in terms of mass load (lb/day) is:

LC = (10 mg/L N) * Q * 5.39

Where:
LC = Load Capacity (lb/day)
10 mg/L N = nitrate-nitrogen target concentration
Q = instream flow in cubic feet per second
5.39 = conversion factor to pounds per day

The loading capacities at specific flows in the creeks are presented in **Tables 41** and **42**.

**Table 40.** Wildhorse Creek, Rivermile 0.75, Daily Average Streamflow (cfs)

ALL SEASONS (Water Years 99-00) RESULTS:

| | |
|---|---|
| Number of data ................ | 393 |
| .... Conf Limit (U) .. ....... | 22.0617 |
| Mean ... (95% CI) ............ | 19.5832 |
| .... Conf Limit (L) ........... | 17.1048 |
| Stdrd Err Mean ................ | 1.2606 |
| Stdrd Deviation ................ | 24.9911 |
| Coef of Variation .............. | 1.2761 |
| Coef of Skewness ............ | 2.7756 |
| n-Kurtosis ......................... | 11.4668 |
| Geom Mean ..................... | 9.2194 |
| Maximum ......................... | 194.0000 |
| 0.750 perc ........................ | 27.5000 |
| Median ............................. | 9.8000 |
| 0.250 perc ........................ | 2.5000 |
| Minimum ........................... | 1.1000 |
| IQR .................................. | 25.0000 |
| Stdzd Range (Mx-Min)/Min. | 175.3636 |
| .. TM Conf Limit (U) ........ | 15.4407 |
| Trim. Mean (2x10%) .......... | 14.7584 |
| .. TM Conf Limit (L) ......... | 14.0762 |
| Trim Mean Stdrd Err .......... | 1.0103 |
| Wins. Mean (2x10%) ......... | 16.6621 |
| Winsored Stdrd Dev .......... | 19.8938 |
| Tukey Trimean ................. | 12.4000 |
| MedAD*1.483 ................... | 11.8640 |
| MnAD*1.483 ..................... | 23.2582 |

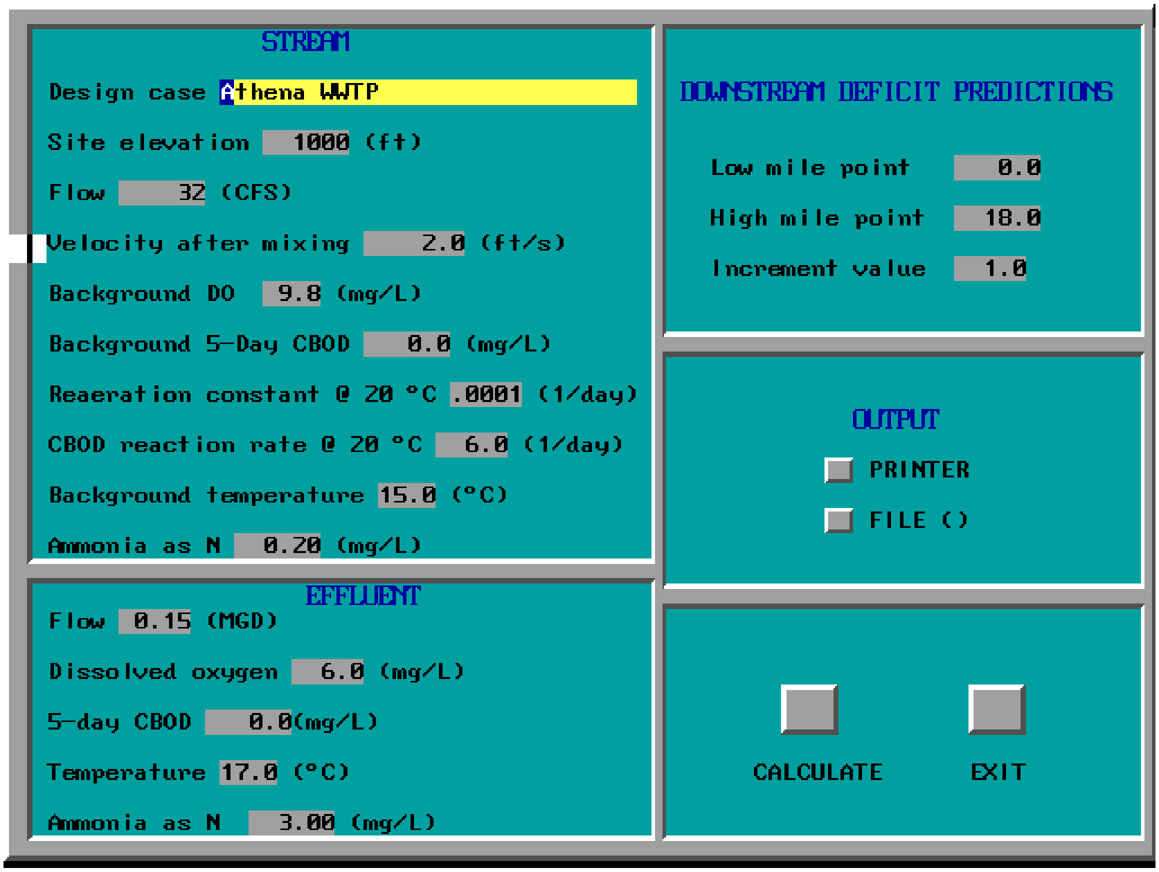
# 2.1.4.6 LOAD ALLOCATIONS/WASTELOAD ALLOCATIONS

The City of Athena wastewater treatment plant (WWTP) discharges treated municipal effluent to Wildhorse Creek during the months of November through April. To calculate the wasteload allocation (WLA) for the plant's discharge, the amount of effluent ammonia that potentially would be converted to nitrate during the instream nitrification process needs to be considered. Ammonia nitrogen may be oxidized by nitrifying bacteria to nitrite and nitrate and utilizing dissolved oxygen as part of the process (Thomann and Mueller, 1987).

A Streeter-Phelps dissolved oxygen model with an ammonia component was used to estimate the maximum dissolved oxygen deficit from the point of discharge to the mouth of Wildhorse Creek. Average November through April streamflow and conservative stream temperature were used as model input. Effluent ammonia data was provided by the City of Athena. This analysis includes only nitrogenous biochemical oxygen demand, assumes a first order nitrification rate of 6.0/day (high end of published range for small streams with a velocity of 1-2 feet per second) (EPA Rates, Constants and Kinetics, 1985, p. 169) and that nitrifying bacteria are present in the creek to facilitate ammonia oxidation.

Due to lack of data the analysis does not include the organic nitrogen which may be present in the effluent. However, this omission should be offset because the analysis does not include the overall loss of instream ammonia due to uptake by aquatic plants, and the overall loss of nitrate due to uptake by aquatic plants or through denitrification. Model input parameters used in the modeling exercise are presented in **Figure 75** below.

**Figure 75.** Streeter-Phelps Dissolved Oxygen Model Input
**(Maximum instream DO reduction (deficit) due to nitrification = 0.9 mg/L)**




In molecular proportion, 4.57 mg/L of dissolved oxygen are required for the complete oxidation of 1.0 mg/L ammonia (EPA, 1985). The model estimates that the dissolved oxygen consumed during instream nitrification from the point of the Athena WWTP discharge to the mouth of Wildhorse Creek = 0.9 mg/L. Therefore, given the conservative model input conditions, the amount of nitrate resulting from the nitrification process, is estimated to be 0.2 mg/L. This nitrate concentration is well within the 10 percent safety factor applied in the Athena WWTP Waste Load Allocation and is not considered a significant factor.

The following table shows, through a range of flows measured at Wildhorse Creek at the mouth, the load allocation (LA) for background and upstream non-point sources, and the waste load allocation (WLA) for the City of Athena wastewater treatment plant, calculated to meet the instream loading capacity for nitrate of 10 mg/L:

**Table 41.** Wildhorse Creek Load and Wasteload Load Allocations

Allocations in Pounds Per Day of Nitrate-Nitrogen in Wildhorse Creek at Specific Flows as Measured at the Mouth (with a 10 percent margin of safety)

| Wildhorse Creek Flow (CFS) Near Mouth | Loading Capacity (lb/day) | Waste Load Allocation - City of Athena WWTP (effluent, lb/day)<br><br>[facility design flow is 0.15 MGD] | Load Allocation to Agriculture (lb/day) | Margin of Safety (lb/day) |
|---|---|---|---|---|
| 1 + | 66 | 11 | 49 | 6 |
| 5+ | 282 | 11 | 243 | 28 |
| 10+ | 552 | 11 | 485 | 56 |
| 20 + | 1091 | 11 | 970 | 110 |
| 40 + | 2169 | 11 | 1940 | 218 |
| 60 + | 3247 | 11 | 2911 | 325 |
| 80 + | 4325 | 11 | 3881 | 433 |
| 100 + | 5403 | 11 | 4851 | 541 |
| 120 + | 6481 | 11 | 5821 | 649 |
| 140 + | 7559 | 11 | 6791 | 757 |
| 160 + | 8637 | 11 | 7762 | 864 |
| 180 + | 9715 | 11 | 8732 | 972 |
| 200 + | 10793 | 11 | 9702 | 1080 |

The Load Allocations for the Wildhorse Creek watershed is allocated to agriculture.

Due to having limited streamflow data for Spring Hollow Creek, a regression analysis (**Figure 76**) was done by Umatilla Basin TMDL Technical Committee to estimate a maximum streamflow for calculating load allocations. The data used in the analysis were collected monthly from October, 1998, to May, 1999. Using the regression equation determined from the analysis, and the maximum flow of 39 cfs for Patawa Creek during water year 1999, the predicted maximum flow in Spring Hollow Creek is 7 cfs. This estimate is outside the range of the data used in the regression analysis, so to be conservative, 10 cfs will be used as the high Spring Hollow Creek streamflow for determining the LAs. Limited flow data for Sand Hollow Creek indicates that the range of flows is similar to those calculated for Spring Hollow Creek. An estimated range of flows used to determine load allocations for both Spring and Sand Hollow Creeks is 0.05 to 10 cubic feet per second.

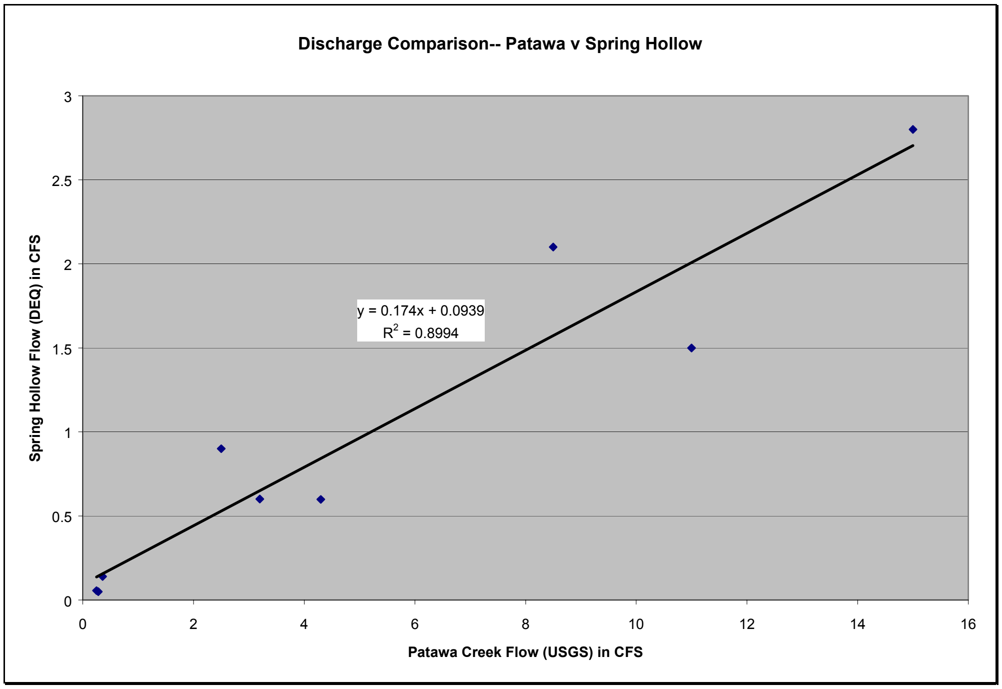



**Figure 76.** Streamflow Regression analysis, Spring Hollow Creek vs. Patawa Creek

There are no point sources on Spring Hollow Creek or Sand Hollow Creek. The LAs for Spring Hollow Creek at the mouth, and for the range of expected flows, are listed in the following table. The LAs for the Spring and Sand Hollow Creeks watershed are allocated to agriculture.

**Table 42.** Spring Hollow and Sand Hollow Creeks Load Allocations

Load Allocations in Pounds Per Day of Nitrate in Spring Hollow and Sand Hollow Creeks at Specific Flows as Measured at the Mouths

| Streamflow at Mouth (cfs) | Loading Capacity (lb/day) | Load Allocation to Agriculture (lb/day) | Margin of Safety (lb/day) |
|---|---|---|---|
| 0.05 + | 3 | 2 | 1 |
| 0.25+ | 14 | 12 | 2 |
| 0.5+ | 27 | 24 | 3 |
| 1.0 + | 54 | 49 | 5 |
| 1.5 + | 81 | 73 | 8 |
| 2.0 + | 108 | 97 | 11 |
| 2.5 + | 135 | 121 | 14 |
| 3.0 + | 162 | 146 | 16 |
| 5.0+ | 270 | 243 | 27 |
| 10+ | 539 | 485 | 54 |

## 2.1.4.7 MARGINS OF SAFETY

The margin of safety in the TMDL is explicitly allocated. Ten percent of the loading capacity has been reserved from allocation as a margin of safety. The numeric margin of safety is presented in **Tables 41** and **42**.

## 2.1.4.8 SEASONAL VARIATION

A seasonal pattern of nitrate loading is not discernable in available data. The stream segments addressed in this TMDL are listed for nitrate year-round. The loading capacities and load / wasteload allocations are also determined year-round.

## 2.1.4.9 SECTION REFERENCES

Anderson Perry and Associates, 1991, *Operation and Maintenance Manual, City of Athena, Oregon, Sewage Treatment System Part I*. Submitted to Oregon Department of Environmental Quality.

Black, C. W., 1999, Draft *Rural Residential Loading of Nitrate and Land Use Planning in Morrow and Umatilla Counties, Lower Umatilla Ground-Water Basin, Oregon*, USEPA Region 10.

Bounds, T. R., 1997, *Design and Performance of Septic Tanks*, Site Characterization and Design of Onsite Septic Systems ASTM STP 901, M. S. Bedinger, A.I. Johnson, and J.S. Fleming, Eds., American Society for Testing and Materials, Philadelphia.

DEQ, 1998, Draft *Umatilla River Basin Data Review*, Oregon Department of Environmental Quality.

Follett, R.F., Keeney, D.R., and Cruse, R.M. 1991, *Managing Nitrogen for Groundwater Quality and Farm Profitability.*

National Academy of Sciences, National Academy of Engineering, 1974.

Shaw, B., 1992, *A Comparative Study of Nitrate Loading to Groundwater from Mound, In-Ground Pressure and At-Grade Septic Systems*, University of Wisconsin Water Resources Institute, Project Number DNR-82.

Thomann, R.V., and Mueller, J.A., 1987, *Principles of Surface Water Quality Modeling and Control*.

Townshend, A.R., 1997, *Nitrogen Removal in Septic Tank Effluent Using Separate Nitrification - Denitrification Biotextile Filters*, Site Characterization and Design of Onsite Septic Systems ASTM STP 1324, M. S. Bedinger, A.I. Johnson, and J.S. Fleming, Eds., American Society for Testing and Materials, Philadelphia.

US EPA, 1986, *Environmental Protection Agency, Quality Criteria for Water* (Gold Book).

US EPA Rates, *Constants and Kinetics*, 1985.

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# 2.1.5 AMMONIA TMDL

## 2.1.5.1 TARGET IDENTIFICATION

### 2.1.5.1.1 Ammonia Related to Aquatic Life

The Lower Umatilla River and North Hermiston Drain are included on the 1998 §303(d) list due to exceedance of the state water quality standard for chronic ammonia toxicity during the summer months.

Concentrations of ammonia acutely toxic to fishes may cause loss of equilibrium, hyperexcitability, increased breathing, cardiac output and oxygen uptake, and, in extreme cases, convulsions, coma, and death. At lower concentrations ammonia has many effects on fishes, including a reduction in hatching success, reduction in growth rate and morphological development, and pathologic changes in tissues of gills, livers, and kidneys (EPA, 1985).

### 2.1.5.1.2 Sensitive Beneficial Uses

The most sensitive beneficial uses affected by ammonia toxicity are resident fish and aquatic life.

### 2.1.5.1.3 Water Quality Standard Identification

The water quality standard pertaining to ammonia is numeric:

> OAR 340-41-645(2)(p)(B): Levels of toxic substances shall not exceed the criteria listed *in Table 20* (of the regulation) which were based on criteria established by EPA and published in Quality Criteria for Water (1986), unless otherwise noted.

Ammonia toxicity criteria are pH and temperature dependent. For the purpose of this TMDL, the Department employs chronic ammonia toxicity thresholds that vary with pH and are based on a temperature of 25 ºC (77 ºF) (**Table 44**).

## 2.1.5.2 Deviation from Water Quality Standard

**Table 43** summarizes the stream segments on the 1998 §303(d) list for ammonia and **Figure 72** is a map of these segments. Oregon's §303(d) list and its supporting data references can be publicly accessed through the Oregon Department of Environmental Quality web page at the following URL: http://www.deq.state.or.us. The language of the relevant standards is provided in **Appendix A-7**.

| **Table 43.** Segments on the 1998 §303(d) List for Ammonia | |
|---|---|
| *Waterbody Name* | *Boundaries* |
| Hermiston Drain, North | Mouth to headwaters |
| Umatilla River | Mouth to RM 5 |

**Recall Figure 72.** Segments on the 1998 §303(d) List for Toxics
(the ammonia listings are in the lower Umatilla Basin)

The data reviewed for the North Hermiston Drain 1998 303(d) listing was collected in 1996 at rivermile 0.5. Two of three samples exceeded the chronic ammonia toxicity criteria. The data that resulted in the Lower Umatilla River listing was collected in 1996 at rivermile 5.0, just downstream of North Hermiston Drain. Three of eight samples exceeded chronic ammonia toxicity criteria. Additional monitoring was conducted in 1999 and is discussed in **Section 2.1.5.6**.

## 2.1.5.3 SOURCE ASSESSMENT

The City of Hermiston municipal wastewater treatment plant (WWTP) intermittently discharges treated wastewater to a side-channel of the Umatilla River during the summer low flow months. The North Hermiston Drain flows into this side-channel 100-feet upstream from the WWTP outfall. Available instream data indicate that the Hermiston wastewater treatment plant is the source of the ammonia toxicity criteria violations, because ammonia concentrations in the Umatilla River downstream of the outfall are high only when the effluent from the plant is discharging. The ammonia concentrations in the Lower Umatilla River are relatively low when the WWTP is not discharging. Data collected in 1999 have shown no indication of elevated ammonia concentrations except just downstream of the outfall.

**Figure 77** shows the results of a Wilcoxon Mann-Whitney t-Test calculated using data collected during the summer low flow season from 1996 to 1999 at Umatilla River sites above and below the Hermiston WWTP. The WWTP was not discharging when the data were collected.

The Wilcoxon Mann-Whitney Test is a non-parametric test for comparing two populations. It is used to test the null hypothesis that two populations have identical distribution functions against the alternative hypothesis that the two distribution functions differ only with respect to location (median), if at all. The Wilcoxon Mann-Whitney test is a distribution-free test which does not require the assumption that the data fit a normal distribution.

The t-Test on available data indicates that there is not a statistically significant difference between the median ammonia concentrations at the monitoring sites above and below the Hermiston WWTP when no effluent is being discharged. The difference in the median ammonia concentrations between the two sites is minimal (0.02 mg/L).

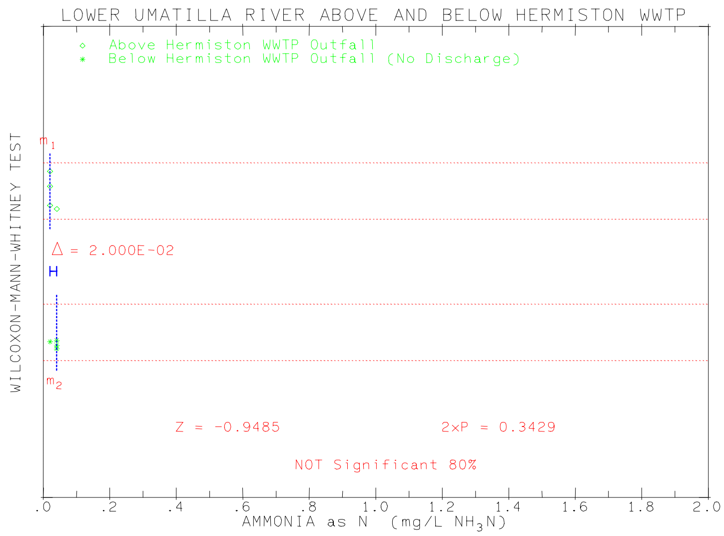


**Figure 77.** Lower Umatilla River Ammonia without Hermiston WWTP Discharge

**Figure 78** shows the impact of the Hermiston WWTP effluent ammonia on the Umatilla River during periods of effluent discharge. The available data collected at Umatilla River sites above and below the Hermiston WWTP outfall during the summer low flow months and when treated effluent was being discharged were used to calculate the Wilcoxon Mann-Whitney t-Test. The test results indicate that there is a statistically significant difference (99% confidence level) in the median instream ammonia concentration during periods of discharge. The median ammonia concentration in the river downstream of the discharge is 1.29 mg/L higher than the upstream median concentration.

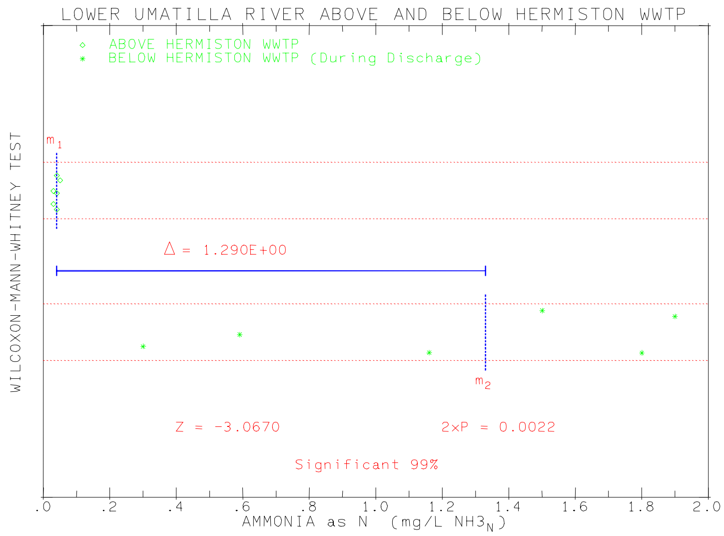


**Figure 78.** Lower Umatilla River Ammonia with WWTP Discharge

## 2.1.5.4 POLLUTANT

Ammonia is present in two states in natural waters: ammonium ion ($NH_4^+$) and un-ionized ammonia ($NH_3$). Un-ionized ammonia is much more toxic to aquatic life than the ionic state. Since the fraction of ammonia that is un-ionized increases as pH increases, systems with relatively high pH, such as the Lower Umatilla River, are highly susceptible to ammonia toxicity. **Table 44** illustrates the pH dependency of ammonia toxicity.

**Table 44.** Total Ammonia Toxicity Criteria When Salmonids are Present

| Total Ammonia | pH Range (standard units) | | | | |
|---|---|---|---|---|---|
| | 6.5-7.0 | 7.0-7.5 | 7.5-8.0 | 8.0-8.5 | 8.5-9.0 |
| Chronic Criteria (mg/L-N at 25° C) | 0.85 | 0.85 | 0.54 | 0.19 | 0.08 |
| Acute Criteria (mg/L-N at 25° C) | 13.48 | 8.38 | 3.95 | 1.41 | 0.59 |

As indicated in **Table 44**, the chronic criteria is much less than the acute criteria. Therefore, the chronic ammonia criteria are limiting and will be used as the target concentration for the TMDL.

## 2.1.5.5 LOADING CAPACITY

For purposes of determining this TMDL to meet the instream chronic ammonia criteria, the loading capacity (**Table 45**) will be based upon a given flow and pH range. In calculating the loading capacity for each range, the Department used the ammonia chronic toxicity criteria at 25 ºC (77 ºF) at the upper end of the stated pH range and the flow rate at the lower end of the flow range. The following equation is used:

Loading Capacity = river flow rate (cfs) x chronic ammonia toxicity criteria (mg/l) x conversion factor

**Table 45.** Ammonia Loading Capacity (total ammonia as Nitrogen, pounds per day)

| | pH Range (standard units) | | | | |
|---|---|---|---|---|---|
| | 6.5-7.0 | 7.0-7.5 | 7.5-8.0 | 8.0-8.5 | 8.5-9.0 |
| Total Ammonia Chronic Criteria (mg/l, as N @25° C) | 0.85 | 0.85 | 0.54 | 0.19 | 0.08 |
| In-stream Flow (cfs) | Loading Capacity (total ammonia-N, pounds per day) | | | | |
| 10 to 19.9 | 46 | 46 | 29 | 10 | 4 |
| 20 to 39.9 | 92 | 91 | 58 | 20 | 9 |
| 40 to 59.9 | 184 | 183 | 117 | 41 | 18 |
| 60 to 100 | 276 | 274 | 175 | 61 | 27 |
| 100 to 200 | 461 | 456 | 292 | 102 | 44 |
| 200 to 300 | 922 | 913 | 585 | 204 | 89 |

As mentioned previously, ammonia toxicity criteria are dependent on instream temperature and pH. This LC assumes an instream temperature of 25 degrees Celsius, which represents "worst case" conditions based on historical data. Also, in determining the LC it is assumed salmonids are present or have the potential to be present.

## 2.1.5.6 LOAD ALLOCATIONS/WASTELOAD ALLOCATIONS

A *Load Allocation* (LA) is the amount of pollutant that **natural plus non-point** sources can contribute to a stream without exceeding state water quality standards.

Load allocations are not established for this TMDL. Available data indicate that the North Hermiston Drain and Lower Umatilla River ammonia toxicity standards exceedances result from the City of Hermiston WWTP intermittent summer discharge.

**Table 46** lists the data collected in the Umatilla River upstream of North Hermiston Drain. None of the data exceeds the target concentrations described in Section 2.1.5.4.

**Table 46.** Umatilla River ammonia - 100 feet Upstream of North Hermiston Drain [this is approximately 200 feet upstream of the WWTP outfall]

| Date | Time | NH3-N (mg/L) |
|---|---|---|
| 05/26/1999 | 13:09p | 0.05 |
| 06/28/1999 | 13:40p | 0.07 |
| 07/23/1999 | 11:15a | 0.08 |
| 08/20/1999 | 10:28a | 0.08 |
| 09/21/1999 | 11:52a | 0.04 |
| 10/27/1999 | 11:15a | 0.05 |
| 11/18/1999 | 10:25a | 0.03 |
| 12/17/1999 | 10:40a | 0.05 |

The maximum observed ammonia concentration = 0.08 mg/L. Therefore, the load allocation for background and nonpoint sources could be calculated as follows:

**LA = 0.08 mg/L * streamflow (cfs) * 5.39**

where 5.39 is a conversion factor.

No particular land uses or non-point sources have been identified as being responsible for the LA because no load reduction is necessary to achieve the instream target concentration. If future data indicate that non-point sources are a concern, additional analysis can be performed to more specifically allocate loads to those sources.

A *Waste Load Allocation* (WLA) is the amount of pollutant that a **point source** can contribute to the stream without exceeding water quality standards.

The City of Hermiston WWTP effluent ammonia concentration necessary to meet the instream loading capacity is a function of dilution available in the receiving stream. Oregon Administrative Rules 340-41-645(4)(a) states: "*The Department of Environmental Quality may allow a designated portion of a receiving water to serve as a zone of dilution for wastewaters and receiving waters to mix thoroughly and this zone will be defined as a mixing zone*." The water outside of the mixing zone boundary must meet all water quality standards under all flow conditions. The effluent loading (wasteload allocations) calculated in **Tables 47** through **51** are computed to meet this requirement. **The wasteload allocation for ammonia as nitrogen for the City of Hermiston WWTP is tabulated in Tables 47 through 51.** The wasteload allocations are expressed as pounds per day of total ammonia as nitrogen. In generating the tables, the Department used the following equation:

$$\textbf{Pounds/day ammonia (as N)} = 8.34 \times [0.9C_T \times (Q_E + Q_R/4) - (Q_R/4 \times C_R)]$$

where
$C_T$ = the chronic ammonia criteria (total ammonia mg/l-N) at the upper end of the pH range
$C_R$ = Umatilla River background concentrations (total ammonia mg/l-N)
$Q_R$ = Umatilla River flow (million gallons per day)
$Q_E$ = WWTP discharge (million gallons per day)
8.34 is a conversion factor
0.9 provides a ten-percent margin of safety to account for uncertainty

The calculation for determining the wasteload allocation includes the upstream background concentration of 0.08 mg/L (**Table 46**), and a ten- percent margin of safety (**Section 2.1.5.8**). The Department used the low ranges for flow and the chronic toxicity for the high end of the pH range. For the purpose of generating the wasteload allocation, it is assumed that no more than 1/4 of the Umatilla River flow will be allowed for mixing. Permit writers should consider the actual dilution at the edge of the mixing zone when establishing permit limits.

**Table 47.** Waste Load Allocation Table for the City of Hermiston WWTP When River pH is Between 6.5 and 7.0.

| River Flow (cfs) | WWTP (million gallons per day) | | | |
|---|---|---|---|---|
| | 2.0 to 2.99 | 3.0 to 3.99 | 4.0 to 4.99 | 5.0 to 5.99 |
| | Wasteload Allocations (lb/day, total ammonia-N) | | | |
| 10 to 19.9 | 22.1 | 28.5 | 35.0 | 41.4 |
| 20 to 39.9 | 31.4 | 37.8 | 44.2 | 50.7 |
| 40 to 59.9 | 50.0 | 56.4 | 62.8 | 69.2 |
| 60 to 100 | 68.5 | 75.0 | 81.4 | 87.8 |
| 100 to 200 | 105.7 | 112.1 | 118.5 | 124.9 |
| 200 to 300 | 198.5 | 205.0 | 211.4 | 217.8 |

**Table 48.** Waste Load Allocation Table for the City of Hermiston WWTP When River pH is Between 7.0 and 7.5.

| River Flow (cfs) | WWTP (million gallons per day) | | | |
|---|---|---|---|---|
| | 2.0 to 2.99 | 3.0 to 3.99 | 4.0 to 4.99 | 5.0 to 5.99 |
| | Wasteload Allocations (lb/day, total ammonia-N) | | | |
| 10 to 19.9 | 22.3 | 28.8 | 35.3 | 41.8 |
| 20 to 39.9 | 31.7 | 38.2 | 44.7 | 51.2 |
| 40 to 59.9 | 50.5 | 57.0 | 63.5 | 69.9 |
| 60 to 100 | 69.3 | 75.7 | 82.2 | 88.7 |
| 100 to 200 | 106.8 | 113.3 | 119.8 | 126.2 |
| 200 to 300 | 200.7 | 207.1 | 213.6 | 220.1 |

**Table 49.** Waste Load Allocation Table for the City of Hermiston WWTP When River pH is Between 7.5 and 8.0.

| River Flow (cfs) | WWTP (million gallons per day) | | | |
|---|---|---|---|---|
| | 2.0 to 2.99 | 3.0 to 3.99 | 4.0 to 4.99 | 5.0 to 5.99 |
| | Wasteload Allocations (lb/day, total ammonia-N) | | | |
| 10 to 19.9 | 13.6 | 17.7 | 21.8 | 25.9 |
| 20 to 39.9 | 19.1 | 23.2 | 27.3 | 31.4 |
| 40 to 59.9 | 30.1 | 34.2 | 38.3 | 42.4 |
| 60 to 100 | 41.1 | 45.2 | 49.3 | 53.4 |
| 100 to 200 | 63.1 | 67.2 | 71.3 | 75.4 |
| 200 to 300 | 118.1 | 122.2 | 126.3 | 130.3 |

**Table 50.** Waste Load Allocation Table for the City of Hermiston WWTP When River pH is Between 8.0 and 8.5.

| River Flow (cfs) | WWTP (million gallons per day) | | | |
|---|---|---|---|---|
| | 2.0 to 2.99 | 3.0 to 3.99 | 4.0 to 4.99 | 5.0 to 5.99 |
| | Wasteload Allocations (lb/day, total ammonia-N) | | | |
| 10 to 19.9 | 6.2 | 7.6 | 9.0 | 10.5 |
| 20 to 39.9 | 9.6 | 11.0 | 12.4 | 13.8 |
| 40 to 59.9 | 16.3 | 17.7 | 19.2 | 20.6 |
| 60 to 100 | 23.1 | 24.5 | 25.9 | 27.3 |
| 100 to 200 | 36.5 | 38.0 | 39.4 | 40.8 |
| 200 to 300 | 70.2 | 71.6 | 73.1 | 74.5 |

**Table 51.** Waste Load Allocation Table for the City of Hermiston WWTP When River pH is Between 8.5 and 9.0.

| River Flow (cfs) | WWTP (million gallons per day) | | | |
|---|---|---|---|---|
| | 2.0 to 2.99 | 3.0 to 3.99 | 4.0 to 4.99 | 5.0 to 5.99 |
| | Wasteload Allocations (lb/day, total ammonia-N) | | | |
| 10 to 19.9 | 3.3 | 3.9 | 4.5 | 5.2 |
| 20 to 39.9 | 5.4 | 6.0 | 6.6 | 7.2 |
| 40 to 59.9 | 9.5 | 10.1 | 10.8 | 11.4 |
| 60 to 100 | 13.7 | 14.3 | 14.9 | 15.5 |
| 100 to 200 | 22.0 | 22.6 | 23.2 | 23.8 |
| 200 to 300 | 42.7 | 43.3 | 43.9 | 44.6 |

## 2.1.5.7 SEASONAL VARIATION

The ammonia toxicity §303(d) listings addressed in this TMDL are for the summer months. Umatilla Basin standards for minimum design criteria for treatment and control of wastes in Oregon Administrative Rules (OAR 340-41-655(1)(a) defines the low streamflow (summer) months as approximately May through October. May through October is the period covered by this TMDL.

Additional information pertaining to seasonality and available upstream flow and ammonia data, is available in the Umatilla River Basin Data Review (1998).

## 2.1.5.8 MARGIN OF SAFETY

The MOS is addressed through the conservative derivation of the loading capacity. The MOS is implicit because conservative (worst case) toxicity criteria, instream pH, flow and temperature were used to calculate the loading capacity. The toxicity criteria, flow and pH values used are at the conservative end of their range. The instream temperature of 25 degrees Celsius (77 degrees F) is rarely exceeded in the lower river. Also, using the current high temperature is conservative because the river will achieve lower temperatures as the temperature TMDL allocations are implemented.

## 2.1.5.9 SECTION REFERENCES

EPA Ambient Water Quality Criteria for Ammonia – 1984 (January, 1985)

Umatilla River Basin Data Review, DEQ draft (March 1998)

# 2.1.6 BACTERIA TMDL

## 2.1.6.1 TARGET IDENTIFICATION

### 2.1.6.1.1 BACTERIA RELATED TO WATER CONTACT RECREATION

Bacteria concentrations exceeding the Oregon water quality standard have been measured in McKay Creek and the Lower Umatilla River. These waterbodies were evaluated based on fecal coliform data and were compared to the criteria which was used prior to March 1996. High levels of bacteria limit the use of the waterbodies for swimming (water contact recreation). **Table 52** lists the stream segments on the 303(d) list for elevated bacteria levels.

### 2.1.6.1.2 WATER QUALITY STANDARD IDENTIFICATION

The following summarizes the bacteria criteria for the Umatilla Basin. The criteria for "recreational contact in water" applies to McKay Creek and Lower Umatilla River 303(d) listings. The beneficial uses affected by elevated bacteria levels are primary contact recreation (swimming).

Recreational Contact in Water

OAR 340-41-645 (2)(e)(A)(i):

> Prior to March 1996: a geometric mean of five fecal coliform samples should not exceed 200 colonies per 100 mls, and no more than 10% should exceed 400 colonies per 100 mls.
>
> Effective March 1996 through present: a 30-day log mean of 126 *E. Coli* organisms per 100 ml, based on a minimum of five samples; and no single sample shall exceed 406 *E. Coli* organisms per 100 ml.

**Additional conditions in the State water quality standards pertinent to this TMDL are as follows:**

> OAR 340-41-645 (2)(e)(B) Raw Sewage Prohibition: No sewage shall be discharged into or in any other manner be allowed to enter the waters of the State unless such sewage has been treated in a manner approved by the Department or otherwise allowed by these rules.
>
> OAR 340-41-645 (2)(e)(C) Animal Waste: Runoff contaminated with domesticated animal wastes shall be minimized to the maximum extent practicable before it is allowed to enter waters of the State.
>
> OAR 340-41-645 (2)(f): Bacterial pollution or other conditions deleterious to waters used for domestic purposes, livestock watering, irrigation, bathing, or shellfish propagation, or otherwise injurious to public health shall not be allowed.

## 2.1.6.2 DEVIATION FROM WATER QUALITY STANDARD

The bacteria data resulting in the 1998 303(d) listing for McKay Creek Mouth to McKay Reservoir (summer) include values exceeding the fecal coliform standard (400 colonies/100ml) collected at two sites below McKay Reservoir between water years 1986 to 1995. Fourteen percent of the 21 samples collected exceeded the water quality standard.

The fall/winter/spring listing for McKay Creek Mouth to McKay Reservoir resulted from 12 percent of the 16 fecal coliform samples collected between water year 1986 to 1995 exceeding the water quality standard.

The Lower Umatilla River (summer - Mouth to Speare Canyon) is listed due to 12 percent of the 25 fecal coliform samples collected between water year 1986 to 1995 exceeding the water quality standard. The watersheds draining to the Lower Umatilla River for which the TMDL applies are Stage Gulch, Canyons and Gulches, and Lower Umatilla.

**Table 52** summarizes the stream segments on the 1998 §303(d) list for bacteria and **Figure 79** is a map of these segments. Oregon's §303(d) list and its supporting data references can be publicly accessed through the Oregon Department of Environmental Quality web page at the following URL: http://www.deq.state.or.us. The language of the relevant standards is provided in **Appendix A-7**.

**Table 52.** Segments on the 1998 §303(d) List for Bacteria

| *Waterbody Name* | *Boundaries* |
|---|---|
| McKay Creek – Summer | Mouth to McKay Reservoir |
| McKay Creek – Fall/Winter/Spring | Mouth to McKay Reservoir |
| Umatilla River – Summer | Mouth to Speare Canyon |

**Figure 79.** Segments on the 1998 §303(d) List for Bacteria

Effective March, 1996, the State of Oregon revised its bacteria standards to be based on *Escherichia coli* (*E. coli*), rather than on fecal coliform. The applicable standard for bacteria (i.e., *E. coli*) in the Umatilla River sub-basin is now as follows:

"Numeric Criteria: Organisms of the coliform group commonly associated with fecal sources (MPN or equivalent membrane filtration using a representative number of samples) shall not exceed the criteria described in subparagraphs (i) and (ii) of this paragraph. Freshwaters:

*A 30-day log mean of 126 E. coli organisms per 100 ml, based on a minimum of five samples;*

*No single sample shall exceed 406 E. coli organisms per 100 ml (OAR 340-41-645(2)(e)(A)).*

*E. Coli* data that was collected in the Umatilla Basin during the months of April through October was reviewed to determine if there were exceedances of the water quality standard. Data collected from the Butter Creek, Wildhorse Creek, Tutuilla Creek, and Birch Creek watersheds had exceedances of the standard. The following table lists the number of data and exceedances:

**Table 53.** *E. Coli* Standards Exceedances

| Watershed | Number of Samples (1993 to 1997) | Number of Exceedances (406 E. Coli / 100 ml) |
|---|---|---|
| Butter Creek | 14 | 5 |
| Birch Creek | 6 | 2 |
| Wildhorse Creek | 14 | 3 |
| Tutuilla Creek | 7 | 2 |

TMDLs are determined for these additional watersheds as they would likely be included on the next 303(d) list as being water quality-limited for bacteria.

All bacteria TMDLs determined for the Umatilla Sub-basin will target the relatively new *E. Coli* water quality standard.

## 2.1.6.3 SOURCE ASSESSMENT

### 2.1.6.3.1 Non-point Sources

Several general land uses occur in the watersheds for which the TMDLs are determined. The land uses, displayed in the following figures, include urban, agriculture (farming and cropland), range, forest, barren, and water/wetlands.

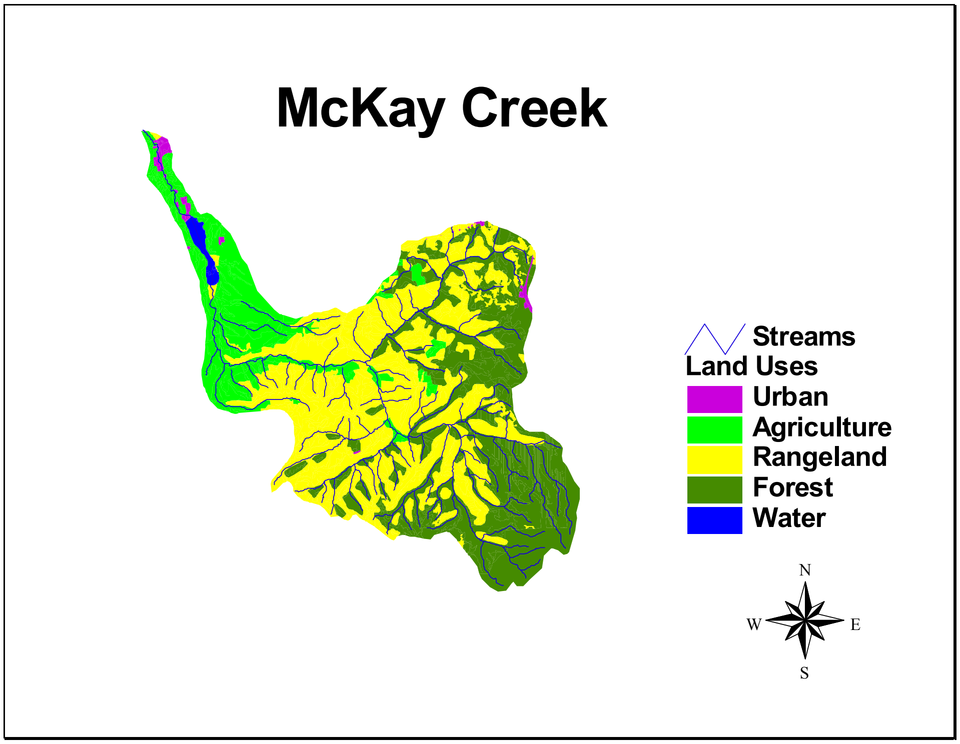


**Figure 80.** McKay Creek Watershed Land Uses

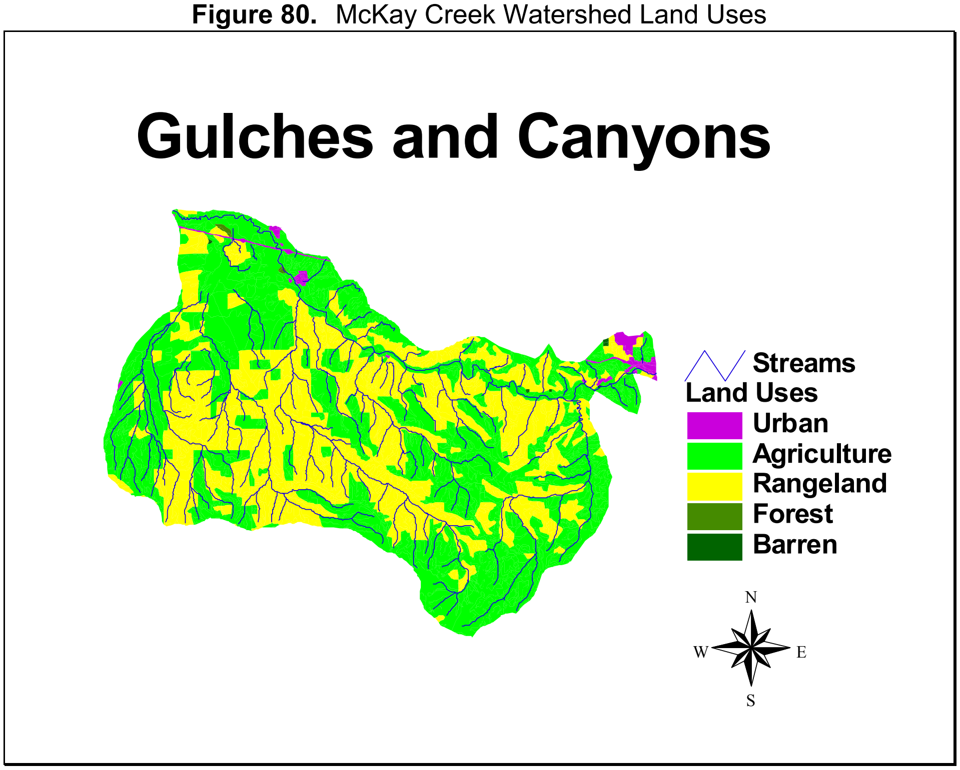


**Figure 81.** Gulches and Canyons Watershed Land Uses

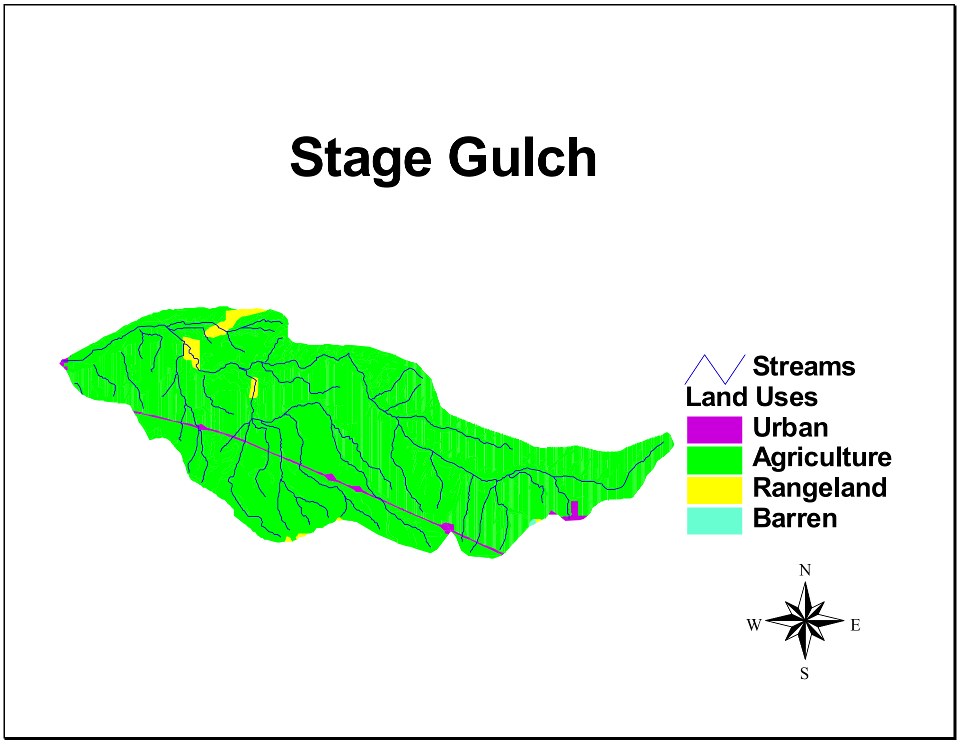


**Figure 82.** Stage Gulch Watershed Land Uses

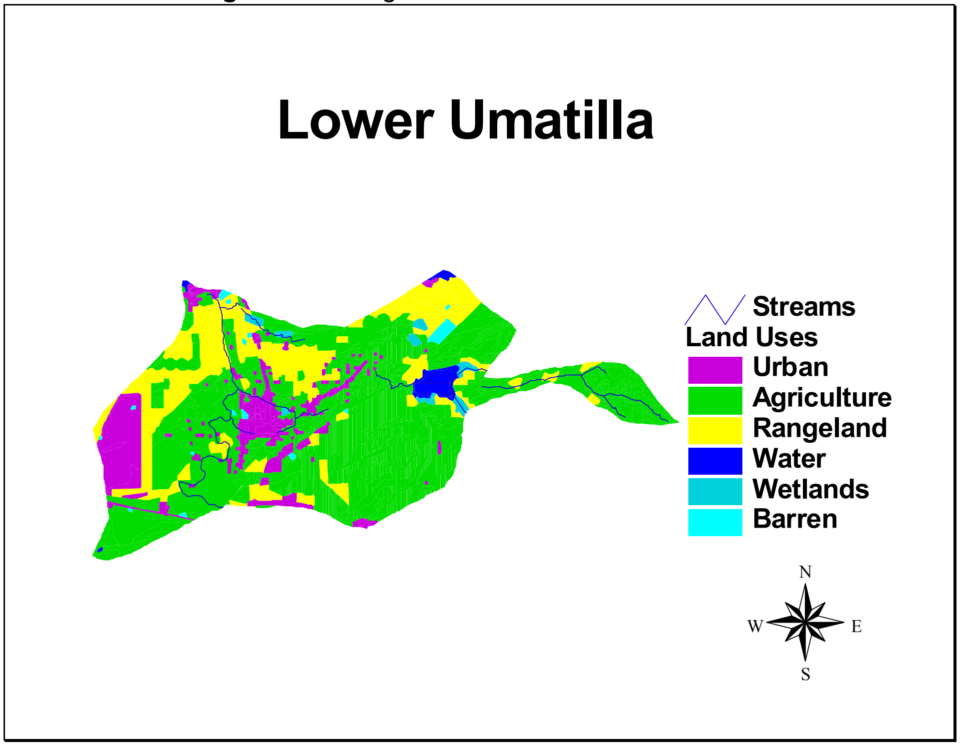


**Figure 83.** Lower Umatilla Watershed Land Uses

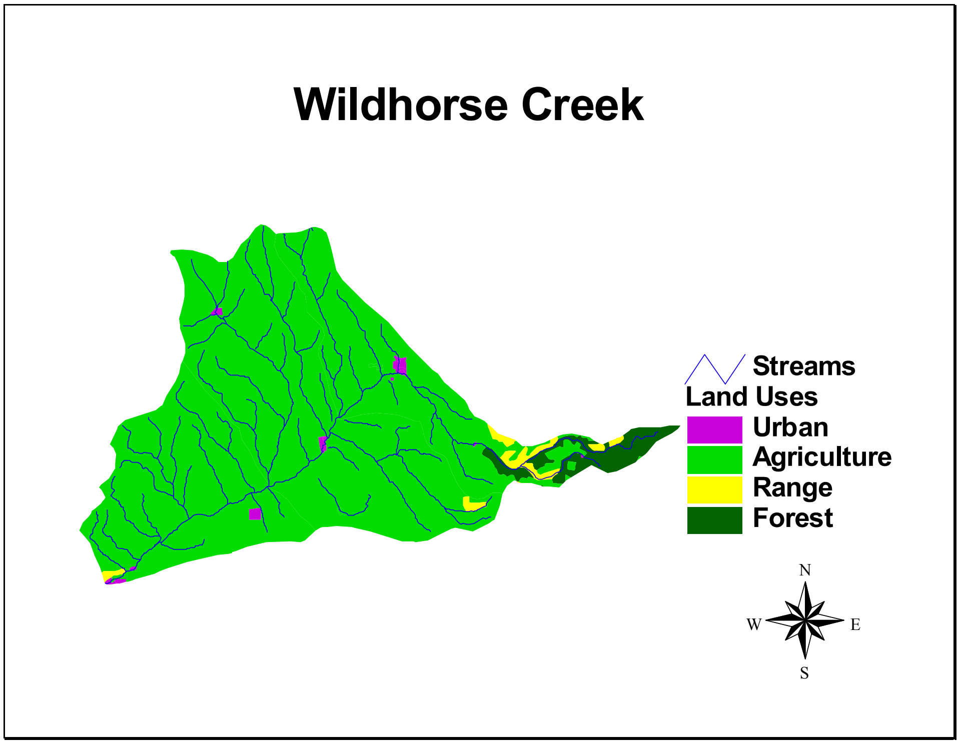


**Figure 84.** Wildhorse Watershed Land Uses

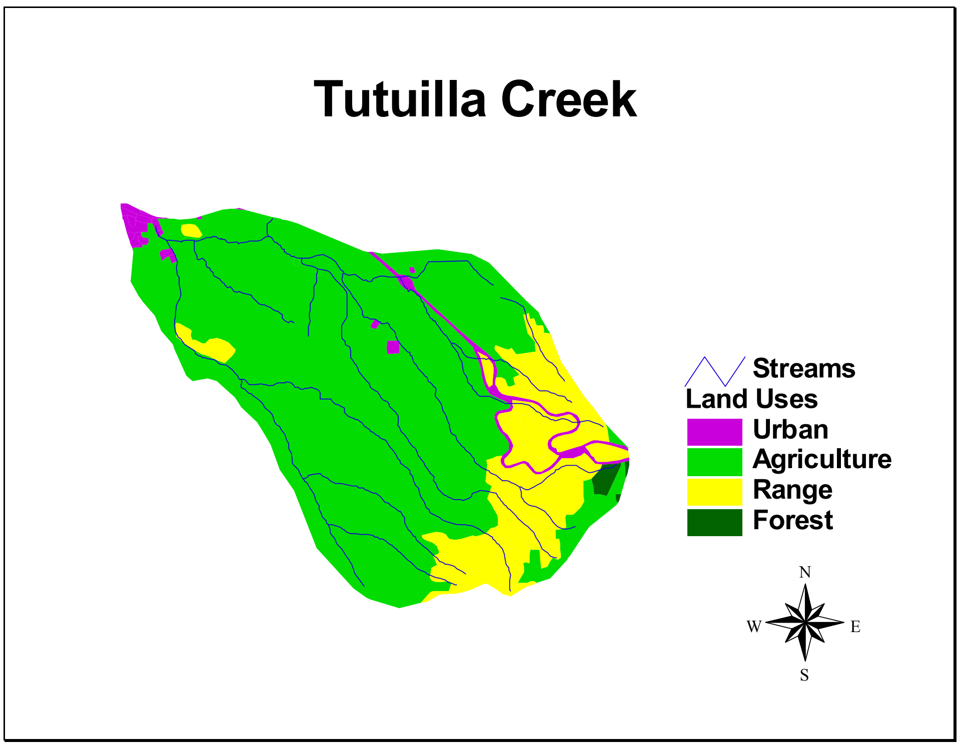


**Figure 85.** Tutuilla Creek Watershed Land Uses

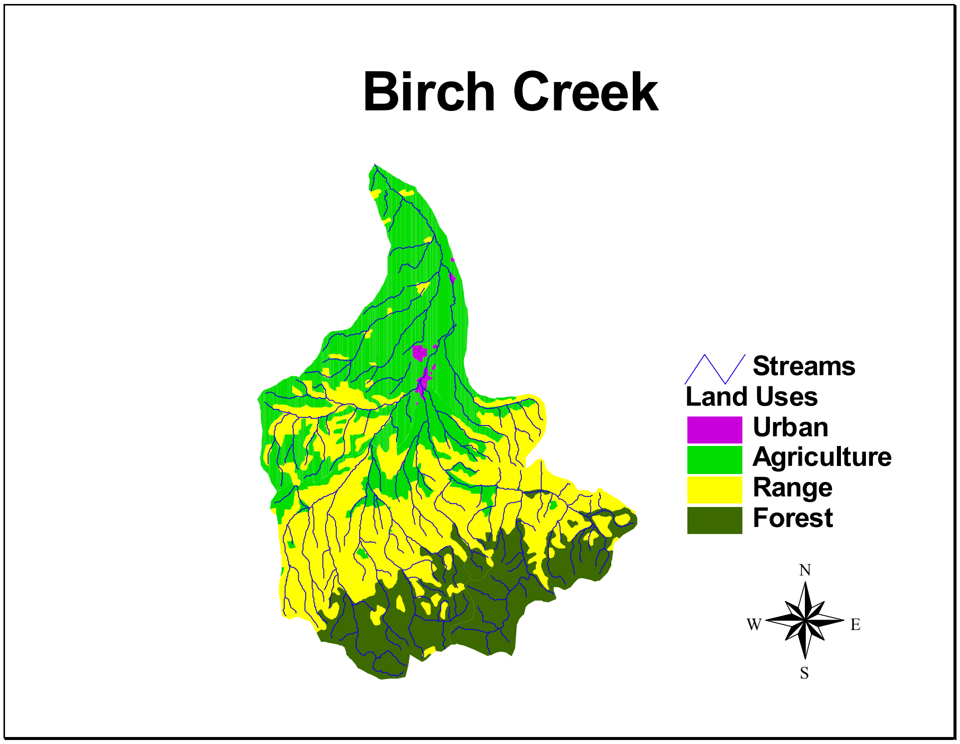


**Figure 86.** Birch Creek Watershed Land Uses

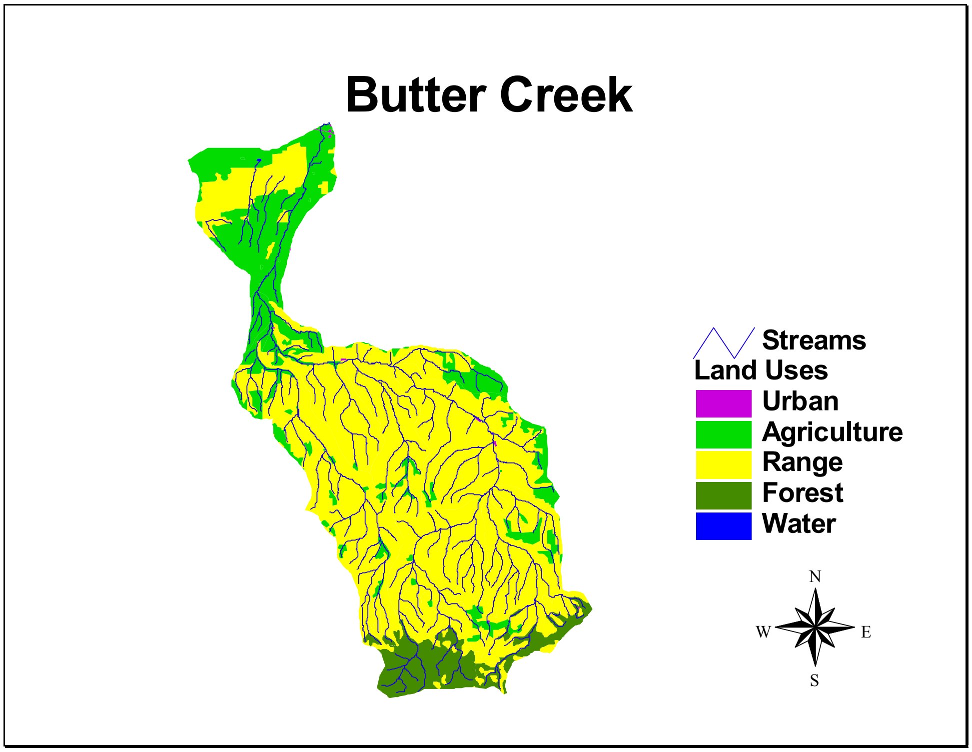


**Figure 87.** Butter Creek Watershed

Potential sources of bacteria load, in addition to general overland runoff, include confined animal feeding operations (CAFOs), urban runoff, and failing septic systems.

The general literature indicates relatively minimal bacteria contributions from forested and range lands. Much larger values are reported for urban and agricultural areas. This is reinforced by Umatilla Basin water quality sampling over the last several years (draft Umatilla Basin Data Review, 1998) – forested watersheds such as in the upper Umatilla Basin have low concentrations of bacteria, whereas the lower watersheds, e.g., Wildhorse, McKay, Butter, exhibit relatively high concentrations.

Assumed relative differences from land use sectors are characterized by literature values for Event Mean Concentrations (EMCs) (values were compiled from many studies done by the USGS and other organizations). For example, the agriculture bacteria EMC is 1.3 times that of the residential/urban EMC.

## 2.1.6.3.2 Point Sources

The City of Pendleton wastewater treatment plant discharges to lower McKay Creek. The Hermiston (year-round discharge) and Stanfield (winter discharge) wastewater treatment plants discharge to the lower Umatilla River. The effluent bacteria limits in the Pendleton and Hermiston wastewater treatment plant NPDES permits will be adjusted to meet the instream *E. Coli* standard. The limits in the City of Stanfield's NPDES permit are already more stringent than the instream bacteria standard because the effluent bacteria limits are based on the level II wastewater reclaimed water criteria.

## 2.1.6.4 POLLUTANT

As mentioned previously, the State of Oregon recently revised its bacteria standards to be based on *Escherichia coli* (***E. coli***), rather than on fecal coliform. McKay and Lower Umatilla Watersheds were listed based on the old fecal coliform standard. The load and wasteload allocations in this TMDL are designed to achieve the *E. Coli* standard.

The following is from the Oregon Health Division, April 1994,
Technical Bulletin on Health Effects – Coliform Bacteria:

> The bacteriam *E. coli* is a member of the fecal coliform group and grows only in the digestive tract of warm-blooded animals and humans. It is present in the fecal material of all healthy warm-blooded animals and humans and it is rarely harmful. Its presence in drinking water, however, definitely shows that sewage or other fecal contamination has occurred and the organisms in that waste are still living in the water. It is very likely that water that contains *E. Coli* could contain disease-causing organisms. Such water should never be consumed without adequate disinfection or boiling. …Pathogenic *E. Coli* (*E. Coli* 0157:H7) is a very specialized and rare strain of *E. Coli* that causes illness and its presence in drinking water would be an extreme health concern.

## 2.1.6.5 LOADING CAPACITY

Loading capacity is a term referred to in the Clean Water Act that establishes an accepted rate of pollutant introduction to a waterbody that is directly related to water quality standard compliance. For purposes of determining this bacteria TMDL, loading capacity for the watersheds addressed by this TMDL is 406 *E. Coli* organisms per 100 milliliters, the single sample water quality standard. This single sample standard is used because the load allocations are calculated using a daily storm event.

### 2.1.6.6 ALLOCATION DEVELOPMENT

This section describes the calculation and approach utilized in developing point and non-point source allocations.

## 2.1.6.6.1 Model Description

A GIS-based model was used to evaluate bacteria loading to the watersheds. The model estimates upland runoff volume using the SCS method and applies EMCs to estimate relative bacteria loading from the various land uses within the individual watersheds. Watershed composite maximum bacteria loads are then calculated to meet the state water quality standard concentration.

Soils (SSURGO) (slope and hydrologic soil group), land use (USGS) and watersheds were the geographic databases used for this modeling exercise. The databases were overlayed in ArcView to create a composite GIS database which was used for estimating flow volume and bacteria die-off rate as function of travel time, and bacteria load. These parameters were modeled for the McKay watershed to address the McKay Creek bacteria summer and winter 303(d) listings, and for the Canyons and Gulches, Stage Gulch, and Lower Umatilla watersheds which to address the Lower Umatilla summer 303(d) listing.

## 2.1.6.6.2 Bacteria Die Off

The bacterial die off rate during overland flow was estimated based on the travel time of the water. The travel time of water (hydrologic time of concentration) was estimated using a kinematic wave equation (Chow et al, 1988):

Travel Time (minutes) = $T = (6.93L^{0.6}n^{0.6})/(i^{0.4}\ S^{0.3})$
Where:
L = Slope length (meters)
n = Manning's n
i = Rainfall Intensity (mm/hr)
S = Slope (m/m)

The generalized slopes were derived from the SSURGO soils data. The Manning's n values were based on land uses (Chow et al, 1988). The slope length was entered as a constant (2000 meters).

Decay is based on the first order decay equation. Coliform bacteria are often modeled as part of water quality studies; first-order decay has been a very good assumption in many studies, with coefficients ranging from 0.0004 to 1.1/hour (Huber, 1993). Reported *E. Coli* decay rates range from 0.08 to 2.0 /day (Thomann and Mueller, 1987).

The model assumes a decay rate of 1.0 /day. The decay rate is expressed as the percentage of bacteria that die in the runoff during its time of travel. For example, using the assumed decay rate of 1.0/day, approximately 33 percent of the bacteria die in runoff with a 4 hour travel time.

First order decay (Boyce and DiPrima, 1977):

$$\frac{N_t}{N_o} = 10^{-kt}$$

Where: $N_t$ = number of bacteria at time t

$N_o$ = number of bacteria at time o

t = time in days

k = first order decay rate constant

The first order decay rates was input as 1.0 in the model and typically range between 0.01 and 2.0 (Moore, 1982).

## 2.1.6.6.3 Hydrology Model: Flow Volume – SCS Method

The runoff volume was estimated using the Soil Conservation Service (SCS) runoff depth estimation (SCS Technical Release 55, June, 1986):

$$Q = (P-0.2S)^2/(P+0.8S)$$

Where
Q = runoff depth in inches
P = rainfall in inches
S = storage parameters = 1000/CN - 10
CN = curve number which is a function of land use (see McCuen, 1998 for Curve Numbers)

The model is spatially-based. Calculations were performed for each polygon within each watershed.

## 2.1.6.6.4 Impacts of Various Land Uses

Event Mean Concentrations (EMCs) are flow weighted average bacteria concentrations during a storm event. The EMCs were also used to study loading to the Corpus Christi Bay System in South Texas (Quenzer, 1998). The EMCs are based on studies done by USGS and many other organizations. EMC estimates were used to assess the relative contributions from the different land uses.

## 2.1.6.6.5 Design Event Magnitude (Seasonal Variation)

As with the sediment TMDL, the load allocations for bacteria are based on a storm of specified intensity, referred to as a design storm. The design condition chosen is the precipitation which is calibrated in the model to the $90^{th}$ percentile streamflow measured at the McKay Creek streamflow gaging station above the reservoir (**Figure 88**).

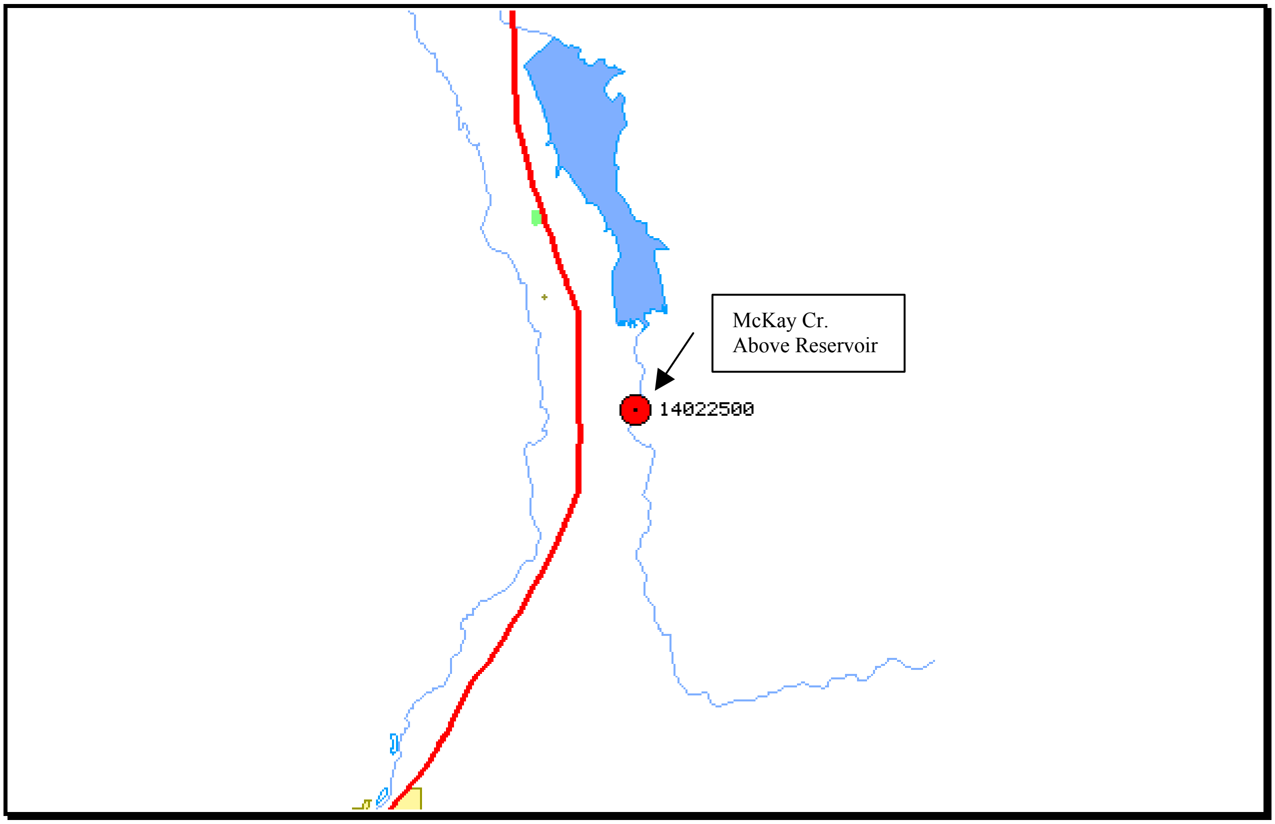


**Figure 88.** McKay Creek USGS Streamflow Gage Station

The 90th percentile daily average flow for the lower flow months (April through October, 1980 to 1989) measured at the McKay Creek gaging station is 225 cubic feet per second. The winter 90th percentile flow (November through March, 1980 to 1989) measured at the same site is 506 cubic feet per second. Precipitation, runoff, and land use coefficients were adjusted in the model to calibrate to the flow values.

## 2.1.6.6.6 Final Composite Load/Concentrations

The bacteria load goal was estimated by the product of upland runoff volume, the target concentration, and the percent living bacteria after die-off. The bacteria loads for all polygons in a watershed where runoff occurred were summed and divided by the flow volume to obtain the bacteria concentration, which does not exceed the instream water quality standard.

## 2.1.6.6.7 Model Calibration - Assumptions

Uncertainty exists in all modeling activities. The hydrology model was calibrated to measured streamflow data collected at McKay Creek at Pilot Rock. The model was calibrated by adjusting the precipitation and SCS curve numbers to fit the McKay Creek streamflow. The same calibration parameters were applied to other watersheds.

Groundwater was not accounted for, which serves as a margin of safety, discussed below in **Section 2.1.6.10**.

## 2.1.6.7 WASTELOAD ALLOCATIONS

A *Waste Load Allocation* (WLA) is the amount of pollutant that a **point source** can contribute to the stream without exceeding water quality standards. The point sources that need WLAs for purposes of the bacteria TMDL are the municipal wastewater treatment facilities operated by the cities of Pendleton, Hermiston and Stanfield. The current NPDES permit limits for Pendleton and Hermiston are based on the old fecal coliform instream standard. During NPDES permit renewal the effluent bacteria limits should be updated to reflect the new *E. Coli* standard:

**Table 54.** WLAs for the City of Pendleton and Hermiston WWTPs

| | |
|---|---|
| *E. Coli* | Shall not exceed 126 organisms/100 ml monthly geometric mean, and no single sample shall exceed 406 organisms/100 mL |

The City of Stanfield bacteria limits are based on the level II wastewater reclaimed water criteria which are more stringent than the instream *E. Coli* standard:

**Table 55.** WLAs for the City of Stanfield WWTP

| | |
|---|---|
| Total coliform | 7-day median <23/100mL with no 2 consecutive samples exceeding 240/100mL. |

If the City of Stanfield determines at a later date that by-passing the effluent storage pond and directly discharging to the river is a preferred alternative to effluent reuse, the City's NPDES could be revised to include *E. Coli* effluent limits which reflect the basin standard. Any revisions to the reuse limits would require modifying the NPDES permit and reclaimed water use plan.

## 2.1.6.8 LOAD ALLOCATIONS

A *Load Allocation* (LA) is the amount of pollutant that **natural plus non-point** sources can contribute to a stream without exceeding state water quality standards. The GIS-based model described in **Section 2.1.6.6** was utilized to determine non-point source LAs.

The calibrated hydrology model predicted runoff from the urban, agriculture, and range land uses. The SCS curve numbers for the hydrologic soil groups within the forest land uses did not result in significant predicted runoff for the summer and winter design precipitation.

Published EMC bacteria concentrations for forest land uses are relatively low (less than the instream water quality standard). The TMDL can be refined if data collected in the future indicate that runoff and bacteria loading from range and forest lands are contributing a significant load.

Target loads for urban, agriculture and range land uses were computed to meet an *E. Coli* concentration within the runoff volume equal to the water quality standard (406 organisms/100mL). The loads are calculated for the total urban, agricultural and range land use area within the watersheds (**Figures 80 through 87,** agriculture and range allocations are combined). The loading was distributed between land uses by assuming that pollutant proportions would not change substantially. For example, published agricultural EMCs are 1.3 times as high as urban EMCs, as cited in this chapter. A 1.3:1 ratio is maintained in the load computation. The load allocations [LAs necessary to meet the instream water quality standard (loading capacity)] are included in the following tables:

**Table 56.** McKay Creek Watershed Load Allocations

| Watershed | Season | Design Precipitation (inches) | Runoff (cfs) (Calibration) | Loading Capacity (counts/100ml) | Load Allocations (E. Coli Organisms) |
|---|---|---|---|---|---|
| McKay | Summer (April through October) | 1.13 | 212 | 406 | Agriculture/ Range 7.4 billion |
| | | | | | Urban 400 million |
| McKay | Winter (November through March) | 1.45 | 519 | 406 | Agriculture/ Range 17.4 billion |
| | | | | | Urban 900 million |

**Table 57.** Lower Umatilla Load Allocations

| Watershed | Season | Design Precipitation (inches) | Runoff (cfs) | Loading Capacity (counts/100ml) | Load Allocations (E. Coli organisms) |
|---|---|---|---|---|---|
| Canyons and Gulches | Summer (April through October) | 1.13 | 762 | 406 | Agriculture/ Range 26.8 billion |
| | | | | | Urban 400 million |
| Stage Gulch | Summer (April through October) | 1.13 | 167 | 406 | Agriculture/ Range 5.7 billion |
| | | | | | Urban 90 million |
| Lower | Summer (April through October) | 1.13 | 134 | 406 | Agriculture/Range 4.2 billion |
| | | | | | Urban 400 million |

**Table 58.** Wildhorse Creek Watershed Load Allocations

| Watershed | Season | Design Precipitation (inches) | Runoff (cfs) | Loading Capacity (counts/100ml) | Load Allocation (E. Coli Organisms) |
|---|---|---|---|---|---|
| Wildhorse | Summer (April through October) | 1.13 | 312 | 406 | Agriculture/ Range 10.8 billion |
| | | | | | Urban 90 million |

**Table 59.** Tutuilla Creek Watershed Load Allocations

| Watershed | Season | Design Precipitation (inches) | Runoff (cfs) | Loading Capacity (counts/100ml) | Load Allocation (E. Coli Organisms) |
|---|---|---|---|---|---|
| Tutuilla | Summer (April through October) | 1.13 | 199 | 406 | Agriculture/ Range 6.8 billion |
| | | | | | Urban 270 million |

**Table 60.** Birch Creek Watershed Load Allocations

| Watershed | Season | Design Precipitation (inches) | Runoff (cfs) | Loading Capacity (counts/100ml) | Load Allocation (E. Coli Organisms) |
|---|---|---|---|---|---|
| Birch | Summer (April through October) | 1.13 | 471 | 406 | Agriculture/ Range 16.5 billion |
| | | | | | Urban 250 million |

**Table 61.** Butter Creek Watershed Load Allocations

| Watershed | Season | Design Precipitation (inches) | Runoff (cfs) | Loading Capacity (counts/100ml) | Load Allocation (E. Coli Organisms) |
|---|---|---|---|---|---|
| Butter | Summer (April through October) | 1.13 | 707 | 406 | Agriculture/ Range 24 billion |
| | | | | | Urban 70 million |

The LAs above were determined based on a "worst case" design storm event where the single sample *E. Coli* standard applies. It is assumed that meeting the worst case condition will result in achieving the "*30-day log mean of 126 E. coli organisms per 100 ml, based on a minimum of five samples"* instream criteria, which applies at all times as an instream target.

## 2.1.6.9 IMPLEMENTATION STRATEGIES

The goal of this TMDL is to meet the instream bacteria water quality standard in the McKay Creek and Lower Umatilla River watersheds. It is suggested that other watersheds that comprise the Umatilla River sub-basin also implement best management practices (BMPs) that minimize non-point sources of bacteria.

Urban BMPs that municipalities can implement to reduce bacterial loading to streams include education programs, reducing impervious surfaces, sewering critical areas and requiring proper septic system placement, creating buffer zones along streams, catch basin cleaning, and street sweeping. Animal wastes, usually from pets, are a source of bacteria in urban runoff. Bacteria levels can be lowered by reducing or eliminating these wastes. Proper disposal of pet wastes from yards, parks, roadways, and other urban areas can help prevent this problem (A Watershed Approach to Urban Runoff: Handbook for Decision Makers, 1996).

Agricultural BMPs that can reduce bacterial loading include reducing animal access to waterbodies, reducing runoff from animal feedlots, prevention of manure from directly or indirectly entering waterbodies, reducing soil erosion, and enhancement of riparian buffer areas.

Ongoing instream monitoring should be conducted to determine the effectiveness of management plan implementation.

## 2.1.6.10 MARGIN OF SAFETY

The margin of safety (MOS) is not explicitly allocated. The MOS is addressed through conservative modeling. The MOS is implicit as only runoff was modeled. The loading estimates are conservative as there is no accounting of dilution by groundwater. For a given source, associated groundwater will generally have lower bacteria concentrations than runoff, due to vadose zone retention during infiltration and the lengthy decay time allowed by slow subsurface transport rates.

## 2.1.6.11 SEASONAL VARIATION

Seasonal variation is addressed through the determination of the bacteria TMDLs for the summer and winter seasons, as appropriate, for the 303(d) listed stream segments.

## 2.1.6.12 SECTION REFERENCES:

Boyce, William E., DiPrima, Richard C., *Elementary Differential Equations and Boundary Value Problems*, 3rd Edition, John Wiley & Sons, 1977.

Chow, V.T., Maidment, D.R., and L.W. Mays, 1988. *Applied Hydrology*, McGraw-Hill, New York.

Huber, W.C 1993, *Contaminant transport in Surface Water*, in Handbook of Hydrology, McGraw Hill, NY,

McCuenm R.H., 1998. *Hydrologic Analysis and Design*, 2nd edition, Prentice Hall, NJ. 814 pp.

Quenzer, A.M. and Maidment, D.R., *A GIS Assessment of the Total Loads and Water Quality in the Corpus Christi Bay System*.

United States Department of Agriculture, Soil Conservation Service, 1988, *Soil Survey of Umatilla County Area, Oregon*.

Terrene Institute, 1996, *A Watershed Approach to Urban Runoff: Handbook for Decision Makers*.

Thomann, R.V., and Mueller, J.A., *Principles of Surface Water Quality Modeling and Control*, Harper and Row, 1987.

United States Department of Agriculture, Soil Conservation Service Technical Release 55, June, 1986, *Urban Hydrology for Small Watersheds*.

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# 2.2 HABITAT AND SUBSTRATE

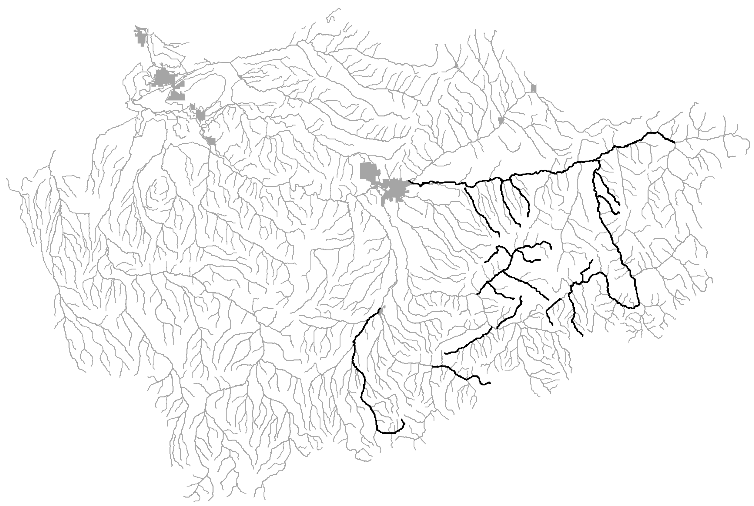
## 2.2.1 MANAGEMENT GOALS

Both habitat modification and sedimentation are 303 (d) listed on several streams in the Umatilla basin based on stream fish habitat survey information collected by the Oregon Department of Fish and Wildlife and Confederated Tribes of the Umatilla Indian Reservation **(Table 62, Figure 89)**. While these data were sufficient for 303 (d) listing, further evaluation was desired for the development of appropriate measures to address these listings. US EPA policy indicates that TMDL allocations such as load capacities are not required or necessarily suitable for parameters such as substrate fines or habitat and flow modification. The substrate and habitat goals in this section provide measures of progress that serve to guide restoration and link these parameters to the TMDL water quality goals.

**Table 62.** Segments on the 1998 §303(d) List for Habitat Modification

| *Waterbody Name* | *Boundaries* |
|---|---|
| Bell Cow Creek | Mouth to Headwaters |
| Birch Creek, East Fork | Mouth to Headwaters |
| Birch Creek, West Fork | Mouth to Headwaters |
| Boston Canyon Creek | Mouth to Headwaters |
| Calamity Creek | Mouth to Headwaters |
| Coonskin Creek | Mouth to Headwaters |
| Cottonwood Creek | Mouth to Headwaters |
| Darr Creek | Mouth to Headwaters |
| Line Creek | Mouth to Headwaters |
| Little Beaver Creek | Mouth to Headwaters |
| Lost Pin Creek | Mouth to Headwaters |
| McKay Creek, North Fork | Mouth to headwaters |
| Meacham Creek | Mouth to East Meacham Creek |
| Meacham Creek | East Meacham Creek to Headwaters |
| Meacham Creek, North Fork | Mouth to Headwaters |
| Mill Creek | Mouth to Headwaters |
| Mission Creek | Mouth to Headwaters |
| Moonshine Creek | Mouth to Headwaters |
| Rail Creek | Mouth to Headwaters |
| Umatilla River | Wildhorse Creek to Forks |
| Woodhollow Creek | Mouth to Headwaters |

**Figure 89.** Segments on the 1998 §303(d) List for Habitat Modification



Habitat modification as indicated by the 303 (d) listing includes "such as large woody material, pool frequency, channel width:depth ratio" [1998 303 (d) list]. Fishery monitoring and evaluation biologists stress the need for substantial improvements in water quality, spawning, instream, and riparian habitats (Umatilla basin fishery research/management review January 1998). A Bonneville Power Administration (BPA) funded study (A Comprehensive Study for Rehabilitation for Anadromous Fish Stocks in the Umatilla River Basin, 1986) clearly described that the habitat improvements proposed in the plan would play an important role in the restoration of summer steelhead and spring chinook in the basin. There is currently a comprehensive effort underway by the Oregon Department of Fish & Wildlife (ODFW) and Confederated Tribes of the Umatilla Indian Reservation (CTUIR) to restore anadromous fish runs in the Umatilla River Basin (CTUIR & ODFW 1990a; CTUIR & ODFWb; Boyce 1986). This comprehensive restoration effort includes a multifaceted approach of addressing passage problems, enhancing streamflows (the Umatilla Basin Water Exchange Project), habitat improvement and hatchery supplementation (CTUIR & ODFW 1990a).

Excessive fine-grained sediment in spawning substrates of salmon and steelhead leads to three effects: filling of interstitial spaces reducing flow that supplies oxygen and carries away waste products, smothering of eggs or sac fry by excessive fine sediment and entrapment of fry in the substrate by an armoring effect of consolidated sediments on the surface (Waters 1995).

Many studies have been conducted relating the size of substrate sediment particles to the survival of embryo's and/or alevin's and emergence success of fry. Waters (1995) has conducted a thorough review on the subject. Harmful size range of sediments are those less than 6.4 mm when at least 20% are less than .84 mm in diameter (Stowell et al. 1983). Bjornn and Reiser (1991) summarized data from several studies relating the emergence of swim-up fry to the percentage of sediment smaller than 2-6.4 mm (Bjornn 1968, Phillips et al. 1975, Hausle and Cobb 1976 and McCuddin 1977). Emergence of fry reduced significantly when sediments smaller than 6.4 mm comprised 20-30% of the substrate.

Following are habitat and substrate goals to address the 303 (d) listings and to protect the beneficial uses (salmonid spawning and rearing) most sensitive to the water quality problems documented by the listings. Because fish habitat modification and substrate fines are related by the kinds of impacts that lead to degradation (removal of vegetation, manipulation of stream channel form and function, etc.) the measures described below will address both parameters. These goals are based on the premise that they can be most effectively met over the long-term by addressing the functionality of stream channels, riparian zones and floodplains. Band-aide type approaches such as streambank stabilization and construction of instream structures to meet identified habitat problems are at best, short-term fixes. While short-term fixes have their place, they are not necessarily cost effective in that they often require ongoing maintenance to function as intended over time. After implementation of limited scope short-term fixes, the root problem still exists.

It is hoped that by developing goals that focus on attaining the appropriate form and function of streams, riparian zones and floodplains, that ensuing restoration efforts will take this approach. This is a different approach than what is often taken for setting goals for habitat restoration efforts. The more traditional approach is to set specific numeric targets for things like pool:riffle ratio, large wood debris, overhanging cover, undercut banks, etc. This methodology works well for one-size fits all kinds of applications, but streams are not one size fits all. The potential for stream channels to realize particular habitat features changes on a relatively small spatial scale. The ways in which these characteristics are expressed on the landscape are reflected in a stream's potential to exhibit certain habitat features. These characteristics include: valley width and slope, stream slope, channel form and pattern, system potential vegetation, geography, soils, geology and hydrograph. These habitat and substrate goals are provided in a format that allows implementation to focus on achieving what is potential based on the characteristics of the stream and watershed.

**Habitat and Substrate Goals:**

<u>Pebble Counts (substrate fines):</u> Wolman (1954) pebble counts will be used as a monitoring tool to detect trends relating to the percentage of fine sediments in spawning and rearing areas. It is realized that this is not the optimal approach for measuring substrate fines. The pebble count biases toward larger substrate sizes (Leopold 1994). However, it is a practical method with generally reproducible results (**Clifton et al 1996)** that current entities conducting monitoring in the basin can likely accomplish. Other measuring techniques such as freeze core samples would provide a more accurate portrayal of subsurface substrate composition, but are very time and labor intensive, and result in "take" of species listed under the Endangered Species Act.

As mentioned above, Stowell et al. (1983) found that the harmful size range of sediments are those less than 6.4 mm when at least 20% are less than 0.84 mm in diameter. This serves as a summary of the information available to date on the impacts of fine sediment and provides a goal that can be assessed through pebble counts.

Substrate size is also largely dictated, anthropogenic impacts aside, by the parent geology, soils, geology, geomorphology and hydrology. It should be realized that streams do not have the same potential to provide optimum substrate for salmonid spawning and rearing. Selection of a goal for substrate size based on survival of fish does not reflect that stream's ability to meet the desired outcome.

The measure of progress is designated as a basin-wide change in the average of substrate sizes less than 6.4 mm as identified by pebble counts. The actual sample design to monitor progress will be developed as part of the long-term TMDL monitoring plan, but should be comprised of both fixed and randomly selected sites to account for both spatial and temporal distributions of substrate sizes. As data emerges, and variance is evaluated, the number of samples and randomization/stratification method should be specified.

<u>Eroding Streambanks:</u> Recent studies indicate that the contribution of streambank erosion to total sediment yield has been greatly underestimated (Rosgen 1996). The relative contribution of streambank erosion to upland erosion is also displayed in the watershed sediment load allocations shown in **Chapter Two**. To delineate application of upland and streambank load allocations, a relationship between percent eroding streambank and total suspended solids was developed in the sediment TMDL. This relationship predicts that the basin-wide average 80mg/L TSS target would be achieved at a percent eroding streambank goal of no greater than 24%. The USDA Forest Service's PACFISH states a goal of eroding streambanks of 20%. Because a relationship between percent eroding streambanks and substrate fines for the Umatilla basin does not currently exist, the recommended measure of progress is a range of 20-

30% based on the above information. This can serve as a guiding "management goal" until better information is available.

It should be noted that a better approach for identifying the desirable percentage of eroding streambanks is to develop a relationship between substrate fines and eroding streambanks specific to the Umatilla basin. However, data are not currently available to develop such a relationship. Further work should be done in the basin to develop this relationship and to use it for measuring progress toward improvement of substrate and fish habitat.

<u>Stream Channel Form and Pattern:</u> The form and functionality of a particular stream channel has much to do with the potential quantity of fine sediments in the substrate. Streams that are not in balance with the characteristics of the watershed are likely to exhibit high erosion rates either vertically or laterally depending on the situation. Streams that are "stable" (maintaining relative dimension, pattern and profile) are at or near their minimum erosion potential under natural conditions.

To assess the form and functionality of stream channels throughout the Umatilla basin, a standardized approach of assigning quantitative and qualitative values related to the form and function of streams with differing characteristics is needed. Rosgen (1996) describes a methodology for classifying stream channel types based on geomorphic features. Stream channels can be grouped into different types by measure of features such as stream slope, width to depth ratio, sinuosity, entrenchment ratio (width of flood prone areas divided by bankfull width), and channel material. Rosgen (1996) also found that channel types are strongly related to valley type. In other words, within a given valley type, certain channel types would be expected. This can be used as a predictive tool for determining system potential channel type.

To assess form and function of streams throughout the Umatilla basin, three primary measures of channel form will be measured (sinuosity, entrenchment ratio and bankfull width to depth ratio). They will be compared to expected values based on assessment of the desired channel type using valley form, and knowledge of channel history as the primary predictive tools. The desired values for each of these parameters will be the mid-range value within the predominant range for each parameter published in Rosgen (1996), based on the desired channel type. Estimates of system potential vegetation and channel morphology have been developed for the Umatilla mainstem from the confluence of the north and south forks to the mouth to provide in-basin derived inputs for the TMDL temperature model. These estimates were based on level II surveys (Rosgen 1996) conducted in 1997 and 1998. These estimates will be the desired values for the Umatilla River mainstem. See the Umatilla TMDL Long Term Monitoring Plan for monitoring protocols.

<u>Riparian Vegetation:</u> Riparian vegetation is critical for maintaining the stability of stream channels, thus strongly related to the composition of streambed substrates. Measures of riparian vegetation are developed as "surrogate measures" for the temperature TMDL. The surrogate measures identified in the temperature TMDL adequately address riparian vegetation as is related to habitat modification and streambed fines.

<u>Pool Frequency:</u> The sequence of pools and riffles in a stream has significant ramifications with respect to the streams ability to produce salmonid fish. Each feature plays a unique part in the ecology of a stream. Riffles are often referred to as the streams "grocery store" as much of the food base is produced in riffles. However, pools also provide important habitat for many aquatic organisms including fish. Pools provide necessary hiding and resting cover for fish. Because both pools and riffles play important roles in the ecosystem, it is important that streams are managed to provide the relative sequence of these habitat types that the stream is capable of producing. By focusing on the stream's natural potential, costly artificial enhancements can be avoided.

The formation of pool and riffle sequences and spacing is affected by several variables including substrate size, sinuosity, the presence of trees in streamside areas, the presence of bedrock etc. However, in gravel bed streams the propensity of a stream to exhibit a pool riffle sequence is largely controlled by the substrate (Leopold 1994). Leopold et al (1964) and Leopold (1994) indicates that the natural sequence of pools in gravel bed streams is 5 to 7 channel widths. Rosgen (1996) further refines the pool sequence to specific channel types according to his classification system. These pool frequencies by channel type are as follows: A channels, 1.5 to 4 bankfull channel widths; B channels, 4 bankfull channel widths; and C, E and F channels, one half the meander wavelength of 10-14 bankfull channel widths or 5-7 bankfull channel widths.

Because each of the Rosgen (1996) channel types discussed above are exhibited in the Umatilla basin, it would be an oversimplification to set a general target. Therefore, as discussed in the stream channel from and function section above, the goal for pool frequency will be based on the system potential channel type.

Actions to Meet habitat and substrate goals:

This section is intended to address restoration and/or management activities associated with streams, riparian zones and floodplains over all settings in the basin. Upland management activities that are related to stream sedimentation and habitat modification are addressed in the Water Quality Management Plan. However, the habitat and substrate goals described above will serve as a tool to monitor the effectiveness of all efforts (upland, valley bottom and instream) toward improving water quality and habitat.

On-the-ground improvement activities should occur to restore streams, riparian zones and floodplains. When possible, each of these elements should be included in restoration activities. As discussed in the introduction to this section, restoration activities should consider the form and function in the development of restoration plans. Failure to address form and function will severely limit the ability to address the problems of substrate fines and habitat modification through on-the-ground improvement projects.

Passive restoration techniques (changes in management activities) are encouraged when conditions are suitable to regain form and function. Restoration of riparian plant communities is the keystone to improving many of the water quality problems in the Umatilla basin.

Active restoration approaches should focus, where possible, on addressing the identified root problems, not consequences. Root problems are often associated with management activities such as vegetation removal, channel straightening to gain floodplain space for development, roading, paving of watershed surfaces, etc. Consequences are often unstable streambanks, large deposits of bedload, channel braiding, rapid channel movements and high erosion rates, etc.

Development of restoration activities should begin with an assessment of stream/floodplain form and function. If the problem area is not in its stable form, then restoration activities should focus on addressing this issue rather than treating the consequences. However, it is realized that some sites do not lend themselves to the restoration of form and function such as within the diked area of Pendleton.

The second primary approach toward addressing stream/floodplain problems is to deal with the management issues. In other words, avoid activities that continue to compromise stream function and instream habitat values. This would include for example the removal of large wood debris from streams. Resource agencies should advocate for not disturbing in-channel wood, as it is a key component of stream ecosystem productivity. Additionally, waterway alteration activities that should be avoided or curtailed include straightening, dredging and hardening of stream channels.

# 2.2.2 SECTION REFERENCES


Bjornn, T.C. 1968. Survival and emergence of trout and salmon fry in various gravel-sand mixtures. Pages 80-88 in Logging and Salmon: proceedings of a forum. American Institute of Fishery Research Biologists, Alaska District, Juneau.

Bjornn, T.C. and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. In W.R. Meehan ed. Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats. American Fisheries Society Special Publication 19. Bethesda, Maryland.

Boyce, R. 1986. A Comprehensive Plan for Rehabilitation of Anadromous Fish Stocks in the Umatilla River Basin.

Clifton et al 1996

CTUIR, and ODFW. 1990a. Umatilla River Subbasin Salmon and Steelhead Production Plan. Northwest Power Planning Council. Portland, Oregon.

CTUIR, and ODFW. 1990b. Umatilla Hatchery Master Plan. Northwest Power Planning Council. Portland, Oregon.

Hausle, D.A. and D.W. Cobb. 1976. Influence of sand in redds on survival and emergence of brook trout (*Salvelinus fontinalis*). Transactions of the American Fisheries Society 105:57-63.

Leopold, L.B. 1994. A View of the River. Harvard University Press. Cambridge, Massachusetts. 298pp.

Leopold, L.B., M.G. Wolman and J.P. Miller. 1964. Fluvial Processes in Geomorphology. Dover Publications, Inc. New York. 522pp.

McCuddin, M.E. 1977. Survival of salmon and trout fry in gravel-sand mixtures. Master's thesis. University of Idaho, Moscow.

Phillips, R.W., R.L. Lantz, E.W. Claire, and J.L. Moring. 1975. Some effects of gravel mixtures on emergence of coho salmon and steelhead trout fry. Transactions of the American Fisheries Society 104:461-466.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, Colorado.

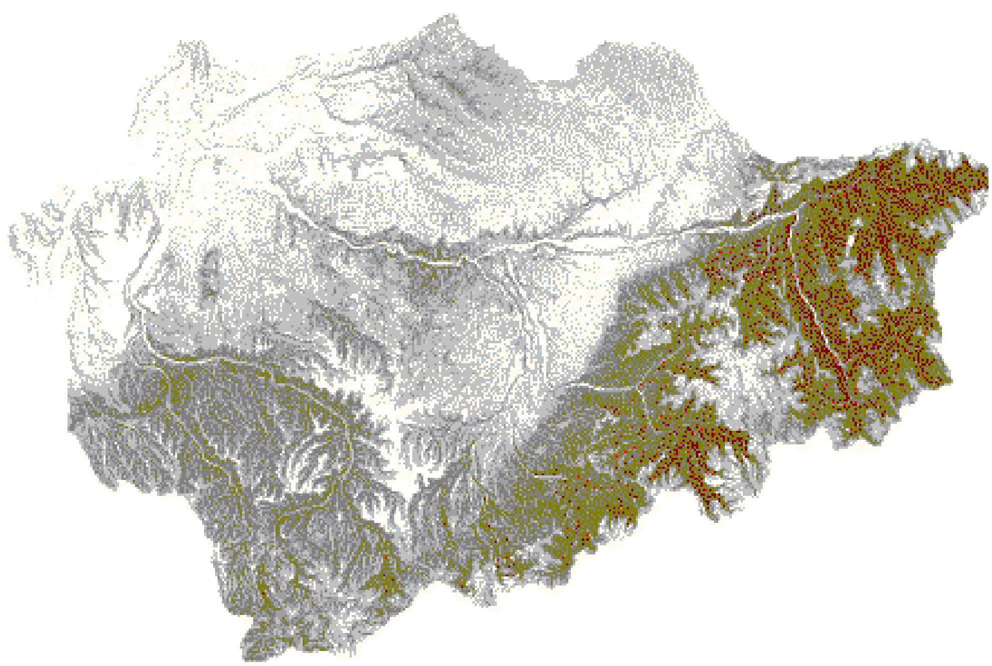
Stowell, R., A. Espinoza, T.C. Bjornn, W.S. Platts, D.C. Burns, and S.J. Irving. 1983. Guide for predicting salmonid response to sediment yields to sediment yields in Idaho Batholith watersheds. U.S. Forest Service, Northern Region, Missoula, Montana, and Intermountain Region, Ogden, Utah.

Waters, T.F. 1995. Sediment in streams: Sources, biological effects and control. American Fisheries Society Monograph 7.

Wolman, M.G. 1954. A method of sampling coarse river-bed material. Transaction of American Geophysical Union 35: 951-956.

# CHAPTER THREE:

# WATER QUALITY MANAGEMENT PLAN



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# 3.1 INTRODUCTION

This plan has been prepared to guide the implementation of the Umatilla Basin watershed (TMDL) goals described in **Chapter Two**. It was prepared through the Basin's TMDL process, primarily by land-use or water-resource workgroups, who worked closely with and were supported by the two principal committees: The Umatilla Basin TMDL Stakeholders Committee and the Umatilla Basin TMDL Technical Committee. All committees were sponsored by a core partnership: The Umatilla Basin Watershed Council, the Confederated Tribes of the Umatilla Indian Reservation and the Oregon Department of Environmental Quality.

The vision of the two committees was Basin-wide input and cooperation in developing goals and plans so that waters of the Basin will again be fishable, swimmable and drinkable. Valuable and dedicated participation was provided by many citizens, the CTUIR, a dozen resource agencies, municipalities and counties.

The TMDL documentation is expressed in two basic parts: the TMDL allocations (**Chapter Two**) and a water quality management plan (WQMP) to implement the allocations (**Chapter Three**). Overview and context common to both is contained in **Chapter One**, including: Basin description, discussion of the TMDL process, the beneficial uses of water, committee process. The participants and agencies authoring this document are identified in the **Chapter One** acknowledgements and in the beginning of the core sections of this **Chapter**. The primary goals, the water quality problems, the data and the method of goal development are addressed in **Chapter Two**.

The TMDL allocations, pursuant to the Clean Water Act, are subject to EPA and ODEQ approval. The WQMP, at the time of preparation, is not subject to such approval. The WQMP is prepared through a multi-agency & public partnership, including ODEQ. It represents the best currently available recommendations for TMDL implementation.

The core sections (3.3.1 through 3.4) of this Chapter were prepared by the following five workgroups, each comprising members representing a major land use or water resources:

- Urban & Industrial
- Agriculture (this plan was developed through the Senate Bill 1010 process)
- Forestry
- Transportation
- Water Quantity

The organization of this plan (**Chapter Three**) is based largely on ODEQ's 1997 guidance document *Guidance for Developing Water Quality Management Plans that Will Function as Non-point Source TMDLs*. This document lays out 10 basic elements:

1) Condition Assessment and Problem Description
2) Goals and Objectives
3) Proposed Management Measures
4) Timeline for Implementation
5) Identification of Responsible Participants
6) Reasonable Assurance of Implementation
7) Monitoring and Evaluation
8) Public Involvement
9) Maintenance of Effort Over Time
10) Discussion of Costs and Funding

Element one is an integral part of **Chapter Two**. Element Two is addressed broadly in the next section and more specifically in the parts of **Section 3.3** that are specific to land use. Element Three is addressed in **Section 3.3**. Elements four through ten are discussed variously in **Section 3.5** (General Elements) and by land use in **Section 3.3**.

The Umatilla Sub-Basin TMDLs of **Chapter Two** are established for point sources (localized outlet such as a pipe) and non-point sources (landscape derived "pollution" such as field erosion, excess sunlight due to vegetation removal). **This plan, i.e., Chapter Three, primarily addresses non-point source pollution, flow impairment and storm water**. Point sources are addressed through a permitting process stemming from the Clean Water Act and administered by ODEQ. Point source permits (National Pollution Discharge Elimination System of the Clean Water Act) will be modified by ODEQ to reflect the **Chapter Two** TMDL waste load allocations soon after TMDL issuance.

## 3.1.1 INTEGRATION WITH MULTIPLE PROGRAMS

The management planning of this chapter relies much on existing programs and makes recommendations for policy and rule development and ongoing monitoring to fully implement TMDLs. Examples of existing programs that are supporting TMDL implementation include:

- The agricultural management plans of Oregon's Senate Bill 1010
- Oregon's Forest Practices Act
- The CTUIR Natural Resource Programs
- ODOT's Routine Road Maintenance and Repair Manual Implementation
- Standards and Guidelines of the Umatilla National Forest
- County and City Comprehensive Plans
- Existing and developing Storm Water Programs
- Umatilla Basin Watershed Council Outreach
- Monitoring programs of CTUIR, ODEQ, USFS, ODFW, OWRD
- The Umatilla Basin Project, Phase I and Phase II

Noteworthy and of particular benefit has been the partnership and cooperation between the UBWC, CTUIR, ODEQ and the natural resource agencies. Inter-organizational planning, goal development, monitoring and resource sharing has been exemplary and very effective in the Umatilla Basin.

As described in the **Chapter One** overview, TMDLs are allocations of pollutants limitations, individually developed for each basin. Substantial components of Oregon's land use and management planning occur on a statewide basis. An important role of this document is to coordinate statewide and Basin planning and goals that are consistent with local values and watershed characteristics. The statewide infrastructure brings guidance, regulation and resources. Each basin is unique in its physiography, ecology and culture. The strategy herein is to draw on existing programs and rules at all levels of government and to integrate basin and regional programs.

TMDLs are only recently being established in many basins. As such it is recognized that existing programs are likely to need modification and evaluation in order to implement TMDLs. In **Section 3.3 and 3.4**, agencies, communities and citizens are encouraged to fill in gaps and conduct ongoing monitoring and evaluation of programs, rules and progress. This applies to water quality monitoring and the effectiveness of programs and practices. It is also recognized that water quality improvement, such as substantially decreased temperatures, will take many decades. Implementation of TMDLs should begin as soon as possible.

### 3.1.2 CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION

The CTUIR has strongly supported the Umatilla TMDL process with staff, monitoring, guidance and TMDL methodology development and examples of watershed restoration projects. The CTUIR have advocated and facilitated the Umatilla Basin Project - providing substantial improvement in flow and water quality, and re-introduction of salmon. This contribution to the basin cannot be overstated.

This document does not apply on the Reservation, as discussed in **Chapter One**. A TMDL is currently being prepared for Reservation land by the CTUIR. The State of Oregon and the CTUIR have worked together closely in Basin-wide TMDL development, recognizing Treaty rights and the mutual interests of both political entities. The core partnership between the Tribes, the Watershed Council and the ODEQ, and five years of cooperation between this partnership and the other Basin natural resource organizations, have laid the foundation for TMDL development within and outside of the Reservation that is mutually supportive and consistent.

Treaty-reserved resources and interests, such as water quality, apply throughout the Umatilla Basin. As discussed in **Chapter One**, the Umatilla Basin lies entirely within the 6.4 million acre CTUIR Ceded Territories (refer to Figure 2 for identification of Ceded Territories). It is important to recognize Tribal rights and Tribal commitment and dedication in supporting Umatilla Basin watershed planning, and specifically this TMDL and WQMP.

## 3.2 OVERALL GOALS

### 3.2.1 TMDL AND RELATED GOALS

The establishment of TMDLs and a continuous planning process to implement them are required via Section 303 of the Federal Clean Water Act. Oregon's TMDL program is codified in state statute and regulation. For further discussion of TMDLs, WQMPs, legal context and adaptive management; refer to **Chapter One** and the balance of **Chapter Three**.

As described in **Chapter Two**, TMDL load allocations are expressed as numeric targets for:

- Minimum stream shading
- Maximum stream channel width
- Maximum stream channel width:depth ratio
- Upland erosion reduction
- Streambank erosion reduction, translated to percent stable streambanks
- Instream nitrate load limitation
- Limitation of bacteria concentrations in runoff

The load allocations are based on 303(d) listings for temperature, turbidity, bacteria and nitrate. Other listings that are not associated with "allocable pollutants" include: flow and habitat modification, sedimentation (excess streambed fines). Flow is addressed generally through the recommendations and programs of **Section 3.4**. To improve the system with regard to these other non-allocable concerns, progress indicators have also been established for (**Section 2.2**):

- Decreased entrenchment
- Streambed grain size
- Percent eroding streambank also meets streambank erosion reduction load allocation referred to above
- Sinuosity
- Entrenchment ratio
- Bankfull width to depth ratio
- Pool frequency

It is important to recognize that each variable above is interdependent, and they should be addressed collectively. Most if not all will passively improve if human stressors are minimized, i.e., allowing banks to stabilize by removing stress or providing space for stable channel development, encouraging the return of riparian vegetation and reconnecting floodplains. When in doubt as to the appropriate vegetation to promote, indigenous species are logical for the system and taller woody species are generally more effective towards reducing temperatures.

## Stakeholders Committee Goals

Listed below are the Umatilla Stakeholders TMDL Committee recommended management goals, prepared to guide management plan development and TMDL allocation attainment. This is included here to relay the Committee's vision of improved water quality, providing perspective and visualization of TMDL implementation.

**Administrative/Planning**

- Target water quality attainment within 20 years, where feasible (It is acknowledged some improvements will be dependent on vegetative growth rates, channel evolution, and other factors that may require many decades to fully manifest).
- Incorporate water quality planning when implementing development.
- Stream classification and stability evaluation are encouraged, to prioritize areas of sediment and temperature improvement and to document current conditions. *Rosgen Level II Inventories* (Rosgen, D.L., 1994) and *Proper Functioning Condition* (BLM Technical Reference 1737-9) are two methods that have been applied in the Umatilla Basin.
- Practice ridgetop to ridgetop management that improves water quality and quantity.
- Conduct public education: resources, practices, funding and other information that supports watershed health.

**Floodplain & Channel Improvement and Reduction in Erosion/Sediment**

- Natural stream development is optimal for maintaining and improving river conditions. Wherever feasible, allow stream channels to develop and flood naturally, while protecting personal property rights and uses. Through time, adopt zoning/incentives encouraging movement of buildings and structures out of the active floodplain.
- Consider (fencing and) alternatives to fencing to protect riparian zones.
- Wherever feasible, including ephemeral and intermittent streams, allow and promote riparian vegetation. Establish improving riparian condition trends.
- Minimize future channel modifications such as straightening, re-locating and constricting, except where beneficial uses are otherwise supported.
- Support existing rules and permitting process regarding instream work. (all workgroups except water quantity)
- Encourage a net decrease in turbidity.
- Promote bank stability through vegetation, animal control and natural channel development, where feasible and beneficial.
- Through erosion reduction, establish decreasing trends in streambed fine particles in depositional reaches.

**Flow and Habitat**

- Encourage water conservation.
- Allow naturally deposited woody debris to remain in stream channels, where appropriate.
- Promote wetland development.
- Encourage beaver re-population, where appropriate.

**Upland and Channel**

- Implement all feasible steps to maintain upland vegetative ground cover.
- Minimize practices that can negatively impact water quality and quantity.
- Improve stream bank stability, to promote naturally functioning systems, where appropriate.
- Identify high priority streams for flow restoration and develop voluntary, market-based approaches to convert consumptive water rights to instream water rights.

**Promote and Implement Oregon Administrative Rules, such as:**

- OAR 340-41-645 (1) “Notwithstanding the water quality standards… the highest and best practicable treatment and/or control of wastes, activities and flows shall in every case be provided so as to maintain dissolved oxygen and overall water quality at the highest possible levels and water temperatures, coliform bacteria concentrations, dissolved chemical substances, toxic materials, radioactivity, turbidities, color, and other deleterious factors at the lowest possible levels.”
- OAR 340-41-026 (6-10) [These rules apply to specific sources or water bodies: lakes, reservoirs, log handling, sand and gravel removal, logging and forest management, road building and maintenance.]
- OAR 340-41-026 (6-10) “…federal, state and local resource management agencies will be encouraged and assisted to coordinate planning and implementation of programs to regulate or control runoff, erosion, turbidity, stream temperature, stream flow, and the withdrawal and use of irrigation water on a basin-wide approach so as to protect the quality and beneficial uses of water and related resources. Such programs may include…development of projects for storage and release…urban runoff control…possible modification of irrigation practices…streambank erosion reduction projects.”

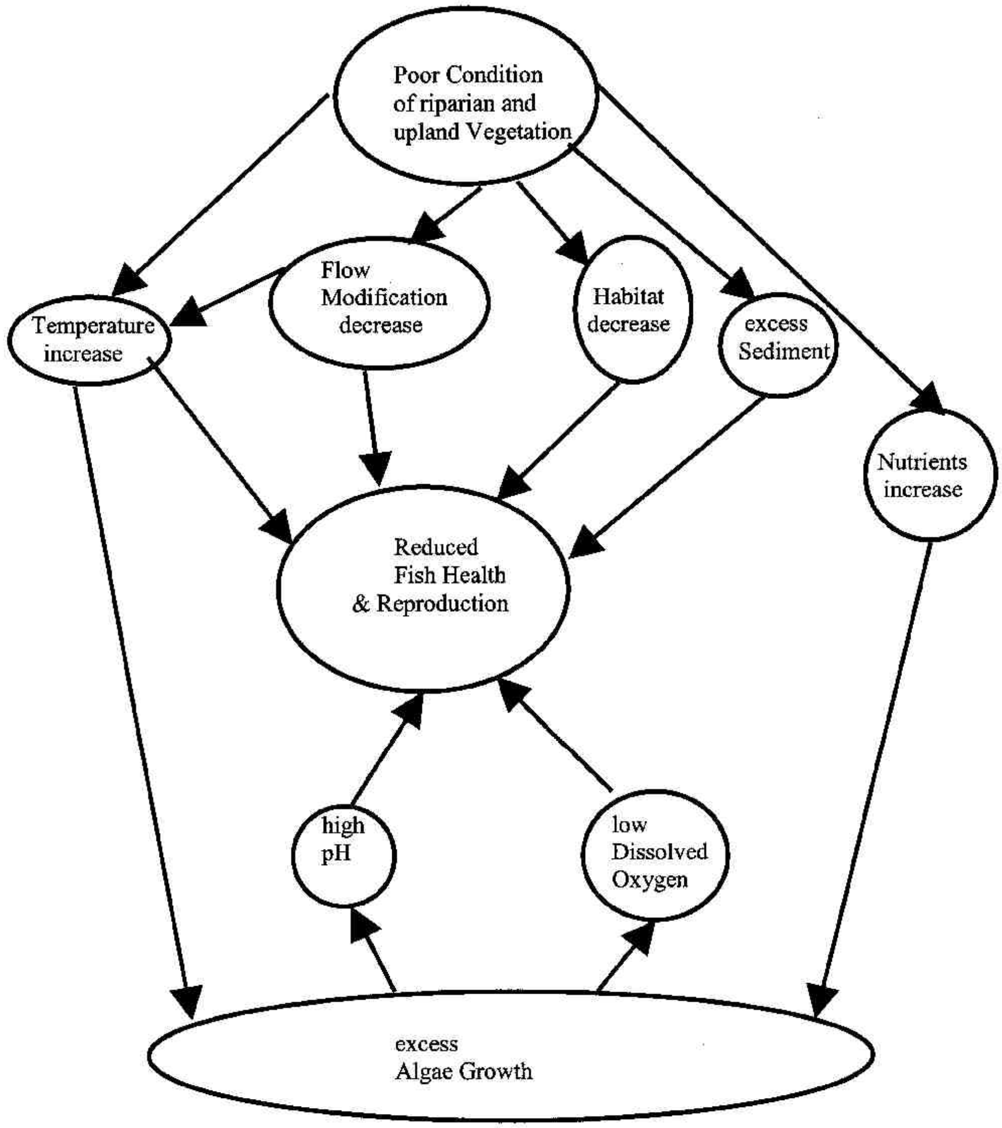
Temperature is the most widespread water quality issue identified in the Basin [§303(d) list]. Along with increased flow and reduced erosion, temperature reduction is the most important improvement related to the most sensitive beneficial use - salmon and trout. Management practices that improve temperature tend to improve all other stream characteristics, to improve habitat and to reduce other pollutants. Strong emphasis is placed upon the effective shade goal. In order to meet this goal, vegetation must be taller and close to the bank and the channel must be narrower. Narrower channels are a normal result of healthy riparian vegetation, floodplain interaction and stable (often sinuous) channel form. The resultant bank stability is expected to achieve the TMDL streambank erosion reduction target. For temperature, the goals above can all be interpreted as increased vegetation and more space for natural stream processes, to the extent feasible. For upland erosion, nitrate and bacteria, ridgetop to ridgetop management modification is needed as well.

Groundwater flow can be an important source of stream cooling and can be enhanced through floodplain re-establishment, increased vegetation in uplands and riparian areas, increased sinuosity and other morphologic and hydrologic changes. The CTUIR is currently developing a method to determine the groundwater potential along the Umatilla mainstem. This should assist in determining where this category of restoration will provide greatest benefit.

**Figure 90** illustrates the importance of riparian vegetation to fish health. Fish and other aquatic organisms are generally the most sensitive indicator of water quality impairment. When combined with other forms of floodplain restoration, system potential cool temperatures can be re-established.

This Chapter makes reference to Section 303(d) of the Clean Water Act. Section 303(d) requires state and federal agencies to list waterbodies that do not meet water quality standards and to establish TMDLs accordingly. For more information refer to **Chapter One**.

**Figure 90.** Relationship of Vegetation to 303(d) Listed Parameters and to Fish Health



## 3.2.2 QUALIFIER ON STRUCTURAL RESTORATION

Progress toward the above goals should be undertaken in a manner which favors the highest ecological potential and greatest channel stability. Encouraging riparian vegetation and providing more space for sinuosity and floodplain connection are nearly always beneficial, and can be all that is needed. On the other hand, installing instream structures, armoring banks and artificially re-shaping channels can be problematic and should be carefully and professional evaluated in terms of:

- water quality and habitat benefits, both near and long-term
- the relative importance and effectiveness of engineered control (typically for protection of property)
- long-term maintenance costs of such structures
- long-term influence of the structure on channel shape
- the appropriateness of design in addressing all these concerns

Up- and down-stream bank stability and habitat quality require environmentally informed analysis of channel materials, hydraulics, vegetation and other system attributes. Instream work, if and when beneficial, can be permitted through DSL, ODFW, the US Forest Service and others. Consultation with these agencies should be obtained. In many instances such consultation or permitting is a legal necessity.

# 3.3 MANAGEMENT BY LAND USE

This section, authored primarily by the land use workgroups, identifies practices and steps for TMDL implementation. Land uses are organized in 4 broad categories; each is addressed separately in this section:

- Urban & Industrial (including non-incorporated residential/commercial)
- Agriculture (addressed through the Senate Bill 1010 Process and included here by reference)
- Forestry (state and federal)
- Transportation corridors (including road, rail and utility corridors)

Agriculture and Forestry are considered separate because they are regulated separately. Agriculture as it is used here includes croplands, range and feeding operations and associated practices including rural residential agricultural activities. Refer to **Chapter One** for a map of Umatilla Basin land uses.

The practices are directed to non-point source pollution, with the exception of storm water, which is generally treated as a non-point source in the TMDL context, and falls under the TMDL load allocations for non-point sources.

Supplementing the contents of this section, The Umatilla TMDL Stakeholders Committee identified two watershed concerns that apply to multiple land uses and recommend they be addressed by all sectors as applicable. These are:

- crop cultivation on road shoulders
- noxious weed control

It is traditional practice in the Basin to cultivate crops on road right-of-ways. This helps control noxious weeds that could invade croplands and can reduce the cost of road maintenance weed control by the transportation authorities. However, this practice also can result in uncontrolled runoff and can directly route sediment, nutrients and pesticides to waterways. It is recommended that this issue be evaluated in terms of the severity of the problem and beneficial alternatives. The logical parties are ODA, SWCD, and Counties and other transportation authorities with the Umatilla Basin Watershed Council.

Noxious weeds are a major watershed concern, near-stream and in the uplands. Noxious weeds such as knapweed have a small fraction of root volume, and consequently they have limited soil retention capability. Thistles and loosestrife out-compete beneficial riparian and upland vegetation. Noxious weed infestations are readily observable virtually throughout the Basin. The Umatilla County noxious weed control authority has stated that the area of infestation is growing, and that in addition to existing populations, noxious weeds in neighboring counties and states are expected to expand into Umatilla County. Millions of acres of land in the Pacific Northwest are occupied by dense stands of noxious weeds. **Appendix A** contains a list of noxious weeds and the Umatilla County noxious weed control ordinance. It is recommended that counties, citizens, municipalities, transportation authorities, federal land managers and industry develop and implement ongoing and increasingly effective noxious weed control programs.

The following is a short list of effective methods for dealing with noxious weeds.

1. Use of desirable herbicides to manufacturer's recommendation
2. Reseeding desirable weed free grass and vegetation in disturbed areas
3. Manage livestock grazing, do not overgraze
4. Biological options (insects)
5. Mowing before undesirable plants go to seed
6. Hand pull or remove
7. Reduce spread by cleaning vehicles and equipment
8. Use of more competitive natural plant species
9. Reduction in soil disturbances as much as possible
10. Road maintenance/closure because roads tend to spread weeds effectively
11. Limit the introduction of non-native species

# 3.3.1 Urban and Industrial

## 3.3.1.1 OVERVIEW AND BACKGROUND

### 3.3.1.1.1 Committee

The Urban/Industrial Workgroup began work in February, 1999. The Workgroup made an effort to reach out to cities, counties, businesses and industry throughout the Umatilla River Basin that might be affected by the TMDL and to include them in the preparation of this Water Quality Management Plan (WQMP). We would like to offer sincere thanks to the following individuals for their efforts and dedication in preparing the Urban/Industrial WQMP:

Emily Bennett (Masonite), Brad Bogus (Tt/KCM Engineering, representing City of Hermiston), Don Butcher (DEQ), Jayne Clarke (Pendleton Ready Mix), Steve Draper (City of Pilot Rock), Aletha Eastwood (Umatilla Basin Watershed Council), Roger Frances (City of Umatilla), Duane Hederly (Kinzua Resources), Larry Hughes (Rocky Mountain Colby), Dave Johnson (Eastern Oregon Correctional Institution), Karen King (City of Pendleton), Sue Lawrence (City of Pendleton & Umatilla Basin Watershed Council), Gilberta Lieuallen (City of Adams), Jeff Lyon (L.P. Consulting, Hermiston), Joe McDonald (Pendleton Grain Growers), Scott Morris (City of Stanfield), Arnie Neely (City of Echo), Patty Perry (Umatilla County Planning Department), Eric Pickard (City of Athena), Robert Ramig (Mayor, City of Pendleton), Harry Schuening (Mayor, City of Helix), Sara Simrell (Umatilla County Soil and Water Conservation District), Bill Smith (Blue Mountain Lumber), Nicole Taylor (Masonite), and Heidi Williams (DEQ).

### 3.3.1.1.2 Scope

This section was prepared by the Urban/Industrial Workgroup as an attachment to the Total Maximum Daily Load (TMDL) for the Umatilla River Basin. The intent of the Urban/Industrial water quality management planning is to address non-point source pollution with achievement of the TMDL load allocations as the primary goal. Another important goal is to fulfill the management goals prepared by the Umatilla River Basin Stakeholders Committee (**Section 3.2**). Point sources of pollution are currently addressed through the state and federal environmental permitting process. The Urban/Industrial Workgroup addresses municipal, industrial, commercial and unincorporated development concerns that are not accounted for by the other Umatilla River Basin WQMP workgroups.

The Urban/Industrial Workgroup believes that the main purposes for addressing municipal, industrial, commercial and unincorporated development areas are to prevent runoff from these sources that could convey pollutants to the stream systems and to enhance and protect riparian areas. The Workgroup also recognizes the need to address impacts of new construction and development. This includes Clean Water Act (CWA) 303(d)-listed parameters that are addressed in the TMDL as well as toxic chemicals that are generated from daily use in urban, industrial and residential areas. It is important to the citizens of the Umatilla Basin to provide both education on hazardous chemicals and simple and accessible methods to properly dispose of these potentially toxic pollutants that could pollute our water sources. Though hazardous chemicals have not been identified through the Umatilla Basin 303(d) process, general pollution prevention is considered an important aspect of watershed enhancement that can be addressed collectively with the Basin-wide concerns such as excess temperature and sediment.

The Urban/Industrial Workgroup recommends addressing the following urban, commercial, industrial and residential land uses in the Umatilla Basin that are not covered by other WQMPs:

- Municipalities including lands within their city limits and lands within their Urban Growth Boundaries (UGBs);
- Industrial and commercial entities within their property lines;
- Other rural community, residential, commercial, and industrial concerns.

The WQMP is designed to address and reduce pollutants associated with runoff from permeable and impermeable surfaces**;** to address issues associated with disposal of potentially toxic pollutants**;** and to protect and enhance riparian zones. Through the use of public education and outreach and the application of Best Management Practices (BMPs) identified in this section, there should be a significant decrease in pollutant loads associated with municipal, industrial, commercial, and unincorporated development areas.

## 3.3.1.1.3 Management Plan Implementation Goals

- Address non-point source (NPS) pollution and achieve TMDL load allocations.
- When and where applicable, meet the Umatilla TMDL Stakeholders Committee management goals listed in **Section 3.2**.
- Encourage public awareness and participation through educational outreach.
- Develop and implement a program to effectively manage household hazardous waste.
- Develop, promote, and implement NPS best management practices (BMPs) for single-family residences, urban, industrial, and commercial entities and unincorporated developments to meet water quality standards.
- Evaluate existing ordinances, rules and policies that address water quality and identify areas that need improvement.
- Develop sample ordinances, rules and policies which could be adopted by city, county, industrial, commercial entities and unincorporated developments to meet water quality goals.
- Implement ordinances, rules and policies as determined appropriate by city, county, industrial, or commercial entities and unincorporated developments to meet water quality goals.

#### 3.3.1.1.4 Management Plan Implementation Objectives

- Identify roles and responsibilities for WQMP implementation.
- Develop measures of progress and mechanisms of reasonable assurance of WQMP implementation.
- Establish a time frame for implementation of the WQMP to meet water quality standards.
- Develop BMPs to be used as a model for residents, cities, counties, industry, and businesses.
- Develop long-term WQMP monitoring and evaluation measures.
- Identify public education and participation efforts.
- Identify costs and funding.

### 3.3.1.2 EXISTING ORDINANCES

One important component of the strategy to address urban and industrial sources is to conduct an evaluation of existing city and county rules and policies and industrial regulations that relate to non-point source (NPS) pollution. After the review is completed, model ordinances and plans or suggested revisions can be developed, approved and implemented. Since the Umatilla River Basin is not a heavily urbanized area, there are not a great many existing relevant ordinances. A preliminary listing of the existing city ordinances and policies is included as **Attachment A**. The documents listed were submitted by members of the Urban/Industrial WQMP Workgroup. A complete review of existing ordinances, rules and policies will be conducted as appropriate by the responsible parties (See Schedule & Responsibilities).

### 3.3.1.3 SCHEDULE & RESPONSIBILITIES

Some of the BMPs discussed in this WQMP have been and will continue to be routinely applied. However, TMDL-related studies indicate that further improvements are needed in the Umatilla Basin to achieve water quality goals. Improvements through implementation of the Urban/Industrial WQMP can be achieved by: 1) Increasing awareness of water quality issues through education, 2) Providing ordinance structure to encourage implementation of BMPs, 3) Identifying funding to implement suggested BMPs and 4) Providing available resources to adequately address water quality issues.

**The Urban/Industrial WQMP Workgroup recommends the following schedule:**

1) Identify existing ordinances, rules, plans, and regulations that address NPS pollution and identify needs in the existing structure. *Estimated completion six months after issuance of the TMDL.*
2) Identify areas of improvement, including potential sources of NPS pollution and points of discharge, i.e. a physical survey. A Pipe Inventory was conducted as a preliminary survey by the Urban/Industrial Workgroup and is included as **Attachment B**. *Estimated completion one year after issuance of the TMDL.*
3) Identify specific BMPs that will address the issues. *Estimated completion eighteen months after issuance of the TMDL.*
4) Draft, pass, and implement ordinances, rules, plans, and policies that address NPS pollution from municipal, industrial, commercial, and unincorporated development sources or develop TMDL implementation plans that identify commitments to specific management practices. *Estimated completion three years after issuance of the TMDL.*
5) Develop and implement a program to educate citizens. *Estimated completion five years after issuance of the TMDL.*
6) Evaluate effectiveness of implementation of WQMP. *Recommend evaluation five years after issuance of the TMDL*.

The Urban/Industrial Workgroup recommends the following areas of responsibility to implement this schedule. Cities are responsible for areas within their city limits. Cities and Counties are jointly responsible for areas that are inside municipal UGBs but outside city limits. Industries are responsible for their own sites. Counties are responsible for all other areas. Those responsible for implementation are accountable to meet and complete the steps in the schedule above. It is understood that many of the activities suggested are ongoing and that the improvements necessary to meet the TMDL load allocations may take decades. However, implementation of the WQMP should begin as soon as possible. Implementation and effectiveness of BMPs will be monitored and evaluated as resources allow.

## 3.3.1.4 BEST MANAGEMENT PRACTICES

Excess temperature and sediment occur throughout the Umatilla Basin (refer to **Chapter 2**). Pollutant reduction load allocations are assigned to urban areas for these and other types of water quality impairments. Each municipality, industry, and unincorporated area should strive to achieve the total sediment reduction for its watershed, including both upland and streambank erosion. Each municipality, industry, and unincorporated area should strive to achieve the percent shade load allocation and associated temperature allocations. This can be accomplished by evaluating the existing riparian conditions and developing and implementing plans that protect water quality and improve riparian zones. In developing plans, potential BMPs should be evaluated for effectiveness and ability to make the necessary improvements to meet the load allocations.

There are existing Best Management Practices (BMPs) that are recognized by a number of agencies as being effective in reducing non-point source pollution and improving water quality. Suggested BMPs are included as attachments in this WQMP to assist cities, counties, industries, and businesses in developing ordinances, rules, policies and education programs. The WQMP Workgroup recognizes that the BMPs included represent only a partial listing and there are many other practices which may improve water quality and may be applicable in a given situation. In addition, new practices will be developed in the future. Therefore, the Workgroup recommends that the suggested BMPs be evaluated when the WQMP is evaluated for effectiveness. The BMPs offered as attachments are not exclusive to the land use or area they are recommended for and are applicable to many situations.

**Attachment C** includes suggested **BMPs for Single-Family Residences**. The actions residents undertake each day in and around their homes have a profound effect on storm water quality in this region. The BMPs in **Attachment C** are practical suggestions for all residents in the Umatilla River Basin, and they should prove helpful to cities and counties in developing plans to meet the TMDL load allocations.

**Attachment D** includes **BMPs for Septic Systems**. Because the Umatilla River Basin is primarily a rural area, there are a large number of residents that utilize septic systems to treat their household waste. For these residents, the information in **Attachment D** provides practical ways to make sure that the septic system is working properly and is not contaminating soil, surface water, or groundwater in the area. Additional information can be obtained from the Lower Umatilla Basin Groundwater Action Plan (LUBGWAP) which addresses groundwater quality and quantity issues.

**Attachment E** is a list of suggested **BMPs for Municipalities and Counties**. Municipalities and counties should set an example of effective pollution prevention for the general public and should endeavor to raise public awareness that poor water quality can result from contamination of storm water which carries the pollutants to rivers and streams. The BMPs included in **Attachment E** should prove helpful to cities and counties in developing plans to meet TMDL load allocations.

**Attachment F** lists suggested **BMPs for Commercial and Industrial Activities** and should be helpful to businesses, industry and commercial entities in developing plans to meet TMDL load allocations. There are two primary types of BMPs for storm water management and pollution prevention included. Source control BMPs are designed to prevent the contamination of storm water, are relatively inexpensive and easy to implement, and may be all that is needed in most cases for pollution prevention. Treatment BMPs are designed to remove contaminants from the storm water, are expensive, and may be necessary in some instances depending on the type of pollutant.

Further information on the suggested BMPs and their effectiveness is listed at the end of each attachment under "Additional Resources." In addition, the following website provides information on BMP effectiveness and performance: Urban Storm Water Best Management Practices Study & Best Management Practices Database <www.epa.gov/OST/stormwater/ >.

## 3.3.1.5 HOUSEHOLD HAZARDOUS WASTE

The Urban/Industrial Workgroup identified Household Hazardous Waste as an important issue. It is important to the citizens of the Umatilla Basin to provide both education on hazardous chemicals and simple and accessible methods to properly dispose of these potentially toxic pollutants. To that end, household hazardous waste (HHW) collection events have been hosted periodically throughout the Umatilla Basin, made possible through grants from the Oregon Department of Environmental Quality (DEQ), Solid Waste Handling and Recycling Grants.

However, the occasional HHW Collection Event is only a short-term solution to the on-going problem of disposal of household hazardous waste. Umatilla County recognized the need for a long-term solution, and they have applied for and received a grant from ODEQ and the U.S. Environmental Protection Agency (U.S.EPA) to study the problem and develop some long-term solutions through development of a Household Hazardous Waste Plan.

## 3.3.1.6 ASSURANCE OF IMPLEMENTATION

The Urban/Industrial WQMP Workgroup recognizes that education is the key to effectiveness of this and any other WQMP. It is important that every citizen in the Umatilla River Basin understand his/her impact on water quality. It will be the responsibility of the cities, counties, industries, and businesses to develop and carry out on-going education programs to educate employees and citizens.

The Urban/Industrial WQMP Workgroup recommends that the cities, counties, industries, and businesses in the Umatilla River Basin carefully review the recommended BMPs provided as attachments to this document. The Workgroup further recommends that the cities, counties, industries, and businesses adopt ordinances, rules, policies or TMDL implementation plans as necessary to ensure that the BMPs are implemented as applicable for their community, industry or business. One way that cities and counties can accomplish this is to form citizen committees to direct education efforts and determine which BMPs would be most effective for their community. The Workgroup recognizes that not all the BMPs will be applicable to any given city, county, industry, or business. The Workgroup strongly recommends that cities and counties carefully review their Master Plans and develop standards, requirements, rules, or policies to ensure that future development and construction have minimal impacts on water quality.

The following references include example ordinances that may prove helpful to cities and counties in developing their own ordinances, rules or policies.

Managing Urban Runoff
http://www.epa.gov/OWOW/NPS/facts/point7.htm

Model Ordinances to Protect Local Resources
http://www.epa.gov/owow/nps/ordinance/

Pierce County Washington
http://co.pierce.wa.us/services/home/environ/water/swm/sppman/

Storm Sewer Water Ordinance, City of Huntsville, Alabama
http://www.ci.huntsvill.al.us/NatRes/sword.htm

Stormwater and Street Ordinance, City of Knoxville, Tennessee
http://wkww.engr.utk.edu/research/water/Knoxville-Ord.htm

Washington State Department of Ecology, 1992, Stormwater Management Manual for the Puget Sound Basin; The Technical Manual.

The Water Librarian's Home Page
http:/wco.com/~rteeter/waterlib.htm

## 3.3.1.7 MONITORING & EVALUATION

Implementation of the Urban/Industrial WQMP will be through adoption of ordinances, rules, and/or policies by cities, counties, industry and business or through development of TMDL implementation plans that identify commitments to specific management practices. A review committee, established by Core Partnership (CTUIR, UBWC, ODEQ) as described in this chapter's *Maintenance of Effort Over Time* section, will monitor progress according to the time line set out in this WQMP and will evaluate the effectiveness of the programs implemented. The Urban/Industrial Workgroup recognizes that the changes suggested in the WQMP will take considerable time to implement and even longer to become effective. The Workgroup recommends that documentation that demonstrates the steps taken by responsible entities toward implementation of the WQMP be provided to the Umatilla Basin Watershed Council three years after the issuance of the TMDL.

## 3.3.1.8 FUNDING

Sources of funding will need to be addressed by the individual city, county, industry or business that will be implementing changes. Some potential funding sources include: grants from ODEQ; grants from Oregon Watershed Enhancement Board; grants from U.S. EPA; development fees; system development fees; storm water system fees; inspection fees; or impact fees. The Urban/Industrial WQMP Workgroup recommends that the individual entities look for opportunities to partner or cost-share with other cities or agencies or with industries, businesses, or community groups to fund water quality improvement activities. It further recommends that the individual entities contact the Umatilla Basin Watershed Council, the Oregon Department of Environmental Quality, the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), or the U.S. EPA for assistance in locating grant sources to help fund storm water activities. EPA's *Guidebook to Financial Tools* (http://www.epa.gov/efinpage/guidbk98/index.htm) may prove helpful.

# ATTACHMENT A: EXISTING ORDINANCES AND POLICIES

| City/Agency | Reference Title | City/Agency Reference Number |
|---|---|---|
| Athena | Nuisance Affecting Public Health | 5-13.11 |
| Echo | Prohibited Drainage to Sewer | 4-4-11 |
| | Required Improvements | 6-1-5 (E) |
| | Flood Hazard Areas, Drainage, & Storm Sewers | 8-6-4 |
| | NON RESIDENTIAL Subdivision Improvements | 8-7-1 & 8-7-2 |
| | Grading & Drainage | 9-3-6 |
| Hermiston | Minimum Improvements Required | Ord. No. 858 |
| Pendleton | Protection of Watercourses | Ord. No. 2287, Sec. 15 |
| | Operation & Maintenance of a Sewerage System | Ord. No. 3237 |
| | Use of Public and Private Sewers & Drains | Ord. No. 3464 |
| | Nuisances Affecting Public Health | Ord. No. 2422, Sec. 7 & 14 |
| | Environmental Releases | Ord. No. 3446 |
| | Utility and Street Oversizing, Storm Sewer Design | Ord. No. 3004, Sec. 5 |
| | Subdivisions | Ord. No. 3251, Sec. 40 |
| U.S. Bureau of Recreation | Regional Policy on the Discharge of Storm water Drainage | Regional Policy Letter no. RES-3.20-400/150-1 |
| | Upper Columbia Area Policy on the Acceptance of Municipal and Industrial Waste and Recycled Water | |

This listing of existing ordinances was compiled through March 2000. The listing may not be all-inclusive. A complete review of existing ordinance, rules, and policies should be conducted as appropriate by responsible parties when implementing this WQMP.

# ATTACHMENT B: SUMMER 1999 PIPE INVENTORY

## Pendleton

Mainstem Umatilla River from ODFW (river mile 58), Pendleton to Reith Bridge (river mile 49), Banks were heavily vegetated and wide. The river was high and swift and measurement are estimates.

| | | |
|---|---|---|
| N4540 10 | W118 4422 | Start |
| N4540 15 | W118 4439 | North Bank - Irrigation Withdrawal |
| N4540 24 | W118 4535 | South Bank - 18" Culvert – dribble |
| N4540 24 | W118 4535 | South Bank – two 6" pipes on east & west sides of Hwy. 11 bridge |
| N4540 27 | W118 4542 | South Bank – 2" withdrawal pipe |
| N4540 26 | W118 4719 | North Bank – two 4" pipes under Main Street bridge |
| N4540 17 | W118 4845 | South Bank – 18" Culvert |
| N4540 59 | W118 4906 | Six 6" down spouts from I-84 bridge |
| N4539 11 | W118 5023 | North Bank – 24" pipe with cover |
| N4540 41 | W118 5127 | South Bank – small tributary |
| N4539 37 | W118 5136 | North Bank – 6" Withdrawal Pipe |
| N4539 28 | W118 5207 | North Bank – partially submerged pipe |
| N4539 28 | W118 5222 | Out at Reith |

West of Walmart, behind old Harris Pine Mill Site – 5' storm drain to Umatilla Mainstem, Small amount (one garden hose) all the time.

McKay Creek

Throughout the residential area there are a number of storm drains going through resident's yards.

Community Park

East side of Struve Bridge, drains hill to the east; has open ditch adjacent to park with 24" outfall by bridge.
NW of Bridge in the park, west side of creek; 8" PVC drain
Near tennis courts on the east side of creek @ 1303 S.W. 41st; 20" drain with flap gate

S. W. Quinney bridge – couldn't locate drain

Tutuilla Creek

New Bridge at Grecian Heights – 12" drains on each side of bridge

There may be additional storm drains located along Tutuilla and Patawa creeks in the Pendleton Area.

## Athena

Wildhorse Creek

Wildhorse Creek R.M. 18.7 – 36" Storm Drain

## Pilot Rock

Birch Creek and Tributaries

*East Fork of Birch Creek*

City Park:

West bank – 6" Spring Fed Drain
East bank – 12" Storm Drain
West bank – 6" Spring Fed Drain

S.W. 2nd Street:

West bank – 12" Storm Drain

Main Street:

South West – 8" Storm Drain
South East – 8" Storm Drain
North West – 8" Storm Drain
North East – 8" Storm Drain

Hwy 395 and East Birch Creek Bridge

North East Corner – 12" Storm Drain

*West Birch Creek*

N.W. Cedar and West Birch Creek Bridge

South East Corner – 12" Storm Drain

*Birch Creek*

Kinzua Mill

North West corner at bridge – Storm Outlet
North West corner of property – 16" Storm Drain

## Echo and Stanfield

Umatilla Mainstem (river miles 34 to 25 and 23 to 16)

Echo Bridge – 10" Drain Pipe
I-84 bridge west of Stanfield exit – Storm Drains from bridge

Stage Gulch

Hwy 395 Bridge – two 10" Storm Drains

## Hermiston

Umatilla Mainstem(river mile 5 to 9)

N4550 4.5 W11920 2.1 24" culvert - 1 cfs below Westland Bridge

# ATTACHMENT C: BEST MANAGEMENT PRACTICES FOR SINGLE-FAMILY RESIDENCES

The actions we take each day in and around our homes have a profound effect on storm water quality in the Umatilla Basin. Small amounts of pollution from many different sources can significantly affect our waterways. Yard maintenance, waste storage, car washing and maintenance, and pool cleaning are some of the activities that can adversely impact water quality. The best management practices (BMPs) discussed in this section are practical ways to keep storm water from becoming polluted in the first place. It is recommended that all residences in the Umatilla River Basin use these BMPs. **Please note that some of these practices may be already required by various state, federal, county, or city laws.**

# Automobile Washing

Most residents wash their cars in the driveway or on the street. Washwaters typically flow to a storm drain or ditch, which discharges storm water directly to the nearest stream, river, lake or ditch. Soaps and detergents, even the biodegradable ones, can have immediate and long-term effects on fish and wildlife living in water bodies. The grime washed off the car also contains a variety of pollutants that can harm fish and wildlife.

**Suggested BMPs:**

- Wash your car directly over your lawn or make sure the wash water drains to a vegetated area. This allows the water and soap to soak into the ground instead of running off to a local waterbody.
- Ideally, no soaps or detergents should be used, but if you do use one, select one without phosphates.
- If you can't wash your car over a lawn, sweep driveways and street gutters before washing vehicles to clean up dirt, leaves, trash and other materials that may flow to the storm drain along with your wash water. This helps reduce storm water collection system maintenance costs as well as protect water quality.
- Commercial products are available that allow you to clean a vehicle without water. These were developed for areas where water is scarce, so a water saving benefit is realized as well as reduced pollution.
- Use a nozzle on your hose to save water.
- Do not wash your car if rain is expected.
- Consider not washing your car at home. Take it to a commercial car wash that has a recycle system and discharges wastewater to the sanitary sewer for treatment.

# Automobile Maintenance

Many of us are "weekend mechanics". We enjoy the cost savings of changing our own oil and antifreeze, topping off the battery with water, and generally making our car perform its best. There are many potentials for storm water pollution associated with these activities. However, the following BMPs will help you minimize pollution while servicing your car.

**Suggested BMPs:**

- Recycle all oils, antifreeze, solvents and batteries. Many local car parts dealers and gas stations accept used oil. Old batteries can actually be worth money. Call shops listed under Batteries in the Yellow Pages of the phone book to find out if they are paying for used batteries. Check with your local solid waste collection facility, listed at the end of this document, to determine which products they will accept.
- **Never** dump new or used automotive fluids or solvents on the ground, on the street, in a storm drain or street gutter, or in a waterbody. Eventually, it can make its way to local surface waters or groundwater, including the water we drink.
- Do not mix wastes. The chlorinated solvents in some carburetor cleaners can contaminate a huge tank of used oil, rendering it unsuitable for recycling. Always keep your wastes in separate containers which are properly labeled and store them out of the weather.
- To dispose of oil filters, punch a hole in the top and let drain for 24 hours. This is where a large funnel in the top of your oil storage container will come in handy. After draining, wrap in 2 layers of plastic and dispose of in your regular garbage.
- Use care in draining and collecting antifreeze to prevent accidental spills. Spilled antifreeze can be deadly to cats and dogs that ingest it.
- Perform your service activities on concrete or asphalt or over a plastic tarp to make spill clean-up easier. Keep a bag of kitty litter on hand to absorb spills. Sprinkle a good layer on the spill, let it absorb for a little while and then sweep it up. Place the contaminated litter in a plastic bag, tie it up, and dispose of it in your regular garbage. Take care not to leave kitty litter out in the rain; it will form a sticky goo that is hard to clean up.
- If you are doing body work outside, be sure to use a tarp to catch material resulting from grinding, sanding and painting. Dispose of this waste by double bagging in plastic and placing in your garbage.

# Storage of Solid Wastes and Food Wastes

Improper storage of food and solid waste at residences can lead not only to water pollution problems, but problems with neighborhood pets and vermin as well. Following the BMPs listed below can help keep your property a clean and healthy place to live.

**Suggested BMPs:**
- All waste containers kept outside should have tight-fitting lids.
- Leaking waste containers should be replaced.
- Store waste containers under cover if possible, or on grassy areas.
- Inspect the storage area regularly to pick up loose scraps of material and dispose of them properly.
- **Recycle** as much as you can. Check with your local solid waste collection facility, listed at the end of this document, to determine what items they recycle.
- Purchase products which have the least amount of packaging materials. Consider buying in bulk quantities and sharing with neighbors or friends.
- Compost biodegradable materials such as grass clippings and vegetable scraps instead of throwing them away. Your flowerbeds will love the finished compost, and we won't fill up our landfills so quickly. Check with your local solid waste collection facility, listed at the end of this document, to determine if they offer composting. See below for more information about composting.

# Composting

Composting is an earth-friendly activity as long as some common sense rules outlined below are followed. If you choose to compost, the following BMPs should be utilized. For more information about composting, contact your local County Extension Service or the Soil and Water Conservation District, which are listed at the end of this section.

## Suggested BMPs:
- Locate compost piles on an unpaved area where runoff can soak into the ground or be filtered by grass and other vegetation. Alternately, locate compost piles on hard surfaces and provide containment.
- Compost piles should be located in an area of your yard not prone to water ponding during storms, and should be kept well away from wetlands, streams, lakes and other drainage paths.
- Avoid putting hazardous or non-decomposable waste in the pile. Examples include plastics, Styrofoam, pesticides, herbicides, and household chemicals.
- Cover the compost pile for two reasons:
    1. To keep storm water from washing nutrients into waterways.
    2. To keep excess water from cooling down the pile, which will slow down the rate of decomposition.
- Build bins of wood, chicken wire or fencing material to contain compost so it can't be washed away.
- Building a small earthen dike around your compost pile is an effective means of preventing nutrient-rich compost drainage from reaching storm water paths.
- Check with your local solid waste collection facility to determine if they offer composting.
- A fun alternative to traditional composting is worm composting. You can let worms do all the work for you by keeping a small vermiculture box just outside your kitchen.

# Yard Maintenance and Gardening

This section deals with the normal yard maintenance activities we all perform at our homes. Over watering, over fertilizing, improper herbicide application and improper disposal of trimmings and clippings can all contribute to serious water pollution problems. Following the BMPs listed below will help alleviate pollutant runoff. For more information about yard maintenance and gardening, contact your local County Extension Service or the Soil and Water Conservation District, which are listed at the end of this section. Ask about the ASK-A-MASTER GARDENER program.

## Suggested BMPs:

- Follow the manufacturer's directions exactly for mixing and applying herbicides, fungicides and insecticides, and use them sparingly. Never apply when it is windy or when rain is expected. Never apply over water, within 100 feet of a wellhead, or adjacent to streams or other waterbodies. Triple-rinse empty containers, using the rinsate for mixing your next batch of spray, and then double-bag and dispose of the **empty** container in your regular garbage.
- Follow manufacturer's directions when applying fertilizers. **More is not better**, either for your lawn or for local waterbodies. Never apply fertilizers over water or adjacent to ditches, streams, dry creek beds, or other waterbodies. Remember that organic fertilizers have a slow release of nitrogen and less potential to pollute than synthetic fertilizers.
- Fertilizers should not be applied during times when plants do not use nutrients, unless they are applied in a form which is highly stable and immobile until needed by the target plants. In the Umatilla Basin, this is typically late October through early March.
- Never dispose of grass clippings or other vegetation in or near storm drains, streams, rivers, lakes, dry creek beds, or other waterbodies.
- Save water and prevent pollution problems by watering your lawn sensibly. Lawns and gardens typically need the equivalent of 1" of rainfall per week. You can check on how you're doing by putting a wide-mouth jar or can out where you're sprinkling and measure the water with a small plastic ruler. Over watering to the point of runoff can carry polluting nutrients to the nearest waterbody. For more information about water conservation or xeriscape, contact the Pendleton Public Works Dept., listed at the end of this section.
- Consider planting a vegetated buffer zone adjacent to streams or other waterbodies on your property.
- Make sure all fertilizers and pesticides are stored in a covered location. Rain can wash the labels off bottles and convert 50 lbs. of fertilizer into either a solid lump or a river of nutrients.
- Compost all yard clippings, or use them as mulch to save water and keep down weeds in your garden. See Composting section for more information.
- Practice organic gardening and virtually eliminate the need to use pesticides and fertilizers.
- Pull weeds instead of spraying and get some healthy exercise, too. If you must spray, use the least toxic formulations that will get the job done.
- Work fertilizers into the soil instead of letting them lie on the ground surface exposed to the next rainstorm.

# Swimming Pool and Spa Cleaning and Maintenance

Despite the fact that we immerse ourselves in it, the water from pools and spas is far from chemically clean. Nutrients, pH, and chlorine can adversely affect fish and wildlife in waterbodies. Following these BMPs will ensure the cleanliness of your pool and the environment.

- **Suggested BMPs:** Pool and spa water should be dechlorinated if it is to be emptied into a ditch, on the ground or lawn, or to the storm water collection system. Contact your pool chemical supplier to obtain the neutralizing chemicals you will need. The rate of flow into the ditch or drainage system should be regulated so that it does not cause problems such as erosion, surcharging or flooding. Water discharged to the ground or a lawn should not cross property lines and should not produce runoff. If you live in a sewered area, you should discharge pool water to the sanitary sewer. Contact your local wastewater treatment facility, listed at the end of this section, for permission prior to discharge.

- If pool or spa water cannot be dechlorinated, it should be discharged to the sanitary sewer. Prior to draining, notify your local wastewater treatment facility to ensure they are aware of the volume of discharge and the potential effects of chlorine levels. A pool service company can help you determine the frequency of cleaning and backwash of filters.
- Diatomaceous earth used in pool filters cannot be disposed of in surface waters, on the ground, into storm water collection systems, into septic systems or into the sanitary sewer. Dry it out as much as possible, bag it in plastic, and dispose of at the land fill.
- Consider hiring a professional pool service company to collect all pool water for proper disposal. Make sure to ask them where they will dispose of it and the kind of permits they hold to do so.

# Household Hazardous Waste

Once we really start looking around our houses, the amount of hazardous materials we have on site is a real eye-opener. Oil-based paints and stains, paint thinner, gasoline, charcoal starter fluid, cleaners, waxes, pesticides, fingernail polish remover, and wood preservatives are just a few that most of us have around the house.

When products such as these are dumped on the ground or in a storm water collection system, they can be washed directly to receiving waters where they can harm fish and wildlife. They can also infiltrate into the ground and contaminate drinking water supplies. The same problem can occur if they are disposed of with your regular garbage; the containers can leak at the landfill and contaminate groundwater. The same type of contamination can occur if hazardous products are poured down a sink or toilet into a septic system. Don’t pour them down the drain if you’re hooked to a municipal sanitary sewer, either. Many compounds will “pass through” the wastewater treatment plant without treatment and contaminate receiving waters, or they can harm the biological process used at the treatment plant, reducing overall treatment efficiency.

With such a diversity of hazardous products present in all homes, a large potential for serious environmental harm exists if improper methods of storage, usage and disposal are employed. Using the following BMPs will help keep these materials out of our soils, sediments and waters.

## Suggested BMPs:

- USE LESS TOXIC PRODUCTS WHENEVER POSSIBLE. Refer to the booklet, *The Hazardless Home*, available from Oregon Department of Environmental Quality, for tips.
- Dispose of hazardous materials and their containers properly. Never dump products labeled as poisonous, corrosive, caustic, flammable, inflammable, volatile, explosive danger, warning, caution, or dangerous outdoors, into a storm drain, a sink, toilet or drain, or onto the ground. Check with your local solid waste disposal service or Oregon Department of Environmental Quality (DEQ) for information on disposal methods, collection events, and alternative products.
- Check containers containing hazardous materials frequently for signs of leakage. If a container is rusty and has the potential of leaking soon, place it in a secondary container before the leak occurs and prevent a clean-up problem.
- Store hazardous material containers under cover and off the ground. Keep them out of the weather to avoid rusting, freezing, cracking, labels being washed off, etc.

- Hazardous materials should be stored out of reach of children. Never transfer to or store these materials in food or beverage containers which could be misinterpreted by a child as something to eat or drink.
- Keep appropriate spill cleanup materials on hand. Kitty litter is good for many oil-based spills.
- Ground cloths and drip pans should be used under any work outdoors which involves hazardous materials such as oil-based paints, stains, rust removers, masonry cleaners, and others bearing label warnings as outlined above.
- Latex paints are not a hazardous waste, but are not accepted in liquid form at the landfill. To dispose, leave uncovered in a protected place until dry, then place in the garbage. If you wish to dry waste paint quickly, just pour kitty litter in the can to absorb the paint. Once paint is dry, leave the lid off when you place it in the garbage so your garbage collector can see that it is no longer liquid.
- If an activity involving the use of hazardous material can be moved indoors out of the weather, then do so. Make sure you can provide proper ventilation, however.
- Follow manufacturers' directions in the use of all materials. Over-application of yard chemicals, for instance, can result in the washing of these compounds into receiving waterbodies. Never apply pesticides when rain is expected.
- When hazardous materials are in use, place the container inside a tub or bucket to minimize spills.

# Additional Resources

**Local Wastewater Treatment Plants:**

City of Athena
Public Works Dept.
541-566-3862

City of Echo
Public Works Dept.
541-376-8411

City of Hermiston
Wastewater Treatment Plant
541-567-5272

City of Pendleton
Wastewater Treatment Plant
541-276-3372

City of Pilot Rock
Public Works Dept.
541-443-2811

City of Stanfield
Public Works Dept.
541-449-3831

City of Umatilla
Public Works Dept.

541-922-5758
541-443-2811

**Local Solid Waste Disposal Services:**

Hermiston Sanitary Disposal
541-567-8842

Humberts Refuse of Milton-Freewater
541-938-4188

Pendleton Sanitary Service
541-276-1271

**Federal Government Sources:**

U.S. Environmental Protection Agency (U.S. EPA)
http://www.epa.gov/epahome/

Natural Resource Conservation Service (NRCS)
Pendleton: 541-278-8049

**State Government Sources:**

Oregon Department of Environmental Quality (DEQ)
Pendleton: 541-276-4063
Salem: 1-800-452-4011
Hazardous Waste: 541-388-6146
http://www.deq.state.or.us/wq

Oregon Water Resources Department (OWRD)
Pendleton: 541-278-5456
Salem: 1-800-624-3199

**County Resources:**

Morrow County Extension Service
Heppner: 541-676-9642
composting; Ask-A-Master Gardener; Home ·A ·Syst Program

Morrow County Soil & Water Conservation District
Heppner: 541-676-5452
composting; Ask-A-Master Gardener; Home ·A ·Syst Program

Umatilla County Extension Service
Pendleton: 541-278-5403
Hermiston: 541-567-8321
Milton-Freewater: 541-938-5597
composting; Ask-A-Master Gardener; Home ·A ·Syst Program

Umatilla County Soil & Water Conservation District
Pendleton: 541-278-8049
www.umatillacountyswcd.com
composting; Ask-A-Master Gardener; Home ·A ·Syst Program

**City Resources:**

City of Pendleton
Public Works Dept. 541-276-3078
Water Conservation & Xeriscape information

**Tribal Government Resources:**

Confederated Tribes of the Umatilla Indian Reservation
Environmental Health Officer/Tribal Planning Office
541-276-3099

**Other Resources:**

Umatilla Basin Watershed Council (UBWC)
Pendleton: 541-276-2190

# ATTACHMENT D:

# BEST MANAGEMENT PRACTICES FOR SEPTIC SYSTEMS

All the wastewater from your house is received by the septic tank. When liquid and solid wastes enter the tank, the bacteria which live in the tank use the organic materials as food. They, in turn, produce their own waste; these are mostly inorganic materials--plant food. They don't eat everything that comes into the tank, and so there is a slow accumulation of solid material, "sludge," at the bottom of the tank and an accumulation of "scum" at the top of the tank. The Best Management Practices (BMPs) mentioned in this section are practical ways to make sure that your septic system is working properly and that you are not contaminating soil, surface water or groundwater in your area. Care in use and periodic maintenance of a properly installed septic system will assure many years of trouble-free and inexpensive waste disposal.

The BMPs included here are specifically for standard septic tank systems. There are a number of new, on-site wastewater treatment options, including secondary treatment systems, that significantly improve the treatment. The Oregon Department of Environmental Quality (DEQ) can provide information on this new technology.

To ensure proper design, location, and construction of your septic system, consult a qualified contractor. (A qualified contractor is one that is licensed by ODEQ according to On-Site Sewage Disposal rules, OAR 340-071.) **All septic systems must be permitted by the Oregon Department of Environmental Quality (DEQ). ODEQ** requires permits for new septic systems, system repairs and alterations, and for authorizations to use existing systems. In general, ODEQ On-Site Program is a good place for people to go for initial contact and information regarding all aspects of their septic system.

## Don't Poison Your Septic Tank

Septic systems work by the action of bacteria in the tank. There are a number of things that can poison septic systems, including many household items. In general, the larger your septic tank, the better it will be able to withstand the shock of poisons.

**Suggested BMPs:**

- Normal amounts of detergents, bleaches, drain cleaners, toilet bowl deodorizers, and other household chemicals can be used and generally won't harm the bacterial action.
- Never dump products labeled as poisonous, corrosive, caustic, flammable, inflammable, volatile, explosive danger, warning, caution, or dangerous outdoors, into your septic system. Drain cleaners, toilet bowl cleaners, and other chemicals can, in large quantities, cause a problem. Even bleach can cause problems, although small quantities used in washing machines should not be harmful.
- Do not use organic chemicals to clean your septic system. The addition of organics can lead to serious groundwater, well water, and drinking water contamination.
- Salt used in regenerating water softeners can be harmful and should not be discharged to septic systems. [Oregon law (OAR 340-071-0130 (4)) specifically prohibits the discharge of water softener brine into any on-site sewage disposal system.]
- Excess water can lead to problems, so be sure that surface runoff cannot drain into the tank. Leaky faucets or doing all laundry at once can also overload a system hydraulically.

- Avoid adding solids to the tank, which cannot be decomposed by the bacteria. Newspaper, paper towels, rags, and coffee grounds will accumulate and will force you to have your tank pumped out more often than normal. They may also clog drainfield lines.
- A “starter” is not needed for bacterial action to begin.
- Additives should not be used. Additives are of no benefit and some may do great harm if they cause the sludge and scum to be flushed out into the drainfield. Beware of magic elixirs designed to revitalize your septic system.
- Don’t deposit coffee grounds, cooking fats, or grease down the drain. These can build up in the tank, plug the inlet and plug the drainfield lines.
- Use a good quality toilet tissue that breaks up easily when wet.
- If you must use a garbage disposal, you may need to remove the septic tank solids every year or more often. Ground garbage will frequently find its way out of the septic tank and clog the drainfield. It is better to compost organic wastes.

## Maintaining the Drainfield

The drainfield receives the water that overflows from the outlet pipe of the septic tank. Long perforated pipes (minimum 4" in diameter) drain this water into beds of gravel which are buried in long trenches. The water seeps through the gravel and into the soil where it is treated by being filtered through the soil particles and where the organisms normally present in the soil devour most of the bacteria carried from the septic tank. Remember that your drainfield must be located at least 100 ft from all drinking water wells.

**Suggested BMPs:**

- Maintain tank properly and pump tank regularly.
- Be careful what you flush into the tank.
- Tree roots can cause failure of the field. Generally, large trees and brush should not be planted in the drainfield. Grasses are best planted over a drainfield.
- Treatment with peroxide or aeration may or may not restore the field for a period of time; the treatment may be expensive.
- Keep initial and replacement drainfield areas free of traffic (cars, livestock), cover (paving, structures, large stored items), and soil disturbance (cut & fill, deep plowing).

*Some signs of failure of your septic system are: septic water surfacing over the drainpipes, obnoxious odors, backing up of water into the septic tank, and backing up of water into the drains of your toilet and bathtub. Generally, when a drainfield fails, you must have a new one installed. This requires ODEQ approval as part of a permitted repair. Consider having a distribution box put in which will direct the water to the new field, but which will keep the old field available for reuse after a year or two of drying out. Reuse of the old drain lines may or may not be allowed.*

# Septic System Capacity

A number of factors may affect your septic system. For example, if you have moved into a home which was previously occupied by fewer people, the septic system may not be adequate for your needs. You may need to enlarge the system (both tank and drainfield), or use less water, or both. Leaking faucets, an added automatic dish or clothes washer, or a new garbage disposal all could cause the capacity of the present system to be exceeded.

**Suggested BMPs:**

- Don't overload your septic system. Understand daily and seasonal variations in your wastewater load. Household water use peaks just after your family awakens and again at bedtime. Try to avoid using more water than necessary during these peak periods.
- Remember that your system may also be under stress during heavy rains and snowmelts, so modify water use accordingly.
- Make sure that outdoor drains do not discharge into the system. Drain water should be discharged elsewhere.
- Be conservative with your use of water. Each gallon of water used must be treated and disposed of. Excessive amounts of water entering the septic system increase the wastewater load on the drain field and reduce the soil's capacity to absorb wastewater.
- Teach family members, especially children, about water-saving practices.
- Repair all leaky fixtures and reduce the amount of water used in laundering, bathing, and toilet flushing.
- Wash only full loads in the washer and spread the washing out during the week to avoid overloading the sewage system in a single day.
- Each bath or shower uses up to 30 gallons of water. Filling the tub not quite so full and not turning the shower on all the way could save 5 to 10 gallons with each bathing. Also consider installing water-saving showerheads, faucets, and appliances.
- Routinely check the toilet float valve to be sure that it isn't sticking and the water running continuously. Be sure the toilet is not flushed unnecessarily. The toilet is not a garbage can and should not be used to flush tissues or insects. Also consider installing water-saving toilets.
- Don't let the water run while shaving or brushing teeth.
- Water softener wastewater will not normally harm septic tanks. However, the additional water will need to be treated and disposed of by the septic system. Salt used in regenerating water softeners can be harmful and should not be discharged to septic systems. [Oregon law (OAR 340-071-130 (4)) specifically prohibits the discharge of water softener brine into any on-site sewage disposal system.]

# When to Call the "Honey Wagon"

NEVER ALLOW ANYONE TO GO DOWN INTO A SEPTIC TANK. Toxic, flammable gases build up in the septic tank and can kill in minutes. Extreme caution should be exercised even if you simply peer into the tank. Do not use torches or flames near the opening of a septic tank.

Know where your septic system is located, and inspect your tank yearly or contact a septic tank service that will perform the annual inspection for a fee. (NOTE: Use only permitted septic tank services. Contact the local ODEQ for a list of permitted septic tank services.) A septic tank service is much better equipped to perform an annual inspection and is accustomed to the stench and mess involved. Choose a reputable septic tank service to inspect and/or pump your septic tank. Septic tank pumpers must have a state permit to handle and dispose of the material removed from a septic tank.

A map of the tank location can save a lot of digging. The purpose of your inspection is to keep track of accumulated scum and sludge. Any indigestible solids must be periodically removed from the tank by a septic system cleaning service, often referred to as a “Honey Wagon.” When half of the capacity of the tank is taken up by solids, it’s time to have the tank pumped out. This accumulation usually takes three to five years.

If you choose to inspect the septic tank yourself, you will need to measure the scum accumulation and the sludge accumulation. To measure the **scum accumulation**, nail a three-inch square block to a pole and poke the block through the scum layer. Carefully move the pole up and down to feel the resistance as you move the block up against the bottom surface of the scum layer. Mark that place on the pole which is level with the ground. Then feel around the bottom of the outlet pipe and mark that level on the pole. If the two marks are three inches or less apart, you tank needs to be pumped out.

To measure **sludge accumulation**, wrap an old towel around the bottom of the pole and fasten it with string or tape. Push the towel down into the bottom of the tank and twirl it around several times. Mark the pole at ground level. After a minute or so, pull it out and measure the distance between the top of the sludge layer (the top of the black material on the towel) and the bottom of the outlet pipe. If this distance is twelve inches or less, your tank needs to be pumped.

You will generally leave a few inches of sludge in the tank after cleaning to help reactivate bacterial action. Never wash, scrub, or disinfect the septic tank. Washing can destroy bacteria that are needed to decompose waste in the tank.

## Additional Resources

Confederated Tribes of the Umatilla Indian Reservation (CTUIR)
Environmental Health Officer/Tribal Planning Office
541-276-3099

Oregon Department of Environmental Quality (DEQ)
Pendleton: 541-276-4063
Salem: 1-800-452-4011

Septic News
www.estd.wvu.edu/nsfc/NSFC_septic_news.html

# ATTACHMENT E: BEST MANAGEMENT PRACTICES FOR MUNICIPALITIES/COUNTIES

*There are a number of measures that municipal and county governments can implement to improve water quality in the Umatilla Basin. Many of the suggestions included in this document are common sense ideas for environmental protection. Most activities can be easily adopted as part of existing daily maintenance routines. There are other good reasons why municipalities, counties and agencies should improve their practices and reduce pollutant loading to water bodies. Municipalities, counties and agencies should set an example of effective pollution prevention for the general public. In addition, the new Clean Water Act (CWA), Phase II storm water regulations will require these types of improved actions for certain municipalities in the near future.*

The following list represents Best Management Practices (BMPs) that cities and counties might implement. It is recommended that municipalities and counties in the Umatilla River Basin review these BMPs and utilize those practices which are best suited and cost-effective for them. **Please note that some of these practices may already be required by various state, federal, county, or city laws.**

## Water-Quality Friendly Maintenance Practices

Cities and counties have equipment and vehicles which are used for routine tasks. Inspection and servicing of fleet vehicles and equipment and the manner in which the maintenance facilities and yards are operated can affect storm water. When waste materials and chemicals leak or spill at maintenance facilities and yards or on-site locations, they may be carried from the site in storm water runoff to nearby streams. Simple housekeeping practices can reduce the risk of adding these pollutants to the environment.

**Suggested BMPs:**

- Use waste minimization and recycling within departments.
- Review current practices for vehicle washing. Determine improvements that could reduce or eliminate discharges to the storm water system. If feasible, perform vehicle & equipment washing in a covered facility. Recycle wash water and/or discharge to the sanitary sewer system.
- Review current practices for vehicle maintenance. Determine improvements that could reduce or eliminate discharges to the storm water system. Perform vehicle & equipment maintenance in a covered facility whenever feasible.
- Clean up spills promptly.
- Provide a dead-end sump in maintenance areas for collecting all spills and leaks. Clean the sump regularly and dispose of wastes properly.
- Review current sludge and sediment disposal methods for vacuum & street sweeping waste. Determine improvements that could reduce or eliminate discharges to the storm water system.
- Review and update plans for hazardous material storage. Make sure all containers are labeled and stored correctly. Store bulk materials under cover.
- USE LESS TOXIC PRODUCTS WHENEVER POSSIBLE. Reduce chemical use whenever possible.
- Minimize disturbance to areas under work in order to decrease erosion and reduce storm water runoff.
- Protect storm drain inlets during maintenance activities.

- When planning maintenance activities, consider the following: rules and regulations; public safety issues; impact on water quality and riparian zones; cost effectiveness; and impacts on other agencies.
- Maintenance activities planned for environmentally sensitive situations or locations require a careful assessment process. Consider the following: topography; materials being used and their potential impacts; location for disposal of materials; type of lands or resources affected; potential effects on water quality and riparian zones.
- Keep records about maintenance practices and make notes on what is and isn't working. Evaluate maintenance procedures annually and make changes as needed.
- Educate maintenance staff about storm water quality issues. This could include making presentations at safety meetings, posting signs at maintenance facilities and yards, and involving the maintenance staff in planned improvements.
- When working with contractors, include conditions in contracts that require contractors to use proper procedures and protect water quality. Be as specific as possible in the contract and check to make sure proper procedures are being followed. Provide copies of educational and informational materials to contractors.

# Maintaining the Storm Water Collection System

Cities and counties are responsible for construction and maintenance of storm water collection systems. Maintenance practices which remove sediment, trash, and debris from roadways and storm water collection systems can help prevent flooding and related damage and erosion as well as protect storm water and stream quality. Sediment removal is particularly important. A maintenance program which removes this material before it is discharged into storm water collection systems and drainage courses helps improve water quality.

**Suggested BMPs:**

- Develop a work plan and record-keeping system for storm drain maintenance activities.
- Develop a regular inspection program for storm drain lines, catch basins, and storm water treatment devices.
- Develop a program for routine street sweeping. Determine the current frequency of street sweeping and, if feasible, increase the frequency in the future.
- Develop a program for routine cleaning of catch basins. Determine the current cleaning frequency and, if feasible, increase the frequency of cleaning in the future.
- Develop a program for routine storm water collection line cleaning and repair. Install downstream debris traps before cleaning to trap silt and debris and prevent it from being washed into streams or waterways.
- Develop a program for routine maintenance of drainage ditches. Removal of silt, debris, and overgrown vegetation helps to maintain the flood control capacity of drainage ditches. However, do not over clean. Leave some vegetation along the banks to help stabilize the soil and prevent erosion.
- Dispose of sediments and debris properly.
- If a storm water collection system drain needs replacement, consider replacing it with one that also improves water quality. An example is replacing inlets with trapped catch basins.
- Eliminate Combined Sewer Overflows (CSOs) to ensure separation of sanitary sewer and storm water collection systems.
- Improve storm water and wastewater lines to minimize Inflow/Infiltration in sanitary sewer systems.
- Develop a program to detect, investigate, and eliminate illicit discharges.
- Educate maintenance staff to integrate storm water quality into their everyday maintenance activities.

# Develop and Define Standard Practices for New Construction & Development

It is important that municipalities and counties encourage erosion control measures on all types of development, from single-family homes to large commercial developments. Developing standard practices can significantly reduce sediment transport from construction sites.

**Suggested BMPs:**
- Use standard practices to control erosion and sediment runoff and reduce storm water pollution.
- Require erosion control plans that control storm water quality and quantity for all construction sites. Examples include the use of mulching and erosion control mats or netting to physically protect exposed soils.
- Use structural controls or vegetative buffer strips to reduce the velocity of runoff flows. Reducing the energy of runoff streams is beneficial because slower flows cause less erosion and do not carry as much sediment.
- Develop erosion control plans before construction.
- Inspect construction sites for implementation of erosion control BMPs.
- Implement measures to preserve wetlands that otherwise may be threatened by development.
- Use natural areas which increase soil infiltration and reduce soil runoff. Examples include grassy channels, swales or detention ponds.
- Use multi-stage filtration systems for removal of specific pollutants where applicable.
- Use site planning that minimizes the amount of impervious area and maximizes the amount of site vegetation. This will increase the infiltration capacity of the soil and thus reduce the volume of runoff.
- Preserve existing vegetation wherever possible.
- Locate developments in appropriate areas, avoiding unstable slopes, wetlands, and areas of high habitat value.
- Avoid stream crossing when possible.
- Protect historic stream meander patterns, flood plains, and channel migration zones when possible.

# Habitat Improvement Along Streams

Both municipalities and counties can promote community programs that actively improve water quality. In addition, citizen committees can be formed to promote habitat improvement.

**Suggested BMPs:**
- Evaluate streambanks for percent shade and stream bank stability.
- Develop zoning standards or planning policies that restrict land use in the flood plain to those uses compatible with the riparian environment.
- Develop zoning for future development that addresses stream bank stability and requires adequate riparian buffers.
- Protect existing riparian vegetation.
- Initiate and support riparian enhancement projects, both within urban growth boundaries (municipalities & industry) and throughout the Umatilla Basin (counties & industry).
- Promote and support community planting projects that re-vegetate exposed and eroding streambanks, utilizing native trees and vegetation as much as possible.

- Promote and support community-based bank stabilization projects.
- Promote and support wetlands restoration projects where appropriate.
- Promote and support community streambank cleanup events.
- Develop incentives for habitat improvement projects.

## Public Involvement & Education

Often the job of maintenance personnel is more difficult because of public actions that result in wastes and other pollutants being spilled or dumped onto streets, into the storm water collection system, or into the sanitary sewer system. It is, of course, important to educate the maintenance staff first. Once this is accomplished, proceed to raise public awareness about water quality issues.

One way that cities and counties can involve and educate the public about water quality issues is to form citizen committees which would direct education efforts and determine which methods would be most effective for their community.

**Suggested BMPs:**
- Develop informational brochures or doorhangers that can be distributed to area residents.
- Work with local newspapers, radio stations, and other media to create an effective media campaign.
- Work with Boy Scouts or other community groups to stencil catch basins with a “No Dumping” message.
- Promote individual responsibility for and link individual behavior to prevention of storm water pollution.
- Illustrate to the public how small quantities of pollutants from one source can contribute to significant pollution problems when mixed with small quantities from other sources.
- Emphasize the importance of the riparian environment and its role in water quality.
- Use self-sustaining vegetation (Xeriscaping) which reduces the need for pesticides, herbicides, fertilizer, and water.
- Promote residential recycling and composting programs.
- Promote water conservation measures.
- Sponsor household hazardous waste collection events.
- Provide the public with a central contact for storm water pollution prevention information.

## Other Suggested BMPs for Municipalities:

- Develop incentive programs that encourage the use of BMPs.
- Control through ordinance, permit, contract, order or similar means, the contribution of pollutants to storm water systems by discharges associated with industrial, commercial, or construction activities.
- Control through ordinance, permit, contract, order, or similar means, illicit discharges to the storm water system, including spills, dumping or disposal of materials other than storm water.
- Work with local solid waste facilities to arrange pro-active leaf pickup programs in the fall to minimize debris entering the storm drain system.
- Look for opportunities to partner or cost-share with other cities or agencies or with industries, businesses or community groups to fund storm water activities or equipment.
- Investigate engineering measures to actively treat storm water or prevent materials from

reaching the stream, river, or lake. Some examples are: 1)Construct facilities which remove pollutants by a combination of settling and filtration, such as wet ponds, sedimentation ponds, marshes, wetlands, and detention ponds; 2) Install debris traps or filtration devices, such as grassy swales, vegetated filter strips, compost filters, sand filters, or infiltration sumps, to trap and remove silt and debris; 3) Install settling devices that remove pollutants by settling, such as oil/water separators, sedimentation basins, vortex separators, trapped catch basins, and sedimentation manholes. Some of these devices can be retrofitted to existing storm drains.

# Additional Resources

American Forests
*Building Cities of Green* video & information available
PHONE: 1-800-368-5748
ADDRESS: PO Box 2000
Washington, DC 20013

American Society of Civil Engineers
http://www.asce.org/peta/tech/

City of Hermiston Public Works
PHONE: 541-567-5521

City of Pendleton Public Works
PHONE: 541-276-3078

Eugene, OR
http://www.ci.eugene.or.us/Pw/storm/stormpg.htm

League of Oregon Cities (LOC)
PHONE: 503-588-6550
Ask about: *Steelhead Supplement to Oregon Salmon Restoration Initiative for Cities in Oregon*

*The Model Urban Runoff Program: A How-To Guide for Developing Urban Run-Off Programs for Small Municipalities*
Contact: Copy King, ATTN: Chris; MURP Order; 498 Calle Principal; Monterey, CA 93940
http://www.swrcb.ca.gov/~rwqcb3/Downloads/downloads.html

Oregon Association of Clean Water Agencies (ACWA)
PHONE: 503-236-6722
Ask about: *Municipal Storm water Toolbox for Maintenance Practices*

Oregon American Public Works Association
www.oregonapwa.org

Oregon Department of Environmental Quality (DEQ)
http://www.deq.state.or.us/wq/
Pendleton: 541-276-4063
Salem: 1-800-624-3199

The Oregon Plan
http://www.oregon-plan.org

Oregon Watershed Information Line
1-888-854-8377
Texas Nonpoint SourceBOOK
www.txnpsbook.org

Urban Storm Water BMP Study & BMP Database
http://www.epa.gov/OST/stormwater/

U.S. Environmental Protection Agency (U.S. EPA)
http://www.epa.gov/epahome/

U.S. Environmental Protection Agency (U.S. EPA) clearinghouse for BMP performance
http://www.epa.gov/OST/stormwater/

Willamette Restoration Initiative
http://www.oregonwri.org

# ATTACHMENT F: BEST MANAGEMENT PRACTICES FOR COMMERCIAL AND INDUSTRIAL

There are two primary types of Best Management Practices (BMPs) for Storm water Management and Pollution Prevention: Source Control BMPs and Treatment BMPs. **Source Control BMPs** are designed to prevent the contamination of storm water and are relatively inexpensive and easy to implement. Source Control BMPs are all that is needed in most cases for pollution prevention. **Treatment BMPs** are designed to try to remove contaminants from storm water and may be necessary in some instances, depending on the type of pollutant. Treatment BMPs are often expensive and may not have 100% effectiveness in contaminant removal. BMPs for construction activities and for habitat improvement along streams are also included.

The following are guidelines to help prevent the degradation of water quality in the Umatilla Basin.

# All Activities Should Follow These Guidelines

**Avoid the activity or reduce its occurrence**
- Try to find other ways to do an activity, or find different materials to do it with.
- Sweep the area rather than hosing the area to a storm drain.
- Have materials delivered when needed and not stockpiled and exposed to the weather. Transfer liquids mechanically instead of by hand.

**Move the activity indoors**
- Unload and store barrels inside to make spill cleanup easier.
- Cover the storage or work area to prevent rain from washing contaminants to the storm drain.

**Use less material**
- Don’t buy more than you need. This can reduce costs for you and will reduce potential disposal, storage and pollution issues.
- Try to reduce the amount of the chemical you use.

**Use the least toxic material available**
- Find out if you can use less toxic material.
- Use a biodegradable cleaner and you may be able to discharge to sanitary sewer (not to storm drains).

**Create and maintain vegetated areas near activity locations**
- Vegetation helps to filter contaminates out of the water.
- Parking areas and roof runoff can be treated and controlled by having vegetated buffer strips designed into the parking area.
- Erosion can also be controlled with vegetation.

**Locate activities as far as possible from surface drainage paths**
- There is more time to clean up a spill if it occurs further away from known drainage paths, ditches, streams, and drains.
- Don’t forget groundwater contamination potential.

**Keep storm water collection systems clean**

- Pollutants concentrate in storm drains and catch basins, so keep them clean so they function properly.
- Develop and implement maintenance practices, inspections, and schedules for treatment devices, such as detention ponds, oil/water separators, vegetated swales, etc.

**Reduce, reuse and recycle as much as possible**

- Look for ways to recycle both hazardous and non-hazardous materials. This can reduce your costs for purchase and disposal.
- Reduce the amount of waste transported to the landfill or transfer station whenever possible.
- Make process changes that can reduce the amount needed or recycle the process waste.
- Your waste may be used in another manufacturing application.

**Be an advocate for storm water pollution prevention**

- The most important part of pollution prevention is education.
- Educate your employees about preventing potential contamination.
- Help friends, partners and other businesses to reduce their pollution potential.
- Try to get people to think about how their everyday activities affect storm water.
- Encourage and support formation of citizen committees that promote healthy watersheds.

**Report violators**

- Allowing anyone to pollute is detrimental for everyone.
- Many times it is the lack of information that allows people to cause pollution.
- Most people want clean water and will change practices to prevent pollution if they know what to do.

# List of Source BMPs

- Eliminate illicit storm water collection system connections.
- Dispose of collected runoff and waste properly.
- Connect process water discharges to a sanitary sewer, holding tank, or water treatment system.
- Cover the activity with a roof or awning.
- Cover the activity with an anchored tarp or plastic sheet.
- Pave the activity area with a curb, dike, or berm, or elevate the activity.
- Implement integrated pest management measures.
- Clean catch basins.

# List of Treatment BMPs

- Install oil/water separators.
- Create a wet pond, wet vault, or constructed wetland.
- Create vegetated biofilters.
- Implement media filtration and adsorption.
- Implement infiltration.
- Implement chemical additions.

# Description of Treatment BMPs

The following is a description of Treatment BMPs that are for different types of pollutants. It may be necessary to utilize one or a combination of more than one to adequately address the contamination that is at a specific location. Location may also be a determining factor in the type of treatment practice needed. Treatments need to be properly designed for flow and the contaminant needing to be removed in order to be effective.

| Pollutant to Remove | Type of Treatment BMPs |
|---|---|
| Oil and Grease | Oil/Water Separator |
| Suspended or Settleable solids | Wet/Pond, Media Filtration, Constructed Wetland, Grass Swale and Strip, Chemical Addition |
| Non Settleable Solids | Chemical addition with Clarification and/or media filtration |
| Nutrients | For particulate matter see Settable Solids, dissolved substances required additional treatment for example: |
| Phosphorus | Chemical addition, filtration with leaf compost or peat/sand and constructed wetland treatments |
| Nitrate | Constructed wetland |
| Metals | Filtration with leaf compost or peat/sand |
| BOD and Trace Organics | Constructed wetland; may need to use activated carbon for additional removal as required |
| Fecal Bacteria | Wastewater Treatment and disinfection |
| pH | Chemical addition for pH adjustment |

**The following describes different treatment practices:**

Oil/water separator – An underground wet vault specifically designed to remove petroleum products. It will also remove floatable and settable solids.

Wet pond – Detention pond with a wet pool that is retained between storms.

Constructed wetland – Similar to a wet pond but shallow so wetland vegetation can grow across the width of the pond.

Wet vault- An underground wet pond.

Bioswale (vegetated swale) – A wide ditch designed specifically to treat storm water that enters as concentrated flow. Grass is the most common vegetation used, although wetland vegetation can sometimes be used.

Vegetated filter strip (biofilter) – Usually a flat strip of grass with water entering as a thin sheet flow from the adjoining pavement.

Media filtration – Storm water is pretreated by one of the above BMP's and is then treated by a filter. The only widely used media is sand. Removal of particles is accomplished by straining.

Media adsorption – Media filtration that removes dissolved pollutants by adsorption. Media used on a limited scale includes peat mixed with sand, leaf compost, treated paper, sand mixed with steel wool and activated carbon.

Infiltration – Variety of systems in which water is treated by the soil as the water infiltrates. Most require pretreatment by one of the above BMP's to protect the infiltration capability.

Chemical addition – Different chemicals can be used for pH control, dissolved phosphorus removal, enhanced removal of suspended solids or non-settleable solids.

# Develop & Define Standard Practices for New Construction and Development

It is important that industrial and commercial entities encourage erosion control measures on all types of commercial and industrial development. Developing standard practices can significantly reduce sediment transport from construction sites.

**Suggested BMPs:**

- Use standard practices to control erosion and sediment runoff and reduce storm water pollution.
- Require erosion control plans that control storm water quality and quantity for all construction sites. Examples include the use of mulching and erosion control mats or netting to physically protect exposed soils.
- Use structural controls or vegetative buffer strips to reduce the velocity of runoff flows. Reducing the energy of runoff streams is beneficial because slower flows cause less erosion and do not carry as much sediment.
- Develop erosion control plans before construction.
- Inspect construction sites for implementation of erosion control BMPs.

- Implement measures to preserve wetlands that otherwise may be threatened by development.
- Use natural areas which increase soil infiltration and reduce soil runoff. Examples include grassy channels, swales or detention ponds.
- Use multi-stage filtration systems for removal of specific pollutants where applicable.
- Use site planning that minimizes the amount of impervious area and maximizes the amount of site vegetation. This will increase the infiltration capacity of the soil and thus reduce the volume of runoff.
- Preserve existing vegetation wherever possible.
- Locate developments in appropriate areas, avoiding unstable slopes, wetlands, and areas of high habitat value.
- Avoid stream crossing when possible.
- Protect historic stream meander patterns, flood plains, and channel migration zones when possible.

# Habitat Improvement Along Streams

Both industrial and commercial entities can promote community programs that actively improve water quality and encourage and support the formation of citizen committees to promote habitat improvement.

**Suggested BMPs:**
- Evaluate streambanks for percent shade and stream bank stability.
- Support zoning standards or planning policies that restrict land use in the flood plain to those uses compatible with the riparian environment.
- Support zoning for future development that addresses stream bank stability and requires adequate riparian buffers.
- Protect existing riparian vegetation.
- Initiate and support riparian enhancement projects, both within urban growth boundaries (municipalities & industry) and throughout the Umatilla Basin (counties & industry).
- Support community planting projects that re-vegetate exposed and eroding streambanks, utilizing native trees and vegetation as much as possible.
- Support community-based bank stabilization projects.
- Support wetlands restoration projects where appropriate.
- Support community streambank cleanup events.
- Develop incentives for habitat improvement projects.

# Additional Resources


Association of Clean Water Agencies (ACWA) *Storm Water Tool Box*

Pierce County, Washington
http://www.co.pierce.wa.us/services/home/environ/water/swm/sppman/
chap5.htm

*Recommended Best Management Practices for Storm Water Discharges*, Oregon Department of Environmental Quality, August 1997.

Water Quality Best Management Practices Manual for Commercial and Industrial Business, City of Seattle, Prepared by Resource Planning Associates, June 30, 1989.

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# 3.3.2 AGRICULTURE

During the initial stages of Umatilla Basin TMDL development the Department of Agriculture and their local Management Agency, the Umatilla County Soil and Water Conservation District, sponsored an agriculture-based citizen's advisory committee to prepare a water quality management plan for the agriculture areas and activities of the Basin. This plan and the associated Basin-specific regulation were established through the Senate Bill 1010 process (ORS 568.900 through 568.933). The plan is translated into rule in OAR 603-095-0300 through 0380.

The plan, *Umatilla River Sub-Basin Agricultural Water Quality Management Area Plan* (AgWQMAP), was issued and approved by the Oregon State Board of Agriculture in September of 1999. **The plan is included in this document as Appendix A-10**.

This plan was prepared within the context of discussion of early Basin TMDL drafts and the 303(d) list, however it was completed more than one year prior to public review of this document. The Oregon Department of Agriculture has agreed to review the plans every two years as needed to evaluate their adequacy as the primary tool of agriculture-related TMDL implementation. It is requested herein that ODA, in consultation with ODEQ, evaluate the Umatilla Basin 1010 plan within two years of its publication date, in the context of implementation of the approved Umatilla Basin TMDLs published in this document. The review is scheduled to begin early in 2002 (refer to **Section 3.5.8** Schedule).

The AgWQMAP and associated administrative rules apply to agricultural activities throughout the Umatilla Basin. The subject of the plan is "for prevention and control of water pollution from agricultural activities and soil erosion" (ORS 568.909(2).

Individual farmers, ranchers and other rural landowners are responsible for managing their lands to address the conditions identified in the AgWQMAP. Additionally, ODA and the SWCD will develop a program for outreach to the local agricultural community to address agricultural water quality issues in a proactive, non-regulatory manner. Oregon statute provides clear enforcement provisions to be utilized where needed as a backstop.

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# 3.3.3 FORESTRY

## 3.3.3.1 COMMITTEE

The Forestry Workgroup, primarily responsible for development of this recommendation, has been meeting since late winter of 1999. Meeting minutes are on file at the Umatilla Basin Watershed Council Office in Pendleton. The Forestry Workgroup is co-chaired by Bill Alexander, a consulting Forester, and Jeff Blackwood, Forest Supervisor for the Umatilla National Forest. Strong support was contributed by John Buckman, Unit Forester, Oregon Department of Forestry. The Workgroup included the following:

- Gary Rhinhart – Stakeholders Committee, interested citizen
- Warren Stewart – interested citizen
- Caroline Davis - interested citizen
- Bob Holowecky – consulting forester
- Dale Jenner – industrial forester
- Stan Wildes – industrial forester
- Kathy Ward – interested citizen
- Mike Thompson – private landowner
- Bob Broden – industrial forester
- Doug Corey - landowner

## 3.3.3.2 BACKGROUND

Non-federal and federal forest lands represent approximately 20% of all lands within the Umatilla Basin (**Table 61**). Over half of the water flowing through the Umatilla Basin originates in the headwaters, generally covered by forested lands (**Table 62**). Ownership and management are by the U.S. Forest Service, private landowners, the Confederated Tribes of the Umatilla Indian Reservation, and the State of Oregon. This section of the Water Quality Management Plan addresses lands and management measures on national forests, private ownerships, and State lands within the Umatilla Basin.

**Table 63.** Forested Lands in the Umatilla Basin

| | Acres | $Mi^2$ | Percent |
|---|---|---|---|
| **Total Umatilla Basin Drainage Area** | 1,465,600 | 2290 | 100 |
| **Federal lands:**<br>**Umatilla NF**<br>**Wallowa-Whitman NF** | <br>185,380<br>3,358 | <br>290<br>5 | <br>13 |
| **CTUIR forested lands** | 14,000 | 22 | 1 |
| **Non Federal forested** | 90,000 | 141 | 6 |
| **Total forested** | 292,738 | 458 | 20 |

**Table 64.** Umatilla Sub-Basin Water Yield
Comparison of Mouth to Upper Watershed

| Stream Gage | Drainage Area ($mi^2$) | Elevation (ft) | Annual Average Discharge (cfs) |
|---|---|---|---|
| **Umatilla River near Umatilla** | 2290 | 330 | 477 |
| **Umatilla River above Meacham** | 131 | 1855 | 228 |

Management measures described or referenced in this section of the Water Quality Management Plan are intended for use, among other things, in meeting the Umatilla Basin TMDLs as influenced by forestry activities. There are differences between management measures, land management objectives, and responsibilities for national forests and private forest lands. Management of national forest lands includes a comprehensive package of laws, regulations and policies addressing all activities on these lands. Management measures generally meet or exceed environmental protection requirements of State law. Management of private forest lands is primarily regulated by the Oregon Forest Practices Act, however private landowners are still responsible to meet requirements of other State laws and national laws such as the Clean Water Act and Endangered Species Act. Since the U.S. Forest Service is responsible for all activities on national forest lands, management measures and programs described for national forests relate to all activities on these lands. Management measures and programs later described for private and State lands are focused on forest operations and associated activities. Other activities, such as recreation, grazing, and transportation on these non-federal forest lands are addressed in other sections of this Water Quality Management Plan.

The area is typical of the northern Blue Mountains. The forested watersheds are characterized by uplifted, moderately dissected plateaus with long narrow ridges, steep escarpments, canyons, and narrow depositional valley bottoms. Most of the forested lands range in elevation from 3,000 to 5,000 feet. Portions of the Umatilla River headwaters and Meacham Creek support bull trout. Many of the major stream systems with the exception of McKay Creek support steelhead trout. These are both listed as threatened under the Endangered Species Act. Many of the streams within the forest lands are listed as 303 (d) water quality limited streams or segments under the Clean Water Act. The forested landscapes have had a long history of management activities. Past actions were conducted for differing objectives, often with the best knowledge of the times, reflecting societal values.

**Sediment, temperature and habitat** are the primary concerns in meeting clean water quality standards on forested lands. Although many management practices employed today are very different from those of the past, some challenging conditions remain that can be addressed through watershed restoration activities. Current laws, regulations, Best Management Practices (BMPs), and incentive programs provide the foundation for improving water quality throughout the forested landscape.

Individual management actions are guided by the implementation of BMPs [Forest Practice Act statute and rules, USFS R6 BMP Guidelines, 1988 (Appendix D)]. BMPs are measures to control identified non-point sources of pollution. BMPs are the measures to reduce to the maximum extent practicable, the level of pollution from such non-point sources. For proposed management actions, BMPs are designed and implemented in accordance with a State approved process and will normally constitute compliance with the Clean Water Act. The BMPs developed under a State approved process may be used as performance standards for proposed actions. Applicable water quality standards along with water quality monitoring should be used to measure the effectiveness of BMPs. The success in applying BMPs for controlling non-point sources of pollution on forest and rangelands is well documented and demonstrated in scientific and historical literature, and anecdotal reports. BMPs are design and implementation guidelines based on the most current science and professional judgement to assure that management actions meet clean water standards. During monitoring of project activities, BMPs (or their surrogates as reflected in the Forest practices Act) are often examined to determine if they were applied, and to the extent possible, if they were effective in meeting clean water standards. BMPs are imbedded within the Oregon Forest Practices Act. On national forest lands, BMPs are selected and applied to projects based on local conditions and risks. A listing of BMPs can be found in the Forest Supervisor's Office, Umatilla National Forest and at the Pendleton Office of the Oregon Department of Forestry.

The Oregon Forest Practices Act (FPA, ORS 527) is the forest management regulatory mechanism for the privately owned forestland. Within the basin, these lands would include industrial and non-industrial forestlands. The FPA is also the regulatory means of the scattered, state-owned forestland in the basin. The FPA is administered by the Oregon Department of Forestry.

National Forest lands in the Umatilla Basin are managed by the US Forest Service. Federal rules and policies are managed for a wide range of uses on these lands, leading to regulation that are comprehensive in terms of resource protection.

Forested lands within the reservation boundary of the Confederated Tribes of the Umatilla Indian Reservation are regulated by the Tribes. Under the 1855 Treaty, land outside of the Reservation that is now managed by the U.S. Forest Service was ceded to the federal government with interests and rights retained on those lands by the Tribes. Treaty-reserved resources and interests, such as water quality, apply on non-Federal land as well. As discussed in **Chapter One**, the Umatilla Basin lies entirely within the 6.4 million acre CTUIR Ceded Territories.

## 3.3.3.3 TMDL CONCERNS

The TMDL analysis indicates that Basin forested areas contribute minimally to turbidity and the aggregate load of in-stream suspended sediment. While the sediment model used for this TMDL analysis indicates no need for significant reductions in fine sediment from forest lands at the basin scale, it is widely recognized that some forestry related activities can lead to increased sedimentation, and in fact have in the past. This can come from upland or riparian disturbances, such as poorly located roads, inadequately drained roads, improperly timed harvest operations or excessive disturbance during harvest operations. Wildland fires, landslides, and other natural or human caused disturbances can also contribute to increased sedimentation. With the current policies, regulations, BMPs, incentives, and adaptive management techniques, unwanted sediment from forestry related activities should be kept at a minimum.

Temperature, however, is a more difficult issue. Improvement of temperature conditions will be achieved through actions such as promoting shade, assuring that streams can utilize their floodplains, and providing large woody debris for stream channels to help achieve temperature goals. Adaptive management techniques will help to assure desired results occur, and new science, knowledge and understanding are being utilized. Temperature goals should be achieved to the “maximum degree practicable” through application of existing policy, regulations, BMPs, and incentive programs. The FPA regulations are currently being evaluated in the context of water quality and are subject to modification, as discussed later in this section.

Habitat measures of progress are addressed through implementation of forest practice BMPs to address temperature reduction, and overall improvement in riparian condition and function. Outcomes will be evaluated through project and long-term monitoring. Activities will be adjusted by adaptive management to assure accomplishment of desired results. Adaptive management relating to TMDLs is discussed in **Chapter One**. Incentive programs should assist forest land managers in improving habitat conditions over time.

## 3.3.3.4 MANAGEMENT MEASURES

# 3.3.3.4.1 General Management Measures – Private and State Forest Lands

### 3.3.3.4.1.1 FOREST PRACTICES ACT OVERVIEW

This section is a general overview of the Oregon Forest Practices Act. Specific measures and practices can be found in **Attachment A**, and within the Oregon Forest Practices Act.

The State of Oregon through the Oregon Department of Forestry (ODF) has been instrumental in developing site specific direction and regulation of forest management activities on private and state-owned forestlands. The State has a long history of involvement pertaining to forest activities. The first efforts at addressing forestland issues pertained to wildfire prevention and dated back to 1911. The first forest management regulation dated back to 1941 with the Oregon Conservation Act. This Act dealt exclusively with reforestation following harvest activities. The Oregon Forest Practices Act, first implemented in 1972, was the beginning of a comprehensive set of regulations that deal with all aspects of the growing and harvesting of forest tree species across the forestlands within the State. The FPA has gone through numerous of changes throughout the years reflecting current data that supports changes in Best Management Practices.

Within the Umatilla River Sub-Basin, ODF implements a comprehensive engineering, education and enforcement program for forest landowners and forest operators. ODF employs a full-time professional forester to oversee the implementation of the Act within the Basin. The FPA has had a positive affect in influencing water quality in the Umatilla River Sub-Basin as far as forest harvest activities are concerned. The FPA will continue to play a positive role into the future of water quality, supporting the implementation of the Umatilla Basin TMDLs.

Forest management activities, and the associated regulation of those activities, must be viewed within the context of time. There is certainly a past, present, and future component of forestry issues within the Basin. Several situations related to forest practices have occurred in the past under a different set of cultural standards. These past accepted practices, which were believed to be proper management practices for their time, have resulted in several site conditions, legacy issues, which are not acceptable by today's cultural standards. Legacy issues have been created that require remedial actions to improve water quality and fish habitat. Examples of forest legacy issues may include the construction of forest roads adjacent to and in close proximity to watercourses and draw bottom log skidding. Another recent example of a legacy issue once believed to be appropriate was the removal of large woody debris from stream channels. No amount of regulation of harvest activities will repair damage related to past practices if those regulations apply to activities that occur only every other decade or so. This need to address legacy issues is what leads the TMDL Forestry Workgroup to stress the need to develop a broad-based multi-partnered forestry incentive and cost-share approach for landowners.

There are forest activities currently underway and activities to come that are subject to the present form of the Oregon Forest Practices Act. The overarching objective of the Act is to:

> *…encourage economically efficient forest practices that assure the continuous growing and harvesting of forest tree species and the maintenance of forestland for such purposes as the leading use on privately owned land, consistent with sound management of soil, air, water, fish and wildlife resources and scenic resources within visually sensitive corridors as provided by ORS 527.755 that assures the continuous benefits of those resources for future generations of Oregonians.* (ORS 527.630 Policy, Oregon Forest Practices Act)

The FPA is a comprehensive set of site-specific regulations designed to achieve the above purpose statement. Specific divisions of the FPA deal with definitions, planning forest operations, reforestation, treatment of slash, chemical and petroleum use, road construction and maintenance, harvesting and water protection. **Attachment A** contains an important and detailed description of the Best Management Practices related to water quality protection as they are addressed by the Oregon Forest Practices Act.

A gap in resource protection currently exists in the area of road maintenance for roads that are used for both agriculture and forestry. The Forestry Workgroup suggests developing a clear distinction between road maintenance responsibility for the various users of the road to assure protection of water quality. Following is a suggested approach for roads regulated through the ODF and ODA: During an active forest operation, road construction and maintenance activities shall be regulated solely through the Forest Practices Act. Following the completion of a forest operation, road maintenance activities shall be regulated solely through the Forest Practices Act for 24 months. Thereafter, until another commercial forest operation takes place, road maintenance will be subject solely to the requirements of the SB 1010 water quality management plan for the particular property.

The Oregon Forest Practices Act is not a static set of statutes. Changes have and will continue to occur as scientists, foresters, interest groups and the public at large gain a deeper understanding of the cumulative and interactive effects of forest management. Mechanisms for change to the FPA came about through various processes including the direction of the Oregon Board of Forestry and the legislative process. ORS 527.765 has required the Oregon Board of Forestry, in consultation with the Environmental Quality Commission (EQC), to establish Best Management Practices (BMPs) for forest practices. The intent of BMPs is to ensure that to the maximum extent practicable non-point source discharges of pollutants resulting from forest operations do not impair the achievement and maintenance of water quality standards established by the EQC. ODF has the responsibility to be the Designated Management Agency (DMA) for non-federal forestland for water quality issues as identified through Oregon statutes. For regulation of water quality on non-federal forestlands, forest operators conducting operations in accordance with ODF BMPs (rules and statutes in the FPA) are considered to be in compliance with Oregon's standards for non-point source pollution reduction.

As the DMA for non-federal forestlands, ODF is working with the ODEQ through a memorandum of understanding (MOU, **Attachment B**) signed in June of 1998. This MOU was designed to improve the coordination between the ODF and the ODEQ in evaluating the water quality adequacy of the forest practices rules. The purpose of the MOU is to guide coordination between the ODF and ODEQ in addressing water quality limited streams on the 303d list. An evaluation of rule adequacy will be conducted (also referred to a "sufficiency analysis") through a water quality parameter by parameter analysis. This statewide demonstration of forest practices rule effectiveness in the protection of water quality will address the following specific parameters and will be conducted in the following order:

- Temperature (estimated completion date Summer 00)
- Sediment and turbidity (Winter 00)
- Aquatic habitat modification (Spring 01)
- Bio-criteria (Fall 01)
- Other parameters (Spring 02)

Prior to their final release, the sufficiency analyses will be reviewed by peers and other interest groups. Once the sufficiency analyses are completed, they will be used as a coarse screen for common elements applicable to each individual TMDL to determine if forest practices relate to water quality impairment within a given watershed.

There may be circumstances unique to this watershed or information generated outside of the statewide sufficiency process that need to be considered to adequately evaluate the effectiveness of the BMPs in meeting water quality standards. Information from the TMDL, ad hoc committee process (a interdisciplinary committee formed by the Governor to review the adequacy of the FPA in terms of salmonid recovery), the ODF monitoring program, and other relevant sources may address circumstances or issues not addressed by the statewide sufficiency process. This information will also be considered in making the FPA sufficiency determination. ODF and ODEQ will share their understanding of whether water quality impairment is due to current forest practices or the long-term legacy of historic forest management practices and/or other practices. The two agencies will then work together and use their determinations to figure out which condition exists (four possibilities regarding water quality and BMP adequacy are discussed) in the MOU. The MOU describes the appropriate response depending on which condition exists.

Currently the ODF and ODEQ have not made a collective determination on the sufficiency of the current FPA BMPs in meeting water quality standards within the Umatilla River Basin. This situation most closely resembles the scenario described under conditions described in b and/or c of the ODF/DEQ MOU.

The draft version of the statewide sufficiency analysis for temperature has been completed.. This analysis is based on data from an ODF/DEQ shade study collected over the summer of 1999. . Information from the ad hoc committee advisory process is now available. Information from these efforts, along with other relevant information provided by the ODEQ and ODF, will be considered in reaching a determination on whether the existing FPA BMPs maintain water quality standards within the Umatilla River Basin. The ODF and ODEQ will then make a collective determination on FPA adequacy for the Umatilla River Basin.

The above adaptive management process may result in findings that indicate changes are needed to the current forest practice rules to protect water quality. Any rule changes that occur must comply with the standard articulated under ORS 527.714(5). This statute requires, among other things, that regulatory and non-regulatory alternatives have been considered and that the benefits provided by a new rule are in protection to the degree that existing forest practices contribute to the overall resource concern.

### 3.3.3.4.1.2 VOLUNTARY AND INCENTIVE FORESTRY PROGRAMS

The TMDL Forestry Workgroup strongly recommends the use and development of voluntary and incentive based programs to promote restoration and improvement of water quality and habitat in the Umatilla Basin. Forest management practices, on a specific site basis, are periodic events at best. Long periods of time may elapse between site activities. As a result, the regulation of management practices may not influence the water quality derived from the forest component of the Umatilla Basin in specific watersheds for many decades. Legacy issues that have impaired water quality may never be addressed through existing regulations. Incentive programs and restoration projects are seen as the preferred catalyst for change in problem areas of the basin. This non-regulatory approach is also seen as the preferred way to engage landowners concerning restoration efforts.

Key to this recommendation is the involvement of the forestry stakeholders of the Umatilla Basin in the Oregon Plan. The Oregon Plan calls for landowners and stakeholders in a particular watershed to organize efforts to address deficiencies in water quality in their basin. The implementation of the Oregon Plan would be greatly enhanced in the Umatilla Basin by the Umatilla Basin Watershed Council (UBWC) and the Soil Water Conservation District (SWCD) working with the forestry community of the Basin to develop a broad-based, coordinated incentive program and encourage voluntary practices in key target areas (see the Oregon Plan measures concerning forestland in **Attachment C**). There are several effective institutions and mechanisms for delivering incentive programs through state, federal, and local entities.

Specific sites within the Umatilla Basin should be identified that are contributing to the impairment of water quality. UBWC, the SWCD and state and federal natural resource agencies should work in conjunction with the non-federal forest landowners to target these areas and engineer projects to improve site conditions. The potential areas to address include restoring fish passage at road crossings, restoring riparian vegetation along stream corridors, retaining additional trees along waterways, active placement of large wood into stream for habitat improvements and assessing surface drainage on forest roads. Incentive monies and appropriate funding sources should be developed to provide the landowner with the means to solve these complex issue questions.

Direct support of programs that improve watershed conditions can be found in the publication entitled: *Public Funding Sources for Landowner Assistance 1/1997*, available through Oregon Coordinated Resource Management.

It is the Forestry Workgroup's opinion that the support and development of a Umatilla Basin forestry incentive program will accomplish more in the short term for the improvement of water quality related to past forest practices than any amount of regulation. This is the key component to addressing forest legacy issues within the Umatilla Watershed Basin.

## 3.3.3.4.2 General Management Measures – National Forest Lands

Federal forest lands are administered by the Umatilla National Forest, with a small portion managed by the Wallowa-Whitman National Forest. These lands include a rich mixture of landscapes with forests, grasslands, and riparian areas that provide a variety of goods, services, and cultural benefits to society. Lands managed by the U.S. Forest Service include about 13% of the lands within the Umatilla Basin. Land management activities are guided by a number of rules, regulations, policies, and directives, for which federal land managers are held accountable. Management Measures can generally be found from several sources. All activities associated with management actions must follow the standards and guidelines (S&Gs) as listed in PACFISH, the Biological Opinion for PACFISH, the Biological Opinions for the Land and Resource Management Plans, the Umatilla and Wallowa-Whitman National Forest Land and Resource Management Plans, and BMPs (USFS R6 BMP Guidelines, 1988). This direction applies to all management actions including grazing, recreation, wildlife enhancement, and other actions in addition to timber management activities. Following is a summary of the general management measures applicable to forested federal lands within the Umatilla Basin. A more detailed listing of S&Gs is referenced in Attachment D.

### 3.3.3.4.2.1 PACFISH

PACFISH is an interim strategy used by the U.S. Forest Service and Bureau of Land Management for managing Pacific anadromous fish-producing watersheds in eastern Oregon and Washington, Idaho, and portions of California. PACFISH provides management direction in the form of interim Riparian Habitat Conservation Areas (RHCAs) and S&Gs for Key Watersheds. These define areas near streams where special management practices are in effect. All of the national forest watersheds in the Umatilla Basin have been designated as Key Watersheds, which require a high degree of conservation and protection.

### 3.3.3.4.2.2 REGULATORY AGENCY BIOLOGICAL OPINIONS FOR LAND AND RESOURCE MANAGEMENT PLANS

Biological Opinions related to aquatic species listed under the Endangered Species Act have been issued by both the National Marine Fisheries Service and the U.S. Fish and Wildlife Service for activities on national forest lands. These Biological Opinions were issued by these agencies after they reviewed current management direction, including PACFISH. The Biological Opinions prescribed Terms and Conditions for conservation of habitat for listed fish under the Endangered Species Act. In the Umatilla Basin, bull trout and mid-Columbia steelhead trout are listed. While National Marine Fisheries Service is still developing the Biological Opinion for mid-Columbia steelhead trout, previous Biological Opinions on PACFISH, Snake River steelhead trout, and Snake River chinook salmon have influenced land management within the Umatilla Basin on federal lands. These Biological Opinions are considered management direction, where non-discretionary Terms and Conditions are given. The Biological Opinions are consistent with PACFISH S&Gs, and include additional monitoring, analysis processes, thresholds for management activities, documentation, and reporting requirements. Copies of these are available at the Forest Supervisor's Office in Pendleton.

### 3.3.3.4.2.3 UMATILLA AND WALLOWA-WHITMAN NATIONAL FORESTS LAND AND RESOURCE MANAGEMENT PLANS

Under the direction and policies prescribed in the National Forest Management Act, the Umatilla and Wallowa-Whitman National Forest Land and Resource Management Plans (Forest Plans) were developed and adopted in 1990. Since that time, they have been amended by PACFISH, the Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales (Eastside Screens), the direction from various Biological Opinions, and several non-significant Forest Plan amendments. The Forest Plans are integrated planning documents that establish land allocations, defines land management goals and objectives, and provides land management direction, standards, guidelines and monitoring requirements for management activities on land managed by these national forests. These are large, comprehensive planning documents with integrated sets of S&Gs that must be met during project planning and implementation. While the Umatilla National Forest Plan is comprehensive and includes many allocations and resource considerations, the following goals are provided for water and aquatic considerations. Standards and Guidelines are included within the Forest Plan that guide attainment of these goals:

**Water:** Manage National Forest resources to protect all existing beneficial uses of water and to meet or exceed all applicable state and federal water quality standards. Within the Forest capability, maintain or enhance water quality, quantity, and timing of stream flows to meet needs of downstream users and other resources, maintain integrity and equilibrium of all stream systems, riparian areas, and wetlands on the Forest. Manage designated municipal supply watersheds to provide water which, with treatment, will result in a satisfactory and safe water supply.

**Riparian/Fish Habitat:** Provide and maintain a diverse, well distributed pattern of fish habitats to assist in doubling anadromous runs in the Columbia River basin in cooperation with states and other agencies. The goal applies to all areas dominated by riparian vegetation including areas containing anadromous and resident fish habitat, perennial and intermittent stream courses, wetlands, and floodplains.

The following are geographically specific land designations linked to water quality programs and measures (Umatilla National Forest Land and Resource Management Plan, 1990).

**Management Area C5 Riparian (Fish and Wildlife)** Maintain or enhance water quality, and produce a high level of potential habitat capability for all species of fish and wildlife within the designated riparian habitat areas (mapped) while providing for a high level of habitat effectiveness for big game.

**Management Area B1 Wilderness** Manage to preserve, protect, and improve the resources and values of the Forest Wildernesses, as directed by the Wilderness Act of 1964.

## 3.3.3.4.2.4 OTHER DIRECTION

The federal lands are subject to numerous other laws, regulations and policies. The Clean Water Act, Clean Air Act, National Environmental Policy Act, Wilderness Act, and the National Forest Management Act are a few examples. In addition, the U.S. Forest Service works with a Memorandum of Understanding with Oregon Dept. of Environmental Quality, related to water and air quality matters. Further information can be found at the Forest Supervisor's Office of the Umatilla National Forest.

The Umatilla National Forest is guided by the following vision statement which influences programs and activities throughout the Forest: "The Umatilla National Forest will be managed to focus on restoring, maintaining, and conserving healthy, sustainable watershed conditions. This includes all aspects of watershed management such as vegetation, risk from natural and human disturbances, production of cold, clean water, and species recovery under the Endangered Species Act. Our funded program of work will include activities that are integrated to achieve watershed objectives that are well defined through Ecosystem Analysis at the Watershed Scale and consistent with Forest Plan direction. We will continue to work with our communities as partners within the larger landscape to achieve overall objectives of society. Products will continue to be produced as outcomes of our work through our focus on healthy watersheds. Although our activities will be guided and driven by the funded program of work, we will provide society with an integrated approach to managing sustainable watersheds for current and future generations."

All of the lands managed by the Umatilla and Wallowa-Whitman National Forests are lands that were ceded to the Federal Government by American Indian Tribes by the Treaties of 1855. In these treaties, lands were conveyed to the Federal Government, while rights and interests were reserved by the Tribes. The US Forest Service has a responsibility to consult with Tribes to assure that Tribal interests are considered in land management decisions.

The above general policies, laws, and direction guide management activities on federal lands within the Umatilla River Basin. As stated above, more specific direction as well as BMPs can be found in the references of Attachment D, or on file at the Umatilla National Forest Headquarters Office in Pendleton. Listed below are summary statements for some of the direction and management measures employed on national forest lands:

**PACFISH RHCAs:** Riparian Habitat Conservation Areas include streamside areas, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems by (1) influencing the delivery of coarse sediment, organic matter, and woody debris to streams, (2) providing root strength for channel stability, (3) shading the stream, and (4) protecting water quality. The interim widths are described as follows:

**Fish-bearing streams:** includes the stream and the area on either side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to the distance equal to the height of two site-potential trees, or 300 feet slope distance (600 feet, including both sides of the stream channel), whichever is greatest.

**Permanently flowing non-fish bearing streams:** includes the stream and the area on either side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year flood plain, or to the outer edges of riparian vegetation, or to the distance equal to the height of one site-potential tree, or 150 feet slope distance (300 feet, including both sides of the stream channel), whichever is greatest.

**Ponds, lakes, reservoirs, and wetlands greater than 1 acre:** Includes the waterbody and the area to the outer edges of the riparian vegetation, or to the extent of the seasonally saturated soil, or to the extent of moderately and highly unstable areas, or to a distance equal to the height of one site potential tree, or 150 feet slope distance from the edge of the maximum pool elevation of constructed ponds and reservoirs or from the edge of the wetland, pond or lake, whichever is greatest.

**Seasonally flowing or intermittent streams, wetlands less than 1 acre, landslides, and landslide-prone areas:** At a minimum, these widths must include: The extent of landslides and landslide-prone areas; the intermittent stream channel and the area to the top of the inner gorge; the intermittent stream channel or wetland and the area to the outer edges of the riparian vegetation; the area from the edges of the stream channel, wetland, landslide, or landslide-prone area to a distance equal to the height of one site-potential tree; or 100 feet slope distance, whichever is greatest.

In general, timber harvest and road building activities are prohibited or highly restricted within RHCAs. New activities within RHCAs are only allowed after a comprehensive watershed analysis has been completed and the results indicate that certain activities will not retard or prevent attainment of Riparian Management Objectives (RMOs), such as streambank stability, sediment, large, woody debris, pool development, shading, and soil stability. In addition, grazing practices are quite restrictive within RHCAs. The Umatilla National Forest has taken steps to assure there is little risk of livestock/fish interactions during spawning and egg development stages. Livestock grazing in RHCAs must not retard or prevent attainment of RMOs. Monitoring of grazing activities is guided by direction from PACFISH, and the Biological Opinions applicable on National Forest Lands for bull trout and steelhead trout. In addition, other activities such as camping, All Terrain Vehicle use, mining, and access are subject to restrictions aimed at protecting and improving riparian conditions.

An Ecosystem Analysis at the Watershed Scale (watershed analysis) has been completed for the national forest lands including the North Fork Umatilla, South Fork Umatilla, and Meacham Creek drainages. This is a comprehensive analysis of existing conditions, trends, risks, and opportunities. Although this is not a decision document, based on the analysis, it recommends management actions by sub-watershed. These management actions are usually projects that maintain or enhance watershed conditions, such as road closures, reductions in fire risk, reductions in susceptibility to insects and disease, and riparian improvements. Watershed analysis has not been completed for other national forest tributaries to the Umatilla River.

#### 3.3.3.4.2.5 POSSIBLE CHANGES FROM OTHER PLANNING ACTIVITIES

The Forest Service and Bureau of Land Management are developing a science based ecosystem management strategy for lands administrated by these agencies throughout the interior Columbia Basin, including the Umatilla Basin. Final decisions are expected in year 2001, and would amend existing land and resource management plans. This plan is the Interior Columbia Basin Ecosystem Management Project (ICBEMP). The Umatilla and Wallowa-Whitman National Forests have been incorporating new science findings from the Project in current activities, and do not anticipate significant changes in the kinds, locations, or mixes of watershed restoration projects as a result of decisions from ICBEMP. If the ICBEMP is implemented and forest plans are amended, anticipated changes would include additional analysis requirements and further protection of intermittent streams, through a new aquatic conservation strategy that would replace PACFISH. The ICBEMP proposals are not yet final, and subject to further changes.

## 3.3.3.5 ASSURANCES OF IMPLEMENTATION

## 3.3.3.5.1. Private and State Lands

The FPA and associated regulations are enforceable and include specific management criteria and BMPs.

The implementation program for the FPA in the Umatilla Basin is as follows. ODF employs a full-time professional forester to administer the engineering, educational and enforcement aspects of the FPA. This individual monitors and inspects approximately 120 - 180 forest operations annually within the Basin. Of these inspections, approximately 60 are related to timber harvest operations annually. On a statewide level, ODF has a strong staff level involvement including technical specialists in the areas of hydrology, geology and fish and wildlife biology.

A statewide monitoring effort is also an on-going program within ODF. The work plan for the monitoring program (eight staff positions) includes an FPA rule compliance project and the monitoring of the effectiveness of the FPA riparian requirements in terms of meeting state water quality standards (discussed previously and in **Attachment A**).

## 3.3.3.5.2 National Forest Lands

Projects and programs that are conducted on National Forest lands are done with full public disclosure and involvement. Prior to project planning, watershed assessments are generally conducted to examine the conditions, trends, risks and opportunities within watersheds. These assessments also recommend actions for consideration, within the constraints of existing laws, regulations and policies. Any federal action is preceded by the National Environmental Policy Act

(NEPA) procedures that assure full disclosure of project alternatives and effects, along with providing for public review and participation. Where species are listed under the Endangered Species Act, consultation with the appropriate listing agency occurs prior to approval of the project. Projects must be designed to conserve listed species, and prevent jeopardy to their continued existence. Once projects are initiated, they are closely reviewed for compliance with existing laws and to assure they meet planned objectives.

The Umatilla National Forest conducts several types of monitoring to assure compliance with project objectives and long-term improvement in watershed conditions. Implementation monitoring is done to assure that projects are implemented as designed. Effectiveness monitoring determines if project design and implementation (including BMPs) are effective in meeting project objectives. Baseline monitoring is done for water quality and other resource issues to help determine trends over time. In addition to this monitoring, periodic project and program reviews are conducted to assure compliance with policies, biological opinions under the Endangered Species Act, regulations, and laws. Often these reviews are conducted on an inter-agency basis, and others, including local officials, tribes, and other interests are invited to participate. The Umatilla National Forest is also an active partner in the coordinated inter-agency water quality monitoring efforts in the Umatilla Basin.

Chapter 5 of the Umatilla National Forest Land and Resource Management Plan describes the implementation and monitoring strategies for carrying out management actions on the Forest. Each year, in conjunction with the Wallowa-Whitman and Malheur National Forests, the Umatilla National Forest produces an annual monitoring report. These reports are available from each national forest. Included in these reports is effectiveness monitoring for BMPs conducted for that particular year. The Umatilla National Forest monitors the effectiveness of BMPs on at least two projects for each ranger district (4) each year. In addition, the Umatilla National Forest manages the High Ridge Barometer Watershed in the headwaters of the Umatilla Basin. This is one of very few long term monitoring projects that has been in existence for over 30 years. Water quality and quantity monitoring in relation to differing management activities has been well documented over time. The results of this monitoring have been useful as other projects are designed in similar situations in other parts of the northern Blue Mountains.

## 3.3.3.6 UNCERTAINTIES AND RISKS FOR ALL FOREST LANDS

As with any planning effort, there are uncertainties and risks. These come in many forms, including natural events that can reshape the landscape, as well as human activities or societal changes. The forested landscapes are very dynamic. Insects, disease, wildland fire, and floods are periodic disturbances that can alter hydrologic conditions, and are expected to influence the landscape over time. Modeling always has a degree of uncertainty, based on assumptions, data and other parameters. Climate changes affect water quality and watershed recovery timeframes. The effectiveness of BMPs may vary, depending on local conditions and other project design criteria. Wide ranging species at risk or listed under the Endangered Species Act are influenced by a wide variety of factors not necessarily controlled by local water quality management plans. Other federal and state programs can alter standards, objectives or options in meeting these. In addition, prescriptive approaches to management, such as buffer widths, do not guarantee desired results. The use of BMPs continues to be a positive means of improving trends and conditions over time. Key to this success are monitoring and adaptive management techniques which provide the best means to assure progress over time in meeting overall water quality goals.

Best Management Practices are designed to control pollution from identified non-point sources to the maximum extent practicable. With this is a degree of variation and uncertainty. Natural levels of sediment delivery to the tributaries of the Umatilla River are highly variable, both seasonally and annually. In years of major storm events, background levels of sediment are likely to be high, and will be lower in years of mild climate. Drought cycles will also affect the natural sediment levels and inputs since there will be less sediment delivered to the channel system from upslope areas and in-channel sediments will tend to remain in place. A major long-term investment of time and money would be necessary to increase any likelihood of detecting sediment changes in the water column, channel morphology, or aquatic habitat related to management activities. (USDA Forest Service TMDL Policy and Framework).

Water temperature in the Umatilla River tributaries and mainstem is highly variable, responding mainly to water quantity, direct solar heating, shading effects, groundwater input and ambient air temperature. Riparian vegetation along tributary streams and the mainstem is mixed, dominated by species of hardwoods and conifers. Vegetation density and resultant shading, varies with the plant community and plant density. Riparian plant communities are subject to considerable variation over time as a result of natural disturbances (e.g., floods, fire, insects, and disease). Natural recovery of riparian disturbances along tributaries and the mainstem can take decades to create plant canopy conditions that provide efficient shading. Water temperature also varies with changes in climate cycles.

With these uncertainties in mind, BMPs are considered to be the most effective means to controlling non-point sources of pollution. Through review and adjustment, BMPs are adaptable and can compensate for uncertainties and variability from unplanned events. BMPs are developed to minimize adverse effects of human induced activities on water quality. They are also designed to help produce long-term positive improvements in watershed conditions over time. Through an interagency approach, BMPs are a set of integrated practices that have periodic review within the scientific community. Attachment D contains a brief list of references on the effectiveness of Best Management Practices. Both the US Forest Service and Oregon Department of Forestry routinely review projects to assure that BMPs are actually used as intended. Other processes, such as the review recently conducted by the Oregon Department of Forestry, review the rate of compliance with BMPs on a broader scale throughout the State. There are several research projects examining the effectiveness of BMPs. And finally, adaptive management used by both agencies, provides the mechanism for updating BMPs and developing new approaches to their applications.

## 3.3.3.7 RECOMMENDATIONS

**It is the recommendation of the Stakeholders Committee and Forestry Workgroup, that on private and State forest lands, to continue to use the current and future BMPs (i.e. Oregon FPA) as the enforceable forestry component for the Umatilla Basin WQMP.**

**It is further recommended that the processes defined in the ODEQ and ODF Memorandum of Understanding (Appendix B) continue to be implemented to assess the adequacy of resource protection on forest lands that fall under the regulations of the Oregon Forest Practices Act. This process may result in findings that indicate changes are needed to the current forest practice rules to protect water quality. Any rule changes that occur must comply with the standards articulated under ORS 527.714(5).**

**It is the recommendation of the Stakeholders Committee and Forestry Workgroup to support a comprehensive forestry incentive program for non-federal forest landowners developed in conjunction with UBWC, SWCD, private, state and federal natural resource agencies. This incentive program should be packaged and ready for implementation within a year of approval of this water quality management plan. A component of this strategy would be for Oregon Department of Forestry to employ a service forester in the Umatilla Basin to facilitate on-the-ground projects.**

**It is the recommendation of the Stakeholders Committee and Forestry Workgroup that the existing procedures, policies and directions for National Forest lands be adopted as the**

**method of meeting water quality objectives under the TMDL process. In addition, strong support is recommended for federal agencies to partner with others to provide resources and funding for watershed improvement projects.**

Under this recommendation, current and planned restoration strategies are moving toward addressing past problems with temperature, sediment, and habitat and other water quality concerns. Within the Umatilla Basin on forested lands, activities regulated by existing procedures, coupled with active watershed restoration is helping assure progress in improving overall water quality conditions. Such things as improving road locations, improved maintenance, and closure and obliteration of unneeded roads are improving sediment conditions. Riparian buffers and management to encourage riparian vegetation growth are addressing temperature concerns. Instream structure maintenance, repair, and improvements are helping to create better aquatic habitat. Upland activities, such as thinning to reduce stresses on vegetation, prescribed burning to reduce fuels, and removing unnatural accumulations of dead and dying trees to reduce wildland fire hazards are contributing to the improvement of sustainable forested lands, more capable of withstanding changes from insects, disease and fire. Watershed analysis helps managers take a broader look at conditions, risks, and opportunities, so that priorities for actions are more in line with watershed restoration needs.

There are many sideboards in place, and more watershed restoration actions being planned. There is a need to continue the strong commitment to monitoring on an interagency basis. There is a high need on public lands and with cooperating private landowners for more information from riparian inventories and classification to know what the riparian areas are capable of growing. These are projects that could be very helpful on both private and public lands to be able to wisely use limited investment and incentive programs for overall riparian improvements.

# ATTACHMENT A: SPECIFIC WATER QUALITY ISSUES AND WQMP'S ADDRESSED BY THE FOREST PRACTICES ACT

The purpose and goals of Oregon's Water Protection Rules (OAR 629-635-100) include protecting, maintaining, and improving the functions and values of streams, lakes, wetlands, and riparian management areas. Best management practices (BMPs) in the Oregon Forest Practices Act (FPA), including riparian zone protection measures and a host of other measures described below, are the mechanism for meeting State Water Quality Standards (WQS). There is a substantial body of scientific research and monitoring that supports an underlying assumption of the FPA, that maintaining riparian processes and functions is critical for water quality and fish and wildlife habitat. These riparian processes and functions include: Shade for stream temperature and for riparian species; large wood delivery to streams and riparian areas; leaf and other organic matter inputs; riparian microclimate regulation; sediment trapping; soil moisture and temperature maintenance; providing aquatic and riparian species dependent habitat; and nutrient and mineral cycling. The FPA provides a broad array of water quality benefits and contributes to meeting water quality standards for water quality parameters such as temperature, sediment, dissolved oxygen, nutrients, and aquatic habitat.

Currently, many streams within the Umatilla River basin significantly exceed the WQS for water temperature. The water quality impairment(s) in the Umatilla River basin clearly do not result solely from current forestry activities. The proposed Umatilla River basin Total Maximum Daily Load (TMDL) demonstrates that urban and agriculture areas contribute significantly to water quality impairment within the Basin. It is also important to note that historic forest practices such as splash dam activities and the widespread removal of wood from streams may continue to influence current stream conditions and riparian functions. In addition, current forest practices occur on forestlands that simultaneously support non-forestry land uses that can affect water quality, such as grazing, recreation, and public access roads. With this noted, the TMDL demonstrates that increasing the level of riparian vegetation retained along forested reaches of these streams reduces solar loading, potentially preventing a substantial amount of stream heating. While providing high levels of shade to streams is an important aspect of meeting instream temperature standards it needs to be considered within the context of past management, stream morphology and flows, groundwater influences, site-productivity, insects, fire, and other disturbance mechanisms that vary in time and space across the landscape.

As described below, ODF and ODEQ are involved in several statewide efforts to analyze the existing FPA measures and to better define the relationship between the TMDL load allocations and the FPA measures designed to protect water quality. The information in the TMDL, as well as other monitoring data, will be an important part of the body of information used in determining the adequacy of the FPA.

Forest practices on non-federal land in Oregon are regulated under the FPA and implemented through administrative rules that are administered by the Oregon Department of Forestry (ODF). The Oregon Board of Forestry (BOF), in consultation with the Environmental Quality Commission (EQC), establish BMPs and other rules to ensure that, to the extent practicable, NPS pollution resulting from forest operations does not impair the attainment of water quality standards. With respect to the temperature standard, surface water temperature management plans are required according to OAR 340-041-0026 when temperature criteria are exceeded and the waterbody is designated as water-quality limited under Section 303(d) of the Clean Water Act. In the case of state and private forestlands, OAR 340-041-0120 identifies the FPA rules as the surface water management plan for forestry activities

ODF and ODEQ statutes and rules also include provisions for adaptive management that provide for revisions to FPA practices where necessary to meet water quality standards. These provisions are described in ORS 527.710, ORS 527.765, ORS 183.310, OAR 340-041-0026, OAR

629-635-110, and OAR 340-041-0120. Current adaptive management efforts under several of the above statutes and rules are described in more detail following the discussion below on the roles of the BOF and EQC in developing BMPs that will achieve water quality standards.

ORS 527.765 Best management practices to maintain water quality.
(1) The State Board of Forestry shall establish best management practices and other rules applying to forest practices as necessary to insure that to the maximum extent practicable non-point source discharges of pollutants resulting from forest operations on forestlands do not impair the achievement and maintenance of water quality standards established by the Environmental Quality Commission for the waters of the state. Such best management practices shall consist of forest practices rules adopted to prevent or reduce pollution of waters of the state. Factors to be considered by the board in establishing best management practices shall include, where applicable, but not be limited to:

(a) Beneficial uses of waters potentially impacted;
(b) The effects of past forest practices on beneficial uses of water;
(c) Appropriate practices employed by other forest managers;
(d) Technical, economic and institutional feasibility; and
(e) Natural variations in geomorphology and hydrology.

ORS 527.770 Good faith compliance with best management practices not violation of water quality standards; subsequent enforcement of standards.
A forest operator conducting, or in good faith proposing to conduct, operations in accordance with best management practices currently in effect shall not be considered in violation of any water quality standards. When the State Board of Forestry adopts new best management practices and other rules applying to forest operations, such rules shall apply to all current or proposed forest operations upon their effective dates.

There are currently extensive statutes and administrative rules that regulate forest management activities in the Umatilla basin that address the key water quality issues of stream temperatures, riparian aquatic functions, and sediment dynamics. The following is a list of specific administrative rules describing the purpose and goals of the FPA towards the achievement and maintenance of water quality standards established by the EQC.

OAR 629-635-100 - Water Protection Rules; Purpose and Goals
(3) The purpose of the water protection rules is to protect, maintain and, where appropriate, improve the functions and values of streams, lakes, wetlands, and riparian management areas. These functions and values include water quality, hydrologic functions, the growing and harvesting of trees, and fish and wildlife resources.
(4) The water protection rules include general vegetation retention prescriptions for streams, lakes and wetlands that apply where current vegetation conditions within the riparian management area have or are likely to develop characteristics of mature forest stands in a "timely manner." Landowners are encouraged to manage stands within riparian management areas in order to grow trees in excess of what must be retained so that the excess may be harvested.
(5) The water protection rules also include alternative vegetation retention prescriptions for streams to allow incentives for operators to actively manage vegetation where existing vegetation conditions are not likely to develop characteristics of mature conifer forest stands in a "timely manner."
(6) OARs 629-640-400 and 629-645-020 allow an operator to propose site-specific prescriptions for sites where specific evaluation of vegetation within a riparian management area and/or the condition of the water of the state is used to identify the appropriate practices for achieving the vegetation and protection goals.
(7) The overall goal of the water protection rules is to provide resource protection during operations adjacent to and within streams, lakes, wetlands and riparian management areas so that, while continuing to grow and harvest trees, the protection goals for fish, wildlife, and water quality are met.
(a) The protection goal for water quality (as prescribed in ORS 527.765) is to ensure through the described forest practices that, to the maximum extent practicable, non-point source

discharges of pollutants resulting from forest operations do not impair the achievement and maintenance of the water quality standards.

(b) The protection goal for fish is to establish and retain vegetation consistent with the vegetation retention objectives described in OAR 629-640-000 (streams), OAR 629-645-000 (significant wetlands), and OAR 629-650-000 (lakes) that will maintain water quality and provide aquatic habitat components and functions such as shade, large woody debris, and nutrients.

OAR 629-640-000 - Vegetation Retention Goals for Streams; Desired Future Conditions

(1) The purpose of this rule is to describe how the vegetation retention measures for streams were determined, their purpose and how the measures are implemented. The vegetation retention requirements for streams described in OAR 629-640-100 through OAR 629-640-400 are designed to produced desired future conditions for the wide range of stand types, channel conditions, and disturbance regimes that exist throughout forestlands in Oregon.

(2) The desired future condition for streamside areas along fish use streams is to grow and retain vegetation so that, over time, average conditions across the landscape become similar to those of mature streamside stands. Oregon has a tremendous diversity of forest tree species growing along waters of the state and the age of mature streamside stands varies by species. Mature streamside stands are often dominated by conifer trees. For many conifer stands, mature stands occur between 80 and 200 years of stand age. Hardwood stands and some conifer stands may become mature at an earlier age. Mature stands provide ample shade over the channel, an abundance of large woody debris in the channel, channel-influencing root masses along the edge of the high water level, snags, and regular inputs of nutrients through litter fall.

(3) The rule standards for desired future conditions for fish use streams were developed by estimating the conifer basal area for average unmanaged mature streamside stands (at age 120) for each geographic region. This was done by using normal conifer yield tables for the average upland stand in the geographic region, and then adjusting the basal area for the effects of riparian influences on stocking, growth and mortality or by using available streamside stand data for mature stands.

(4) The desired future condition for streamside areas that do not have fish use is to have sufficient streamside vegetation to support the functions and processes that are important to downstream fish use waters and domestic water use and to supplement wildlife habitat across the landscape. Such functions and processes include: maintenance of cool water temperature and other water quality parameters; influences on sediment production and bank stability; additions of nutrients and large conifer organic debris; and provision of snags, cover, and trees for wildlife.

(5) The rule standards for desired future conditions for streams that do not have fish use were developed in a manner similar to fish use streams. In calculating the rule standards, other factors used in developing the desired future condition for large streams without fish use and all medium and small streams included the effects of trees regenerated in the riparian management area during the next rotation and desired levels of instream large woody debris.

(6) For streamside areas where the native tree community would be conifer dominated stands, mature streamside conditions are achieved by retaining a sufficient amount of conifers next to large and medium sized fish use streams at the time of harvest, so that halfway through the next rotation or period between harvest entries, the conifer basal area and density is similar to mature unmanaged conifer stands. In calculating the rule standards, a rotation age of 50 years was assumed for even-aged management and a period between entries of 25 years was assumed for uneven-aged management. The long-term maintenance of streamside conifer stands is likely to require incentives to landowners to manage streamside areas so that conifer reforestation occurs to replace older conifers over time.

(7) Conifer basal area and density targets to produce mature stand conditions over time are outlined in the general vegetation retention prescriptions. In order to ensure compliance with state water

quality standards, these rules include requirements to retain all trees within 20 feet and under-story vegetation within 10 feet of the high water level of specified channels to provide shade.

(8) For streamside areas where the native tree community would be hardwood dominated stands, mature streamside conditions are achieved by retaining sufficient hardwood trees. As early successional species, the long-term maintenance of hardwood streamside stands will in some cases require managed harvest using site specific vegetation retention prescriptions so that reforestation occurs to replace older trees. In order to ensure compliance with state water quality standards, these rules include requirements in the general vegetation retention prescription to retain all trees within 20 feet and under-story vegetation within 10 feet of the high water level of specified channels to provide shade.

(9) In many cases the desired future condition for streams can be achieved by applying the general vegetation retention prescriptions, as described in OAR 629-640-100 and OAR 629-640-200. In other cases, the existing streamside vegetation may be incapable of developing into the future desired conditions in a "timely manner." In this case, the operator can apply an alternative vegetation retention prescription described in OAR 629-640-300 or develop a site specific vegetation retention prescription described in OAR 629-640-400. For the purposes of the water protection rules, "in a timely manner" means that the trees within the riparian management area will meet or exceed the applicable basal area target or vegetation retention goal during the period of the next harvest entry that would be normal for the site. This will be 50 years for many sites.

(10) Where the native tree community would be conifer dominant stands, but due to historical events the stand has become dominated by hardwoods, in particular, red alder, disturbance is allowed to produce conditions suitable for the re-establishment of conifer. In this and other situations where the existing streamside vegetation is incapable of developing characteristics of a mature streamside stand in a "timely manner," the desired action is to manipulate the streamside area and woody debris levels at the time of harvest (through an alternative vegetation retention prescription or site specific vegetation retention prescription) to attain such characteristics more quickly.

The Water Protection Rules are an important component of the rules that are designed to achieve and maintain water quality standards. The rules identify seven geographic regions and distinguishes between streams, lakes, and wetlands. The rules further distinguish each stream by size and type. Stream size is distinguished as small, medium, or large, based on average annual flow. Stream type is distinguished as fish use, domestic use, or neither.

Generally, no tree harvesting is allowed within 20 feet of all fish bearing, all domestic-use, and all other medium and large streams unless stand restoration is needed. In addition, all snags and downed wood must be retained in every riparian management area. Provisions governing vegetation retention are designed to encourage conifer restoration on riparian forestland that is not currently in the desired conifer condition. Future supplies of conifer on these sites are deemed desirable to support stream functions and to provide fish and wildlife habitat. The rules provide incentives for landowners to place large wood in streams to immediately enhance fish habitat. Other alternatives are provided to address site-specific conditions and large-scale catastrophic events.

The goal for managing riparian forests along fish-use streams is to grow and retain vegetation so that, over time, average conditions across the riparian landscape become similar to those of mature unmanaged riparian stands. This goal is based on the following considerations:

(1) Mature riparian stands can supply large, persistent woody debris necessary to maintain adequate fish habitat. A shortage of large wood currently exists in streams on non-federal forestlands due to historic practices and a wide distribution of young, second growth forests. For most streams, mature riparian stands are able to provide more of the functions and inputs of large wood than are provided by young second-growth trees.

(2) Historically, riparian forests were periodically disturbed by wildfire, windstorms, floods, and disease. These forests were also impacted by wildlife such as beaver, deer, and elk. These disturbances maintained a forest landscape comprised of riparian stands of all ages ranging from early successional to old growth. At any given time, however, it is likely that a significant proportion of the riparian areas supported forests of mature age classes. This distribution of mature riparian forests supported a supply of large, persistent woody debris that was important in maintaining quality fish habitat.

The overall goals of the riparian vegetation retention rules along Type N and Type D streams are the following:

- Grow and retain vegetation sufficient to support the functions and processes that are important to downstream waters that have fish;
- Maintain the quality of domestic water; and
- Supplement wildlife habitat across the landscape.

These streams have reduced buffer widths and reduced basal area retention requirements as compared to similar sized Type F streams (Table 1). In the design of the rules this was judged appropriate based on a few assumptions. First, it was assumed that the amount of large wood entering Type N and D channels over time was not as important for maintaining fish populations within a given stream reach. And second, it was assumed that the future stand could provide some level of "functional" wood over time in terms of nutrient inputs and sediment storage. The validity of these assumptions needs to be evaluated over time through monitoring.

**Table 1**. Riparian Management Area widths for streams of various sizes and beneficial uses (OAR 629-635-310).

| | Type F | Type D | Type N |
|---|---|---|---|
| *LARGE* | 100 feet | 70 feet | 70 feet |
| *MEDIUM* | 70 feet | 50 feet | 50 feet |
| *SMALL* | 50 feet | 20 feet | Apply specified water quality protection measures, and see OAR 629-640-200 |

For all streams that require an RMA, basal area targets are established that are used for any type of management within the RMA. These targets were determined based on the data that was available at the time, with the expectation that these targets could be achieved on the ground. There is also a minimum tree number requirement of 40 trees per 1000 feet along large streams (11-inch minimum diameter at breast height), and 30 trees per 1000 feet along medium streams (8-inch minimum diameter at breast height). The specific levels of large wood inputs that the rules are designed to achieve are based on the stream size and type. The biological and physical characteristics specific to a given stream are taken into account in determining the quantity and quality of large wood that is functional for that stream. Given the potential large wood that is functional for a given stream, a combination of basal area targets, minimum tree retention, buffer widths, and future regenerated stands and ingrowth are used to achieve the appropriate large wood inputs and effective shade for a given stream.

The expectation is that these vegetation retention standards will be sufficient towards maintaining stream temperatures that are within the range of natural variability. In the design of the Water Protection Rules shade data was gathered for 40 small non-fish-bearing streams to determine the shade recovery rates after harvesting. One to two years after harvest, 55 percent of these streams were at or above pre-harvest shade levels due to under-story vegetation regrowth. Most of these streams had a bankfull width averaging less than six feet, and most shade was provided by shrubs and grasses within 10 feet of the bank. Since 1991 there has also been a 120-acre limit on a single clearcut size, which is likely to result in a scattering of harvested area across a watershed over time. In the development of the rules it was assumed that this combined with the relative rapid shade recovery along smaller non-fish-bearing streams would be adequate in protecting stream temperatures and reduce possible cumulative effects. For fish bearing streams it is assumed that a 20-foot no-harvest buffer, combined with the tree retention requirements for the rest of the RMA, will be adequate to maintain shade levels necessary to achieve stream temperature standards. The monitoring program is currently collecting data to test these assumptions, evaluate the effectiveness of the rules, and evaluate whether or not water quality standards for temperature are being achieved.

In terms of sediment issues specific to forest roads, there are BMPs within the FPA specifically designed to regulate road design, construction and maintenance. The bulk of the BMPs are directed at minimizing sediment delivery to channels. The primary goals of the road rules are to: (1) protect the water quality of streams, lakes, and wetlands; (2) protect fish and wildlife habitat; and (3) protect forest productivity.

The Board of Forestry revised several BMPs related to road design when the new Water Protection Rules were adopted in the fall of 1994. Significant changes made to the road construction rules include the following:

- The requirement for operators not to locate roads in riparian management areas, flood plains, or wetlands unless all alternative locations would result in greater resource damage.
- The requirement for operators to design stream crossings to both minimize fill size and minimize excavation of slopes near the channel. A mandatory written plan is required for stream crossing fills over 15 feet deep.
- The requirement to design stream crossing structures for the 50-year flow with no ponding, rather than the 25-year storm with no specification of allowable ponding.
- The requirement that stream crossing structures be passable by juvenile fish as well as adult fish.
- The requirement that fish must be able to access side channels.
- The requirement that stream structures constructed under these rules must be maintained for fish passage.

In determining the location of a new road, operators are required to avoid steep slopes, slides and areas next to channels or in wetlands to the extent possible. Existing roads should be used when possible, and stream crossings should be used only when essential. The design of the road grade must vary to fit the local terrain and the road width must be minimized. The operator must also follow specific guidelines for stream-crossing structures (listed above). Cross-drainage structures must be designed to divert water away from channels so that runoff intercepted by the road is dispersed onto the hillslope before reaching a channel. The specific method used is up to the operator, but the end result should be the dispersal of water running off of the road and the filtering of fine sediment before the water reaches waters of the state.

Construction and maintenance activities should be done during low water periods and when soils are relatively dry. Excavated materials must be placed where there is minimal risk of those materials entering waters of the state, and erodible surfaces must be stabilized. Landings must be built away from streams, wetlands and steep slopes.

Road maintenance is required on all active and inactive roads. Regardless of when a road was constructed, if the road has been used as part of an active operation after 1972, it is subject to all maintenance requirements within the current rules. Culverts must be kept open, and surface road drainage and adequate filtering of fine sediment must be maintained. If the road surface becomes unstable or if there is a significant risk of sediment running off of the road surface and entering the stream, road activity must be halted and the erodible area must be stabilized. Abandoned roads constructed prior to 1972 and not used for forest management since that time are not subject to Forest Practices regulatory authority.

All roads in use since 1972 must either be maintained or vacated by the operator. Vacated roads must be effectively barricaded and self-maintaining, in terms of diverting water away from streams and off of the former road surface, where erosion will remain unlikely. Methods for vacating roads include pulling stream-crossing fills, pulling steep side cast fills, and cross ditching. It is up to the landowner to choose between vacating a road and maintaining a road. If a road is not vacated, the operator is required to maintain the road under the current rules whether it is active or inactive, however they are not required to bring the design up to current standards outside of the normal maintenance and repair schedule.

The ODF has a monitoring program that is currently coordinating separate projects to monitor the effectiveness of the forest practice rules with regard to landslides, riparian function, stream temperature, chemical applications, sediment from roads, BMP compliance, and shade. The results from some of these projects have been released in the form of final reports and other projects will have final reports available in the spring of 2000, 2001 and beyond.

Voluntary measures are currently being implemented across the state under the Oregon Plan for Salmon and Watersheds (OPSW) to address water quality protection. These measures are designed to supplement the conifer stocking within riparian areas, increase large wood inputs to streams, and provide for additional shade. This is accomplished during harvest operations by (1) placing appropriate sized large wood within streams that meet parameters of gradient, width and existing wood in the channel; and (2) relocating in-unit leave trees in priority areas[10] to maximize their benefit to salmonids while recognizing operational constraints, other wildlife needs, and specific landowner concerns.

<u>The measures include the following:</u>

ODF 8S: Riparian Conifer Restoration

Forest practice rules have been developed to allow and provide incentives for the restoration of conifer forests along hardwood-dominated RMAs where conifers historically were present. This process enables sites capable of growing conifers to contribute conifer LWD in a timelier manner. This process will be modified to require an additional review process before the implementation of conifer restoration within core areas.

ODF 19S: Additional Conifer Retention along Fish-Bearing Streams in Core Areas -
This measure retains more conifers in RMAs by limiting harvest activities to 25 percent of the conifer basal area above the standard target. This measure is only applied to RMAs containing a conifer basal area that is greater than the standard target.

ODF 20S: Limited RMA for Small Type N Streams in Core Areas

This measure provides limited 20 foot RMAs along all perennial or intermittent small Type N streams for the purpose of retaining snags and downed wood.

ODF 21S: Active Placement of large wood during Forest Operations

This measure provides a more aggressive and comprehensive program for placing large wood in streams currently deficient of large wood. Placement of large wood is accomplished following existing ODF/ODFW placement guidelines and determining the need for large wood placement is based upon a site-specific stream survey.

ODF 22S: 25 Percent In-unit Leave Tree Placement and Additional Voluntary Retention -

This measure has one non-voluntary component and two voluntary components:

1) The State Forester, under statutory authority, will direct operators to place 25 percent of in-unit leave trees in or adjacent to riparian management areas on Type F and D streams.
2) The operator voluntarily locates the additional 75 percent in-unit leave trees along Type N, D or F streams, and

[10] The Executive Order replaced the concept of “core areas” with “priority areas”. See (1)(f) of the Executive Order (p.5).

3) The State Forester requests the conifer component be increased to 75 percent from 50 percent.

ODF 61S: Analysis of "Rack" Concept for Debris Flows

OFIC members will conduct surveys to determine the feasibility and value of retaining trees along small type N streams with a high probability of debris flow in a "rack" just above the confluence with a Type F stream. The rack would extend from the RMA along the Type F stream up the Type N stream some distance for the purpose of retaining trees that have a high likelihood of delivery to the Type F stream.

ODF 62S: Voluntary No-Harvest Riparian Management Areas

Establishes a system to report and track, on a site-specific basis, when landowners voluntarily take the opportunity to retain no-harvest RMAs.

The voluntary management measures are implemented within priority areas. Several of the measures utilize in-unit leave trees and are applied in a “menu” approach to the extent in-unit leave trees are available to maximize their value to the restoration of salmonid habitat. The choice of menu measures is at the discretion of the landowner, but one or more of the measures is selected.

The measures can be described as either active restoration measures, or passive restoration measures that provide long-term large wood recruitment. Voluntary measures ODF 8S and 21S are active restoration activities. ODF 8 restores hardwood-dominated riparian areas back to a conifer-dominated condition, where appropriate, using a site-specific plan. Site-specific plans require additional consultation with the ODFW to minimize potential damage to the resource. They often result in conditions that are more protective of the resources than would occur without the site-specific plan. ODF 21S addresses large wood placement if stream surveys determine there is a need. Measures ODF 19S, 20S, 22S, and 62S provide future large wood recruitment through additional riparian protection. This additional protection is accomplished by retaining in-unit leave trees, snags, and downed wood within and along RMAs, and by changing the ratio of in-unit leave trees to 75 percent conifer.

The following application priority has been developed for OPSW voluntary measures for harvest units containing more than one stream type. The list establishes the general priority for placement of in-unit leave trees.

1) Small and medium Type F streams.
2) Non-fish bearing streams (Type D or Type N), especially small low-order headwater stream channels, that may affect downstream water temperatures and the supply of large wood in priority area streams.
3) Streams identified as having a water temperature problem in the ODEQ 303(d) list of water quality limited waterbodies, or as evidenced by other available water temperature data; especially reaches where the additional trees would increase the level of aquatic shade.
4) Potentially unstable slopes where slope failure could deliver large wood.
5) Large Type F streams, especially where low gradient, wide floodplains exist with multiple, braided meandering channels.
6) Significant wetlands and stream-associated wetlands, especially estuaries and beaver pond complexes, associated with a salmon core area stream.

The Oregon Plan also has voluntary measures addressing sediment issues related to forest roads. Many forest roads built prior to the development of the FPA or prior to the current BMPs continue to pose increased risk to fish habitat. Industrial forest landowners and state forest lands are currently implementing the Road Hazard Identification and Risk Reduction Project, measures ODF 1S and ODF 2S, to identify risks to salmon from roads and address those risks. The purposes of this project are:

1. Implement a systematic process to identify road-related risks to salmon and steelhead recovery.
2. Establish priorities for problem solution.
3. Implement actions to reduce road related risks.

The Road Hazard Identification and Risk Reduction Project is a major element of the Oregon Plan. The two major field elements of this project are (1) the surveying of roads using the Forest Road Hazard Inventory Protocol, and (2) the repairing of problem sites identified through the protocol. Road repairs conducted as a result of this project include improving fish passage, reducing washout potential, reducing landslide potential, and reducing the delivery of surface erosion to streams.

Roads assessed by this project include all roads on Oregon Forest Industry Council member forestland, plus some other industrial and non-industrial forestland, regardless of when they were constructed. Industrial forest landowners have estimated spending approximately $13 million a year, or $130 million over the next 10 years, on this project for the coastal ESUs alone. However, the effort is not limited to nor bound by this funding estimate. Funding for the implementation for this measure within the other ESUs will be reflective of road problems found.

Under ODF 2S, the State Forest Lands program has spent over $2.5 million during the last biennium (1997-1999) for the restoration of roads, replacement of culverts and other stream crossing structures damaged by the 1996 storm. State Forest Lands are also proposing to spend an additional $2.5 million dollars in each of the next two biennia to improve roads, including stream crossing structures. This effort will upgrade approximately 130 miles of road in each biennium.

In addition to ODF 1S & 2S, there are additional measures under the Oregon Plan that address road management concerns:

ODF 16S - Evaluation of the Adequacy of Fish Passage Criteria: Establish that the criteria and guidelines used for the design of stream crossing structures pass fish as intended under the goal.
ODF 34S - Improve Fish Passage BMPs on Stream Crossing Structures: Ensure that all new stream crossing structures on forestland installed or replaced after the fall of 1994 will pass both adult and juvenile fish upstream and down stream.

## Adaptive Management Process

By statute, forest operators conducting operations in accordance with the BMPs are considered to be in compliance with Oregon’s water quality standards. The 1994 Water Protection Rules were adopted with the approval of the Environmental Quality Commission as not violating water quality standards. However, there are several provisions within the FPA and rules that require adaptive management.

The ODF is currently in the process of reviewing the effectiveness of the forest practice rules. In January of this year the Governor of Oregon signed Executive Order no. EO 99-01 that directed the Oregon Board of Forestry, with the assistance of an advisory committee, to determine to what extent changes to forest practices are needed to meet state water quality standards and protect and restore salmonids. The committee is directed to consider both regulatory and non-regulatory approaches to water quality protection. To carry out this charge, an ad hoc advisory committee is in the process of developing four separate issue papers on the following topics:

- Fish passage restoration and water classification
- Forest roads
- Riparian functions
- Landslides

The committee represents diverse interests, including environmental, industrial, non-industrial, county, and public advocates. In addition to ODF technical staff, the Oregon Department of Environmental Quality (DEQ) and Oregon Department of Fish and Wildlife (ODFW) have technical staff participating in the process. The committee expects to make recommendations to the Board of Forestry in early 2000. The Board will then consider the recommendations in determining whether revisions to the FPA and additional voluntary approaches are necessary consistent with ORS 527.710.

As the designated management agency (DMA) for water quality management on nonfederal forestlands, the ODF is also working with the ODEQ through a memorandum of understanding (MOU) signed in June of 1998. This MOU was designed to improve the coordination between the ODF and the ODEQ in evaluating and proposing possible changes to the forest practice rules as part of the Total Maximum Daily Load process. The purpose of the MOU is also to guide coordination between the ODF and ODEQ regarding water quality limited streams on the 303d list. An evaluation of rule adequacy will be conducted (also referred to as a "sufficiency analysis") through a water quality parameter by parameter analysis. This statewide demonstration of forest practices rule effectiveness in the protection of water quality will address the following specific parameters and will be conducted in the following order[11]:

1) Temperature (estimated draft report target completion date Spring, 2000)
2) Sediment and turbidity (estimated date Fall, 2000)
3) Aquatic habitat modification (estimated date Spring, 2001)
4) Bio-criteria (estimated date Fall, 2001)
5) Other parameters (estimated date Spring, 2002)

These sufficiency analyses will be reviewed by peers and other interested parties prior to final release. The analyses will be designed to provide background information and techniques for watershed-based assessments of BMP effectiveness and water quality assessments for watershed with forest and mixed land uses. Once the sufficiency analyses are completed, they will be used as a coarse screen for common elements applicable to each individual TMDL to determine if forest practices are contributing to water quality impairment within a given watershed and to support the adaptive management process.

There may be circumstances unique to a watershed or information generated outside of the statewide sufficiency process that need to be considered to adequately evaluate the effectiveness of the BMPs in meeting water quality standards. Information from the TMDL, ad hoc committee process, ODF Water Protection Rule effectiveness monitoring program, and other relevant sources may address circumstances or issues not addressed by the statewide sufficiency process. This information will also be considered in making the FPA sufficiency determination. ODF and ODEQ will share their understanding of whether water quality impairment is due to current forest practices or the long-term legacy of historic forest management practices and/or other practices. The two agencies will then work together and use their determinations to figure out which condition exists (a, b, c, or d in the MOU). The MOU describes the appropriate response depending on which condition exists.

Currently the ODF and ODEQ do not have adequate data to make a collective determination on the sufficiency of the current FPA BMPs in meeting water quality standards within the Umatilla River basin. This situation most closely resembles the scenario described under condition c of the ODF/DEQ MOU. Therefore, the current BMPs will remain as the forestry component of the TMDL. The draft versions of the statewide FPA sufficiency analyses for the various water quality parameters will be completed as noted above. The proposed Umatilla River basin TMDL will be completed in Summer 2000. Data from an ODF/DEQ shade study will be collected over the summer of 1999 and a final report will be completed by the Spring of 2000. The final report for ODF's Water Protection Rules effectiveness monitoring program will be completed by March 2000. Information from the ad hoc

[11] The estimated completion dates listed here differ from those dates listed in the MOU. Due to unforeseen circumstances the DEQ and ODF have agreed to revise the dates.

committee advisory process may be available by early 2000. Information from these efforts, along with other relevant information provided by the ODEQ, will be considered in reaching a determination on whether the existing FPA BMPs meet water quality standards within the Umatilla River basin. ODF and ODEQ will either make a collective determination on FPA adequacy for the Umatilla River basin, or if data is still inconclusive, ODF will design and implement a specific monitoring program as part of the basin plan under a schedule and scope jointly agreed to by ODF and ODEQ. A collective determination on FPA adequacy would then be made upon completion of the specific monitoring program.

The above adaptive management process may result in findings that indicate changes are needed to the current forest practice rules to protect water quality. Any rule making that occurs must comply with the standards articulated under ORS 527.714(5). This statute requires, among other things, that regulatory and non-regulatory alternatives have been considered and that the benefits provided by a new rule are in proportion to the degree that existing forest practices contribute to the overall resource concern.

# ATTACHMENT B: MEMORANDUM OF UNDERSTANDING BETWEEN ODF AND DEQ

## I. Introduction and Statement of Purpose

A. Introduction

1. The Environmental Quality Commission (EQC) and the Oregon Department of Environmental Quality (DEQ) are responsible for implementing the Federal Clean Water Act in Oregon, ORS 468B.035, including adoption of water quality standards. The DEQ has adopted and the U.S. Environmental Protection Agency (EPA) has approved Oregon's water quality standards and its 1994/1996 303(d) list. DEQ intends to update and resubmit its 303(d) list to EPA in 1998 and subsequent years as required by federal regulations. DEQ is setting priorities for TMDL preparation.

2. Subsection 303(d) of the Federal Clean Water Act (the Act), 33 U.S.C. §1313(d), requires states to identify waters for which effluent limitations or other pollution control requirements required by local, State, or Federal authority are not stringent enough to implement applicable water quality standards, 40 C.F.R. §130.7 (b). These water bodies are referred to as "water quality limited." For each water on the 303(d) list that is not removed from the list by findings of water quality impairment due to natural conditions or best management practice (BMP) effectiveness, the state must establish a total maximum daily load (TMDL) allocation at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality. A TMDL is the sum of the individual wasteload allocations for point sources and load allocations for non-point sources and natural background, 40 C.F.R. §130.2(i).

3. TMDLs must be incorporated into the continuing planning process required by Section 303(e) of the Act and the continuing planning process must be included in the state's water quality management plan. Sections 208 and 319 of the Act, 33 U.S.C. §1288 and §1329, require the state to prepare non-point source management plans.

4. ORS 527.765 requires the Oregon Board of Forestry (the Board), in consultation with the EQC, to establish Best Management Practices (BMPs) and other rules applying to forest practices to ensure that to the maximum extent practicable non-point source discharges of pollutants resulting from forest operations do not impair the achievement and maintenance of water quality standards established by the EQC. The Oregon Department of Forestry (ODF) is the Designated Management Agency (DMA) by DEQ for regulation of water quality on nonfederal forestlands. Forest operators conducting operations in accordance with ODF BMPs are considered to be in compliance with Oregon's water quality standards.

5. The Board in consultation and with the participation and support of DEQ, has adopted water protection rules in the form of BMPs for forest operations, including, but not limited to, OAR Chapter 629, Divisions 635-660. These rules are implemented and enforced by ODF and monitored to assure their effectiveness. DEQ participates in the design and implementation of these monitoring efforts. The EQC, DEQ, the Board and ODF determined that pollution control measures required as BMPs under ORS 527.765 will be relied upon to result in achievement of state water quality standards.

6. The EQC, DEQ, the Board, and ODF are all committed to restoring salmon and meeting water quality through the Healthy Streams Partnership and Oregon Plan for Salmon and Watersheds, 1997 Oregon Laws, Ch. 7.

B. Purposes of MOU

The purposes of this memorandum of understanding:

1. To further define the respective roles and responsibilities of the EQC, the DEQ, the Board, and ODF in preventing, controlling and reducing non-point source discharges to achieve and maintain water quality standards;

2. To explain the process for determining whether (a) forest practices contribute to identified water quality problems in listed water quality limited streams; (b) if so, to determine whether existing forest practice rules provide sufficient control to assure that water quality standards will be met so that waters can be removed from the 303(d) list;

3. To describe the process for interagency coordination in revising forest practice rules, if necessary, to assure the achievement of water quality standards; and

4. To encourage the use of voluntary and incentive-based regulatory solutions to achieve and maintain water quality.

## II. Forest Practice BMPs and Water Quality Standards

Since ODF is the DMA for water quality management on nonfederal forestlands and ODF's BMP's are designed to protect water quality, ODF and DEQ will jointly demonstrate how the Forest Practices Act (FPA), forest practice rules (including the rule amendment process), and BMP's are adequate protection pursuant to ORS 527.765. This demonstration of the ODF BMP program adequacy will be done at the statewide scale with due consideration to regional and local variation in effects including non-anthropogenic factors that can lead to water quality standard violations.

Water quality impairment related to aquatic weeds, bacteria, chlorophyll a, dissolved oxygen, flow modification, many nutrients, total dissolved gas, or toxics are generally not attributable to forest management practices as regulated by the EPA. However, it is generally accepted that forest management practices have in some cases caused documented changes in temperature, habitat modification, sedimentation, turbidity, and bio-criteria. Therefore, this statewide demonstration of FPA effectiveness in protection of water quality will address these specific parameters and will be conducted in the following order:

a. temperature (draft report target completion date Spring, 1999),
b. sedimentation and turbidity (draft report target completion date Summer, 1999),
c. aquatic habitat modification (draft report target completion date fall 1999),
e. bio-criteria (draft report target completion date end 1999), and
f. other parameters (draft report target completion date spring 2000).

The analyses will be presented in a format compatible with EPA region 10 guidance (pages 4-6, dated November 1995) regarding BMP effectiveness determinations, and will include:

a. "Data analysis of the effectiveness of controls relative to the problem": analyze relevant data and studies on the parameter and known control methods,
b. "Mechanisms requiring implementation of pollution controls": give a clear exposition of the rules/programs that are designed to provide for protection,
c. "Reasonable time frame for attaining water quality standards": discuss expected recovery times which may be long for some parameters because the ecological processes that bring recovery are long-term, and

d. "Monitoring to track implementation and effectiveness of controls": describe the scope and extent the effectiveness and implementation monitoring program and how they tie back to program changes for adaptive management.

In addition, these analyses will address attainment of state anti-degradation policy. These demonstrations will be reviewed by peers and other interested parties prior to final release. While analysis is being conducted and unless or until changes are made in accordance with ORS527.765, the EPA and implementing rules will constitute the water quality BMP program for forestlands. These sufficiency analyses will be designed to provide background information and techniques for watershed based assessments of BMP effectiveness and water quality assessments for watersheds with forest and mixed land uses.

# III. ODF and DEQ coordination for listed waterbodies (i.e., 303(d) list)

A. Waterbody Specific Coordination

The following coordination will occur between ODF and DEQ regarding the TMDL process and water quality management plans:

(a) For basins where agreement is reached that water quality impairment is not attributable to forest management practices (Figure 1), the forest practice rules will constitute the water quality compliance mechanism for forest management practices on nonfederal forestland. ODF will not participate in the development of the TMDL or water quality management plan except as requested to assist DEQ as ODF budgeted resources permit. If the basin associated with a listed waterbody is entirely or almost entirely on federal land or non-forestland ODF will have little or no involvement (Figure 1).

(b) For basins where water quality impairment is attributed to the long-term legacy of historic forest management and/or other practices, but ODF and DEQ jointly agree that the forest practice BMPs are now adequately regulating forest management activities and not adding to further degradation of water quality, the forest practice rules will be designated in the water quality management plan as the mechanism to achieve water quality compliance for forest operations. ODF will participate with the other DMAs in developing the water quality management plan as necessary.

(c) For basins where water quality impairment may be attributable to forest management practices and ODF and DEQ cannot agree that the current BMPs are adequately regulating forest management activities (Figure 1), the current forest practice rules will be designated in the water quality management plan as the mechanism to achieve water quality compliance for forest operations. However, ODF will design and implement a specific monitoring program as part of the basin plan to document the adequacy of the best management practices. The schedule and scope of the monitoring program will be jointly agreed to by DEQ and ODF. During the interim, while monitoring is being conducted, the current rules will constitute the water quality compliance mechanism. If the monitoring results indicate that changes in practices are needed in a basin, the DEQ and the Board will use OAR 629-635-120 to create watershed specific protection rules or use other existing authority to ensure that forest management activities do not impair water quality.

(d) For basins where both ODF and DEQ agree that there are water quality impairments due to forest management activities even with FPA rules and BMP's, the DEQ and the BOF will use OAR 629-635-120 to create watershed specific protection rules or use other existing authority to ensure that forest management activities do not impair water quality.

In deciding between conditions (a)-(d) above, the statewide rule sufficiency analysis (described in G) will be critical in determining which situation exists. If the practices and impairments are found by DEQ and ODF to be regional or statewide in nature the BOF will create or modify statewide or regional rules or design other effective measures to address the impairment.

## B. Removal or Reclassification of Waterbodies

DEQ will propose removal of waterbodies (Figure 1) on the 303(d) list when:

(a) additional data indicates that the waterbody is not in violation,

(b) water quality parameters are found to be in violation for reasons other than human activities,

(c) TMDL's, or water quality management plans or their equivalents, have been established in compliance with the Clean Water Act §303, or

(d) the FPA, forest practice rules and BMP's are found to be adequate for a given water quality parameter in a given basin via the statewide demonstration or watershed based demonstration (see section n above) and all land affecting the listed waterbody is deemed forestland that is regulated under the FPA. Forest basins that have water quality impairment due to legacy conditions that will not be corrected by the current BMPs alone, remain listed with their present status until voluntary or incentive based actions are implemented that are intended to restore watershed conditions such that water quality standards can be met.

# IV. Voluntary and Incentive-Based Approaches

DEQ and ODF will work jointly with landowners and watershed councils, as resources permit, to use innovative approaches to resolving water quality problems. DEQ and ODF will use other pollution control requirements when appropriate to restore watershed conditions such that water quality standards can be met in waterbodies listed under Section 303(d) of the Clean Water Act. These pollution programs include but are not limited to the following:

1. Oregon Laws 1997, ch. 553, The Green Permits Act,;

2. Oregon Laws 1995, ch. 413, The Forest Stewardship Act,;

3. Oregon Laws 1997, ch. 7, Healthy Streams Partnership and the Oregon Plan for Salmon and Watersheds;

4. DEQ's Environmental Management Systems Incentives Project;

5. Habitat Conservation Plans adopted and approved under the Endangered Species Act;

6. Project XL agreements with the EPA; and

7. Pollution Prevention Partnership agreements with the EPA Some of these alternative approaches will become critical and complementary to the forest practices program when attempting to restore water quality in streams with significant legacy conditions caused by past actions such as channel simplification from splash damming and stream cleaning.

## V. Other key coordination points for DEQ and ODF

There are two other issues that will require special coordination between DEQ and ODF. These coordination issues regard:

1. Outstanding Resource Water designations and management measures, and
2. Coordination between the two agencies when there is a land use conversion.

Both agencies agree to open discussion on how to coordinate on these issues but they are separate issues that are not covered by this particular MOU.

## VI. Signatures

Signed:____________________________

James E. Brown, State Forester
Oregon Department of Forestry

Signed:____________________________

Langdon Marsh, Director
Oregon Department of Environmental Quality

# ATTACHMENT C: OREGON PLAN INVOLVEMENT FOR FORESTLAND OWNERS

Forestland owners are currently participating in regulatory and voluntary measures across the state to improve water quality and aquatic habitat under the Oregon Plan for Salmon and Watersheds (OPSW). At this time, there are a total of 63 measures in the OPSW that deal with private and state forestlands. Several of these OPSW measures pertain to the regulatory and monitoring programs that are being conducted by the Oregon Department of Forestry. This attachment spotlights the voluntary actions in the OPSW that forestland owners under take to improve conditions on forestlands.

As noted in the Forestry Chapter of the WQMP, active involvement and restoration of legacy issues on forestlands is seen as the most effective and productive way to engage the landowners in watershed restoration efforts. OPSW has several suggested voluntary measures for forestland landowners.

The voluntary measures include:

**ODF 8S:** Riparian Conifer Restoration.
Forest practices rules have been developed to allow and provide incentives for the restoration of conifer forests along hardwood-dominated Riparian Management Areas (RMAs) where conifers historically were present. This process enables sites capable of growing conifers to contribute, at a future point in time, conifer large woody debris (LWD).

**ODF 19S:** Additional Conifer Retention along Fish-Bearing Streams.
This measure retains more conifers in Riparian Management Areas (RMAs) by limiting harvest activities to 25 percent of the conifer basal area above the standard target. This measure is only applied to RMAs containing a conifer basal area that is greater than the standard target.

**ODF 20S:** Limited RMA for Small Type N Streams.
This measure provides limited 20 foot RMAs along all perennial or intermittent small Type N streams for the purpose of retaining snags and downed wood.

**ODF 21S:** Active Placement of large wood during Forest Operations.
This measure provides a more aggressive and comprehensive program for placing large wood in streams currently deficient of large wood. Placement of large wood is accomplished following existing ODF/ODFW placement guidelines and determining the need for large wood placement is based upon a site-specific stream survey.

**ODF 22S:** 25 Percent In-unit Leave Tree Placement and Additional Voluntary Retention. This measure has one non-voluntary component and two voluntary components:

1. The State Forester, under statutory authority, will direct operators to place 25 percent of in-unit leave trees in or adjacent to riparian management areas on Type F and D streams.
2. The operator voluntarily locates the additional 75 percent in-unit leave trees along Type N, D or F streams, and
3. The State Forester requests the conifer component be increased to 75 percent from 50 percent.

**ODF 61S:** Analysis of "Rack" Concept for Debris Flows.
Oregon Forest Industry Council (OFIC) members will conduct surveys to determine the feasibility and value of retaining trees along small type N streams with a high probability of debris flow in a "rack" just above the confluence with a Type F stream. The rack would extend

from the RMA along the Type F stream up the Type N stream some distance for the purpose of retaining trees that have a high likelihood of delivery to the Type F stream.

**ODF 62S:** Voluntary No-Harvest Riparian Management Areas.
Establishes a system to report and track, on a site-specific basis, when landowners voluntarily take the opportunity to retain no-harvest RMAs.

These measures can be described as either active restoration measures, or passive restoration measures that provide long-term large wood recruitment. Voluntary measures ODF 8S and 21S are active restoration activities. ODF 21S addresses large wood placement if stream surveys determine there is a need. Measures ODF 19S, 20S, 22S, and 62S provide future large wood recruitment through additional riparian protection. This additional protection is accomplished by retaining in-unit leave trees, snags, and downed wood within and along RMAs, and by changing the ratio of in-unit leave trees to 75 percent conifer.

The following application priority has been developed for OPSW voluntary measures for harvest units containing more than one stream type. The list establishes the general priority for placement of in-unit leave trees.

1. Small and medium Type F streams.
2. Non-fish bearing streams (Type D or Type N), especially small low-order headwater stream channels, that may affect downstream water temperatures and the supply of large wood in priority area streams.
3. Streams identified as having a water temperature problem in the ODEQ 303(d) list of water quality limited waterbodies, or as evidenced by other available water temperature data; especially reaches where the additional trees would increase the level of aquatic shade.
4. Potentially unstable slopes where slope failure could deliver large wood.
5. Large Type F streams, especially where low gradient, wide floodplains exist with multiple, braided meandering channels.
6. Significant wetlands and stream-associated wetlands, especially estuaries and beaver pond complexes, associated with a salmon core area stream.

The Oregon Plan for Salmon and Watersheds also has voluntary measures addressing sediment issues related to forest roads. Many forest roads built prior to the development of the FPA or prior to the current BMPs continue to pose increased risk to fish habitat. Industrial forest landowners and state forest lands are currently implementing the Road Hazard Identification and Risk Reduction Project, measures ODF 1S and ODF 2S, to identify risks to salmon from roads and address those risks. The purposes of this project are:

1. Implement a systematic process to identify road-related risks to salmon and steelhead recovery.
2. Establish priorities for problem solution.
3. Implement actions to reduce road related risks to water quality.

The OPSW measures that address road related issues include:

ODF 1S and ODF 2S- Road Erosion and Risk Project.
The Road Hazard Identification and Risk Reduction Project is a major element of the OPSW. The two major field elements of this project are (1) the surveying of roads using the Forest Road Hazard Inventory Protocol, and (2) the repairing of problem sites identified through the protocol. Road repairs conducted as a result of this project include improving fish passage, reducing washout potential, reducing landslide potential, and reducing the delivery of surface erosion to streams. ODF 1S deals with private forest roads and ODF 2S deals with road segments on State managed forestlands.

ODF 16S - Evaluation of the Adequacy of Fish Passage Criteria: Establish that the criteria and guidelines used for the design of stream crossing structures pass fish as intended under the goal.

ODF 34S - Improve Fish Passage BMPs on Stream Crossing Structures: Ensure that all new stream-crossing structures on forestland installed or replaced after the fall of 1994 will pass both adult and juvenile fish upstream and down stream.

# ATTACHMENT D: FEDERAL LAND MANAGEMENT REFERENCES

## Management Policies and BMP Effectiveness

**Water Quality Policy, Plans, and Regulations**

U.S. Department of Agriculture, Forest Service, 1990. Final Environmental Impact Statement, Land and Resource Management Plan, Umatilla National Forest. *These documents formulate the 10-year plan for National Forest management. Other documents such as PACFISH have amended this plan.*

U.S. Department of Agriculture, Forest Service, 1994. Monitoring Strategy: Land and Resource Management Plan, Umatilla National Forest. *This document provides direction and guidance for annual monitoring and identifies key components from the 1991 strategy. Included are specific monitoring elements for: Water Quantity, Water Quality, Water Temperature, Sedimentation, and Channel Morphology.*

U.S. Department of Agriculture, Forest Service, U.S. Department of Interior, Bureau of Land Management, 1995. Environmental Assessment for the Interim Strategies for Managing Anadromous Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, and portions of California. *This document, also known as PACFISH, is an interim management strategy to halt habitat degradation and begin restoration of habitat for Pacific salmon, steelhead, and sea-run cutthroat trout (anadromous fish).*

R-6 MOA with Oregon DEQ, 1990. *This document outlines federal responsibilities for water quality protection and includes a non-point source control action plan.*

R-6 BMP Guidelines, 1988. *List of "best management practices" for timber, roads, recreation, mining, and restoration projects.*

FS/BLM Protocol for 303(d) Listed Waters, 1999. *Federal strategy and framework for addressing 303(d) streams.*

USDA FS TMDL Policy and Framework internal memo, 1999. *Describes national policy on TMDLs with emphasis on application of BMPs, addresses variability and risk.*

Umatilla NF MOUs with tribes

Clean Water Action Plan
- Unified Watershed Assessments
- Unified Federal Policy (October, 2000)

Chief's Natural Resource Agenda

ESA Consultation documents

**Selected References on the Effectiveness of Forestry Best Management Practices**

GENERAL

Dissmeyer, 1995. Evaluating the effectiveness of forestry best management practices in meeting water quality goals or standards. Miscellaneous publication 15-20, USDA Forest Service. 179 p.

MacDonald, Smart and Wissmar, 1991. Monitoring guidelines to evaluate effects of forestry activities on streams in the Pacific Northwest. EPA Region 10 Report 910/9-91-001.

Megahan, W. F. and J. Schweithelm, 1983. Guidelines for reducing negative impacts of logging. Appendix C in: Hamilton and King, Tropical watersheds: hydrologic and soils response to major uses or conversion. Boulder, CO Westview Press, p. 143-154.

Lynch, J. A., Corbett, E. S. and K. Mussaliem, 1985. Best management practices for controlling nonpoint-source pollution on forested watersheds. J. Soil and Water Conservation, 40:1, 164-167.

NCASI, 1999. Silviculture and water quality: a quarter century of Clean Water Act progress. Special Report No. 99-06, National Council for Air and Stream Improvement, Inc. Research, Triangle Park, N.C. 15 p.

USDA Region 6, 1990. Water Quality Best Management Practices Guidelines.

U.S. Environmental Protection Agency. 1980. An Approach to Water Resources Evaluation of Non-Point Silvicultural Sources. EPA-600/8 8-80-012.

STREAM/WETLAND BUFFERS

Belt, George, O'Laughlin, Jay and Troy Merrill, 1992. Design of forest riparian buffer strips for the protection of water quality: analysis of the scientific literature. Report No. 8, University of Idaho Policy Analysis Group, University of Idaho. 35 p.

Castelle, Johnson, and Connolly, 1994. Wetland and stream buffer size requirements – a review. J. Env. Quality, 23:878-882.

Castelle and others, 1992. Wetland buffers, use and effectiveness. Publication #92-10, Washington State Department of Ecology. 171 p.

EROSION CONTROL/SEDIMENT

Bunte, Kristin and Lee MacDonald, 1998. Scale considerations and the detectability of sedimentary cumulative watershed effects. Report to Forest Service and NCASI.

Cook and King, 1983. Construction cost and erosion control effectiveness of filter windrows on fill slopes. Research Note INT-335, Ogden, UT, USDA Forest Service. 5 p.

Burroughs, E. R. and John G. King, 1989. Reduction of soil erosion on forest roads. USDA-Forest Service GTR INT-264.

Schmidt, L. 1987. Calculated risk and options for controlling erosion. In: Proceeding of the 18th International Erosion Control Association Conference, Reno Nevada, Feb. 26-27, 1987.

ROADS

USDA San Dimas Technology and Development Center, 1998. Water/Roads Interactions Technology Series.

RESTORATION

Anon. 1998. Stream corridor restoration: principles, processes and practices. Federal Interagency Stream Restoration Working Group.

Luce, 1997. Effectiveness of road ripping in restoring infiltration capacity of forest roads. Restoration Ecology 5 (3), p. 265-270.

UMATILLA BASIN

Helvey J. D. and W. Fowler, 1997. Effects of timber harvest on the hydrology and climate of four small watersheds. Report on file, Umatilla National Forest.

Umatilla National Forest, 1998. Preparation and checking guide for timber sale appraisal and contract packets. 67 p.

Umatilla National Forest, 1998. Timber sale administration guide. 50 p.

Umatilla National Forest, 2000. Umatilla and Meacham Ecosystem Analysis at the watershed scale. Report on file, Umatilla National Forest.

**Other References**

Oregon Coordinated Resource Management, 1997, Public Funding Sources for Landowner Assistance, 19 p.

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# 3.3.4 TRANSPORTATION

## 3.3.4.1 OVERVIEW AND BACKGROUND

This section identifies transportation-specific elements of Umatilla Basin TMDL implementation. The intent is to identify existing polices, rules and programs that improve and maintain water quality; and to make recommendations for any un-addressed areas.

This section is generally applicable to agencies and individuals responsible for transportation corridors. The transportation system comprises a particularly complex network of jurisdictions and stakeholders. It is understood that the combined participation of transportation agencies, planning authorities, landowners and the public will be an important aspect of transportation-related TMDL implementation.

The Transportation Workgroup recognizes that the primary mission of the transportation agencies is to produce and maintain a safe and effective transportation network. Transportation corridors provide widespread and vital benefits to Oregon citizens and communities. The Workgroup also recognizes that complete attainment of load allocations applicable to transportation corridors may not be feasible, certainly in the short term and likely in the long term due to safety concerns or other important factors. With that said, however, it is the expectation of this document that every reasonable and practicable effort should be made to achieve the load allocations when transportation management agencies consider new or modifications to existing corridors and changes in operation and maintenance procedures.

In circumstances where TMDL allocations appear infeasible, transportation authorities and communities are encouraged to evaluate the full spectrum of societal beneficial uses and resource availability and take steps as soon as possible to *move toward* attainment of load allocations for temperature and sediment. Fulfillment of load allocations can take decades and requires both long-range and near-term planning beyond the scope of this document.

Other sections of this document are also relevant to transportation corridors, namely the load allocations of **Chapter Two** and the balance of **Chapter Three**.

### 3.3.4.1.1 Committee

The Transportation Workgroup, sponsored by the Umatilla TMDL Stakeholders Committee, prepared this section during September 1999 through August of 2000.

The Transportation Workgroup membership consisted of:

- Carter Kerns, Workgroup Chair, Stakeholders Committee
- Karen Wagner, citizen representative and coordinator
- Hal Phillips, Umatilla County Road Department
- Jayne Clarke, Industry, Stakeholders Committee
- Terry McArtor, ODOT
- Chuck Howe, ODOT
- Sue Chase, ODOT

Other input and review was provided by:
- Jim Diel of Union Pacific Railroad
- Pat Napolitano, City of Hermiston
- Matt Voile, Umatilla County Weed Control
- Jeff Blackwood, USFS
- John Buckman, ODF
- Alanna Nanegos, CTUIR

# 3.3.4.1.2 Goals and Scope

The primary goal of this plan is fulfillment of the Umatilla Basin TMDL allocations and stream habitat and substrate goals for 303(d) listed impairments (**Chapter Two**). The Stakeholders Committee 'Management Goals' (**Section 3.2**) also serve as guidance to this end. This document is applicable throughout the Umatilla Basin. This plan applies to existing and future transportation corridors, including roads (paved, gravel, concrete, oil mat, native-surface), railroads, and utility corridors, and associated right-of-ways.

## 3.3.4.1.2.1 APPLYING LOAD ALLOCATIONS

Umatilla Basin Load allocations have been established for temperature, turbidity, bacteria and nitrate. Other goals have been established for habitat modification, streambed fines and flow. These issues are listed as water quality limited on the Umatilla Basin 303(d) list. **Chapter Two** details the load allocations. The load allocations and habitat goals are summarized in **Chapter One**. The following paragraphs discuss application of these allocations to transportation corridors and activities.

The temperature and sediment load allocations apply throughout the Umatilla Basin and include goals for:

- effective shade
- channel narrowing
- reduction in wetted width/depth ratios
- streambank stability
- erosion reduction (landscape and streambank)

These variables are influenced by the presence of transportation corridors. The allocations are applicable across the landscape regardless of land use or land ownership. For instance, the percent effective shade surrogates of the temperature TMDL are calculated incrementally along the entire length of the main-stem and tributaries. If reduction of this potential has occurred, the land use authorities, whether state, county, city or private; are entrusted with the responsibility to assure progress toward load allocation attainment. All feasible steps toward meeting water quality standards and hence TMDL attainment are called for in the Oregon Administrative Rules (OAR 340-41). It is recognized that once vegetative buffers are established and space for stable channel gradient, cross-section and floodplain is allowed, channel width and width/depth goals should passively follow. Riparian buffer strips and lessened channel and floodplain constriction are, in much of the Basin, the optimal practices to be promoted by transportation authorities. In addition, large woody debris should typically remain in streams where this does not jeopardize public safety.

Other Umatilla Basin load allocations and the 303(d)-based goals for stream habitat and substrate (**Chapter 2**) will be implemented by other land use categories such as agriculture, forestry and urban/industrial or should passively occur with improved vegetation and bank stability.

#### 3.3.4.1.2.2 CHAPTER ORGANIZATION

This section (**3.3.4**) is organized based on the Stakeholders Committee recommendation tabulated below. This identifies plan topic organization, not authority. Management practices applicable to agricultural and forested roadways are only generally included herein to help account for multi-use and multi-jurisdictional roads.

| Transportation Corridor | Management Plan |
|---|---|
| Roads used primarily for Agriculture | Agriculture |
| Roads used primarily for State or Private Forestry<br>National Forest Roads | Forestry |
| All other transportation corridors, including: State, County, Urban, Private, Railroad, Public Utility | **Transportation** |

## 3.3.4.1.3 Problem Statement

**General**

The Umatilla watershed does not currently meet water quality standards for temperature or sediment. Water temperatures in its streams and rivers are too high during the summer for salmonids and many other organisms they depend upon for food. Excess sediment clouds the water, clogs spawning gravels and can cause changes in stream channel form. The high stream temperatures are due, in large part, to the removal of shading riparian vegetation. Greatly increased sediment loads come from areas that have been disturbed and have had their vegetation removed. The exposed soil is then easily eroded by runoff and streams.

Transportation corridors, primarily paved and gravel roads and railroads, have the potential to exacerbate these problems. Vegetation removal where corridors are close to streams reduces shading, thereby leading to increased water temperatures. Because there is little summer rainfall, warm runoff from hot pavement is not a contributor to increased warm season stream temperatures in the basin. Sediment loads may be increased by erosion at construction sites, failure of embankments and cut slopes, sanding material, inadequately designed or built drainage ditches or erosion caused by funneling hillside runoff through culverts. Runoff from paved surfaces is not a major contributor of sediment to streams.

The transportation agencies are actively developing programs to reduce the impacts of their projects and facilities on water quality in the Umatilla watershed. Actions include: increasing riparian vegetation in transportation corridors, reducing erosion at construction sites and designing new projects to protect or enhance water quality.

The Umatilla Basin TMDLs generally do not identify relative amounts of pollution by land use, however in parts of the basin the contributing causes of pollution or habitat degradation are clear. For instance, in some locations a roadway is the only feature preventing achievement of the effective shade goal. In contrast, the cause of severe erosion in other locations may stem from multiple land uses. As improvements towards the load allocations are implemented by *each* sector, TMDL attainment becomes realizable.

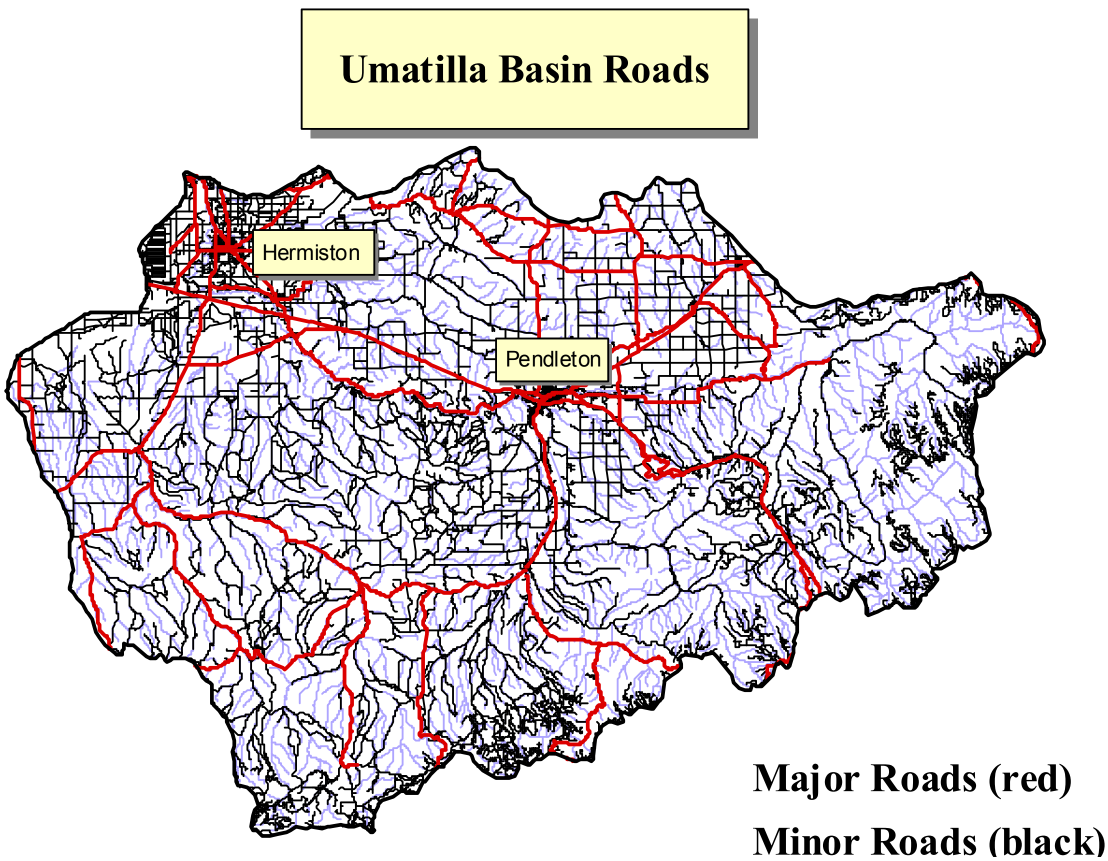
The *Areas of Emphasis* section (**3.5.2**) lays out issues and areas of focus by watershed and by management category. A map of Umatilla Basin roads, **Figure 91**, assists in illustrating road densities. Areas where corridors are in close proximity to streams can be logical places to focus efforts for water quality impacts associated with transportation.

**Railroad**

Particular note is made of railroad corridors in the Umatilla Basin. The Umatilla Basin TMDL Stakeholders and Technical Committees have recognized substantial impacts relating to water quality and stream habitat along most of the Umatilla River and in major tributaries. A floodplain and railroad map has been prepared. It can be narratively described: Active railways (Union Pacific Railroad (UPRR)) occupy or constrict floodplain area along 30-miles of Meacham Creek, 15-miles of Birch Creek and the Umatilla River from Meacham Creek to the mouth (80 miles). An abandoned Burlington Northern grade still exists on floodplains and terraces of Wildhorse Creek from the town of Athena to the mouth (18 miles). The following is provided by the Committees to the Transportation workgroup and the UPRR:

> The completion of the railroad in 1883 affected the Umatilla Basin in three ways: (1) the construction of the railroad grade with fill and ballast material cut off meanders by channelization and encroached on the valley widths thus reducing stream miles and increasing velocities, (2) steam powered engines required wood for fuel, hence cottonwoods and conifers were removed along rivers and mountain passes (The East Oregonian Newspaper, Sept 9, 1904: "*R.R. Collins, one of the most prominent wood dealers of Kamela - The only drawback to the wood situation in the mountains is the fact that it must be hauled farther, as the good timber near the track is all cut out")* and (3) Railroad crossings and other channel constrictions have adversely influenced channel morphology, causing habitat degradation and increased erosion and thermal loading.
>
> The UPRR impacts the floodplain of the mainstem Umatilla River (59 miles of railroad in the historic floodplain of the Umatilla River) and Meacham Creek. In specific places this impact is in the form of a dike or levee that restricts the natural hydrologic functions of the river system. In the reach between Reith and Echo the railbed restricts the natural sinuosity of the channel and seasonal floodplain recharge. In other places the rail bed restricts the growth of streamside vegetation.
>
> The participation of the UPRR is essential to re-establishing floodplain functionality and riparian vegetation needed to meet the TDML allocations of: effective shade, channel narrowing and erosion reduction.
>
> The Committees have indicated: "The lack of participation by the UPRR during development of this TMDL and WQMP has prevented the kind of coordination needed to give assurance that the proper steps will be taken to restore water quality." It is the hope of the Umatilla TMDL Stakeholders Committee, and the expectation of the authors of this document, that the UPRR implement management to address the Umatilla Basin TMDL.

**Figure 91.** Map of Umatilla Basin Roads (Oregon Geographic Information Center)




Discussions of watershed impacts and solutions specific to roadways are available in local and National literature, for example:

Barrett, M.E. et al, 1995, *A Review and Evaluation of Literature Pertaining to the Quantity and Control of Pollution from Highway Runoff and Construction*. Center for Research in Water Resources, University of Texas at Austin. Technical Report CRWR 239.

Bertran and Kaster, 1982, *Biological Assays of Highway Runoff Water*. Draft. Federal Highway Administration. April 1982.

Bjornn and Reiser, 1991, *Habitat Requirements of Salmonids in Streams*.

Columbia River Inter-Tribal Fish Commission, 1999, *Protecting and Restoring Watersheds - A Tribal Approach to Salmon Recovery*.

Driscoll, E. et al, 1990, *Pollutant Loadings and Impacts from Highway Stormwater Runoff*, 5 vols. Federal Highway Administration Report FHWA-RD-88-006.

Dorman, M. et al., 1996, *Retention, Detention and Overland Flow for Pollutant Removal from Highway Stormwater Runoff*. Vol 1 Research Report. Vol 2 Design Guidelines. Federal Highway Administration. Report FHWA-RD-96-096.

Dupuis et al, 1984, *Effects of Highway Runoff on Receiving Waters, vol II. Results of field monitoring program*. Draft Report FHWA-RD-84-065.

Dupuis and Kobriger, 1985, *Effects of Highway Runoff on Receiving Waters, vol IV. Procedural Guidelines for Environmental Assessments*. Draft Report FHWA-RD-85-065.

Furniss et al., 1996, *Watershed-scale Road Stream Crossing Risk Assessment*.

Harr and Nichols, 1993, *Stabilizing Forest Roads to Help Restore Fish Habitats: A Northwest Example*.

Weaver and Hagans, 1994, *Handbook for Forest and Ranch Roads: A Guide for Planning, Designing, Constructing, Reconstructing, Maintaining and Closing Wildland Roads*.

Winters and Gidley, 1980, *Effects of Roadway Runoff on Algae*. Federal Highway Administration. Report FHWA-CA-TL-80-24.

Young, K. et al, 1995, *Evaluation and Management of Highway Runoff Water Quality*. Federal Highway Administration. Report FHWA-PD-96-032.

## 3.3.4.1.4 Agencies and Corridor Types

It is recognized that primary jurisdictional organizations are generally as follows:

| Corridor Usage | Jurisdiction |
|---|---|
| Interstate and State Roads | Oregon Dept. Transportation |
| National Forest Roads | US Forest Service |
| Other Forest Use Roads | Oregon Dept. Forestry |
| Agricultural Use Roads | Oregon Dept. Agriculture |
| County Roads | County |
| City Roads (incorporated) | City, private, etc. |
| Railroads | Federal Railroad Commission |
| Private/Industry | Various |
| Utility Corridors | State, Federal, Local |

Umatilla County road mileage is described in the following table [information provided by ODOT (periodic update) and Umatilla County Road Department]. Note that most of the Umatilla Basin lies within Umatilla County with a relatively small area (parts of Butter Creek and Sand Hollow drainages) in Morrow County.

**Table 65.** Road Types and Mileage

| Jurisdiction/ mileage | Asphalt | Concrete | Gravel and Graded | Oil Mat | Primitive and Unimproved |
|---|---|---|---|---|---|
| State Highways | 340 | 48 | 1 | - | - |
| County Roads | 307 | 1 | 1064 | 205 | 124 |
| City Roads | 167 | 1 | 27 | 19 | 12 |

The Union Pacific Railroad follows 30 miles of Meacham Creek, 80 miles of the Umatilla River and there is roughly 25 miles of abandoned Burlington Northern grade in and north of Wildhorse Creek valley.

## 3.3.4.2 MANAGEMENT RECOMMENDATIONS

This section identifies the management recommendations of the Umatilla Basin Transportation Workgroup.

## 3.3.4.2.1 Introduction

The transportation practices related to water quality and identified herein have been developed through ODOT, ODF, USFS and other state and local agencies. Further guidelines may become available through the Oregon Association of Counties for gravel roads. Some discussion of developing urban transportation guidance has occurred with the Oregon League of Cities. County, private, urban and industrial authorities that may be lacking in resources to locally define practices are encouraged to utilize the applicable management practices provided in this section.

The Transportation Workgroup recognizes that these management practices are not an exhaustive list of what is in place, currently planned or available. Ongoing review and development of programs is encouraged in the context of water quality and habitat improvement.

## 3.3.4.2.2 Overarching Guidelines

The Stakeholders Committee developed the *Management Goals* of **Section 3.2** to add clarity to TMDL implementation.

Other overarching guidelines developed by the Transportation Workgroup are listed here:

**Administrative**

- Develop, promote and implement non-point source (NPS) best management practices (BMPs) relating to maintenance, construction and siting for paved and non-paved corridors in city, county, state, federal and railroad jurisdictions, to meet water quality standards.

**Road Maintenance, Construction, Siting and Enhancement**
Where safety and right-of-way allow:

- Fulfill TMDL load allocations for effective shade and erosion reduction (these goals are described in **Section 3.3.4.1.2.1** and **Chapter 2**)
- Construct, stabilize and maintain road prisms to minimize erosion
- Encourage riparian vegetation, minimize removal of existing beneficial riparian vegetation
- Minimize removal of large woody debris in-stream, where appropriate and feasible
- During construction and siting minimize floodplain impediment and maximize fish habitat, passage and channel stability; minimize stream straightening, constriction and re-location

## 3.3.4.2.3 Existing Policies

**Table 66** identifies the transportation activity category of potential concern by jurisdiction and corridor type; and is linked to the list following the table that describes existing programs.

**Table 66.** Matrix of Potential Water Quality Related Activities by Jurisdiction and Corridor Type (this list is not exhaustive - environmental improvements are also addressed through general programs and standard operating procedures). Table numeric entries are explained in the text beginning on the next page.

| Jurisdiction | Corridor Type | Activity Type | | | |
|---|---|---|---|---|---|
| | | Routine Maintenance & Repair | New Structures, Construction Activities | Siting & Possible Re-Location | Environmental Enhancement (e.g., constriction removal, improved crossings) |
| Federal (forest only, further information in Forestry Section) | paved | 1 | 1 | 1 | 1 |
| | gravel & oil | 1 | 1 | 1 | 1 |
| | native | 1 | 1 | 1 | 1 |
| State * | paved & concrete | 2 | 2 | 2 | 2 (storm water mgmt) |
| | gravel & oil | assumed slight contribution to Basin-wide water quality impairment (<1% of State roads in Umatilla County are gravel) | | | |
| County * | paved & concrete | 3 | 3 | | |
| | gravel & oil | 3 | | | |
| | native (7% of rds) | | | | |
| Urban | paved & concrete | 4 | | | 4 (storm water mgmt) |
| | gravel & oil | | | | |
| | native | | | | |
| Private/ Corporate* | paved & concrete | 4 | | | 4 (storm water mgmt) |
| | gravel & oil | | | | |
| | native | | | | |
| Railroad | | | | | |

* Roads with a primary purpose of agriculture or forestry are addressed through Senate Bill 1010 and the Forest Practices Act and Rules (OAR 629-625); and are discussed in the agriculture and forestry sections of **Chapter Three**.

Programs of **Table 66**

1 - **US Forest Service:** Federal lands in the Umatilla Basin are managed by the US Forest Service (Umatilla National Forest) with few exceptions. Umatilla National Forest road management policy is described in a compilation of documents with publication dates from 1989 to 1998. The core document is *Road Maintenance Standards and Operating Procedures*, 1989 (Umatilla National Forest). Drainage maintenance, surface maintenance, dust abatement, bridge and culvert maintenance and small project construction are examples of the topics addressed. Two 1998 reports address recent PACFISH guidelines and erosion management. The April 1998 *Project Summary: Maintenance and Management of National Forest Roads* includes discussion of road obliteration and provides updating of the 1989 document, as does the April 1998 *Wet Weather Haul* memorandum discussing wet weather timber hauling and its potential to effect endangered species. Attachments to this memorandum discuss a threshold road density as an indicator of streambed impacts through sedimentation and road maintenance frequency related to sediment production. This policy, coupled with PACFISH guidelines, addresses siting, re-location and environmental enhancements as well as maintenance and operation. Further discussion of Umatilla National Forest policy and roads management is provided in the Forestry Section of **Chapter Three**.

   Federal entities implement environmental decision making associated with all major federal actions pursuant to the National Environmental Policy Act.

2 - **Oregon Department of Transportation:** Water quality management policy for paved road routine maintenance and repair is described in: *Routine Road Maintenance, Water Quality and Habitat Guide Best Management Practices,* ODOT, July 1999. The ODOT has entered into formal agreement with the National Marine Fisheries Service to implement these practices (1999). ODOT (1999) describes such activities as training, shoulder blading, ditch maintenance, vegetation management, erosion repair and chemical usage and cleanup. Runoff and erosion control and other aspects of pollution prevention (e.g., chemical storage and spills) during construction projects are addressed through the ODOT Erosion Control Plan and Pollution Control Plan. Ongoing control of storm water and pollutant runoff is addressed through the NPDES process including implementation of Retention, Detention and Overland Flow for Pollutant Removal from Highway Storm Water Runoff (Dorman et al., 1996). ODOT receives federal funds, consequently, projects are required to go through an environmental review process under the National Environmental Policy Act (1969). If the project area has the potential to impact a species, or its habitat, listed under the federal Endangered Species Act, biological assessments and consultations with the National Marine Fisheries Service or the U.S. Fish and Wildlife Service are undertaken. Impacts to the species, habitat, cumulative effects and mitigation are addressed in the development of the project. ODOT construction activities relevant to storm water control occur under a State General Permit: National Pollutant Discharge Elimination Permit System [permit 1200-CA, construction permit applicable statewide, expires December, 2000 (DEQ, 1996)]. This permit requires minimization of pollutant levels and storm water discharge to waters of the state. ODOT is currently preparing a statewide NPDES permit that will address the Phase II storm water provisions of the Clean Water Act.

3 - **Counties:** The Oregon Association of Counties is working with the National Marine Fisheries Service to determine how to incorporate best management practices for gravel roads.

4 - **Urban and Industry:** The *Urban/Industrial* Section of **Chapter Three** recommends street sweeping, storm water control and pollution minimization, and describes and references associated best management practices.

Related policies

- **ODA** addresses agricultural road management with water quality management plans developed through Senate Bill 1010. The associated Oregon Administrative Rules are referenced in the SB1010 Plan for the Umatilla Basin (ODA 1999). The plan and rule are designed to reduce erosion and to protect and improve water quality and includes goals such as minimization of stream de-stabilizing activities and erosion reduction. The plan acknowledges sediment production from an extensive network of roads and recommend grass seeding of rights of way, rock placement in borrow ditches, sediment basins, proper culvert design/placement and weed control.
- **ODF** addresses road-related water quality impairment through ongoing review and implementation of the Oregon Forest Practices Act (Oregon Administrative Rules Chapter 629 and Oregon Revised Statute 527). This Act prescribes road maintenance and construction designed to protect and improve water quality and habitat. The Forest Practices Act and Rules (roads addressed in OAR 629-625) and the included road-related water quality measures are discussed in the forestry section of **Chapter Three**. The ODF has published a *Forest Road Management Guidebook*, 2000.
- **The Union Pacific Railroad** has reviewed and input to drafts of this section and has indicated that though they have limited basin-specific resources for TMDL compliance evaluation, they will review TMDLs and implementation plans and respond as resources allow. The TMDL allocations that apply to other responsible entities apply to the Railroad as well.
- **County and Urban** Comprehensive Plans contain broadly stated transportation-related goals that are consistent with TMDL implementation. For example, the Comprehensive Plan of the City of Pendleton (1974 and subsequent updates) states: "programs will be provided that will: (1) ensure open space, (2) protect scenic and historic areas and natural resources for future generations, and (3) promote healthy and visually attractive environments in harmony with the natural landscape character" and "A transportation plan shall... minimize adverse social, economic and environmental impacts and costs."

## 3.3.4.2.4 Recommended Practices

The following practices are recommended, as applicable:

- The implementation of the *Existing Policies* and programs outlined above, including ongoing effectiveness monitoring and program review, provides important institutionalized basis for the maintenance and improvement of water quality and stream habitat.

- The following are key resources for transportation management practices. These practices are generally available on-line or through the authoring agencies.

  - ODOT BMPs, including *Routine Road Maintenance, Water Quality and Habitat Guide Best Management Practices,* ODOT, July 1999
  - ODOT Pollution Control Plan and Erosion Control Plan
  - Umatilla National Forest BMPs, including *Road Maintenance Standards and Operating Procedures*, 1989
  - Oregon Forest Practice Rule BMPs (OAR 629-625) and the *Forest Road Management Guidebook: Maintenance and Repairs to Protect Fish Habitat and Water Quality*, ODF, 2000
  - Umatilla River Sub-basin Agricultural Water Quality Management Area Plan, ODA and Umatilla County SWCD, 1999

- The following list of best management practices is excerpted from the Grande Ronde TMDL implementation plan (WQMP). These practices are recommended, as applicable, in the Umatilla Basin. This list has undergone public review and has received input from various state and local transportation agencies.

## 3.3.4.2.4.1 BEST MANAGEMENT PRACTICES

The intent of this section is to insure that appropriate BMPs are being used throughout the Basin. As indicated above, it is the responsibility of the appropriate agency/entity to demonstrate that adequate BMPs are in place. The following is a list of commonly accepted BMPs for roads:

## 3.3.4.2.4.2 PLANNING PRACTICES

Activity Evaluation Process. Before any construction or maintenance activities occur the following questions should be answered and appropriate action should be taken:

- Does the activity have potential to pollute a receiving stream?
- How does it effect runoff, sediment, other pollutants?
- What solutions can be employed to minimize effects?

Assessment Process – to be followed whenever there is a sensitive situation.

- Assess situation considering: Topography (streams, drainage channel, wetlands, slope stability, etc.), materials being used (what's being used, how much, what's its potential effect?), location for disposal of materials.
- What type of resources will be affected? (Waters of the state, downs stream effects, fish, wildlife, habitat)
- contact and consult appropriate agencies (ODFW, ODEQ, DSL).
- Proceed using input from appropriate agencies.

## 3.3.4.2.4.3 CONSTRUCTION AND MAINTENANCE ACTIVITIES

a. CHIP SEALING/OIL MAT

Description: Apply liquid asphalt and cover with aggregate on sections of bituminous roadway surfaces to seal cracks, rejuvenate dry weathered areas, improve friction characteristics and prolong life of the surface.

Concerns: total suspended solids (TSS), oil and grease (O/G), diesel, disposal of excess materials, and disposal of surplus liquid asphalt

Actions to improve practice:

① Use environmentally sensitive cleaning and releasing agents.
② Carry adequate supplies for small spill containment to ensure liquid asphalt does not reach receiving waters.
③ Work in dry weather.
④ Dispose of excess material in an approved manner and location.
⑤ Use heat source to heat and clean tack nozzles.

b. SHOULDER BLADING/REBUILDING

Description: Blading: Shoulder blading is the blading and shaping of unpaved shoulders and ditches to correct rutting, buildup of materials, excessive weed growth, and to maintain proper drainage.

Rebuilding: Restoration of unpaved sections by adding, reshaping, and compacting aggregate material, disposing of excess material, and/or pulling ditches. This activity is performed when blading cannot correct the problem due to the lack of material.

Concerns: Disposal of material and TSS

Actions to improve practice:
① Blade in dry weather, but while moisture is still present in soil and aggregate. Evaluate specific areas for alternatives such as berming or paving shoulder.
② Dispose of excess material at an approved location.
③ Install erosion control devices to prevent materials entering water bodies.
④ Permanently stabilize disturbed soils using best management practices- seeding, plants, etc., depending on site locations, cost and effectiveness.

c. <u>DITCH SHAPING AND CLEANING</u>

Description: Machine cleaning and reshaping of ditches including loading, hauling and disposing of excess materials.

Concerns: TSS, Debris and disposal of material

Actions to improve practice:
① Dispose of removed material at an approved location.
② Use erosion control devices when the potential exists to have sediment or other materials enter an aquatic system.
③ Re-seed where appropriate for grade, slope, etc.
④ Perform work in optimum weather when possible.
⑤ Recycle excavated material.

d. <u>CULVERT AND INLET CLEANING</u>

Description: Cleaning of dirt and debris from culverts, siphons, box culverts, catch basins, drop inlets, and other minor drainage facilities to restore proper operation.

Concerns: TSS, O/G, Disposal or storage of material, Timing of activity

Actions to improve practice:
① Provide erosion/sediment control during culvert/trash rack cleaning.
② Communicate by letter to ODFW on cleaning schedule and methods to clean culverts/trash rack at least two weeks prior to cleaning in ODFW identified sensitive areas such as spawning grounds.
③ Dispose of materials at an identified location with proper erosion and sediment control measures.
④ Know and follow in-stream work windows for specific streams and systems.

Bridge, Culvert, and Inlet Cleaning:
① Remove material on structure by shovel and dispose of appropriately above flood plain.
② Clean regularly to minimize buildup.
③ Inspect and clean before winter season and prior to rainy season.

e. <u>CULVERT AND INLET REPAIR/REPLACE</u>

Description: Repair and/or replace culverts, siphons, box culverts, catch basins, and drop inlets to restore proper operation.

Concerns: TSS, debris, timing of work, proper culvert installation

Actions to improve practice:
① Perform activities during the ODFW in-stream work window, or as negotiated with ODFW when working in or near surface waters.
② Provide erosion/sediment control during culvert or inlet repair as appropriate.
③ Inspect and prioritize repairs.
④ Involve ODFW with planning and implementation of any in-channel or riparian area work that could affect habitat or channel characteristics. Obtain proper permits for in-stream construction.

f. <u>CHANNEL MAINTENANCE</u>

Description: Cleaning and repairing of drainage channels including hauling and placing of riprap to restore slope and grade.

Concerns: TSS, disposal of material, impacts to fish, channel morphology

Actions to improve practice:
① Perform activities during the ODFW in-stream work window, or as negotiated with ODFW when working in or near surface waters.
② Involve ODFW with planning and implementation of any in-channel or riparian area work that could affect habitat or channel characteristics.
③ Identify and stockpile clean rock sources.

g. <u>MINOR SURFACE REPAIR</u>

Description: Hand patching of intermittent potholes, small depressions, and edge breaks in the bituminous surfaces and shoulders with hot or cold mix material.

Concerns: TSS, O/G, diesel, disposal of materials and CSS1

Actions to improve practice:
① Eliminate diesel as a releasing or cleaning agent.
② Use Environmentally sensitive cleaning and releasing agents.
③ Carry supplies for small containment (diapers, kitty litter).
④ Work in dry weather.

h. <u>MAJOR SURFACE REPAIR</u>

Description: Major patching of distortions, rutting, and surface irregularities with plant mixed asphalt concrete material.

Concerns: TSS, O/G, diesel, disposal of material, grinder slurry, and CSS1

Actions to improve practice:
① Eliminate diesel as a releasing or cleaning agent.
② Use heat sources to heat and clean tack nozzles during operation.
③ Use environmentally sensitive releasing and cleaning agents.
④ Carry adequate supplies to keep materials out of water bodies (diapers, kitty litter, shovel, etc.).
⑤ Work in dry weather.

i. <u>DEEP BASE PATCHING</u>

Description: Deep base patching is performed by grinding and removing deteriorated surface and base material, and replacing it with asphalt mix. This process provides a structurally sound driving surface.

Concerns: TSS, O/G, diesel, and disposal of removed materials

Actions to improve practice:
① Eliminate diesel as a releasing or cleaning agent.
② Dispose of removed material at an approved location.
③ Use environmentally sensitive releasing agent.
④ Carry adequate supplies to contain small spills and to keep materials out of water bodies.
⑤ Recycle grindings - add to new asphalt or use a substitute for new aggregate.
⑥ Coordinate with other jobs to use material as fill.

j. PROFILING AND TEXTURING

Description: Road surfaces that have lost their design shape due to overlay, patching, slides and settlements, rutting, raveling, which are otherwise structurally sound may be reshaped by cold planing to improve the traverse and longitudinal profiles and to improve the ride and drainage. Extreme buildup of bituminous material over PCC pavements and bridge decks may require complete removal to restore cross slope on the highway and reduce loading on bridge decks. Utility cuts will generally require extensive repair. Installations such as manholes and water valves will need to be adjusted to the new surface. All cracks in the PCC surface should be filled with a flexible sealant material.

Concerns: TSS, O/G, and material of disposal

Actions to improve practices:
① Use water to control dust.
② Dispose of materials in an approved manner at an approved location.

k. INLAY REPAIR (small and large)

Description: Cold planer removal and inlay paving with bituminous materials to correct local base failures, utility cuts, shoving, raveling, eliminate rutting and other surface irregularities to maintain a reasonable cross section and grade for drainage and rideability.

Concerns: TSS, O/G, disposal of material, and dust

Actions to improve practice:
① Eliminate diesel for use as releasing/cleaning agent.
② Use heat source to heat/clean tack nozzles.
③ Use environmentally sensitive releasing/cleaning agents.
④ Carry adequate supplies for spill containment to ensure spills/materials do not reach water bodies.
⑤ Dispose of debris material at an approved location.
⑥ Work in dry weather.

l. SWEEPING AND FLUSHING NON-PICKUP

Description: Sweeping and flushing of roadways, curbs, bikeways, bridge decks, and intersections to remove dirt, debris, and other loose materials. This activity pushes or flushes material to the side areas rather than picking it up and hauling it away.

Concerns: TSS, O/G, metals, and debris

Actions to improve practices:
① Use water when needed to reduce dust.
② Schedule sweeping during damp weather.
③ Use anti-icer to lessen sanding material where appropriate.
④ Remove sweepings within 25 feet of identified sensitive areas.

m. EROSION REPAIR

Description: Repairing damage caused by water or wind erosion including hauling and shaping of material to restore slope and grade. Restore vegetation for erosion control.

Concerns: TSS, and disposal of material

Actions to improve practices:
① Dispose of removed material at an approved location.
② Perform erosion control in a timely manner.
③ Seed and mulch susceptible areas with non-invasive species.
④ Install silt fences and other erosion control devices as appropriate.
⑤ Take precautionary measures on erodible areas.

n. OTHER DRAINAGE MAINTENANCE

Description: Miscellaneous maintenance activities to inspect and repair or restore the operation of drainage facilities.

Concerns: TSS, debris, and disposal of material

Actions to improve practices:
① Perform work during the ODFW in-stream work window, or as negotiated with ODFW in sensitive areas.
② Prioritize and treat sediment problems adjacent to significant aquatic resources including fish ladders, tidegates, trash racks.
③ Place removed material at an approved site, with appropriate erosion control.
④ When conditions allow, provide erosion control measures.

o . OTHER SHOULDER WORK

Description: Miscellaneous maintenance activities performed on shoulder surfaces that are not specifically listed as separate activities.

Concerns: TSS and others depending on activity

Actions to improve practices:
① Dispose of waste material at an approved location.
② Environmental concerns such as wetlands, erosion control, and waterway pollution are to be addressed in the performance of these activities and the disposal of waste material.

p. OTHER SURFACE MAINTENANCE

For BMPs relating to specific surface maintenance activities, refer to attachments A, B, and C, depending on the appropriate jurisdiction.

q. FENCE MAINTENANCE

Description: Repair and replace right-of-way and access control fence to restrict access, provide screening, and control livestock access. Includes fence inspection.

Concerns: TSS and litter

Actions to improve practice:
① Pick up litter.
② Use good housekeeping practices.

r. PAINT STRUCTURES

Description: Sandblasting, surface cleaning, and painting of structure elements.

Concerns: TSS, metals, and paint cleanup

Actions to improve practice:
① Remove steel rail and take to shop for rust removal and painting.
② Block bridge deck drains and route any water off structure to detention facility.
③ Eliminate use of lead based paints.

s. SNOW REMOVAL

Description: Removing snow, ice, and slush from the roadway and shoulders including ramps and intersections by plowing or blading.

Concerns: TSS, and debris

Actions to improve practice:
① Identify sensitive areas and educate crews on winter maintenance activity expectation.
② Develop winter maintenance plans for specific, sensitive areas.
③ When plowing next to a body of water, or on a structure that spans water, adjust speed to keep material out of waterway.
④ Educate staff on water quality issues.

t. EMERGENCY MAINTENANCE

Description: Emergency or extraordinary repair of damage to roadway, roadside, and structures resulting from storms, floods, wind, civil disorder, and other disasters.

Concerns: Incidental wetland impacts, riparian areas, and stream bed impacts

Actions to improve practices:
① Provide quick response and first inspection, notify appropriate resource staff.
② Repair any damage to fishery or water resources caused by response activities as opposed to damage caused by emergency action.
③ Remove all excess material to pre-approved disposal location.
④ Provide adequate erosion control or bank stabilization necessary to keep material from entering waterway.
⑤ Identify and plan for slide debris disposal sites.

u. SETTLEMENTS AND SLIDES

Description: Repairing roadway settlements and slides including loading, hauling, and placing of suitable materials.

Concerns: TSS, impacts to wetlands, and disposal of material

Actions to improve practice:
① Notify appropriate resource staff and agencies.
② Provide adequate erosion control and containment to eliminate sediment from entering waterway.
③ In coordination with ODFW, repair any damage caused by activities to water resources.
④ Avoid additional impacts to wetlands/streams.

v. ROADSIDE VEGETATION MAINTENANCE

Description: Mechanically mowing, trimming, removing/disposing of brush (i.e., to restore sight distance, road safety), hand cutting, applying herbicide to eradicate, prevent, or retard growth of noxious weeds, brush and other undesirable vegetation.

Concerns: TSS, particle drift, residual effects in soil, post application impacts to human and animals, public perception, threatened and endangered species impacts, disposal of waste material, contamination from runoff, and dust

Actions to improve practice:
① Investigate mechanical means to reduce chemical use.
② Evaluate site (see Planning Practices; Assessment Process).
③ Minimize removal of vegetation.
④ Plant/re-seed area.
⑤ Public and staff education programs.
⑥ Emphasize, utilize and implement vegetation control policies, including noxious weeds.
⑦ Dispose of waste material according to ODEQ's required procedure.
⑧ Dispose of debris material in an approved location.
⑨ When appropriate, designate "No Spray" zones.

## 3.3.4.2.5 Evaluation of Priorities

The Core Umatilla TMDL partnership (UBWC, CTUIR, ODEQ) will take the lead in establishing and coordinating a committee made up of at least, but not limited to, the following organizations: Umatilla County, ODOT, ODF, ODEQ, CTUIR, ODFW, US Forest Service, Municipalities. This may occur as part of the Core Partnership's periodic *Maintenance of Effort Over Time* (refer to this section in **Chapter Three**) activities. Within the first year of sponsorship the group will complete the following tasks as they relate to transportation corridors and activities:

- Identify and inventory localized transportation related "hot spots" such as stream bank stability problems associated with roads, roads that are major sediment sources, improperly sized or maintained culverts, roads that are seriously constraining a stream, limiting shade, storm water associated with new development, etc.
- Assign priorities to these "hot spots" based on professional judgment of the magnitude of effect on water quality.
- Identify solutions and make rough estimates of costs of correction of the problems.
- To the extent possible address the problems working from highest priority (most serious problem) to lowest.
- For problems that cannot be addressed with existing road maintenance and construction funding, begin seeking other funds (OWEB, Bonneville Power Authority, etc.) again working in priority order.

The group would then oversee implementation of solutions..... 2000–2005.

## 3.3.4.2.6 Population Growth and New Construction

Design and construction of future roads or transportation corridors that support development or population expansion should implement TMDL load allocations for effective shade, channel narrowing and erosion reduction. The TMDL allocations for temperature and sediment are based on predicted system potential. Habitat and substrate goals should be addressed as well.

New construction and repair provide important opportunities to implement practices or structures that lead to improved water quality and habitat. The long-term goal is to reverse the trend of human-induced water quality impairment until water quality standards are met. New development should lead to improvement of water quality. Currently, storm water management is generally not regulated by the State unless a site is more than 5 acres. Whether or not this threshold is modified through the impending Phase II storm water regulations that may apply to the larger towns of the Basin, construction area storm water control should be considered as an aspect of the sediment load allocation implementation.

Transportation planning for new development should be linked to water quality. Solutions should be implemented that mutually address livability, traffic control/routing, riparian protection and enhancement, erosion control, and hydrologic or runoff attenuation to better simulate natural conditions. Broadly stated environmental quality goals in County and Municipal Comprehensive plans should be translated into specific elements of transportation corridor design, construction and maintenance.

## 3.3.4.3 MONITORING AND EVALUATION

Basin-wide Water quality monitoring is addressed in the *Long Term Monitoring* Section of **Chapter Three**. Implementation of best management practices will be conducted by the responsible agencies and reviewed periodically through a Basin-wide multi-agency advisory committee, as discussed in the *Maintenance of Effort Over Time* Section.

ODOT, ODF and the US Forest Service state commitment to long term monitoring of BMP implementation and effectiveness in the manuals cited herein.

Transportation agency monitoring of TMDL implementation is requested. This is particularly important where a corridor is within a few hundred feet of an active channel: percent effective shade, channel width and depth, and streambank stability.

## 3.3.4.4 SECTION REFERENCES

Barrett, M.E. et al, 1995, A *Review and Evaluation of Literature Pertaining to the Quantity and Control of Pollution from Highway Runoff and Construction*. Center for Research in Water Resources, University of Texas at Austin. Technical Report CRWR 239.

Bertran and Kaster, 1982, *Biological Assays of Highway Runoff Water*. Draft. Federal Highway Administration. April 1982.

Bjornn, T. and Reiser, D., 1991, *Habitat Requirements of Salmonids in Streams.* In W.R. Meehan, ed., Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication 19. Bethesda, MD.

City of Pendleton (1964, 1974...), City of Pendleton Comprehensive Plan, pursuant to ORS 197.175.

Driscoll, E. et al, 1990, *Pollutant Loadings and Impacts from Highway Stormwater Runoff*, 5 vols. Federal Highway Administration Report FHWA-RD-88-006.

Dorman, M. et al., 1996, *Retention, Detention and Overland Flow for Pollutant Removal from Highway Stormwater Runoff*. Vol 1 Research Report. Vol 2 Design Guidelines. Federal Highway Administration. Report FHWA-RD-96-096.

Dupuis et al, 1984, *Effects of Highway Runoff on Receiving Waters, vol II. Results of field monitoring program*. Draft Report FHWA-RD-84-065.

Dupuis and Kobriger, 1985, *Effects of Highway Runoff on Receiving Waters, vol IV. Procedural Guidelines for Environmental Assessments*. Draft Report FHWA-RD-85-065.

Furniss, M.; Flanagan, S.; Ory, K.; Moore, K. and Ledwith, T.; 1996, *Watershed-scale Road Stream Crossing Risk Assessment*, Watershed Management Council Networker 6(4).

Harr, R. and Nichols, R., 1993, *Stabilizing Forest Roads to Help Restore Fish Habitats: A Northwest Example*. Fisheries 18(4):19-22.

Hollenbach, M. and Ory, J., 1999, *Protecting and Restoring Watersheds - A Tribal Approach to Salmon Recovery,* Columbia River Inter-Tribal Fish Commission.

Oregon Department of Agriculture, 1999*, Umatilla River Subbasin Agricultural Water Quality Management Area Plan*, ODA and the Umatilla Soil and Water Conservation District.

Oregon Department of Environmental Quality, 1996, *General Permit: National Pollutant Discharge Elimination System Storm Water Discharge Permit*, ODEQ, 811 SW Sixth Ave, Portland, OR.

Oregon Department of Forestry, 2000, *Forest Road Management Guidebook, Maintenance and Repairs to Protect Fish Habitat and Water Quality*, ODF, January 2000.

Oregon Department of Transportation, 1999, *Routine Road Maintenance, Water Quality and Habitat Guide Best Management Practices,* ODOT, July 1999.

Oregon Plan for Salmon and Watersheds, www.oregon-plan.org

Poertele et al, 1982, *Effects of Seattle Area Highway Stormwater Runoff on Aquatic Biota*. Washington DOT Report WA-RD-39.11.

US Forest Service, 1989, *Road Maintenance Standards and Operating Procedures*, Umatilla National Forest, April 1989, 121 p. *Protecting and Restoring Watersheds* (Columbia River Inter-Tribal Fish Commission, 1999).

Weaver, W. and Hagans, D., 1994, *Handbook for Forest and Ranch Roads: A Guide for Planning, Designing, Constructing, Reconstructing, Maintaining and Closing Wildland Roads.*

Winters and Gidley, 1980. *Effects of Roadway Runoff on Algae*. Federal Highway Administration. Report FHWA-CA-TL-80-24.

Wolman, M., 1954, *A Method of Sampling Coarse River-bed Material*. Transactions of American Geophysical Union 35: 951-956.

Young, K. et al, 1995, *Evaluation and Management of Highway Runoff Water Quality*. Federal Highway Administration. Report FHWA-PD-96-032.

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# 3.4 WATER QUANTITY MANAGEMENT

## 3.4.1 Overview and Background

### 3.4.1.1 COMMITTEE

Appreciation for their dedication and contribution is extended to the Water Quantity workgroup Members:

- Ron Deutz Chairperson, Pendleton OR
- Phil Reeves, Pendleton OR
- Bob Hoeffel, Hermiston OR
- Tracy Bosen, Pendleton OR
- Shauna Mosgrove, LaGrande OR
- Don Butcher, Pendleton OR
- Dale McKain, Pendleton OR
- Jeff Newtson, Pendleton OR
- Mike Ladd, Pendleton OR
- Rosenda Shippentower, Pendleton OR
- Renee Moulun, Salem OR
- Ed Farren, Pendleton OR

This plan was written with input and/or assistance from the following agencies and organizations:

- Oregon Water Resources Dept.
- Confederated Tribes of the Umatilla Indian Reservation
- Oregon Dept. of Environmental Quality
- Oregon Water Trust
- Umatilla Basin Watershed Council
- US Bureau of Reclamation
- Oregon Water Coalition
- Umatilla County Soil and Water Conservation District
- Oregon Department Fish and Wildlife

Committee members involved in authoring the plan:

Ron Deutz............................................... Overall Plan Development

Ron Deutz & Rosenda Shippentower..... Umatilla Basin Project Phase III

Phil Reeves............................................. Natural and Constructed Wetlands
Jeff Newtson & Bob Hoeffel.................... Constructed Ponds

Ron Deutz & Phil Reeves........................Large Reservoir/Water Storage

Rosenda Shippentower...........................Purchasing/Leasing Water Rights

Ed Farren................................................ Water Law and Regulation

Renee Moulun.........................................Allocation of Conserved Water Program

Renee Moulun.........................................Municipal and Agricultural Water Management and Conservation Plans

Bob Hoeffel............................................ Updating/Improving Irrigation Systems

Phil Reeves & Ron Deutz....................... Water Inventory

## 3.4.1.2 PLAN DEVELOPMENT COMMENTARY

The purpose of this plan is to improve instream water quantity (flows) for all beneficial uses. The beneficial use most sensitive and dependent on the quantity of water is fisheries. Therefore, water quantity for fisheries is the key focus of this plan.

The development of a water quantity plan was both unique and complex. The committee developing this plan had to consider and deal with the following:

Unlike other watershed plans within this document, which were written to address sediment, temperature, nutrients, etc., and had specific standards or endpoints (i.e. 64°F, 30 NTU) to guide plan development, there were no precise standards regarding instream flow. Instream water rights protect flow relative to a priority date, but are generally superceded by senior rights during low flow periods.

The Oregon Water Resource Department (OWRD) has statutory authority to regulate flows "among the various users of the water from any natural … supply…" (ORS 540.045a). The state legislature has ruled that it is in the public interest that: … state water resources policy be formulated… by a single state agency which… shall give…consideration to the multiple aspects of beneficial use… designed to best protect and promote the public welfare (ORS 536.220 2 a).

Additionally, two Oregon Administrative Rules that give limited authority to promote flow improvement are:

- OAR 340-41-645 (1) "Notwithstanding the water quality standards… the highest and best practicable treatment and/or control of wastes, activities and flows shall in every case be provided so as to maintain dissolved oxygen and overall water quality at the highest possible levels and water temperatures, coliform bacteria concentrations, dissolved chemical substances, toxic materials, radioactivity, turbidities, color, and other deleterious factors at the lowest possible levels."

- OAR 340-41-026 (6-10) "…federal, state and local resource management agencies will be encouraged and assisted to coordinate planning and implementation of programs to regulate or control runoff, erosion, turbidity, stream temperature, stream flow, and the withdrawal and use of irrigation water on a basin –wide approach, so as to protect the quality and beneficial uses of water and related resources. Such programs may include…development of projects for storage and release…urban runoff control… possible modification of irrigation practices…streambank erosion reduction projects."

The Oregon Dept. of Fish and Wildlife (ODF&W) and ODEQ requested and were granted instream water rights for minimum flows for fish survival. These water rights aimed at reducing impairment of fisheries, place emphasis on the issue of quantity / flows, though the rights are relatively junior. In summary, though no specific instream flows (c.f.s.) are required by the Environmental Protection Agency (E.P.A.) or the Oregon Dept. of Environmental Quality (D.E.Q.), there are laws and administrative rules that address flow, albeit not at specific levels.

One of the more complex aspects of writing a water quantity plan has to do with attempting to increase flows without adversely affecting natural water temperatures, sediment and hydrology. Water storage might best illustrate this point. Any impoundment, be it a large reservoir or a series of constructed ponds will affect water temperature; and sediment and flow quantity and variability. Reservoirs can cause either heating or cooling down-stream. High flows are needed to scour the riverbed and for stable channel maintenance, whereas extreme flows are typically limited by dam operation. Any attempt to store water has to be balanced with the questions: Will this adversely alter natural water temperatures, sediment and hydrology? Will there be a net water quality and habitat benefit?

Developing strategies to benefit both instream and diverted flow during the low flow summer months, is also complex. Adding flows to the system doesn't necessarily increase downstream flow. Irrigators, and other water rights holders, could consume increased flows. Therefore strategies to promote instream flow, such as buying water rights, were employed in the plan. Also needing consideration was the problem of getting conserved water to the fish when they need it most. Water left instream for the fish (via water conservation plans etc.) is needed most during low flow periods. Also, though a conservation plan such as converting flood irrigation to overhead sprinkler irrigation reduces out of stream consumption, the fish could be negatively impacted due to a reduction of cool water re-entering the river system through groundwater recharge. Less water applied on the ground (overhead sprinklers) can mean less groundwater recharge to the river systems, particularly where levies have limited flooding. These complexities have no easy answers. An attempt was made to consider all the issues, pro and con, as the plan was developed.

Relatively late in their process, the workgroup was asked to consider direct appropriation (as distinguished from exchange) of Columbia River water to increase Umatilla Basin water availability (through the appropriate Oregon water laws, including but not limited to OAR 690-033-0140). Questions of legal basis and in-stream benefits were discussed and not resolved. Given the timing and complexity of the request, and lack of consensus within the workgroup, the workgroup elected to not make a recommendation for or against pursuing this suggestion.

Another issue for the committee was the lack of available water quantity plans to use as models. To our knowledge no watershed plan simultaneously addresses both instream and diverted flow in the needed context. No plan spells out the practices needed to insure and/or increase flows.

Finally, because four other committees (Forestry, Urban/Industrial, Transportation and Agriculture) and the Tribal Water Health Committee were writing plans affecting water quality and quantity, it would have been redundant to address management practices already recommended in their plans (i.e. riparian areas, waste water uses etc.) Though these can affect water quantity, their plans covered those strategies. Therefore the water quantity plan focused on methods of improving flows not covered by the other committees.

## 3.4.1.3 SCOPE

The Water Quantity Workgroup views its main purpose to be that of insuring adequate flows of water year-around to provide for all designated beneficial uses (refer to **Chapter One** for a list of Umatilla Basin designated uses). The Water Quantity Plan is viewed as an integral part of the overall basin plan. The Water Quantity Plan proposes to implement strategies to enhance flows, strategies not addressed by other workgroup plans. Included in the plan are objectives that target public education and outreach.

An optimistic view would be that this plan lays some groundwork for achieving flows in the Umatilla watershed that sustain all beneficial uses now and far into the future. Beyond the scope of this plan are issues that will need to be resolved. It should suffice to say that this plan focuses only on identifying potential opportunities to improve water quantity. Water law will address the issues related to distribution and regulation.

This plan is composed of specific strategies or best management practices (BMPs). Included in each sub-plan are components dealing with ordinances, responsibilities for implementation, time lines, funding sources and technical assistance from agencies.

## 3.4.1.4 GOALS

The goals are stated in specific language in each management plan. Therefore no attempt is made here to state plan goals, except in general terms.

- Maintain existing flow improvements.

- Provide year around flows in the Umatilla watershed that are needed to satisfy all beneficial uses.

- As a minimum goal, work toward achieving existing Umatilla Basin instream water rights (IWR), flows determined to be necessary for salmonid life cycles. [the IWR were requested by ODFW and ODEQ and held in trust by the OWRD, refer to **Section 3.4.5** for tabulation and discussion of IWR]

- An accurate system of measuring stations (which for the most part is in place) is critical to determining whether or not the above stated goals are met.

# 3.4.2 PHASE III OF THE UMATILLA BASIN PROJECTS

## 3.4.2.1 GOAL

To support the completion of Phase III of the Umatilla Basin Project (UBP) in order to restore instream flows for fisheries and aquatic life in the Umatilla River and to protect the stability of the local irrigation economy.

## 3.4.2.2 CURRENT CONDITION

In the Umatilla Basin, the U.S. Bureau of Reclamation (BOR) built a large irrigation project in the early part of this century. The irrigation economy was born and flourished, but the salmon were driven into extinction. The project de-watered the Umatilla River several months out of the year, and its dams blocked fish passage. To improve conditions, the Umatilla Basin Project was developed by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), the irrigators, the Bonneville Power Administration (BPA), the Oregon Water Resources Department and the Oregon Department of Fish and Wildlife.

The UBP includes fish passage improvements and a water exchange that delivers Columbia River water to the participating irrigation districts. In exchange, the irrigation districts leave water in the Umatilla River for instream flow when it is needed for fish. In addition, a large portion of space in the McKay Reservoir is devoted for instream flow augmentation use. The Columbia River is not impacted, because for every bucket of water taken from the Columbia River, a bucket remains in the Umatilla River, ultimately to flow back to the Columbia River. The exchange includes three of the four major irrigation districts in the Umatilla Basin. While it does not increase flow year-round, it does increase flows during critical salmon migration periods in the spring and fall.

The first work completed under the UBP was to fix dam passage problems. Fish ladders were improved or installed at five dams along the Umatilla River.

Phases I and II of the UBP are described in more detail in **Chapter One**, **Section 1.2**. Additional Phase III information is available in **Sections 1.2** and **3.4.6**.

Phase III, authorized for study by Congress in 1966, would similarly deliver Columbia River water to the one large irrigation district and individuals not served by Phases I and II. This District continues to divert about half of the Lower Umatilla River flows from June to September. The Bureau of Reclamation is currently working on a feasibility study for Phase III. At this point, Phase III is merely a feasibility study. In mid-summer, the Lower Umatilla River is still nearly dry. Such continued loss of flow and habitat lessens the recovery potential of anadromous salmon, reintroduced to the Umatilla beginning in 1985, and dramatically increases river temperatures.

## 3.4.2.3 TO CORRECT/IMPROVE CURRENT CONDITIONS

Coming on the heels of the completed Phase I and II of the UBP, Phase III would complete the exchange of lower Umatilla Irrigation District water. Diverted from the Umatilla River for the last 70 years, this water would be exchanged for Columbia River water. If completed, Phase III (like Phase II) would provide a new water source from the Columbia River for Westland Irrigation District.

Phase III would allow nearly the entire Umatilla River stream flows to remain in the Umatilla River. Phase III would benefit salmon restoration by providing more natural levels of instream flow and would help with the ongoing effort to reduce pollution levels in the Umatilla River. On the irrigation side, **tapping into the Columbia River provides farmers a more reliable** source of water than they currently have from the Umatilla River. Ultimately, completion of the Phase III project will benefit farmers and the local agricultural economy, non-Indian and Indian fishers, and the region by providing a cooperative, mutually beneficial solution to a very contentious issue, an over appropriated river with seemingly mutually exclusive demands.

## 3.4.2.4 RECOMMENDATIONS

1. Promote a Phase III by bringing attention to the successes of Phase I and II. As the attention on the existing UBP changes from construction to operations, it is important to monitor the project's operations to ensure the maximum benefits for fish. In addition, irrigators' operational concerns should be recognized and addressed.

2. Public education activities are very important in making Phase III a popularly supported project by giving people of the Umatilla Basin a sense of ownership of the project. Newspaper articles showing how supported the UBP is will be compelling to members of Congress, increasing funding potential.

3. Seek solutions to the competition for BPA's limited Fish and Wildlife Program funds, which have been capped. The original UBP Act required BPA to fund the pumping costs for the project out of its Fish and Wildlife Program funds.

4. Getting the UBP authorized and funded by Congress. Broad support for legislation is the best bet for getting a Phase III authorized.

5. Getting the US Office of Management and Budget (OMB) to support the Phase III proposal. OMB opposed the original UBP in 1988 as well as the Phase III proposal in 1996. OMB reports to the Administration and gives recommendations on all proposed projects.

6. Developing a forum to bring water users together in a cooperative format to discuss the water prioritization and management problems. The Umatilla Basin Watershed Council has offered to facilitate the Phase III process.

## 3.4.2.5 IDENTIFY COOPERATING PARTIES

- Oregon Water Resources Department
- Confederated Tribes of the Umatilla Indian Reservation
- U.S. Congress
- Municipalities (Pendleton, Echo, Stanfield, and Hermiston)
- U.S. Bureau of Reclamation
- Lower Umatilla Irrigation Districts (West Extension, Hermiston, Stanfield, Westland)
- Other Irrigators
- Oregon Department of Fish and Wildlife
- Bureau of Indian Affairs
- Umatilla Basin Watershed Council

### 3.4.2.6 COST AND FUNDING SOURCES

- US Office of Management and Budget
- Bonneville Power Administration

### 3.4.2.7 ENDORSEMENTS

The completion of Phase III is of the utmost importance to the Umatilla Basin and will greatly enhance several beneficial uses. The Water Quantity Workgroup strongly endorses the completion of Phase III.

Letters were submitted to show support for Phase III and to elaborate on issues that will need to be resolved as Phase III moves forward. These letters from, from the City of Pendleton, the CTUIR, and Hermiston Irrigation District, are included in Attachment A.

## 3.4.3 Natural and Constructed Wetlands Management

### 3.4.3.1 GOAL

Improve water quality and dry season quantity in the Umatilla River Basin through protection of existing wetlands and restoration of degraded or nonfunctional wetlands where feasible, through implementation and use of an integrated organized system of constructed ponds and/or marshes.

### 3.4.3.2 CURRENT CONDITIONS

The Umatilla River and tributaries experience high flows at times during winter and early spring and low flow in the summer and early fall. This is due mostly to natural conditions but is further exacerbated by water withdrawal from streams, floodplain modification and a loss of wetlands. These conditions cause increased risk of flooding and a high sediment load in winter and early spring. Low flows contribute to the violation of temperature and other TMDL standards, and underlie the disparity between water rights for irrigation and instream water rights for salmonid passage and rearing.

An assessment of basin wetlands (primarily on the Umatilla River mainstem) by CTUIR[1] and the EPA shows a large loss of wetlands acreage due to levee and dike construction for purposes of urban, residential area and farmland development. Additional loss can be attributed to construction of transportation routes including the railroad and Interstate-84. Removal of beaver from most of the watershed has also had a negative impact on wetland areas.

The purpose of this WQMP and the proposed BMP's is to improve water quantity and quality by recommending restoration of natural wetlands where feasible, and development of an integrated system of constructed ponds and wetlands.

[1] CTUIR 1997 Wetland Protection Plan

### 3.4.3.3 DEFINITION OF WETLANDS

Wetlands are "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR 328.3; 40 CFR 230.3). Wetlands generally include lakeshores, riparian areas, swamps, marshes, bogs and similar areas.

### 3.4.3.4 VALUES AND FUNCTIONS OF WETLANDS

Wetlands provide many benefits, including food and habitat for fish and wildlife; flood protection; shoreline erosion control; natural products for human use; water quality improvement; and opportunities for recreation, education, research and cultural benefits.

Wetlands often function like natural tubs or sponges, storing water (floodwater, or surface water that collects in isolated depressions) and slowly releasing it. Trees and other wetland vegetation help slow floodwaters. This combined action, storage and slowing, can lower flood heights and reduce the water's erosive potential.

Wetlands thus -

- reduce the likelihood of flood damage to crops in agricultural areas
- help control increases in the rate and volume of runoff in urban areas
- buffer shorelines against erosion.

Wetlands help improve water quality, including that of drinking water, by intercepting surface runoff and removing or retaining its nutrients, processing organic wastes, and reducing sediment before it reaches open water.

### 3.4.3.5 BEST MANAGEMENT PRACTICES

Best Management Practices (BMPs) are site-specific applications of management techniques (e.g., grade control, run-off control, sediment control, public education, etc.). These activities address site-specific problems and the overall watershed health.

New projects will go through all these phases whether a State, County, City or private project. It should be noted that there is an expedited process for ponds storing less than 9.2-acre feet or with a dam less than 10 feet in height (OAR 690-11-041). It should also be noted that certain water uses are exempt from the permit process: natural springs, stock watering holes, and land management practices where water use is not the primary intended activity.

The BMPs that follow are known to be generally beneficial to watersheds. While these are the practices currently recommended, better new ideas may come along as more people get involved in the process.

For structural BMPs the two most prominent design criteria are to enhance retention of water and to reduce sediments in the Basin's waters. This function can be performed by constructed and natural wetlands. In the text following, natural wetlands are discussed first, followed by constructed wetlands and ponds.

# 3.4.3.5.1 NATURAL WETLANDS SUSTAINABILITY AND RESTORATION

It is recommended that existing wetlands be maintained in a functional status wherever possible. Historic or degraded wetlands and sinuosity should be restored wherever feasible.

Assessment of the main stem Umatilla River corridor by CTUIR[2] and EPA shows approximately 10,090 acres of existing wetlands. Of those acres approximately 4,400 are lacustrine wetlands (associated with lakes, ponds, and reservoir), 4,030 are palustrine (generally swamps, marshes, and bogs), 1,440 are riverine (adjacent to river channel), and the remaining 220 are seeps, springs and wet meadows not directly associated with stream channels.

Best management practices for forest, urban, and agricultural lands and transportation corridors should allow for no negative impacts on remaining wetland areas. Where feasible, wetlands restoration should be implemented on historic degraded wetlands areas. Restoration efforts will be site specific. Historical wetlands may be restored through protection alone allowing for a natural recovery. In other potential historic wetlands areas it may be necessary to implement active restoration. Where active restoration is feasible it can be costly. Individual landowners are encouraged to use financial assistance from federal, state, and private sources to make restoration feasible.

Three areas on the main stem corridor have been specifically identified for protection and/or restoration.[3] These areas, Minthorn Springs on the Umatilla Indian Reservation; a braided portion of the Umatilla River downstream of Pendleton (approximately river mile 47); and the Echo/Umatilla Meadows complex.

The Echo/Umatilla Meadows complex represents a very large historic wetlands area. Reconnecting as much of this area as is feasible with the flood plain is desirable. Where flood plain reconnection is not feasible, there may be potential to artificially recharge historic wetlands areas during high water periods in the winter and early spring. Further study of this as a possible BMP should be undertaken.

An assessment of the tributaries is necessary to determine system potential for wetlands protection and restoration throughout the remainder of the watershed. On the tributaries best management practices should be implemented which protect existing wetlands from degradation. Potential restoration sites when identified should be afforded protection and allowed to recover naturally or where feasible be targeted for active restoration.

Urban growth planning should minimize negative impacts on wetlands.

Reintroduction of beaver into areas of suitable habitat can be a long term BMP for wetlands restoration. Beaver should not be reintroduced without adequate habitat (a large quantity of well-established trees).

Where feasible, move dikes and levees farther from the river to approximate a more natural flood plain.

The US Forest Service uses interim guidelines that can assist in defining or protecting wetlands (PACFISH, USFS 1995). PACFISH (**REFERENCE**) defines Riparian Habitat Conservation Areas (RHCAs). RHCAs include traditional riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems by: (1) influencing the delivery of coarse sediment, organic matter, and woody debris to streams, (2) providing root strength for channel

[2] CTUIR 1997 Wetlands Protection Plan

stability, (3) shading the stream, and (4) protecting water quality. Interim buffer widths are described as follows:

> Ponds, lakes, reservoirs, and wetlands greater than 1 acre: Includes the waterbody and the area to the outer edges of the riparian vegetation, or to the extent of the seasonally saturated soil, or to the extent of moderately and highly unstable areas, or to a distance equal to the height of one site potential tree, or 150 feet slope distance from the edge of the maximum pool elevation of constructed ponds and reservoirs or from the edge of the wetland, pond or lake, whichever is greatest.
>
> Seasonally flowing or intermittent streams, wetlands less than 1 acre, landslides, and landslide-prone areas: At a minimum, these widths must include: The extent of landslides and landslide-prone areas; the intermittent stream channel and the area to the top of the inner gorge; the intermittent stream channel or wetland and the area to the outer edges of the riparian vegetation; the area from the edges of the stream channel, wetland, landslide, or landslide-prone area to a distance equal to the height of one site-potential tree; or 100 feet slope distance, whichever is greatest.

# 3.4.3.5.2 Constructed Ponds and Marshes

Constructed ponds ands marshes are just that. They would not exist if it were not for a man made structure (dam, embankment, terrace etc.) They are not a natural wetland but rather a water body created by construction.

It is recommended that constructed ponds be developed in a top to bottom sequence. That is, start in the upper reaches of the watershed and work down to the mouth of the river.

## 3.4.3.5.2.1 WET PONDS

**Description.** Wet ponds appear as a depression that contains a permanent pool, often behind an existing road fill or constructed embankment. Wet ponds are deeper on the average than a wetland and typically larger than a sedimentation pond. Treatment occurs through a variety of natural, physical, and biological processes in the aquatic environment. Since embankments/road fills are usually utilized to establish the ponding, wet ponds are generally deeper at one end (near the embankment) than at the upstream end.

**Concept Variations.** Ponded wetlands, extended detention ponds and conjunctive-use flood detention ponds are all variations of wet ponds. Extended detention ponds or other facilities that remain dry much of the time are the most noticeably different.

**Maintenance Requirements.** Wet pond maintenance includes periodic sediment removal; debris removal and cleaning particularly from trash racks; vegetation management around, and often within, the pond; periodic checks on hydraulic function; and periodic review of facility condition. During the first three years, maintenance inspection should occur at least quarterly but could be less frequent after three years.

**Local Implementation Options.** The implementation options include land use regulations, which require constructed wet ponds or variations of constructed ponds and design-construction standards for both private and public lands. Operation and maintenance programs are required, should be defined during the design and construction process, and should include an adequate budget.

### 3.4.3.5.2.2 SEDIMENTATION PONDS

**Description.** During normal dry periods a sedimentation pond is often a dry depression behind a road fill or constructed berm. It could also be a pond located in the uplands or on cultivated lands. Some are designed to provide a permanent, or semi-permanent, pool of water and resemble a wet pond, though they are usually smaller. During storm periods, particularly intermediate level storms, a sedimentation pond is designed to provide a quiescent pool where settling of sediments can occur. During base flow periods, low intensity storms and higher flood flows, sedimentation ponds are not designed to provide much settling. Sedimentation ponds can vary in size from one-fourth an acre up to twenty or more acres depending on the drainage area served. One of the most common applications is at construction sites during and immediately following construction to intercept soil particles disturbed by the construction. However, they can also serve urban, agricultural or silvicultural areas effectively. A sedimentation pond is similar to a wet pond but typically does not have a permanent pool. It is different from a sedimentation wetland or a ponded wetland because of an absence of, or less, wetland vegetation.

**Parameters/Pollutants Potentially Addressed.** If designed correctly sedimentation ponds can do an excellent job of removing suspended sediments and associated pollutants such as phosphorus and metals.

**Concept Variations.** Extended detention ponds are very similar to sedimentation ponds but cover a considerably larger area because of the storage volume needed to reduce peak flood flows. Wet ponds are usually larger but very similar to wet sedimentation ponds. Sedimentation wetlands are wet sedimentation ponds with wetland vegetation to provide additional sediment removal functions.

**Maintenance Requirements.** Sedimentation ponds require frequent periodic sediment removal, the cleaning and removing of debris, and periodic checks regarding facility condition and hydraulic function. The periodic checks should occur at least twice annually, quarterly is recommended. For new facilities, or the ones with high sediment loads, monthly inspections are advisable. Sedimentation ponds during the first few years of operation should be maintained two or three times per year and more often if construction areas are being served. After construction, or after the first two or three years some sedimentation ponds can be maintained on an annual basis and this should generally be done during the late spring or early fall depending on drainage area characteristics and runoff conditions.

**Local Implementation Options.** The primary local implementation options involve land use regulations, water management/master plans, capital improvement plans and design-construction standards. An operation and maintenance (O&M) program for each facility is recommended. If very many facilities are involved an integrated O&M plan should be developed.

Ponds will reduce peak flows and provide flood damage reductions. Extended detention ponds are generally regional public facilities.

### 3.4.3.5.2.3 EXTENDED DETENTION PONDS

**Description.** Extended detention ponds look very much like sedimentation ponds with the most notable exception being size. Detention ponds are usually larger, in some cases much larger, due to the area required to contain the floodwater volume. The size of a detention pond is directly related to the magnitude of the design flood. During low intensity storm events, the lower part of an extended detention pond fills and provides for quiescent settling of sediments. During high flows a much larger area would be inundated. They best serve relatively large areas since the complex design and O&M requirements are usually more involved than that justified for private construction.

**Parameters/Pollutants Potentially Addressed.** The primary parameter involved is suspended sediments and attached pollutants such as phosphorus and metals.

**Concept Variations.** Extended detention ponds are very similar to sedimentation ponds.

**Maintenance Requirements.** Sediment removal, debris removal and cleaning, vegetation management and a periodic check of hydraulic function and facility condition are all required during maintenance. The frequency should be three or four times annually during the first two years and adjusted according to experience thereafter. Most extended detention ponds will require at least an annual maintenance under even the best conditions.

**Local Implementation Options.** The primary implementation options are surface water management/master plans and capital improvement plans since most facilities are regional and public in nature. They should be designated in a community's comprehensive plan and considered for new developments where appropriate through land use regulations. Design-construction standards are required since the facilities are moderately complex and the facilities should be integrated into the O&M work program.

#### 3.4.3.5.2.4 MAINTENANCE AND CONSTRUCTION PRACTICES IN CONSTRUCTED PONDS AND MARSHES

In planning the specific procedures and times for maintenance activities these are some of the criteria to be considered:

- Rules and regulations
- Habitat concern: water resources and fish
- Seriousness of impact to resources – real vs. perceived
- Can it be implemented?
- Cost effectiveness?
- Location (jurisdictional)
- Geography (topography, terrain, water bodies)
- Weather

### 3.4.3.6 Rationale

For landowners, wetlands restoration and constructed ponds could be part of their management plan. It should enhance landowner opportunities for funding and management plan approval by regulatory agencies. The same could be said for industries and municipalities.

The need for funding for wetlands restoration and constructed ponds is becoming increasingly recognized through both private and governmental agencies. Since 1995 a total of $63.5 million has been spent in Oregon on watershed restoration (OWEB); much of this was directed to riparian restoration.

Efforts to conserve and clean the basin waters should add to the livability for all members of the watershed.

### 3.4.3.7 PLANNING, ASSESSMENT & SUPPORT ORGANIZATIONS

An assessment process should be followed when there are sensitive situations or locations involved with activities being performed. The recommendations in this document are to be used as a guide and implemented when the activity, whether restoration or resource usage, may affect water quality or riparian habitat.

The Planning Phase begins with project conceptualization through the completion of design drawings, specifications, and administrative and contract documents. For information, permits and resources, contact agencies or organizations such as Oregon Departments of Fish and Wildlife, Water Resources, Environmental Quality, Agriculture and Division of State Lands; Umatilla Soil and Water Conservation District, Natural Resource and Conservation Service, Oregon Watershed

Enhancement Board, Umatilla Basin Watershed Council, Cities, Umatilla and Morrow Counties, Transportation authorities, the Confederated Tribes of the Umatilla Indian Reservation.

In all restoration implementation, and assessment of environmental impacts, consider the following:

- Topography: streams, drainage channel, wetland, pond, stability of slopes.
- Materials: what is being used, amount involved, will material have an impact (turbidity, leaching). Location for disposal of materials.
- Type of lands or resources affected: Natural waters vs. drainage facility. What bodies of water could be affected (downstream)? Is wildlife present? Will habitat be affected?
- Do other agencies have interests or concerns?

Contact and consult with appropriate staff.

Proceed if directed using any input from agencies.

Review project.

Gather information from on-site crew.

### 3.4.3.8 KEY FUNDING SOURCES

Following is a listing of the key sources for funding. It is not all-inclusive but offers good starting points.

## 3.4.3.8.1 Government sources

- U.S. Fish & Wildlife Service
- Oregon Department of Fish & Wildlife
- Oregon Department of Environmental Quality
- U.S. Department of Forestry
- Oregon State Department of Forestry
- Soil and Water Conservation Districts
- U.S. Natural Resource Conservation Service
- Oregon Watershed Enhancement Board
- U.S. Environmental Protection Agency
- Army Corps of Engineers

# 3.4.3.8.2 Private Sources

- Oregon Wetlands Joint Venture
- The Nature Conservancy
- Oregon Trout
- Ducks Unlimited
- Pheasants Forever
- Oregon Duck Hunters Assoc.
- The Wetlands Conservancy
- Trout Unlimited
- The Audubon Society
- Izaak Walton League

# 3.4.3.9 IMPLEMENTATION

By the end of 2003, the Umatilla Basin Watershed Council plans to identify and prioritize wetland sites for protection or restoration and pond sites for development. This will be done with assistance from the previously listed agencies and organizations. Landowners with potential sites will be provided with an information packet on wetlands protection/restoration and pond development and information on agencies that provide funding and/or technical assistance.

# 3.4.3.10 COSTS AND FUNDING

No accurate methods currently exist to determine the overall cost of developing an integrated, organized system of constructed ponds and marshes. As individual sites are restored or constructed, cost data will emerge. As this data is collected, a working estimate of costs can be extrapolated for the Basin.

# 3.4.4 Large Reservoir Development / Water Storage

## 3.4.4.1 GOAL

To insure an adequate water supply for the Umatilla Basin now and in the future by exploring potential storage reservoir sites. Additional water storage in the Umatilla Basin could be used for augmentation of low summer flows to improve anadromous fish passage and rearing, for industrial and agricultural uses, and for municipal water supply.

## 3.4.4.2 CURRENT CONDITIONS

Substantial progress has been made in the basin below Pendleton to address low summer flows through implementation of Phases I and II of the Umatilla Basin Project. The main stem above the mouth of McKay Creek and portions of the lower main stem and tributaries continue to experience low summer flows.

## 3.4.4.3 POSSIBLE REMEDIES

This committee recommends that further study be given to potential storage reservoirs in the basin in order to address low flows, the water needs of Municipalities, CTUIR, and future industrial or agricultural needs.

Currently under consideration is Phase III of the Umatilla Basin Project, which should include a complete water exchange for the Westland Irrigation District and should also include a project to address the water needs of the community of Pendleton and the CTUIR.

One proposed portion of Phase III would include water storage in the form of a reservoir. The Bureau of Reclamation released a feasibility study in July 1999, which studied 39 on-stream and 7 off-stream locations for reservoirs in the Umatilla Basin. For a variety of reasons the Bureau of Reclamation has ruled out more than half of the sites. The Oregon Department of Agriculture has requested (November 1992) a reservation of 179,000-acre feet water from the Umatilla River Basin. For this they proposed 5 storage sites in the upper Basin. Three of the sites have been rejected by the Bureau of Reclamation, however two sites with substantial storage capacity remain.

W & H Pacific completed the *Feasibility Study: Regional Water System* for City of Pendleton and CTUIR in May, 1999. The study considered four main options for a new regional water system and concluded that an off-stream impound for storage of winter and spring water from the Umatilla River was the best option. The study also considered six potential locations and concluded that an off-stream impound was feasible using any of three preferred sites.

Reservoir sites should be sufficiently large enough and deep enough to maintain a pool of cool subsurface water so that releases of water do not contribute to in stream warming. Careful consideration must be given to the amount and timing of water removed from the main stem or tributaries for storage purposes in order to not adversely affect the hydrodynamic workings of the watershed. If this altered significantly, other recovery efforts will be impaired. Careful consideration should be given to the elevation and type of release structure. For instance top withdrawal is likely to release warm water and bottom withdrawal can discharge excessive sediment and nutrients. The system design should result in the release of high quality and cool summer water.

Reservoir sites in the upper basin could contribute cool flow augmentation on the upper mainstem of Birch Creek. However, flow augmentation and cooling may be less critical for these reaches as they recover. As width to depth ratios improve, and riparian vegetation grows, the current flow levels may be adequate. Reservoir sites should be carefully selected so as not to impair anadromous fish migrations or threaten salmonids.

## 3.4.4.4 OREGON WATER RESOURCES DEPARTMENT'S ROLE

Generally, Oregon water law relies on interested water users to initiate and develop specific water storage projects. The OWRD works closely with water users interested in developing proposed storage projects by providing technical information relating to water quantity issues, reviewing water right applications, and offering water development loan opportunities.

The OWRD recognizes that as demands for instream and out-of-stream water uses continue to increase, watershed councils, tribes, local governments, interest groups, water users and natural resources agencies need up-to-date, accurate and accessible data in order to make informed decisions on future water supply options and key stewardship issues. Toward that end, the OWRD is focusing on ways to help these interests with their information needs. For example, OWRD will seek support from the Oregon Legislature for the “Stewardship and Supply Initiative,” a proposed Department project which would collect and package core water resources data throughout the state and make the data easily available to the public. This effort would provide information on basin conditions, surface and ground water supply, water uses and water rights, and instream flow and storage opportunities. The initiative would also create an up-to-date, statewide inventory of potential surface water and ground water storage sites.

The OWRD is also currently working with the Joint Task Force on Water Supply and Conservation, a group created by legislation in 1999. This group is broadly reviewing Oregon’s water supply and conservation policies, including the question of whether the state should take a more proactive role in developing new water supply opportunities. The task force will submit recommendations to the Legislative Assembly during the 2001 and 2003 sessions.

## 3.4.4.5 IMPLEMENTATION

By the year 2003, it is requested that the parties that have a mutual interest (irrigation districts, municipalities, Confederated Tribes of the Umatilla Indian Reservation, and others) in reservoir construction make a decision for / against reservoir construction.

If the decision is made to construct a reservoir, the following agencies would need to determine if the plan is viable and work toward a completion date as near to 2010 as possible.

- Corp of Engineers
- Oregon Water Resources Dept.
- Confederated Tribes of the Umatilla Indian Reservation
- Oregon Dept. of Fish and Wildlife
- Bureau of Reclamation
- Irrigation Districts
- Municipalities

# 3.4.5 Purchasing / Leasing Water Rights

## 3.4.5.1 GOAL

Assist in restoring the Umatilla River and tributary stream flows, in support of fish and other beneficial uses through buying or leasing existing water rights[12] for conversion to instream water rights.[13]

## 3.4.5.2 CURRENT CONDITION

The Umatilla River/tributaries are over-appropriated. Low stream flow is a limiting factor for fish habitat, spawning, rearing of salmonids and for water quality. People are not well informed about converting water rights into instream flow rights.

Existing instream water rights are tabulated in **Table 67**.

[12] ORS 537.348 – Purchase, lease, or gift of water for conversion to instream water right; priority dates. Any person may purchase, lease or gift an existing water right for conversion to an instream water right. Any water right converted will retain the priority date of the water right.

[2] "In-stream water right" means a water right held in trust by the Oregon Water Resources Department for the benefit of the people of the State of Oregon to maintain water instream for public use. An instream water right does not require a diversion or any other means of physical control over the water.

**Table 67.** Umatilla Basin instream water rights (OWRD)

| Stream | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Umatilla River, Meacham Ck to Mckay Ck | 200 | 240 | 240 | 240 | 240 | 200 | 100 | 60 | 60 | 200 | 200 | 200 |
| Umatilla River, McKay Ck to Mouth | 250 | 250 | 250 | 250 | 250 | 250 | 120 | 85 | 85/ 250 | 300 | 300/ 250 | 250 |
| North Fork Umatilla River | 40 | 68 | 68 | 68 | 68 | 40 | 26.5 | 22.5 | 24.5 | 24.7 | 27 | 40 |
| South Fork Umatilla River | 55 | 110 | 110 | 110 | 110 | 55 | 25.5 | 20.5 | 20.4 | 22.1 | 39 | 55 |
| Thomas Creek | 25 | 43 | 43 | 43 | 43 | 23.7 | 10.8 | 8.05 | 8.4 | 8.84 | 14.3 | 24.6 |
| Buck Creek | 16 | 16 | 16 | 16 | 16 | 15 | 5 | 5 | 5 | 5 | 5 | 15 |
| Ryan Creek | 15 | 15 | 15 | 15 | 15 | 8.45 | 3.45 | 3.35 | 2.96 | 3.37 | 6.7 | 15 |
| Meacham Ck u/s North Fk | 47.9 | 102 | 102 | 102 | 92.7 | 18.2 | 5.57 | 2.34 | 2.55 | 3.38 | 7.64 | 39.2 |
| North Fork Meacham Ck | 53.9 | 76.5 | 95.9 | 100 | 100 | 39.7 | 10.5 | 6.01 | 6.56 | 8.03 | 16.3 | 50.7 |
| Camp Creek | 11 | 11 | 11 | 11 | 11 | 5 | 1.19 | 0.91 | 0.82 | 1.09 | 2.26 | 5 |
| Meacham Ck d/s North Fk | 150 | 225 | 225 | 225 | 225 | 68.8 | 18.9 | 10.9 | 11.3 | 14.4 | 33.1 | 120 |
| Squaw Creek | 27 | 40 | 40 | 40 | 27.4 | 2.26 | 0.59 | 0.45 | 0.56 | 1.39 | 3.99 | 27 |
| McKay Creek | 65 | 80 | 130 | 130 | 87.1 | 18.4 | 8.1 | 5.4 | 4.2 | 4.9 | 17.2 | 54 |
| North Fork Mckay Ck | 35 | 42 | 70 | 66.3 | 23.3 | 4.6 | 1.4 | 0.9 | 1.1 | 1.8 | 8 | 28 |
| Birch Creek, Forks to Mouth | 20 | 30 | 30 | 30 | 30 | 20 | 12 | 8 | 8 | 8 | 8 | 20 |
| East Birch Creek | 28.2 | 38 | 38 | 38 | 38 | 16.5 | 9.84 | 6.55 | 5.63 | 6.53 | 10.7 | 23 |
| Pearson Creek | 8.3 | 16.2 | 12.8 | 18 | 12.9 | 3.18 | 1.54 | 0.94 | 0.85 | 1.18 | 2 | 5 |
| West Birch Creek | 21.7 | 30.2 | 32 | 32 | 32 | 14.8 | 12 | 9.67 | 5.94 | 3.46 | 5.64 | 16.7 |
| Stanley Creek | 1.59 | 1.97 | 3.81 | 4.67 | 6 | 2 | 0.74 | 0.49 | 0.35 | 0.38 | 0.4 | 0.71 |
| Bridge Creek | 2.78 | 3.24 | 6.61 | 7 | 6.03 | 2 | 0.33 | 0.14 | 0.09 | 0.19 | 0.4 | 1.28 |

## 3.4.5.3 TO CORRECT/IMPROVE CURRENT CONDITIONS

An effective way to ensure more water in the river and streams is to lease or purchase existing, senior water rights and transfer them to instream use through groups such as the Oregon Water Trust (OWT) formed in 1993.

OWT identifies priority streams where stream flow is a limiting factor for fish habitat, water quality, and there is potential for acquiring water rights to **convert** to instream use to enhance flows. OWT concentrates acquisition efforts on small to medium size tributaries that provide spawning and rearing for salmonids.

Through federal legislation, the Bureau of Reclamation (BOR) is able to lease and/or permanently acquire water rights to increase flows for salmon.

## 3.4.5.4 OBJECTIVE

Inform and educate water right holders of the incentives to convert their consumptive water rights to instream water rights.

**Implementation.** Find out whether there are priority streams in the Umatilla Basin that have a potential for water right acquisition and contact water rights holders and inform them regarding converting water rights to instream water rights. Educate water rights holders of instream leases/purchases. Obtain a list of water rights holders, by March of 2001 from the Oregon Water Resources Department (OWRD), who do not use their water rights.

**Education and/or Public Involvement**. Provide forums for education and outreach to local irrigators and other water diverters regarding the use of instream leases by January of 2002. Local citizens can provide public outreach regarding donations of water rights for instream flows.

**Responsible Parties**. Umatilla Basin Watershed Council (UBWC) can request a list of water rights holders of priority stream rights from OWT for contact purposes. UBWC can request a list of the water rights holders not using their water rights from the OWRD. It is recommended that the UBWC and the OWRD coordinate and provide forums in Morrow/Umatilla County for education and outreach purposes to local irrigators and to answer questions on instream leases and sales.

**Cost/Funding Sources**. The OWT provides recompense for water rights leased instream. Recommend that the UBWC assist with mailings and notices for local forums on educating the community on instream leases/purchases.

### Possible Funding Sources and/or matching funds

- Oregon Wildlife Heritage Foundation
- Trout Unlimited
- National Audubon
- Oregon Trout
- The Wetlands Conservancy
- The Nature Conservancy
- Oregon Duck Hunter’s Association

## 3.4.5.5 INCENTIVES AND BACKGROUND

**Reasons water rights holders might be interested in leasing or selling their water rights for instream flow:**

Nearly all rivers and streams are fully appropriated or over-appropriated and such measures as water conservation by itself is not an effective way to increase instream flow. Conserved water goes to additional irrigation and instream rights but purchasing and leasing water insures that fish will get more water.

Currently OWT may be the sole entity in the State of Oregon that monetarily compensates water rights holders for potential conversion of their water rights; thus, OWT is a good model of how ORS 537.348 can potentially benefit instream flows.

1. OWT is market based and this approach provides water right holders with a variety of incentives to convert their consumptive water rights to instream water rights. These include:

   - Income from marginally productive areas
   - Replacement feed for lost production
   - Funding for irrigation efficiency projects
   - A possible tax break for permanent donations of water rights
   - Flexibility in managing water rights
   - In 1998 alone, the OWT completed 26 leases and 5 permanent deals. In the Western United States, on average, water rights for instream use are selling for about $400 per acre-foot for permanent sales and $30 per acre-foot for annual leases. (An acre's worth of irrigation rights are worth $500 to *$1500, making a total of $20,000 to $60,000 for every cubic foot per second left in the stream.

2. OWT works with local and community groups, agency staff and others interested in water rights issues so as not to duplicate the efforts of others. Potential users of OWT would not be required to wade through a maze of data and procedures and would receive assistance without expending a great amount of time and effort.

3. OWT uses ecological science, hydrology and water rights data to identify priority streams and evaluate potential water right acquisitions. Potential water rights lessees/sellers would have access to information that shows them the importance of what their possible conversion of water rights means to the public good. Analysis of stream flows and habitat conditions includes:

   - delineating fish use and distribution for each segment;
   - documenting the current and ecological value of the waterway for fish;
   - evaluating current habitat and water quality conditions;
   - describing the current water availability situation;
   - summarizing the relationship of the water right to other water rights in the stream segment; and
   - evaluating and summarizing the potential benefits of acquired water on fish habitat and water quality conditions.

4. OWT has a 9-person Board of Directors, which includes agricultural, environmental, legal and tribal perspectives, with an Executive Director, and a five-person staff. A professional staff ensures that accountable and credible information is provided to interested parties.

5. OWT has a track record of showing results. Between 1994-98 OWT spent $2,284,000 acquiring water rights and received donations rights estimated to be worth $370,000. Deals have been negotiated with more than 50 right holders. More than one-half of the agreements negotiated were for less than 500 acre-feet of water. Stream flows between 69.70 cfs and 77.86 cfs along 450 miles are now protected.

## 3.4.6 Water Law and Regulation

### 3.4.6.1 GOAL

Protect Umatilla Basin instream water rights issued by OWRD while preserving the legal rights of existing water users. Attempt to increase flows above current levels through a variety of tools identified in Oregon Water Law and the Oregon Plan for Salmon and Watershed.

### 3.4.6.2 HISTORIC PRACTICES

It is not known with certainty what the stream flows in the Umatilla Basin were before settlement by immigrants, but it is assumed that geology and climate have been relatively stable for the last 10,000 years. It is known that the settlers diverted and appropriated water from the streams and aquifers for agricultural, municipal, industrial, and domestic uses, and thus created the local agriculture-based economy. This water use has been institutionalized and is regulated, distributed, and enforced by OWRD through Oregon Water Law.

The result of these practices has been a reduction in stream flows in much of the basin and modification of the habitats of fish and riparian species. Specifically, the live flow in streams has been reduced or modified in most months of the year, but particularly during irrigation season, March 1 to November 1. There has also been a general decline in the basalt (deep) water table in the basin. The construction of Three Mile Falls Dam in the 1920s was the most important local factor interfering with the life cycle of salmon in the Umatilla Basin. The decline in stream flows and modification of habitat are among several factors, which are linked to the decline and extirpation of anadromous fish populations.

According to the Doctrine of Prior Appropriation that governs Oregon water law, the senior water right holders are entitled to the use of the water during periods of shortage. Each year beginning in May or June after major snowmelt, there is a seasonal shortage of water flow. This shortage lasts until the fall rains in November or December. During this shortfall, OWRD regulates and distributes water in favor of the senior water right holders. Historically, the practice has been to allocate water to consumptive uses without regard to protection of instream flows.

Early settlers diverted water from streams with ditches and flood irrigated lands adjacent to the channel. Irrigated agriculture was limited to the flood plains. Around the turn of the century, irrigation companies and districts were formed, and federal reclamation projects were completed. Several large canals were built which brought cheap, gravity flow Umatilla River water to good farmland in what has become the Westland Irrigation District (WID), the Stanfield Irrigation District (SID), the Hermiston Irrigation District (HID), and West Extension Irrigation District (WEID). The completion of two federal projects, Cold Springs Reservoir in 1905 and McKay Reservoir in 1927, ensured that water for agriculture would be available during the time of naturally occurring low flows.

### 3.4.6.3 EXISTING PRACTICES AND OWRD'S ROLE

For nearly half a century following the adoption of Oregon's 1909 Water Code, the public benefits of leaving water instream were not addressed by the water appropriation system. Past water appropriations have severely damaged or depleted instream water uses. This statement does not diminish the significant contributions that these appropriations have made to the state's people, economy and quality of life. In 1955, the Legislature recognized the Code's failure to address needs for instream water uses and set up the Water Resources Board. This Board studied water uses and needs and had authority to classify water uses, withdraw streams from appropriation, and authorize the adoption of minimum stream flows for instream uses such as fish, wildlife, recreation, pollution abatement, and aesthetic purposes. These studies culminated in programs for each of Oregon's major stream basins. The Umatilla Basin Program was created in 1964, and amended in 1981, 1985, 1988, and 1991 (OAR 690-507). According to the program, water rights for most classifications cannot be issued for the Umatilla River and its tributaries for use from June 1 to October 31. In 1987, the Legislature directed that the existing minimum stream flows be converted to instream water rights. It also authorized three state agencies to file instream water rights to protect fish and wildlife habitat, recreation, and water quality. All reaches of the Umatilla River and its significant tributaries have instream water rights.

At the request of the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), Oregon Department of Fish and Wildlife (ODFW), and others, Congress directed the Bureau of Reclamation (BOR) to plan a project that would help resolve the potential conflict between the water needs of fish and irrigation. The primary goal was to resolve the need for the Umatilla River fishery restoration without harming the existing irrigation-based economy. A cooperative agreement was reached between the CTUIR and the irrigators, which resulted in the passage, by Congress of the Umatilla Basin Project Act (Public Law 100-557-Oct. 28, 1988). The project (Umatilla Basin Project, discussed in **Chapter One** and **Section 3.4.2**) was built and is operated by the BOR with the cooperation and assistance of: Stanfield Irrigation District (SID), Hermiston Irrigation District (HID), West Extension Irrigation District (WEID), CTUIR, OWRD, ODF&W, and Bonneville Power Administration (BPA). The project exchanges Columbia River water for Umatilla River irrigation water. This allows some live flows and stored Umatilla water to remain instream instead of being diverted for irrigation.

Phases 1 and 2 of the project are now complete, and periods of flow insufficient for the needs of fish in the mid and lower river have been reduced to approximately July and August. While the instream water right is often not met during irrigation season, the Umatilla Project has substantially increased flows during that time. Living conditions for anadromous fish have significantly improved, and more fish are returning.

The key tasks of OWRD in this process are to use its statutory authority to shepherd and protect fish water from its release at McKay reservoir and points of exchange to the mouth of the river, and to insure that irrigators take only the water to which they are entitled. OWRD is also responsible for measuring and accounting for exchanged water, ensuring that it is used appropriately, and for coordinating start up, shut down, and adjustment of the various facilities.

The basic regulatory objectives for McKay Creek and the Umatilla River are found in the McKay and Umatilla River Water Management Plan. This plan was written by a citizens' task force, and was approved by the Water Resource Commission in July 1991. The Management Plan requires flow meters, monitoring the rate of water use and the total amount of water used, and accounting for use of live flow and stored water. It allows rotations and regulates hydraulically connected wells. It also mandates protection of instream water rights, supports the Basin Project, and protects water released from McKay Reservoir from unauthorized diversion.

The Oregon Water Resource Commission has adopted a Strategic Plan for the 1999-2001 biennium. Two relevant goals are to "Actively enforce the state's water laws and uphold its policies and to lead efforts to restore and safeguard the long-term sustainability of stream flows, watersheds, and ground water." (p. 57).

The Water Resources Commission, composed of citizens appointed by the Governor with Senate confirmation, sets policy for OWRD. At their April 29, 1999 meeting, they prioritized OWRD's tasks identified in the Oregon Plan for Salmon and Watersheds. As a lead agency in the Oregon Plan, OWRD has a number of responsibilities. The high priority objectives of the Oregon Plan, which are most relevant to the development of this TMDL, are as follows:

a. WRD-6. Identify Unmet Instream Flow Needs. In this process, the OWRD Watermasters determine which streams have the best opportunities for improving flows, and the ODFW biologists determine the streams where improving flows would most benefit fish. The two sets of data are then matched to isolate the highest priority streams for flow restoration. Once the streams that have a high priority for restoration are determined, the Watermasters will write work plans for flow restoration.

b. WRD-8. Increased Distribution and Enforcement. Distribution is the process OWRD uses when it regulates the water right holders on a stream to their priority dates and to the conditions of their water right. Distribution is initiated when there is not enough water to satisfy all the water rights. Enforcement of water law is the step taken when water users refuse to follow voluntary distribution guidelines. The high priority streams identified in WRD-6 are likely sites for increased distribution by OWRD.

c. WRD-9. Installation of Monitoring Stations. These stations are important tools for measuring flows. While there are currently gauging stations on most important streams, a new one was installed in 1999 on Wildhorse Creek. The gauging stations will be operated as long as their data is needed and funds are available.

d. WRD-15. Instream Transfers and Leases. Each OWRD region has a coordinator to assist in transferring or leasing existing water rights to instream use.

e. WRD-32. Coordinate Water Release Requests for Federal Umatilla Basin Reservoirs. This is done for McKay Creek Reservoir and Willow Creek Reservoir.

## 3.4.6.4 CURRENT CONDITIONS

The highly managed Umatilla River is, at times, very far removed from its natural state. Fish returns are increasing. Three out of four major irrigation districts are included in Basin Project Exchanges. Water quantity is improved in May and June, higher than natural from September through November, and still depleted in July and August. OWRD is close to achieving 100% compliance with Oregon water law on the streams that it regulates. As time and budget allow, the Watermaster will regulate and distribute other high priority streams.

## 3.4.6.5 OWRD'S PLAN

Continue implementation of the Umatilla Basin Program, McKay and Umatilla River Water Management Plan, The OWRD Strategic Plan, The Oregon Plan for Salmon and Watersheds, and The Umatilla Basin Project Act to protect current stream flows as allowed by Oregon Water Law. Of particular importance is to institute the Basin Project oversight committee and to clarify the accounting for conjunctive use and McKay Reservoir use. Tasks identified in the Oregon Plan that will help restore and enhance stream flow should be pursued. One key task identified in the Oregon Plan is to develop stream flow restoration plans for high priority water availability basins, task WRD-6. The Upper Umatilla River is one such high priority stream. As such, the Watermaster will craft a stream flow restoration plan while considering all of the tools available through Oregon Water Law to restore stream flow.

**IMPLEMENTATION.** The activities and programs, which currently increase stream flow will continue. Starting the Basin Project oversight committee will be completed by January 2001. To further the Oregon Plan, the work plans required by task WRD-6 will be completed by Jan. 2001. If funding is available, implementation of the plans will begin in March 2002. WRD-8 and WRD-9 are directed toward high priority streams identified in WRD-6, and will commence when the work plans are completed. WRD-15 and WRD-32 are already being done.

**EDUCATION AND PUBLIC INVOLVEMENT.** OWRD currently maintains close communication with agencies, Indian tribes, irrigation districts, individual water users, environmental groups, elected officials, and basin watershed councils. When appropriate, as in the case of the McKay and Umatilla Plan, stakeholder committees are convened to make policy decisions. There is also participation in public schools.

**RESPONSIBLE PARTIES.** OWRD is responsible for the commitments presented in the OWRD PLAN and IMPLEMENTATION sections of this document.

**FUNDING SOURCES.** The Watermasters, employees of OWRD are funded by the state general fund. The counties in which they operate fund Watermasters' staffs. The Umatilla County Watermaster/Assistant Regional Manager has five county employees and one federal employee under his supervision. The US Bureau of Reclamation funds some activities in support of the Umatilla Basin Project Act. Maintaining and increasing current levels of service depend on the approval of elected county, state, and federal officials, and the appropriation of sufficient funds.

**RATIONALE.** There are many competing demands for our precious water resources. This is especially true in the arid climate of Eastern Oregon. Water rights are now issued for instream needs as well as consumptive uses. OWRD considers the public interest, the availability of water, the applicable Basin Program, and Oregon Water Law when issuing new water rights. In this way, OWRD represents the interest of the public.

# 3.4.7 Allocation of Conserved Water Program

## 3.4.7.1 GOAL

The goal of the conserved water program is to benefit both instream needs and the water right holder. Under the conserved water program, the law allows a water user who conserves water to lease or sell that water (see **Section 3.4.7.3**). A portion of the conserved water may be used on additional lands, provided that 25% of the water conserved goes instream to benefit fish and wildlife habitat. The conserved water program is found at ORS 537.455 — 500 and OAR Chapter 690 Division 18.

## 3.4.7.2 CURRENT CONDITIONS AND PROBLEMS

As stated previously, each year the Umatilla basin faces water shortages during summer periods. Especially during the summer months, instream water rights in the Umatilla River and its tributaries are not met. At the same time, agriculture and urbanization are resulting in a continually expanding need for water supplies. It is increasingly important to the state's environment and economy to maintain adequate stream flows to support aquatic life and maintain water quality.

## 3.4.7.3 THE ALLOCATION OF CONSERVED WATER PROGRAM

### 3.4.7.3.1 Objectives to Improve Instream Flows Using the Allocation of Conserved Water Statute

The conserved water program is unique to Oregon. Under the Prior Appropriation Doctrine, in the absence of this law, the water right holder would not be entitled to use the conserved water to meet additional water needs, but would have to return that water conserved back to the stream for the next appropriator. Instead, the conserved water program allows a water right holder to implement conservation measures (such as switching from flood irrigation to sprinkler) and hold onto the water saved by this measure. After mitigating the effects on any other water rights, the Water Resources Department allocates 25% of the conserved water to the state (for an instream use) and 75% of the conserved water back to the water right holder. The water right holder may in turn, sell or lease this conserved water, or use it to irrigate additional lands not covered by the original water right certificate. The exception to 75% allocation occurs if more than 25% of the conservation project costs come from federal or state non-reimbursable sources. If that is the case, then that percentage of the non-reimbursable costs is translated into the percentage of water transferred instream.

Once a water right holder implements the conserved water program, the original water right is reissued to reflect the quantity of water being used with the improved technology and the priority date stays the same. Another water right certificate is issued for the conserved water use with either the same priority date (if they want to hold onto the conserved water and use it on additional lands), or a priority date of one minute after the original water right (if the user wants to sell the conserved water to someone else and then doesn't want to compete with them on a priority date basis). Objectives of the Allocation of Conserved Water Program are as follows:

Objective One: Promote water conservation and water use efficiency and maximize beneficial use.

Objective Two: Augment instream flows by requiring at least 25% of water conserved be returned instream for the benefit of fish and wildlife.

Objective Three: Encourage local cooperation and coordination in development of conservation proposals.

# 3.4.7.3.2 Timeline for the Program

### 3.4.7.3.2.1 IMPLEMENTATION OF THE PROGRAM

The Allocation of Conserved Water Program statute was first passed in 1987, but implementation of the program has been slow. However, since the passage of the Oregon Plan and the listing of several salmonid species, interest in the program has increased substantially. Pursuant to implementing the Oregon Plan, the program is being used as a tool for augmenting stream flow in basins deemed a high priority for fish restoration efforts. The program is also being used as a way to restore fish habitat and increase stream flows. OWRD is responding to increased interest by allocating more staff time to meet with applicants to explain the program and help water users complete applications.

In the next year OWRD expects to complete at least six conserved water program applications in the Walla Walla River area. Successful implementation of this program in the Walla Walla will likely encourage agricultural water users in the Umatilla Basin to explore use of the program as well.

### 3.4.7.3.2.2 EDUCATION AND OUTREACH

Increased implementation of the conserved water program will raise awareness of the program in adjacent areas such as the Umatilla River watershed. OWRD will also work in the next year to increase public awareness of the program and encourage application. Groups such as the Umatilla Water Quantity Work Group have been one avenue by which OWRD has educated the community about the program and its potential benefits to irrigators and fish alike.

OWRD offers an educational brochure on the Allocation of Conserved Water Program. OWRD's web page also has a description of the program (See http://www.wrd.state.or.us, under "programs").

There is a good opportunity for watershed councils and citizen groups to begin working with the Water Resources Department in providing education and outreach for the program. OWRD looks forward to working with citizen groups, watershed councils and soil and water conservation district offices to educate and implement the conserved water program.

#### 3.4.7.3.2.3 INTER AGENCY COORDINATION

Thus far, the Allocation for Conserved Water Program has essentially been in its infancy. However, as mentioned above, this is changing due to increased awareness of fish habitat issues. To this end, the Water Resources Department is increasingly working with other agencies to implement the program. In the next two years OWRD will be stepping up coordination with other agencies to implement the program and raise awareness of its potential fish habitat and water use efficiency benefits.

1. Coordination with Fisheries Agencies

Coordination with fisheries agencies such as the Oregon Department of Fish and Wildlife (ODFW) will become increasingly important as priority water availability basins are identified pursuant to the Oregon Plan. After basins are identified as high priority (having a high likelihood for water restoration efforts and habitat for listed species), Watermasters will write work plans that include cooperation with ODFW. Such cooperation includes close communication with ODFW field biologists about which streams OWRD needs to pay close attention to with regard to enforcement and stream flow restoration efforts, which are accomplished by OWRD through programs such as the allocation of conserved water program.

2. Coordination with the Oregon Department of Agriculture

In the last year the Water Resources Department co-authored a brochure about the conserved water program for use by the Oregon Department of Agriculture (ODA). This effort involved meeting with the ODA, and educating that agency about how the program works and the potentials for use by agricultural water users. The Water Resources Department then helped write a brochure outlining the program for distribution by the ODA. OWRD will continue to work with the ODA to help them educate water users about the program and help that agency implement the program where appropriate.

3. Agencies Implementing the Program

The Oregon Water Resources Department is the primary agency implementing this program. OWRD has recently begun working with the ODA and with other state and federal fisheries agencies to begin implementation of the program on a wider scale.

## 3.4.7.3.3 Possible Funding Sources

Possible funding sources for individuals wishing to use the allocation of conserved water program include: Oregon Watershed Enhancement Board, local Soil and Water Conservation Districts, the Bureau of Reclamation, and the Natural Resource Conservation Service.

## 3.4.8 Municipal and Agricultural Water Management and Conservation Plans

### 3.4.8.1 GOAL

The Oregon Water Resource Department's rules governing agricultural and municipal water management and conservation plans are found in OAR Chapter 690, Division 86. There are provisions for both Agricultural and Municipal Water Management and Conservation Plans. The goal of the Water Resources Department's Division 86 rules governing Water Management and Conservation Plans is to implement conservation measures to help restore stream flows, stabilize water supplies and provide for future needs for economic development and growth.

### 3.4.8.2 CURRENT CONDITIONS AND PROBLEMS

As discussed previously the Umatilla basin faces water shortages each year. Especially during the summer months, instream water rights in the Umatilla River and its tributaries are not met. At the same time agriculture and urbanization are resulting in a continually expanding need for water supplies. It is increasingly important to the state's environment and economy to maintain adequate stream flows to support aquatic life and maintain water quality.

### 3.4.8.3 MUNICIPAL WATER MANAGEMENT AND CONSERVATION PLANS

#### 3.4.8.3.1 Objectives to Improve Current Conditions Using the OWRD's Municipal Water Management and Conservation Plan Program.

Municipal water suppliers are encouraged to prepare water management plans but are not required to do so unless a plan is prescribed by a condition of a water use permit. Municipal plans include the following elements: 1) a description of the water system; 2) a water conservation element; 3) a water curtailment element and 4) a long-range water supply element. Objectives of OWRD Division 86 rules are as follows:

Objective One: Help municipalities achieve conservation measures so that municipal water supplies are stabilized and new diversions unnecessary.

Objective Two: Help municipalities achieve conservation measures so that municipalities are assured water supplies sufficient for future needs and economic growth without complete reliance on developing new diversions.

Objective Three: Use municipal water management conservation plans as a way to implement the Oregon Plan and restore identified priority streams.

# 3.4.8.3.2 Timeline/Tasks for Program

In the last year, OWRD has worked on implementing the Division 86 rules for municipalities. Below is a summary of OWRD activities. OWRD plans to continue implementing the program in the future with an increased emphasis on outreach and education. By the end of the year 2000, the Department expects to have elicited water management and conservation plans from all municipalities, which have such a requirement as a condition of their water use permits. In the next year, OWRD will also be contacting municipalities in priority salmonid recovery basins regarding submission of volunteer plans.

**a. Data Base**

For the last year OWRD has focused on creating a database that lists all municipalities required to submit a water management and conservation plan as a condition of their permit. This database is in the process of being updated on a regular basis. In addition, OWRD has drawn up a list of municipalities in the Umatilla Basin that are required to submit a WMCP and have not as yet. OWRD is in the process of contacting all municipalities that are delinquent with their plans and working with them to submit them as soon as possible. This status is shown in the following table.

| **Municipality** | **Status of Plan (as of 4/2000)** |
|---|---|
| City of Adams | In Progress |
| City of Athena | Complete & Approved |
| City of Helix | In Progress |
| City of Hermiston | Under Review |
| City of Pendleton | Complete and Approved |
| City of Pilot Rock | In Progress |
| Port of Umatilla | Unknown (will contact in the next year) |

**b. Inter-Agency Coordination**

In the last year OWRD has also been working with other agencies, both federal and state, to recommend WMCPs as a condition of grant funding. In the last year the Water Resources Department has worked with the Oregon Department of Economic Development to condition several development projects with the requirement that WMCPs be prepared as a condition of funding. This coordination is an ongoing effort. In the next year, OWRD will be exploring other opportunities for coordination with other funding agencies. OWRD has also been coordinating with the Oregon Department of Fish and Wildlife in identifying basins that are priorities for restoration of cold-water fish species under the Oregon Plan. In the last year, the agencies have succeeded in identifying these basins and are now developing strategies for recovery in these basins. One strategy includes implementing Division 86 in priority basins. See above section.

**c. Voluntary Plans**

OWRD works with municipalities, which have expressed an interest in voluntarily submitting WMCPs, and helps them develop their plans. However, to date, few municipalities have volunteered to write plans because they have been unaware of the Division 86 rules and the opportunity they provide, or they have been unwilling to invest the time and effort into writing a plan. However, this may be changing as the Oregon Plan is implemented on a wider scale and in the face of Endangered Species Act listings. This is an area where efforts could be expedited with outreach help from local watershed councils.

**d. Outreach and Education**

OWRD is currently working on improving its outreach and education efforts with regard to WMCPs. Every year, a workshop is held by OWRD, which focuses on the writing and implementation of plans. OWRD last held a workshop in October 1999 and is currently working on the year 2000 workshop. OWRD also makes guest presentations on the Division 86 rules when invited, and will be making such a presentation before the American Water Works Association in April 2000. OWRD is working on developing a web page, which will serve as a resource for municipalities and citizens alike, providing information on water conservation and tips for implementing conservation strategies.

**e. Implementation of the Oregon Plan**

Division 86 rules for municipalities will be one of the tools OWRD uses in writing restoration plans for basins identified by the Water Resources Department and the Oregon Department of Fish and Wildlife as priorities for salmon restoration efforts. Priority basins have been identified in the Umatilla Basin, and OWRD is in the process of contacting municipalities in these basins to explore their willingness to prepare voluntary water management plans.

# 3.4.8.3.3 Agencies Implementing Program

Currently the Water Resources Department is the primary agency implementing the Division 86 rules. OWRD has been developing interagency contacts with agencies such as Oregon Economic Development to coordinate water development projects with efforts at conserving existing water resources.

There is tremendous opportunity for watershed councils and citizen groups to begin working with the Water Resources Department on this issue. Below are some roles that watershed councils could take in implementing this program.

- Watershed councils can conduct community outreach to citizens to help implement conservation measures.
- Watershed councils could provide a forum for discussion of WMCPs between citizens and council members.
- Watershed councils could help OWRD with its efforts to promote voluntary water management and conservation plans.

## 3.4.8.4 AGRICULTURAL WATER MANAGEMENT AND CONSERVATION PLANS

Provisions for Agricultural Water Management and Conservation Plans are found at OAR 690-86-240. Plan elements include: 1) Description of the water system; 2) a water conservation element; 3) a water allocation/curtailment element and 4) a long-range water supply element.

### 3.4.8.4.1 Objectives to Improve Current Conditions Using the OWRD's Agricultural Water Management and Conservation Plan Program

Objective One: Help irrigation districts and water providers achieve conservation measures so that water supplies are stabilized and new diversions unnecessary.

Objective Two: Help irrigation districts and water providers achieve conservation measures so that they are assured water supplies sufficient for future needs without complete reliance on developing new diversions.

Objective Three: Use agricultural water management conservation plans as a way to implement the Oregon Plan and restore identified priority streams.

### 3.4.8.4.2 Timeline for Program

In the last year, OWRD has worked on implementing the Division 86 rules for irrigation districts. Below is a summary of OWRD's activities. OWRD plans to continue implementing the program in the future with an increased emphasis on encouraging agricultural water users to write and implement water conservation plans. Agricultural water suppliers are not required to submit plans unless they want to transfer water rights under ORS 540.572 within the boundaries of the districts to other lands within the districts.

**a. Data Base**

For the last year OWRD has focused on creating a database that lists all agricultural water suppliers that have written plans. This database is in the process of being updated on a regular basis. Current status is shown in the following table:

| Organization | Status |
|---|---|
| West Extension Irrigation District | In Progress |

**b. Coordination with the Bureau of Reclamation**

Often the Bureau of Reclamation (BOR) requires a water management and conservation plan as a condition of grants provided by the BOR. OWRD has been working closely with the BOR in the last year on coordinating comments on plans submitted by irrigation districts. The BOR in turn helps the district find ways and funding sources for implementing the plan requirements. Specifically, in the last year, OWRD and the BOR have been working with districts on water measurement issues.

**c. Coordination with Consultants**

OWRD is working with consultants who are contracted to write the plans and educating them on the requirements of Division 86. To this end OWRD has met repeatedly with consultants writing the plans and will continue to work more closely with them in the next year.

**d. Implementation of the Oregon Plan**

Division 86 rules for irrigation districts will be one of the tools OWRD uses in writing restoration plans for basins that have been identified by the Water Resources Department and the Oregon Department of Fish and wildlife as priorities for salmonid (e.g. salmon, steelhead and trout) restoration efforts.

**e. Education and Outreach**

Thus far, OWRD has not dedicated much time to education and outreach to irrigation districts on writing and implementing agricultural water management and conservation plans. In the next year, OWRD would like to begin working with watershed councils and Soil and Water Conservation District offices to expand the program and invite more agricultural water suppliers to participate in the program.

## 3.4.8.4.3 Agencies Implementing Program

The Water Resources Department and the Bureau of Reclamation are the primary agencies implementing the Division 86 rules.

There is tremendous opportunity for watershed councils and citizen groups to begin working with the Water Resources Department on this issue. Below are some roles that watershed councils could take in implementing this program.

- Watershed councils could provide a forum for discussion and education regarding agricultural water management plans between agricultural water suppliers, citizens and OWRD.

- Watershed councils could help OWRD with its efforts to promote voluntary water management and conservation plans.

## 3.4.9 Updating / Improving Irrigation Systems

### 3.4.9.1 GOAL

Increase water instream (for fish, recreation, habitat and other beneficial uses) and for irrigation during low flow seasons. Improve water supply for all beneficial uses by implementing Agricultural Water Management and Conservation Plans[14], as described in the previous section.

### 3.4.9.2 CURRENT CONDITIONS

Increased awareness of water quantity, quality and uses throughout the Umatilla Basin Watershed have caused users to look for ways to improve system delivery, conserve the amount of water used and evaluate the economics of that use.

Most of the main delivery infrastructure has been in use since the early 1900's and some are very antiquated by today's technology. Some are in need of updating and maintenance. Due to varying use, higher demands and increasing costs of water and its delivery, water managers are looking at curtailing seepage from the system and applying the least amount of water needed to finish a crop or maintain a project, with emphasis on limiting rising costs.

### 3.4.9.3 RECOMMENDATIONS FOR IMPROVEMENT

- Encourage the preparation of landowner, farm or irrigation district Conservation Plans.
- Where feasible replace open ditch laterals with buried pipe.
- Install flow meter at the head of all laterals and diversions from a main canal.
- Develop a procedure to read, record and track daily withdrawals from the main canal. With the flow metering capability recommended above, developing such a procedure would be a fairly easy and inexpensive task.

[14] OAR 690-86-240 Plan Elements include:

(1) Description of the water system

(2) A water conservation element

(3) A water allocation/curtailment element

(4) A long-range water supply element

- Develop a procedure to read and record daily flow rates at all weir locations. In conjunction with the measured withdrawals, this information would enable water managers to regulate head diversions far more precisely, reducing tail water waste.
- Encourage the conversion of flood irrigation to other more efficient methods of irrigation such as set-sprinkler and center pivot or drip irrigation. At an average conversion cost of $300 per acre, some conversions may be more realizable when changing from pasture to higher value crops.
- Encourage replacement of all on-farm ditches with buried pipe. If all on-farm ditches were so replaced, this could minimize all on-farm seepage and spillage losses.
- Encourage the use of gated pipe for all on-farm buried pipe.
- Encourage the use of irrigation scheduling with all set-sprinkler and pivot irrigation systems.
- Recommend continuance of on going maintenance and updating of main canals.

## 3.4.9.3.1 Identify Responsible Parties for Implementation

- Land Owners and Managers
- US Bureau of Reclamation
- Natural Resource Conservation Service
- Oregon Department of Agriculture
- Oregon Department of Fish & Wildlife
- Umatilla Soil & Water Conservation Districts
- Irrigation Districts
- Umatilla Basin Watershed Council
- Oregon Water Resources Department

## 3.4.9.3.2 Implementation

Implementation should begin with acceptance of an individual, district or agency Conservation Plan, commencing in early 2001.

## 3.4.9.3.3 Education and/or Public Involvement

The Umatilla Basin Watershed Council will carry out the education and outreach of this project.

**Possibilities**

- Coordinating informational spots with local media.

- Informing Umatilla Basin land managers of the program benefits.

# 3.4.9.3.4 Identify Cost and Funding Sources

Size and extent of the varied problems addressed by each individual plan make it impossible to set a cost of implementation. Funding agencies would have an approximate per acre figure for each recommendation used in any given plan. Some of the recognized funding sources are the following:

- US Bureau of Reclamation
- US Department of Agriculture
- Oregon Watershed Enhancement Board
- Oregon Department of Fish & Wildlife
- Oregon Department of Environmental Quality
- Natural Resource Conservation Service
- Local Soil & Water Conservation Districts
- Land Owners and Managers

# 3.4.9.3.5 Incentives

The formation, acceptance, implementation and ongoing use of a Farm Plan, Conservation Plan or Water Management Plan will enhance water quality in the Umatilla Basin. Using a mix of the above recommendations could open various funding sources. Improving delivery systems and application methods are major factors in reducing costs. Conflicts among users could be reduced, and in some cases allows the user to expand his acreage or operation (see **Allocation of Conserved Water Program**, **Section 3.4.7**). Responsible development, conservation and utilization of our natural resources promotes sustainability far into the future.

# 3.4.10 Water Inventory / Study of Surface and Ground Water

## 3.4.10.1 CURRENT CONDITIONS

In the Umatilla Basin demand for water is greater than the available supply. We can only assume that this situation will become worse. Residential and industrial demand for water will begin to compete more with the water needs of fish, agriculture and other uses as population and economic development increases.

Though water availability in the Basin has been reviewed, e.g., OWRD 1988, no comprehensive study of available water has been done. Also, since 1988 several changes have taken place (i.e. phases I & II exchanges, changes in groundwater levels etc.). A thorough study of all ground and surface waters in the Umatilla Basin is necessary for planning for future water needs. More research on quantity, origin, rate of replenishment and interaction between surface and groundwater would be especially helpful. Certainly, for the long-term environmental and economic health of this basin there must be an accurate estimate of ground water as well as surface water.

## 3.4.10.2 RECOMMENDATION

Before a comprehensive long-term water quantity management plan can be made, an inventory of available resources must be conducted. This is essential for the health of the Basin's watersheds, for aquatic habitat and fish passage, for the maintenance of a viable agricultural economy, and future municipal and industrial growth.

## 3.4.10.2.1 Implementation

It is recommended that the following parties cooperate to complete this study by 2005.

- Oregon Water Resources Department
- Confederated Tribes of the Umatilla Indian Reservation
- US Bureau of Reclamation
- Irrigation Districts
- Industry
- Municipalities

# Attachment A: Phase III Letters of Support

# CITY OF PENDLETON

*Office of the City Manager*
500 S.W. Dorion Avenue
Pendleton, Oregon 97801-2090
Telephone (541) 966-0201
FAX (541) 966-0231
TDD (541) 966-0230

April 7, 2000

TO: Umatilla Basin Stakeholders Committee
Water Quantity Workgroup

FROM: City of Pendleton

RE: Umatilla Basin Project, Phase III

The Umatilla Basin Project, Phase I & Phase II, has provided water for irrigation from the Columbia River in exchange for irrigation water from McKay Reservoir. The Project has provided flow augmentation on the Umatilla River and improved the habitat for anadromous fish. The proposed Phase III of the Umatilla Basin Project would complete the exchange of McKay Reservoir irrigation water, currently utilized by Westland Irrigation District and Teel Irrigation District, with Columbia River water. There are a number of different approaches to Phase III currently under consideration.

The City of Pendleton (CoP) supports the general intent of Phase III. However, there is no current decision as to which Phase III approach will be preferred, and there are a number of issues that must be clarified before the CoP can fully support Phase III.

The water stored in McKay Reservoir is presently dedicated either for irrigation or, through Phase I & II, for flow augmentation for anadromous fish. This stored water is not available for municipal or industrial uses. The CoP would favorably consider a Phase III project if the project includes provisions allowing a portion of the water stored in McKay Reservoir to be available for municipal and industrial use.

In order to provide for the long range water needs of the citizens of Pendleton, the CoP must protect it water rights on the Umatilla River. The CoP intends to exercise all of those water rights in the future. Therefore, the CoP cannot support a Phase III approach unless existing municipal, industrial, and irrigation water rights are protected.

If Phase III of the Umatilla Basin Project is to occur, there are a great many issues that will need to be resolved, and, as pointed out in the Water Quantity WQMP, the cooperation of all the affected parties will be necessary. The CoP is willing to work with other parties toward the development of a mutually beneficial approach to Phase III.

Sincerely,

Larry Lehman
City Manager

LL:kk

*. . . . Home of the World Famous Pendleton Round-Up . . . .*

CONFEDERATED TRIBES
of the
*Umatilla Indian Reservation*
**Department of Natural Resources**
**WATER RESOURCES PROGRAM**
P.O. Box 638
Pendleton, Oregon 97801
Area code 541 Phone 278-5297 FAX 276-3317

April 7, 2000

Tracy Bosen
Umatilla Basin Watershed Council Coordinator
#1 NW Nye, Suite B
Pendleton, OR 97801

Dear Tracy:

A few weeks ago, Ron Deutz, Chairman of the Water Quantity Work Group, asked me if the Umatilla Tribes would provide a brief write-up of the Tribes' goals for a Phase III of the Umatilla Basin Project. Mr. Deutz told me that the Work Group was seeking input about Phase III from other stakeholders as well and that the write-ups would be incorporated into the Work Group's final report.

Our Tribal Water Committee has agreed to provide a summary statement about our goals for Phase III. They met earlier this week, reviewed their written statement, and asked that I forward it to you. Please find attached the Tribal Water Committee's statement on their goals of Phase III.

If you have any questions, you may contact me at 278-5297.

Sincerely,

Aaron A. Skirvin
Water Resources Program Manager

Attachment

GENERAL COUNCIL
and
BOARD OF TRUSTEES

Water Committee

CONFEDERATED TRIBES
of the
*Umatilla Indian Reservation*
P.O. Box 638
PENDLETON, OREGON 97801
Area code 541 Phone 276-3165 FAX 276-3095

## UMATILLA BASIN PROJECT – PHASE III

**Confederated Tribes of the Umatilla Indian Reservation**
**April 2000**

Nearly 150 years ago, the Umatilla, Walla Walla, and Cayuse Tribes entered into a treaty with the United States government. In the Treaty, the Tribes reserved a homeland (the Umatilla Indian Reservation) and gave up (ceded) control of about 6.4 million acres of land located in northeast Oregon and southeast Washington to the United States. In the Treaty, the Indians reserved their right to fish at all usual and accustomed sites off reservation and the exclusive right to fish in the streams on and bordering the Reservation. Salmon were, and continue to be, a fundamental part of the Tribes' religion, culture, and economy.

As part of the reclamation project in the early 1900's, the federal government developed irrigation diversion dams, canals, and storage reservoirs to supply water to irrigation districts in the lower Umatilla River Basin near Echo, Hermiston, Stanfield, and Umatilla. These irrigation projects dried up the lower Umatilla River and established barriers and other obstacles to fish migration. As a result of the irrigation development, salmon became extinct in the Umatilla River about 1920.

Beginning in the late 1970's and extending through the 1980's, the Tribes, federal agencies, local irrigation districts, and the state of Oregon engaged in cooperative efforts to restore salmon in the Umatilla River Basin. In the mid-1980's, the Tribes released several million juvenile salmon into the Umatilla River, with the intent of restoring salmon (the Tribes' treaty right) to the Umatilla River by the end of the decade. In addition, irrigation diversions were fitted with fish passage improvements, including ladders and screens. After nearly a decade of negotiations and planning, the local stakeholders crafted legislation to help resolve the water conflict in the Umatilla Basin and to assist in the restoration of salmon. In 1988, with the strong support of Senator Mark Hatfield, Congress passed the Umatilla Basin Project Act, which authorized the construction and operation of Phases I and II of the Project. The intent of the Act was to help restore salmon to the Umatilla River and not harm existing irrigated agriculture.

Phase I was completed in the mid-1990's, and exchanges Umatilla River water with Columbia River water for West Extension Irrigation District during the spring and fall salmon migration periods. Phase I maintains up to 140 cubic feet per second of flow in the Umatilla River below Three-Mile Falls Dam. Phase II was completed in 1999 and exchanges Umatilla River water for Columbia River water for Hermiston and Stanfield Irrigation Districts. These exchanges allow tribal and state fisheries managers to maintain "target flows" in the lower Umatilla River (mouth of McKay Creek to the Columbia River)

TREATY JUNE 9, 1855 + CAYUSE, UMATILLA AND WALLA WALLA TRIBE during critical migration periods. Operation of Phases I and II has restored spring and fall chinook and coho salmon to the Umatilla River. However, target flows remain at 0 cubic feet per second in the lower river (25 river miles) during the summer.

PHASE III PROJECT GOALS

Currently, the river runs dry from Echo downstream due to irrigation withdrawals during part of July and September and all of August, annually. A Phase III water exchange with Westland Irrigation District is needed to allow the Umatilla River to flow year-round to meet fish needs. Under Phase III, water exchanged with Westland Irrigation District would be used to:

- reduce stream temperature when fish are present from spring through fall,
- ensure water for out-migrating juvenile salmon and returning adult salmon in July,
- ensure adequate water for fall-returning salmon and steelhead,
- ensure year-round streamflow in lower McKay Creek to maintain anadromous fish habitat,
- restore pacific lamprey (eels) in the Umatilla River, and
- provide water to meet target fish-flows during drought years.

The principal components of the Phase III exchange include:

Westland Irrigation District Water Exchange - Full water exchange, modeled on the Phase II exchange, for Westland Irrigation District. Construct and operate facilities that pump and deliver 220 cfs of Columbia River water for irrigation use by Westland ID and Teel ID. The "bucket-for-bucket" exchange of Westland's live flows and McKay Reservoir stored water for Columbia River water would maintain the districts' irrigation water supply.

Boundary Expansion for Westland Irrigation District – All lands which were petitioned by Westland for inclusion in-boundary and which received project water as of 10/1/88 would be added to Westland Irrigation District and receive the same amount of water. Measures would be determined and implemented to mitigate for any reduced return flows to the river due to Westland's boundary expansion.

Watershed Restoration – Restoration and stabilization of the stream channel, flood plains, and riparian areas will improve salmon survival and reproduction in the Umatilla Basin. Funds would be provided for land/water rights acquisition and for stream restoration throughout the Umatilla Basin.

CTUIR/Pendleton Joint Water Supply Project – The City of Pendleton needs a water treatment plant to provide potable water to its municipal users; the city also needs water storage to meet municipal demands during the summer high-use period. CTUIR municipal water needs are increasing significantly as well. An off-stream impoundment, filled from the Umatilla River during the winter/spring high-flow period (up to 10,000 acre feet capacity), would meet the current and near-term municipal needs of the CTUIR and city. Phase III legislation would provide funding for planning and for cost share for construction of the joint municipal water impoundment.

Water Planning – The legislation would include funding for the development of a comprehensive water management plan for the Umatilla River Basin. The project would include the development of an integrated surface water/ground water model for use as a tool in the management of the basin's water resources.

The Tribes are working with the other stakeholders in the Umatilla Basin to prepare congressional legislation for authorizing Phase III of the Umatilla Basin Project. Senator Gordon Smith has offered his support for such an effort, and we will need a consensus among the stakeholders in the basin on the scope of the legislation and their support to ensure its passage in Congress.

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**WESTLAND IRRIGATION DISTRICT**

P.O. BOX 416
100 WEST COE
STANFIELD, OR 97875

Phone (541) 449-3272
Fax (541) 449-1239

May 17, 2000

Tracy Bosen
Umatilla Basin Watershed Council
P.O. Box 1551
Pendleton, OR 97801

Dear Tracy:

The Westland Irrigation District (WID) supports the concept of a Phase III water exchange, and is working cooperatively with the U.S. Bureau of Reclamation in the development of a feasibility study focused on such an exchange. The decision on implementation of a Phase III project which would involve a specific quantity of water exchanged will be based on the information produced from the feasibility study once it is completed. For example, one alternative being analyzed is a full exchange of WID's live flow and stored McKay water. Since this alternative could have significant impacts on WID, as well as private water users, it is not possible to endorse or reject this alternative at this time simply because not enough information has been generated from the feasibility study.

A properly planned and designed exchange project would have significant benefits to a number of different parties in this basin. WID is committed to exploring all possibilities through the feasibility study which could result in such a successful project being realized. Please feel free to contact me if you have any questions.

Sincerely,

Mike Wick

Mike Wick
WID Board Chairman

# 3.5 GENERAL ELEMENTS

## 3.5.1 COSTS AND FUNDING

The purpose of this section is to describe estimated costs and demonstrate there is sufficient funding available to begin implementation of the WQMP. Another purpose is to identify potential future funding sources for project implementation. There are many natural resource enhancement efforts and programs occurring in the Basin which are relevant to the goals of this plan that were being implemented prior to the completion of the TMDL and WQMP. These would be ongoing with or without the TMDL and WQMP. For example, the CTUIR, USFS, NRCS, SWCD and ODFW were all involved in implementing resource enhancement projects prior to the development of this plan.

This cost analysis is limited because the planning in this WQMP generally does not prescribe specific measures. Much of the recommendations are an array of beneficial practices to select from, schedules to develop further planning/policy, or an indication that further evaluation or program development is needed. The approach identified in the Agricultural Management Area Plan is to identify conditions that would be prohibited rather than identify practices that would be implemented. Many of the forestry and transportation recommendations are outcome-based rather than implementation-based. Cost estimating is a rough approximation, where specific actions have not yet been identified.

The temperature TMDL, however, serves as a relatively specific and available tool for evaluating costs. Implementation of the temperature TMDL surrogates encompasses much of the Basin area and other impairments such as pH, nuisance aquatic plants and streambank erosion on perennial streams. Accordingly, it is one of the most important aspects of TMDL implementation for which to conduct economic evaluation. The temperature TMDL is largely implemented through the effective shade surrogate, which is most practically and beneficially addressed through riparian vegetation. Consequently, the cost of riparian re-vegetation is focused upon in the following section.

### 3.5.1.1 IMPLEMENTATION

#### 3.5.1.1.1 Non-point Sources

It is important to recognize that the process of implementing this plan and installing BMPs and restoration projects will continue for decades. Unlike point sources that must fully construct improvements within a few years, it is neither necessary nor possible to identify and secure all of the funding that will be needed to implement all NPS controls identified in the WQMP. Definition of optimal practices often requires implementation, monitoring and ongoing evaluation. It is also important to understand that while there will be costs to individuals who need to install improvements or practices on their own property, the funding of resource enhancement projects often includes public sources. These kinds of improvements have public as well as private benefits and a portion of the costs of eligible projects can be covered through a variety of public funding sources (discussed below), within the budgets of the sources. In some instances where an individual declines to correct an identified problem on a voluntary basis an enforcement action could be initiated. Such a situation could result in loss of eligibility for some public funding sources.

## 3.5.1.1.1.1 MANAGEMENT ORGANIZATIONS/AGENCIES

Transportation related practices will be applied as discussed in **Section 3.3.4**. Specific, localized, road or railroad related "hot spots" have not yet been identified, so an accurate estimate of these costs is not possible. It is known that the County, State and USFS all have budgets for road maintenance. These budgets have not grown in recent years and, in fact, have shrunk in some cases. Likewise, the Cities will use existing public works budgets and USFS will use existing road maintenance budgets to direct resources toward the prioritized road related problems as resources allow. Where existing resources cannot cover the expense of a priority project, the State, County, City, and USFS are encouraged to pursue grant funds in cooperation with the Watershed Council. Agencies are encouraged to form partnerships to leverage resources or request increased funding through the State Legislature.

Regarding urban issues, the counties and cities in the Basin plan to conduct the ordinance evaluation and revisions discussed under municipal sources in **Section 3.3.1**. This will include policies relating to management implemented by public employees, new development both during and after construction, evaluation and improvement of existing non-point source controls. This may result in increased development and municipal government/operations costs. Some other cities in Oregon, facing similar TMDL challenges and needing to implement non-point source controls to improve the quality of urban runoff, have established surface water management fees of $3.00 to $4.00 per month in addition to sewer fees.

Direct costs of the federal forestland component of this plan will be born by the USFS and funded through their appropriations. Umatilla County and industry could incur indirect costs as a result of reduced timber harvest and subsequent losses of forest receipts. USFS has also actively pursued resource enhancement project funding through partnerships and grants in recent years. These efforts are expected to continue.

As currently written, the private forest land component of this WQMP consists of continued implementation of the existing forest practice rules. This means that at the current time there is no incremental cost to the forest industry on private land. This could change as a result of the "sufficiency analysis" and basin specific evaluation discussed under Non-Federal Forest Lands in **Section 3.3.3**. Even so, it is important to recognize that ODF has on-going costs associated with implementing the FPA in the Basin. The forest industry overall incurs continuing costs to comply with the regulations. It is also important to recognize that the forest industry has voluntarily helped financially support the Oregon Plan. Forest land managers are encouraged to seek funding, such as through the Oregon Watershed Enhancement Board.

As mentioned previously, the Agricultural Water Quality Management Area Plan (AgWQMAP) and rules represent a new effort to control non-point source pollution from agriculture. Costs are not identified in the plan. Suggested funding sources include: Environmental Quality Incentives Program, Continuous Conservation Reserve Program, EPA's non-point source implementation grants (CWA 319), the Oregon Watershed Enhancement Board and the Conservation Reserve Enhancement Program. The ODA, NRCS and Umatilla County SWCD provide technical assistance to landowners who develop voluntary individual farm plans or enhancement projects. The Farm Services Agency and NRCS are active in providing financial and technical assistance to the agricultural community. The CWA 319 program has supported agricultural water quality management in the Basin.

In year 2000, the Clean Water Act Section 319 program funded $242,000 to Umatilla Basin projects: $140,000 to the Umatilla County SWCD, $29,000 to the UBWC, $43,000 to the CTUIR and $30,300 to monitoring/consulting for non-point source water pollution control projects. OWEB similarly funded Umatilla Basin projects. The Conservation Reserve Program currently leases more than 20,000 acres of agricultural land that is set aside and managed for conservation. It is important that similar and increased funding continue to be available for TMDL-related projects. Incentive payments to promote conservation agriculture at $10.00 and $20.00 per acre are included in the above, supporting in excess of 20,000 acres of land undergoing direct seeding and annual cropping in the Basin.

It is emphasized that though some aspects of TMDL implementation can be expensive, many others are cost free, or can provide cost savings. Examples include: daily practices such as residential water conservation or detergent reduction, setting back a levee or fence to reduce flood damage, applying the OWRD conserved water program, allowing trees to grow, reduced soil loss through annual cropping.

### 3.5.1.1.1.2 RIPARIAN VEGETATION

Throughout much of the Basin, even in the arid Lower Basin shrub land, riparian trees are viable and indigenous trees probably formed a relatively continuous riparian forest of varying width along the mainstem and its tributaries. The approximation of system potential shade-producing vegetation used for the temperature TMDL assumes primarily willows, alders and cottonwoods along the perennial tributaries and the Umatilla mainstem from the mouth upstream until conifers begin to dominate. The cottonwood galleries of the lower and mid-Basin are particularly important for temperature reduction because of their height and shade density in the summer.

Current levels of effective shade along the Umatilla River range from zero to six percent (running average over distance, **Section 2.1.1**) through its lower eighty miles. The TMDL shade goal ranges from twenty to sixty percent. The goal is calculated to be realizable, assuming increased vegetation height and estimated channel narrowing associated with a more stable vegetated system. The improved channel cross-section, pattern and vegetation can be described in two quantities: more trees and more area for sinuosity and floodplain interaction. Practical measures to accomplish this include protecting existing beneficial tree stands and the following:

First, enable space and suitable growing conditions through:
- modify current land management (minimize tree removal & near-stream ground disturbance)
- fence, establish cattle rotation/exclusion
- implement road modification or closure
- establish land set-asides through lease, purchase, donation, stewardship
- consider reducing near-stream cropland, forest yield, vehicle access, river views
- apply urban riparian area management (vegetation control, floodplain ordinances, etc.)

When the above stresses are sufficiently decreased,
- allow vegetation to re-establish
- allow channel to stabilize

As needed, consider active restoration
- engineered grade control
- floodplain restoration such as levee setbacks
- removal of competing unwanted vegetation
- tree planting
- channel re-shaping

### 3.5.1.1.1.3 RESTORATION BUDGETS AND EXAMPLE COSTS

Some of the unit costs of the above actions, identified in year 2000 are as follows. Typical Conservation Reserve Program (CRP) leases in Umatilla Basin are $40 to $70/acre-year. Typical Conservation Reserve Enhancement Program (CREP) rental rates, including incentive, are $80 to $130/acre-year or as much as $150/acre-year for irrigated acreage. CREP startup costs for riparian buffers, including government match, are $1,000/acre for planting plus $1,250/acre for drip irrigation if needed. Land prices in riparian areas of Umatilla County generally ranges from $2,000 to $10,000 per acre. Fencing costs in eastern Oregon range from $4,000 to $8,000 per mile. Typical crop profits range from $200/acre to $300/acre.

Restoration projects in the Umatilla Basin administered through the CWA 319 program typically range from $10,000 to $300,00 and address various aspects of management over large acreage's such as the upper Butter Creek and Buckaroo Creek watersheds, or the more than 20,000 acres of land under direct seeding. The Buckaroo and Butter Creek projects included riparian vegetation improvement.

ODFW has managed intensive projects with active tree planting, channel engineering and instream structures/treatment, typically for $100,000 dollars per mile. This pays for the use of heavy equipment, purchase of logs, root wads, coconut matting, imported soil, indigenous vegetation from donor sites, etc.; and does not include costs absorbed by the agency that are associated with project design, management, monitoring and overhead costs. Specific project costs and stream lengths include:

- The Lobato project, lower Birch Creek, 1/3 mile: $100,000
- The Houser project, East Birch Creek, 1 mile: $250,000
- The Gambil/Weinke project, upper Birch Creek, 1 mile: $170,000
- Westgate Canyon project, off East Birch Creek, 1.25 mile: $57,000

The year 2000 CTUIR budget for watershed planning and improvement activities throughout the Umatilla Basin was as follows (next year's budget is 15% larger):

- Basin watershed habitat enhancement: $345,000
- Basin stream flow operations: $10,000

### 3.5.1.1.1.4 RESTORATION COST ESTIMATE

A TMDL cost estimate was locally prepared by ODFW in behalf of the TMDL Committees (**Cost Sheet,** below). Explanation of terms and restoration strategies for this estimate is described in insets following the **Cost Sheet**. This estimate accounts for the installation of stream channel restoration. Ongoing maintenance costs should also be considered:

> Operation and Maintenance Costs
>
> With each of the prescribed treatment strategies there are inherent costs associated with operations and/or maintenance. Failure to plan and follow through with appropriate maintenance, particularly with fencing projects will lead to failure of restoration efforts. The listed treatments (1-10) will require varying levels of maintenance, particularly during the first decade after installation. Some will require little maintenance beyond the first decade.
>
> To estimate the full cost of restoration, maintenance of the installations must be included. Maintenance costs can vary widely based on climatic events (flooding), land use intensity, etc. For example, a major flood could cause large-scale damage to instream projects, particularly when the projects are newly installed. However, these kinds of events are unpredictable and therefore will not be accounted for. The estimated O & M cost estimate below is based primarily on the cost incurred by ODFW to maintain fish habitat improvement projects (primarily riparian fencing projects) in northeastern Oregon. This cost estimate includes planning, design, implementation, administration and other associated overhead costs.
>
> Cost per mile per year: $250.00
>
> <u>Annual restoration maintenance</u>: $250 x 669 miles = 1,675,5000

This estimate does not necessarily account for structural improvements to levees, road crossings and other points of constriction. It does not address the cost of land purchase or outreach to citizens and organizations. It does not address inflation. The work identified in this estimate provides progress toward attainment of all Umatilla Basin TMDL allocations. It does not account for all aspects of TMDL implementation, however. Potential concerns not fully addressed here include: sediment from intermittent streams, direct discharges, nutrients from livestock and storm water runoff.

Also note that the costs will be born in some way by virtually every member of the Basin community and by the state and counties, and with federal support. Some of the cost will be accounted for by individual actions and changes in operations that become standard behavior. Some is accounted for by existing programs such as CREP.

In addition to these general riparian practices, there are potentially large costs associated with projects that are beyond the normal capability of individual land managers or municipalities. Paved road re-location and Umatilla Basin Project Phase III are examples. The specifics of such actions and costs are beyond the scope of this document, other than to recommend that such actions be evaluated and considered as they relate to water quality and quantity.

**Table 68.** Cost Sheet

| Stream Reach | Length (Miles) | Treatment Strategy | Cost/mile | Restoration Factor | Total Cost |
|---|---|---|---|---|---|
| Umatilla - Forks to Meacham | 11 | 4,5,7 | $230,000 | 1.00 | $2,530,000 |
| Umatilla - Meacham to Pendleton | 24 | 2,8 | $530,000 | 0.80 | $10,176,000 |
| Umatilla - Pendleton to 3-mile Dam | 51 | 1,8 | $830,000 | 1.00 | $42,330,000 |
| Umatilla - 3-mile Dam to mouth | 4 | 9 | $0 | 1.00 | $0 |
| Umatilla - upper tributaries | 42 | 9 | $0 | 1.00 | $0 |
| Umatilla - N. Fork | 10 | 9 | $0 | 1.00 | $0 |
| Umatilla - S. Fork | 10 | 10 | $35,000 | 0.40 | $140,000 |
| Meacham - Mouth to N. Fork | 15 | 2,5,8 | $550,000 | 0.60 | $4,950,000 |
| Meacham - Tributaries | 40 | 6 | $30,000 | 0.50 | $600,000 |
| Meacham - N. Fork to Meacham | 15 | 5,7 | $110,000 | 0.75 | $1,237,500 |
| Meacham - Upper | 6 | 6 | $30,000 | 1.00 | $180,000 |
| Squaw Creek | 15 | 9 | $0 | 1.00 | $0 |
| Reservation Tributaries | 20 | 8 | $80,000 | 0.60 | $960,000 |
| Wildhorse - Mouth to Athena | 19 | 2,8 | $530,000 | 1.00 | $10,070,000 |
| Wildhorse - lower tributaries | 30 | 8 | $80,000 | 1.00 | $2,400,000 |
| Wildhorse - Athena to Eagle Cr. | 5 | 8 | $80,000 | 0.75 | $300,000 |
| Wildhorse - Headwaters | 5 | 6 | $30,000 | 1.00 | $150,000 |
| Wildhorse - upper tributaries | 5 | 8 | $80,000 | 1.00 | $400,000 |
| Tutuilla | 20 | 8 | $80,000 | 1.00 | $1,600,000 |
| Mckay - Mouth to Forks | 19 | 2,8 | $530,000 | 0.50 | $5,035,000 |
| McKay - N. fork & tributaries | 15 | 6 | $30,000 | 1.00 | $450,000 |
| McKay - S. Fork | 10 | 2,8 | $530,000 | 0.50 | $2,650,000 |
| McKay - S. Fork tributaries | 25 | 6 | $30,000 | 0.80 | $600,000 |
| Birch - Mainstem | 16 | 2,8 | $530,000 | 0.90 | $7,632,000 |
| Birch - East Birch | 15 | 2,8 | $530,000 | 0.80 | $6,360,000 |
| Birch - Pearson (federal) | 10 | 9 | $0 | 1.00 | $0 |
| Birch - Pearson | 4 | 3,7 | $170,000 | 1.00 | $680,000 |
| Birch - East tributaries | 15 | 6 | $30,000 | 1.00 | $450,000 |
| Birch - West Birch | 20 | 2,8 | $530,000 | 0.75 | $7,950,000 |
| Birch - Bear | 18 | 8 | $80,000 | 0.50 | $720,000 |
| Birch - West tributaries | 15 | 6 | $30,000 | 0.50 | $225,000 |
| Birch - Mainstem tributaries | 5 | 8 | $80,000 | 1.00 | $400,000 |
| Butter - Mouth to Forks | 49 | 2,8 | $530,000 | 0.75 | $19,477,500 |
| Butter - Little Butter | 31 | 1,8 | $180,000 | 0.80 | $4,464,000 |
| Butter - Upper | 20 | 1,7 | $170,000 | 0.80 | $2,720,000 |
| Butter - Johnson | 10 | 6 | $30,000 | 1.00 | $300,000 |
| Butter - East Butter | 25 | 6 | $25,000 | 1.00 | $625,000 |
| TOTAL | 669 | | | | $138,762,000 |

**Cost Sheet Explanation: Heading Terms**

**Stream Reach**: Reaches of perennial stream in the Umatilla Basin.
**Length**: Estimated length of perennial stream reach.
**Treatment Strategy**: Treatment strategy(s) necessary to bring the stream into fully functional form and provide the attributes necessary to meet the TMDL. Reference to the adjoining list of treatment strategies.
**Cost/Mile**: Cost per mile associated with the installation/implementation of the listed treatment strategies. Costs for multiple treatment strategies are not necessarily additive. Some treatment strategies may be accomplished, at least in part, by the implementation of other strategies. This includes the total cost of the project installation including planning, design, administration and implementation.
**Restoration Factor**: This factor accounts for variation of needed treatment intensity throughout a given reach. Even within an identified reach, the level of treatment needed can vary. This factor accounts for this variability. A factor of 1 indicates that the entire reach will need to be treated at the cost per mile estimated. A factor of less than one indicates that there are portions of stream not needing the estimated cost per mile treatment level.
**Total Cost**: Total estimated cost of installing the prescribed treatments to accomplish the TMDL.

**Cost Sheet Explanation: Strategy Unit-Costs**

| Treatment Strategies | Cost/Mile |
|---|---|
| 1. Large stream channel restoration | $750,000 |
| 2. Medium stream channel restoration | $450,000 |
| 3. Small Stream channel restoration | $100,000 |
| 4. Bank stabilization | $150,000 |
| 5. Instream habitat improvement | $40,000 |
| 6. Corridor fencing/passive | $30,000 |
| 7. Corridor fencing/planting | $70,000 |
| 8. Corridor fencing/CREP/planting | $80,000 |
| 9. Management issues | $0 |
| 10. Planting only | $35,000 |

**Cost Sheet Explanation: Description of Treatment Strategies**

1. Large Stream Channel Restoration: This strategy involves active restoration to correct stream channel function on larger streams. Activities focus on restoring stream channel sinuosity, appropriate channel cross-section and reconnection to an adequate floodplain area. Site re-vegetation is approached aggressively to naturally stabilize the stream and provide shading.

2. Medium Stream Channel Restoration: This strategy involves active restoration to correct stream channel function on medium sized streams. Activities focus on restoring stream channel sinuosity, appropriate channel cross-section and reconnection to an adequate floodplain area. Site re-vegetation is approached aggressively to naturally stabilize the stream and provide shading.

3. Small Stream Channel Restoration: This strategy involves active restoration to correct stream channel function on small streams. Activities focus on restoring stream channel sinuosity, appropriate channel cross-section and reconnection to an adequate floodplain area. Site re-vegetation is approached aggressively to naturally stabilize the stream and provide shading.

4. Bank Stabilization: This strategy involves measures to stabilize actively eroding streambanks utilizing bioengineering techniques which include vegetative plantings to provide natural, long-term stabilization and stream shading. Bank stabilization techniques that do not include the use, to some degree, of native riparian vegetation should not be used as a means of meeting the TMDL.

5. Instream Fish Habitat Improvement: These measures are specifically for the installation of instream features to improve fish habitat such as tree placements, weirs, boulders, etc.

6. Corridor Fencing/Passive: The purpose of this strategy is to restore/enhance riparian vegetation through managing livestock by either excluding them from riparian zones for a determined length of time or by developing pasture fencing systems. Off-stream water developments are often provided as part of this treatment strategy. No other restoration actions are included. Re-vegetation is expected to occur without planting.

7. Corridor Fencing/Planting: The purpose of this strategy is to restore/enhance riparian vegetation through managing livestock by either excluding them from riparian zones for a determined length of time or by developing pasture fencing systems. Off-stream water developments are often provided as part of this treatment strategy. Existing vegetative stock is not adequate to result in expedient recovery so re-vegetation efforts are implemented.

8. Corridor Fencing/CREP: This strategy is the same as 7, but includes an incentive program such as CREP for restoring and setting aside riparian/floodplain areas.

9. Resource Management: This category includes many activities taken by land managers that are beneficial to streams and water quality. There are various means of accomplishing this all with differing costs to the land manager. Because this category can be so variable, no cost per mile estimates are included.

10. Planting Only: This strategy involves planting of riparian vegetation and no other activities. This would be undertaken in areas where livestock grazing is not affecting riparian plant communities or water quality.

### Active vs. Passive Restoration

Where passive types of restoration (fencing and other land use management actions) are capable of achieving complete restoration of aquatic resources; it is the most effective and economical restoration measure. Passive restoration is most suited to moderately degraded streams that are either functional or nearly so.

However, passive restoration techniques are often not effective at restoring dysfunctional streams. In the Umatilla basin there are many miles of dysfunctional streams. These streams are evidenced by either excessive down-cutting (ditch like) or overly widened channels. These situations are not easily corrected by passive restoration techniques because passive restoration generally deals specifically with the lack of vegetation. Vegetation is a key component of functional and stable streams, but vegetation enhancement alone can often not alone overcome larger geomorphic problems. While re-vegetation efforts along unstable reaches of stream can be successful in some cases over the short term (10-20 years), they will likely fail due to the pre-existing channel problems over the long term. Many streams in the Umatilla basin are in a state that cannot be corrected by passive or re-vegetation treatments alone. The physical attributes of the stream channel must be corrected as well.

Active restoration techniques such as treatment strategies 1-3 are critical for the accomplishment of re-vegetation of waterways where stream channels are “unstable”. Unstable streams are not able to maintain healthy stands of riparian vegetation over the long term due to their instability. Unstable streams often erode laterally or vertically faster than natural re-vegetation can occur. Active restoration approaches seek to create a stream environment that will lead to optimum vegetation communities that are sustainable.

# 3.5.1.1.2 Point Sources

As mentioned previously, this WQMP (**Chapter Three**) addresses non-point and storm water sources of pollutants. For completeness however, point sources are addressed briefly in the following:

Point sources are addressed through the National Pollutant Discharge Elimination System (NPDES). There are five individual-facility NPDES point sources in the Umatilla Basin that directly discharge to surface waters of the state (refer to discussion and map in **Chapter One**). Each is a municipal wastewater treatment plant. These point sources serve the cities of Athena, Pendleton, Stanfield, Echo and Hermiston. Only Pendleton and Hermiston are permitted to discharge during the summer. Waste load allocations for temperature are established in **Chapter Two**. The need for plant modification to address temperature is still being evaluated at these facilities, so no costs are available. For parameters such as TSS, turbidity and bacteria, existing permit requirements at all facilities are at least as stringent as this TMDL; so no upgrades specific to these analytes are envisioned. However, meeting nutrient waste load allocations may require upgrades at Athena (for nitrate) and Hermiston (ammonia). This is currently being evaluated and will be addressed in upcoming permit renewal, which has been timed to await TMDL issuance. Costs will not be estimated until further evaluation and design is proposed.

Costs of improving storm water facilities, increasing street sweeping and other storm water/pollutant control measures are also deferred until surface water management plans are drafted. These costs will be born by the ratepayers of Basin municipalities and by industries and the county.

# 3.5.1.2 STREAM MONITORING

The water quality and quantity monitoring effort described in **Section 3.5.4** comprises key sites identified by the Technical Committee for documenting and understanding the long-term water quality trends in the Umatilla Basin. Part of this monitoring is already underway and is expected to continue at this level. Other components such as the stream morphology surveys and additional requested water quality sample sites will require additional budget evaluation. Annual resources by agency are identified below, if available. Availability of funding in future years is subject to state and federal appropriations. These are current annual budgets (figures obtained in 6/2000) or where noted* estimated for the next fiscal year.

Oregon Water Resources Department $40,000*
Oregon Department of Environmental Quality $5,000*
Confederated Tribes of the Umatilla Indian Reservation

- Basin habitat enhancement $26,000
- Basin salmonid natural production $8,000
- Basin fish passage structure operations $10,000
- on-Reservation stream-gaging $76,000
- on-Reservation water quality analysis $2,300
- on-Reservation water quality monitoring $35,000

Confederated Tribes of the Umatilla Indian Reservation*

- next fiscal year - same as above, except habitat enhancement is increased to $32,000 and gaging undergoes 5% annual increases

Several organizations have sponsored this long-term monitoring plan: CTUIR, USFS, ODEQ, OWRD, City of Pendleton, ARS, SWCD, UBWC and others have made commitments of funds, labor, lab analyses, equipment, ongoing program overhead, etc. Cost estimates for these contributions are generally not yet available.

## 3.5.1.3 POTENTIAL SOURCES OF PROJECT FUNDING

Funding is essential to implementing projects associated with this water quality management plan or with any natural resource improvement or enhancement effort. There are many sources of public financial assistance that can be accessed for improving natural resources. Unfortunately finding the source most appropriate to a particular project and then working through the necessary paper work is sometimes a cumbersome process. The Oregon Coordinated Resource Management (CRM) Task Group has compiled an annotated list and description of available programs in Oregon: Public Funding Sources For Landowner Assistance, January, 1997, Oregon CRM Task Group. (The list is currently being revised and updated.) A copy of the complete brochure can be obtained from Oregon CRM member agencies which include:

| |
|---|
| Oregon Department of Forestry (ODF) |
| Oregon Division of State Lands (DSL) |
| Oregon Department of Fish & Wildlife (ODFW) |
| Oregon Department of Water Resources (WRD) |
| Oregon Department of Agriculture (ODA) |
| Oregon State University Extension Service |
| Oregon Association of Conservation Districts (OACD) |
| USDA Forest Service (USFS) |
| USDA Natural Resources Conservation Service (NRCS) |
| USDA Farm Service Agency (FSA) |
| USDI Bureau of Land Management (BLM) |
| USDI Fish & Wildlife Service |

The following is a partial listing of assistance programs available in the Umatilla Basin. For more options, or for more complete information on purpose and eligibility, either call the sponsoring agency or obtain a copy of the annotated listing described above.

| |
|---|
| Umatilla Basin Watershed Council 541 276-2190 |
| Oregon Watershed Enhancement Board OWEB 503 378-3589 x 831 |
| Environmental Quality Incentives Program USDA-NRCS 541 963-4231 x 3 |
| Wetland Reserve Program USDA-NRCS 541 963-4231 x 3 |
| Conservation Reserve Enhancement Program USDA-NRCS 541 963-4231 x 3 |
| Stewardship Incentive Program ODF 541 963-3168 |
| Access & Habitat ODFW 541 963-2138 |
| Partners for Wildlife Program USDI-Fish & Wildlife 503 231-6179 |
| Conservation Reserve Program USDA-FSA 541 963-4231 x 2 |
| Conservation Implementation Grants ODA 503 986-4700 |
| Water Projects w/ Public Benefits OWRD 503 378-3739 |
| Nonpoint Source Water Quality Control ODEQ 503 229-5279 |

The following is a partial list of organizations that have cooperated in watershed restoration projects and monitoring in the Umatilla Basin.

| |
|---|
| ARS Agricultural Research Service |
| BOR Bureau of Reclamation |
| BPA Bonneville Power Administration |
| COE U.S. Army Corps of Engineers |
| CTUIR Confederated Tribes of the Umatilla Indian Reservation |
| City of Pendleton |
| City of Hermiston |
| Other Umatilla Basin Cities |
| DEQ Dept. of Environmental Quality |
| EPA Environmental Protection Agency |
| FEMA Federal Emergency Management Agency |
| FSA Consolidated Farm Services Administration |
| Umatilla Basin Irrigation Districts |
| NRCS Natural Resources Conservation Service |
| ODA Oregon Dept. of Agriculture |
| ODF Oregon Dept. of Forestry |
| ODFW Oregon Dept. of Fish and Wildlife |
| ODOT Oregon Dept. of Transportation |
| OSPRD Oregon State Parks & Recreation Dept. |
| OSU Oregon State University |
| OSUE Oregon State Univ. Extension |
| OWC Oregon Water Coalition |
| OWEB Oregon Watershed Enhancement Board |
| OWRD Oregon Water Resources Dept. |
| Pheasants Forever |
| SWCD Soil and Water Conservation District |
| TNC The Nature Conservancy |
| TU Trout Unlimited |
| Umatilla and Morrow Counties |
| UBWC Umatilla Basin Watershed Council |
| USFS U.S. Forest Service |
| USBR U.S. Bureau of Reclamation |

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# 3.5.2 AREAS OF EMPHASIS

Actions that improve water quality, stream flow and habitat are important throughout the Umatilla Basin. Fulfillment of TMDL allocations is a high priority throughout the Basin. This section identifies specific areas where actions are likely to be most effective in restoring unimpaired beneficial usage of basin waters. In addition, consideration must be given to varying levels of implementation capability and potentially divergent goals of landowners and agencies. Strategic planning helps direct limited resources to the locations (geographic priorities) and project types (management practice categories) that will be most likely to produce the desired improving trend in water quality.

The Umatilla TMDL Technical Committee developed the strategy herein for determining areas of emphasis for restoration at the scale of major tributaries. The goal is to guide projects, large and small, and to provide a framework for focusing combined efforts of numerous agencies and individuals, maximizing restoration effectiveness. This section is directed to an audience of restoration planners, developers, funding sources, etc., at the project level. This evaluation of emphasis for planning and funding is a component in common of the Umatilla Basin TMDL implementation plans. It is based in best professional judgement with strong emphasis on community input and interest. It is not intended to be binding or directive, but rather it is envisioned as a living document that continually incorporates an evolving understanding of opportunity, goals and limitations.

The intent is that agencies, cities and the counties should focus their project solicitation efforts on high priority management categories and high priority geographic areas. This should not discourage efforts that do not rank high with this strategy. When opportunities present themselves to do beneficial projects outside of the areas emphasized decisions to proceed should be made on a case by case basis. Efforts should be made to accommodate, include and reinforce other planning processes. Each year CTUIR, ODEQ and UBWC plan to impanel a group to monitor TMDL implementation progress. This is an ideal forum for ongoing improvement of the prioritization strategy herein or to develop support and mutuality.

**Several overarching points are recommended for planning:**

- Priorities should be set first at the major tributary scale, then prioritize sub-watersheds within the watershed.
- All things being equal, effective restoration commences in headwaters and works down. However many improvements are relatively independent of watershed position and downstream activities should not await up-stream progress.
- Restoration that addresses multiple impairments, e.g., temperature, sediment, and bacteria, is important.
- Riparian areas are high priority.
- Activities that support goals of multiple programs, laws and agencies should be high priority. The Umatilla Basin has an outstanding record of collaborative projects and planning crossing sector boundaries. Maintaining this cooperation is key to efficient project startup and effective and rewarding outcomes.
- Areas with high quality water & habitat should be protected wherever they are found. Cold water refugia should be protected and expanded.
- Readily implementable restoration should be targeted as soon as possible, as should planning for long range implementation.

**The following sections identify three types of emphasis:**

Type of impairment for a given watershed (**Section 3.5.2.1**)

- E.g., sediment, temperature, bacteria - which impairment drives restoration design in a given major tributary watershed?

Location (**Section 3.5.2.2**)

- Efforts should be focused on geographic areas of greatest importance. This geographic emphasis reflects areas where action is most needed to support sensitive beneficial uses. It is understood that high quality areas should be protected wherever they are found regardless of this ranking. These include: North Fork of the Umatilla, North Fork of Meacham Creek and all areas with stable channels and riparian areas of high ecological status.

Restoration management category (**Section 3.5.2.3**)

- These are general categories of restoration that are considered important in the Umatilla Basin, e.g., flow restoration, re-vegetation. This section is not ranked or geographically specified; other than to emphasize the importance of riparian vegetation, particularly trees. Decisions should be made at the project level, based largely on deviation from system potential.

## 3.5.2.1 AREAS OF EMPHASIS BY WATER QUALITY IMPAIRMENT

The Umatilla Basin TMDLs are goals designed to achieve Oregon water quality standards. The target that the TMDL is quantitatively based on can be simply the water quality standard (e.g., temperature) or another numeric endpoint designed to achieve the standard (e.g., 30 NTU for the relative turbidity standard or percent effective shade for temperature). The method chosen for evaluation of emphasis by impairment (elevated temperature, sediment, bacteria and nitrate) is based in evaluation of divergence from this target. **A scoring method is utilized for temperature and fine sediment/turbidity (described in Tables 69 & 70 below). Aquatic weeds and algae are closely linked with, and are implicitly accounted for by temperature. Regarding habitat modification and nitrate, emphasis is based on whether the watershed contains 1998 303(d) listed streams. Bacteria emphasis is assigned where exceedances of water quality standards occur (the recent bacteria standard change to *E. Coli* was not reflected in the 1998 303(d) list. Areas of emphasis for habitat, nitrate and bacteria are denoted in *Figure 62* with 'yes.' Flow restoration is of greatest importance where summer flow is substantially less than an instream water right.**

First, **Table 69** identifies key indicators for evaluating the temperature concern. Each indicator is assigned a value of 1 or -1. The sum correlates to the degree of concern, i.e., the degree of divergence from goal. **Table 70** addresses sediment. The sums and the indicators associated with each watershed are listed in **Table 71**.

**Table 69.** Temperature Criteria for Evaluating Divergence from Goal

| Notation | |
|---|---|
| | **Equally weighted indicators for high priority** |
| 1 | divergence from applicable bull trout goal of 50 °F |
| 2 | divergence from applicable spawning goal of 55 °F |
| 3 | divergence from applicable general salmonid goal of 64 °F |
| | *note: the lowest applicable temperature threshold is employed - the above three criteria are not counted in combination |
| 4 | documented historic decline in salmonid populations (not related to barriers) |
| 5 | Meacham Creek can link separated bull trout populations (N. Fk. Umatilla, N. Fk. Meacham) |
| | **Equally weighted indicators for low priority** |
| A | isolated from mainstem due to seasonal low flow or interior drainage |
| B | not high potential for salmonid habitat |
| | *note the above two criteria are not counted in combination |
| Explanation of rating: +1 point for each of the numbered indicator above, -1 point for each lettered indicator. The sum of the indicators gives the degree of concern: 0=low, 1=medium, 2=high, 3 or greater=very high. For example, a watershed denoted with '2,4' would receive a score of 2 (+1 for each numeral), where as a watershed with '3,A' would receive a score of zero (+1 for '3' and -1 for 'A'). These would be assigned high and low priorities, respectively. | |

Next, the divergence from the goal of fine sediment entering the stream is rated according to **Table 70**, based on the sediment (suspended solids) TMDL. The output is listed in **Table 71**.

**Table 70.** Sediment Criteria for Evaluating Divergence from Goal

| Source | Method for evaluating emphasis |
|---|---|
| Streambank restoration priority | From the Chapter Two erosion reduction TMDL allocations. Allocated streambank percent reductions from 0-30 are low, 31-60 are medium, 61-90 are high. |
| Upland restoration priority | Also from the Chapter Two erosion reduction TMDL allocations. Allocated upland percent reductions from 0-15 are low, 16-30 are medium, 31-45 are high. |

Finally, the rating from the methods described in **Tables 69 and 70** and the first paragraph of **Section 3.5.2.1** are shown in **Table 71**. The table indicates which impairment types, e.g., temperature, nitrate, etc., are of greatest concern within each major watershed of the Umatilla Basin.

The map enclosed below, recalled from **Figure 47**, relates geographic area to the watershed names used here. The only exception is that the North Fork of the Umatilla River is considered separately due to its uniqueness. Note that the remainder of the 'Forks' watershed extends from the headwaters of the South Fork down to the confluence of Meacham Creek and the Umatilla River.

**Reference Map** from **Figure 47** Distribution of Sediment Allocations

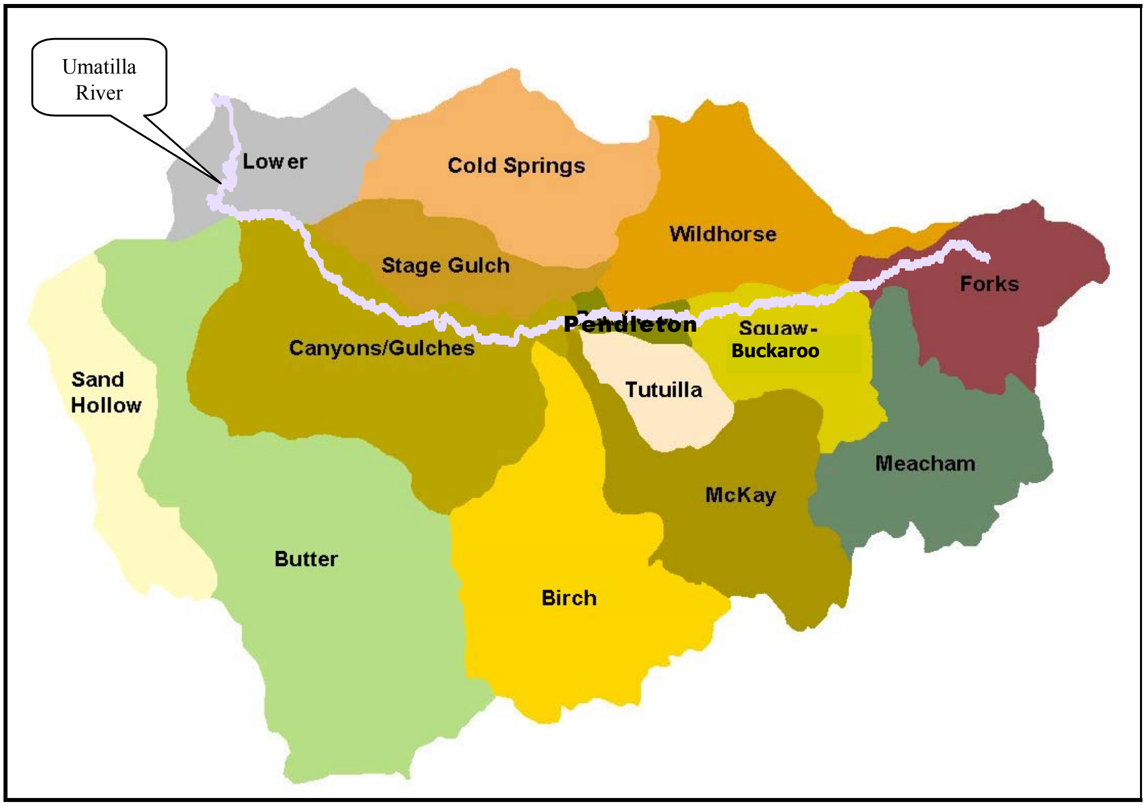

**Table 71.** Areas of Emphasis by Type of Impairment
(refer to evaluative criteria discussed previously in this section)

| Watershed | Temperature (rated as indicated in Table 69) | | | Fine sediment (rated as indicated in Table 70) | | Nitrate | Habitat | Bacteria | Flow |
|---|---|---|---|---|---|---|---|---|---|
| | emphasis based on sum, refer to Table 69 | note from Table 69 | sum, refer to Table 69 | up-land | bank | | emphasis as indicated and along upper mainstem | | |
| | | | | emphasis | | emphasis | | emphasis | emphasis |
| North Fork | medium | 1 | 1 | low | low | | | | |
| Forks | medium | 2 | 1 | low | low | | | | |
| Meacham | very high | 1,4,5 | 3 | low | low | | yes | | yes |
| Squaw & Buckaroo | medium | 2 | 1 | high | med | | | | |
| McKay | medium | 2 | 1 | high | med | | yes | yes | |
| Wildhorse | medium | 2 | 1 | med | high | yes | | yes | |
| Birch | medium | 2 | 1 | med | med | | yes | yes | yes |
| Butter | medium | 2 | 1 | low | high | | | yes | |
| Tutuilla | medium | 3 | 0 | high | med | | | yes | |
| Pendleton | medium | 3 | 1 | high | med | | | | |
| Cold Springs | low | 3,A | 0 | med | high | | | | |
| Stage Gulch | low | 3,B | 0 | med | high | | | yes | |
| Canyons & Gulches | medium | 3 | 1 | low | high | | | yes | |
| Sand Hollow | low | 3,A/B | 0 | low | high | | | | |
| Lower Umatilla | medium | 3 | 1 | low | low | | | yes | yes |

## 3.5.2.2 AREAS OF EMPHASIS BY GEOGRAPHIC AREA

This section evaluates the locations of greatest emphasis for overall restoration, particularly restoration that is not specific to an impairment such as excess nitrate or bacteria. Overall stream stability and morphology is addressed through the divergence from temperature and soil erosion reduction goals. Sensitivity of beneficial uses is accounted for by these goals, including consideration of salmonid spawning and incubation. Effectiveness of restoration is accounted for through recovery potential. Opportunity should be accounted for separately during planning. It may be arguable that sediment goal divergence is weighed heavily since it is counted twice, however, it is the only criteria that stresses uplands and non-perennial streams - much of a watershed's area. Temperature concerns are weighted with greater values than the other criteria - the ad hoc committee and the Basin fish biologists find elevated temperature to be one of the single most limiting impairments in the Umatilla Basin for fish populations.

The degree of divergence from goals for specific types of impairment is evaluated in the previous section. Here the task is to score and combine the key variables. **Table 72** lays out this basis for ranking watersheds by geographic area.

**Table 72.** Scoring of Variables for Emphasis by Geographic Area

| Criteria ID | Criteria | Values | | | | | |
|---|---|---|---|---|---|---|---|
| | | low | med | high | very high | no | yes |
| | | **Scoring based on Table 71** | | | | | |
| T | deviation from temperature goal ( weighted 2x Table 71 value) | 0 | 2 | 4 | 6 | | |
| U | deviation from upland erosion reduction goal (Table 68) | 0 | 1.5 | 3 | | | |
| B | deviation from streambank erosion reduction goal (Table 68) | 0 | 1.5 | 3 | | | |
| I | number of impairments of concern | count number of impairments on Table 71 (not counting "low"), with upland & bank erosion as a single category | | | | | |
| | | **Scoring for other basis** | | | | | |
| S | contains key warm season (May 1- Sep 30) spawning/ incubation areas | | | | | 0 | 3 |
| R | recovery potential (best professional judgement, ODFW) | 0 | 1 | 2 | | | |

The final step in determining geographic area of emphasis is to sum the criteria values of **Table 72**. This result is shown in **Table 73** with the major watersheds placed in order of emphasis, with greater emphasis at the top. Each numeric column is based on **Table 72**. The criteria ID letters in the column headings of **Table 73** identify the **Table 72** criteria.

This geographic emphasis does not differentiate the various stream sizes or types. Each area should be evaluated to determine optimal objectives for each waterbody within it. For example, differing restoration strategies may be applied for the Umatilla River and a major tributary within a watershed.

**Table 73.** Geographic Emphasis

| Table 4 Criteria ID: | T | U | B | I | S | R | |
|---|---|---|---|---|---|---|---|
| Watershed | Temperature | Erosion upland | Erosion bank | Number of Impairments | Spawning | Recovery Potential* | **TOTAL SCORE** |
| McKay | 2 | 3 | 1.5 | 4 | 3 | 1 | **14.5** |
| Birch | 2 | 1.5 | 1.5 | 5 | 3 | 1 | **14.0** |
| Wildhorse | 2 | 1.5 | 3 | 4 | 3 | 0 | **13.5** |
| Meacham | 6 | 0 | 0 | 3 | 3 | 1 | **13.0** |
| Squaw & Buckaroo | 2 | 3 | 1.5 | 2 | 3 | 1 | **12.5** |
| Butter | 2 | 0 | 3 | 3 | 3 | 1 | **12.0** |
| Tutuilla | 2 | 3 | 1.5 | 3 | 0 | 1 | **10.5** |
| Canyons & Gulches | 2 | 0 | 3 | 3 | 0 | 1 | **9.0** |
| Pendleton | 2 | 3 | 1.5 | 2 | 0 | 0 | **8.5** |
| Forks | 2 | 0 | 0 | 1 | 3 | 2 | **8.0** |
| Stage Gulch | 0 | 1.5 | 3 | 2 | 0 | 1 | **7.5** |
| North Fork | 2 | 0 | 0 | 1 | 3 | note* | **6.0** |
| Lower Umatilla | 2 | 0 | 0 | 3 | 0 | 1 | **6.0** |
| Cold Springs | 0 | 1.5 | 3 | 1 | 0 | 0 | **5.5** |
| Sand Hollow | 0 | 0 | 3 | 1 | 0 | 0 | **4.0** |

* note: relatively limited recovery is needed (0).

### 3.5.2.3 AREAS OF EMPHASIS BY MANAGEMENT CATEGORY

This section lists high priority management actions categorically. Optimal management is often location-specific and will require evaluation at the project or reach level. Riparian vegetation is emphasized because it is has the dual advantage of being one of the most readily available measures and most beneficial to a wide variety of water quality and habitat impairments, and is corollary to other key attributes such as ground water input and channel narrowing.

A. Riparian Vegetation (restore to system potential)
   - use active restoration, plant and manage
   - improve conditions over time, move toward system potential
   - include management, improvement, or removal of problem roads
   - manage or remove any existing disturbances

B. Improve In-stream Flow
   - irrigation water management, improve efficiency
   - leave a portion of conserved water in the stream
   - augment stream flow

C. Stream Channel/Morphology Improvement
   - improve width to depth ratios
   - increase channel stability (both horizontal and vertical)

D. Flood Plain Reconnection
   - encourage floodplain functionality
   - attenuation of high flows
   - leads to improved conditions for riparian vegetation
   - manage/improve impediments to stream health: levees, transportation corridors and structures, embankments, compacted areas, incised and straightened channels

E. Groundwater Connection/Storage
   - increase groundwater storage for late season flow

F. Upland Vegetation Improvements
   - forest stand structure improvements
   - range/agriculture land improvements

Groundwater flow can be an important source of stream cooling and can be enhanced through floodplain re-establishment, increased vegetation in uplands and riparian areas, increased sinuosity and other morphologic and hydrologic changes. The CTUIR is currently developing a method to determine the groundwater potential along the Umatilla mainstem. This should assist in determining where this category of restoration will provide greatest benefit.

# 3.5.3 PUBLIC INVOLVEMENT

To be successful at improving water quality a Water Quality Management Plan must include a process to involve interested and affected stakeholders in both the development and the implementation of the plan. This public involvement element of the WQMP first describes how interested stakeholders were provided the opportunity to be involved in the development of the plan. The second section of this element describes a strategy by which the affected agencies/organizations will continue to involve and educate the public during the implementation of the Umatilla Basin Water Quality Management Plan (WQMP).

## 3.5.3.1 PLAN DEVELOPMENT

The process that led to the development of this WQMP began in January of 1996 with the appointment of the Umatilla TMDL Technical Committee. The Technical Committee was established jointly by the ODEQ, the Umatilla Basin Watershed Council and the Confederated Tribes of the Umatilla Indian Reservation. Membership of the Committee is identified in the beginning of **Chapter One** and included representation from affected stakeholder groups and the public. Meetings were generally held monthly. Membership and all meetings were open to the public. The Watershed Council advertised the process and encouraged meeting attendance through community meetings, mailings and radio and newspaper notification/articles. Early meetings focused on identification of technical and legal issues, and on monitoring. Later in the process the topics shifted towards modeling and data evaluation for TMDL development and Stakeholders Committee appointment and education. The Stakeholders Committee was established to formally recommend the TMDL and WQMP based on the Technical Committee's output. A steering group of the Technical Committee made recommendations guiding appointment of the Stakeholders Committee.

The Stakeholders Committee first met in January of 1998 and have convened once per month or more frequently throughout the process. All meetings were widely announced through mailings and newspaper articles. Membership for the Committee's WQMP workgroups was recruited through community workshops and newspaper and radio articles. The following is a summary of outreach that was conducted to recruit participation and to inform the public of the Umatilla Basin TMDL process and opportunities for input.

- Technical Committee recruitment
- Stakeholders Committee recruitment
- Stakeholders meetings & public comment period each meeting
- Mailings for minutes and notices
- Workgroup (WQMP subcommittees) recruitment
- TMDL community meetings in Hermiston and Pendleton (co-sponsored by Blue Mountain Community College)
- Various newspaper articles
- Letters sent to community leaders
- Numerous City Council meetings (at most municipalities in the basin)
- Watershed Council monthly meetings
- Legislative meetings
- County Commissioner periodic updates
- SWCD monthly meetings
- Contact with schools/teachers and Educational Services District
- Civic group presentations
- Public meeting notices (radio & newspaper)
- Radio programs

To provide leadership for the Stakeholders Committee, Tribal and Non-Tribal Co-Chairs were recruited early on. The Co-Chairs assisted in assuring broad-based land use and citizen representation by approving the following criteria:

> Areas of Consideration: watershed health, sustainable economy, sustainable communities, sustainable resources
>
> Individual member criteria: open-minded, multi-issue insight, community leaders, visionary, function in group process, commitment of time, vested in community, ability to work with diverse cultures, patience, focus.
>
> Group criteria: broadly located geographically, diverse backgrounds (gender, culture, age), balance of experience across resources, adequacy of representation in:

- farming/grazing/ranching
- transportation
- urban
- business and industry
- environmental/conservation
- local government
- community beyond "affected sectors"
- forestry
- fisheries
- Hispanic
- tribal
- technical and non-technical backgrounds
- small and large landholders

The Committee organization is described in **Chapter One**. In addition to the formal workgroups, there were ad hoc technical discussions on specific topics including monitoring, system potential vegetation, prioritization, public involvement, and others. No final decisions were made by either the formal or ad hoc workgroups (with the exception of the agriculture group which legally makes its own decisions and recommendations on agricultural pollution control plans under the Agricultural Water Quality Management Act (SB 1010)). These groups functioned as a forum for people with interest or expertise in particular areas to develop recommendations that were brought back to the Stakeholders Committee for consideration.

A formal public comment period with media outreach, informational meetings and hearing was conducted prior to the finalization of this TMDL & WQMP document. The public notice and hearings officer report are an **Appendix** of this document.

### 3.5.3.2 PLAN IMPLEMENTATION

As mentioned previously, public awareness and involvement will be crucial to the successful implementation of this plan and resulting improvements in water quality. The paragraphs that follow identify public involvement activities recommended to take place during the implementation of this plan.

The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) has initiated and funded a Watershed Assessment for the entire Umatilla Basin and sub-watershed plans for Squaw, Meacham, Buckaroo and Mission watersheds. The watershed assessment and the sub-watershed plans prioritize public outreach and education as a tool to be used to insure the continuation of the best science approach in the Umatilla Basin.

The CTUIR has taken a lead role in public outreach and environmental education in the Umatilla Basin, involving all the stakeholders and K-12 school systems within the basin. The CTUIR public outreach and environmental education curriculum includes a group of water quality courses that are specific to the lifecycle of the salmonid and other fishes. This includes habitat, water quality and water quantity and wildlife issues and CTUIR Tribal Culture, CTUIR Treaty reserved rights and ceded lands issues that are an integral part of current and continued successful restoration and protection of quality of living and economies in the Umatilla Basin.

The Umatilla Basin Watershed Council (UBWC) has begun an outreach program that includes the Educational Services District and city councils. The Umatilla County SWCD is developing and implementing a Lower Umatilla Basin educational program to deal with watershed issues.

The UBWC and the Umatilla County Soil and Water Conservation District (SWCD) will work with the CTUIR combining their outreach efforts to maximize the best potential outcome and decrease duplication while providing the public with information based on science and biology rather than political agendas. The Umatilla Basin Watershed Council will act as a clearinghouse for information regarding existing conditions and progress, and the Confederated Tribes will continue to house and provide access to the largest GIS library in the basin.

The Umatilla County SWCD is directed by an elected board of community members. Monthly meetings are held on the second Wednesday of every month and are open to the public. The public is encouraged to attend and participate in the efforts of the Soil and Water Conservation District to implement conservation practices. The District has an ongoing outreach program for the Senate Bill 1010 *Umatilla River Subbasin Agricultural Water Quality Management Area Plan*. The program includes working with landowners for the development of conservation farm plans focusing on improving water quality in the Umatilla River and Walla Walla River basins. The District is the lead sponsor of Envirothon, an educational program providing hands on environmental awareness for 13-18 year olds. Often the District brings landowners and government agencies together to organize watershed restoration projects. Some of the District's partners for restoration, education and outreach include the OSU Extension Service, Farm Service Agency, Natural Resource Conservation Service, Environmental Protection Agency, Oregon Department of Fish and Wildlife, Oregon Department of Forestry, Confederated Tribes of the Umatilla Indian Reservation, Department of Environmental Quality, Pheasants Forever, Umatilla Basin Watershed Council, Walla Walla Basin Watershed Council, and the Columbia-Blue Mountain Resource Conservation Development Council. Combined outreach efforts include sponsorship of annual agricultural tours and workshops throughout the Umatilla Basin. The District supports an annual Conservation Farmer Award to recognize a farmer who is striving to improve his/her conservation programs. The Umatilla County Soil and Water Conservation District is dedicated to developing strategies for improving awareness about conservation issues throughout the Umatilla Basin.

The Cities of Pendleton and Hermiston, and Umatilla County, will likely be the lead, or active participants, in urban and rural residential related issues. Outreach to city and county planning and public works staff is important in addition to general public outreach. Because these cities have more resources than the other towns in the Basin, they may develop programs and materials (and even management practices) that could be shared with the other cities.

The Department of Forestry, using its connections with the forest industry and small wood lot owners seems the logical lead for forest public involvement on private land (perhaps with the help of forestry extension). The USFS is the obvious lead on federal land.

# 3.5.3.2.1 Urban Education & Outreach Strategy

The Urban & Industrial management recommendations of **Section 3.3.1** emphasize education. In particular, implementation planning and outreach is needed to reduce storm water runoff and attain the effective shade surrogate of the temperature TMDL. Storm water control and stands of trees are needed along streams throughout the Umatilla Basin in order to attain erosion reduction and temperature TMDL goals.

**Primary message to citizens:** Everyone is a contributor to the water quality in the Basin and everyone needs to participate in the efforts to improve water quality. All citizens can participate by using less fertilizer and garden chemicals, washing vehicles on the lawn, keeping wastes of all kinds out of storm drains, drainage ditches, and creeks, and similar measures. Special emphasis will be given to protection of riparian vegetation, especially retention of trees along the river and urban streams.

**Primary message to the real estate and development community:** Management measures (**Section 3.3.1**) for municipal sources should be adhered to during and after construction and development activities. Development should be designed to protect and retain vegetation (especially trees), minimize impervious surfaces, and retain storm water on-site to the extent possible.

**Primary message to public works and Transportation employees:** Emphasize the importance of water quality and the potential effect of their activities on water quality. Adherence to the BMPs for construction and maintenance described in the urban and transportation portions of **Section 3.3** should be emphasized.

**Strategy:** City and County mailings, storm drain stenciling, displays in public places, public service announcements, outreach to city and county planing departments, outreach to city and county public works departments.

**Time Frame:** Ongoing.

**Responsible Party:** Municipalities, counties.

# 3.5.3.2.2 Forestry Education & Outreach Strategy

The Department of Forestry is expected to continue current programs to educate forest landowners and operators on all elements of the Forest Practices Act. The department monitors and reports on forest practice rule compliance and effectiveness. If forest practice rule modifications are planned, a public involvement process will be designed. Such processes typically include Eastern Oregon Regional Forest Practice Committee review, other advisory group review, board of Forestry public meetings, interagency coordination, scientific review, informal and formal opportunities for public comment, and feedback from the department on how the public comments were used in the revision process. Such revision processes will be governed by the rulemaking requirements of the Forest Practices Act and, in particular, ORS 527.714. The following objectives are recommended regarding the two-way communication sought by the department during this phase:

- Explain and exchange information regarding the nonfederal forestland component of the plan in order to build understanding, acceptance, and support for this component; including how land users are affected.
- Exchange information and encourage cooperative monitoring efforts that can lead to further improvements in the nonfederal forestland component and/or the overall plan in the future.
- Encourage forestry community involvement in future revisions of this WQMP.

**Audience:** Nonfederal forest landowners, operators and other interested stakeholders.

**Primary Message:** Water quality standards and load allocations during commercial activities on nonfederal forestlands will continue to be implemented through compliance with the best management practices (BMPs) established under the Oregon Forest Practices Act and forest practice rules. Consistent with the ODEQ/ODF Memorandum of Understanding, the Act and BMPs may be modified in the future, on either a statewide or watershed-specific basis to target TMDL water quality goals. If and when such changes occur, forest landowners and operators will be expected to implement those revised requirements. The forestry community will also be encouraged to continue their voluntary efforts, consistent with the Oregon Plan for Salmon and Watersheds.

**Strategy:** Meetings, field consultations, and other direct communications with individual landowners and operators, industrial landowner associations, non-industrial landowner associations, logger associations, the Eastern Oregon Regional Forest Practice Committee, OSU Forestry Extension, and other interested parties.

**Time Frame:** Ongoing, with significant increase in both targeted and broad public involvement during periods of rule revision.

**Responsible Party:** Forest Practices Program, ODF.

## 3.5.3.2.3 Agriculture Education & Outreach Strategy

The Agriculture Water Quality Management Area Plan (SB1010) is Basin-wide and is carried out in part through the design and implementation of voluntary farm plans. Outreach should convey incentives for developing these plans and applying prevention and control measures (BMPs) and should raise awareness of the need for conservation agriculture and riparian area protection. The agricultural community has been increasingly active in addressing soil erosion for decades, both out of necessity for protecting the resource and as a requirement of federal farm programs. Further erosion reduction is needed to meet water quality goals and more emphasis is needed toward outreach and implementation associated with stream temperature reduction. Riparian vegetation, including trees, are needed along streams throughout the Umatilla Basin in order to filter sediment and wastes from runoff, stabilize streambanks, store water as well as providing for the attainment of the temperature load allocation surrogate of effective shade.

**Audience:** Landowners, farmers, ranchers, rural residents, advisory committee members, general public and schools.

**Primary message:** Explain SB 1010 and how it works, raise awareness of what the goals are, what the available solutions are, and where financial and technical assistance is available.

**Strategy:** Public meetings, hearings, direct mail, newspaper articles, workshops, project tours, public service announcements, presentations at commodity group meetings and tours.

**Time Frame:** Ongoing.

**Responsible Party:** ODA, Umatilla County SWCD, OSU Extension Service.

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# 3.5.4 LONG TERM MONITORING PLAN

## 3.5.4.1 INTRODUCTION

The Umatilla River and some of its tributaries are designated as water quality limited under Section 303 (d)(1) of the Clean Water Act. They are not meeting water quality standards from the headwaters of the Umatilla River to its mouth at the Columbia River. As a result, the goals of the Clean Water Act for “fishable & swimmable” waterbodies are not being met. Total maximum daily loads (TMDLs), for the allocation of acceptable levels of pollutants, and management plans to address point and non-point sources of pollution for the Umatilla River Basin have been developed. This long-term monitoring plan is designed to provide the data needed to evaluate water quality trends in the Umatilla Basin. It serves as a measure of effectiveness of TMDL implementations.

The results of the 1993, 1996, 1997, 1998 and 1999 sampling and analysis plans were taken into consideration as this monitoring plan was developed. These previous data collections provided for the development of the TMDLs for the Umatilla River Basin. The parameters to be monitored by this long-term monitoring plan include temperature, sediment, channel shape and chemical/physical laboratory analyses. The results will be compiled and analyzed to provide information for long-term assessment and effectiveness of the implementation of water quality management plans. Except where otherwise stated, this plan describes trend monitoring to evaluate long-term progress, and it implicitly addresses validation monitoring to inform future re-evaluation of TMDL goals. Specific management practice implementation and effectiveness monitoring is generally deferred to land management agencies.

This plan was developed in cooperation with multiple agencies and individuals in the Umatilla Watershed including; Umatilla County Soil and Water Conservation District, United States Forest Service, Oregon Water Resources Department, Confederated Tribes of the Umatilla Indian Reservation, Agricultural Research Service, United States Bureau of Reclamation, City of Pendleton, Umatilla Basin Watershed Council, Oregon Department of Environmental Quality and the Oregon Department of Fish and Wildlife. It reflects the care and knowledge of the people who live and work in the watershed. While the range of interest in water-related issues may differ by individual or group, it is envisioned that the goal of clean water for future generations is common to all. This monitoring plan represents a key step toward working together to achieve this common goal. The Umatilla TMDL Technical Committee has developed this monitoring plan to address the following issues and concerns.

## 3.5.4.2 ISSUES AND CONCERNS

- Is there sufficient baseline data to enable evaluation of progress?
- Does implementation of the Water Quality Management Plans show improvement in water quality within the Umatilla Basin?
- What is the system capable of achieving, once all feasible steps toward increased quality have been implemented?
- Is there sufficient data to enable recognition of goal attainment and in some cases the rate of improvement?
- Is there sufficient data to support ongoing pollutant source analysis, or reflect changes in source as improvements are made?

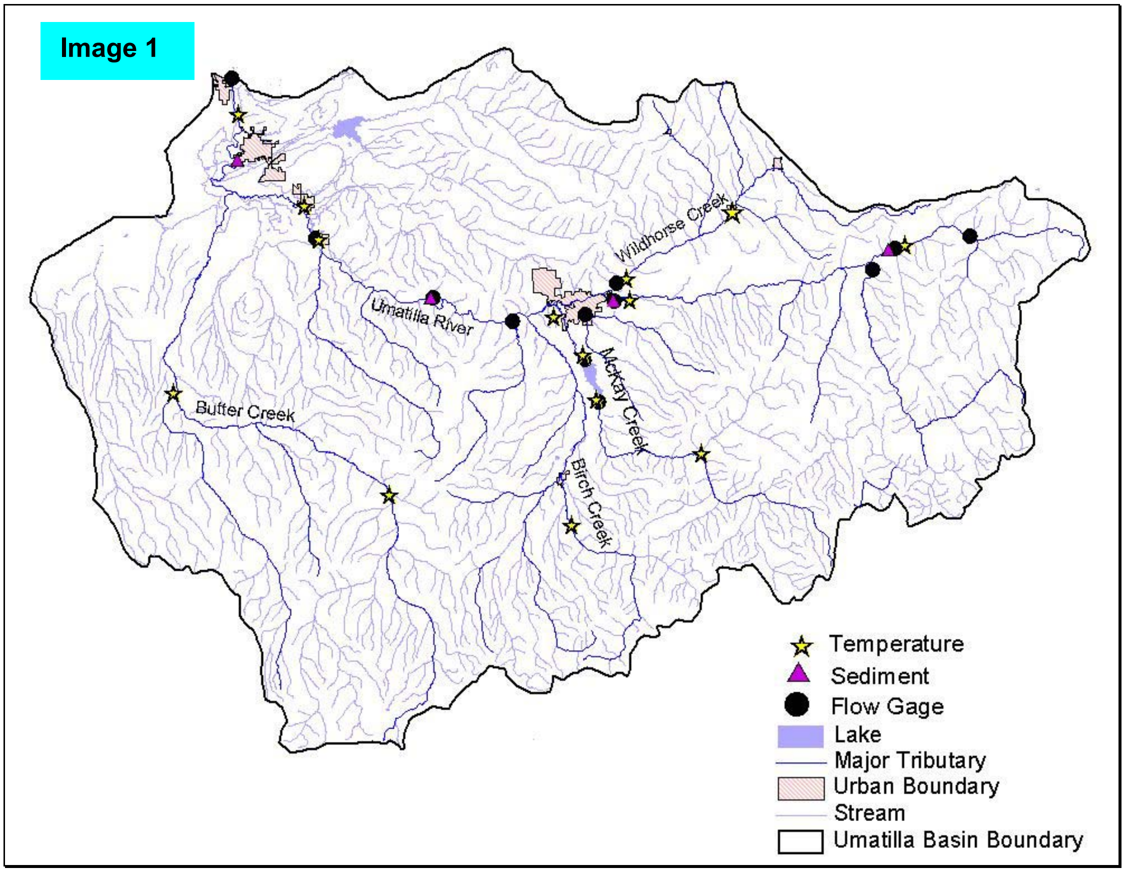
## 3.5.4.3 MONITORING OBJECTIVES

- Conduct monitoring at the same sites as past surveys to support long-term trend evaluation.
- Collect additional data to complement existing information from the Oregon Department of Environmental Qualities routine quarterly monitoring network and special water quality (WQ) studies conducted in 1993, 1996, 1997, 1998 and 1999.
- Collect data relevant to all 303(d) listed parameters and all TMDL allocations or surrogates.
- Identify monitoring responsibilities for various agencies

## 3.5.4.4 CLIMATE AND FLOW

### 3.5.4.4.1 Monitoring Strategy

Stream discharge rates are important for assessing pollutant concentration and channel dynamics. Precipitation events influence stream discharge and consequently pollutant concentrations. Climate parameters and stream discharge rates are monitored by the Oregon Water Resource Department, United States Geological Service and other various weather station operators. It is requested that these agencies continue the current level and location of monitoring. Additional coverage is requested as well: ongoing maintenance and recording at the flow gage at the mouth of Wildhorse Creek. Flow at other major tributaries is currently being monitored. (Image 1).



# 3.5.4.4.2 Monitoring Design

| Agency | station # | Site Description |
| --- | --- | --- |
| USGS | 14033500 | Umatilla River near Umatilla, OR (RM 2.1) |
| OWRD | 14031600 | Boyd Power Plant, Umatilla R. (used to estimate flow at Westland) |
| OWRD | 14029900 | Umatilla near Echo |
| OWRD | 14026000 | Umatilla at Yoakum |
| OWRD | 14025000 | Birch Creek at mouth |
| USBR | | McKay Creek near Pendleton |
| OWRD | 14022500 | McKay Creek above Reservoir |
| USGS | 14021980 | Patawa Creek (used to estimate Tutuilla) |
| USGS | 14020850 | Umatilla River at west boundary of CTUIR |
| OWRD | 14020990 | Wildhorse Creek near mouth |
| USGS | 14020000 | Umatilla River at Gibbon |
| USGS | 14020300 | Meacham Creek near mouth |
| USFS | | Umatilla River at Corporation |
| OWRD | | Other stream flow sites as requested |

# 3.5.4.4.3 Data Management and Analysis

The Water Quality Data Analyst with the Soil and Water Conservation District (SWCD) or the Umatilla Basin Watershed Council (UBWC) will complete a summary report of water quality within the Umatilla basin for the months of October 1 to September 30. As funding allows, the position of the Water Quality Data Analyst will be maintained by the SWCD or the UBWC. The statistical summary of water quality data should be completed by the 1$^{st}$ of January following the water year. The purpose of the report is to summarize monitoring data for presentation to the Technical committee. The Technical committee can then respond with suggested recommendations and/or revisions to the TMDL and the long term monitoring plan. Mean daily discharge for each month is requested from each respective agency by November 1, in support of the annual summary report. Supportive climatology data, such as mean monthly air temperature and mean monthly precipitation, will be considered in preparation of the summary report.

# 3.5.4.5 TEMPERATURE

## 3.5.4.5.1 Monitoring Strategy

Many streams in the Umatilla Basin are listed as water quality limited due to high temperatures during summer months. This temperature monitoring strategy is designed to support long-term basin wide evaluation of progress toward meeting the TMDL allocations. Implementation of this monitoring effort is through the cooperation of the Confederated Tribes of the Umatilla Indian Reservation, United States Forest Service, Oregon Department of Fish and Wildlife, the Agricultural Research Service and other individuals. These groups have agreed to provide personnel and equipment for field audits, deployment, and retrieval of temperature loggers.

# 3.5.4.5.2 Monitoring Design

The basis for selection of sites is to monitor mainstem trends and tributary inputs and to consider the relative influences of local and upstream heat sources and sinks (Image 1). Water temperature has been shown to increase from the headwaters of tributaries to the mouth of the Umatilla River. This increase in temperature is attributed to many factors such as a decrease in shade producing vegetation, an increase in stream widths and a decrease in water flows. (See **Section 2.1** of the TMDL document) The TMDL Technical Committee, for monitoring purposes divides the Umatilla River Basin into 14 drainage areas. This delineates the major tributaries resulting in a scale between the $4^{th}$ and $5^{th}$ levels of the hydrologic unit code classification. Temperature will be monitored at 17 sites within these sub-watersheds. Temperature loggers will be placed in streams at monitoring sites each year so that seasonal heating and cooling trends can be analyzed. Streams will be monitored during the months of May through October. In non-average climate years the monitoring equipment may need to stay in the stream longer or be placed in the stream earlier. Temperature loggers will be set to record temperatures hourly. Refer to the Oregon Plan for Salmon and Watersheds, Water Quality Monitoring Technical Guide Book for monitoring protocols, Section 6. River miles throughout this document are based on the OWRD 1988 map for the Umatilla drainage basin.

| Storet # | Description | River Mile | Agency |
|---|---|---|---|
| 405523 | Umatilla River at Corporation | 88.3 | USFS |
| 405647 | Umatilla River at Gibbon gauge | 81.7 | CTUIR |
| 402763 | Umatilla River west boundary of the CTUIR | 56 | CTUIR |
| 402075 | Umatilla River at Reith bridge | 48.5 | CTUIR |
| 402074 | Umatilla River at Yoakum | 37 | CTUIR |
| | Umatilla River at Stanfield | 21 | CTUIR |
| 404725 | Umatilla River above 3 Mile Dam | 4.1 | CTUIR |
| | Birch Creek | 6.5 | ODFW |
| | East fork Birch Cr. | 8.5 | ODFW |
| | McKay Creek below North Fork confluence at gauge | 22 | CTUIR |
| 404704 | McKay Creek above reservoir at gauge | 10.5 | USBR |
| | McKay Creek below reservoir at gauge | 6 | USBR |
| 406048 | McKay Creek at mouth | | CTUIR |
| 405498 | Tutuilla Creek at Burger King | 0.5 | ARS |
| | Wildhorse Creek at Athena on Labor Camp Rd. Bridge | 18 | CTUIR |
| 404722 | Wildhorse Creek at gauge | 2 | CTUIR |
| 404750 | Meacham Creek at mouth at gauge | 1.4 | CTUIR |
| 405906? | Butter Creek at Pine City gauge | 20 | CTUIR |
| | Butter Creek at Vinson | 43.5 | CTUIR |

# 3.5.4.5.3 Data Management and Analysis

Each designated agency will be responsible for the data collection and reporting to the Oregon Department of Environmental Quality (DEQ). The seven-day rolling average of the daily maximums will be used to evaluate water temperatures against the State temperature standard. All incremental data collected, or sometimes called continuous data, will be maintained by the agency collecting the data. Data should be reported to ODEQ in a timely manner following the end of the monitoring season. A complete summary of the data for each water year, October 1 to September 30, will be completed by January 31. The Water Quality Data Analyst will complete the analysis and summary. It is understood that these agencies contributing data have additional monitoring sites in the basin. The monitoring sites for this long term monitoring plan are locations that have a relative assurance of being monitored in the future. Should there be a need to include the other data in an analysis of stream temperatures, the Water Quality Data Analyst may access this additional data.

# 3.5.4.6 SEDIMENT

## 3.5.4.6.1 Monitoring Strategy

The strategy is to monitor sediment and turbidity conditions in the Umatilla River below major tributary confluence and to compare those values to the TMDL allocation. The long-term monitoring of sediment will be used to track the progress toward meeting the TMDL allocation due to the implementation of the Water Quality Management Plans. A turbidity target of 30 NTU not to be exceeded in a 48-hour duration, has been recommended in the sediment TMDL (see **Section 2.2.5**). Thirty NTU is the target and is achieved with varying TSS concentrations depending on the stream. In-stream sediment erosion, transport and deposition are highly variable throughout the basin, in part due to source material. Daily composite water samples will undergo laboratory analysis for total suspended solids and turbidity. In addition, it is recommended that turbidity be monitored on major tributaries. Portable turbidimeters are sufficient for the additional turbidity monitoring.

# 3.5.4.6.2 Monitoring Network Design

Daily composite samples will be collected with automated ISCO samplers at each location throughout the monitoring period (Nov.-May) (Image 1). The four monitoring locations are strategically placed to characterize the sediment output from the contributing watersheds. Automated samplers combine 4 samples taken over a 24-hour period into one daily sample. Samples are collected for 24 days and stored in the base of the ISCO sampler. The intake is screened, pointed downstream and located near the thalwag. The Water Quality Data Analyst keeps instructions for setting up the ISCO and collecting the samples. Staff from CTUIR and personnel from the city of Echo and Hermiston will collect the daily composite samples from the ISCO samplers once every three weeks and deliver them to the USFS Lab for analysis of total suspended solids and turbidity. The USFS Lab follows quality assurance and quality control guidelines in their analysis. Specific quality assurance objectives include analyzing a sufficient number of quality control standards, blanks and duplicate samples internally to effectively evaluate results against numerical quality assurance goals established for precision and accuracy.

These composite samples become estimates of total suspended solids and turbidity due to the exceedance of holding time before analysis. Protocols for holding times are 7 days for total suspended solids and 48 hours for turbidity after which the growth of algae could contaminate the samples. During the winter sampling months it is not expected that algae growth will contaminate the samples. Refer to ODEQ's Field Sampling Reference Guide for correct sample containers and holding times.

It is recommended that additional turbidity measurements be made, in the locations listed below, with portable turbidimeters to be able to better evaluate improvements in the Umatilla Basin. Due to limited monitoring resources a designated agency has not been identified for monitoring the additional locations. Measurements should be taken in accordance with the Oregon Plan for Salmon and Watershed, Water Quality Monitoring Technical Guide Book, Section 11.

| Storet # | Description | River Mile | Agency | Parameter |
|---|---|---|---|---|
| 404168 | Umatilla R. at Westland Rd, Hermiston | 8.7 | Hermiston/Echo | Composite |
| 402074 | Umatilla River at Yoakum | 37 | Hermiston/Echo | Composite |
| 406052 | Umatilla River west boundary of CTUIR | 56 | CTUIR | Composite |
| 405647 | Umatilla River at Gibbon flow gauge | 81.7 | CTUIR | Composite |
| 405520 | Birch Creek at mouth | 0.2 | | Turbidity |
| 404704 | McKay Creek at Shaw road | 10.2 | | Turbidity |
| 406048 | McKay Creek at mouth at gauge | 0.5 | | Turbidity |
| 405498 | Tutuilla Creek at Burger King | 0.5 | | Turbidity |
| 404722 | Wildhorse Creek at gauge | 0.75 | | Turbidity |
| | Butter Creek at mouth | 0.1 | | Turbidity |

### 3.5.4.6.3 Data Management and Analysis

Baseline data for total suspended solids and turbidity was collected once a week from the automated ISCO samplers during the 1997-1998, 1998-1999, 1999-2000 winter sampling seasons. Future sample collection will occur once every three weeks during the winter sampling season. The change from a 1-week collection period to a three-week collection period may change the statistical relationship between total suspended solids and turbidity. Long-term data analysis will include documentation of any statistical change in the regression correlation between total suspended solids and turbidity due to changing the sampling procedure. The CTUIR will collect the sediment data from the USFS Lab at the end of the sampling season and submit the data to ODEQ to be entered into Storet. A summary of the data for each water year, October 1 to September 30, will be completed by January 31. The Water Quality Data Analyst will complete the analysis and summary.

## 3.5.4.7 GEOMORPHIC ASSESMENT

### 3.5.4.7.1 Monitoring Strategy

Stream morphology is an important attribute of watershed health. Geology, hydrology, climate, and land management practices affect stream morphology. The Rosgen (1996) system of stream classification is used in conjunction with permanent photo sites and Wolman pebble counts to quantitatively and qualitatively describe the Umatilla Basin river system. A Level II inventory was conducted in 1998 on the Umatilla River Basin. It was used to describe portions of the principal headwater tributaries and main stem of the Umatilla River (Williams et al. 1998). At each site bankfull stage was identified; width, depth, floodprone width, channel materials, and observations of bank erosion potential were made along with written and photographic documentation. The long term monitoring protocols for the annual geomorphic assessment are based on the 1998 inventory and include some additional monitoring.

The geomorphic assessment should be conducted every year in the Umatilla Basin. Analysis of collected data may lead to refinement of the sampling process and recommendations of longer periods between sampling. The geomorphic assessment will address load allocations and measures of progress for habitat modification and substrate fines as addressed in the temperature and sediment TMDL's. Those measures outline the target goals for substrate fines, desired morphology, effective shade, bank stability and vegetation characteristics. This assessment will be conducted in cooperation by the local land management agencies. Coordination of this assessment should begin in May. The actual monitoring should take place during the summer, when vegetation production has peaked and stream flows are low.

### 3.5.4.7.2 Monitoring Network Design

A dual sampling regime will be used for monitoring. This includes repeated annual monitoring of 10 fixed sites and monitoring of 20 randomly chosen sites within the Umatilla basin. Measurements from the fixed sampling sites will be analyzed to show the trend in parameters at each location. The repeated fixed sampling sites are from the 1998 geomorphic assessment. Measurement from the randomly sampled sites will be used to show basin wide trends in monitoring parameters. This plan uses a dual sampling regime to show statistical changes at strategic locations over the long run and to show basin wide trends in monitoring parameters.

Due to high variation in parent material, vegetation types, stream types and land uses in the Umatilla basin a random sampling of locations will be used to assess measures of progress towards the Basin wide desired goals for stream quality. Due to limited funds, 20 randomly selected sites will be used in the initial assessment, should more funds become available more sites will be used. The number of randomly sampled sites will be refined using a statistical formulation for determining the number of sites necessary for a desired detectable difference. Until a measure of variation is estimated, the number of sites can not be determined accurately. A map of the Umatilla basin will be overlain with a grid and a random sampling of 20 numbers will be used to determine sampling locations. When the exact location is identified a detailed site description will be written and will include a geographical coordinate position (gps) along with written description of distances from landmarks and photographic documentation. As with any monitoring, permission from private landowners to monitor on their land will be required along with full disclosure of what this information will be used for.

The same measurements will be taken on the fixed monitoring sites as are taken on the randomly sampled monitoring sites. The assessment follows a level 2 Rosgen stream classification (Rosgen 1996). This includes stream typing and estimates of sinuosity, entrenchment ratios, wetted width to depth ratios, bankfull width to depth ratios and pool frequency. Sinuosity is the ratio calculated by dividing stream length by valley length. Entrenchment ratio is the average width of flood-prone areas divided by bankfull width. Flood prone width is a function of the flood plain area. Wetted width to depth ratio is the width of the stream at waters edge and the average depth of the cross sectional area. Bank full width to depth ratio is the channel measurement that contains the momentary maximum peak flow, one which occurs several days in a year and is often related to the 1.5 year recurrence interval discharge (EPA 910/R-93-017 Section D). Pool frequency is a measure of habitat quality and will be included in the monitoring. These measurements will be compared to the mode of the expected value for the potential channel type using the Rosgen (1996), stream channel classification. Potential channel types for the mainstem of the Umatilla River were determined by local land management agencies. The determination of potential channel type is based on the highest ecological status attainable without social constraints. Descriptions of potential channel types are included in the Site Potential Memo appendix.

Measures of progress for a reduction in substrate fines are made with assessment of riparian vegetation, pebble counts and estimates of percent eroding stream banks. Riparian vegetation is important for providing shade, stabilizing stream banks and filtering pollutants from runoff. Assessments of riparian vegetation will be made at each monitoring location including community type height, width and density. The Green Line method for estimating vegetation composition along the linear length of stream reach should be used. The Green Line method identifies community types to a resolution of one foot (EPA 910/R-93-017 Section H). For each community type beginning at the stream edge, the estimated height, width to next community type and density will be measured. Height will be measured with a clinometer. An average height of the community will be reported. Vegetation width, perpendicular to the stream edge will be measured using a measuring tape. Density will be measured with a densiometer. The average density within the community type will be reported. Locations that do not have trees or willows will be reported as having no woody dominant vegetation types. At each monitoring location potential effective shade will be measured using a Solar Pathfinder®. Potential effective shade measurements address the temperature TMDL surrogate measures #1 and 2. Surrogate measures #1 and 2 call for the attainment of potential effective shade levels specified for an appropriate geographical location. Surrogate measures for the temperature TMDL define the desired potential vegetation. The desired potential vegetation adequately address riparian vegetation as is related to habitat modification, stream temperature and streambed fines. Descriptions of potential riparian vegetation characteristics are included in the Site Potential Memo appendix.

Pebble counts give the composition of size classes of the stream bottom and the percent surface area composed of particles that are less than 6.4mm or 0.25inches. It is a desired goal to have a basin wide reduction in average substrate fines of size less than 6.4mm; therefore pebble counts will be conducted at each monitoring location. Ocular methods for estimating surface fines and embeddedness have the potential to introduce bias and is inappropriate for purposes of time trend monitoring and multiple site comparisons (EPA 910/R-93-017 Section F). Wolman (1954) pebble counts will be conducted at each monitoring location. This will determine the percentage of fine sediments. Detailed procedures are on file with the Oregon Department of Fish and Wildlife.

The measure of percent eroding stream bank is an estimate of stream bank stability throughout the entire linear distance of the stream reach containing the monitoring site. Ocular estimates of stream bank stability introduce personal bias into the measurements, therefore a quantitative approach to monitoring stream bank stability outlined in EPA's Monitoring Protocols to Evaluate Water Quality Effects of Grazing Management on Western Rangeland Streams Section E is recommended to be used. Four classes are identified using streambank cover and streambank stability. One class identified is stable and non-erosional. Two classes are identified as being vulnerable to potential erosion. One class is identified as being unstable and eroding. From these class estimates the percentage of eroding streambank within a reach can be determined. The TMDL target goal for percent eroding streambanks is included in **Chapter Two**.

Representative photographs of site locations will be collected at both the fixed monitoring sites and the randomly sampled monitoring sites. A photographic record of the permanent monitoring sites will be used to show changes in site composition over long periods of time. Photographic records of the randomly chosen sites will be kept for documentation purposes. The intention of the photographs is to provide a representative view of the actual stream channel, bank, and bank vegetation. Protocols for taking the photographs should follow those of Frederick Hall, 1999. The guidebook is titled Ground-Based Photographic Monitoring and includes worksheets for QC/QA procedures. Upstream, downstream and across stream photos should be taken.

**Fixed Monitoring Locations**

| Storet # | Description |
|---|---|
| 404725 | Umatilla River at Umatilla City Gravel Pit |
| 404168 | Umatilla River at Westland Rd. in Hermiston, RM 8.7 |
| 402075 | Umatilla River at Reith Bridge RM 49 |
| 402764 | Umatilla River u/s Cayuse bridge by 100 yards RM 67 |
| 406051 | Umatilla River at Gibbon 1.5 miles d/s of Meacham |
| | Wildhorse Creek at Adams |
| 404750 | Meacham Creek about 1.5 miles u/s of mouth of Meacham Creek |
| 404704 | McKay Creek 400 yards u/s of Shaw Road |
| 404707 | East Fork Birch Creek at East Birch Creek Road, RM 3.7 |
| | Butter Creek at Butter Creek Junction |

# 3.5.4.7.3 Data Management and Analysis

Separate statistical analyses will be made among the permanent monitoring locations and the randomly sampled locations. Data from the fixed monitoring locations can not be combined with the randomly sampled locations for analysis due to the violation of the independence assumption. Each of the fixed monitoring locations will be analyzed to show changes in trend at a specific location. The randomly sampled locations will be analyzed to estimate the basin wide average of each parameter. Regression analysis will be used to assess the trend (increasing, decreasing or no change) in the monitoring parameters over time. Annual trends in the averages of the permanent and randomly selected data sets will be analyzed after a minimum of five years of data collection. Five data points is the minimum requirement for statistical analysis. Monitoring parameters include sinuosity, entrenchment ratio, wetted width to depth ratio, bankfull width to depth ratio, pool frequency, green line vegetation, vegetation height, vegetation width, vegetation density, potential effective shade, percent sediment fines, and percent eroding streambank.

The Agricultural Research Service will handle the organization and distribution of the data collected. After the survey is completed the Agricultural Research Service will provide ODEQ and the Water

Quality Data Analyst with a copy of the data. Photo documentation will be kept by the Water Quality Data Analyst and will be made available for agency and public review. Comparisons of the annual estimates of the parameters will be made to the recommendations in the measures of progress for habitat modification and substrate fines and the surrogate measures for the temperature TMDL. Assessment of the number of sites meeting the potential stream type and potential riparian vegetation composition will be reported in a written summary. The Water Quality Data Analyst will complete the data analysis and summary. Following a review period the TMDL Technical Committee may issue statements of recommendations based on the annual monitoring report. Assessing the existing morphologic character of the Umatilla river and its tributaries and comparing them to past documented conditions will help show changes in site composition and stream morphology, due to changes in land use practices and site conditions, over a long period of time.

## 3.5.4.8 WATER QUALITY

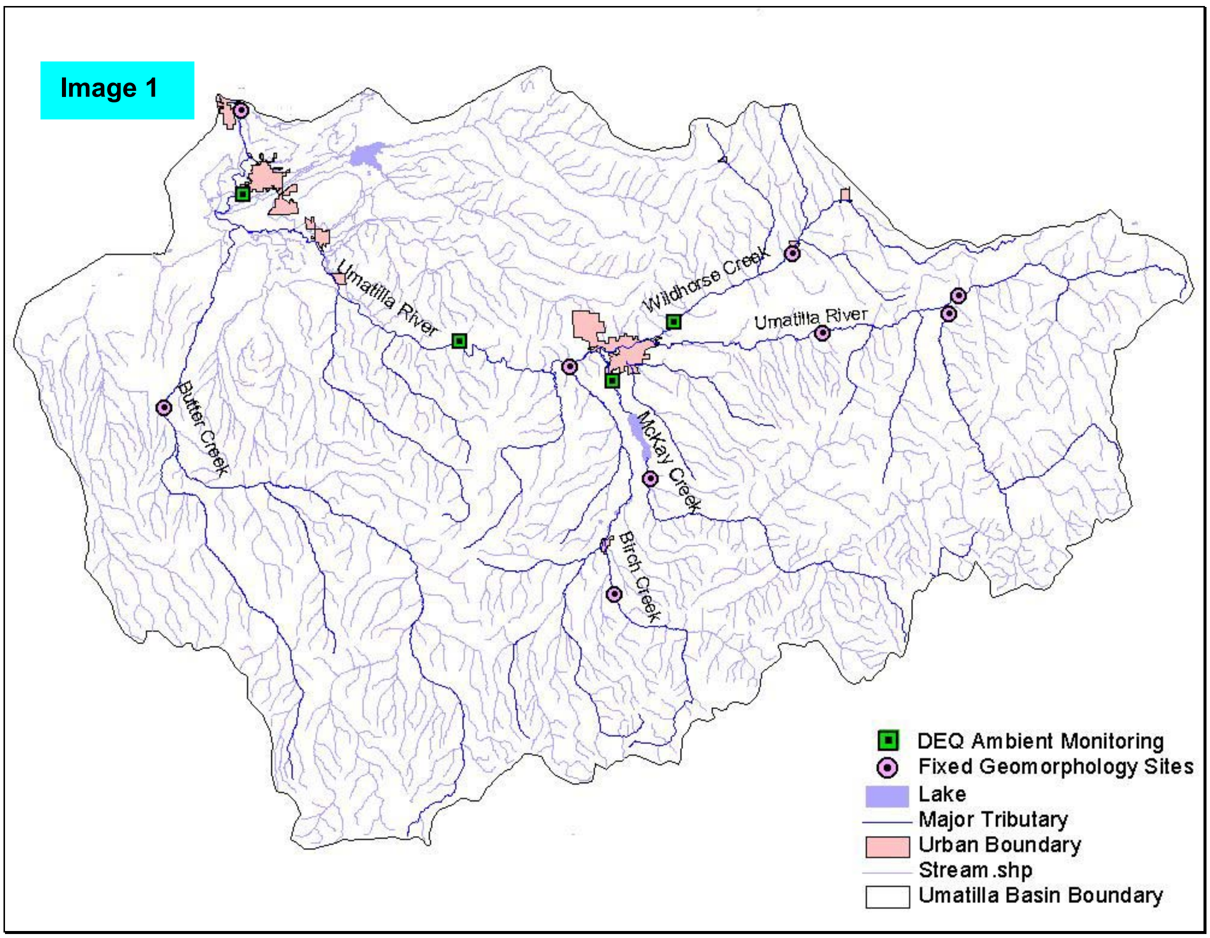
### 3.5.4.8.1 Monitoring Strategy

Other water quality parameters are in exceedance of the standard in the Umatilla basin. These parameters include ammonia, nitrates, bacteria, and pH. The Oregon Department of Environmental Quality has conducted monitoring quarterly within the Umatilla Basin in the 1980's and 1990's, as part of its ambient monitoring network. The ambient monitoring network includes sites throughout the state of Oregon. The Oregon Department of Environmental Quality characterizes these parameters on an annual basis. The commitment to the ambient monitoring network is ongoing for the foreseeable future. Ambient monitoring occurs at 4 sites in the Umatilla Basin. This network of ambient monitoring sites plus the two additional requested sites will be used to characterize long term trends of these parameters.

# 3.5.4.8.2 Monitoring Network Design

Ambient monitoring is conducted by ODEQ as a quarterly sampling of 4 sites on the Umatilla River (Image 2). The technical committee requests that a fifth and sixth site be added, Wildhorse Creek at the mouth and Wildhorse Creek at Athena Bridge above the wastewater treatment plant. These new sites will be monitored in the same manner as the existing sites by ODEQ. Ambient monitoring includes the following parameters; fecal coliform, *E. Coli*, total suspended solids, total solids, ammonia, nitrate and nitrite, total kjeldahl nitrogen, total phosphorus, total organic carbon, chemical oxygen demand, common cations, temperature, conductance, turbidity, pH, alkalinity, and dissolved oxygen.

| Storet # | Description | River Mile |
|---|---|---|
| 404703 | McKay Creek at Kirk Road in Pendleton | 1.5 |
| 404168 | Umatilla River at Westland Road Bridge in Hermiston | 8.7 |
| 402074 | Umatilla River at Yoakum Bridge | 37.2 |
| 402076 | Umatilla River at Highway 11 Bridge in Pendleton | 57.1 |
| | Wildhorse Creek at mouth | |
| | Wildhorse Creek at Athena Bridge above the WWTP | |



### 3.5.4.8.3 Data Management and Analysis

The purpose of the ambient monitoring network is to monitor the trends in water quality parameters. Data analysis is conducted by the Oregon Department of Environmental Quality. A summary of the monitoring data is provided to Agencies and the Public by January 31 of each year. The summary includes data collected from the previous water year, October 1 through September 30. The original data will be stored in Storet.

## 3.5.4.9 SECTION REFERENCES

Hall, F.C. 1999. Ground-based photographic monitoring. Pacific Northwest Region, USDA Forest Service.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, Colorado.

The Oregon Plan for Salmon and Watersheds. 1999. Water Quality Monitoring, Technical Guide Book. Version 2.0.

United States Environmental Protection Agency. 1993. Monitoring Protocols to Evaluate Water Quality Effects of Grazing Management on Western Rangeland Streams. EPA 910/R-93-017.

Williams, J.D., C.F. Clifton, and R.W. Rickman. 1998. Stream Morphological Description of the Umatilla River. Columbia Basin Agricultural Research Center Annual Report. Special Report 989.

Wolman, M.G. 1954. A method of sampling coarse river-bed material. Transaction of American Geophysical Union. 35:951-956.

# 3.5.5 MAINTENANCE OF EFFORT OVER TIME

The purpose of this element of the management plan is to demonstrate a strategy for maintaining the implementation of the water quality management plan and the resulting water quality improvements over the long term. The key components of this strategy are:

(1) Legislated and institutionalized programs. Many such programs applicable in the Umatilla Basin exist, for example:

- Agricultural management plans of Oregon's Senate Bill 1010
- Oregon's Forest Practices Act
- The CTUIR Natural Resource Programs
- ODOT's Routine Road Maintenance and Repair Manual Implementation
- Standards, Guidelines and BMPs of the Umatilla National Forest
- County and City Comprehensive Plans
- Existing and developing Storm Water Programs
- Umatilla Basin Watershed Council Outreach and project coordination
- Umatilla County Soil and Water Conservation District project development and coordination
- Monitoring programs of CTUIR, ODEQ, USFS, ODFW, OWRD
- The Umatilla Basin Project

(2) Volunteer and Incentive based projects, programs and stewardship.

- These are discussed in **Sections 3.3 & 3.4** (management practices sections) and **3.5.6** (*Reasonable Assurance of Implementation*).

(3) Ongoing education and outreach.

- The Umatilla Basin Watershed Council has agreed to guide and promote education and outreach.
- Education and outreach are recommended in Sections of **3.3 & 3.4** (management practices sections).

(4) Ongoing long term monitoring of water quality and BMP implementation.

- Water quality and habitat monitoring is discussed in **Section 3.5.4**, *Long Term Monitoring*.
- Implementation will be monitored by the entities responsible for applying BMPs. Each is requested to provide this information to the Umatilla Basin Watershed Council, for Basin-wide evaluation on a yearly basis (discussed in the following paragraph).

(5) Ongoing program effectiveness evaluation.

- This is an ongoing task linking: the programs of **Sections 3.3 & 3.4**, water quality monitoring and trend analysis, level of BMP/WQMP implementation, research and progress indicators. This is primarily the responsibility of state, local and federal agencies. Technology sharing between ODEQ, and ODF, ODA and USDFS and others, to evaluate practices and interim measures of progress will be important if program implementation is well-established and improving water quality trends are not significant.

(6) Ongoing financial support.

- This is discussed in **Section 3.5.1**.

(7) Review and revision of the TMDL as needed.

- To be considered each 5 years. (DEQ policy, as listed in **Section 1.3.7**, *Implementation and Adaptive Management Issues*)

To insure long term implementation of the Umatilla Basin Water Quality Management Plan the UBWC, CTUIR and ODEQ will impanel an ongoing committee which will meet regularly (at least 1 time per year) to oversee plan implementation, review plan priorities and practices, and encourage public education and involvement (referenced in Item 4 above). This committee will be made up of private citizens and representatives of the management agencies involved in implementation of the water quality management plan. At a minimum the membership will include:

- Umatilla Basin Watershed Council
- Umatilla County Soil and Water Conservation District
- Umatilla County
- Confederated Tribes of the Umatilla Indian Reservation
- Oregon Department of Agriculture
- Oregon Department of Forestry
- Oregon Department of Environmental Quality
- U.S. Forest Service
- Basin municipalities
- Basin Fisheries managers
- Public/Citizen

Involvement of other agencies will be sought as needed. These may include ODFW, DSL, Morrow County, environmental interests, EPA, industry groups, or others. Land management agencies are asked to submit documentation of BMP implementation to this committee through the Umatilla Basin Watershed Council.

The committee's major charge will be to periodically review the entire plan and revise as necessary, and make recommendations to implementing organizations. This will involve:

- Review of the activities of the responsible agencies to determine if implementation is occurring as planned. If it is not, determine the reason and revise the plan timeline for implementation as necessary.
- Promotion of ongoing communication and education among the public on the goals of the plan and on the availability of financial and technical assistance for implementing priority projects.
- Continuing efforts to encourage adequate technical and financial assistance programs that are active in the Basin to help implement resource enhancement projects.
- Continue efforts to explore revised or additional management measures.
- As additional information becomes available, continue to improve and revise cost/benefit estimates.

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# 3.5.6 REASONABLE ASSURANCE OF IMPLEMENTATION

## 3.5.6.1 THE OREGON PLAN

The Oregon Plan for Salmon and Watersheds represents a major effort, unique to Oregon, to improve watersheds and restore endangered fish species. The Oregon Plan is a major component of the “reasonable assurance” that this Water Quality Management Plan will be implemented. The Oregon Plan consists of four essential elements:

**1. Coordinated Agency Programs**
Many state and federal agencies administer laws, policies, and management programs that have an impact on salmon. These agencies are responsible for fishery harvest management, production of hatchery fish, water quality, water quantity, and a wide variety of habitat protection, alteration, and restoration activities. Previously, agencies conducted business independently. Salmon and water quality suffered because they are affected by the actions of all the agencies, but no single agency was responsible for comprehensive, life-cycle management. Under this plan, all government agencies that impact salmon are accountable for coordinated programs in a manner that is consistent with conservation and restoration efforts.

**2. Community-Based Action**
Government, alone, cannot conserve and restore salmon across the landscape. The Oregon Plan recognizes that actions to conserve and restore salmon must be worked out by communities and landowners, with local knowledge of problems and ownership in solutions. Watershed councils, soil and water conservation districts, and other grassroots efforts are vehicles for getting the work done. Government programs will provide regulatory and technical support to these efforts, but much of the work to conserve and restore watersheds must be done locally. Education is a fundamental part of community based action. People must understand the needs of salmon and watersheds in order to make informed decisions about how to make changes to their way of life that will support water quality and habitat.

**3. Monitoring**
A monitoring program, described in **Sections 3.5.4** (Long-term monitoring - water quality and habitat) and **3.5.5** (Maintenance of Effort Over Time - BMP implementation) combines an annual appraisal of work accomplished and results achieved. Work plans will be used to determine whether agencies meet their goals as requested. Biological and physical sampling will be conducted to determine water quality and habitat respond as expected to conservation and restoration efforts.

**4. Appropriate Corrective Measures**
The Oregon Plan includes an explicit process for learning from experience, discussing alternative approaches, and making changes to current programs. The Plan emphasizes improving compliance with existing environmental laws rather than arbitrarily establishing new protective laws. Compliance will be achieved through a combination of education and prioritized enforcement of laws that are expected to yield the greatest ecological benefits.

**In summary**, the Oregon Plan involves the following: (1) coordination of effort by all parties, (2) development of action plans with relevance and ownership at the local level, (3) monitoring progress, and (4) making appropriate corrective changes in the future. The following table identifies specific elements of the Oregon Plan, and the responsible agencies that are directly relevant to the implementation of the Umatilla Basin WQMP. An 'X' indicates that the water quality parameter associated with that column is addressed by the Oregon Plan Objective associated with that row. (Note: The initials that proceed the objective identify the responsible agency. For example: ODA2 – Implementation of CAFO Program, means that the Oregon Department of Agriculture (ODA) is responsible for implementing a confined animal feeding operation (CAFO) program. Acronyms and abbreviations are defined in **Appendix A-2**.

| **Table 74.** Oregon Plan Measures by Parameter<br>**Oregon Plan Objective** ↓ | **Water Quality Parameters Addressed** | | | | | | |
|---|---|---|---|---|---|---|---|
| | Temperature | Sediment | Habitat Modification[1] | pH [2] | Flow | Dissolved Oxygen | Bacteria |
| ODA1 - Implementation of SB1010 Program | X | X | X | X | | X | X |
| ODA2 - Implementation of CAFO Program | | X | X | X | | X | X |
| | | | | | | | |
| OEDD7 - Assist Dairy Industry to Reduce Non-point Source Pollution | | X | X | X | | X | X |
| | | | | | | | |
| DEQ1S - Implementation of Recently Revised Water Quality Standards for Temperature, Dissolved Oxygen, and Sedimentation | X | X | | | | X | |
| DEQ2S - Development of 303(d) List and Identification of Priorities for TMDL Development | X | X | X | X | X | X | X |
| DEQ3S - Watershed Council Support | X | X | X | X | X | X | X |
| DEQ4S - Enhanced 401 Certification for Fill and Removal Operations | X | X | X | X | X | X | X |
| DEQ5S - Revise Water Quality Standard for Sediment | | X | | | | | |
| DEQ7S - Apply for Instream Water Rights on Streams with TMDLs | X | X | X | X | X | X | X |
| DEQ9S - Implement Water Quality Standards for Biological Criteria, Nutrients, Toxics and pH | | | X | X | | | |
| DEQ10S - Develop Water Quality Standards for Wetlands | | | X | X | | | |
| DEQ11S - Revise Water Quality Standards for Nutrients | | | X | X | | X | |
| DEQ13S - Implementation of SDWA Source Water Protection Program | | X | | X | | X | |
| DEQ14S - Management of Point Source Discharges through NPDES Permits | X | X | X | X | X | X | X |
| DEQ15S - Management of Storm Water Discharges through NPDES Permits | X | X | X | X | X | X | X |
| DEQ16S - Revise SRF Loan Criteria to Help Protect Salmon | X | X | X | X | X | X | X |
| DEQ17S - Implement On-Site Program to Control | | | | X | | X | X |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Nutrient Loads to Surface Waters | | | | | | | |
| DEQ18S - Implement Groundwater Protection Act to Prevent Adverse Impacts to Salmonid-Bearing Watersheds | | | | X | | X | |
| DEQ31S - 401 Certification of Grazing leases on Federal Lands | X | X | X | X | X | X | X |
| DEQ32S - Evaluate and Require Mitigation for the Impacts of Dams and Hydroelectric Projects on Water Quality During Re-licensing or Reauthorization | X | X | X | X | X | X | X |
| DEQ33S - Evaluate and Require Mitigation for the Impacts of Dams and Hydroelectric Projects on Water Quality During Development of TMDLs | X | X | X | X | X | X | X |
| | | | | | | | |
| ODFW IVA3 - Protect Instream Flows | X | | | | X | X | |
| ODFW IVA8 - Identify Instream Flow Priorities | X | | | | X | X | |
| ODFW IVB3 - Promote Use of Beavers to Restore Salmonid Habitat | | | X | | | | |
| | | | | | | | |
| ODF 1S - Road Erosion And Risk Project | X | X | X | | | | |
| ODF 2S - State Forest Lands Road Erosion And Risk Project | X | X | X | | | | |
| ODF 3S - Technical And Policy Review Of Rules And Administrative Processes Related To Slope Stability | X | X | X | | | | |
| ODF 4S - Stream Habitat Assessments | | | X | | | | |
| ODF 7S - Fund 7 New Fish Biologists To Provide Technical Assistance For Salmonid Habitat Restoration | | | X | | | | |
| ODF 8S - Riparian Hardwood Conversions | | | X | | | | |
| ODF 15S - Evaluation Of Road And Timber Harvest Bmps To Minimize Sediment Impacts | X | X | | | | | |
| ODF 18S - Wildlife Tree Placement On State Forest Lands | X | | X | | | | |
| ODF 19S - Additional Conifer Retention Along Fish-Bearing Streams In Core Areas | X | | X | | | | |
| ODF 20S - Limited Rma For Small Type N Streams | X | | X | | | | |
| ODF 21S - Active Placement Of Lwd During Forest Operations | | | X | | | | |
| ODF 22S - 25 Percent In-Unit Leave Tree Placement And Additional Voluntary Retention | X | | X | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ODF 23S - Bmp Compliance Audit Program | X | X | X | | | | |
| ODF 24S - State Forest Lands Stream Habitat Assessment And Instream Projects | | | X | | | | |
| ODF 25S - Fish Presence/Absence Surveys And Fish Population Surveys | X | X | X | | | | |
| ODF 27S - Increased Riparian Protection | X | X | X | | | | |
| ODF 28S - Protection Of Significant Wetlands, Including Estuaries | X | X | X | | | | |
| ODF 29S - Forest Practice Chemical Protection Rules Increased Buffers | X | | | | | | |
| ODF 30S - Large Woody Debris Recruitment Incentives | | | X | | | | |
| ODF 31S - Large Woody Debris Placement Guidelines | | | X | | | | |
| ODF 32S - Fish Presence Survey (OAR 629-635-200(11)) | X | X | X | | | | |
| ODF 33S - Increase Number Of Streams And Stream Miles Protected | X | X | X | | | | |
| ODF 34S - Improve Fish Passage Bmps On Stream Crossing Structures | | | X | | | | |
| ODF 35S - Increase Design For Larger Flows | | X | | | | | |
| ODF 36S - Upgraded Road Construction & Fill Requirements | | X | | | | | |
| ODF 37S - Upgraded Skid Trail Construction And Fill | | X | | | | | |
| ODF 53S - Oregon Professional Logger Program | X | | X | | | | |
| ODF 61S - Analysis Of "Rack" Concept For Debris Flows | | X | | | | | |
| ODF 62S - Voluntary No Harvest In Riparian Management Areas | X | X | X | | | | |
| | | | | | | | |
| DOGAMI1 - Sediment Management at Mine Sites | | X | | | | | |
| DOGAMI2 - Mine Operator Assistance to Watershed Councils | | X | | | | | |
| DOGAMI3 - Good Mine Operators Award | | X | | | | | |
| DOGAMI4 - Best Management Practices Manual | | X | | | | | |
| DOGAMI5 - Storm Water Management at Mine Sites | | X | | | | | |
| | | | | | | | |
| DLCD2 - Riparian Area Technical Assistance | X | X | X | | | | |
| DLCD4 - Implement New Goal 5 Rules for Riparian and Wetland Protection | X | X | X | | | | |
| | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DSL 1 - Update Standard Permit Conditions | | X | | | | | |
| DSL 5-8 - Revised General Authorizations | X | | | | | | |
| DSL 20 - Revised Standard Waterway Lease | | | X | X | | | |
| | | | | | | | |
| OSMB1 - Increase Number of Streams Adopted through Adopt-A-River Program | X | | | | | | |
| OSMB2 - Increase Number of Boat Waste Pump-Outs and Dump Stations | | | | X | | | X |
| | | | | | | | |
| ODOT1 - Protection and Replacement of Riparian Vegetation | X | | | | | | |
| ODOT2 - Erosion and Sediment Management | | X | | | | | |
| ODOT3 - Protection of Aquatic Habitat | | | X | | | | |
| ODOT5 - Stream Fertility | | | X | X | | | |
| | | | | | | | |
| BLM/USFS1 - Watershed/Habitat Restoration | X | X | X | X | | X | |
| BLM/USFS13 - Hydropower Licensing and Relicensing Coordination | X | | X | | | | |
| BLM/USFS 14- Clean Water Act Section 303 Compliance | X | X | X | X | | | |
| | | | | | | | |
| USFWS1 - Jobs-in-the-Woods Program | X | X | X | X | | X | |
| USFWS11 - Comments and Prescriptions on Federal Energy Regulatory Commission Hydropower Projects | X | | X | | | | |
| USFWS13 - Review of Dredge and Fill Projects | X | X | X | | | | |
| USFWS14 - Response to Oil and Hazardous Substances Spills | | | X | | | | |
| USFWS15 - Natural Resource Damage Assessment | | | X | | | | |
| USFWS23 - Environmental Contaminant Investigations | | | X | | | | |
| | | | | | | | |
| NOAA-NMFS1 - Habitat Restoration | X | X | | X | | X | |
| NOAA-NMFS13 - Hydropower Facilities | X | | X | | | | |
| NOAA-NMFS14 - Non-Hydropower Facilities | X | | X | | | | |
| NOAA-NMFS35 - Hazardous Materials Response & Assessment | | | X | | | | |
| | | | | | | | |
| EPA6 - Water Quality Standards for Temperature and Total Dissolved Gas | X | | | | | | |
| | | | | | | | |

**TABLE NOTES:**
#1 -- The most closely related Oregon Plan parameter is "Biological Condition." Factors for decline in this parameter include habitat degradation and channel modification.
#2 -- The Oregon Plan recognizes that pH problems may be due to factors such as excessive algal growth attributable to excess nutrient loading from point and non-point sources. Therefore, Oregon Plan objectives addressing pH generally also address nutrients and/or algal growth, parameters that are 303(d) listed in the Umatilla Basin. Another Oregon Plan parameter of concern is "Stream Fertility," which refers to problems stemming from either excess or inadequate nutrients. Consequently, for purposes of this table, Oregon Plan objectives addressing Stream Fertility are assumed to relate to nutrients and thus to pH.

## 3.5.6.2 VOLUNTARY MEASURES

There are many voluntary, non-regulatory, watershed improvement programs (activities) that are in place and are helping to address the water quality concerns in the Umatilla Basin. Both technical expertise and partial funding are provided through these programs. Examples of activities promoted and accomplished through these programs include: planting of trees and other vegetation along streams; promotion and implementation of conservation agriculture; replacing problem culverts with adequately sized structures; and relocating, improving & maintaining legacy roads known to cause water quality problems. These activities have been and are being implemented to improve watersheds and enhance water quality. Many of these efforts are helping resolve water quality related legacy issues. The programs addressing these problems include, but are not limited to, the following:

**1. Umatilla Basin Watershed Council**
The mission of the Watershed Council is to foster cooperation and to provide facilitation and activities coordination that restore and enhance Umatilla Basin watershed health. The central strategy of the approach is based upon the belief that a locally based effort to improve coordination, integration and implementation of existing local, state, and federal programs can effectively protect, enhance, and restore a regional watershed area.

**2. Landowner Assistance Programs**
A variety of incentive programs are available to landowners in Umatilla Basin. These incentive programs are aimed at improving the health of the watershed, particularly on private lands. They include technical and financial assistance, provided through a mix of state and federal funding. Local natural resource agencies administer this assistance, including the Oregon Department of Forestry (ODF), the Oregon Department of Fish and Wildlife (ODFW), and the Natural Resource Conservation Service (NRCS). These agencies work with local organizations including the Umatilla County Soil and Water Conservation District (SWCD) and the Watershed Council to provide this assistance. In addition, the Clean Water Act 319 program has provided incentive funds for conservation agriculture through the SWCD.

Field workers from the ODF, ODFW, NRCS, and USWCD; provide technical assistance and advice to individual landowners/operators. These services include on-site evaluation, technical project design, stewardship/conservation plans, and referrals for funding as appropriate.

Financial assistance is provided through a mix of cost-share, tax credit, and grant funded incentive programs designed to improve on-the-ground watershed conditions. Some of these programs, due to source of funds, have specific qualifying factors and priorities.

Cost share programs include the Forestry Incentive Program (FIP), Stewardship Incentive Program (SIP), Environmental Quality Incentives Program (EQIP), and the Wildlife Habitat Incentive Program (WHIP).

The **Forestry Incentive Program (FIP)** provides up to 50% of actual costs for qualifying projects to reforest, treat pre-commercial forest stands, and treat forest fuels. Contact ODF.

The **Stewardship Incentive Program (SIP)** provides up to 75% of actual cost to develop a Stewardship Plan on forestland, or land capable of growing forest species. Once a plan is developed, SIP can provide up to 50% of actual costs for a variety of projects including reforestation, pre-commercial forest stand and fuel treatment, fish and/or wildlife habitat improvements, soil conservation measures, and riparian and wetland improvements. Contact ODF.

The **Environmental Quality Incentives Program (EQIP)** provides funding for a wide variety of practices to improve watershed conditions on forest, agricultural, and grazing lands. These include stream and riparian area improvements, grazing and water management measures, vegetation improvements, and agricultural practices. Contact NRCS.

The **Wildlife Habitat Improvement Program (WHIP)** provides funding for a variety of practices to improve wildlife habitat, including planting, vegetation management, and other measures. Contact NRCS.

The **Conservation Reserve Program (CRP)** is designed to take highly erodible farmlands out of production to reduce erosion. This is done through a rental payment applied through a 10-year contract with the landowner/operator. Land enrolled in CRP must have permanent cover established, grass or tree/shrub. The establishment of this cover is cost-shared if the landowner/operator chooses. Grazing and agricultural production is prohibited during the 10-year contract. Contact NRCS.

The **Conservation Reserve Enhanced Program (CREP)** is similar to CRP, except it focuses on riparian areas along designated fish-bearing streams. Eligible lands include agricultural and marginal pasture lands. Contracts may run up to 15 years. Cover including trees/shrubs must be established, and is cost-shared at 75%. Rental rates are higher than CRP rates. Contact NRCS or ODF.

The **Forest Resource Trust (FRT)** is a long-term trust program designed to help convert under producing forestland into productive forests. Funding and technical assistance is provided as an investment in the landowner's forest. When the timber is harvested, a percentage of the net revenue is then paid back to the Trust by the landowner. A landowner may receive up to $100,000 every two years, and up to 100% of reforestation costs. Contact ODF.

State and federal tax credit programs also provide incentives for resource improvement. The **Oregon Reforestation Tax Credit** provides a 30% state income tax credit for reforestation costs on under productive forestlands. Contact ODF.

There is a **10% Federal Income Tax Credit for Reforestation**. Contact individual tax accountant.

Grant funds are available for improvement projects on a competitive basis. Field agency personnel assist landowners in identifying, designing, and submitting eligible projects for these grant funds. Projects are often submitted through an organization such as an SWCD or Watershed Council. Grant fund sources include:

- **Oregon Watershed Enhancement Board (OWEB)** which funds watershed improvement projects with state money. This is an important piece in the implementation of Oregon's Salmon Plan. Current and past projects have included road relocation/closure/improvement projects, in-stream structure work, riparian fencing and re-vegetation, off stream water developments, and other management practices.
- **Bonneville Power Administration (BPA)** funds are federal funds for fish habitat and water quality improvement projects. These have also included projects addressing road conditions, grazing management, in-stream structure, and other tools.
- **The Clean Water Act 319 Program** routes funding through a program administered by the Department of Environmental Quality for nonpoint source water quality improvement. ODEQ is the contact.

The Umatilla Basin has a number of past, current, and proposed projects funded through the assistance programs listed above.

**3. Private Lands Forest Network (PLFN)**
The Private Lands Forest Network is a non-profit landowner cooperative formed to improve reforestation efforts on private forest and riparian areas. The purpose of the PLFN is: (1) Educate and demonstrate to landowners/managers the benefits of quality reforestation and aforestation. (2) Provide high quality site specific tree seedlings in significant quantities to meet private landowners'/managers' needs. (3) Further enhance current supplies of tree seeds/seedlings by establishing a tree seed bank which would contain a ten-year supply of select, high quality seed of both conifer and riparian species needed for future plantings. (4) Provide high quality site specific forest tree seedlings in significant quantities to meet the needs and requirements of the Blue Mountains. (5) Increase the survivability of planted seedlings by providing cold storage facilities, tree planting tools and instructions on the care and correct planting techniques of those seedlings.

**4. Oregon State University Extension Service**
OSU Extension Service provides educational opportunities to private landowners on a variety of forest and agriculture related topics; as an example, a session on forest road location, construction and maintenance was recently provided. OSU provides continuing education to operators and landowners on forest management practices and new issues in forestry.

**5. Oregon Department of Fish and Wildlife Programs**
ODFW has several watershed improvement programs that help maintain or improve water quality. The programs include: streamside fencing that assist in management of livestock to encourage riparian vegetation, provide shrubs and trees for riparian area planting and grass seed for stabilization of disturbed sites, and technical assistance for riparian area and instream projects.

## 3.5.6.3 REGULATORY/STRUCTURED PROGRAMS

There are a variety of structured programs that are either in place or will be put in place to help assure that this Water Quality Management Plan will be implemented. Some of these are traditional regulatory programs such as discharge permit programs for industry or municipalities. In these cases the pollutants of concern in the Umatilla Basin will be considered and the regulation will be carried out as required by federal, state, and local law. Other programs, while structured, are not strictly regulatory (transportation and agricultural programs described below). In these cases local implementing agencies agree to make a good faith effort to implement the program.

**1. NPDES and WPCF Permit Programs**
The ODEQ administers two different types of wastewater permits in implementing Oregon Revised Statute (ORS) 468B.050. Briefly, the statute requires that no person shall discharge waste into waters of the state or operate a waste disposal system without obtaining a permit from the ODEQ. Discharge and disposal are terms of art that characterize the means of discarding of waste. Discharge pertains to getting rid of the waste by putting it into some kind of surface water. Disposal pertains to getting rid of the waste by other means, such as evaporation, seepage, or land application, among others.

Consequently, the ODEQ administers National Pollutant Discharge Elimination System (NPDES) permits for waste discharge, and Water Pollution Control Facilities (WPCF) permits for waste disposal. The NPDES permit is also a Federal permit, which is required under the Clean Water Act for discharge of waste into waters of the United States. ODEQ has been delegated authority to issue NPDES permits from EPA. The WPCF permit is unique to the State of Oregon. As the permits are renewed they will be revised to insure that all 303(d) related issues are addressed in the permit.

**2. Transportation**
It is anticipated that the management practices for transportation sources identified by the transportation work group will be voluntarily implemented by the responsible agencies. There is incentive to voluntarily implement the practices not only to improve water quality and protect listed species but also to proactively minimize the need for any additional regulation. In addition to voluntary incentives, there are existing authorities and agreements that are adequate to assure implementation:

The US Forest Service (USFS) is required by federal law to comply with the Clean Water Act and meet Oregon Water Quality Standards on national forests. The Umatilla National Forest standards and guidelines are references in the Transportation and Forestry sections (**3.3.3, 3.3.4**) of this document.

The Oregon Department of Transportation (ODOT) reviewed its Maintenance Management System in 1997. The review acknowledged the potential of routine maintenance activities to pollute receiving waters and made recommendations for improvements to the current maintenance practices. These recommendations are included in this plan and were adopted by ODOT district managers in the spring of 1997. Implementation of these practices is also an integral part of ODOT's efforts in support of the Governor's Oregon Plan for addressing listed fish species and improving watersheds.

The Oregon Forest Practices Act and its implementing rules (OAR 629-625, Road Construction and Maintenance) establish minimum requirements for transportation system maintenance and construction on private forestlands. The Oregon Department of Forestry administers these rules.

Umatilla and Morrow Counties and the Basin municipalities have been requested to supply or adopt policies or ordinances to address TMDLs, as discussed in the Urban/Industrial and Transportation planning sections (**3.3.1, 3.3.4**) of this document.

Private roads on agricultural land will be addressed through the Agricultural Water Quality Management Area Plan that has been adopted into administrative rule by the Oregon Department of Agriculture.

**3. Municipal & Rural Residential**
Umatilla and Morrow Counties and the Basin municipalities have been requested to supply or adopt policies or ordinances to address TMDLs, as discussed in the preceding paragraphs. These Ordinances and Policies should be developed and reviewed as described in **Section 3.3.1**.

**4. Forestry**
The Oregon Department of Forestry (ODF) is the designated management agency for regulation of water quality on nonfederal forestlands. The Board of Forestry has adopted water protection rules, including but not limited to OAR Chapter 629, Divisions 635-660, which describe BMPs for forest operations. These rules are implemented and enforced by ODF and monitored to assure their effectiveness. The Environmental Quality Commission, Board of Forestry, ODEQ and ODF have agreed that these pollution control measures will be relied upon to result in achievement of state water quality standards. ODF provides on the ground field administration of the Forest Practices Act. For each administrative rule, guidance is provided to field administrators to insure proper, uniform and consistent application of the Statutes and Rules. The FPA requires penalties, both civil and criminal, for violation of Statutes and Rules. Additionally, whenever a violation occurs the responsible party is obligated to repair damage. For more information see **Section 3.3.3**.

**5. Agriculture**
The Oregon Department of Agriculture (ODA) has primary responsibility for control of pollution from agricultural sources. This is done through the Agricultural Water Quality Management (AWQM) program authorities granted ODA under Senate Bill 1010 adopted by the Oregon State Legislature in 1993. A plan and rules specific to the Umatilla Basin have been developed and adopted and are now in effect in the sub-basin.

The AWQM Act directs ODA to work with local farmers and ranchers to develop water quality management area plans for specific watersheds that have been identified as violating water quality standards and having agricultural water pollution contributions. The agricultural water quality management area plans are expected to identify problems in the watershed that need to be addressed and outline ways to correct those problems. These water quality management area plans are developed at the local level, reviewed by the State Board of Agriculture, and then adopted into Oregon Administrative Rules. It is the intent that these plans focus on education, technical assistance, and flexibility in addressing agricultural water quality issues. There may be, however, situations that require corrective action. In those cases when an operator refuses to take action, the law allows ODA to take enforcement action.

**6. Federal Forest Lands**
The USDA-Forest Service is required by federal law to comply with the Clean Water Act and to meet Oregon Water Quality Standards. The Wallowa-Whitman and Umatilla Forest Plans as amended by PACFISH and INFISH include implementation of BMPs and other specific standards and guidelines as part of the structured program in place to insure WQMPs will be implemented.

**7. General**
Instream work and stream re-location is regulated through the Oregon Division of State Lands (DSL) Remove & Fill Permitting program as provided by statute (ORS 196.800 - 196.990). Implementing requirements include minimizing ecological impacts. Restrictions apply to any perennial stream and intermittent streams with fisheries value and confines work to instream work windows designated by ODFW for protection of salmonid spawning and incubation. Minimization of impact is particularly stringent in or near essential salmonid habitat streams. This classification includes the Umatilla mainstem, Birch Creek, Meacham Creek, the CTUIR tributaries, the North and South Fork of the Umatilla River and part of Butter Creek.

# 3.5.7 POPULATION GROWTH

The Basin population has been relatively constant for decades, with the exception of the Hermiston area, which is undergoing rapid expansion due to incoming industry, retail distribution and government projects.

US EPA TMDL guidance provides for a TMDL *Reserve Capacity* - an allocation of allowable pollutant reserved for population growth. The newly proposed federal TMDL regulations call for "an allowance for future growth, if any, which accounts for reasonably foreseeable increases in pollutant loads" (proposed 40 CFR 130.33).

The Stakeholders Committee recognized this concern and advocated for an accounting for future growth. What is proposed could be thought of as an *implicit* reserve capacity and is not practically expressed in terms of unit load per time:

The Umatilla Basin TMDLs, as established herein, are applicable now and in the future. The pollution addressed is pervasive across much of the landscape and is attributable primarily to practices rather than population. For instance, agriculture and forestry land occupy much of the Basin currently and the land proportion and pollutant loads are unlikely to increase through population growth. Increasing population of urban centers and increased road mileage are not correlative to water quality degradation **IF** the load allocations are implemented with new development.

The Umatilla Basin, compared with Basins high urban density, has low population density and is expected to remain so for the foreseeable future (urban populations are provided in **Chapter One**).

Currently, Basin-wide temperature load allocations are zero for the identified societal sources; hence, there is no remaining load capacity to be held in reserve. Practically, this means that for current and future construction, land management and floodplain/channel activities, adverse influence must be minimized, and system potential vegetation and channel and floodplain morphology enabled. If new development is constructed near the river, the effective shade TMDL surrogate is in effect - buffer strips with beneficial shade-producing vegetation should be included in site plans. In the uplands, storm water control and other pollutant/erosion measures apply, such as the percent erosion reduction relative to current levels.

Load allocations for nitrate, turbidity and bacteria set ceilings not to be exceeded collectively by existing and future development.

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# 3.5.8 SCHEDULE OF IMPLEMENTATION

The purpose of this section is to provide a chronological list of actions that will take place during the implementation of this plan. Each of these activities are discussed in more detail elsewhere in the document. The table below lists the completion date, activity to be completed, responsible organization and a reference to additional information elsewhere in the plan. In many cases the organization listed under “Responsibility” in the table is not the only organization with responsibility for implementing the activity, but is the lead or primary agency. Some of the tasks listed in this section are reliant on new funding appropriations and as such are not firm commitments. The lead agencies are requested to seek funding sources as needed.

Many activities are on going. They do not have specific completion dates but will continue to be implemented throughout the life of the plan. These are listed in a separate table following the timeline table.

It is the intent in implementing this Water Quality Management Plan that each of the activities identified in this timeline will be carried out in a way that acknowledges and considers the planning emphasis identified in **Section 3.5.2**. Setting management and geographic focus helps direct limited resources to the most important project types and locations. This will lead to changes in management practices that are having the most impact on watershed health and will do so in the most critical watersheds first. Numerous studies and assessments carried out over the past decade have repeatedly identified similar priorities. Keeping a strong focus on those priorities will help to insure that the implementation of the plan will result in the desired improving trend in water quality in the most timely and efficient manner possible. This means that, to the extent that resources allow, the activities identified below will focus on the management categories and geographic areas of emphasis identified in **Section 3.5.2**. For example, when the cities and county “Identify existing ordinances, rules, plans...within 6 months of TMDL issuance," they will do so with reference to the high priority management categories: restore (or protect) riparian vegetation, improve in-stream flow, and improve stream channels, etc. When, for example, assigning priorities for transportation related issues/problems and begin implementing solutions (by 2005), problems in high priority sub-watersheds will, in general, be addressed ahead of problems in low priority sub-watersheds. As a final example, when implementing the public information/education strategies identified under on-going activities, the responsible organizations should focus their efforts on high priority management categories in high priority watersheds.

**Table 75.** Scheduled or One-time Activities

| | Implementation | Responsibility | Reference |
|---|---|---|---|
| un-specified | evaluate crop cultivation on road right-of-ways | ODA, SWCD and transportation authorities | Section 3.3.3 introductory paragraphs |
| 2001 | complete individual facility NPDES permit re-evaluation/re- issuance for all Basin direct discharge permits | DEQ | Section 1.2.6 |
| 2005 | complete general NPDES permit re-evaluation/re-assignment for all Basin direct discharge permits | DEQ | Section 1.2.6 |
| 6 months after TMDL issuance | Urban/Industrial: Identify existing ordinances, rules, plans and regulations that address NPS pollution and identify needs in the existing structure | Cities, counties, industry | Section 3.3.1 |
| 1 year after TDML issuance | Urban/Industrial: Identify areas of improvement, including potential sources of NPS pollution and points of discharge, i.e., a physical survey | Cities, counties, industry | Section 3.3.1 |
| 18 months after TMDL issuance | Urban/Industrial: Identify specific BMPs that will address the (NPS) issues | Cities, counties, industry | Section 3.3.1 |
| 3 years after TMDL issuance | Draft, pass and implement ordinances, rules, plans and policies that address NPS pollution from municipal, industrial, commercial, and unincorporated development sources or develop TMDL implementation plans... | Cities, counties, industry | Section 3.3.1 |
| 5 years after TMDL issuance | Urban/Industrial: Develop and implement a program to educate citizens | Cities, counties, industry | Section 3.3.1 |
| 5 years after TMDL issuance | Urban/Industrial: Evaluate effectiveness of implementation of WQMP | Cities, counties, industry | Section 3.3.1 |
| 2000 | Review effectiveness of forest practice rules, statewide, make recommendations to Board of Forestry | Oregon Department of Forestry | Section 3.3.3 |
| 2000 | Prepare final report from the ODF/DEQ shade study | Oregon Department of Forestry | Section 3.3.3 |
| 2000 | ODF/DEQ make collective determination of FPA adequacy for Upper Grande Ronde Basin, or if inconclusive, design and implement specific monitoring program to resolve questions (this potentially applies in each Basin with forestry TMDLs, refer to ODF/DEQ MOU) | ODF/DEQ | Section 3.3.3 |
| begin 4/2002 | Evaluation to determine if agricultural WQMAP implementing rules and plan adequately address TMDLs | ODA/DEQ | Section 3.3.2 |

| | | | |
|---|---|---|---|
| 2001-<br>2005 | Identify and inventory transportation related "hot spots" | UBWC/CTUIR/DEQ and transportation authorities | Section 3.3.4 |
| 2001-<br>2005 | Assign priorities for transportation related issues/problems. | UBWC/CTUIR/DEQ and transportation authorities | Section 3.3.4 |
| 2003 | Identify and prioritize wetland sites for protection and development, with agency and landowner assistance | UBWC | Section 3.4.3.9 |
| 2003<br><br>2010 | Generate decision for or against large reservoir construction<br><br>Evaluate decision above, if viable design and construct | Irrigation Districts, CTUIR, OWRD, cities, US ACE, US BOR, ODFW, | Section 3.4.4.5 |
| 3/2001 | Assess priority streams for instream water right viability & benefit. List existing rights. | OWT, UBWC, OWRD | Section 3.4.5.4 |
| 1/2002 | Promote conversion of existing consumptive rights (lease/sell) through public forums | OWT, UBWC, OWRD | Section 3.4.5.4 |
| 1/2001 | Convene Umatilla Basin Project Oversight Committee | OWRD | Section 3.4.6.5 |
| 1/2001 | Oregon Plan task WRD-6 | OWRD | Section 3.4.6.5 |
| 3/2002 | Begin implementation of plans of Oregon Plan task WRD-6 | OWRD | Section 3.4.6.5 |
| 2001<br><br>2002 | Complete six conserved water program applications.<br>Increased coordination with other ODFW, ODA | OWRD | Section 3.4.7.3.2 |
| 2000 | Elicit water management & conservation plans from all municipalities having this as a condition of their water use permits. | OWRD | Section 3.4.8.3.2 |
| 2001 and ongoing | Outreach and associated development of agricultural water management and conservation plans | UBWC, water users | Section 3.4.9.3 |
| 2005 | Complete a thorough Basin study of ground- and surface-water availability | OWRD, CTUIR, US BOR, Irrigation Districts, Industry, Cities | Section 3.4.10.2.1 |
| Annual | Long term monitoring plan | SWCD, UBWC | Section 3.5.4 |

**Table 76.** On-going Activities

| Implementation | Lead Responsibility | Reference |
|---|---|---|
| Actively and passively promote riparian vegetation, implement other TMDL goals | Agencies, counties, cities and Landowners | Sections 3.1, 3.2, 3.3, 3.5.2 |
| Noxious weed control | Agencies, counties, cities and Landowners | Section 3.3 introductory paragraphs |
| Agriculture WQMAP Implementation | ODA, SWCD | Section 3.3.2 |
| ODOT Erosion Control and Pollution Control Plans | ODOT | Section 3.3.4 |
| ODOT Routine Road Maintenance Program | ODOT | Section 3.3.4 |
| Transportation: Encourage & promote use of BMPs for transportation relates sources | Umatilla and Morrow Counties, Basin cities | Section 3.3.4 |
| Transportation: Implement, as feasible the BMPs of Section 3.3.4.2.4 | Transportation authorities | Section 3.3.4 |
| Oregon Forest Practice rules update | ODF | Section 3.3.3 |
| Standards, guidelines and BMPs of Umatilla National Forest | USFS - Umatilla National Forest | Section 3.3.3<br>Section 3.3.4 |
| Watershed Council outreach | UBWC | Section 3.5.3 |
| Umatilla Basin Project Phases I & II | BOR, CTUIR, Irrigation Districts, Cities | Section 3.4 |
| Umatilla Basin Project Phases III: promote, seek funding for, obtain congressional authorization of, Phase III | UBWC, BOR, CTUIR, Irrigation Districts, Cities | Section 3.4.2.3 |
| Maintain existing wetlands | Agencies, counties, cities and Landowners | Section 3.4.3.5 |
| Promote and implement wetland, wet pond, detention/sedimentation pond establishment | UBWC, agencies, counties, cities and Landowners | Section 3.4.3.5 |
| Oregon Plan Measures | DEQ, OWRD, ODA, USFWS, USEPA, NOAA, OED, ODFW, ODF, DOGAMI, DLCD, OSMB, ODOT, BLM/USFS | Section 3.5.6 |
| Development and promotion of voluntary and incentive-based measures | UBWC, agencies, counties and cities | Section 3.5.5 |
| Implement Urban, Industrial, Agricultural, Forestry Public information & outreach | UBWC, ODA/SWCD, ODF, Industry, USFS, Cities, Counties | Section 3.3<br>Section 3.4<br>Section 3.5.3 |
| BMP implementation monitoring, documentation submittal and effectiveness evaluation | Agencies, counties, cities and Landowners | Section 3.3 & 3.4<br>Section 3.5.5 |
| Impanel ongoing plan oversight and review committee | UBWC, CTUIR, ODEQ | Section 3.5.5 |