Water Quality Report

State of Oregon
Department of Environmental Quality

John Day River Basin Total Maximum Daily Load (TMDL) and Water Quality Management Plan (WQMP)

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Executive Summary

The Department of Environmental Quality has been working in the John Day Basin for several years to assess water quality in rivers and streams. At some locations and times, water is not healthy for people to swim in or drink from, or for fish survival. Issues of concern include high temperatures and bacteria levels, low oxygen concentrations, impaired aquatic life and excessive amounts of fine-grained streambed sediment. This document addresses waters of the John Day Basin.

This document includes a stream assessment and management plan addressing these issues of concern, to protect human health and aquatic life. Pollutant limits are established, targeting water quality standards. These limits are total maximum daily loads (TMDLs) for pollutants entering the water system. This document details TMDLs addressing temperature, bacteria, biological conditions and dissolved oxygen. Each TMDL is expressed as a maximum daily load, and where appropriate, in terms of allocation surrogates as practical alternative expressions of daily loads.

DEQ is in the process of developing quantitative methods and benchmarks to evaluate sedimentation impairment in Oregon streams. Because this work is not yet complete, DEQ is postponing a sedimentation TMDL until these methods are in place.

In calculating TMDLs, DEQ takes into account the pollution from all sources, human and natural. The temperature and bacteria TMDLs apply to all streams throughout the basin. The dissolved oxygen TMDL and biological condition TMDLs apply to the identified water quality limited stream segments.

Water temperature is influenced by a variety of human activities. These include land and water uses associated with forestry, agriculture, transportation, recreation, and urban and rural development and activities. The principal causes of stream heating in the basin are near-stream vegetation removal, channel reconfiguration and instream flow loss, primarily due to irrigation. Wastewater discharges have potential to warm streams, as well. The temperature TMDL calls for natural thermal conditions (shade, channel form, flow) throughout the basin. Quantitative limits are set for solar heating and effective shade. For the temperature TMDL, impoundments are addressed as well as streams.

While the bacteria TMDL applies basin-wide, emphasis is placed on the upper John Day River, where the standard is exceeded most frequently. Runoff from farms and urban areas, and natural sources such as wildlife, all contribute to bacterial contamination. The bacteria standard numeric criteria serve as wasteload allocation targets to address point sources. For nonpoint sources, phased, basin wide *E. coli* percent reductions are called for (69 and 83 percent). Percent reductions are calculated as load allocation surrogates for runoff and direct deposition (nonpoint sources).

The dissolved oxygen TMDL addresses summer dissolved oxygen concerns. The summer dissolved oxygen TMDL is the temperature TMDL. During the summer, temperature TMDL implementation is expected to address dissolved oxygen concerns. In addition, DEQ identified spawning season concerns during the dissolved oxygen TMDL assessment. Spawning season concerns will require further study. DEQ is deferring spawning season dissolved oxygen TMDL development until more information is available.

DEQ has addressed the biological criterion water quality standard as well. This standard is a measure of biological-community health, including the diversity of aquatic insects. The biological criterion TMDL applies to wadeable streams throughout the basin. As for the summer dissolved-oxygen TMDL, the biological criterion TMDL is based on temperature TMDL implementation.

This document lays out TMDL numeric objectives and the level of pollutant reduction needed to achieve them. DEQ expects that meeting these targets will substantially improve water quality in the basin and eliminate identified water quality impairment for the pollutants addressed. TMDL allocations and surrogates include measures for increased streamside shading, increased instream flow, bacteria load reduction, improved channel form and minimization of adverse effects from facilities (point sources).

Seven water quality permitted (National Pollutant Discharge Elimination System -NPDES) facilities have potential to contribute to water pollution in the basin. These include the wastewater treatment plants for the Cities of Mt. Vernon, Dayville, Long Creek (each permitted for direct discharge) and John Day (permitted for discharge to sewage lagoons). DEQ developed wasteload allocations (point source TMDLs) for the three direct-discharge facilities and assimilative capacity is held in reserve for the John Day plant. The remaining three NPDES permitted facilities are animal feedlot operations. DEQ assigned three confined animal feeding operations limits of zero discharge, with regard to the pollutants of concern.

Supporting data are available from 1972 to 2009. DEQ carried out TMDL-specific monitoring from 2002 to 2006. DEQ analyzed this data during 2004 to 2010.

Chapter 3 of this document is a water quality management plan that describes DEQ's expectations for planning and improvements by the designated participants. DEQ calls on these implementing organizations to submit water quality plans addressing TMDLs, generally within 18 months of the date of TMDL issuance. The designated participants include the Oregon Department of Agriculture, U.S. Forest Service (Umatilla, Malheur, Wallowa-Whitman and Ochoco National Forests), Oregon Department of Forestry, U.S. Bureau of Land Management, specified counties and cities and other pollution control managers.

Acknowledgements

Volunteers and individuals in numerous organizations have supported this assessment with thoughtful input and by providing discussion venues, monitoring information and knowledge of the John Day Basin. We are grateful for the guidance and contributions from so many, including community residents and members of natural resource agencies, local government, Tribes, watershed groups, permittees, various associations, media, educators and researchers. In particular, the Department acknowledges the abundance of effort towards stream restoration and protection that is occurring throughout the Basin – a testimony of watershed stewardship initiative.

Through eight years of monitoring, planning and document development, we have received input from a diversity of stakeholders. We send our thanks to: citizens, County Commissioners and planners, City officials and staff, farmers, ranchers, Agricultural Planning Local Management Agencies, the Confederated Tribes of the Warm Springs and Umatilla Indian Reservations, Burns-Paiute Tribe, For the Sake of the Salmon, Grant County Farm Bureau, the Oregon Farm Bureau, the Oregon Wheat League, Wild Salmon Center, Friends of Bates, the Oregon Cattlemen's Association, Watershed Councils, Soil and Water Conservation Districts, Oregon Natural Desert Association, Eastern Oregon Mining Association, Oregon State University, Lower John Day Basin Work Group, Salmon Stronghold, Upper Middle Fork Working Group, Oregon Trout, Native Fish Society, Oregon Water Trust (the Freshwater Trust); Oregon Paleo Lands Institute; Blue Mountain Resource, Conservation and Development Area; Mid-Columbia Economic Development District, National Policy Consensus Center, The Sonoran Group, the Nature Conservancy, the John Day Basin Trust, the four National Forests in the Basin (Ochoco, Umatilla, Malheur and Wallowa-Whitman National Forests), Prineville District Bureau of Land Management, US Environmental Protection Agency, NOAA Fisheries, US Department of Fish and Wildlife, US Bureau of Reclamation, John Day Fossil Beds National Monument, US Natural Resource Conservation Service; and Oregon Departments of Agriculture, Water Resources, Fish and Wildlife, Parks and Recreation, Transportation, Forestry, Geology and Mineral Industries, State Lands and Oregon Watershed Enhancement Board.

This list is not exhaustive and continues to grow. We look forward to ongoing collaboration in the John Day Basin, in natural resource protection and enhancement.

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1.0 INTRODUCTION

1.1 TMDL Purpose and Background

Waters of the State of Oregon are monitored by the DEQ and other organizations. This information is used to determine whether water quality standards are met, and consequently, whether beneficial uses of waters are fully supported. Section 303(d) of the Clean Water Act (CWA, 1977) calls for a list of *water quality limited* waters. The term *water quality limited* is applied to streams, lakes and estuaries where treatment requirements are met where applicable, and violations of State water quality standards continue to occur. With a few exceptions, such as in situations where violations are due solely to natural causes, the State must establish *a TMDL* for any water body designated as *water quality limited*. DEQ is responsible for assessing data, compiling the 303(d) list and developing TMDLs. Both the list and TMDLs are submitted to EPA for approval.

Water quality standards are designed to protect all designated beneficial uses of waters of the state including recreation, drinking water supply and fisheries. TMDLs establish the maximum level of pollutant allowable in order to meet water quality standards.

The term *loading capacity* is foundational to understanding TMDLs. Loading capacity (LC) is defined as "the greatest amount of loading that a water body can receive without violating water quality standards" [OAR 340-041-0002(31)]. The LC is allocated to point, nonpoint, background, and future sources of pollution, along with a margin of safety (MOS) to account for uncertainty.

Uncertainty and natural pollutant sources are accounted for as well. *Point sources* are those associated with discrete human-made conveyances such as pipes from wastewater treatment plants (WWTP). *Wasteload allocations* are the portions of TMDLs attributed to point sources. *Nonpoint sources* are diffuse sources such as field runoff or excess solar radiation. *Load allocations* are the portions of TMDLs attributed to nonpoint sources, either natural or human. Where feasible, the natural and human-related components are delineated. TMDLs are implemented via water quality management plans (WQMP) or administrative rules and procedures and, for point sources, permits issued through the National Pollutant Discharge Elimination System (NPDES) program.

The data review and analysis contained in this document summarizes information currently available regarding water quality in the John Day Basin. Data from many sources served as the basis of establishing the TMDLs. The allocations will be used to directly set limits on point source discharges, and serve as objectives for nonpoint source water quality protection and restoration. The WQMP describes existing programs, lays out planning goals for TMDL implementation, and is included with the TMDL documentation. The TMDL assessment will be used as a benchmark of water quality and landscape conditions that currently exist. This provides a baseline to assess future trends and effectiveness of planned water quality improvement efforts.

Waterbodies in the John Day Basin have been listed as water quality limited for several indicators. This document describes the development and components of TMDLs for the associated pollutants of concern.

1.1.1 Document Structure and TMDL Process

Chapter 1 describes the physical and cultural Basin as well as the TMDL process, water quality concerns, facilities and existing permits. **Chapter 2** of this document lays out the TMDLs, addressing stream temperature, dissolved oxygen and bacteria. **Chapter 2** is organized based on the list of elements in Oregon TMDLs according to rule (OAR 340-042). A checklist prepared by the US Environmental Protection Agency (EPA, TMDL Review Guidelines, 2002) provides further guidance for TMDL content.

Table 1.1-1 identifies the relationship between the Oregon Administrative Rule requirements and the elements contained in the EPA checklist. The John Day Basin TMDLs will be implemented through the WQMP of **Chapter 3** and through NPDES permits.

The efforts of Designated Management Agencies (DMAs) and other participants are the foundation of TMDL implementation. The WQMP serves as guidance and as a placeholder for the various DMAs, for preparation of sector or source specific TMDL Implementation Plans. This process is further discussed in **Chapter 3**.

TMDL Implementation. As implementation proceeds, the TMDLs will be re-visited as needed to address progress and new information regarding management effectiveness, limitations and water quality processes. The WQMP provides a broad strategy for implementing TMDL allocations. The WQMP is included with the TMDL package submitted to US EPA. Such submissions serve to update the State's continuous planning process for water quality. As stated in **Section 1.3**, TMDLs are reviewed periodically, and updated as more information becomes available, or if correction is needed.

Table 1.1-1. Relationship between State and Federal identification of key TMDL elements

Oregon Administrative Rule (340-042)	EPA Checklist
(a) Name and Location	Scope of TMDL
(b) Pollutant Identification	Applicable Water Quality Standards and Numeric Targets
(c) Water Quality Standards and Beneficial Uses	
(d) Loading Capacity	Loading Capacity
(e) Excess Load	
(f) Sources or Source Categories	
(g) Wasteload Allocations	Wasteload Allocations
(h) Load Allocations	Load Allocations
(i) Margin of Safety	Margin of Safety
(j) Seasonal Variation	Seasonal Variation
(k) Reserve Capacity	
(l)(j) Reasonable Assurance*	Reasonable Assurance (if wasteload allocations depend on load allocations)
OAR 340-042-0050 Public Participation	Public Participation

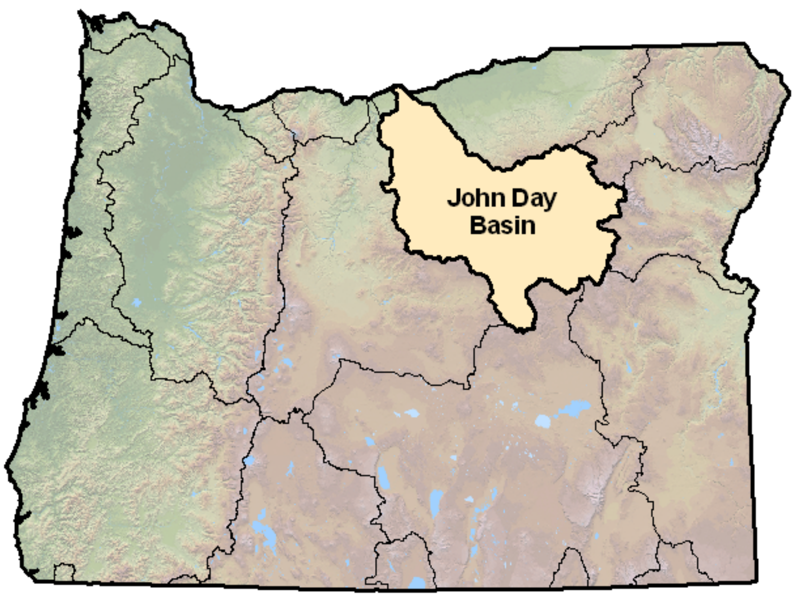
*in Water Quality Management Plan

1.2 Scope of TMDL

1.2.1 Geographic Scope

The TMDLs herein address the John Day Basin [Hydrologic Unit Code (HUC) 170702] including all current 303(d) pollutant listings in the Basin 2004/2006 303(d) list except for the sedimentation listings (as explained in **Sections 1.2.3** and **1.2.4**). **Figure 1.2-1** indicates the location of the John Day Basin. Wasteload allocations address all point sources of concern in the Basin. The load allocations of this document are applicable across large areas of the Basin. The spatial applicability of each load allocation is described in **Chapter 2**, in the sections pertaining to each pollutant category. The WQMP addresses all TMDL allocations throughout the entire Basin.

Figure 1.2-1. John Day Basin location



1.2.2 Water Quality Impairment and 303(d) Listings

The John Day Basin 303(d) listings are mapped in **Figure 1.2-2** through **Figure 1.2-6**. These are from the 2004/2006 list, which is the most current edition at the time this document was written. The listings for the John Day are for temperature, bacteria, dissolved oxygen, sedimentation and biological criteria; all applicable to streams or rivers. Temperature is the most widespread concern identified.

Much of the temperature assessment of this document was carried out in metric or international units and temperature inputs and outputs are typically in degrees Celsius (ºC). **Table 1.2-1** is included here to assist in translation. In the following **Table 1.2-2**, temperatures followed by 'C' are in degrees Celsius. **Chapter 2** utilizes Celsius units as well.

For each impaired stream segment, the criteria applied and stream name are listed in **Table 1.2-2** through **Table 1.2-6**. The tables organize information by parameter (water quality indicator, e.g., temperature or bacteria) and by Basin. For the John Day Basin, the term 'crosses subbasins' refers to listed mainstem segment(s) that cross the subbasin boundary near North Fork mouth. Further details are available in the Department's database: http://www.deq.state.or.us/wq/assessment/rpt0406/search.asp.

Counting Stream Segments

DEQ tracks completed TMDLs using the method established for a Consent Decree between the US EPA and Northwest Environmental Defense Center (John R. Churchill, and Northwest Environmental Advocates, October 17, 2000). The Consent Decree lists the cumulative number of TMDLs to be established through 2010. As per the Consent Decree, the John Day River Basin TMDL document addresses the completion of 135 TMDLs (**Table 1.2-7**). This number would change to 130 if the biological condition were not considered (not a pollutant TMDL). EPA uses a different method when reporting the number of completed TMDLs to the plaintiff. According to current EPA policy on counting TMDLs, the John Day River Basin TMDL addresses 122 TMDLs (**Table 1.2-8**).

Human and Ecological Concerns Related to 303(d) listings

The temperature standard is based on fisheries as the most sensitive beneficial use of waters of the State. Cold-water fish such as salmon and trout are particularly sensitive to temperature. As discussed in **Section 2.1**, substantial stream heating occurs each year due to human-related landscape modifications. Dissolved oxygen is also of critical importance to fish health. Low dissolved oxygen is lethal to fish at any life stage, and available oxygen is particularly important during incubation and hatching. Healthy concentrations of dissolved oxygen are difficult to maintain at high temperatures and dissolved oxygen concentrations range to dangerously low levels in the presence of excess algae associated with high heat and nutrient loading. Excess fine sediment in streambeds leads to unsuitable spawning grounds, also jeopardizing fish populations. Fine sediment loading that exceeds a stream's carrying capacity tends to cause widening and shallowing of channels, further contributing to stream solar heating. Regarding bacteria, the most sensitive beneficial uses are drinking water and water contact recreation. The *E. coli* species of coliform bacteria is an indicator of the potential presence of human pathogens from fecal material. Lastly, the biological criterion addresses the abundance and diversity of aquatic organisms including insects. Aquatic insects are a key component of the food chain supporting fish and other species, and serve as effective indicators of a stream's overall biological condition.

Figure 1.2-2. Map of temperature 303(d) listings (2004/2006)

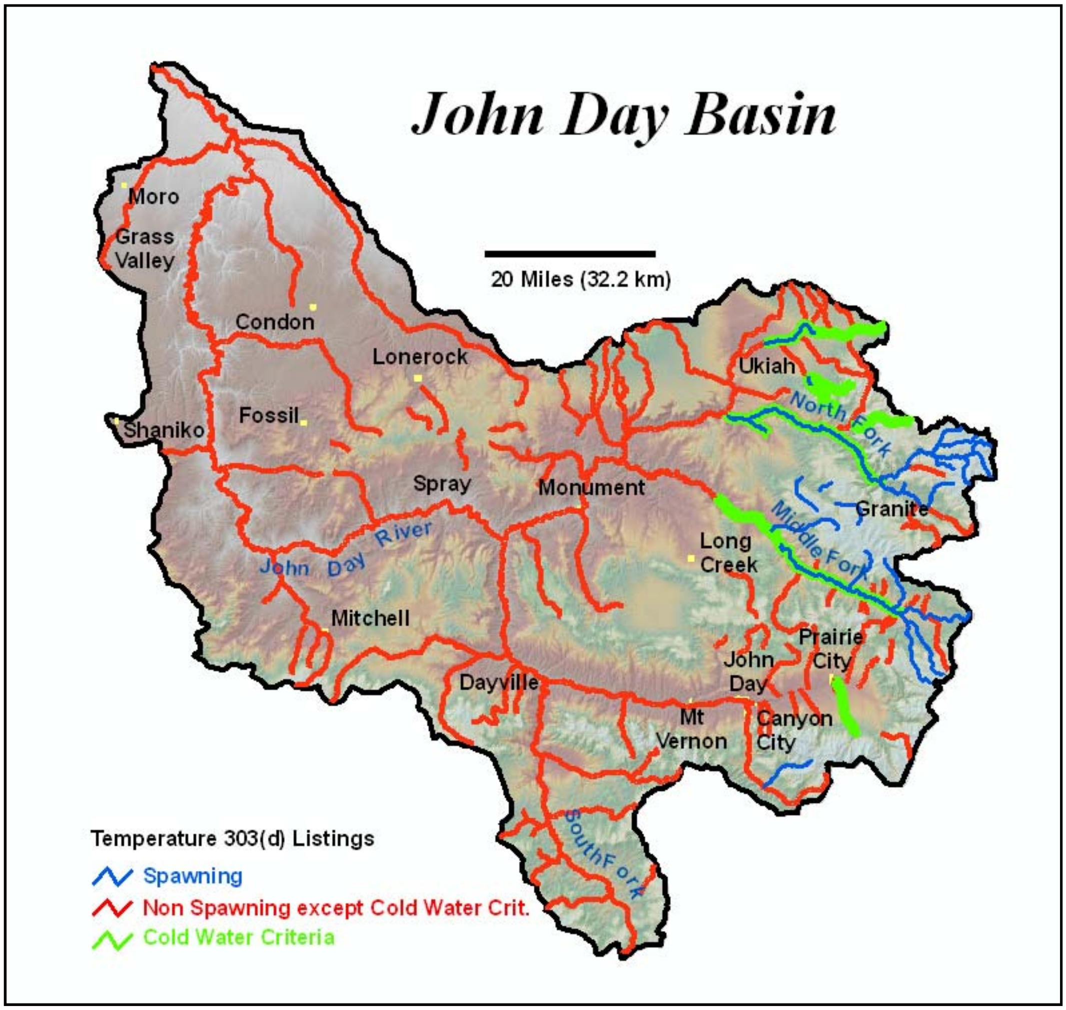


Figure 1.2-3. Map of dissolved oxygen 303(d) listings (2004/2006)

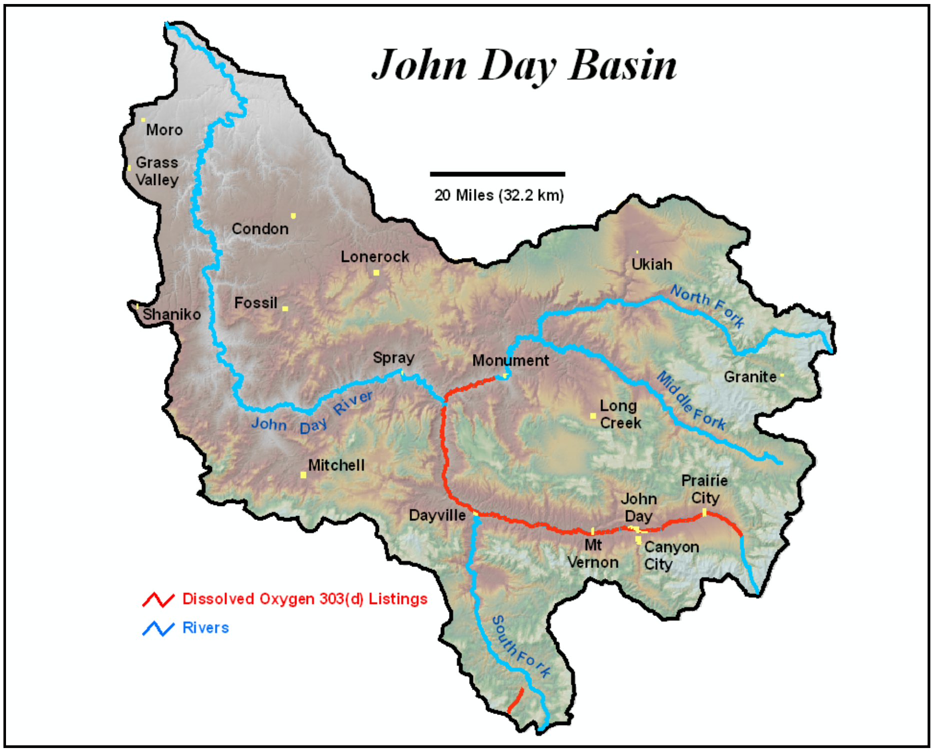


Figure 1.2-4. Map of bacteria 303(d) listings (2004/2006)

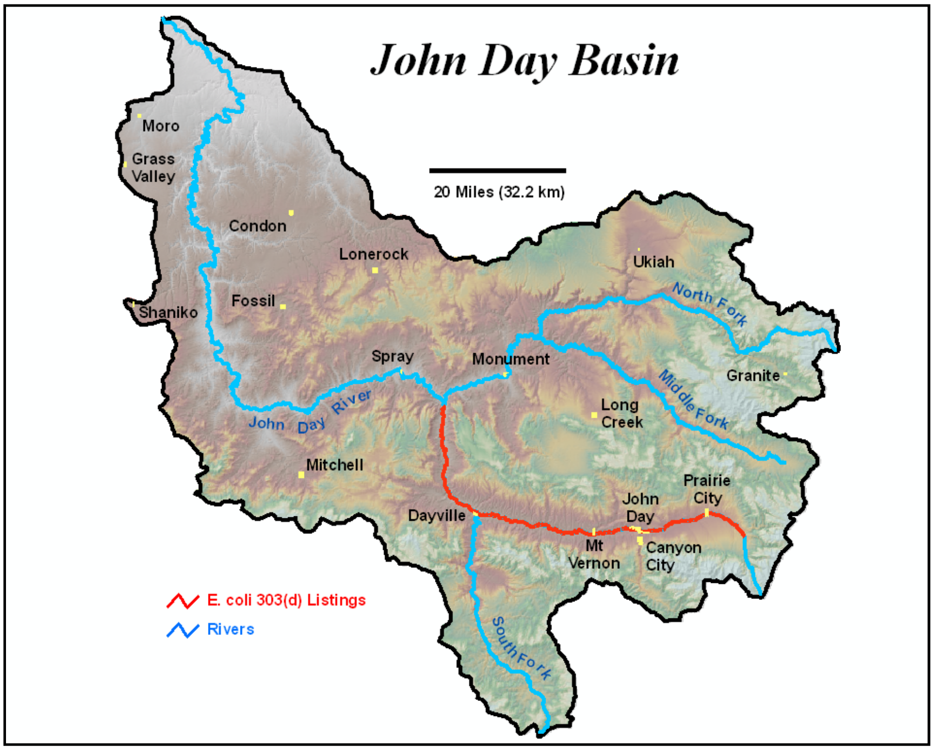


Figure 1.2-5. Map of sedimentation 303(d) listings (2004/2006)

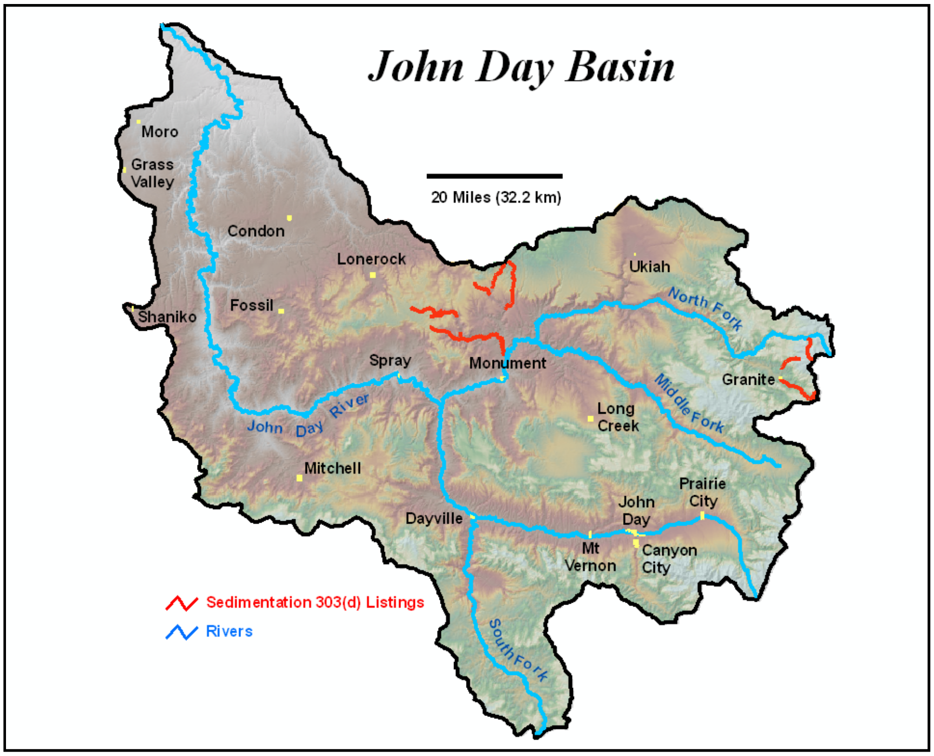
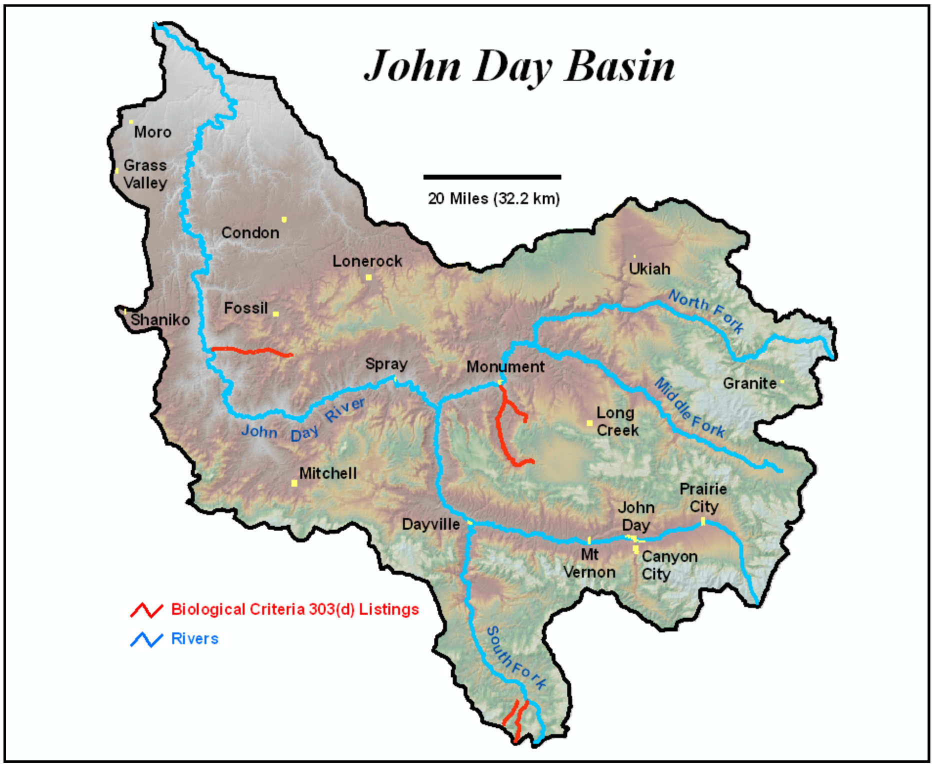


Figure 1.2-6. Map of biological criterion 303(d) listings (2004/2006)



Much of the temperature assessment of this document was carried out in metric or international units and temperature inputs and outputs are typically in degrees Celsius (ºC). **Table 1.2-1** is included here to assist in translation. In the following **Table 1.2-2**, temperatures followed by 'C' are in degrees Celsius. **Chapter 2** utilizes Celsius units as well.

Table 1.2-1. Celsius to Fahrenheit conversion table for selected temperatures

Celsius	Fahrenheit
0.00	32.00
0.10	32.18
0.20	32.36
0.30	32.54
0.50	32.90
1.00	33.80
10.00	50.00
12.00	53.60
12.78	55.00
13.00	55.40
16.00	60.80
17.78	64.00
18.00	64.40
20.00	68.00
21.00	69.80
22.00	71.60
23.00	73.40
24.00	75.20
25.00	77.00
26.00	78.80
27.00	80.60
28.00	82.40
29.00	84.20
30.00	86.00

Table 1.2-2. Temperature 303(d) listings (2004/2006)

Temperature					
Watershed (USGS 4th Field Name)	**Criteria**	**Water Body Name**	**Beginning River Mile**	**Ending River Mile**	**Record ID**
CROSSES SUBBASINS	Salmon and steelhead migration corridors: 20.0 degrees Celsius 7-day-average maximum	John Day River	0.4	182	12719
CROSSES SUBBASINS	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	John Day River	182	243.7	12720
LOWER JOHN DAY	Rearing: 17.8 C	Bear Creek	0	4.6	1487
LOWER JOHN DAY	Rearing: 17.8 C	Bridge Creek	0	28.7	1491
LOWER JOHN DAY	Rearing: 17.8 C	Gable Creek	0	7.7	1499
LOWER JOHN DAY	Rearing: 17.8 C	Grass Valley Canyon	0	39.8	1501
LOWER JOHN DAY	Rearing: 17.8 C	Henry Creek	0	7.1	1504
LOWER JOHN DAY	Rearing: 17.8 C	Nelson Creek	0	5.7	1510
LOWER JOHN DAY	Rearing: 17.8 C	Sorefoot Creek	0	7.5	1521
LOWER JOHN DAY	Rearing: 17.8 C	Stahl Canyon	0	5.7	1522
LOWER JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Brown Creek	0	9.5	12675
LOWER JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Hay Creek	0	24.8	12699
LOWER JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Pine Creek	0	15.8	12704
LOWER JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Rock Creek	0	79.2	12701
LOWER JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Service Creek	0	11.3	12681
LOWER JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Straw Fork	0	3.4	12690

LOWER JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Thirtymile Creek	0	39.4	12706
MIDDLE FORK JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	Big Creek	0	11.6	12630
MIDDLE FORK JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	Clear Creek	0	12.7	12602
MIDDLE FORK JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	Dry Fork Clear Creek	0	11	12600
MIDDLE FORK JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	Granite Boulder Creek	0	8.1	12613
MIDDLE FORK JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	Middle Fork John Day River	65.8	71.1	12651
MIDDLE FORK JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	Summit Creek	0	8.6	12598
MIDDLE FORK JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	Vinegar Creek	0	9.4	12605
MIDDLE FORK JOHN DAY	Core cold water habitat: 16.0 degrees Celsius 7-day-average maximum	Middle Fork John Day River	25.2	65.8	12650
MIDDLE FORK JOHN DAY	Rearing: 17.8 C	Camp Creek	0	15.6	1462
MIDDLE FORK JOHN DAY	Rearing: 17.8 C	Caribou Creek	0	3.6	1463
MIDDLE FORK JOHN DAY	Rearing: 17.8 C	Coyote Creek	0	2.5	1914
MIDDLE FORK JOHN DAY	Rearing: 17.8 C	Crawford Creek	0	3.5	1466
MIDDLE FORK JOHN DAY	Rearing: 17.8 C	Davis Creek	0	6.8	1467
MIDDLE FORK JOHN DAY	Rearing: 17.8 C	Little Boulder Creek	0	2.1	1458
MIDDLE FORK JOHN DAY	Rearing: 17.8 C	Little Butte Creek	0	2.6	1461
MIDDLE FORK JOHN DAY	Rearing: 17.8 C	Lunch Creek	0	4.1	1474
MIDDLE FORK JOHN DAY	Rearing: 17.8 C	Mill Creek	0	3.1	1475
MIDDLE FORK JOHN DAY	Rearing: 17.8 C	Placer Gulch	0	4.2	1478
MIDDLE FORK JOHN DAY	Rearing: 17.8 C	Ragged Creek	0	4.1	1479
MIDDLE FORK JOHN DAY	Rearing: 17.8 C	Squaw Creek	0	9.4	1481
MIDDLE FORK JOHN DAY	Rearing: 17.8 C		0	2.4	1459

MIDDLE FORK JOHN DAY	Salmon and steelhead spawning: 13.0 degrees Celsius 7-day-average maximum	Middle Fork John Day River	41.4	49.6	13358
MIDDLE FORK JOHN DAY	Salmon and steelhead spawning: 13.0 degrees Celsius 7-day-average maximum	Middle Fork John Day River	49.6	65.8	13359
MIDDLE FORK JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Long Creek	25.6	36.7	12644
MIDDLE FORK JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Middle Fork John Day River	0	25.2	12649
NORTH FORK JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	Baldy Creek	0	5	12593
NORTH FORK JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	Buck Creek	0	1.6	12601
NORTH FORK JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	Crawfish Creek	0	5.3	12590
NORTH FORK JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	Granite Creek	0	16.3	12606
NORTH FORK JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	Junkens Creek	0	7	12625
NORTH FORK JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	North Fork Desolation Creek	0	6.6	12616
NORTH FORK JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	North Fork John Day River	86.3	111.2	12666
NORTH FORK JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	North Trail Creek	0	5.1	12595
NORTH FORK JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	Onion Creek	0	4.5	12596
NORTH FORK JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	South Trail Creek	0	6.6	12594
NORTH FORK JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	Sponge Creek	0	2.7	12618
NORTH FORK JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	Trail Creek	0	1.9	12597
NORTH FORK JOHN DAY	Bull Trout: 10.0 C	Crane Creek	0	5.9	1415

NORTH FORK JOHN DAY	Core cold water habitat: 16.0 degrees Celsius 7-day-average maximum	Camas Creek	15.5	36.7	12636
NORTH FORK JOHN DAY	Core cold water habitat: 16.0 degrees Celsius 7-day-average maximum	Desolation Creek	0	3.8	12633
NORTH FORK JOHN DAY	Core cold water habitat: 16.0 degrees Celsius 7-day-average maximum	Meadow Creek	0	10.4	12610
NORTH FORK JOHN DAY	Core cold water habitat: 16.0 degrees Celsius 7-day-average maximum	North Fork Cable Creek	0	7.5	12622
NORTH FORK JOHN DAY	Core cold water habitat: 16.0 degrees Celsius 7-day-average maximum	North Fork John Day River	56	86.3	12665
NORTH FORK JOHN DAY	Core cold water habitat: 16.0 degrees Celsius 7-day-average maximum	South Fork Cable Creek	0	8.4	12621
NORTH FORK JOHN DAY	Rearing: 17.8 C	Bear Wallow Creek	0	7.4	1404
NORTH FORK JOHN DAY	Rearing: 17.8 C	Beaver Creek	0	6.1	1403
NORTH FORK JOHN DAY	Rearing: 17.8 C	Big Creek	0	10.7	1405
NORTH FORK JOHN DAY	Rearing: 17.8 C	Bowman Creek	0	6.9	1407
NORTH FORK JOHN DAY	Rearing: 17.8 C	Bridge Creek	0	9	1408
NORTH FORK JOHN DAY	Rearing: 17.8 C	Bull Run Creek	0	9.3	1409
NORTH FORK JOHN DAY	Rearing: 17.8 C	Cable Creek	0	7.1	1410
NORTH FORK JOHN DAY	Rearing: 17.8 C	Clear Creek	0	7.1	1412
NORTH FORK JOHN DAY	Rearing: 17.8 C	Ditch Creek	0	19.5	1422
NORTH FORK JOHN DAY	Rearing: 17.8 C	Fivemile Creek	0	21.3	1424
NORTH FORK JOHN DAY	Rearing: 17.8 C	Frazier Creek	0	6.2	1426
NORTH FORK JOHN DAY	Rearing: 17.8 C	Hidaway Creek	0	16.2	1429
NORTH FORK JOHN DAY	Rearing: 17.8 C	Lane Creek	0	7.1	1435
NORTH FORK JOHN DAY	Rearing: 17.8 C	Mallory Creek	0	14.3	1436
NORTH FORK JOHN DAY	Rearing: 17.8 C	Owens Creek	0	14.8	1439
NORTH FORK JOHN DAY	Rearing: 17.8 C	Potamus Creek	0	18.4	1442
NORTH FORK JOHN DAY	Rearing: 17.8 C	Rancheria Creek	0	5.1	1443
NORTH FORK JOHN DAY	Rearing: 17.8 C	Skookum Creek	0	12.4	1445

NORTH FORK JOHN DAY	Rearing: 17.8 C	Stalder Creek	0	4.1	1446
NORTH FORK JOHN DAY	Rearing: 17.8 C	Swale Creek	0	11.1	1447
NORTH FORK JOHN DAY	Rearing: 17.8 C	Wilson Creek	0	10.7	1454
NORTH FORK JOHN DAY	Salmon and steelhead spawning: 13.0 degrees Celsius 7-day-average maximum	Camas Creek	15.5	25	13357
NORTH FORK JOHN DAY	Salmon and steelhead spawning: 13.0 degrees Celsius 7-day-average maximum	Desolation Creek	0	3.5	13356
NORTH FORK JOHN DAY	Salmon and steelhead spawning: 13.0 degrees Celsius 7-day-average maximum	North Fork John Day River	56	59.6	13360
NORTH FORK JOHN DAY	Salmon and steelhead spawning: 13.0 degrees Celsius 7-day-average maximum	North Fork John Day River	59.6	86.3	13361
NORTH FORK JOHN DAY	Salmon and steelhead spawning: 13.0 degrees Celsius 7-day-average maximum	South Fork Cable Creek	0	1.5	13354
NORTH FORK JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Big Wall Creek	0	21.3	12653
NORTH FORK JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Camas Creek	0	15.5	12635
NORTH FORK JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Cottonwood Creek	0	22.5	12654
NORTH FORK JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Indian Creek	0	5.4	12656
NORTH FORK JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	North Fork John Day River	0	56	12664
NORTH FORK JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Rudio Creek	0	16.8	12662
UPPER JOHN DAY	Bull trout spawning and juvenile rearing: 12.0 degrees Celsius 7-day-average maximum	East Fork Canyon Creek	0	9.2	12632
UPPER JOHN DAY	Bull Trout: 10.0 C	Rail Creek	0	7.1	1385
UPPER JOHN DAY	Core cold water habitat: 16.0 degrees Celsius 7-day-average maximum	Strawberry Creek	0	8.6	12617
UPPER JOHN DAY	Rearing: 17.8 C	Badger Creek	0	9	1330
UPPER JOHN DAY	Rearing: 17.8 C	Battle Creek	0	7.3	1331

UPPER JOHN DAY	Rearing: 17.8 C	Bear Creek	0	10.1	1332
UPPER JOHN DAY	Rearing: 17.8 C	Canyon Creek	0	27.5	1342
UPPER JOHN DAY	Rearing: 17.8 C	Cottonwood Creek	0	16.4	1345
UPPER JOHN DAY	Rearing: 17.8 C	Dads Creek	0	8.6	1348
UPPER JOHN DAY	Rearing: 17.8 C	Dans Creek	0	6	1349
UPPER JOHN DAY	Rearing: 17.8 C	Deer Creek	0	11.9	1351
UPPER JOHN DAY	Rearing: 17.8 C	Dog Creek	0	5.5	1355
UPPER JOHN DAY	Rearing: 17.8 C	Grub Creek	0	13.5	1363
UPPER JOHN DAY	Rearing: 17.8 C	Indian Creek	0	6.1	1928
UPPER JOHN DAY	Rearing: 17.8 C	Little Pine Creek	0	5.1	1381
UPPER JOHN DAY	Rearing: 17.8 C	McClellan Creek	0	6.4	1376
UPPER JOHN DAY	Rearing: 17.8 C	Mountain Creek	0	21.7	1378
UPPER JOHN DAY	Rearing: 17.8 C	Murderers Creek	0	24.7	1379
UPPER JOHN DAY	Rearing: 17.8 C	North Fork Deer Creek	0	4.2	1352
UPPER JOHN DAY	Rearing: 17.8 C	Pine Creek	0	3.8	1382
UPPER JOHN DAY	Rearing: 17.8 C	Slyfe Creek	0	6	1389
UPPER JOHN DAY	Rearing: 17.8 C	Sunflower Creek	0	8.7	1393
UPPER JOHN DAY	Rearing: 17.8 C	Tinker Creek	0	4.6	1394
UPPER JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Ennis Creek	0	2.8	12639
UPPER JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Fields Creek	0	10.2	12648
UPPER JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Flat Creek	0	11.8	12652
UPPER JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Grasshopper Creek	0	5.3	12646
UPPER JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Murray Creek	0	1.8	12661
UPPER JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Pine Creek	0	8	12655

UPPER JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Porcupine Creek	0	2.1	12660
UPPER JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Rock Creek	0	24.8	12663
UPPER JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	South Fork John Day River	0	57.4	12658
UPPER JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Spring Creek	0	3	12657
UPPER JOHN DAY	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Tex Creek	0	6.9	12647

Table 1.2-3. Dissolved oxygen 303(d) listings (2004/2006)

Dissolved Oxygen						
Watershed (USGS 4th Field Name)	Criteria	Water Body Name	Season	Beginning River Mile	Ending River Mile	Record ID
CROSSES SUBBASINS	Cold water (Added to database 1998)	John Day River	Spring/Summer	243.7	265	1538
CROSSES SUBBASINS	Cool water (added to database in 2004, replaces part of earlier listing)	John Day River	Year Around (Non-spawning)	182	243.7	11877
NORTH FORK JOHN DAY	Spawning (added to database in 2004)	North Fork John Day River	January 1 - May 15	0	13.1	20879
UPPER JOHN DAY	Spawning (added to database in 2002)	Utley Creek	October 1 - June 30	0	5.5	9100

Table 1.2-4. Bacteria 303(d) listings (2004/2006)

Bacteria						
Watershed (USGS 4th Field Name)	Parameter/Criteria	Water Body Name		Beginning River Mile	Ending River Mile	Record ID
CROSSES SUBBASINS	E. Coli/Single Sample Criteria (added to database in 2004)	John Day River	Summer	182	265	14669
CROSSES SUBBASINS	Fecal Coliform/Single Sample Criteria (prior to E. coli-based standard)	John Day River	Summer	182	265	1908

Table 1.2-5. Sedimentation 303(d) listings (2004/2006)

Sedimentation					
Watershed (USGS 4th Field Name)	Criteria	Water Body Name	Beginning River Mile	Ending River Mile	Record ID
NORTH FORK JOHN DAY	Narrative	Alder Creek	0	5.5	1733
NORTH FORK JOHN DAY	Narrative	Baldy Creek	0	5	1936
NORTH FORK JOHN DAY	Narrative	Big Wall Creek	0	21.3	1799
NORTH FORK JOHN DAY	Narrative	Bull Run Creek	0	9.3	1932
NORTH FORK JOHN DAY	Narrative	Granite Creek	11.2	16.2	1930
NORTH FORK JOHN DAY	Narrative	Hog Creek	0	4.1	1731
NORTH FORK JOHN DAY	Narrative	Porter Creek	0	7.4	1732
NORTH FORK JOHN DAY	Narrative	Swale Creek	0	11.1	1734
NORTH FORK JOHN DAY	Narrative	Wilson Creek	0	10.7	1735

Table 1.2-6. Biological criterion 303(d) listings (2004/2006)

Biological Criteria					
Watershed (USGS 4th Field Name)	Criteria	Water Body Name	Beginning River Mile	Ending River Mile	Record ID
LOWER JOHN DAY	Narrative	Pine Creek	0	15.8	1534
NORTH FORK JOHN DAY	Narrative	Cottonwood Creek	0	22.5	1533
NORTH FORK JOHN DAY	Narrative	East Fork Cottonwood Creek	0	6.5	1532
UPPER JOHN DAY	Narrative	Corral Creek	0	8.7	1530
UPPER JOHN DAY	Narrative	Utley Creek	0	5.5	1531

Table 1.2-7. John Day River Basin 303(d) Listings Addressed in this TMD: DEQ Method

Parameter	Criteria	North Fork Subbasin		Middle Fork Subbasin		Lower Subbasin		Upper Subbasin		Crosses Subbasins		Total	
		Miles	Segments	Miles	Segments	Miles	Segments	Miles	Segments	Miles	Segments	Miles	Segments
Biological Criteria	Narrative	29.0	2			15.8	1	14.2	2			59.0	**5**
	Subtotal	29.0	2.0			15.8	1.0	14.2	2.0			**59.0**	**5**
Bacteria	E. Coli - summer									83.0	1	83.0	1
	Fecal Coliform - summer									83.0	1	83.0	1
	Subtotal									**166.0**	**2**	**166.0**	**2**
Dissolved Oxygen	Cool water									61.7	1	61.7	1
	Subtotal									**61.7**	**1**	**61.7**	**1**
Temperature	Bull Trout	93.4	13	66.7	7			16.3	2			176.4	22
	Spawning	44.8	5	24.4	2							69.2	7
	Core cold water habitat	81.6	6	40.6	1			8.6	1			130.8	8
	Rearing	362.3	27	100.3	15	290.2	15	341.2	31	61.7	1	1155.7	89
	Migration corridors									181.6	1	181.6	1
	Subtotal	**582.1**	**51**	**232.0**	**25**	**290.2**	**15**	**366.1**	**34**	**243.3**	**2**	**1713.7**	**127**
Mileage Total		**611.1**		**232.0**		**306.0**		**380.3**		**471.0**		**2000.4**	
Segment Total			**53**		**25**		**16**		**36**		**5**		**135**

Table 1.2-8. John Day River Basin TMDL Listings Addressed: EPA Method

Parameter	North Fork Subbasin	Middle Fork Subbasin	Lower Subbasin	Upper Subbasin	Crosses Subbasins	Total
Bacteria					1	**1**
Dissolved Oxygen					1	**1**
Temperature	46	23	15	34	2	**120**
Segment Sum	46	23	15	34	4	**122**

1.2.3 TMDLs in this Document

This document includes TMDLs to address the 303(d) listed impairment for temperature, bacteria, biological criterion and dissolved oxygen.

1.2.4 Other Water Quality and Related Indicators

In addition to the four TMDL constituents listed in the previous section, streams in the John Day Basin are listed as water quality limited for sedimentation (**Section 1.2.2**). Sedimentation has been co-assessed in parts of the John Day Basin during TMDL monitoring and development. Many measures designed to decrease stream temperature will also address sedimentation. Other fine sediment reduction measures are encouraged as well, however a sedimentation TMDL is not established at this time. The Department is in the process of developing quantitative methods and benchmarks to evaluate sedimentation impairment in Oregon streams. Because this work is not yet complete issuance of a sedimentation TMDL will be postponed until these methods are in place.

1.2.5 Indian Lands

Various Tribal nations have ceded territory or areas of interest within the John Day Basin. These include the Confederated Tribes of the Warm Springs Indian Reservation (CTWSIR), the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and the Burns-Paiute Tribes. Tribes have treaty rights and interests in their traditional homeland, including those relating to natural resources and water quality, such as fishing and subsistence activities. **Figure 1.2-7** is a map showing aggregate inter-Tribal ceded lands, which encompass the John Day Basin (the John Day Basin is entirely within CTWSIR ceded land). The Department appreciates that Tribes are effective proponents of species recovery in the John Day Basin and throughout the Columbia Basin, carrying out restoration and research, monitoring and evaluation in support of protection and restoration of ecological conditions. The CTWSIR and CTUIR natural resource department staff contributed to the TMDL effort with expertise in hydrology, ecology, aquatic biology and monitoring; and provided water quality and habitat data.

The John Day Basin does not include Indian Reservation land. However, off-Reservation Tribal holdings are present in the Basin. For example, the CTWSIR Oxbow and Forrest properties, in the upper Middle Fork and Upper Mainstem watersheds, combine conservation and restoration with ranch management and stewardship.

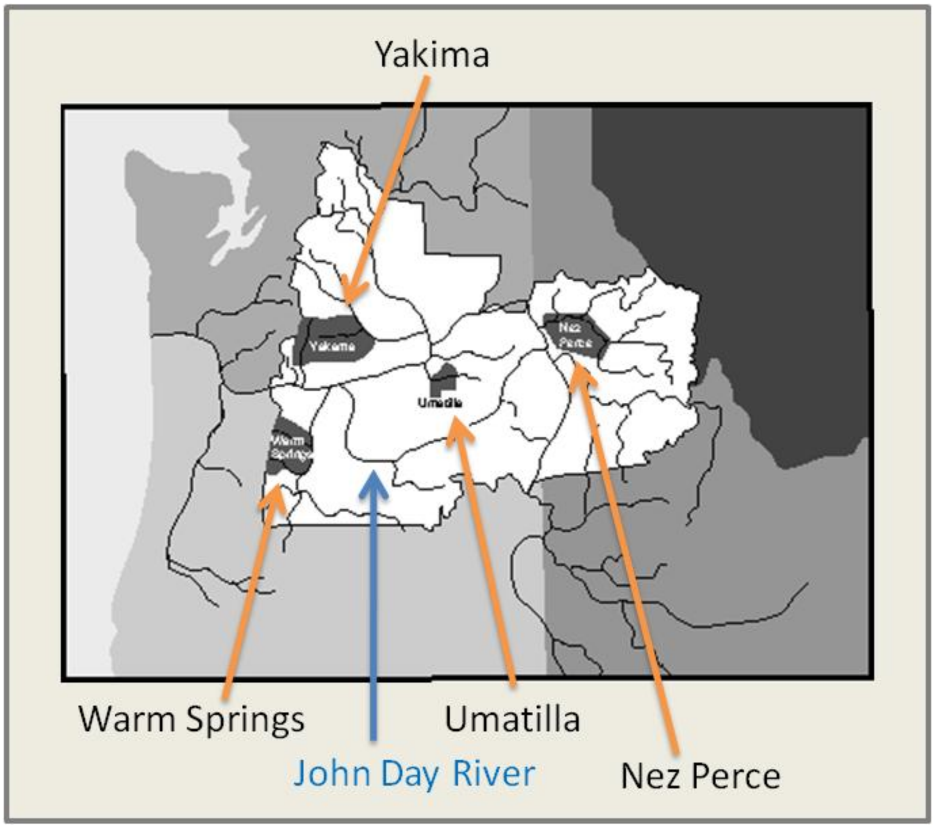
TMDL applicability. In cooperation with the Warm Springs Tribes, the TMDL assessment was developed to include Tribal restoration properties. For example, the temperature TMDL includes existing and potential temperature, flow and shade profiles along the entire Middle Fork and mainstem, crossing Tribal lands. From DEQ's perspective, the load allocations for these areas (the CTWSIR Oxbow, Forrest and Pine Creek properties) serve for informational purposes. The Department views that TMDL implementation is underway in these properties. At some point, further coordination may be beneficial, and DEQ understands that Tribes and EPA may choose to formalize Tribal water quality efforts in relation to TMDLs.

The Oregon Blue Book (http://bluebook.state.or.us/national/tribal/tribal.htm) describes the foundations of Tribal rights and discusses State-Tribal relations:

> Native American tribes represent unique legal entities in the United States and are distinct political communities with extensive powers of self-government. Oregon tribes are separate sovereigns with powers to protect the health, safety and welfare of their members and to govern their lands. This tribal sovereignty predates the existence of the U.S. government and the State of Oregon.
>
> Since 2001, Oregon has operated on a government-to-government relationship with Oregon tribes as directed in ORS 182.162 – 182.168. This statute codifies Executive Order 96-30 signed by Governor Kitzhaber in 1996. Oregon law requires state agencies to develop and implement

policies to include tribes when state agency policies and programs affect tribal interests, and to have a key contact for state/tribal relations to promote communication and positive government-to-government relations.

Figure 1.2-7. Tribal ceded lands
[Columbia River Intertribal Fish Commission (http://www.critfc.org/oldsite/handbook/Partnerships.html#Ceded). Note that the Burns-Paiute Tribes area of interest extends into the John Day Basin as well]



1.3 Implementation and Adaptive Management

The WQMP directs various organizations to undertake planning leading toward TMDL attainment. Designated participants include Oregon Department of Agriculture (ODA), the US Forest Service (USFS, Umatilla National Forest), the Oregon Department of Forestry (ODF), US Bureau of Land Management, Counties, Cities and other representatives of pollution control sources or sectors. Through development of this TMDL, pollutant sources and associated jurisdictions were assessed. **Chapter 3** includes a comprehensive list of designated management agencies and/or designated participants called on to provide TMDL implementation planning. The form of response varies by organization. Some are governed by existing inter-agency agreements. *TMDL Implementation Plan*, specific to land use or water quality authorities, is the general term for nonpoint source TMDL planning documentation called for in the WQMP. Normally a participant's *Implementation Plan* represents an expansion of an existing program. DMAs are expected to respond in accordance with a timeline specified in **Chapter 3** of this document.

The goal of the Clean Water Act and associated Oregon Administrative Rules (OAR) is to ensure that water quality standards are met or that all feasible steps are taken towards achieving the highest quality water attainable. DEQ recognizes that some improvement will require decades to manifest fully, particularly where nonpoint sources are the main concern. To achieve this goal, implementation should commence as soon as possible.

To clarify the Department's expectations, the following principles guide the TMDL process and associated planning and implementation:

- The TMDL process occurs in ongoing cycles, based on implementation effectiveness, the availability of information, new 303(d) listings and the state of understanding of watershed and management processes. DEQ recognizes that TMDL allocation attainment is not always feasible, due to socioeconomic constraints. To the extent possible, the Implementation Plans should identify potential constraints, but should also provide the ability to address those constraints over time as new opportunities arise.
- TMDL targets typically include some amount of uncertainty and estimation. Errors are possible as well. This can influence whether the allocations are realistic. TMDLs are reviewed periodically, and updated as more information becomes available, or if correction is needed. When discovered, errors can be addressed via errata issuance.
- Reduced stream heating often requires minimization of riparian disturbance. That said, the purpose of the TMDL is not to eliminate human activity in riparian areas. It is DEQ's expectation, however, that designated agencies will address how management will achieve the allocations.
- DEQ also recognizes that at various times and locations attainment of estimated natural conditions may be impeded by natural disturbance. The definition of *natural conditions* in rule includes: "…Disturbances from wildfire, floods, earthquakes, volcanic or geothermal activity, wind, insect infestation, diseased vegetation are considered natural conditions" (OAR 340-041-0002(40)).
- TMDLs require reasonable assurance of implementation (EPA, 1998). DEQ envisions that substantial initiative exists to achieve water quality goals in Oregon. Should the need for additional effort emerge, the responsible agency will work with land managers to overcome impediments through education, technical assistance, funding, enforcement or other incentives and support. The implementation of TMDLs and the associated plans are enforceable by DMAs such as state agencies, federal land managers, local government, or ODEQ. For example, Agricultural Water Quality Management Area Plans or Rules for agricultural areas and Forest Practices Act for nonfederal forests are TMDL implementation tools. DMAs or sources specifically named in the TMDL or WQMP as needing to submit a TMDL Implementation Plan may be subject to DEQ enforcement action for failure to submit or receive approval of a TMDL Implementation Plan that was required in the TMDL or WQMP or for failure to implement an approved TMDL Implementation Plan.
- DEQ anticipates that each management agency will monitor and document its progress in implementing the provisions of its Implementation Plan. This information will be provided to DEQ for TMDL review.

- Where implementation of TMDL planning or effectiveness of management techniques is found to be inadequate, DEQ expects management agencies to revise planning or benchmarks to address these deficiencies.

As discussed elsewhere in this document, DEQ emphasizes that watershed protection and restoration is underway in the John Day Basin. The Department recognizes and appreciates the decades-long efforts of landowners, agencies, Watershed Councils, Conservation Districts, Tribes, local government and others in water quality progress and stewardship.

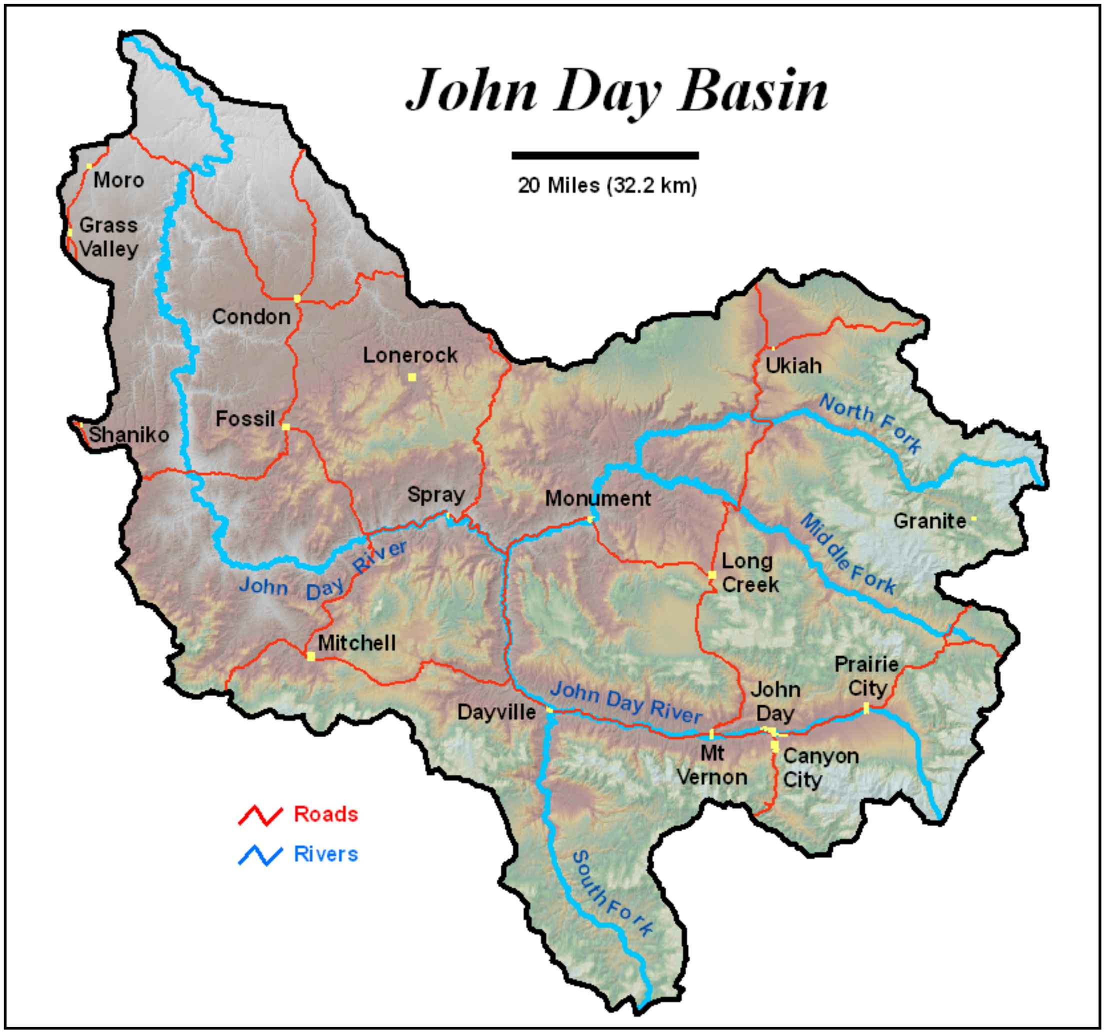
1.4 Basin Background

1.4.1 Physical Geography

1.4.1.1 Topography and Geomorphology

Large mountains form the eastern and southern highlands of the John Day Basin - The Blue, Strawberry, Aldrich and Ochoco Mountains, ranging to just over 9,000 feet (2,750 m) in elevation. The Basin drains to the Columbia River just above the John Day Dam. The lower mainstem dissects the Deschutes-Umatilla Plateau. Basin topography is illustrated in **Figure 1.4-1**, with the principal rivers relevant to this document.

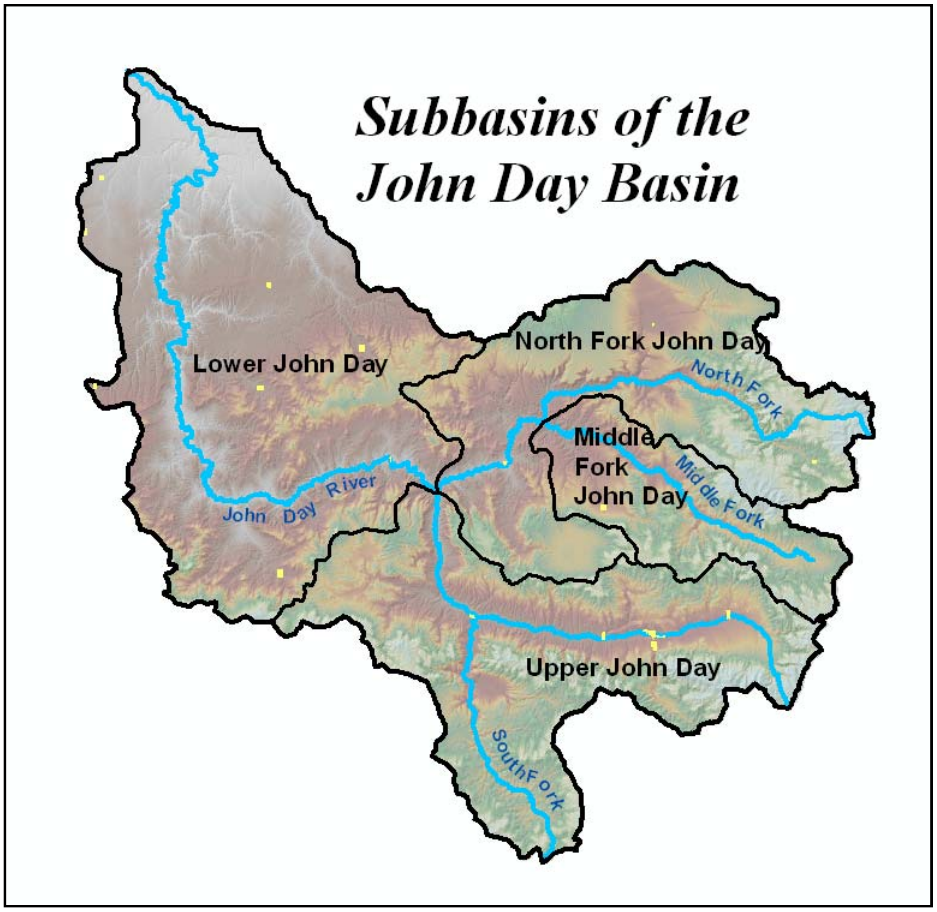
Figure 1.4-1. Basin map with roads, topography and major rivers



The largest rivers in the Basin are the John Day River, and the North, Middle and South Forks, in order of volume. The lengths of these major arteries are 284 miles (457 km), 112 miles (180 km), 76 miles (122 km), 60 miles (97 km), respectively. The John Day River is the largest un-dammed tributary to the Columbia River, in the United States.

The hydrologic unit code (HUC) classification divides the basin into four subbasins as illustrated in **Figure 1.4-2**. The North Fork is distinctive, a narrow and steep-walled valley with greater discharge than the mainstem at their confluence. The lower subbasin has a plateau form, broken by the sinuous valley of the mainstem and its steep-walled tributaries. Much of the North Fork Basin is a plateau as well. The Middle Fork and upper mainstem include the few areas of wide riparian meadow complexes in the basin, though both are interspersed with confined reaches and narrow valley floors. The South Fork drainage area is included in the upper Basin, though in character it is different from the upper mainstem and its other tributaries. It is the largest upper subbasin tributary, and has a much narrower valley than the mainstem. Much of the South Fork valley is trough or v-shaped, with a large mid-section of coniferous riparian area and a relatively arid upper watershed. This contrasts with most of the upper basin streams, which become increasingly steep, forested and wet with increasing elevation.

Figure 1.4-2. Delineation of Subbasins (fourth level HUC, Hydrologic Unit Code system, USGS)



The subbasins of the John Day River drainage, while differing substantially, do have characteristics in common. In much of the basin, channel morphology is strongly influenced by valley form, alluvial fans and large terraces. Each is highly variable in terms of elevation, climate and soil. The major rivers of each are relatively low in gradient through much of their length. Valleys tend to be trough-shaped, with steep slopes separating narrow riparian areas from uplands. The narrow and sometimes meandering valleys often limit channel migration and sinuosity. Basin and subbasin land area is listed in **Table 1.4-1**.

Table 1.4-1. John Day Basin land area by Subbasin

Basin	Total Basin Area (square miles)	Total Basin Area (square kilometers)	Percent of Basin Area
Lower	3,156	8,173	39.7
North Fork	1,851	4,794	23.3
Middle Fork	793	2,055	10.0
Upper	2,141	5,546	27.0
Total	7,941	20,568*	100

Data from USDA Natural Resource Conservation Service (NRCS, 2005)
*7940 square miles

1.4.1.2 Geology

[excerpt from Basin Plan, Columbia - Blue Mountain Resource Conservation and Development Area (CBRCD, 2005)]

The John Day Basin is characterized by diverse landforms ranging from loess-covered plateaus in the lower sections to alpine peaks in the headwaters. Rock assemblages within the John Day Basin include masses of oceanic crust, marine sediments, volcanic materials, ancient river and lake deposits, and recent river and landslide deposits. Major geologic events shaping the Basin include volcanic eruptions, uplifting, faulting and erosion.

Volcanic activity in the form of lava flows, mudflows and ash fall formed and stratified three key formations in the Basin over the course of approximately 37 to 54 million years – the Clarno Formation, John Day Formation, and the Columbia River Basalt Group. The Columbia River Basalt Group, a less-erodible formation, resulted from a series of basalt floods 12 to 19 million years ago. Columbia River basalts are the dominant rocks at elevations below 4000 feet. Igneous rocks are exposed in the higher reaches of the Basin, while the lower subbasin exposures are primarily extrusive rocks, ash and wind-blown loess.

After volcanic activity ceased 10 million years ago, erosion and faulting continued to alter the landscape. The Mascall Formation resulted from waterlain fine volcanic sediments. The Rattlesnake Formation, a thick sequence of sand and gravel, was deposited in the ancestral John Day Valley. A final layer of predominantly unconsolidated silt, sand, and gravel comprises the Quaternary Alluvium.

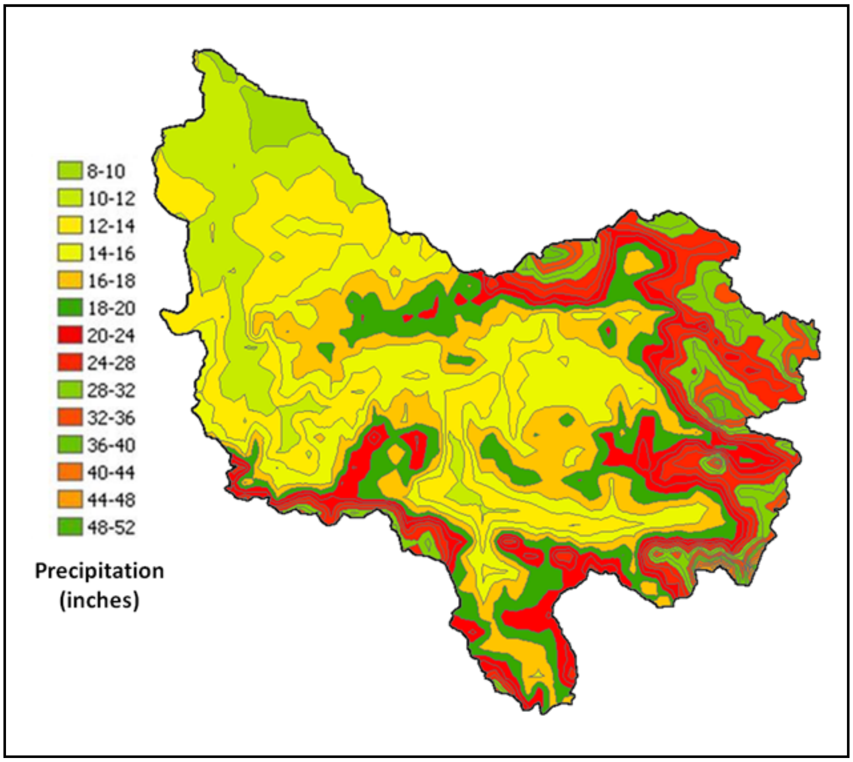
1.4.1.3 Climate

The John Day Basin has a continental climate characterized by low winter and high summer temperatures, low average annual precipitation and dry summers. Rain, snowfall, and temperature regimes vary substantially across the Basin. Climate in the Basin ranges from sub-humid in the upper Basin to semi-arid in the lower subbasin. Most precipitation falls between November and March. Less than 10% of the annual precipitation falls as rain during July and August, usually from sporadic thunderstorms. The upper elevations receive up to 50 inches (127 cm) of precipitation annually, mostly in the form of snow; lower elevations typically receive 12 inches (30.5 cm) or less of annual precipitation. Several feet of snow accumulate in the mountains bordering the Basin to the east and south. See **Figure 1.4-3** for a precipitation map of the Basin. In more general terms, the John Day Basin receives less precipitation than much of the Columbia Basin.

Mean annual temperature is 38° F (3.3 ºC) in the upper Basin and 58° F (14.5 ºC) in the lower Basin. Across the Basin, air temperature varies from sub-zero during winter months to over 100°F (37.8 ºC) during the summer. Inflows of moist Pacific air moderate extreme winter temperatures. The average frost-free period is 50 days in the upper Basin and 200 days in the lower Basin.

The John Day Basin portion of the Deschutes Umatilla Plateau experiences cold winters and hot summers, with moderate night temperatures. Most precipitation is discharged over the Coast Range and Cascade Mountains before reaching the Plateau. Physical features of the area create microclimates that deviate from the general pattern of warmer lower elevations and colder higher elevations. Eastern Oregon's precipitation is highly influenced by elevation.

Figure 1.4-3. Basin annual average precipitation map [1961-1990, (OSU, 1998)]



1.4.1.4 Land Cover

The Basin's dominant vegetation ranges from coniferous forest at higher elevations to perennial grassland at middle elevations to desert shrub-steppe at lower elevations. Riparian habitats are found along the Basin's waterways, both disturbed and relatively intact. Irrigated agriculture is undertaken on many floodplain meadows throughout the Basin, and dry land farming is present to varying degrees. Large wheat farms are common in the lower subbasin and dry land hay is grown in scattered areas throughout the Basin (CBRCD, 2005).

Dramatic differences in plant communities in the Basin are highlighted by (1) presence or absence of conifer forest based on elevation, precipitation and soil, and (2) the difference between riparian and upland assemblages. Riparian vegetation in the higher reaches is a mix of conifer and deciduous trees. In the lower and middle basin, river valley floors are occupied by grasses, sedges, shrubs, alders, large and small willows, cottonwood, juniper and other trees in varying proportions. Cottonwood galleries are still prevalent in valley bottoms, such as along large sections of the upper mainstem above Picture Gorge.

Diminished cottonwood abundance and recruitment has been documented along the Middle Fork (Beshta, 2005).

As part of the estimation of natural conditions for the temperature TMDL, natural potential vegetation was assessed throughout the Basin based on historical accounts, historic photos, and extensive research carried out by the US Forest Service, US BLM and others. This assessment is included as **Appendix C.**

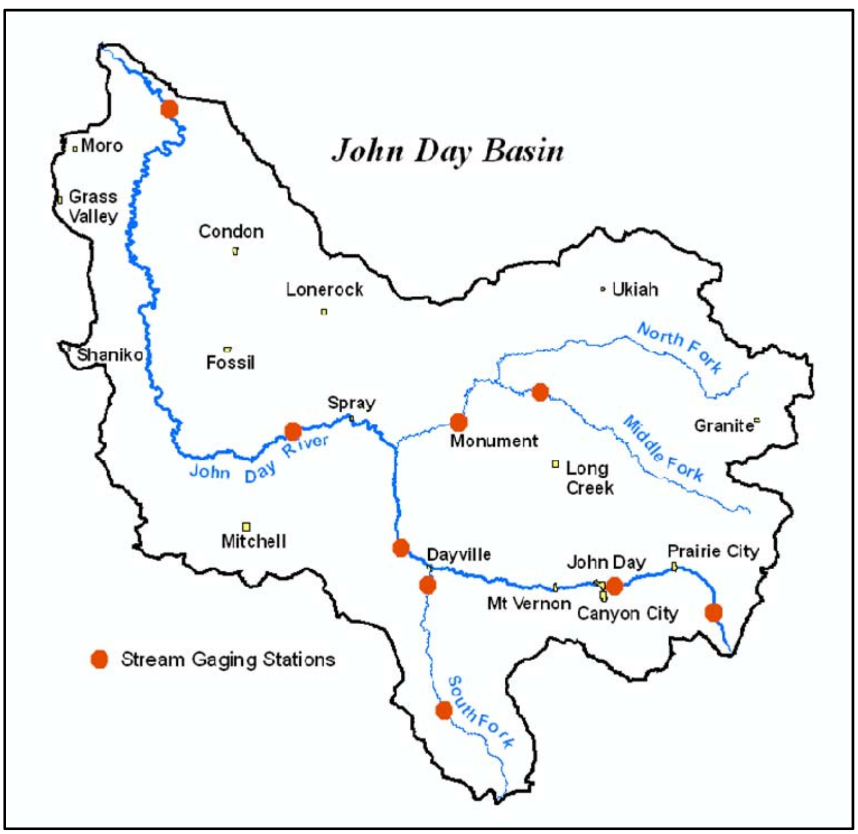
1.4.1.5 Hydrology

Most water in the John Day Basin is derived from the upper watershed, primarily in the form of melting snow. Discharge from the free-flowing (no large-scale dams) John Day River is highly variable from peak to low flows. An unusually large stage-range is discussed in hydrological memos relating to mainstem morphologic and vegetation assessment (Fogg, 2007) (Smith, 2006).

Flow data in the John Day River Basin is currently being collected from 18 stations located on the river and various tributaries. These and historic gages were used in calibrating the hydrology Basin-wide for TMDL development. However, the bulk of the TMDL analysis relied on the currently active gaging mapped in **Figure 1.4-4**.

These gages are at McDonald Ferry (mainstem river mile 21), Service Creek (mainstem river mile 157), Picture Gorge (mainstem river mile 205), City of John Day (mainstem river mile 253), Blue Mountain Hot Springs (mainstem river mile 275), City of Monument (North Fork river mile 16), above Dayville (South Fork river mile 5), Ritter Hot Springs (Middle Fork river mile 15), and near Izee (South Fork river mile (river mile 34). Other streams currently being monitored include: Mountain Creek, Lone Rock Creek, Butte Creek, Murderer's Creek, Deer Creek, Canyon Creek, Strawberry Creek, Camas Creek and Bridge Creek.

Figure 1.4-4. Primary stream flow gaging stations used in TMDL assessment



The USGS-maintained gage at McDonald Ferry, Oregon (gage # 14048000), the oldest gage in the Basin, has been in operation since December 1904. The discharge measured at this station represents 7580 square miles, or approximately 96% of the entire Basin, providing Basin-scale hydrologic patterns. Long-term month-averages are plotted in **Figure 1.4-5**. John Day River mean annual discharge ranges from a high of 4818 CFS-cubic feet per second (136 CMS-cubic meters per second) in 1984 to the low of 603 CFS (17 CMS) in 1934, as portrayed in **Figure 1.4-6**. The River's long-term mean annual discharge into the Columbia River is slightly more than 2000 CFS (56.6 CMS). This information is from the Northwest Power and Conservation Council (NWPC, 2001) Subbasin Plan for the John Day Basin.

Peak stream flows in the John Day River usually occur from March through May while the seasonal low flows typically occur from August through October. The highest recorded discharge of the John Day River was 42,800 CFS (1210 CMS) on December 24, 1964, caused by warm rain melting large amounts of snow. The lowest recorded discharge from the McDonald Ferry station was zero for part of September 2, 1966, August 15 to September 16, 1973, and August 13, 14 and 19 to 25, 1977. Peak flow at the McDonald Ferry gaging station is typically over 100 times greater than the lowest flows of the same year. From year to year, peak flows can vary as much as 300 to 700% (CBRCD, 2005). This unusual stage range has implications for rates and pattern of riparian vegetation growth and recovery.

Figure 1.4-5. Mean monthly discharge from 1904 to 2002, McDonald Ferry gage #14048000

(CBRCD, 2005)

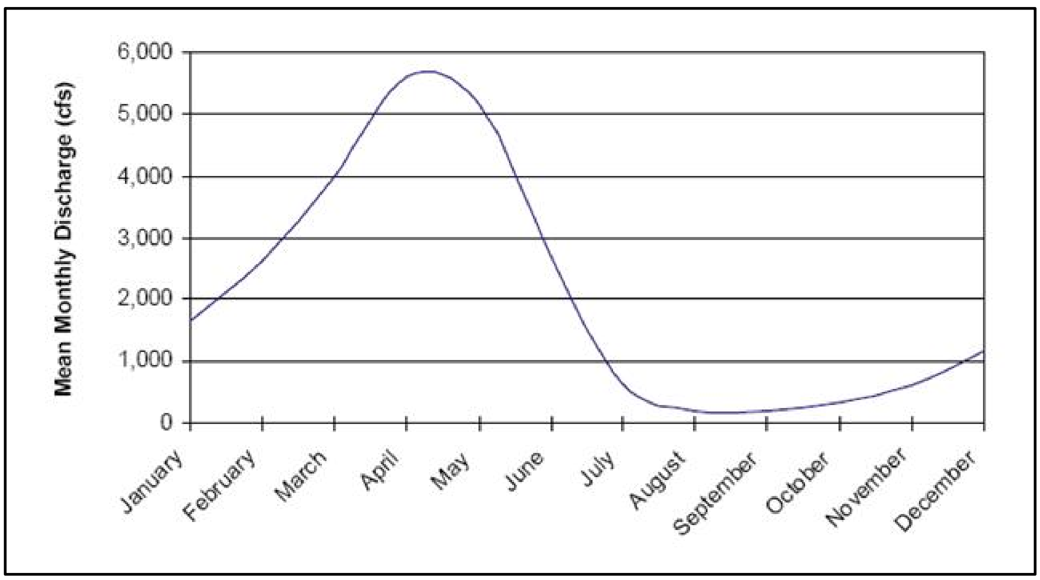
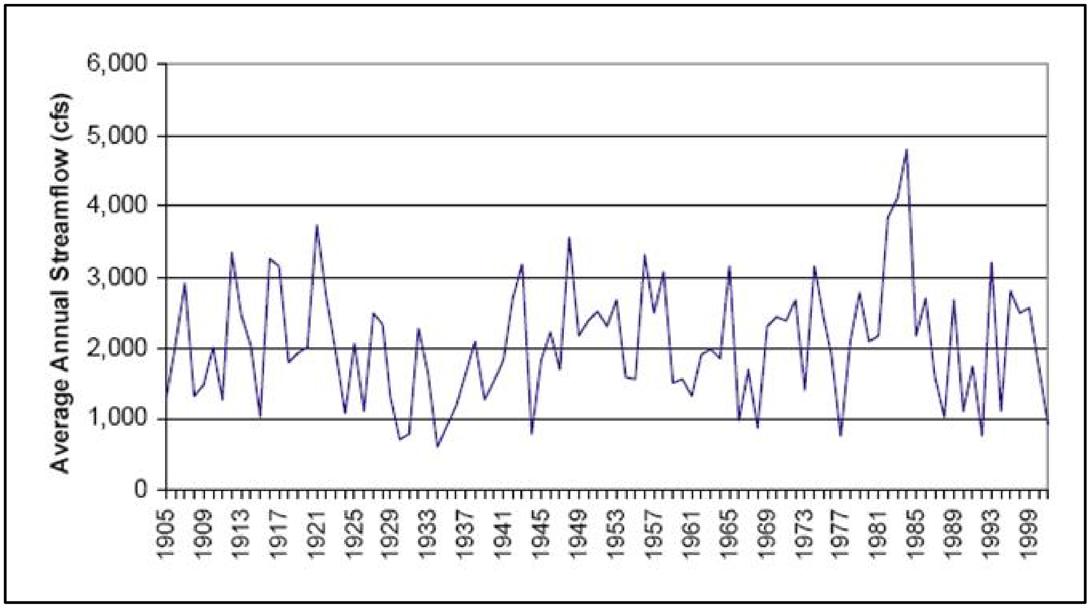


Figure 1.4-6. Mean annual flows in the John Day Basin, McDonald Ferry gage #14048000
(CBRCD, 2005)



1.4.2 Beneficial Uses of Water

Water quality standards address the most sensitive beneficial use, for any given type of impairment, thus protecting all uses. Salmonids are particularly sensitive to temperature, hence the temperature standard criteria applicable in the John Day are based on salmon and trout. The dissolved oxygen standard is based on salmon and trout as well, and cold and cool water aquatic communities. The fresh water bacteria standard is based on water contact recreation. Designated beneficial uses for the purpose of water quality standards are listed in **Table 1.4-2**, for the John Day Basin.

Table 1.4-2. Designated Beneficial Uses
(OAR 340-41-0170, Table 170A)

Beneficial Uses	John Day River & All Tributaries
Public Domestic Water Supply[1]	X
Private Domestic Water Supply[1]	X
Industrial Water Supply	X
Irrigation	X
Livestock Watering	X
Fish & Aquatic Life[2]	X
Wildlife & Hunting	X
Fishing	X
Boating	X
Water Contact Recreation	X
Aesthetic Quality	X
Hydro Power	
Commercial Navigation & Transportation	
[1] With adequate pretreatment (filtration & disinfection) and natural quality to meet drinking water standards.	
[2] See also Figures 170A and 170B for fish use designations for this basin.	

1.4.3 Location Reference

Throughout this document there are charts and discussions with references to river kilometer. As with the conventional use of 'river mile,' river kilometers are measured from the mouth upward. Because stream channels move through time and methods of measuring irregular geographic distances improve, reference distances can change. For the same reason, river miles assessed many years ago cannot be simply converted to recently assessed river kilometers. For the temperature TMDL in particular, assessment requires high spatial resolution over large scales. This was carried out through tracing the stream in Geographic Information (GIS) software on high-resolution color air photos and using a program to locate equidistant nodes at each 0.05 km (0.031 mile) along modeled streams. **Table 1.4-3** through **Table 1.4-5** are provided to assist in spatially coordinating the resultant river kilometers with familiar landmarks, for the North Fork, Middle Fork and mainstem John Day River.

Table 1.4-3. Location key by river kilometer, John Day River

John Day River		
Confluence	City or Landmark	Kilometers from Tumwater Falls
Uppermost model boundary	Trout Farm FS Campground	437.00
Call Creek		434.85
Roberts Creek		430.85
Rail Creek		430.70
Blue Mt. Hot Springs	Gage Site	429.85
Graham Creek		427.75
Deardoff Creek		424.75
Reynolds Creek		421.70
Strawberry Creek		412.15
	Prairie City	409.05
Dixie Creek		408.40
Indian Creek		400.05
Pine Creek		397.65
Canyon Creek		384.70
	John Day WWTP	384.20
Laycock Creek		376.35
Beech Creek		370.55
	Mt Vernon WWTP	370.50
Belshaw Creek & Fields Creeks		352.15
	Dayville WWTP	328.30
South Fork John Day River		326.00
Cottonwood Creek		318.95
	Picture Gorge (Gage Site)	314.65
Rock Creek		314.25
Squaw Creek		306.25
Johnson Creek		283.50
North Fork John Day River		282.20
Alder Creek		241.85
	Service Creek (Gage Site)	237.00
Shoofly Creek		226.70
Bridge Creek		202.25
Pine Creek		164.50
	Clarno	160.10
Butte Creek		139.65
Thirtymile Creek		118.15
	Condon-Wasco Hwy 206	46.85
Hay Creek		30.10
Rock Creek		17.25
	McDonald Ferry (Gage Site)	16.50
Tumwater Falls (16 km upstream from mouth)		0.00

Table 1.4-4. Location key by river kilometer, North Fork John Day River

North Fork John Day River		
Confluence	City or Landmark	Kilometers from mouth
Uppermost model boundary		172.90
	Wilderness lower boundary	170.34
Onion Creek		164.40
	North Fork Campground/ Hwy	164.45
Trail Creek		163.80
	Wilderness upper boundary	163.30
Trout Creek		159.70
Crane Creek		153.85
Bear Gulch		146.30
Granite Creek		141.40
Backout Creek		139.40
Glade Creek		134.85
Basin Creek		129.50
Big Creek		123.60
	Wilderness lower boundary	122.67
Oriental Creek		118.20
Otter Creek		115.05
Texas Bar Creek		105.50
Desolation Creek		97.20
Meadowbrook Creek	Dale/ Hwy 395	96.45
Camas Creek	Hwy 395	91.45
Stony Creek		72.10
Potamus Creek		61.95
Mallory/Stalder Creeks		60.40
Ditch Creek		56.60
Middle Fork John Day River		51.65
Cabin Creek		44.80
Wall Creek		35.95
Deer Creek		27.85
	Monument	25.65
	Gage Site	24.40
Cottonwood Creek		25.35
Rudio Creek		8.30

Table 1.4-5. Location key by river kilometer, Middle Fork John Day River

Middle Fork John Day River		
Confluence	City or Landmark	Kilometers from mouth
Uppermost model boundary		112.95
Clear Creek		111.50
Bridge Creek	Bates Town/Mill Site	110.70
Davis Creek		109.35
Vinegar Creek		108.65
Vincent Creek		107.55
Dead Cow Creek		107.45
Deerhorn Creek		102.60
Little Boulder Creek		101.85
Little Butte Creek		99.75
Hunt Gulch		99.30
Butte Ck		95.25
Granite Boulder Ck		93.55
Ruby Creek		92.20
Beaver Creek		92.15
Ragged Creek		91.88
Dry Creek		88.90
Big Boulder Ck		87.40
Dunston Creek		83.60
Camp Creek		79.25
Gibbs Creek		77.95
Quartz Gulch		76.35
	Galena	75.60
Deep Creek		74.50
Armstrong Creek		69.30
Big Creek		64.25
Huckleberry Creek		62.15
Cross Hollow		61.15
Indian Creek		58.35
Slide Creek		53.70
Lick Creek		44.35
	Highway 395	41.85
Granite Creek		41.80
Flowers Gulch		41.30
Ritter Hot Springs	Gage Site	22.85
Long Creek		9.25

1.4.4 Population, Local Government and Land Use

1.4.4.1 Land Use and Ownership

The ownership makeup of the John Day Basin is 59% private, 31% USFS, 9% BLM/miscellaneous federal and 1% state ((OGDC, 2004) – Oregon Geospatial Data Clearinghouse). The largest proportion of private ownership is in the lower subbasin. Basin ownership has been relatively static for the last decade or more, even though some federal-private exchanges have occurred(CBRCD, 2005). See **Figure 1.4-7** for an ownership map of the Basin.

The USDA Forest Service manages much of the higher elevations in the Basin. The Basin overlaps four USFS jurisdictions - the Umatilla, Wallowa-Whitman, Malheur and Ochoco National Forests.

Private forestlands are concentrated in pine and lower elevation mixed-conifer stands. They consist of a mix of large forest industry holdings (though many of these have been sold off in recent years), smaller private woodlots managed for timber and forage production, and recreational properties managed for aesthetics and hunting uses. Clear cutting is rare on private lands, and past logging on private lands in the region has generally resulted in low-to-moderate density stands of younger trees (CBRCD, 2005). Range and forestry land uses overlap.

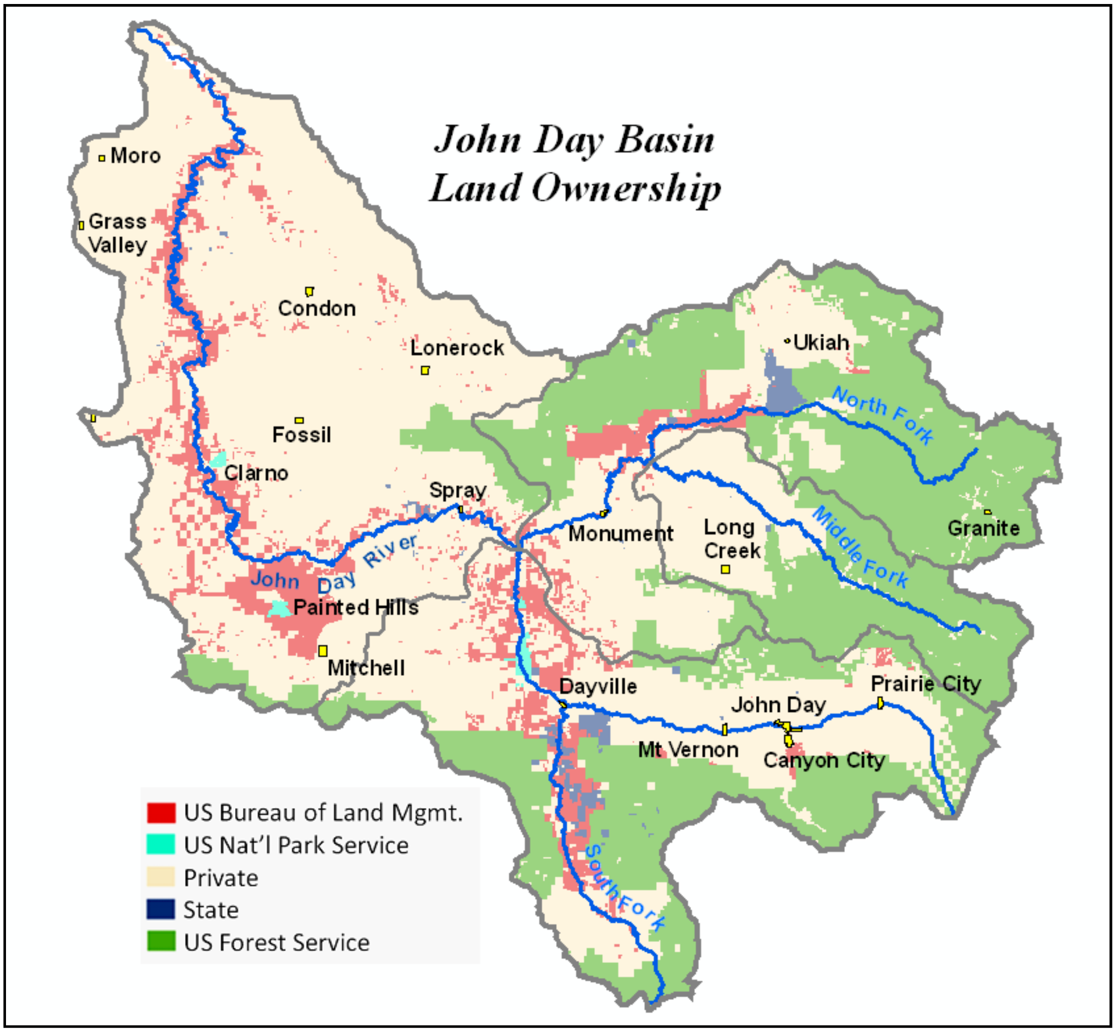
Mid-elevation grasslands and shrub-steppe plant communities are primarily in private ownership. Grazing of livestock is the predominant land use here, though dry land farming occurs in places, primarily in the lower subbasin, but also in scattered small fields used for hay production on higher elevation ranches in the upper Basin. Livestock are primarily cattle, representing a change from wide-ranging sheep herding early in the 20th century. Wheat is the primary crop. Recreation is an increasingly common use of these private lands (CBRCD, 2005).

In the larger river corridors and associated floodplains and terraces, irrigated agriculture is widespread. A mix of grass, alfalfa and grain hay is the primary product from irrigated lands. Some areas are managed as irrigated pasture; scattered small areas are managed for orchard and specialty crops. The vast majority of the irrigation is from surface waters of the John Day and its tributaries. Riparian areas are typically managed as part of larger agricultural operations, and many have been altered from their natural state by water diversions, channelization, vegetation changes and the like. An increasing number of riparian areas are being managed with an emphasis on protecting fish and wildlife values and water quality through a combination of individual landowner initiatives and contractual agreements associated with incentive programs such as USDA's Conservation Reserve Enhancement Program (CREP) and Conservation Reserve Program (CRP) programs, the riparian fencing programs run by ODFW, CTWSIR and CTUIR restoration programs with Bonneville Power Administration (BPA) funding support (CBRCD, 2005).

Much of the near-stream land along the lower mainstem, and portions of the South Fork and the North Fork are managed by the Bureau of Land Management, which also manages scattered upland parcels throughout the Basin. A recent land exchange program – including the Northeastern Oregon Assembled Land Exchange of 1998 and the changes resulting from the Oregon Land Exchange Act of 2000 - has provided some consolidation of BLM-administered lands in the upper part of the Basin. The river corridor managed by the BLM is primarily made up of steep, lower elevation canyon country. Primary uses of BLM lands are grazing and recreation - particularly fishing and boating in the river corridors.

Urban lands comprise only a small portion of the land base; rural residential land use is scattered throughout the private lands of the middle and lower elevations. Rural development is governed by county land use plans and zoning. There is an increasing trend towards fragmentation of large private land holdings and associated rural development ranging from hunting cabins to small subdivisions. In a few instances conservation easements are being used to keep larger holdings intact and promote conservation goals on private lands (CBRCD, 2005).

Figure 1.4-7. General land ownership in the John Day Basin (Data from US BLM and the Oregon Geospatial Clearinghouse)



Perhaps the most visible demarcation in the landscape is apparent through comparing forested with non-forested lands (**Figure 1.4-8**). The Basin area is 45% forested (public and private). The bulk of non-forest area is generally classified as agricultural (54% of Basin area) and the remaining as urban, where agriculture is defined as: shrub/range + grass/pasture/hay +CRP + grain crops [derived from USDA-NRCS subbasin profiles (NRCS, 2005)]. In terms of land use, these broad divisions must be qualified with the recognition that mixed-use is predominant as well. For instance, forestry, cattle grazing and recreation are commonly permitted on BLM and USFS forest areas.

In addition to forestry, agriculture, recreation and urban, other land uses include mining, transportation, utility corridors. Off-highway vehicular recreation is increasingly popular; both dispersed and within areas set aside for that use. Mining activities and impacts include both current and legacy. Existing practices are primarily suction dredge operations and panning. Legacy mining activities include hydraulic mining, placer mining, large and small dredge mining. In the upper Middle Fork, North Fork and mainstem, dredge tailings and channel disturbance are still apparent. The USFS has undertaken substantial restoration at tailing sites as well.

Figure 1.4-8. Forest land ownership in the John Day Basin (Data from ODF, US BLM and the Oregon Geospatial Clearinghouse)

1.4.4.2 Cities and Counties

The Basin population is small and widely dispersed. The Basin boundary overlaps ten rural Counties (**Table 1.4-6**). The largest and most populated is Grant County. There are seventeen incorporated cities in the Basin, listed by County in **Table 1.4-7**, all with population under 2000. John Day and Prairie City are the largest Cities in the Basin. County Seats in the Basin include Canyon City (Grant County), Fossil (Wheeler County), Moro (Sherman County) and Condon (Gilliam County).

Table 1.4-6. Population of all Counties with land area in the John Day Basin (data are from Oregon Blue Book, 2000 Census)

County Population	
Crook County	25885
Gilliam County	1885
Grant County	7580
Harney County	7680
Jefferson County	22030
Morrow County	12335
Sherman County	1855
Umatilla County	72245
Union County	25250
Wasco County	24125
Wheeler County	1570

Table 1.4-7. Population of incorporated Cities in the Basin (data are from Oregon Blue Book, 2000 Census)

City	City Population	County
Condon	775	Gilliam County
Lone Rock	20	Gilliam County
Canyon City	670	Grant County
Dayville	175	Grant County
Granite	30	Grant County
John Day	1850	Grant County
Long Creek	220	Grant County
Monument	135	Grant County
Mt Vernon	600	Grant County
Prairie City	1100	Grant County
Grass Valley	170	Sherman County
Moro	380	Sherman County
Ukiah	260	Umatilla County
Shaniko	40	Wasco County
Fossil	465	Wheeler County
Mitchell	175	Wheeler County
Spray	160	Wheeler County

1.4.4.3 Dedicated Preservation and Restoration Areas

USFS Wilderness Areas include the North Fork John Day Wilderness, Strawberry Wilderness, Black Canyon Wilderness and Bridge Creek Wilderness. USBLM has recently established the Spring Basin Wilderness. Wilderness Area locations are shown in **Figure 1.4-9**.

The National Park Service manages the 14,000-acre (5,666 hectare) John Day Fossil Beds National Monument within the John Day Basin. This monument, noted for its cultural and paleontological resources, includes three separate units: Sheep Rock (northwest of Dayville), Painted Hills (northwest of Mitchell), and Clarno (east of Clarno).

The Confederated Tribes of the Warm Springs Indian Reservation either owns or manages approximately 35,000 acres (14,160 hectare) throughout the Basin. This acreage includes the Pine Creek, Oxbow (upper Middle Fork, upper Mainstem) and Forrest properties (Middle Fork), all managed with an emphasis on fish and wildlife conservation (CBRCD, 2005).

The Nature Conservancy owns the Dunstan Preserve on the Middle Fork and carries out management and restoration focusing on ecological status enhancement.

State-owned lands include wildlife management areas. These are administered by ODFW, with the purpose of conserving the state's numerous fish and wildlife species, and to provide them optimum economic, commercial, recreational and aesthetic benefits for present and future generations. These include:

- the Bridge Creek Wildlife Area near Ukiah
- the Phillip W. Schneider Wildlife Area south of Dayville
- Moon Creek Wildlife Area west of Mt. Vernon

State-owned lands also include State Parks, administered by Oregon Parks and Recreation Department (OPRD) including the following (in development if italicized):

- *Bates State Park at the historic Bates townsite near Austin*
- *Cottonwood Canyon State Park on the Condon-Wasco highway (206),* adjacent to JS Burres State Park river access point
- Clyde-Holliday State Park near Mt. Vernon
- Ukiah-Dale Forest

Bates and Cottonwood Canyon are recently acquired and park establishment is still in the planning stage. Clyde-Holliday State Park focuses on recreational values. Another OPRD holding, JS Burres State Park, is under long term lease to the USBLM and is managed through the Prineville District office for recreational and natural resource values.

The locations of the Fossil Beds National Monument, Confederated Tribes of the Warm Springs Indian Reservation, the Nature Conservancy properties, and State Parks and Wildlife Management lands are illustrated in **Figure 1.4-10.**

Four segments of the John Day River system are designated as State Scenic Waterways by the State of Oregon, which restricts development and other activities in the scenic corridor. The program is administered by the Oregon Parks and Recreation Department. The Oregon Scenic Waterways System was created by a ballot initiative in 1970. The system of rivers was expanded by another ballot initiative in 1988. The current rules place restrictions on road development, vegetation removal, visibility of new mines and structures. Other restrictions are included, targeting a “blending with the natural character of the landscape” (OAR 736-040-0065) within ¼ mile (0.40 km) of the bank of designated scenic waterways. The four John Day segments designated as State Scenic Waterways include (**Figure 1.4-11**):

- John Day River mainstem from Tumwater Falls upstream to Parrish Creek.
- North Fork John Day River from near Monument upstream to the North Fork John Day Wilderness boundary.
- Middle Fork John Day River from its confluence with the North Fork John Day River upstream to the Crawford Creek Bridge.
- South Fork John Day River from the north boundary of the Phillip W. Schneider Wildlife Management Area to County Road 63.

In addition, below the North Fork, the John Day River has been assessed as a navigable waterway through the Department of State Lands (DSL). This includes certain restrictions as to activities that can occur below the ordinary high water mark. These submersible lands are administered by DSL, as follows:

> DSL's proprietary interest in the John Day River stems from the 2005 State Land Board navigability declaration, which asserts that the State of Oregon has owned the bed and the banks of the John Day River from river mile 10 to 184 (16 to 284 km) up to the ordinary high water mark since Statehood. DSL authorizes various structural uses of the river such as docks, boat ramps, power line crossings and bridges or any private or commercial use of the river for that matter that is tied to a structure on the river with in DSL's ownership. DSL recently conducted an inventory of much of the John Day River, identifying uses on the River (2/4/2010 email from DSL to DEQ staff).

DSL is currently working to attain compliance with regard to non-exempt structures under authorization with DSL. DSL and OPRD would coordinate with regard to applications for actions or development that would influence this zone.

Three segments of the John Day River system were designated as Federal Wild and Scenic Rivers by the Omnibus Oregon Wild and Scenic Rivers Act of 1988 (Public Law 100-558). Most of the federally designated Wild and Scenic Rivers in the John Day Basin are managed by the BLM according to its 2001 John Day River Management Plan (USBLM, 2001). These Wild and Scenic segments total approximately 249 miles. The three John Day segments are designated as Wild and Scenic (**Figure 1.4-12**).

- Lower John Day River mainstem from Tumwater Falls upstream to Service Creek, classified as “Recreational” and managed by the BLM.
- North Fork John Day River from Camas Creek upstream to the headwaters. One portion of this segment is classified as “Wild,” two portions are classified as “Scenic,” and two are classified as “Recreational.” These segments are primarily managed by the Umatilla and Wallowa-Whitman National Forests.
- South Fork John Day River from Smokey Creek upstream to the Malheur National Forest Boundary, classified as “Recreational” and primarily managed by the BLM.

As used here, the intent of the term 'dedicated preservation and restoration areas' is to identify areas that are specifically set aside for environmental preservation as a major part of their mission. We realize that many other areas in the Basin could fall into this category. For example, private holdings, USFS, and US BLM lands include areas of dedicated preservation and restoration, outside of Wilderness Areas, as well as mixed use. These were not included in this section due to lack of geographic information, or because they are discussed elsewhere.

Figure 1.4-9. Basin Wilderness Areas

Figure 1.4-10. Locations of dedicated preservation and restoration areas other than Wilderness Areas and other USBLM - USFS restoration areas. [Fossil Beds National Monument (green), Confederated Tribes of the Warm Springs Indian Reservation (yellow) and the Nature Conservancy (tan) properties, State Parks (red) and State wildlife management lands managed by ODFW (blue) and OPRD (purple)]

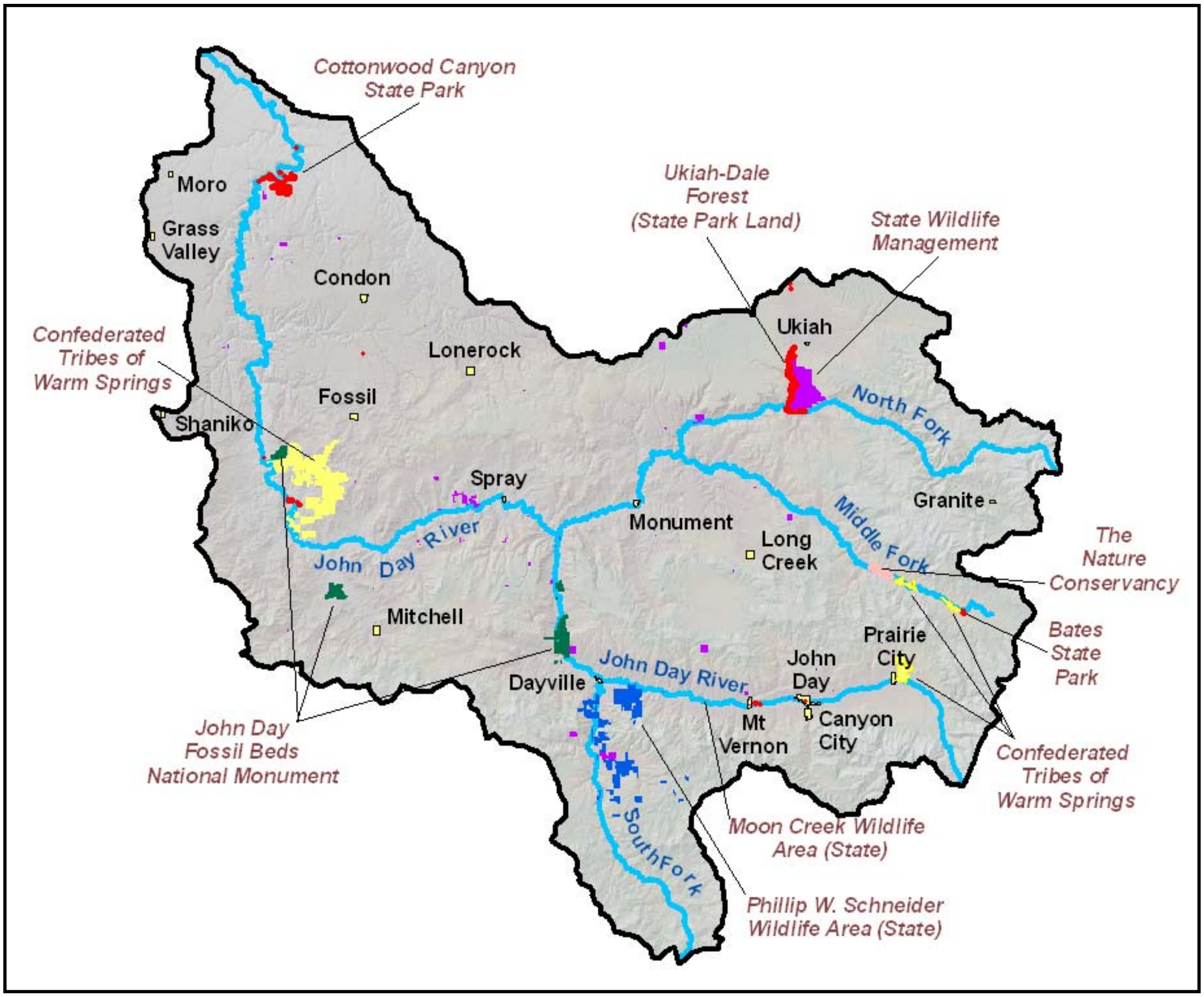


Figure 1.4-11. State Scenic Waterways

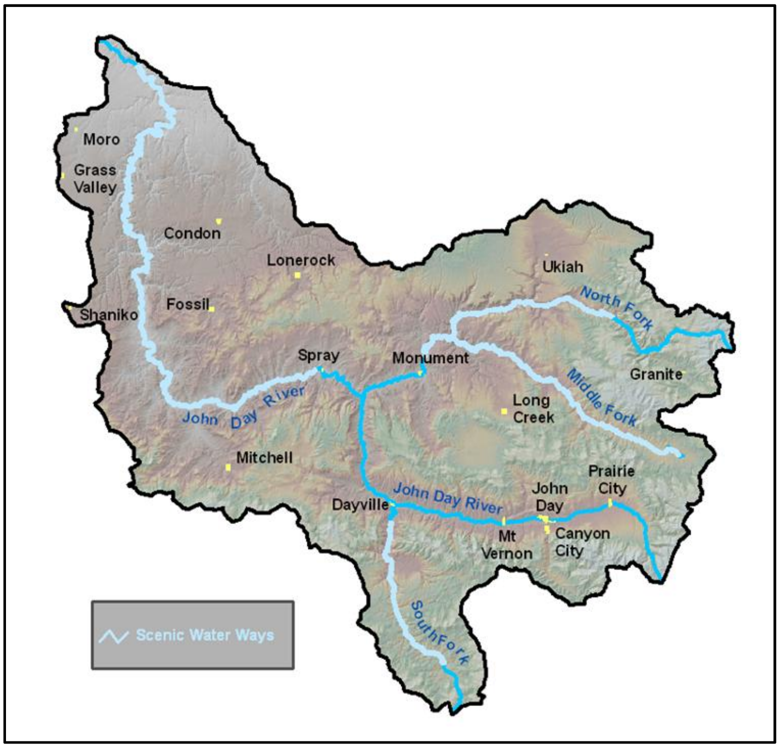


Figure 1.4-12. Federal Wild and Scenic Riverways

1.4.5 Water Management

Consumptive water use in the Basin occurs primarily through irrigation. There are no irrigation districts in the Basin and no large reservoirs. Individual irrigators and ditch companies or associations divert instream water to fields. Water has been diverted and stored for hydropower historically. Much of the concentrated irrigation with multi-user ditch systems occurs along the mainstem from below Dayville to above Prairie City; and to a lesser extent along the North Fork below Monument. The proportion of irrigated land area in each subbasin is listed in **Table 1.4-8**.

Oregon Water Resources Department regulates stream flow in Oregon. OWRD management activities include enforcement against illegal use, measurement of water use, conditioning of new reservoir permits to protect peak and ecological flows, coordinating with DEQ on the application/approval of instream water rights, providing incentives (e.g., Allocation of Conserved Water Program) and other mechanisms of water conservation. Water availability, based on modeled un-appropriated stream flow, has been assessed by OWRD. This information can be accessed at: http://apps2.wrd.state.or.us/apps/wars/wars_display_wa_tables/search_for_WAB.aspx

As indicated in the temperature TMDL (**Chapter 2.1**) and the Basin Plan, thermal and ecological impairment associated with reduced instream flow is a warm season concern, when temperature is high, natural flow levels are low, and water is diverted for irrigating crops and pastures. Synoptic flow monitoring was conducted for the temperature TMDL, in coordination with thermal infrared flights, in the summers of 2002 and 2004. The level of summer flow depletion can be roughly estimated by the longitudinal flow profiles prepared from this monitoring (**Figure 1.4-13 through Figure 1.4-15**), where a more natural summer profile would be expected to generally gain in discharge rate downstream, particularly in the headwaters. The current pattern deviates from this general trend in certain areas – on the mainstem between John Day and Blue Mountain Hot Springs and above Clyde Holliday State Park; and on the lower North Fork.

Table 1.4-8. John Day Basin irrigated land area by Subbasin (NRCS, 2005)
(1 square mile = 2.59 square kilometer)

Subbasin	Total Subbasin in Area*	Irrigated Area* (non-federal cultivated and uncultivated cropland, pasture)	Irrigated Lands (percent of subbasin area)
Lower	8,173	40	0.5
North Fork	4,794	53	1.1
Middle Fork	2,055	0	0.0
Upper	5,546	108	1.9
Total	20,568	202	

*square kilometers

Figure 1.4-13. August 2004 measured flow profile, John Day River (TMDL monitoring, DEQ) (1 CMS = 35.315 CFS)

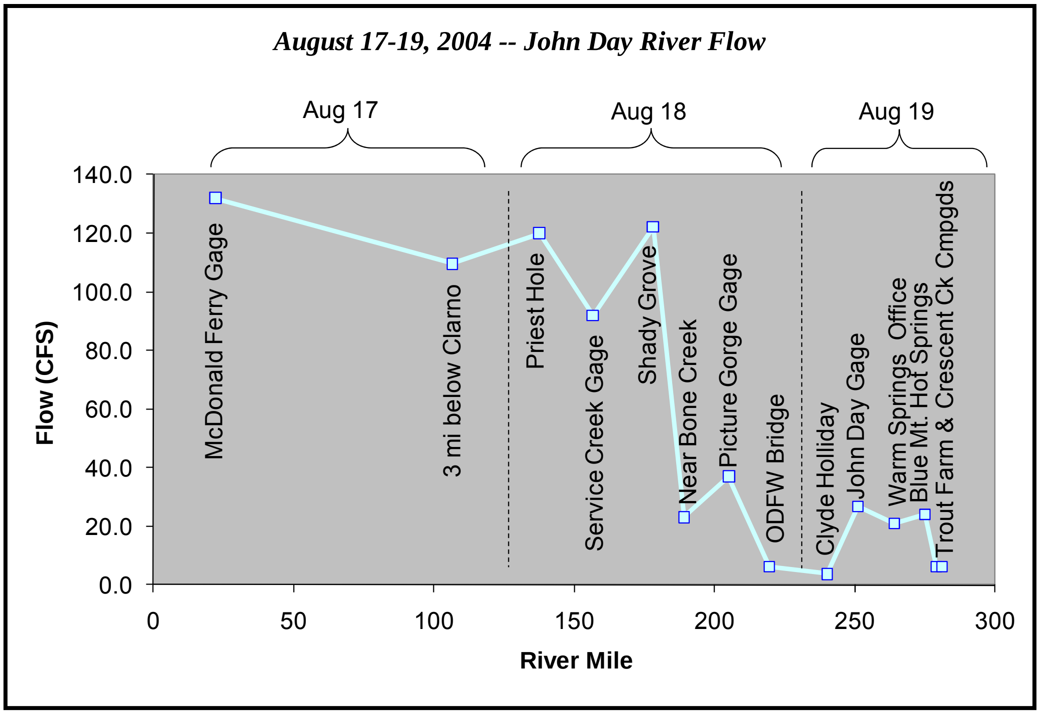


Figure 1.4-14. August 2002 measured flow profile, North Fork John Day River (TMDL monitoring, DEQ) (1 CMS = 35.315 CFS)

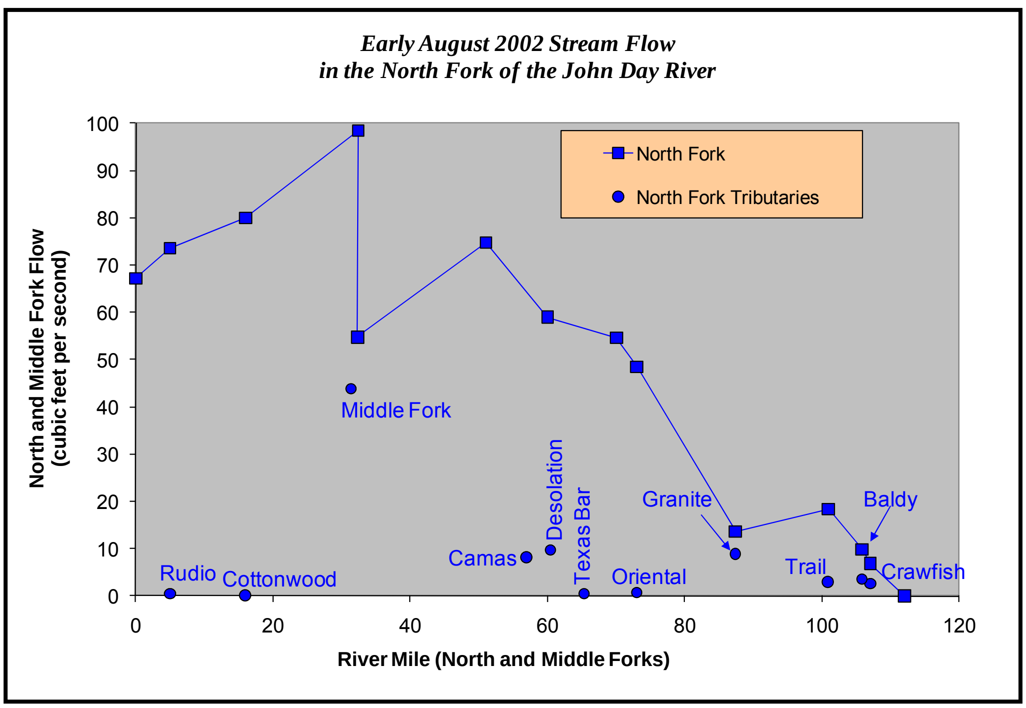
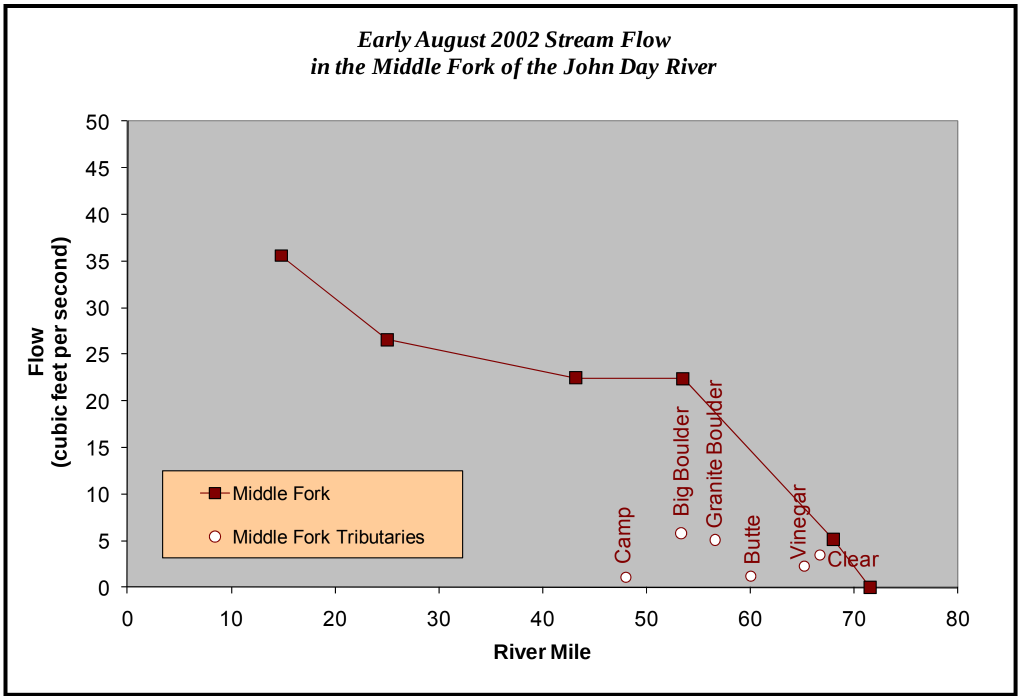


Figure 1.4-15. August 2002 measured flow profile, Middle Fork John Day River (TMDL monitoring, DEQ) (1 CMS = 35.315 CFS)



1.4.6 Point Sources and Impoundments

1.4.6.1 Permitted Point Sources, Identification and Description

There are three individual-facility NPDES permitted discharges in the Basin – the sewage treatment plants of Mt. Vernon, Dayville and Long Creek. Other permitting mechanisms are generally employed for treatment plants that do not discharge to streams and rivers. The John Day sewage treatment plant is the largest municipal facility in the basin, and discharges adjacent to the stream via a Water Pollution Control Facility permit. The three NPDES facilities and the John Day sewage treatment plant will receive non-zero wasteload allocations or reserve capacity through this TMDL, as detailed in **Chapters 2.1-2.3**. The locations of these point sources are shown in **Figure 1.4-16**. In addition, two NPDES confined animal feeding operations (CAFOs, General Permits) are permitted in the Basin, and one is pending. Because the CAFO and WPCF facilities are generally not permitted to discharge pollutant to waters of the state, they are not discussed in detail here, with the exception of the John Day WWTP (refer to **Chapter 2.1** and **2.2**, and subsequently in this section). At the time of this writing, there are no other individual NPDES or CAFO NPDES facilities in the Basin. Permit numbers for all individual NPDES, CAFO NPDES and WPCF facilities in the Basin are listed in **Table 1.4-9** through **Table 1.4-11**.

At the time of writing this document, there are 17 facilities with NPDES permits to discharge to the John Day River or its tributaries (**Table 1.4-9** through **Table 1.4-11**):

- 9 general storm water, log pond and onsite permits
- 3 individual permits
- 2 CAFO) general permits (and one pending)

Given the type of pollutants (temperature and bacteria) addressed in this TMDL, the relatively small size of the discharges and the controls required through the existing permits, the general NPDES and WPCF permitted facilities (**Table 1.4-11**) are not likely to cause water quality impairment. This applies to the John Day WWTP as well, though it does have potential to interact with surface water. Additionally, stormwater-permitted facilities generally do not discharge during the warm season. Summer, the time of greatest concern for temperature impairment, is the dry period for the John Day Basin. Summer thunderstorms can be intense, but are occasional and short-lived, and just as likely to have cooling influence. No significant sources of pollutants, other than those addressed via the TMDLs of **Chapters 2.1** through **2.4**, were identified during TMDL development. Wasteload allocations are assigned as follows:

- Existing and future NPDES General Permit CAFOs receive WLAs of zero for stream heating and bacteria loads.
- Other existing NPDES General Permit facilities are allocated their current loads, if any. Their allocation is here defined as: *facilities must not exceed their current range of loading to waterbodies, and they must not contribute to exceedance of bacteria and temperature water quality criteria.* The latter stipulation applies to future permits as well.
- In general, WPCF facilities other than the John Day WWTP do not receive WLA, and existing and future facilities can be considered to have WLAs of zero for stream heating and bacteria loads.
- The John Day WWTP WPCF facility is addressed as described in **Chapters 2.1** and **2.2**.
- Existing NPDES Individual Permit facilities receive quantified non-zero WLA for heat and bacteria as detailed in **Chapters 2.1** and **2.2**. Future Individual Permit NPDES facilities may be addressed through the reserve capacity provided for in **Chapters 2.1** and **2.2**.

Figure 1.4-16. Location of municipal NPDES facilities and the John Day treatment plant

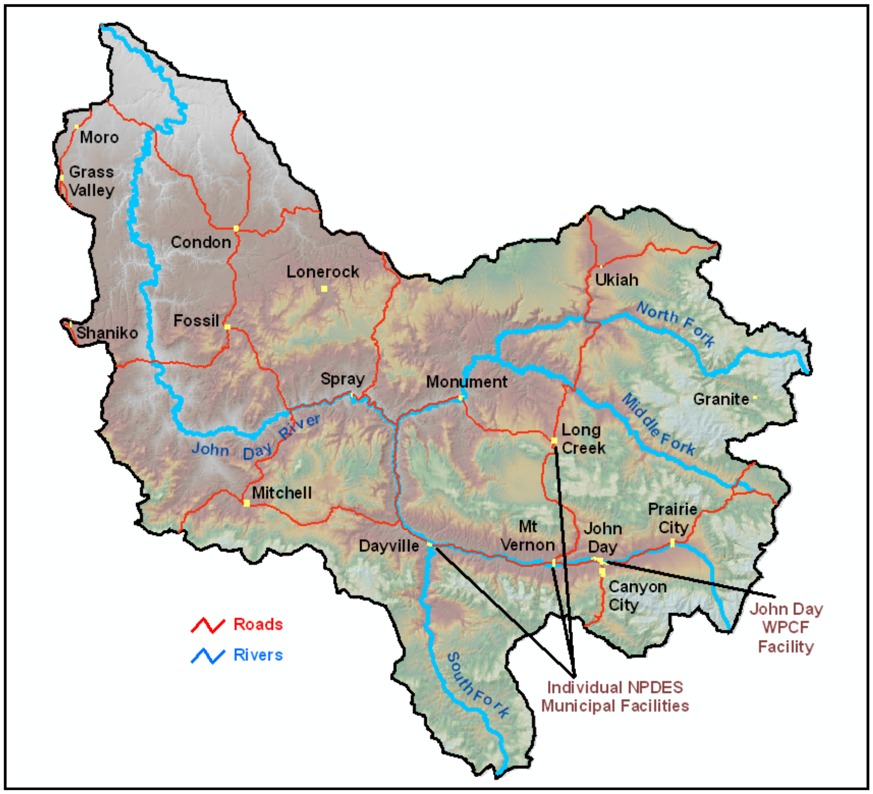


Table 1.4-9. Individual NPDES permit sewage treatment plants

Permit	Permittee	Water body
59065	Mt Vernon WWTP	John Day River
23560	City of Dayville WWTP	John Day River
51180	Long Creek WWTP	Long Creek

Table 1.4-10. John Day Basin NPDES confined animal feeding operations

Facility (County)	Permit Number
Holliday Land and Livestock (Grant Co.)	AG-P0174438CAFG
Bridge Creek Ranch, LLC. (Wheeler Co.)	NA*
Reitmann Ranch (Gilliam Co.)	AG-P0172429CAFG

* This facility is in the process of permit issuance at the time of TMDL development.

Table 1.4-11. All non-CAFO wastewater permits in the John Day River Basin (for description of permit types, refer to http://www.deq.state.or.us/wq/wqpermit/genpermits.htm)

Water Quality File Number	SIC	Legal Name	Common Name	City	County	Permit Type	Permit is currently active?
100059	2421	D. R. JOHNSON LUMBER CO.	PRAIRIE WOOD PRODUCTS (ABN)	PRAIRIE CITY	GRANT	GEN04	TRUE
116347	6552	STRAWBERRY VIEW ESTATES, LLC	STRAWBERRY VIEW ESTATES	JOHN DAY	GRANT	GEN12C	TRUE
114841	4911	D.H. BLATTNER & SONS, INC.	BIGLOW CANYON WIND FARM	WASCO	SHERMAN	GEN12C	TRUE
118568	4952	HAP TAYLOR & SONS, INC.	SPRAY WASTEWATER SYSTEM IMPROVEMENTS	SPRAY	WHEELER	GEN12C	TRUE
118623	9199	WHEELER COUNTY	NOTCH ROAD CULVERT REPLACEMENTS	SPRAY	WHEELER	GEN12C	TRUE
100043	9511	CHEMICAL WASTE MANAGEMENT OF THE NORTHWEST, INC.	CHEMICAL WASTE MANAGEMENT OF THE NW	ARLINGTON	GILLIAM	GEN12Z	TRUE
103989	4953	WASTE MANAGEMENT DISPOSAL SERVICES OF OREGON, INC. DBA OREGON WASTE SYSTEMS, INC.	COLUMBIA RIDGE LANDFILL & RECYCLING CENTER	ARLINGTON	GILLIAM	GEN12Z	TRUE
100059	2421	D. R. JOHNSON LUMBER CO.	PRAIRIE WOOD PRODUCTS (ABN)	PRAIRIE CITY	GRANT	GEN12Z	TRUE
110457	5812	DODD, DAJUANA D.; DODD, HAROLD M.	LITTLE PINE CAFE (ABN)	MITCHELL	WHEELER	GEN56B	TRUE
51180	4952	LONG CREEK, CITY OF	LONG CREEK STP	LONG CREEK	GRANT	NPDES-DOM-Da	TRUE
23560	4952	DAYVILLE, CITY OF	CITY OF DAYVILLE	DAYVILLE	GRANT	NPDES-DOM-Db	TRUE
59065	4952	MT. VERNON, CITY OF	MT VERNON STP	MT VERNON	GRANT	NPDES-DOM-Db	TRUE
19057	4952	CONDON, CITY OF	CONDON STP	CONDON	GILLIAM	WPCF-DOM-E	TRUE
115255	6552	RADAR HOLDING L.L.C.	RADAR HOLDING	CONDON	GILLIAM	WPCF-DOM-E	TRUE
43569	4952	JOHN DAY, CITY OF	JOHN DAY STP	JOHN DAY	GRANT	WPCF-DOM-E	TRUE
110070	4952	MONUMENT, CITY OF	MONUMENT STP	MONUMENT	GRANT	WPCF-DOM-E	TRUE
71909	4952	PRAIRIE CITY, CITY OF	PRAIRIE CITY STP	PRAIRIE CITY	GRANT	WPCF-DOM-E	TRUE
90929	4952	USDA; FOREST SERVICE	USFS - UMATILLA NATIONAL FOREST; DALE WORK CENTER	DALE	GRANT	WPCF-DOM-E	TRUE
117097	6515	MORROW COUNTY PUBLIC WORKS	MORROW COUNTY OHV PARK	HEPPNER	MORROW	WPCF-DOM-E	TRUE
58508	4952	MORO, CITY OF	MORO STP	MORO	SHERMAN	WPCF-DOM-E	TRUE
90657	4952	UKIAH, CITY OF	UKIAH STP	UKIAH	UMATILLA	WPCF-DOM-E	TRUE
73432	7997	YOUNG LIFE	YOUNG LIFE	ANTELOPE	WASCO	WPCF-DOM-E	TRUE
30641	4952	FOSSIL, CITY OF	FOSSIL STP	FOSSIL	WHEELER	WPCF-DOM-E	TRUE
116353	9199	SPRAY, CITY OF	SPRAY STP	SPRAY	WHEELER	WPCF-DOM-E	TRUE
115311	4911	CO-GEN CO, LLC	CO-GEN CO.	PRAIRIE CITY	GRANT	WPCF-IW-B16	TRUE
109987	2421	GRANT WESTERN LUMBER CO.	GRANT WESTERN LUMBER CO.	JOHN DAY	GRANT	WPCF-IW-B19	TRUE
111239	5541	KEFFER, JEFFREY L.; KEFFER, CHRISTY	AUSTIN HOUSE	BATES	GRANT	WPCFOS-Bii	TRUE
115364	9512	OREGON PARKS & RECREATION DEPARTMENT	CLYDE HOLLIDAY STATE PARK	MT. VERNON	GRANT	WPCFOS-Bii	TRUE
111533	9512	USDOI; NATIONAL PARK SERVICE	USNPS - THOMAS CONDON PALEONTOLOGY CENTER	KIMBERLY	GRANT	WPCFOS-Bii	TRUE
102919	7011	SHANIKO CORPORATION	SHANIKO HOTEL	SHANIKO	WASCO	WPCFOS-Bv	TRUE

The aerial photographs of **Figure 1.4-17** through **Figure 1.4-20** illustrate outfall locations, where applicable, and the lagoon configuration of the four facilities receiving quantified non-zero TMDL allocations. The approximate distance to the adjacent stream is shown, from the high water edge of the lagoon to bankfull, at the nearest point.

Figure 1.4-17. Aerial photo of the John Day WWTP lagoons (north is up, stream flow is from right to left, Google Earth™)

Figure 1.4-18. Aerial photo of the Mount Vernon WWTP lagoons (north is up, stream flow is from right to left, Google Earth™)

Figure 1.4-19. Aerial photo of the Dayville WWTP lagoons (north is up, stream flow is from right to left, Google Earth™)

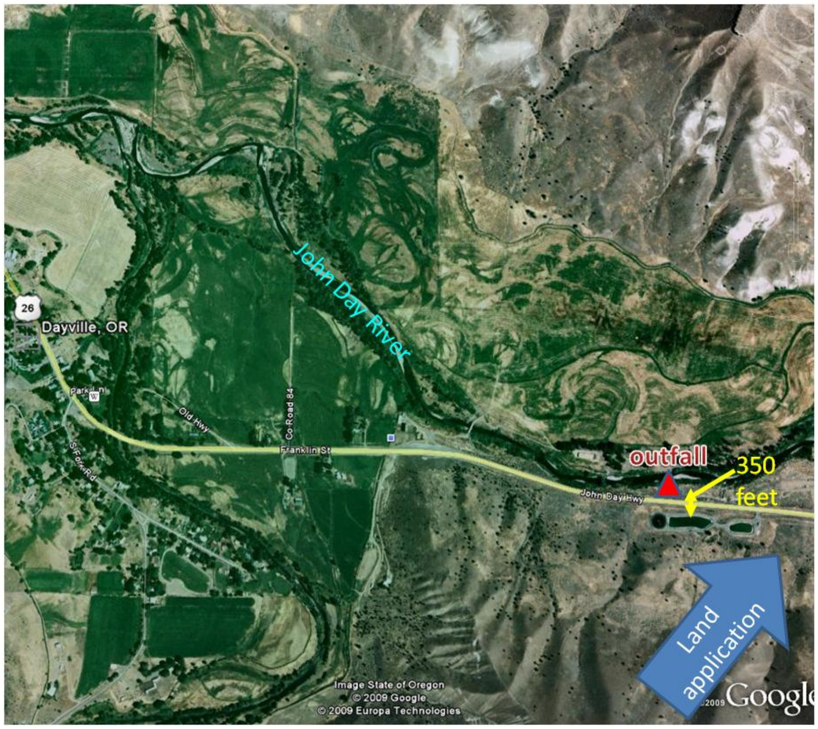


Figure 1.4-20. Aerial photo of the Long Creek WWTP lagoons (north is up, stream flow is from right to left, Google Earth™)

Facility size, permit and discharge information, for the four sewage treatment plants addressed in this TMDL are as follows:

Facility Name: City of John Day Waste Water Treatment Plant
Oregon File/Permit Number: 43569 (permit #102481)
Permit Type: Oregon Water Pollution Control Facility
Adjacent Water Body: John Day River
Location: John Day, Oregon
Period of Discharge to Lagoon: Year Round
Current Permit Effluent Limit Parameters:
Outfall to Lagoons: BOD5, Residual Chlorine
Dry Weather Design Flow: 0.6 million gallons/day (0.026 cubic meters per second)
Operational Status: Operating. Planning for treatment plant upgrade is currently underway.
Facility Description: The facility is a municipal sewage treatment plant. The facility includes two primary clarifiers, two trickling filters, a secondary clarifier, chlorination and chlorination contact basin, and four receiving ponds. Pond effluent is dispersed through evaporation and infiltration. The lagoons are un-lined The underlying materials, floodplain and river banks are composed of porous alluvium and gravel from fluvial, dredge mining and industrial processes. Due to substrate permeability, lagoon residence time is minimal. The permit does not provide for land application of recycled water or direct discharge to surface water. Because of the apparent hydraulic connect to the John Day River, monitoring wells have been installed. Near-stream nitrate and bacteria concentrations have been monitored.

Facility Name: Mount Vernon Waste Water Treatment Plant
Oregon File/Permit Number: 59065 (permit #101316)
EPA Permit Reference Number: OR-103069-4
Permit Type: NPDES Individual-facility
Receiving Water Body: John Day River
Location: Mount Vernon, Oregon
Discharge Mechanism: Pipe
Period of Permitted Discharge to Stream: year round
Current Permit Effluent Limit Parameters
Direct Discharge outfall: TSS, BOD, *E. coli*, pH, Residual Chlorine
Operational Status: Operating
Dry Weather Design Flow: 0.10 million gallons/day (0.0044 cubic meters per second)
Facility Description: The facility is a municipal sewage treatment plant. The facility includes a four-cell facultative lagoon and an outfall to the John Day River. Effluent is routed to lagoons, where it is dispersed through evaporation and infiltration. The lagoons are lined with clay. Wastewater treatment does not currently include chlorination in or preceding the lagoons. The lagoon capacity and loss rate is such that direct discharge, though allowed, is not known to occur. The permit does not provide for land application of recycled water.

Facility Name: City of Dayville Waste Water Treatment Plant
Oregon File/Permit Number: 23560 (permit #101794)
EPA Permit Reference Number: OR004150-5
Permit Type: NPDES Individual-facility
Receiving Water Body: John Day River
Location: Dayville, Oregon
Discharge Mechanism: Pipe
Period of Permitted Discharge to Stream: November 1 - May 31
Current Permit Effluent Limit Parameters
Direct Discharge outfall: TSS, BOD, *E. coli*, pH, Total Chlorine Residual, Temperature
Land Application outfall: *E. coli*
Operational Status: Operating
Dry Weather Design Flow: 0.048 million gallons/day (0.0021 cubic meters per second). Effluent limits are based on a monthly average flow of 0.037 million gallons/day (0.0016 cubic meters per second).
Facility Description: The facility is a municipal sewage treatment plant. The facility includes three lagoons (aerated primary cell, a secondary and third cell) and an outfall to the John Day River. During June 1 through October 31, when direct discharge is prohibited, land application may occur. The facility is relatively new, beginning operation in year 2000.

Facility Name: Long Creek Waste Water Treatment Plant
Oregon File/Permit Number: 51180 (permit #101751)
EPA Permit Reference Number: OR003407-0
Permit Type: NPDES Individual-facility
Receiving Water Body: Long Creek
Location: Long Creek, Oregon
Discharge Mechanism: Pipe
Period of Permitted Discharge to Stream: November 1 - May 31 (pending mixing zone study and Department authorization)
Current Permit Effluent Limit Parameters:
Direct Discharge outfall: TSS, BOD, *E. coli*, pH
Land Application outfall: *E. coli*
Operational Status: Operating
Dry Weather Design Flow: 0.03 million gallons/day (0.0013 cubic meters per second)
Facility Description: The facility is a municipal sewage treatment plant. The facility includes two facultative bentonite-lined lagoons, a City-owned land application site and an outfall to Long Creek. During June 1 through October 31, recycled water may be land applied. Though the City retains an NPDES permit, capacity is such that direct discharge has not occurred since lagoon construction. Currently direct discharge is prohibited, pending a mixing zone study and Department approval.

1.4.6.2 Impoundments

There are no large reservoirs in the John Day Basin. Olive and Magone Lakes are examples of the few once-natural lakes in the Basin. Olive Lake was deepened by dam installation for hydropower that was used at mine sites in the Granite Creek drainage. Olive Lake is the largest lake in the Basin, considering natural and built lakes, and is roughly one square kilometer (0.4 sq. mi) in area. Magone Lake, originated from a natural landslide blockage of a tributary to East Beech Creek, receives substantial recreational use.

A smaller reservoir, Bates Pond, is an impoundment of Bridge Creek (Upper Middle Fork watershed), developed as a Mill Pond (operated approximately 1929 to 1975) – probably the only lake or pond in the Basin with a fish ladder, constructed in year 2000. The pond is approximately nine acres in area, with an

18-foot (5.5 m) maximum depth. The Bates Pond area was recently acquired by the OPRD. The OPRD plans to develop the Park area with emphasis on water quality and fish habitat.

Several other ponds are visible in available maps and aerial photography: Officer Reservoir (Upper South Fork), Fopiano and Painted Hills Reservoirs (near Mitchell), Rock Creek Lake (near Picture Gorge) and Lake Penland (near Cutsforth Park) are examples. Most Basin ponds and lakes are used for recreation, irrigation, and livestock operations.

Most of the ponds and lakes in the Basin are not in or near TMDL-assessed river corridors. Bates Pond is an exception, where outfall temperature scenarios were simulated as inputs to the Middle Fork John Day River temperature model. Impoundments will be addressed in general terms in the temperature TMDL (**Chapter 2.1**).

1.4.7 Nonpoint Sources of Pollution

The pollutants addressed in this document are heat and fecal bacteria with *E. coli* as the indicator.

1.4.7.1 Causes

Temperature. Human-related summer heating in the Basin is primarily due to *nonpoint source* (widespread) heating. Using computer simulations, nonpoint source solar heating was evaluated by comparing the existing vegetation and channel with an estimate of undisturbed conditions. Substantial solar heating occurs due to the combined effects of reduced riparian vegetation height and density and increased channel width, caused by human-related activities. Diminished instream flow contributes to high temperature as well, particularly in July and August as flow approaches the annual minimum, surrounding temperatures are high and solar radiation is relatively direct – and irrigation crops need ample water.

Solar radiation is the energy source driving daily stream heating. Solar radiation is directly influenced by channel and vegetation conditions as stated previously. In addition, streams manifest indirect causes of solar heating. Stream straightening can be an indirect cause of solar heating. Straightening increases gradient, in turn increasing velocity and associated erosivity. This typically enlarges the channel, resulting in a wide and shallow stream, particularly during the low flow season. Bank weakening, by vegetation disturbance and associated loss of soil/root strength, similarly results in wide and shallow channels. Bank disturbance by livestock, vehicles and development generally leads to increases in stream width. A wide shallow stream is readily heated by the sun if not shaded. These situations are common in the John Day Basin, as elsewhere.

In addition, ground water provides thermal moderation. Summer daily temperature increases are less when ground water interacts with streams. The subsurface zone of water exchange between ground water and a stream is called the *hyporheic zone.* This zone, along with net ground water input to the stream, absorbs heat and directly cools stream water via mixing (in the summer subsurface water is generally cooler than stream water). Common causes of decreased groundwater input and exchange are less floodplain area to collect spring floodwater, decreased sinuosity and associated reduction in bank area to transmit pore water, incision-lowered water tables, well withdrawal and decreased vegetative trapping and storage of precipitation and floodwater. The type, amount and location of crop irrigation often influence groundwater patterns as well. In the John Day Basin, channel and floodplain modifications that contribute to loss of groundwater-stream interaction include loss of channel complexity. Channel complexity typically includes pool frequency, sinuosity, large woody debris and other attributes. Enabling sinuosity, wet meadows, large woody debris and floodplain area and connection will ultimately provide for a natural channel form with increased groundwater interaction and decreased channel width for solar heating.

Because channel form provides important thermal control, erosion control should be addressed as well. Increased fine sediment loading is generally detrimental to channel form, typically leading to widening and shallowing of the stream. Excess fine sedimentation in streambeds results from excess erosion (upland and channel) and altered stream hydraulics. Stream straightening, bank disturbance, riparian and upland

land cover disturbance are common causes of accelerated erosion. Watershed capture/funneling by road emplacement commonly exacerbates erosion. Best management practices for erosion control are effective and readily found in watershed literature.

Area climate is another important stream temperature control; though one not subject to locally based human influence. The expected changes coming to the region's climate underscore the importance of protecting and restoring the mechanisms that help keep stream temperatures cool. The thermal regimes of streams are expected to change in response to reduced summer stream flows, and increased air temperatures. Climate change can influence vegetation and shade patterns as well.

Stream temperature improvements obtained by growing mature riparian vegetation corridors along stream banks, reducing channel widths, and enhancing summer base flows will help mitigate the expected stream heating resultant from climate change. While some numeric objectives of the TMDL may not be attainable due to factors such as climate change, the general goal remains – natural thermal conditions, given the climatic conditions of the future.

Changes in stream temperature associated with global and regional climate change may require further modifications to the human-source allocations at some time in the future.

E. coli. Bacteria sources generally include livestock, pets, septic and sewer systems and wildlife. In addition to sources, transport mechanisms are important in addressing bacterial inputs to streams. For instance, high bacteria levels in a field would generally not lead to instream excesses if runoff were controlled by slope, detention or effective buffers. Transport mechanisms include ditches, roads, tributary streams, sewer systems, field and slope runoff and direct deposition.

Natural sources of fecal bacteria include those sources associated with wildlife (non-domestic animals, such as deer, rats, raccoons, ducks, geese and others that live or feed near or in surface waters. For the purposes of TMDL implementation, natural background is generally not targeted for reduction.

1.4.7.2 Management Roles

Land use categories with activities that influence channel and vegetation structure include agriculture, forestry, urban and transportation. As discussed in **Section 1.4.4.1,** agriculture comprises the largest area of land use in the Basin. Forestry and other forest land uses are the other predominant land uses. Roadways are commonly close enough to constrain channels or limit vegetative shading, as well as contributing to upland erosion. Artificial channel constraints can lead to increased bank and bed erosion and associated channel widening. The area of urban development in the Basin is quite small. Each category of land use has a legacy of vegetation removal/alteration, channel modification and increased erosion, leading to increased stream heating and fine sediment deposition. That said, each land use sector is actively involved with water quality protection and enhancement as well and we at DEQ promote best management practices to enable land uses to meet water quality objectives. We also recognize that part of the difficulty in achieving water quality standards relates to decades-old legacy impacts to the Basin. Planning processes should inventory these issues and we will support the various participants in achieving resources to address them.

Water management plays an important part in water quality in the John Day Basin and throughout the western US. The primary cause of unnaturally low stream flow in the John Day Basin is irrigation withdrawal. While DEQ is not the regulatory agency for stream flow in Oregon, we encourage and will work with OWRD and irrigators in implementing, as feasible, instream flow restoration (further discussion can be found in **Section 2.1.3.5**).

Agriculture, through livestock operations, close association with water, and its land area predominance, is the land use most associated with above-natural fecal bacteria input to streams, as well as nutrient loading. This is reinforced by stream data indicating high bacterial concentrations where the sole land use is agriculture, such as above Prairie City on the John Day River. While natural sources are also present along this reach and above it, bacteria concentrations above the area of agricultural land use are low.

Bacteria measurements in forested areas in and near the John Day Basin, indicate forest bacteria contributions are slight, though forest sample sites are few in number in the Basin. In forested areas, high levels of fecal bacteria, if occurring, usually will be associated with inadequate waste disposal by recreational users, the presence of livestock or other animals in the stream channel or riparian zone, and poorly maintained on-site treatment systems.

Urban areas are likely contributors of bacteria – through runoff, sewer and storm water systems. However, Basin urban areas are small and excessive bacteria loading is observed above urban areas. Wastewater treatment plants are addressed through permits, and cities are encouraged to assess their source potential and apply standard urban best management practices.

1.5 References

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2.0 TOTAL MAXIMUM DAILY LOADS

2.1 Temperature TMDL

This Chapter describes the elements of the temperature TMDL for the John Day Basin, summarized in **Table 2.1-1**. The temperature allocations herein address streams and rivers throughout the Basin, based on Basin-scale monitoring and analysis. This is the first temperature TMDL established for the Basin. TMDLs establish the assimilative, or loading, capacity of waterbodies, in this case streams and rivers. In this TMDL, the temperature loading capacity is broadly defined to encompass stream solar heating in modeled and un-modeled corridors as well as inflows from wastewater treatment plants and other sources of stream heating. This chapter primarily employs Celsius units for temperature. **Table 1.2-1** is a conversion table included to assist in translating to Fahrenheit units.

Table 2.1-1. Temperature TMDL summary information

Water body	John Day Basin stream network, HUC 170702
Water Quality Standard	OAR 340-041-0028 (Temperature)
Applicable Water Quality Standard Criteria	Generally, the natural conditions criterion is applied across the Basin. For point sources at times or locations without natural temperature determination, other narrative and biologically based criteria of the standard are applied.
Target Pollutant	Heat
Loading Capacity	The daily sum of the natural background solar heat load, throughout the Basin stream network, and the heat load corresponding to the Human Use Allowance (HUA).
Wasteload Allocation	Heat and temperature WLA for three WWTP. Zero stream heating for CAFOs.
Load Allocation	The daily sum of the natural background solar heat load, throughout the Basin stream network, and the heat load corresponding to the additional 0.1ºC human use allowance (HUA).
Load Allocation Surrogates	Quantitative: site-specific and generalized percent effective shade; reservoir heating limits. Narrative: natural channel form and natural stream flows for perennial streams; and natural channel and land cover conditions specific to ephemeral and intermittent streams.
Existing Pollutant Sources	Nonpoint source vegetation reduction and channel alteration (agriculture, flood control, forestry, urban, transportation). NPDES point sources. Small reservoirs and warm irrigation return flows.
Margin of Safety	Implicit
Reserve Capacity	0.2 ºC – in general. 0.1 ºC – within thermal overlap with point sources. 0.1 ºC – specific to the John Day WWTP

Natural thermal potential (NTP) is an important objective in this TMDL. NTP is defined in the context of the natural conditions criterion and its evaluation is discussed in detail in **Appendix B**. NTP refers to the best estimate of vegetation, channel shape, stream flow and other thermal controls that would occur without past and present human disturbance. The NTP channel and vegetation geometry, not flow, are the basis for the quantitative load allocations of this TMDL, and figure into the wasteload allocation method. The NTP temperature simulation addresses natural channel form, vegetation *and* flow.

Potential vegetation, flow and channel width and depth were simulated along much of the length of the John Day River and its North and Middle Forks. Analytical capabilities for solar heating assessment are generally robust, though other factors also influence natural temperatures. Practical difficulties in assessing the influence of groundwater and increased sinuosity limit the ability to estimate natural temperatures. A best approximation of natural conditions is made by simulating point source removal and assessing solar heating in relation to changes in channel cross-section, vegetation geometry and surface flow. Improved flow and riparian conditions sets the stage for channel evolution and shading that ultimately lead to natural temperatures, particularly if management allows for restoration of lesser understood stream functions as well, such as floodplain recharge and increased sinuosity.

2.1.1 (a) Waterbody Names, Locations and 303(d) Listings

This Chapter defines the temperature TMDL for the John Day Basin. The basin Hydrologic Unit Code is 170702. The John Day Basin temperature TMDL applies to all streams in the Basin, year round. The 303(d) listings for the John Day Basin are identified in **Section 1.2.2**.

2.1.2 (b) Pollutant Identification

Change in water temperature is an expression of heat energy transfer per unit volume. Heat is the pollutant addressed in this TMDL. For nonpoint sources, this is assessed as heat originating from solar radiation received by streams. For point sources, heat is assessed via mass transfer of effluent discharge to streams.

Throughout this chapter, the assessment and expression of solar heating includes direct and diffuse solar radiation. Heating due to direct solar radiation is associated with direct sunlight. Diffuse, or indirect solar radiation is that which is attenuated, for example through clouds and trees, or reflected from other surfaces prior to reaching a stream. The referenced solar radiation is assessed immediately above (prior to) the stream surface.

2.1.3 (c) Water Quality Standard, Beneficial Uses and TMDL targets

In order to protect all designated beneficial uses, water quality standards are developed to protect the most sensitive beneficial use of waters. Designated beneficial uses for the John Day Basin are listed in **Section 1.4.2**. The Oregon temperature water quality standard (OAR 340-041-0028) is based on protection of sensitive fish through various life phases. Several criteria apply in the John Day Basin, depending on location and time of year. **Figure 2.1-1** and **Figure 2.1-2** map the distribution of sensitive fish usage in the Basin, for applying the biologically based criteria of the standard. Other criteria apply as well including the *natural conditions* and *protecting cold water* criteria.

2.1.3.1 Target Criteria

The TMDL assessment presented in **Appendix B** establishes the natural conditions criterion applicability, for the warm season. The temperature standard states “Where the Department (DEQ) determines that the natural thermal potential of all or a portion of a water body exceeds the biologically based criteria in section (4) of this rule, the natural thermal potential temperatures supersede the biologically based criteria, and are deemed to be the applicable temperature criteria for that water body” (OAR 340-041-0028(8)). This determination has been made by the Department, as demonstrated in **Appendix B**, based on warm season analysis of the natural thermal potential of three corridors: the John Day River, the North and Middle Fork John Day Rivers. Analysis outcomes are summarized in **Figure 2.1-3** through **Figure 2.1-5**. For each modeled river, these scenarios are shown: (1) the *current condition* that the model was calibrated to, (2) *restored vegetation*, which is the estimated natural vegetation, (3) estimated natural *flow*, (4) a *30% width reduction*, the mid-range of modeled channel width/depth reductions, and (5) *natural thermal potential* (NTP), which combines the thermal influence of restored channel geometry, vegetation and flow. The NTP scenario (5), compared to the biologically based criteria, provides the basis for determining the applicability of the natural conditions criteria.

It follows that the assessed NTP temperatures generally supersede the warm season biological criterion as the TMDL target. This is because (1) estimated maximum warm-season natural temperatures exceed biologically based criteria (**Section 2.1.3.3**) through most of length of the modeled rivers, and (2) above-natural temperatures preclude downstream attainment of NTP at local scales (i.e., even where biologically based criteria are above NTP temperatures, application of the former could preclude attainment of the latter in downstream reaches where NTP is applicable). Exceptions to NTP applicability may occur where (and when) biologically based criteria are greater than NTP and cumulative effects are not an issue, particularly regarding point sources.

The natural conditions criterion, accordingly, is the basis for John Day Basin load allocations, as indicated in **Section 2.1.8**. Because the load allocations, though based peak annual heating, lead to conditions that sustain perennially (presence of natural vegetation, natural channel form), nonpoint source of stream heating is addressed year round.

The natural conditions criterion provides for wasteload allocations as well (**Section 2.1.7**). However, natural conditions were not estimated for all locations and times. One individual NPDES facility, the Long Creek WWTP, is located adjacent to an un-simulated receiving water. Across the Basin, where temperature was simulated, only the warm season is addressed. Point sources along the upper mainstem do not have NTP temperature targets during September through June. Where or when NTP temperatures are not known, the biologically based criteria may be applicable (**Section 2.1.3.3**). An additional criterion, the cold water protection criterion applies at temperatures below biologically based criteria. Typically, the cold water protection criterion will only apply in spawning waters. In the John Day Basin, the summer cold water protection applicability is rare – it is unusual for peak warm season temperatures to be less than the biologically based criterion.

2.1.3.2 Seven Day Average of the Daily Maximum

All temperature targets called for in this TMDL are the seven-day average of daily maximum temperatures (7DADM) unless otherwise specified. An exception occurs with regard to the spawning waters cold water protection criterion, where a 60-day average is applied, as mentioned in **Section 2.1.3.4.2**.

2.1.3.3 Applicable Biologically Based criteria

The temperature standard includes the following biologically based numeric criteria, as mapped in **Figure 2.1-1** and **Figure 2.1-2** and as described in **Section 2.1.7**.

[OAR 340-041-0028(4)]

- migration corridor – 20.0 degrees Celsius (68.0 degrees Fahrenheit)
- salmon and trout rearing and migration – 18.0 degrees Celsius (64.4 degrees Fahrenheit)
- core cold water habitat – 16.0 degrees Celsius (60.8 degrees Fahrenheit)
- salmon and steelhead spawning – 13.0 degrees Celsius (55.4 degrees Fahrenheit)
- bull trout spawning and juvenile rearing – 12.0 degrees Celsius (53.6 degrees Fahrenheit)

Figure 2.1-1. Fish use designations in the John Day Basin

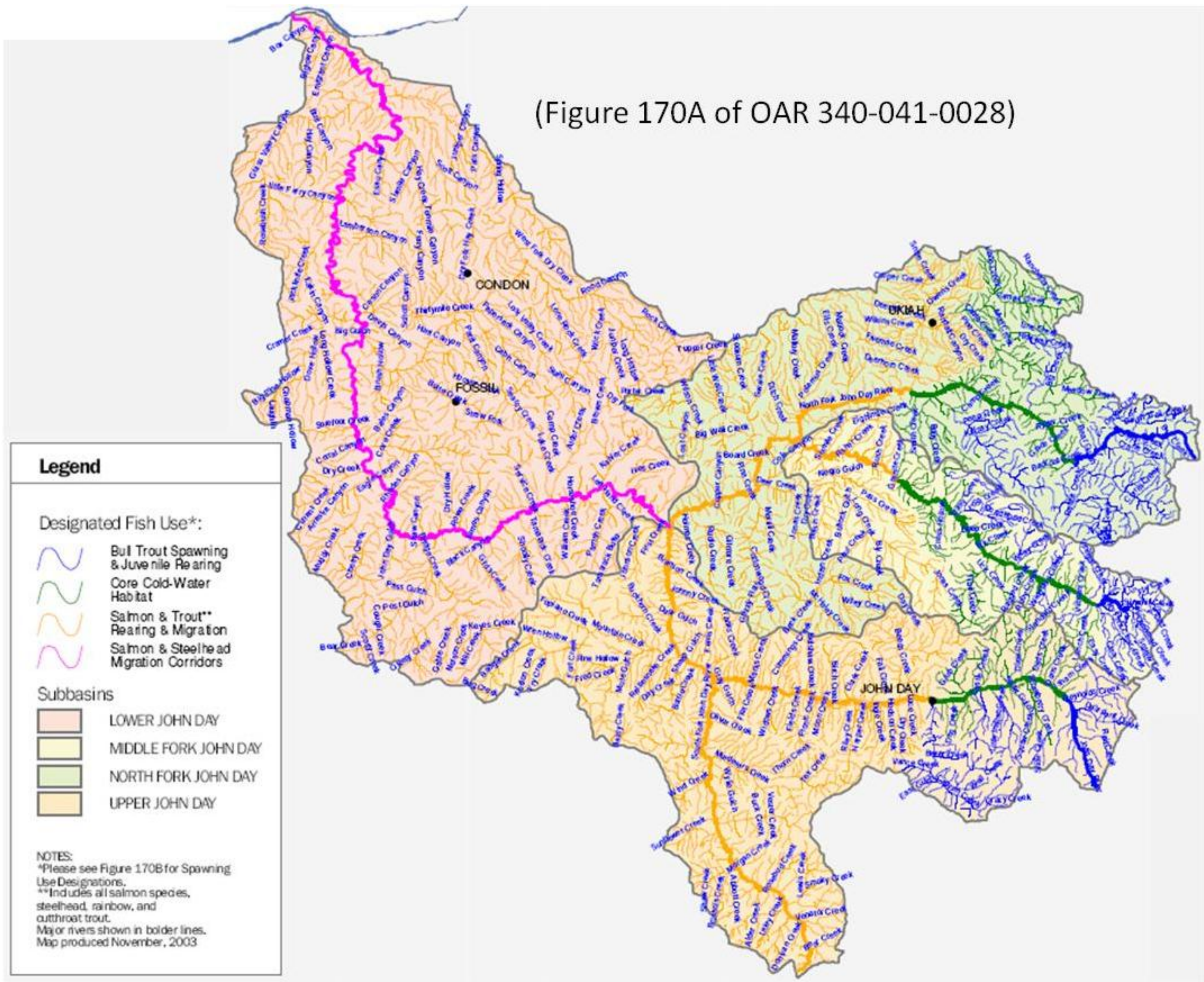


Figure 2.1-2. Salmon and steelhead spawning use designations in the John Day Basin

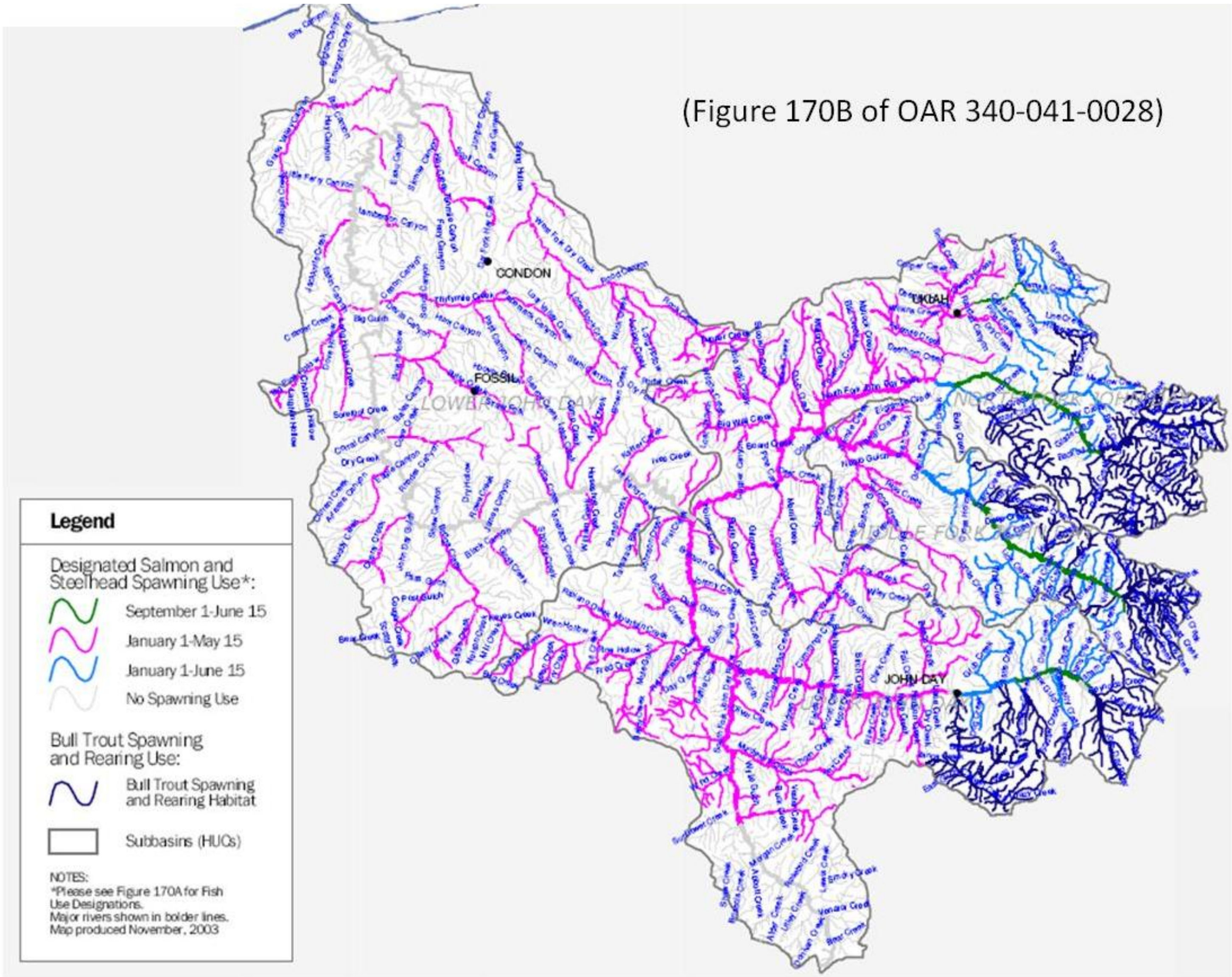


Figure 2.1-3. Simulated maximum 7DADM temperature, John Day River from described scenarios during the model period, warm season 2004 (recall of Figure B-3, Appendix B)

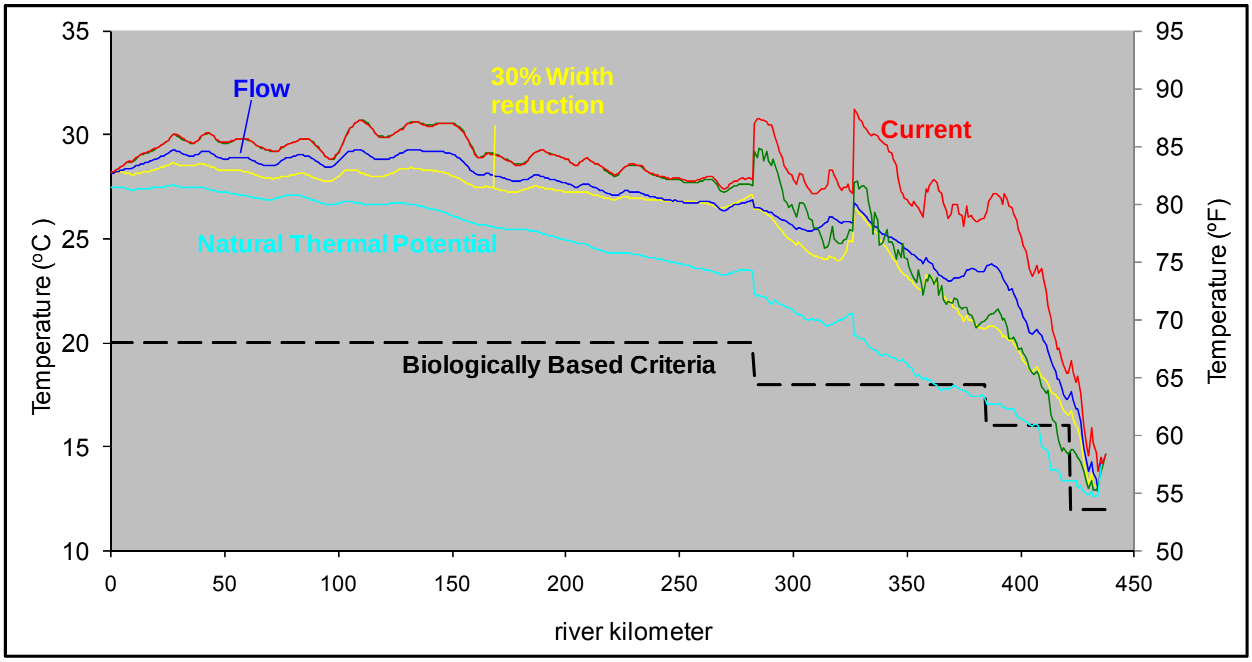


Figure 2.1-4. Simulated maximum 7DADM temperature, North Fork John Day River from described scenarios during the model period, warm season 2002 (recall of Figure B-18, Appendix B)

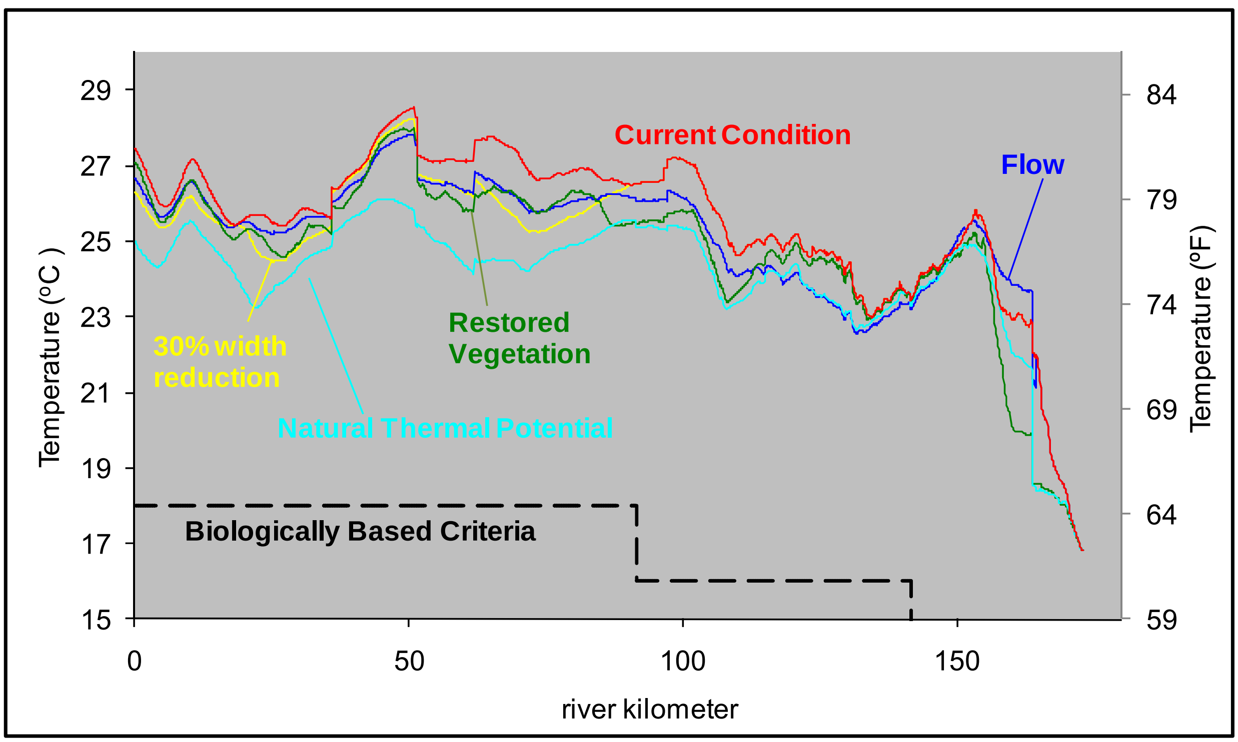
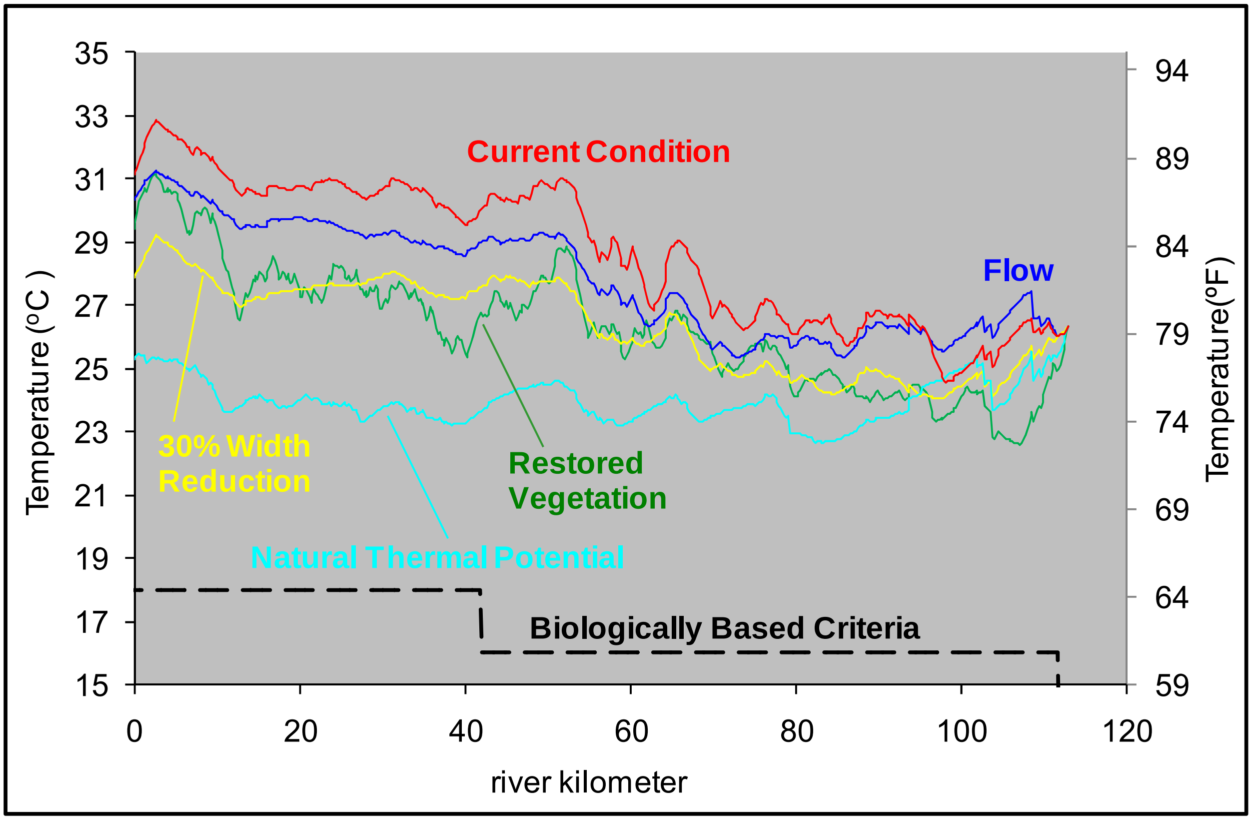


Figure 2.1-5. Simulated maximum 7DADM temperature, Middle Fork John Day River from described scenarios during the model period, warm season 2002 (recall of Figure B-32, Appendix B)



2.1.3.4 Human Use Allowance

The temperature standard provides for temperature increases, above applicable criteria, through a human use allowance (HUA): "Following a temperature TMDL or other cumulative effects analysis, wasteload and load allocations will restrict all NPDES sources and nonpoint sources to a cumulative increase of no greater than 0.3 degrees Celsius (0.5 degrees Fahrenheit) above the applicable criteria after complete mixing in the water body, and at the point of maximum impact" (OAR 340-041-0028(12)(b)(B)). It follows that the TMDL allocations of this chapter are based on the applicable criteria described earlier in this section (**Section 2.1.3.1**), plus the portion of the human use allowance allotted to any given source.

The HUA is apportioned as indicated in **Table 2.1-2** for all waters in the John Day Basin except for parts of Long Creek (drains into lower Middle Fork) and the John Day River upstream of the North Fork where waters are thermally influenced by point sources. The HUA for the waterbodies potentially impacted by existing point sources (John Day River above the North Fork, Long Creek) is apportioned as indicated in **Table 2.1-3**. This apportionment was based on general consistency with other basins and on John Day Basin community input. Potential future sources may draw on the reserve capacity. The general HUA of 0.3 ºC applies throughout the Basin and this TMDL prohibits human-related warming in excess of 0.3 ºC at any given location.

Table 2.1-2. HUA apportionment for reaches not having existing point sources (up- or down-stream reaches not exhibiting thermal overlap with point sources)

Application	Portion of HUA	Notes
Load Allocation	0.10 °C	All nonpoint sources
Reserve Capacity	0.20 °C	

Table 2.1-3. HUA apportionment – areas of potential influence from existing point sources (part of Long Creek and the upper John Day River)

Application	Portion of HUA	Notes
Load Allocation	0.10 °C	All nonpoint sources
Wasteload Allocation	0.10 °C	Combined increase in temperature associated with effluent from Long Creek WWTP, Dayville WWTP, Mt. Vernon WWTP
Specific Reserve Capacity		John Day WWTP
General Reserve Capacity	0.20 ºC	outside reaches with cumulative effect relating to existing point sources
	0.10 °C	within reaches with cumulative effect relating to existing point sources

Table note: the HUA apportionment above reflects an allowance of 0.1 ºC for cumulative effects of all point sources, including the existing WLA and the John Day WWTP specific RC. Note that the tabulated HUA portions are not necessarily additive – while the apparent sum of the HUA portions here exceeds the general maximum of 0.3 ºC, this is not allowed at any given location.

To clarify that the HUA apportionment of **Table 2.1-2** and **Table 2.1-3** does not provide for exceedance of 0.30 ºC warming, examples at different locations are included here:

John Day River upstream of the City of John Day. If a new point source upstream of the City of John Day would not result in any overlapping thermal influence with the John Day WWTP, then:

- NPS HUA = 0.10 ºC
- new source (WLA) maximum HUA = 0.20 ºC (assuming authorization of the new sources usage of the entire general reserve capacity)
- this would deplete the General RC HUA to zero
- total HUA used = 0.30 ºC

This scenario would not change the current apportionment in the downstream reach, because the river temperature increase from the new source did not extend downstream to the City of John Day WWTP.

John Day River from the City of John Day WWTP to below Dayville at a point where point source influence has attenuated to zero. This TMDL prescribes the following current HUA apportionment:

- NPS HUA = 0.10 ºC
- Mt Vernon, Dayville WWTP (WLA) and John Day WWTP collective HUA = 0.10 ºC (it is shown in **Section 2.1.7.2.1** that with 0.10 ºC river warming from the John Day WWTP and with Mt Vernon and Dayville WWTP effluent temperatures maximized, the cumulative allowed temperature increase for all point sources would not exceed 0.10 ºC at any location.
- this usage of the specific RC depletes the general RC HUA to 0.10 ºC in this reach
- total HUA used = 0.30 ºC (at any location in the reach)

If a new point source requests to access the general reserve capacity, DEQ will evaluate the discharge and assign the appropriate reserve capacity HUA so that the overall HUA threshold of 0.3 ºC is not exceeded.

2.1.3.4.1 Effluent Mixing Proportions

Following TMDL development, the HUA applies after complete mixing and at the point of maximum impact [OAR 340-041-0028(12)(b)(B)]. This allowance for complete mixing extends to all applicable criteria. As well, it extends throughout the year, given that the TMDL addresses the entire year. We note also that permitted mixing zones may be more restrictive.

2.1.3.4.2 Spawning Waters Cold Water Protection Allowance

The HUA is generally set at 0.3 ºC for all sources combined [OAR 340-041-0028(12)(b)(B)]. However, under certain conditions, heating of up to 0.5 ºC to 1.0 ºC is allowed and stream temperatures are assessed at 60-day, instead of seven-day, averages. The greater allowance and 60-day averaging apply via the cold water protection criteria [OAR 340-041-0028(11)(b)] when point sources are discharging into spawning area waters that are cooler than the spawning criterion.

2.1.3.4.3 Point of Maximum Impact

Along the modeled corridor, the warm season "point of maximum impact" (POMI) is where the greatest difference between existing and NTP 7DADM temperatures occur. The existing points of maximum impact, along modeled rivers during the maximum 7DADM, are identified in **Table 2.1-4**. In addition, it is noted that the location of the POMI may change seasonally and with changes in human impacts.

Table 2.1-4. Points of maximum impact
(longitudinal maximum difference between current and estimated natural conditions with the location of the maximum difference – recall of Table B-1, Appendix B)

Waterbody	Greatest excursion from NTP (maximum 7DADM, Δ °C)	Current point of Maximum Impact (river km)
John Day River (summer 2004)	10.8 (19.4 °F)	327.00
North Fork John Day River (summer 2002)	3.6 (6.5 °F)	168.70
Middle Fork John Day River (summer 2002)	7.6 (13.7 °F)	2.55

Note: to convert km to river-specific river miles, refer to **Table 1.4-3** through **Table 1.4-5**

2.1.3.5 Natural Conditions Flow Context and Implementation

TMDL allocations set pollutant limits calculated to achieve water quality standards. The TMDL analysis demonstrates that natural thermal conditions are needed to meet the stream temperature standard, throughout the John Day Basin. This includes natural conditions with regard to vegetation, channel form and flow.

As described subsequently in this Chapter, in developing this temperature TMDL, DEQ estimated natural potential temperature profiles for major rivers, focusing on summer afternoons (**Figure 2.1-3** through **Figure 2.1-5**). This is an outcome of the natural conditions provision of the temperature standard. Locally based temperature targets are established, that vary along a stream corridor, for the warmest part of the day. To address this, the TMDL allocations are prepared as heat limits targeting natural temperatures. The heat load maxima are based on reduced solar heating associated with natural potential vegetation and channel form. Natural flows are accounted for as well, though not through heat loads.

Pollutant (heat) reduction alone will not lead to attainment of temperature objectives in Basin streams with flow depletion. In order to address both heat inputs and flow, DEQ applies a dual approach for the TMDL: (1) set TMDL solar heating allocations (vegetation and channel form) and call for their implementation, and (2) establish a non-quantitative load allocation surrogate to address flow. This surrogate is defined as: Where feasible, instream flows should be protected to target natural discharge levels during April through September (**Section 2.1.8.7**).

DEQ's current process to promote flow protection and restoration relies on voluntary measures and community initiative. This approach is planned to include instream water right acquisition through DEQ (OAR 340-056) and mechanisms that will be determined through the Integrated Water Resources Strategy (http://www.oregon.gov/OWRD/LAW/Integrated_ Water_Supply_Strategy.shtml) and discussions with basin communities and other agencies. In the past, DEQ has applied for in-stream water rights in some basins, as has the Oregon Department of Fish and Wildlife.

The TMDL allocations do not state or assume that a DMA (DMA- a legal authority for sectors contributing pollutants to waterbodies) must cease withdrawing water in order to meet this TMDL and the water quality standard. How a sector makes its operations consistent with the allocation is to be established later through the planning process provided through sector-specific TMDL Implementation Plans, developed following TMDL issuance (**Chapter 3**).

In general, water diversions are regulated by the Oregon Water Resources Department. We do not name the OWRD as a DMA. DEQ and OWRD are cooperating to develop strategies to address the influence of water quantity on water quality, through the Integrated Water Resources Strategy noted above.

Flow Estimates. A point of clarification is important with regard to flow simulation (temperature results are portrayed in **Figure 2.1-3** through **Figure 2.1-5**). The John Day River August flows at the City of John Day were relatively high during the model year (2004), whereas the North Fork John Day River August flows at Monument were relatively low during its model year (2002), relative to period of record averages. On the other hand, the natural flow estimates provided for by OWRD are for a median year. Accordingly, the temperature reduction due to flow improvement is over-estimated in the North Fork and under-estimated for the mainstem. There is relatively little consumptive use in the upper North Fork drainage – progressively less above Monument and much less above the Middle Fork. In particular, the difference between 2002 and NTP temperature and flow profile, for the North Fork above the Middle Fork confluence, should not be interpreted as human-caused flow deficit. Rather, the estimate reflects annual variability and generalized estimation methods. The intent is to evaluate how much a given flow change can influence temperature, not to specify numeric flow targets or deficits.

2.1.3.6 Thermal Plume Limitations

Additional components of the temperature standard are applicable to point sources including the *thermal plume limitations* section [OAR 340-041-0053(2)(d)]. While this will be addressed through permitting and is not part of this TMDL, it is included here for context. In **Section 2.1.6**, the cumulative effects analysis invokes the instantaneous lethality threshold below as a limiting factor.

(d) Temperature Thermal Plume Limitations. Temperature mixing zones and effluent limits authorized under 340-041-0028(12)(b) will be established to prevent or minimize the following adverse effects to salmonids inside the mixing zone:

- *(A) Impairment of an active salmonid spawning area where spawning redds are located or likely to be located. This adverse effect is prevented or minimized by limiting potential fish exposure to temperatures of 13 degrees Celsius (55.4 Fahrenheit) or less for salmon and steelhead, and 9 degrees Celsius (48 degrees Fahrenheit) for bull trout;*
- *(B) Acute impairment or instantaneous lethality is prevented or minimized by limiting potential fish exposure to temperatures of 32.0 degrees Celsius (89.6 degrees Fahrenheit) or more to less than 2 seconds);*

(C) Thermal shock caused by a sudden increase in water temperature is prevented or minimized by limiting potential fish exposure to temperatures of 25.0 degrees Celsius (77.0 degrees Fahrenheit) or more to less than 5 percent of the cross section of 100 percent of the 7Q10 low flow of the water body; the Department may develop additional exposure timing restrictions to prevent thermal shock; and

(D) Unless the ambient temperature is 21.0 degrees of greater, migration blockage is prevented or minimized by limiting potential fish exposure to temperatures of 21.0 degrees Celsius (69.8 degrees Fahrenheit) or more to less than 25 percent of the cross section of 100 percent of the 7Q10 low flow of the water body.

2.1.4 (d) Loading Capacity

The loading capacity can consist of several components, as shown below. The various John Day Basin loading capacity components are described in **Sections 2.1.7** through **2.1.9,** and **2.1.11**.

$$LC = WLA + LA_h + LA_{bkgd} + MOS + RC$$

Where,

LC = Loading Capacity
WLA = Wasteload Allocation
LA_h = Load Allocation from human nonpoint sources
LA_{bkgd} = Load Allocation from natural background
MOS = Margin of Safety
RC = Reserve Capacity, for population growth or increased human loading

The term *Loading Capacity* (LC) is defined as “the greatest amount of loading that a water can receive without violating water quality standards” [OAR 340-041-0002(31)]. The thermal loading capacity for the John Day Basin is defined here as: ***the daily sum of the natural background solar heat load, throughout the Basin stream network, and the heat load corresponding to the Human Use Allowance (HUA).*** For modeled corridors, the LC is assessed throughout the surface area of the stream. The LC varies daily, based primarily on changing stream flow, cloud cover and solar altitude. Changes in foliage add seasonal variability. The LC was assessed through computer simulation of heat and temperature, for modeled streams, typically for a few months during the warm season. **Table 2.1-5** provides examples of John Day Basin LCs at the mouths of simulated rivers, using July 1 as the day in common (to each model stream period) that is closest to the solstice. Simulation details are summarized in **Section 2.1.4.1** and further documented in **Appendix B**.

Table 2.1-5. July 1 thermal loading capacities at the mouths of Basin rivers (24-hour longitudinally cumulative solar load for modeled rivers)

Waterbody	July 1 model year Flow (CMS)	Current Max 7DADM Temp. (ºC)	NTP Max 7DADM Temp. (ºC)	July 1 NTP loading (gcal/day)	July 1 HUA (0.3 ºC) Approx. Loading (gcal/day)	July 1 Approx. Loading Capacity (gcal/day)
John Day River	31.22	28.2	27.5	47462	809	48270
North Fork	12.00	27.4	25.0	17459	311	17770
Middle Fork	1.67	31.1	27.9	5248	43	5290

Table Notes:

- load calculations:
    - HUA Loading = the daily flow volume * 0.3 ºC * heat capacity of water
    - the approximate LC = NTP loading + HUA loading, where the nonpoint source component of the HUA is approximated with the heat per volume method that is applicable to mass transfers including point sources. The metric of nonpoint source

solar heating, radiant heat just prior to interaction with the stream surface, is greater than that resolved as temperature increase, because part of the incoming radiation is reflected, lost to evaporation, etc. However assessed, we note that nonpoint HUA heating is slight in comparison to total NTP heating.

- CMS = cubic meters per second, C = Celsius, Max 7DADM = maximum seven day average of the daily maximum, RC= reserve capacity, HUA = human use allowance, NTP = natural thermal potential; gcal = giga calories = 10^9 calories
- for time frames of 7DADM, refer to temporal charts in **Section 2.1.10**

2.1.4.1 Notes on Simulated Heat Loading

The LCs were computed through deterministic temperature modeling (**Appendices A and B**). Calibration to current thermal conditions is followed by simulation of thermal controls estimated at natural potential, including flow, vegetation and channel width and depth. The NTP scenario combines these potential conditions. No point sources currently convey surface discharge to the river during the summer, so no point source inputs were considered in the evaluation of NTP loading presented in **Table 2.1-5**. We further clarify that while tributary inputs to rivers are accounted for as mass transfers in flow and temperature simulation in this TMDL assessment, tributary solar radiation is not included in the LCs of **Table 2.1-5** (or the site-specific LA described in **Section 2.1.8.2**). Un-modeled tributary solar radiation is addressed in generalized (not site-specific) shade curve LA and LA surrogates as discussed in **Sections 2.1.8.1** and **2.1.8.3**. As noted in **Section 2.1.2**, the assessed loading of the LC is the simulated incoming solar heat load (direct and diffuse) prior to interacting with the water surface. Loading is quantified each 24-hours during the model period, and reflects the heat loading directed to the stream for the surface area of each model distance step [John Day River = 1000m (3280 feet), North Fork = 200m (655 feet), Middle Fork 200m (655 feet)]. Dates of simulation are based on the model year (2002 for the North and Middle Forks, 2004 for the John Day river).

2.1.5 (e) Excess Load

The amount of daily solar energy the river surface receives is dependent on the date, the amount of sun during the day, the amount of shade, and the stream surface area. The difference between the solar energy that reaches the river currently and under NTP conditions is the excess solar load. The current excess solar load (longitudinally and cumulatively) based on July 1 of the model calibration year, is shown in **Figure 2.1-6** for the three assessed rivers. As with the loading capacity and load allocations, explanatory simulation information is briefly stated in **Section 2.1.4.1** and elaborated upon in **Appendices A** and **B**. It should be noted that for some reaches in the North Fork and Middle Fork John Day Rivers, despite the applied channel width/depth reduction, the potential stream wetted width is predicted to be wider than current (due to increased flow). This representation caused the amount of radiation that reaches the surface to increase from the current condition, at some locations. July 1st current, NTP and excess heat loads at the mouths of the three rivers are listed in **Table 2.1-6**.

Figure 2.1-6. Excess solar load for all modeled reaches (recall of Figure B-49, Appendix B)

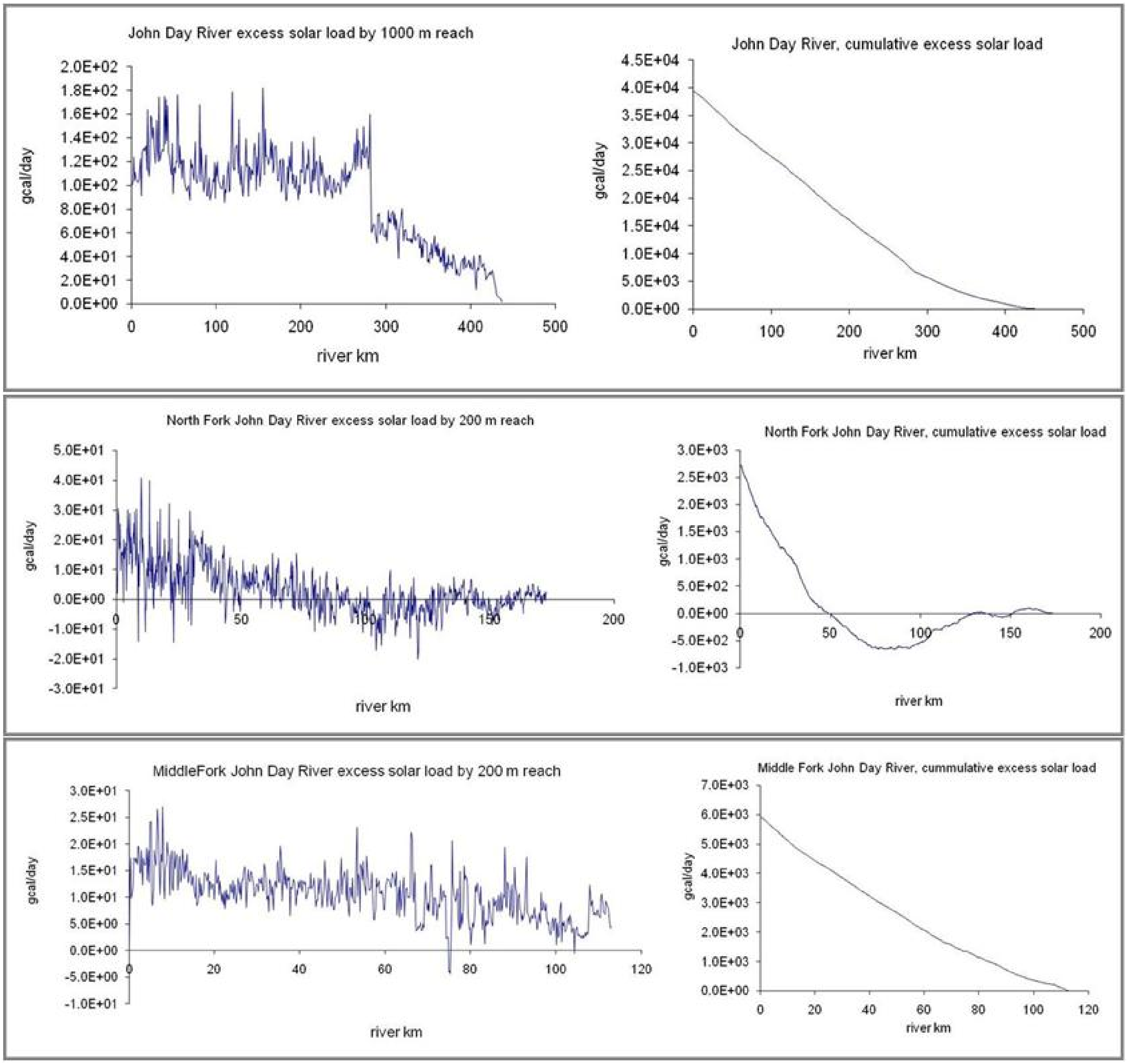


Table 2.1-6. July 1 solar heat loading on model corridors

Waterbody	NTP Cumulative Loading (gcal/day)	Current Condition Cumulative Loading (gcal/day)	Excess Loading (gcal/day)
John Day River	47462	86801	39339
North Fork	17459	20181	2722
Middle Fork	5248	11172	5924

2.1.6 (f) Pollutant Sources and Jurisdictions

2.1.6.1 Point Sources and Nonpoint Sources

Based on the lack of point source volumetric input, and as reflected in **Table 2.1-5,** human-related stream heating in the Basin is primarily *nonpoint source* heating. Using computer simulation, nonpoint source solar heating was evaluated by comparing the existing vegetation and channel geometry with an estimate of undisturbed conditions. Substantial increases in solar heating occurs due to the combined effects of reduced riparian vegetation height and density and increased channel width – both related to human activities. The temperature and heating profiles of **Figure 2.1-3** through **Figure 2.1-5**, and **Figure 2.1-6** graphically illustrate the amount of human-caused heating in the principal Basin streams. This heating is entirely from nonpoint sources as no permitted point source surface discharges were occurring at the time of assessment. Point source loading was reviewed as well, where applicable, and individual WLA are established for each. Responsible parties for NPDES point sources with non-zero WLA are as follows:

- Mount Vernon Waste Water Treatment Plant – City of Mount Vernon
- Dayville Waste Water Treatment Plant – City of Dayville
- Long Creek Waste Water Treatment Plant – City of Long Creek

Point source characteristics and locations are described in **Section 1.4.6.1**.

Land use categories with activities that influence channel and vegetation structure include: agriculture, urban, forestry, recreation and transportation corridors. The general distribution of land ownership and types of land use are described and mapped in **Section 1.4.4**. Agriculture comprises the largest area of land use in the Basin. Forestry has next predominance, regarding aerial extent. Roughly eighty percent of the forested landscape is in Federal ownership. Along the mainstem and tributaries, roadways are often close enough to constrain channels or limit vegetative shading. The area of urban development is quite small. Small reservoirs in the basin are used for irrigation, recreation and livestock (refer to discussion in **Section 1.4.6.2**). In general, based on their small fraction of Basin area and low volume, reservoirs are a relatively slight source of stream heating.

2.1.6.2 Physical Causes of Stream Heating

Causes of human-related stream heating in the John Day Basin include:

- Vegetation disturbance/removal
- Removal of large woody debris and its sources
- Stream straightening
- Bank disturbance
- Channel de-stabilization due to structures or the above factors, leading to increased channel cross-sectional area (causing increases in ratio of wetted width/depth during low flow). Channel complexity, including large wood, sinuosity and pool frequency are important for habitat as well as

reduced temperature. These factors lead to thermal moderation from increased groundwater input and can contribute to decreased width/depth.

- Decreased groundwater input and hyporheic exchange during the warm season (associated with morphologic and hydrologic modification). Stream-cooling wet meadows can be inadvertently destroyed by incision associated with channelization.
- Reduction in floodplain area or accessibility
- Decreased instream flow
- Modified upland hydrology influencing timing of instream flow
- Warm water discharges
- Increased retention time and effective width/depth ratio associated with impoundments (reservoirs)

Section 1.4.7 includes additional discussion of the causes of high stream temperature and the role of land managers.

2.1.6.3 Jurisdictions

Systemic thermal modifications have resulted from a complex mix of land use, structural modifications and management scenarios – both past and present. Most modifications are, or have been, prevalent across the basin landscape as well as throughout the region. Each land use category is involved in several causal factors. The Department has identified entities having land use jurisdiction or pollution control authority, across the basin, in relation to stream heating and the other pollutants of concern discussed in this document. With regard to nonpoint sources, these entities are listed in **Chapter 3**, **Table 3-3**, and are called on to conduct TMDL implementation planning and/or assessment addressing the load allocations and surrogates established in this Chapter. Point sources are addressed through DEQ's NPDES program.

2.1.7 (g) Wasteload Allocations

2.1.7.1 Identification of Facilities

Wasteload Allocation is defined as "The portion of receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution" [OAR 340-041-0002(67)]. **Section 1.4.6.1** identifies and describes John Day Basin point sources of pollution, including a list of facilities and permit identification numbers. This temperature TMDL addresses two types of NPDES permits; CAFO general permits and individual facility permits for municipal wastewater treatment plants. In addition, this temperature TMDL addresses the John Day wastewater treatment plant, a facility currently permitted through DEQ's water pollution control facility (WPCF) program.

Wasteload allocations of zero discharge are herein issued to existing and future CAFO facilities in the Basin. The two existing and one pending CAFO-permit facilities in the Basin are identified in **Section 1.4.6.1**. This is logical in that their permits generally prohibit discharge to waters of the state.

The three individual NPDES permitted facilities receiving WLA are the WWTP of the Cities of Mt. Vernon, Dayville and Long Creek. These will receive non-zero WLAs, as discussed subsequently in this section.

As mentioned in **Section 1.4.6.1**, the Department believes that the lagoon wastewater, of the WWTP for the City of John Day, interacts with the John Day River. The basis for this includes the proximity of the four treatment lagoons to the river [25 m (80 feet) at closest point], the coarse unconsolidated lagoon substrate and surrounding floodplain materials, the lack of an engineered lagoon liner, visibly rapid infiltration rates and monitoring well nitrate data that serves as a tracer to a near-bank point. In this TMDL, the Department is allocating a thermal load as reserve capacity for the City of John Day (**Section 2.1.11.2**). The facility is believed to have no adverse thermal impact currently, based on (1) subsurface discharges are normally cool in the warm season due to thermal moderation below ground, and (2) assessment of summer thermal infrared flight data (8/29/2004, no heat signal). However, the Department elects to accommodate the facility in the event that NDPES permitting is considered or assimilative capacity is needed.

2.1.7.2 Wasteload Allocation Definition and Target

For each individual facility NPDES source, the ***John Day Basin temperature WLA is here defined as the maximum heat loading from the facility that will restrict the source to an increase of no greater than the portion of the HUA assigned, above specified temperature targets after complete mixing in the receiving waterbody***. Addressing the entire year, these 'specified temperature targets' are as follows:

(1) Warm season targets for modeled streams: In order to address the natural conditions criterion of the temperature water quality standard, the target is the warm season maximum NTP or ambient background temperature, whichever is less. This target supersedes the warm season biologically based criterion when waters are warmer than the superseded criterion.* This occurs during the periods identified below, for the upper mainstem – the only modeled waterbody with individual NPDES permitted discharges.

   i. Between the North Fork and Canyon Creek: May 16-December 31 or when stream temperature is greater than 18 ºC (64.4 ºF)
   ii. Between Canyon Creek and Indian Creek: June 16-December 31 or when stream temperature is greater than 16 ºC (60.8 ºF)
   iii. Between Indian Creek and just below Reynolds Creek: June 16-August 31 or when stream temperature is greater than 16 ºC (60.8 ºF)
   iv. From just below Reynolds Creek to the headwaters: when stream temperature is greater than 12 ºC (53.6 ºF)

(2) For all other times and for un-modeled streams, the normally applicable criteria (e.g. biologically based or cold water protection) of the temperature standard are targeted via this TMDL.

* Capping the target at maximum NTP temperature ensures that natural peak temperatures of a relatively normal year's climate and flow (the 2004 model calibration year), will not be exceeded at any time during the warm seasons to come. Integrating background into the target ensures that ultimately, as surrounding conditions become more natural, natural temperatures will be targeted by point sources throughout the warm season.

As used herein, the NTP targets are derived from simulation of natural conditions based on the climate of 2002 (North and Middle Forks) and 2004 (mainstem). With further analysis for subsequent TMDL development, NTP estimates could be updated, particularly as climate change is better understood. In the interim, as these years were not abnormal flow or climate years (and note that only 2004 is used as the basis for point source targets), the simulated NTP temperatures are considered a suitable target to apply as an annual maximum temperature limit that approximates natural conditions. We note that while daily maximum temperature fluctuates substantially through the year and within any season, the reducing trend of annual 7DADM maxima will exhibit much less variance.

According to the Basin WLA definition above, the applicable HUA for each source must be determined in order to calculate WLA temperature limits. Cumulatively, point sources may not impact stream temperatures more than 0.1 ºC, above the portion of the HUA established in **Section 2.1.3.4**. In order to determine the HUA for each individual facility, a cumulative effects analysis was carried out and is summarized below.

2.1.7.2.1 Cumulative Effects Analysis

This section addresses the three individually permitted NDPES sources in the Basin and the City of John Day WWTP. **Table 2.1-7** lists these four facilities, their discharge periods and the current condition summer maximum background temperature of the River just upstream from the outfalls (the temperature model is calibrated to 2004 conditions). The John Day, Mt. Vernon and Dayville WWTPs are located adjacent to the John Day River. The Long Creek WWTP has the capability of discharging to Long Creek, which flows to the Middle Fork, which flows to the North Fork, which flows to the John Day River at km 282.2 (river mile 185). For Long Creek and Mt. Vernon, lagoon evaporation and infiltration occur at rates such that their direct discharge outfalls are not utilized. The Dayville WWTP episodically discharges treated effluent directly to the John Day River from Nov 1 – May 31. All three NPDES sources have provisions in their permits to allow direct discharges during part or all of the year. The John Day WWTP discharges effluent to lagoons under a Water Pollution Control Facility (WPCF) permit (WQF#43569). Assimilative capacity is held as Reserve Capacity (**Section 2.1.11**) specifically for the John Day WWTP, to be used as needed through current or future permitting mechanisms.

Table 2.1-7. Facility discharge periods and stream maximum 7DADM temperature

Common Name	WQ File Number	Receiving Water	Direct Discharge Permitted Period	Comments	2004 Modeled Maximum 7DADM
CITY OF DAYVILLE	23560	John Day R	November 1 - May 31		27.1
LONG CREEK WWTP	51180	Long Creek	November 1 - May 31	outfall not utilized	Not modeled
MT VERNON WWTP	59065	John Day R	Year round	outfall not utilized	26.7
John Day WWTP	43569	discharges year round to lagoons adjacent to John Day River			26.0

Given the HUA breakdown described previously in this chapter, the point sources may not cause a cumulative temperature increase of more than 0.1 °C. The Long Creek WWTP is the only NPDES permitted source in the North and Middle Forks Subbasins. Given the geographic separation, overlapping thermal effects are not feasible between Long Creek and the mainstem WWTPs. The cumulative effects analysis for the upper John Day River sources shows that each of the point source's potential temperature impacts dissipates before causing an instream increase of 0.1 ºC. This was assessed based on maximizing discharge and temperature from the three point sources, starting with the current condition calibrated model and increasing flow to potential. We simulated an up to 0.1 ºC river temperature increase associated with each point source discharge, added to potential flow conditions (which represents higher flow than 7Q10, increasing the likelihood of thermal overlap between sources) and followed the resultant temperature departure downstream to complete attenuation. For the purpose of testing worst-case effluent temperatures prior to mixing with the River, the effluent discharge temperatures were capped at 32 ºC (thermal plume rule limits exposure inside mixing zone at or above this temperature – refer to **Section 2.1.3.6**).

Explanatory notes:

32 ºC is not necessarily an allowable maximum effluent temperature for the facilities. Rather it is an extreme value used to conservatively test cumulative effects. Other thermal plume and post-mixing limits criteria will be factored in to the permit limit-setting process.

While low-stage river flow will be more thermally influenced by individual point sources, downstream retention of a given river temperature increase is maintained for further distances at high flow. At low flow, rivers quickly equilibrate to their surroundings. At high flows, the receiving volume is such that point sources are not capable of causing HUA exceedances. The optimal test flow for cumulative impacts is obtained by increasing flow to the upper range of where individual point sources can make a significant difference in stream temperature. Summer NTP flow served as a balancing point to test this.

Figure 2.1-7 plots both the maximum 7DADM temperatures under the potential flow scenario, and the potential flow scenario with the three point source discharges added. The difference is difficult to discern at this scale. To better illustrate, this graph is zoomed in to the area around the John Day WWTP at river km 384.0 (river mile 248, **Figure 2.1-8**). The graph shows the point source causing an up to 0.1 ºC increase in temperature, relative to the potential flow condition without point sources. **Figure 2.1-9** shows that the maximized temperature increases (either 0.1 ºC or the maximum river temperature increase resultant from facility design flow at 32 ºC) from all three point sources rapidly decrease before the next point source in-flow. In combination, the three maximized thermal impacts do not cause the river temperature to increase above 0.1ºC.

Figure 2.1-7. Point sources' effluent simulated to increase river temperature by up to 0.1 ºC (John Day River, using the current condition model with natural potential flow)

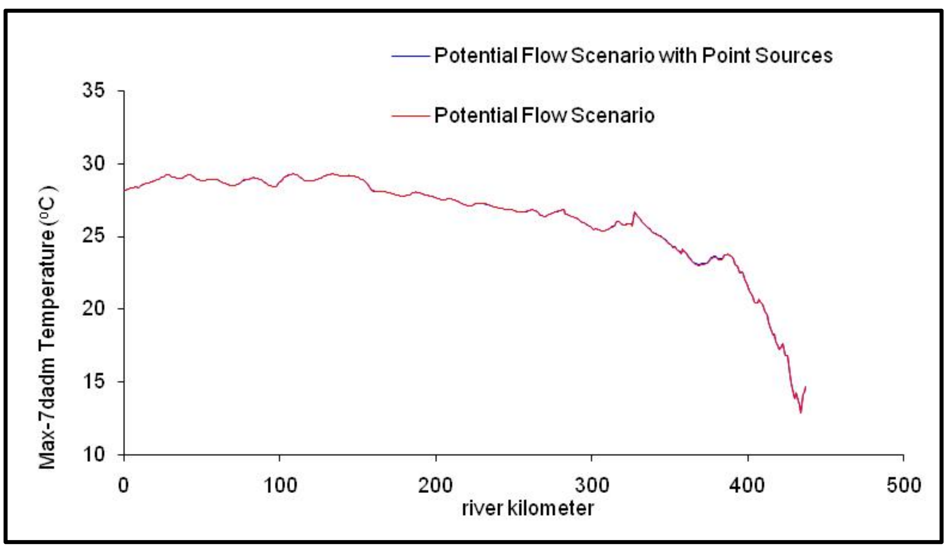


Figure 2.1-8. Zoom of previous graph around John Day WWTP at river km 384.

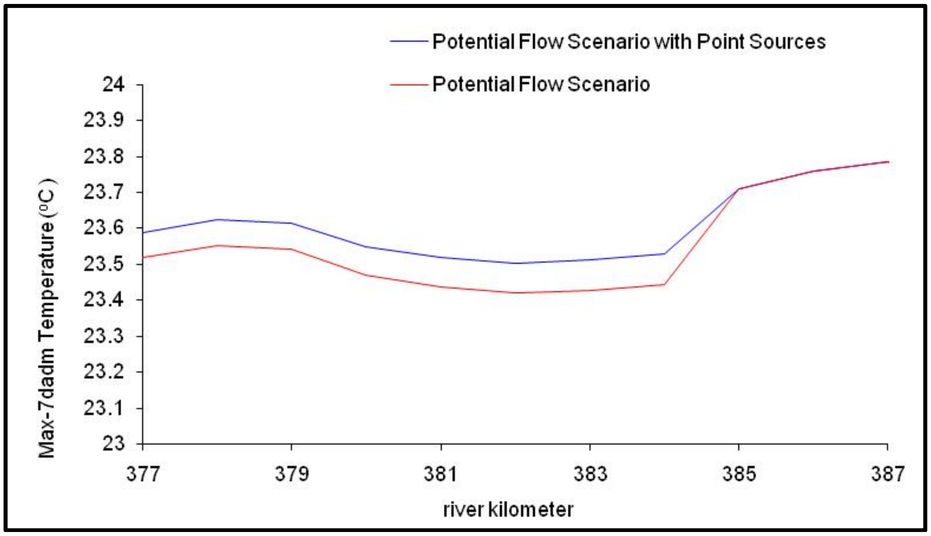
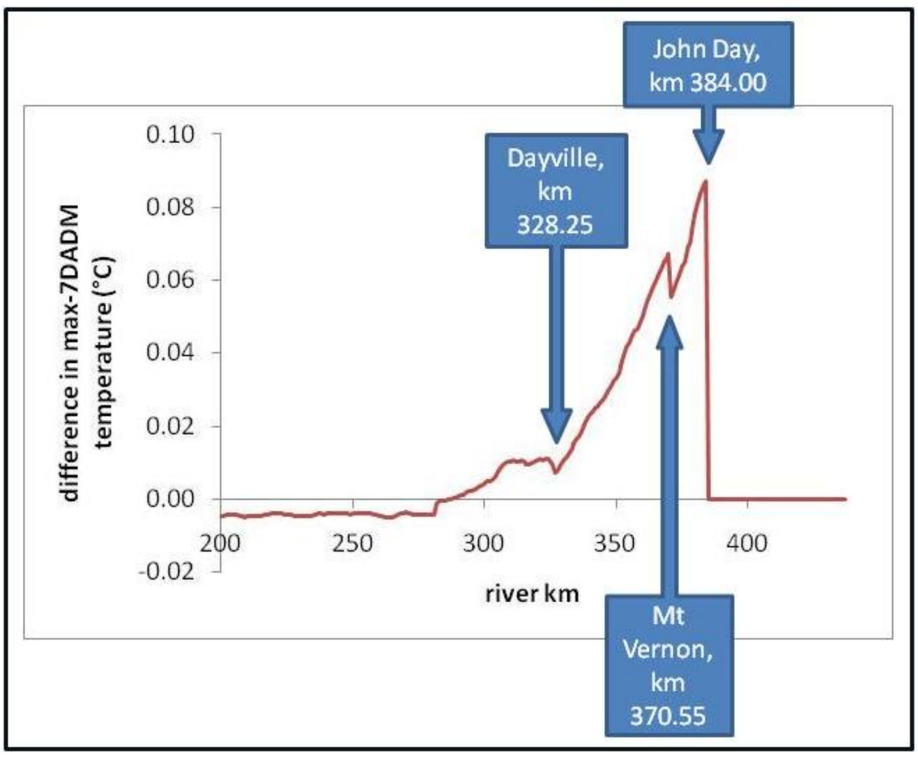


Figure 2.1-9. Difference between potential flow scenario with and without point sources (point source effluent simulated to increase John Day river temperature by up to 0.1 ºC)



2.1.7.3 Wasteload Allocations

In order to meet the specified temperature targets of **Section 2.1.7.2**, the John Day Basin temperature WLA limits allowable heat loads and effluent temperatures. Both heat loads and temperature limits are dependent upon effluent flow and upstream river flow. Effluent flow and river flow change over time. **Equation 2.1-1** provides for calculation of the WLA heat load increase, and **Equation 2.1-2** yields the maximum WLA temperature (exiting facility, assuming 100 percent mixing). From the WLA perspective, a variety of scenarios could be constructed and this may occur during permit development, but examples are shown here in **Table 2.1-8** (WLA heat) and **Table 2.1-9** (WLA temperature). To quantify the allowable heat load, a "worst-case" scenario was created to simulate the convergence of critical conditions in the John Day River. The "worst-case" scenario assumes a 7Q10 flow (the lowest 7-day average flow within 10 years, on the average) and effluent flows equal to the average dry weather design flow in the permit, except for Dayville where less than design flow was used in order to be consistent with the permit.

During the "worst-case" scenario conditions, the permit holder can discharge the allocated amount of heat without impacting the river more than 0.1 °C above the applicable criteria. If the water quality standard is met during the "worst-case" scenario, the WQS will probably be met during most conditions. In the John Day River, the 7Q10 low flow was calculated at the USGS station above the City of John Day, both for the full year and exclusively during the spawning season (which is Jan 1- May 15 at the points where existing sources are located). For the Long Creek WWTP, the 7Q10 low flow in Long Creek was approximated due to the lack of available flow data. Through permitting or future TMDL development, the "worst-case" scenario WLA of **Table 2.1-8** may need to be revised, and the 7Q10 could be revised on a facility specific basis.

The following equation is used to calculate the WLA heat load for any given effluent flow and river flow (**Equation 2.1-1**):

$$H_{WLA} = (\Delta T)(Q_e + Q_R)C_F$$

Where,

H_{WLA} = Waste Load Allocation, heat load, $\frac{gcal}{day}$

ΔT = allowable temperature increase, ^oC

Q_R = river flow rate, upstream, $\frac{ft^3}{s}$

Q_e = effluent flow rate, $\frac{ft^3}{s}$

C_F = combined heat capacity and unit conversion factor = $2.44667\text{E-}6 \times \frac{gcal \cdot s}{^oC \cdot ft^3 \cdot day}$

Table 2.1-8. WLA heat load example calculations

Point Source Name	River Kilometer	Dates Applied	Dry Weather Design Flow (MGD)	Receiving Stream 7Q10 (John Day R. and Long Ck, CFS)	HUA (°C)	Heat Component of WLA (gcal/day)
Mt. Vernon WWTP	370.55	5/16-12/31	0.1	7.88**	0.1	1.97
Mt. Vernon WWTP	370.55	1/1-5/15	0.1	68.1	0.1	16.70
Dayville WWTP	328.25	5/16-5/31 & 11/1-12/31	0.037*	7.88**	0.1	1.94
Dayville WWTP	328.25	1/1-5/15	0.037*	68.1	0.1	16.68
Long Creek WWTP	20	5/16-5/31 & 11/1-12/31	0.03	1.5 (est.)	0.1	0.378
Long Creek WWTP	20	1/1-5/15	0.03	1.5 (est.)	0.1	0.378

Table notes:

- MGD – million gallons per day (1 MGD = 1.547 CMS)
- *discharge used in Dayville permit for determination of effluent limits
- 7Q10 for Long Creek is estimated for the season of permitted discharge, based on comparison to nearby drainage areas.
- 7Q10 values are seasonal unless noted, based on dates shown
- **annual 7Q10 (seasonal 7Q10 if no asterisk)
- to convert km to river-specific river miles, refer to **Table 1.4-3** through **Table 1.4-5**

In order to calculate WLA temperature limits, the current river ambient background or applicable temperature criterion must be known. The following equation is used to calculate the effluent temperature limit for any given effluent flow, river flow, and instream temperature target. The applicable instream temperature target is specified in **Section 2.1.7.2**. Example calculations are provided in **Table 2.1-9**.

The following equation is used to calculate the WLA temperature for any given effluent flow and river flow (**Equation 2.1-2**):

$$T_{WLA} = \frac{(Q_e + Q_R)(T_T + \Delta T) - (Q_R)(T_T)}{Q_e}$$

Where,

T_{WLA} = Wasteload allocation temperature, as a 7DADM (ºC)

T_T = Applicable 7DADM target (ºC) from **Section 2.1.7.2**

Q_e = effluent flow rate (ft^3/s)

Q_R, ΔT - as for **Equation 2.1-2**

Table 2.1-9. WLA example temperature limits, prior to mixing with waterbody

Point Source Name	River Km	Dates	Receiving Stream 7Q10 (John Day R. and Long Ck, CFS)	Bio-logically based Criterion (ºC)	Effluent Temperature Limit (ºC) Based on Biological Criterion at Left (ºC) – Capped at 32ºC	Maximum 7DADM NTP (ºC)	Effluent Temperature Limit (ºC) Based on Maximum 7DADM NTP at Left (ºC)
Mt. Vernon WWTP	370.55	7/1-8/31	8.19	18	23.4	17.90	23.3
Mt. Vernon WWTP	370.55	9/1-12/31	12.3	18	26.0	Unknown	Unknown
Mt. Vernon WWTP	370.55	1/1-5/15	68.1	13	32	Unknown	Unknown
Mt. Vernon WWTP	370.55	5/16-6/30	31.9	18	32	Unknown	Unknown
Dayville WWTP	328.25	11/1-12/31	69.4	18	32	Unknown	Unknown
Dayville WWTP	328.25	1/1-5/15	68.1	13	32	Unknown	Unknown
Dayville WWTP	328.25	5/16-5/31	97.7	18	32	Unknown	Unknown
Long Creek WWTP	20	5/16-12/31	1.5 (est.)	18	21.3	Unknown	Unknown
Long Creek WWTP	20	1/1-5/15	1.5 (est.)	13	16.3	Unknown	Unknown

Table notes:

- also used in WLA temperature equation:
    - HUA is 0.1 for all facilities throughout the period of permitted discharge
    - facility design flows are available in **Table 2.1-8**
    - 7Q10 values are seasonal based on dates shown
    - 7Q10 for Long Creek is estimated as for **Table 2.1-8**
- all temperature targets are assessed in terms of maximum-7DADM
- un-permitted periods are not shown
- all calculations assume 100% of the receiving river is used for mixing
- temperature modeling is limited to the warm season
- cold water protection criteria, not addressed here, is likely to apply within the spawning season
- effluent temperatures are limited by the WLA temperature limits and may be further limited by permit constraints such as thermal plume limitations and other permit conditions.
- to convert km to river-specific river miles, refer to **Table 1.4-3** through **Table 1.4-5**

2.1.8 (h) Load Allocations and Surrogates

2.1.8.1 Load Allocations – Solar Heating

Load allocation is defined as “The portion of a receiving water’s loading capacity that is attributed either to one of its existing or future nonpoint sources or to natural background sources” [OAR 340-041-0002(30)]. “Sources” means *sources of pollutants*, in this case excess heat. The John Day Basin load allocations are defined here as ***the daily sum of the natural background solar heat load, throughout the Basin stream network, and the heat load corresponding to the additional 0.1ºC human use allowance (HUA).*** Explanatory information for the simulations is briefly discussed in **Section 2.1.4.1** and elaborated upon in **Appendices A** and **B**. John Day Basin load allocations are simulated via two methods. First the LA is expressed as a site-specific daily solar heating rate per stream surface area (heat flux in W/m^2), assessed longitudinally for temperature-modeled stream corridors (**Figure 2.1-10** through **Figure 2.1-12**). As described for the LC, while tributary inputs to rivers are addressed as mass transfers in temperature simulations, tributary solar radiation is not included in this site-specific stream profile LA.

The second LA assessment method is through generalized (non site-specific) heating curves, and this does address insolation to tributaries. This load allocation applies to perennial, or potentially perennial, tributaries where temperature and heating were not simulated. It is expressed as daily solar heat load (also in heat flux in W/m^2) in relation to channel width for specified stream aspects (**Figure 2.1-13**, **A-I**). The curves are based on NTP vegetation. NTP vegetation is described and mapped in **Appendix C**. Details regarding curve selection are provided in **Section 2.1.8.3**.

In both the site-specific LA graphs (**Figure 2.1-10** through **Figure 2.1-12**) and the generalized LA graphs (**Figure 2.1-13**, **A-I**), the heating directed to the streams is based on NTP vegetation without the additional 0.1 ºC HUA. In comparison to the total nonpoint source solar input, the heating associated with an additional 0.1 ºC would not appreciably change the appearance of the graphs. While heating leading to such small amounts of temperature change can be precisely calculated in controlled circumstances, the standard error of temperature simulation exceeds 0.1 ºC at scales employed herein (**Appendix A**).

As with the solar heating elsewhere in this Chapter, solar radiation is assessed just prior to the stream. **Figure 2.1-10** through **Figure 2.1-12** illustrate, longitudinally, the difference between human-related and natural heating. The gray-shaded area is the potential natural disturbance range. The cumulative heating from natural and human related conditions is identified in **Section 2.1.5**.

Natural disturbance is implicitly accounted for in the John Day TMDL (**Section 1.3**). While not simulated in this TMDL, increased solar radiation is considered acceptable when resultant from natural disturbance. Natural disturbance is included in the definition of 'natural conditions' in OAR 340-041-0002(40).

2.1.8.2 Load Allocation Surrogate – Site-specific Effective Shade

The John Day Basin temperature TMDL applies site-specific shade curves as a LA surrogate. Site-specific effective shade targets are developed for temperature-simulated streams: the John Day, the John Day Middle Fork and the John Day North Fork Rivers. This effective shade surrogate is portrayed graphically on the same figures as the site-specific heat LA (**Figure 2.1-10** through **Figure 2.1-12**). Effective shade is inversely proportional to heat flux. It is expressed as a percentage, reflecting the amount of solar radiation blocked or attenuated by topography and vegetation at a given location. That is, one hundred percent shade would be complete blockage of direct solar radiation and zero percent shade would be full day long exposure as if the horizon were flat. Further information regarding the simulation of percent effective shade and the associated heat loading is available in this chapter in **Sections 2.1.4** and **Appendices A** and **B**.

Figure 2.1-10. Effective shade and heat load targets for John Day River (from Figure B-50, Appendix B, heat loads represent summer daily average)

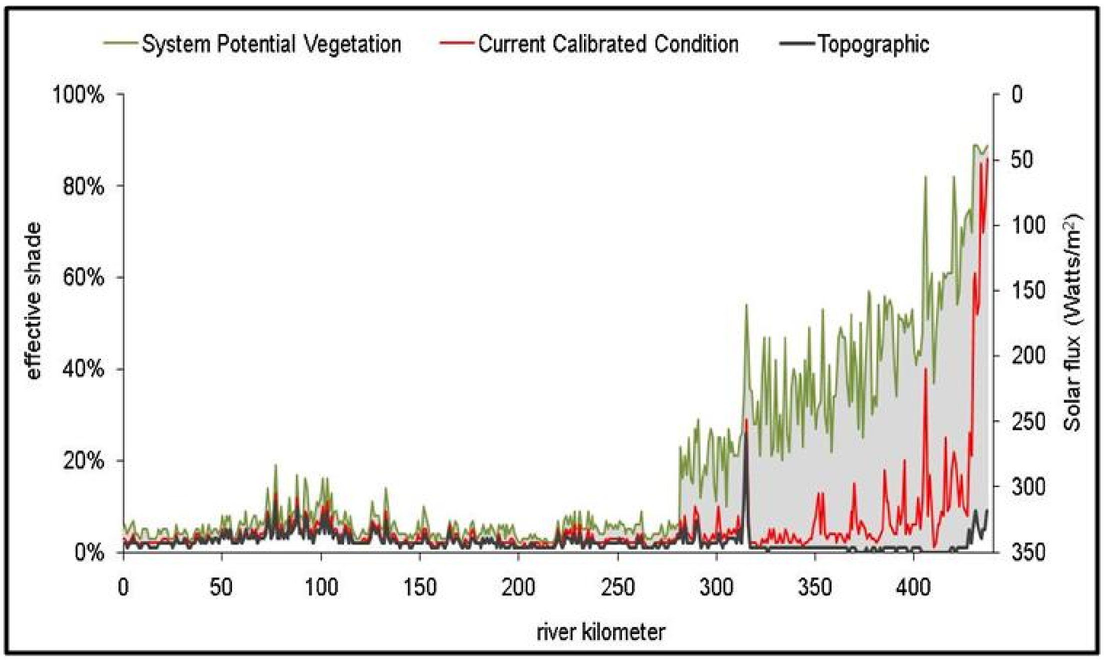


Figure 2.1-11. Effective shade and heat load targets for the North Fork John Day River (from Figure B-50, Appendix B, heat loads represent summer daily average) (river kilometer 120-164 is in the North Fork John Day Wilderness Area, where potential and existing shading are assumed to be equivalent)

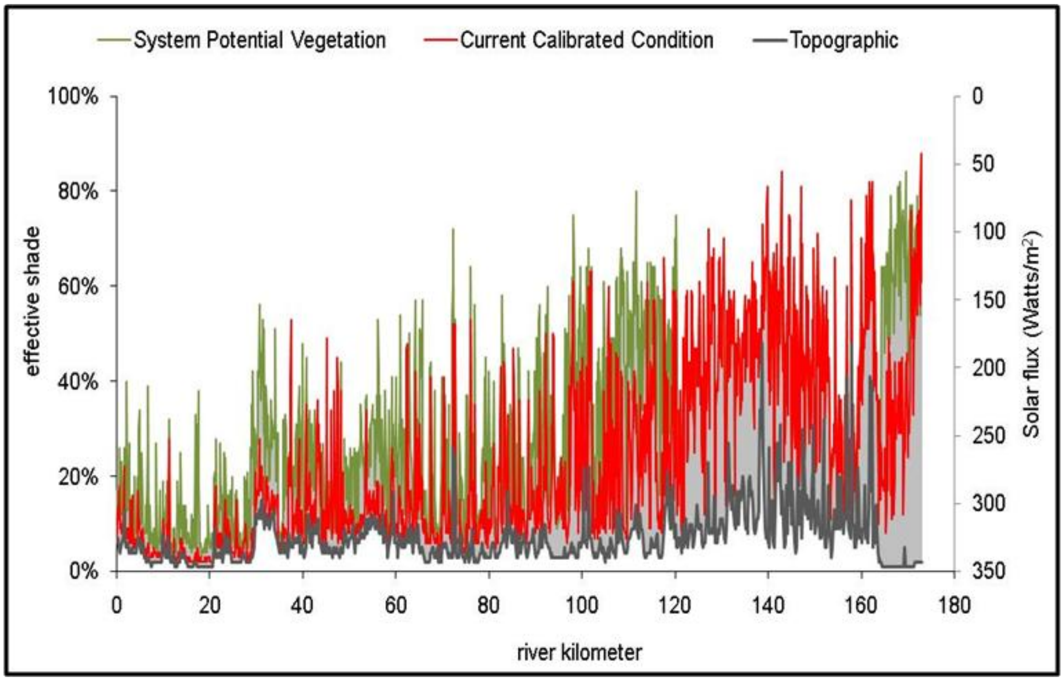
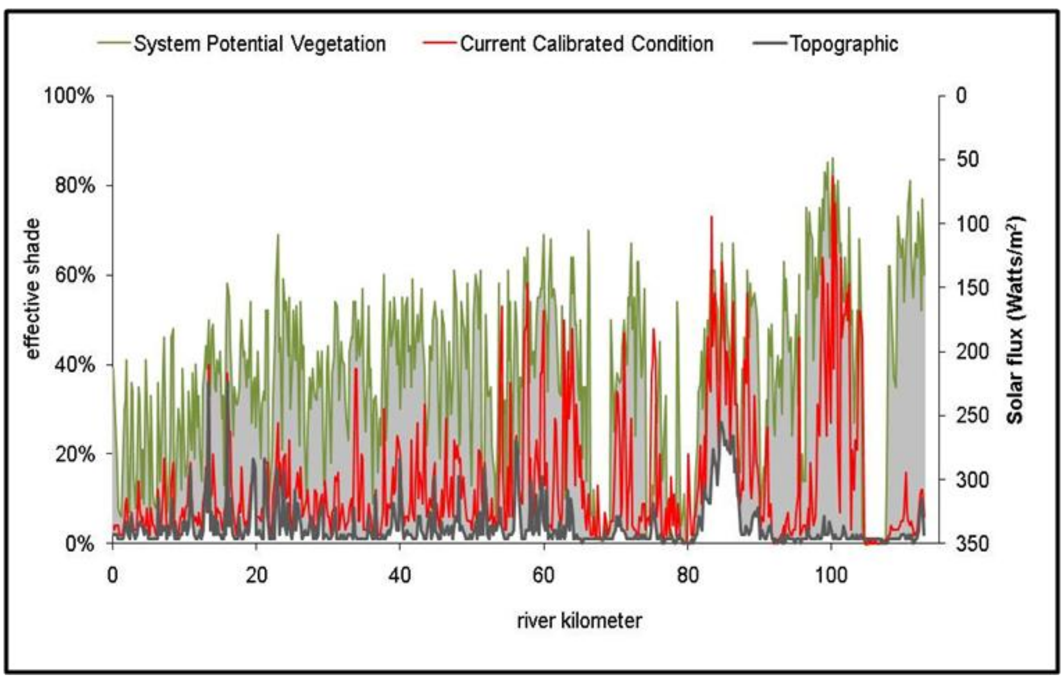


Figure 2.1-12. Effective shade and heat load targets for the Middle Fork John Day River (from Figure B-50, Appendix B, heat loads represent summer daily average)



2.1.8.3 Load Allocation Surrogate – Effective Shade v. Channel Width

The John Day Basin temperature TMDL applies generalized (non site-specific) shade curves as a LA surrogate. As with the site-specific LA and surrogate, effective shade for the generalized curves is portrayed graphically on the same figures as the corollary heat LA (**Figure 2.1-13, A-I**). This surrogate applies throughout the basin on perennial streams where temperature was not simulated. Here, site-specific assessment of channel width is required. **Section 2.1.8.2** briefly explains the term effective shade and its relationship to stream heating. **Section 6.5** of **Appendix B** includes additional discussion of the development of the generalized shade curves.

The method considers stream aspect (flow direction) as well as geographic position and date. August 1 was selected as the date represented. Several shade curve graphs are prepared to address ranges of estimated natural potential vegetation height, for identified NTP vegetation densities. In order to apply these graphs, a resource manager will (1) choose a stream location, (2) measure the existing channel width (3) select the appropriate shade curve figure (**Figure 2.1-13**, **A-I**) in accordance with the instructions of the next paragraph, (4) and select the appropriate curve within the figure, based on flow direction. The effective shade indicated by the curve for that channel width is the expected shade if NTP vegetation height and density is in place. Simply put, perennial tributaries should target the NTP vegetation range.

The following steps describe the procedure for selecting a shade curve figure for a given location:

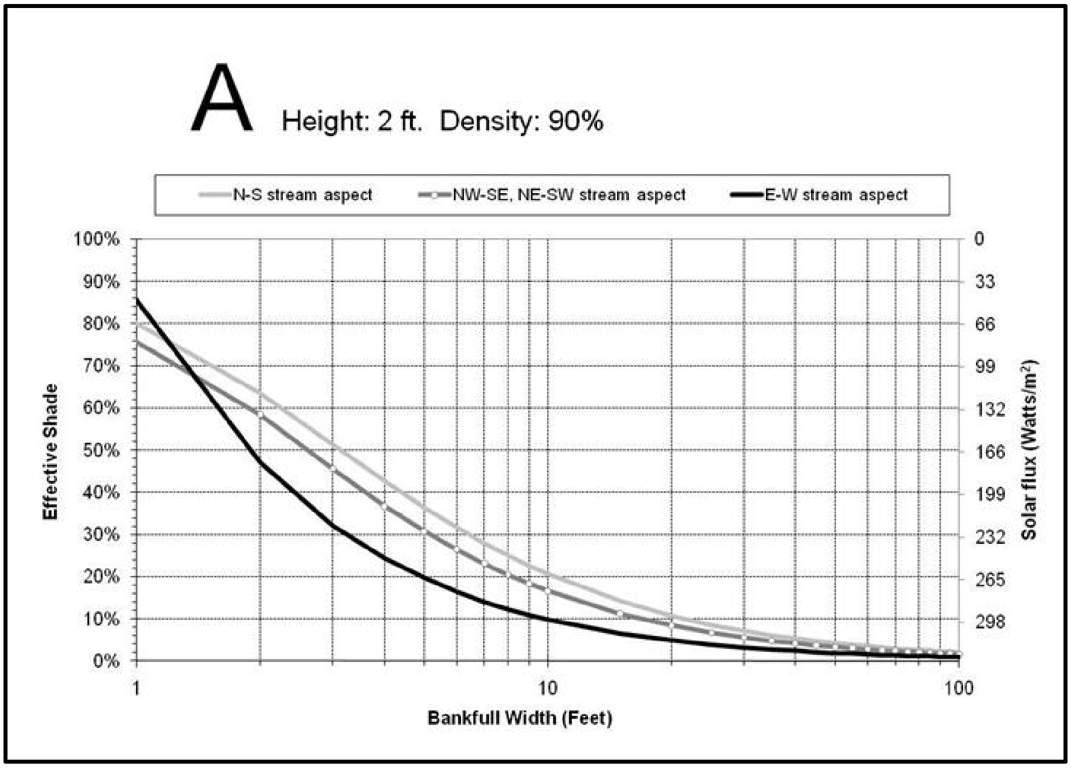
1. Identify the Level 4 ecoregion at the location of concern (**Appendix C**, **Figure C-9**).
2. Identify the ecoregion-physiographic valley type (**Appendix C**, **Tables C-4** and **C-5**).
3. Based on the ecoregion and valley type of the previous two steps, identify the Ecoregion-Physiographic (EP) Type (**Appendix C**, **Table C-1**).
4. Identify the height and density of vegetation, based on EP Type, in **Table C-12**.
5. The associated height and density ranges are then located in **Table 2.1-10** below, producing a letter that is keyed to the load allocation and percent effective shade curves of **Figure 2.1-13**.

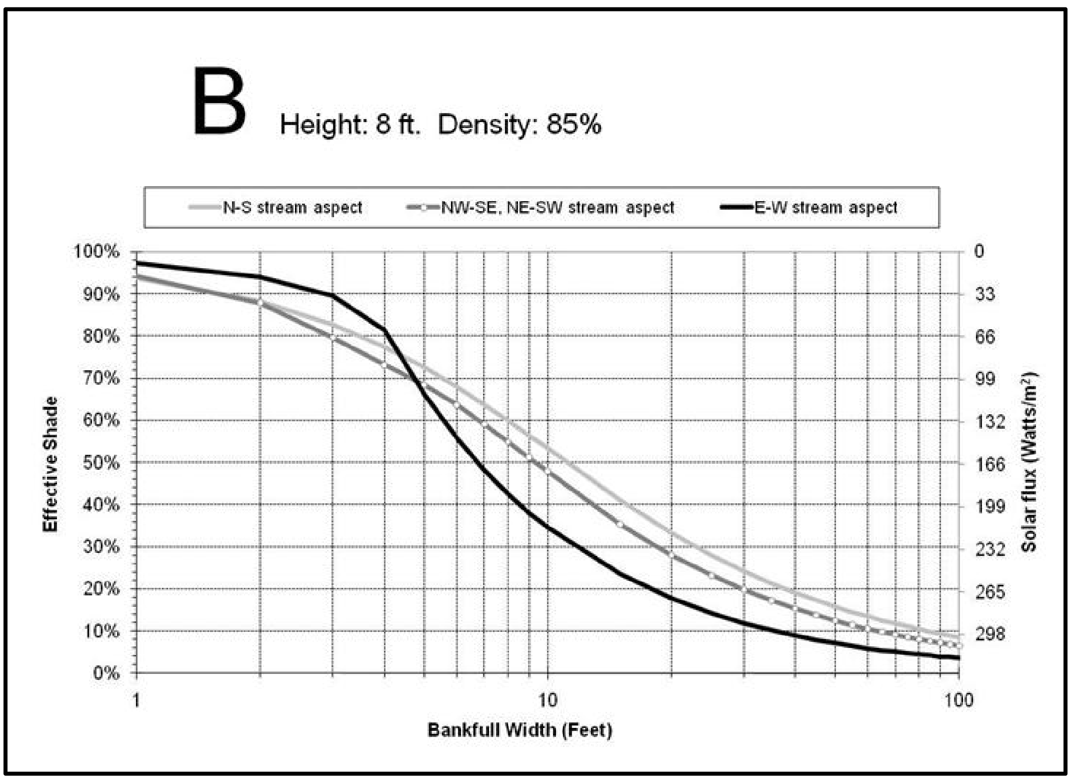
Table 2.1-10. Key to applicable generalized heat curves

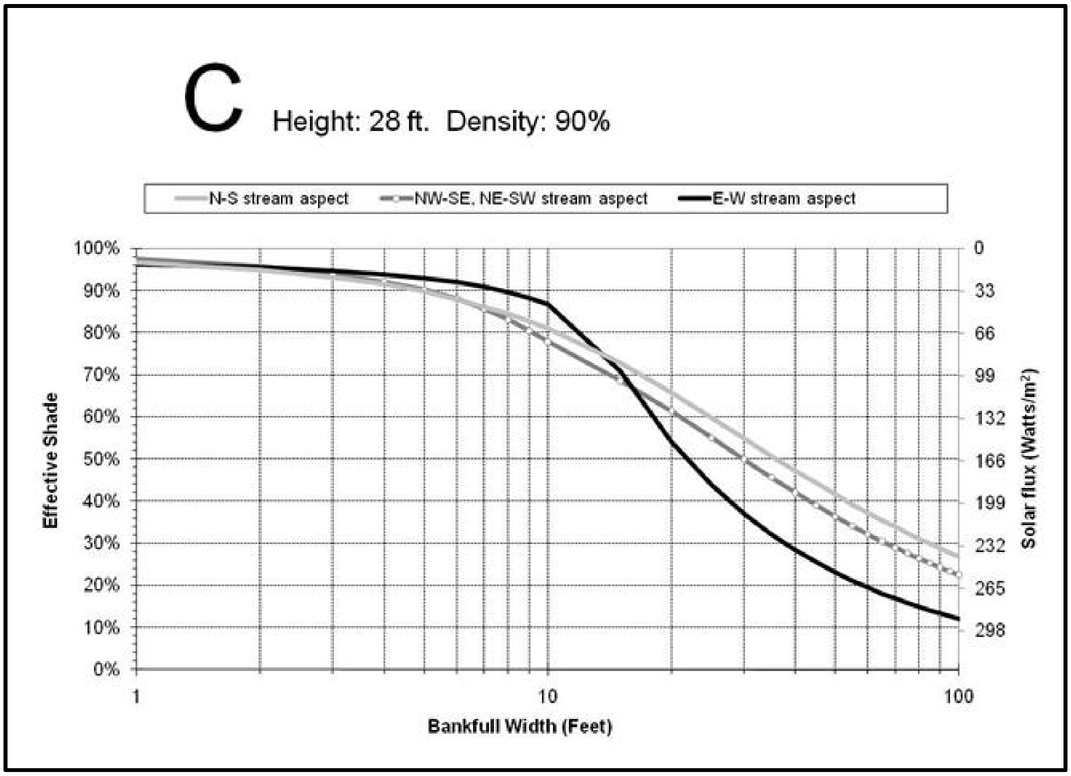
<table>
<tr><th></th><th colspan="6">Density</th></tr>
<tr><th>Height (feet)</th><th>90</th><th>85</th><th>80</th><th>53</th><th>43</th><th>25</th></tr>
<tr><td><5 feet</td><td colspan="6">A</td></tr>
<tr><td>5-20</td><td colspan="5">B</td><td>A</td></tr>
<tr><td>21-40</td><td colspan="3">C</td><td></td><td></td><td></td></tr>
<tr><td>41-60</td><td colspan="3">D</td><td></td><td></td><td></td></tr>
<tr><td>61-85</td><td></td><td colspan="2">E</td><td colspan="2">F</td><td></td></tr>
<tr><td>>85</td><td></td><td colspan="2">G</td><td>H</td><td>I</td><td></td></tr>
</table>

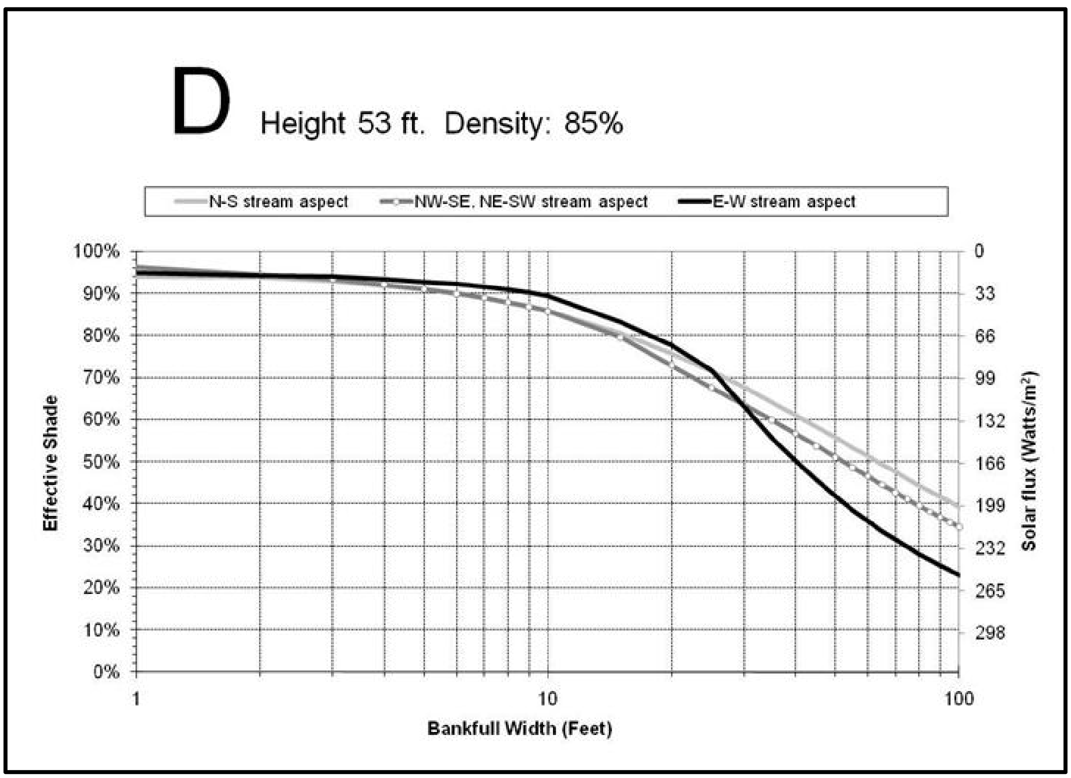
Potential plant communities are not estimated for gray-highlighted cells

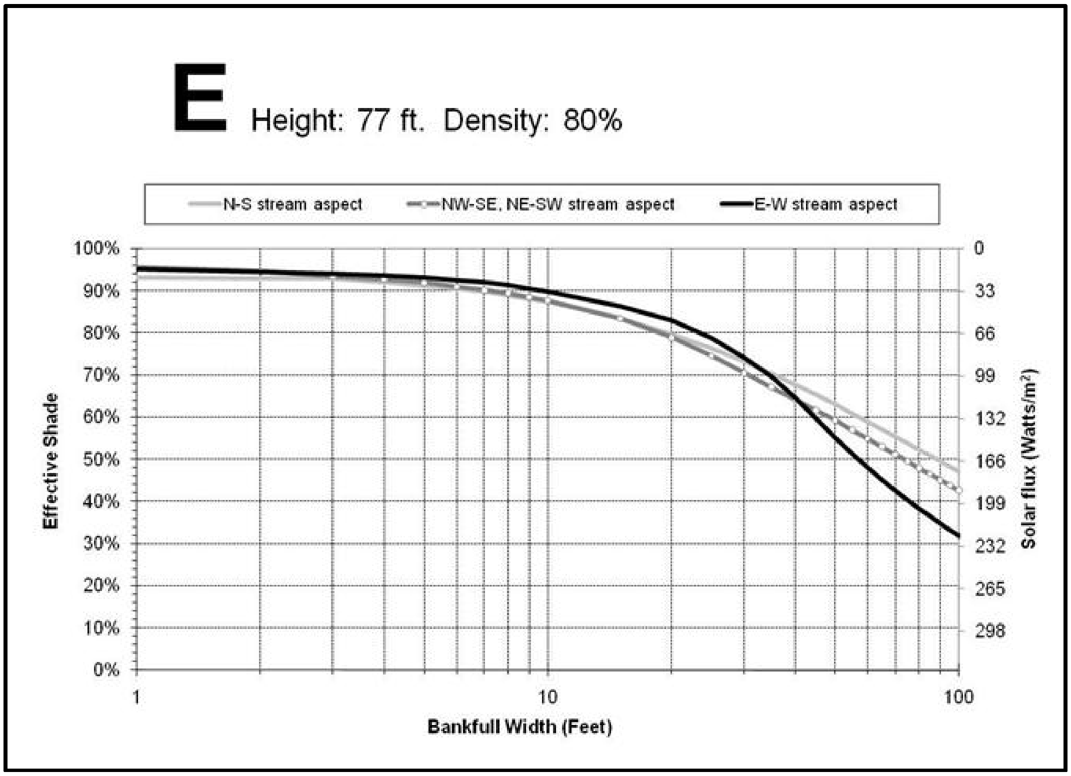
Figure 2.1-13. Generalized curves, heat and shade
(A-I, next 5 pages, heat loads represent summer daily average)

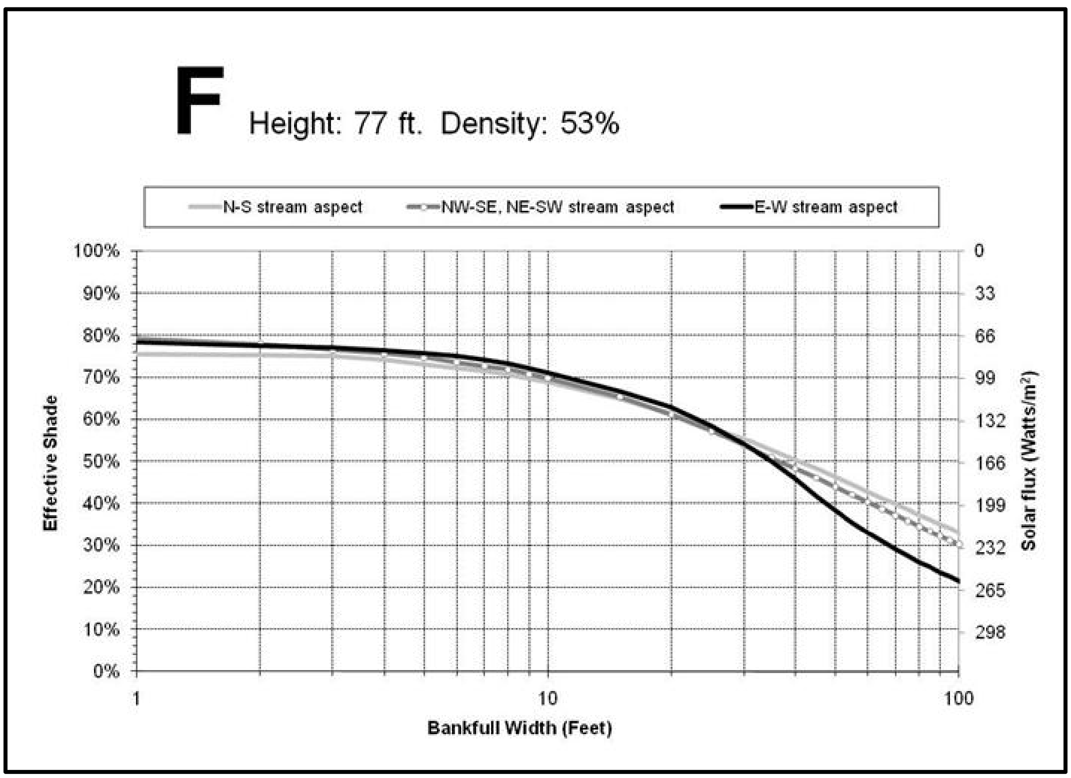


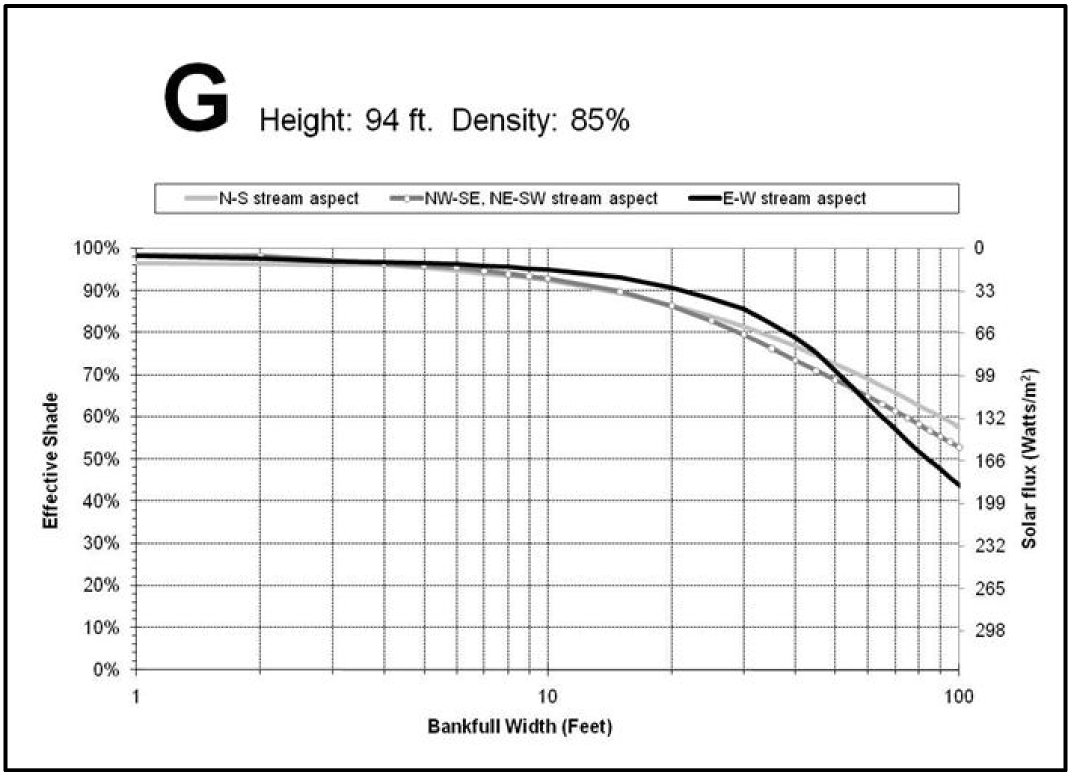



C Height: 28 ft. Density: 90%
N-S stream aspect
NW-SE, NE-SW stream aspect
E-W stream aspect
Effective Shade
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Solar flux (Watts/m²)
0
33
66
99
132
166
199
232
265
298
1
10
100
Bankfull Width (Feet)

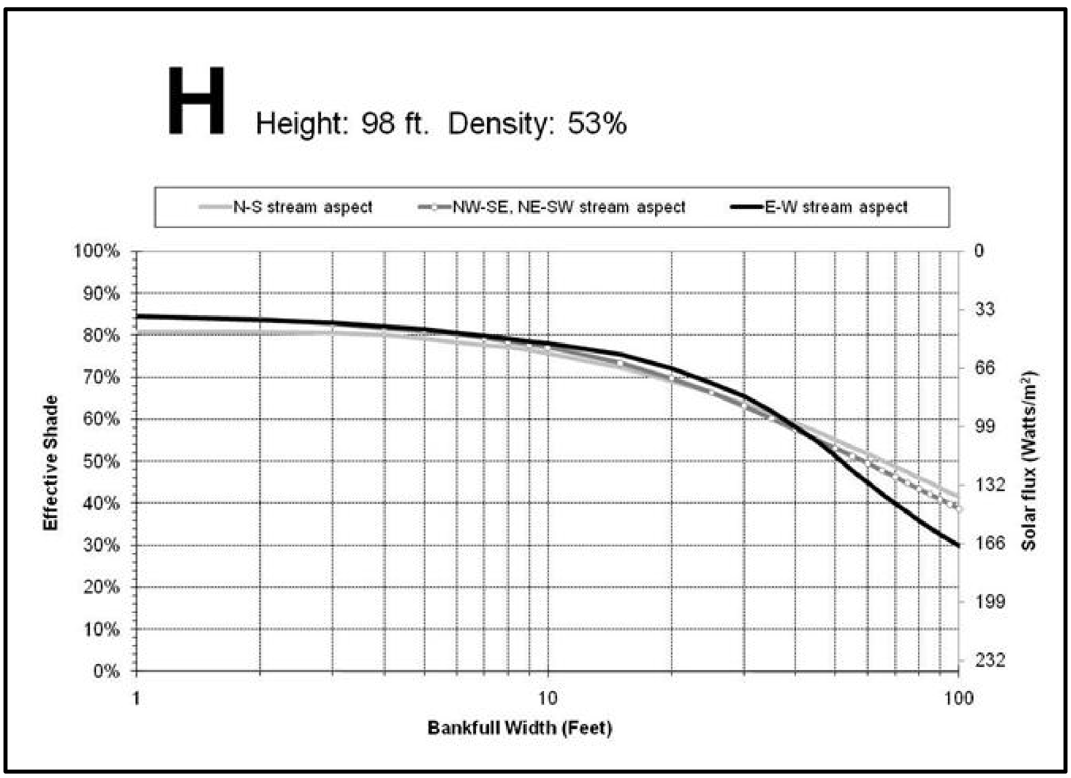

D Height 53 ft. Density: 85%
N-S stream aspect
NW-SE, NE-SW stream aspect
E-W stream aspect
Effective Shade
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Solar flux (Watts/m²)
0
33
66
99
132
166
199
232
265
298
1
10
100
Bankfull Width (Feet)


E
Height: 77 ft. Density: 80%
N-S stream aspect
NW-SE, NE-SW stream aspect
E-W stream aspect
Effective Shade
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
33
66
99
132
166
199
232
265
298
Solar flux (Watts/m²)
1
10
100
Bankfull Width (Feet)

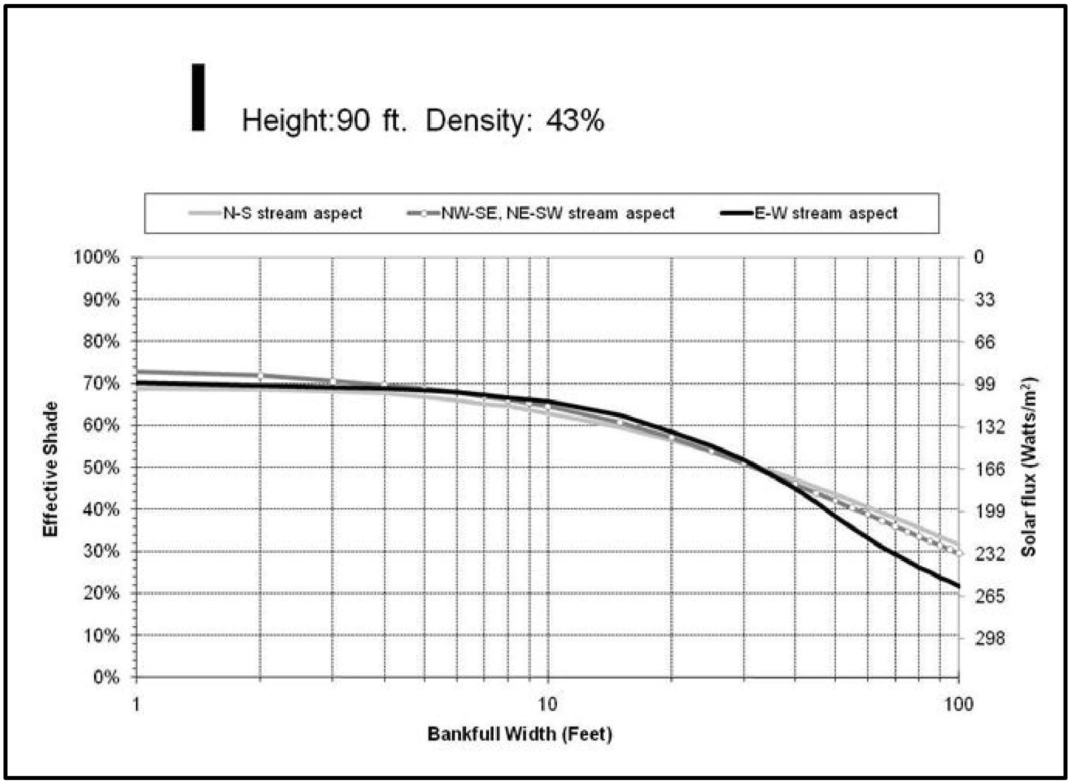

F
Height: 77 ft. Density: 53%
N-S stream aspect
NW-SE, NE-SW stream aspect
E-W stream aspect
Effective Shade
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
33
66
99
132
166
199
232
265
298
Solar flux (Watts/m²)
1
10
100
Bankfull Width (Feet)



G
Height: 94 ft. Density: 85%
N-S stream aspect
NW-SE, NE-SW stream aspect
E-W stream aspect
Effective Shade
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Solar flux (Watts/m²)
0
33
66
99
132
166
199
232
265
298
1
10
100
Bankfull Width (Feet)



H
Height: 98 ft. Density: 53%
N-S stream aspect
NW-SE, NE-SW stream aspect
E-W stream aspect
Effective Shade
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Solar flux (Watts/m²)
0
33
66
99
132
166
199
232
1
10
100
Bankfull Width (Feet)


I
Height:90 ft. Density: 43%
N-S stream aspect
NW-SE, NE-SW stream aspect
E-W stream aspect
Effective Shade
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
10
100
Bankfull Width (Feet)
Solar flux (Watts/m²)
0
33
66
99
132
166
199
232
265
298

2.1.8.4 Load Allocation Surrogate – Channel Morphology

A narrative channel morphology LA surrogate is included herein, defined as all reasonable efforts toward achieving a ***natural channel form, in terms of sinuosity, complexity, floodplain connectivity and cross-sectional dimension***. Various attempts were made during TMDL development to identify and quantify potential channel form. However, because of the geomorphic complexity of the stream network and insufficient data, only a rough estimate was made – a general likelihood of thirty percent reduction in channel width. Beyond that, model sensitivity scenarios were run at 10, 20, 30, 40 and 50 percent reductions in channel width and concomitant increases in depth based on trapezoidal assumptions (refer to **Appendix B**). From Basin literature, history and existing reference conditions, it is clear that much of the channel network has been modified – straightened, dozed, leveed, bank disturbance, etc. and that natural channel width estimates range widely from 5 to more than 50 percent less than today's. As well, there is one example where nine-miles of channel in the Umatilla National Forest has generally, albeit slightly, widened through restoration efforts.

Given this uncertainty, numeric objectives are not established as LA or surrogates. Because of the importance of stream morphology in moderating temperature, the narrative surrogate of this section is established.

2.1.8.5 Load Allocation Surrogate – Reservoirs

For reservoirs, the load allocation surrogate assigned herein is: ***reservoir downstream heating is restricted to a cumulative increase of no greater than their HUA portion, above NTP temperatures and other applicable criteria***. The associated reservoir outlet targets are as follows.

- In the warm season the greater of NTP or biologically based criteria temperatures would apply, and
- In spawning waters when ambient temperatures are less than 13 ºC (55.4 ºF), instream ambient temperatures would be targeted, based on the cold water protection criterion 60-day averaging and its allowances of up to 1.0 º C (1.8 ºF).
- At other times and in bull trout or non-spawning waters, applicable biologically based criteria would be targeted. Note that the summer cold water protection criteria will rarely apply in the Basin in the current temperature regime [e.g., current maximum 7DADM is greater than biologically based criteria on the entire simulated length of the mainstem (**Figure 2.1-3**)].

As NTP is generally not determined for reservoirs, and the targets listed above could be complicated, other approaches may be preferred. For reservoirs in the John Day Basin (Basin reservoirs are described in **Section 1.4.6.2**), a trajectory toward NTP temperatures could be established by equating outlet to inlet temperatures, recognizing that as upstream heating diminishes through time, NTP is approached downstream. Ultimately, the natural conditions are ecologically conservative and generally an acceptable alternative to other criteria. Accordingly, the Department recommends restricting reservoir outlets to temperatures that are less than instream ambient temperatures (upstream where uninfluenced by reservoir), plus the temperature allowance described in the following paragraph. We also note that as Basin heating and thermal impacts are better understood, reservoirs could be further restricted in the future, for instance to near term compliance with biologically based criteria or targets based on NTP studies.

In summary, stream heating should be, at a minimum, restricted to ambient temperatures upstream of the reservoir, plus potential allowances. The potential allowance alternatives are:

- On a case-by-case basis, there may be circumstances allowing the Department to apportion part or the entire 0.1 º C nonpoint source HUA to a reservoir (HUA specific to reservoirs has not been apportioned).
- Reserve capacity may be available.

- The spawning waters cold water protection criterion, assessed on a 60-day rolling average, restricts increases to 0.5 ºC (0.9 ºF) and 1.0 ºC (1.8 ºF), depending on ambient stream temperature.

Where there are identified thermal issues, or if identified in the future, the Department will call for a temperature management plan or TMDL implementation plan. Temperature targets or other metrics from which to determine compliance with the load allocation should be incorporated into the plan. These requirements stem from the temperature standard and OAR 340-041-0028(12)(h): "Other Nonpoint Sources. The department may, on a case-by-case basis, require nonpoint sources (other than forestry and agriculture), including private hydropower facilities regulated by a 401 water quality certification, that may contribute to warming of State waters beyond 0.3 degrees Celsius (0.5 degrees Fahrenheit), and are therefore designated as water-quality limited, to develop and implement a temperature management plan to achieve compliance with applicable temperature criteria or an applicable load allocation in a TMDL pursuant to OAR 340-042-0080". Currently, only one reservoir has been specifically identified in the WQMP to be included in a planning response to this TMDL. This is Bates Pond in the upper Middle Fork Subbasin, where limited temperature data are available (TIR and instream). That said, the Department expects that reservoir administrators throughout the basin will target this reservoir temperature LA surrogate, as soon as feasible, potentially eliminating the need for a reservoir TMDL implementation plan in the future.

We note that the term 'reservoir' used here applies to any human-made impoundment. However, instream "pushup" dams fall in a different category and should be addressed through improvements relevant to the shade and morphology based load allocations. Hundreds of miles of TIR data were examined during this TMDL development. Diversion pools in the major stream channels rarely produced a discernable TIR signal, and are likely a larger concern with regard to fish passage and loss of instream flow. We also note that in the section, as elsewhere, referenced temperature targets and triggers are assessed in terms of 7DADM.

2.1.8.6 Load Allocation Surrogate – Intermittent and Ephemeral Streams

During the critical dry season, the condition of intermittent and ephemeral streams can indirectly influence stream temperature in perennial streams. Vegetation disturbance and channel modifications along non-perennial streams typically increase the delivery of fine sediment. This in turn, increases sediment loading in perennial streams, generally leading to shallowing and widening and corollary increases in solar heating. Accordingly, while conditions have not been quantified on non-perennial streams, this TMDL **calls for NTP vegetation and channel conditions throughout the basin stream network**. The Department recognizes that NTP vegetation assessment and planning, in non-perennial settings may require site-specific assessment. However, minimization of erosion-causing disturbance is expected and does not necessarily require extensive evaluation.

2.1.8.7 Load Allocation Surrogate – Instream Flow

This load allocation surrogate is defined as ***where feasible, instream flows should be protected to target natural discharge levels during April through September***. Flow restoration is critical to attainment of water quality standards. For further discussion of flow in relation to this TMDL, refer to **Section 2.1.3.5**.

2.1.9 (i) Margin of Safety

The Clean Water Act requires that each TMDL be established with a margin of safety (MOS). The statutory requirement that TMDLs incorporate a MOS is intended to account for uncertainty in available data or in the effect controls will have on achieving reductions in pollutant loading and restoring water quality. A MOS is expressed as unallocated loading 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 MOS for the John Day Basin Temperature TMDL is implicit, based on the following:

- Heat reduction objectives are maximized through targeting natural conditions and adaptively re-assessing natural condition targets through an iterative TMDL process.
- The estimate of natural thermal potential temperature does not include an estimate of the impact of natural disturbance of the riparian area. This likely results in a cooler estimate than actual NTP.

2.1.10 (j) Seasonal Variation and TMDL Time Frame

Period of Applicability. The John Day temperature TMDL applies year round. As noted in **Section 2.1.3.1**, because load allocation implementation will result in sustained system restoration, water quality is addressed on a year round basis, with regard to nonpoint source of stream heating. Through the TMDL assessment, point sources are assigned targets based on the human use allowance, the natural conditions criteria during the warm season, and the various other applicable temperature standard criteria through the remainder of the year.

Seasonal Variation. **Figure 2.1-14** through **Figure 2.1-16** portray current and NTP temporal stream temperature patterns, for selected sites on modeled rivers, in terms of the rolling 7DADM.

Figure 2.1-14. Existing and target temperature profiles, John Day River at four locations on the John Day River using the rolling 7DADM. (recall of Figure B-15, Appendix B) (dashed lines are biologically based criteria)

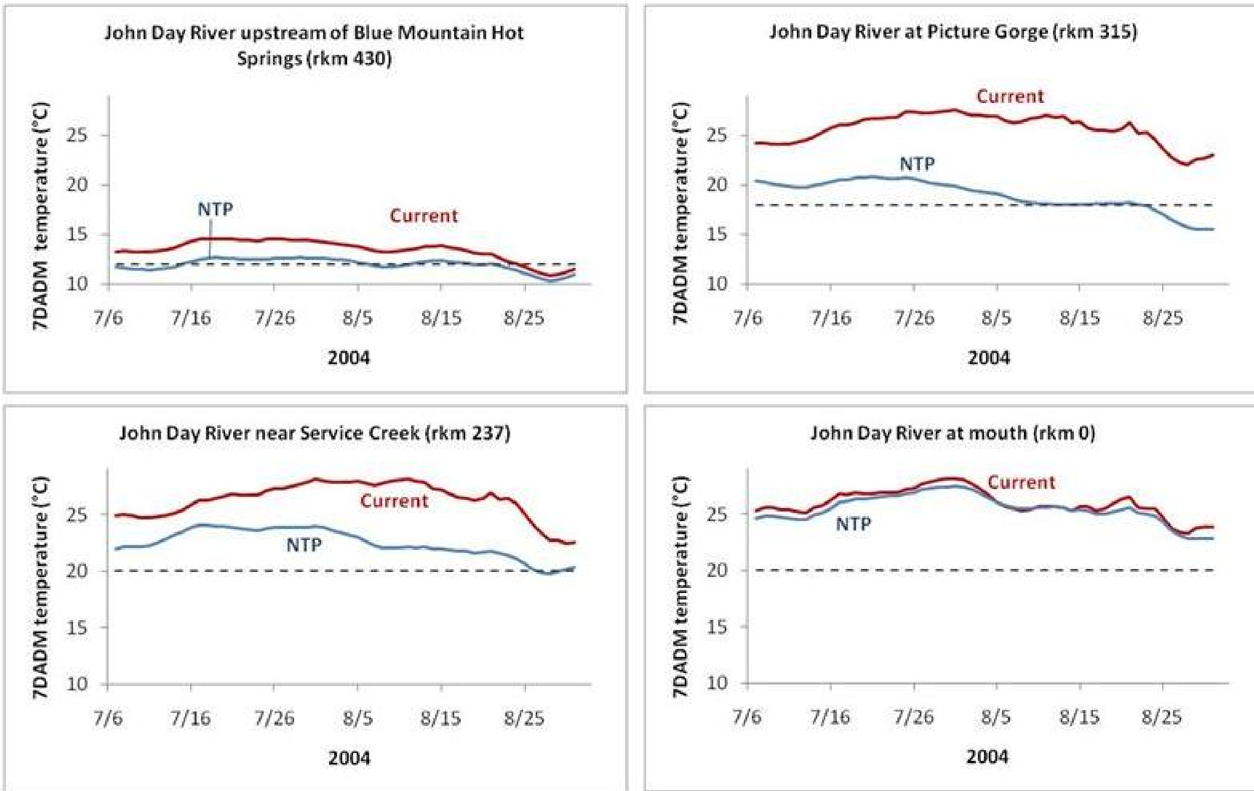


Figure 2.1-15. Existing and target temperature profiles, North Fork at four locations on the North Fork John Day River using the rolling 7DADM (recall of Figure B-29, Appendix B) (dashed lines are biologically based criteria)

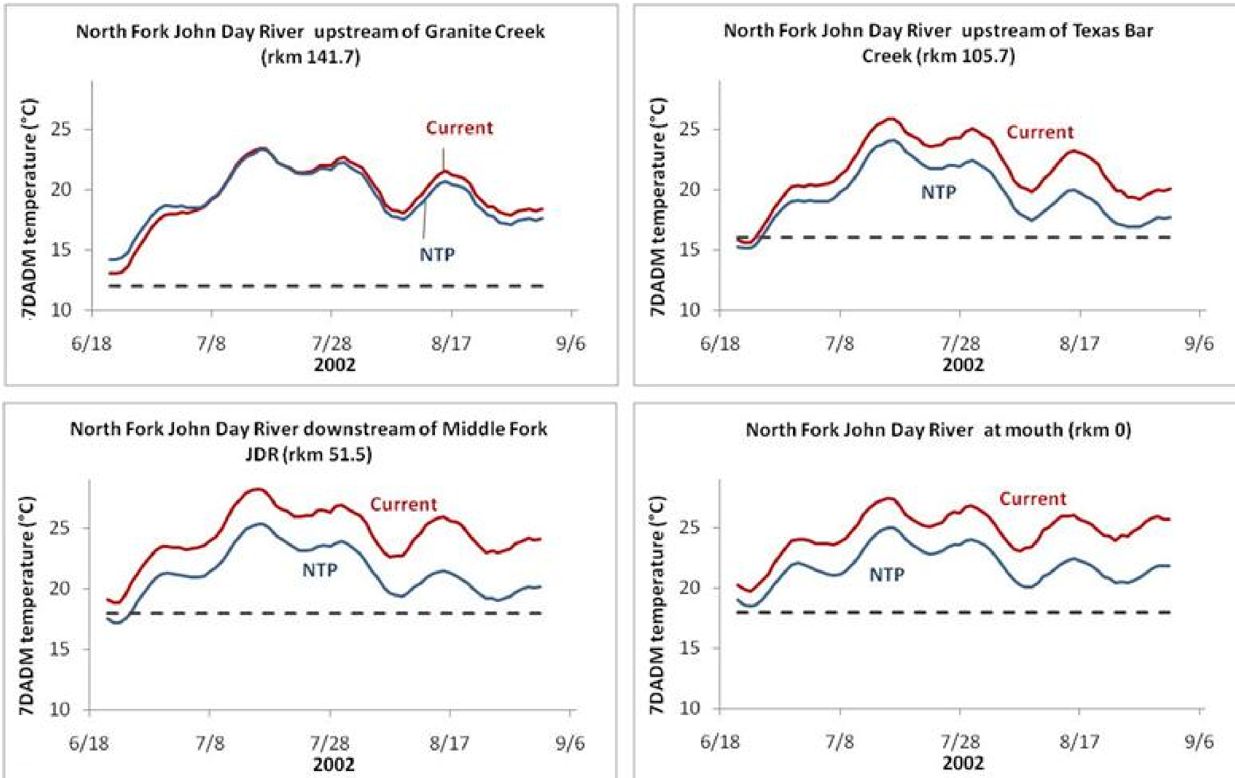
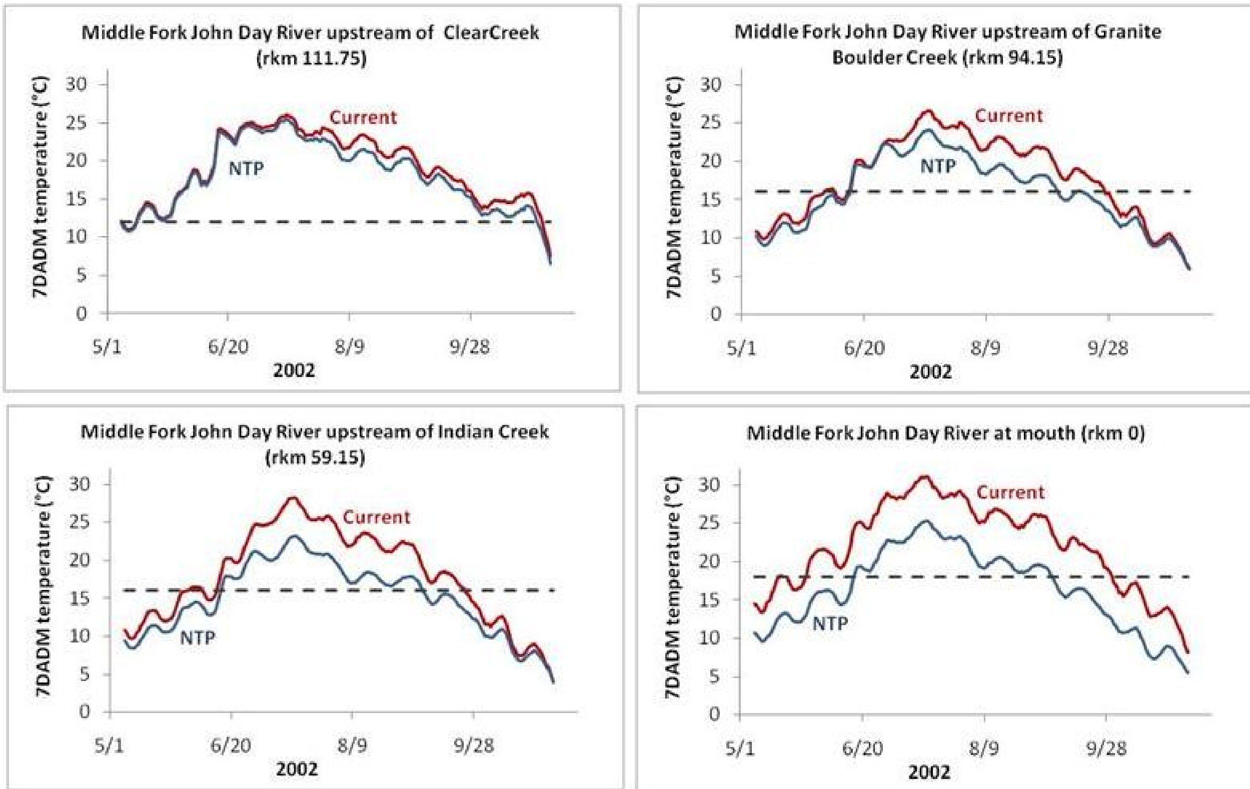


Figure 2.1-16. Existing and target temperature profiles, Middle Fork at four locations on the Middle Fork John Day River using the rolling 7DADM. (recall of Figure B-43, Appendix B) (dashed lines are biologically based criteria)



2.1.11 (k) Reserve Capacity

2.1.11.1 General Reserve Capacity

An explicit allocation is established herein for reserve capacity throughout the John Day Basin. This is the amount of heating that would result in the temperature increase allowed by that part of the HUA assigned to reserve capacity. The HUA portion assigned as RC is generally 0.2 ºC year round, but during periods of permitted discharge this would decrease by as much as 0.1 ºC in areas of thermal overlap with existing individual facility NPDES sources or the City of John Day WWTP. Reserve capacity is available for use by either nonpoint or point sources to accommodate future growth as well as to provide an allocation to any existing source that may not have been identified during the development of this TMDL.

If new WLA are issued for new or increased sources, pending Department approval, cumulative impacts would be assessed and the WLA would be calculated as in **Section 2.1.7.3**. Temperature targets would be those of **Section 2.1.7.2**, or would incorporate NTP from other assessed rivers, or new NTP assessments.

2.1.11.2 Specific Reserve Capacity

Reserve capacity is set aside in this TMDL specifically for the John Day WWTP (**Section 2.1.7.1**), and is intended to be available as needed for current or future permitting or discharge mechanisms. As indicated in **Section 2.1.3.4**, the John Day WWTP is apportioned 0.1 °C of the human use allowance, in combination the WWTP of Mt Vernon and Dayville. This is available year round. The combined point source reserve capacity is defined as ***a maximum heat loading that will restrict the three sources to an increase of no greater than 0.1 ºC, above specified temperature targets after complete mixing in the receiving waterbody***. The specified temperature targets of the receiving water are listed in **Section 2.1.7.2** and, with regard to biologically based criteria, **Table 2.1-11**. Heat loads and pre-mix temperatures would be calculated with the methods described in **Section 2.1.7.3**. The Department envisions that this facility-specific reserve capacity is of limited duration. From the perspective of this TMDL, after relevant permitting decisions are made, it will be considered a load allocation or wasteload allocation depending on permit type, or if not needed, become part of the general reserve capacity.

Table 2.1-11. John Day WWTP reserve capacity target temperatures

point source name	River km	Dates	Current Condition Modeled Maximum 7DADM (ºC)	Biologically based criterion (ºC)	Modeled Maximum 7DADM NTP (ºC)
John Day WWTP	384.2	7/1-8/31	26.0	18[1]	17.5
John Day WWTP	384.2	9/1-12/31	Not modeled	18	Unknown
John Day WWTP	384.2	1/1-5/15	Not modeled	13[2]	Unknown
John Day WWTP	384.2	5/16-6/30	Not modeled	18	Unknown

Table notes:

[1] The Department considers the warm season biologically based criteria [18.0 ºC (64.4 ºF)] as applicable at the facility site during the time that NTP was simulated. At locations where NTP is less, the biologically based criteria are generally applicable unless this is likely to cause exceedance of NTP downstream at a point where the latter is clearly applicable. For the John Day WWTP, **Figure 2.1-9** demonstrates a rapid relaxation of thermal inputs from the facility, such that the additional 0.5 ºC (0.9 ºF, that would result by targeting 18.0 ºC (64.4 ºF) instead of NTP), would cause an exceedance of the NTP by roughly 0.11 ºC (0.198 ºF) at river kilometer

360, the point where NTP begins to exceed 18.0 ºC (64.4 ºF) during maximum 7DADM. However, this slight exceedance [0.01 ºC (0.018ºF)] is within analytical uncertainty and the estimation error associated with predicting potential conditions.

[2] This is the most likely time frame within which the spawning season 'protecting cold water' criteria would apply and would supersede the 13 ºC (55.4 ºF) spawning criteria.

2.1.12 Water Quality Standard Attainment Analysis

Oregon Administrative Rule 340-042-0040(4)(l)(F) calls for the WQMP to include a timeline for attainment of water quality standards. For point sources, attainment is addressed through DEQ's NPDES permitting program. For receiving waters, attainment is approached through an adaptive process, wherein TMDL implementation plans include milestones and strategies that are revised as capacity for and mechanisms of improvement are better understood.

At this time, minimum time frames can only be roughly estimated. On smaller order streams where vegetation or flow diversion is the thermal control, temperature standard attainment could occur within 1-15 years. On larger order streams and where channel evolution is needed, many decades may elapse before natural conditions are approached, even without considering the amount of time before land uses enable that trajectory. Attainment timing is informed by estimation of the current departure from water quality standards. At the Basin scale, the general target of the temperature standard in the John Day Basin is a temperature pattern reflecting natural conditions, with accounting for biologically based criteria at certain places and times. The warm-season existing departure from these goals, along model corridors, is portrayed in **Figure 2.1-17** through **Figure 2.1-19**. Note that for the model corridors, during the illustrated time of maximum 7DADM, biologically based criteria are applicable only on the mainstem and only for two relatively short upper reaches (red line in **Figure 2.1-17**).

Figure 2.1-17. Differences between existing and NTP temperature, John Day River.
Blue and red lines correspond to natural conditions and biologically based criteria comparisons.
(in terms of maximum 7DADM, recall of Figure B-16, Appendix B)

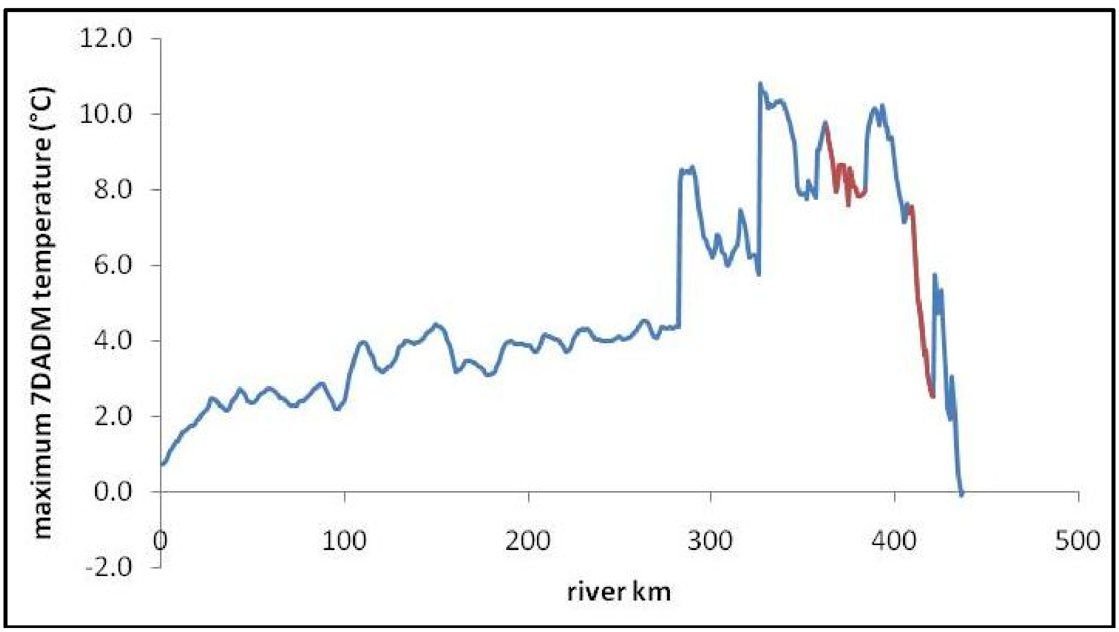


Figure 2.1-18. Differences between existing and NTP temperature, North Fork (in terms of maximum 7DADM, recall of Figure B-30, Appendix B)

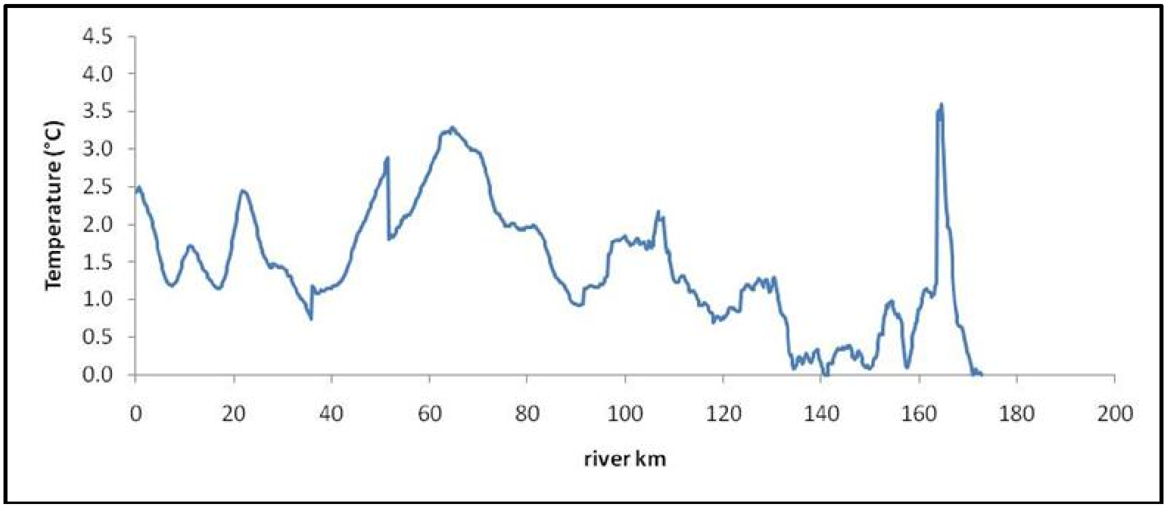
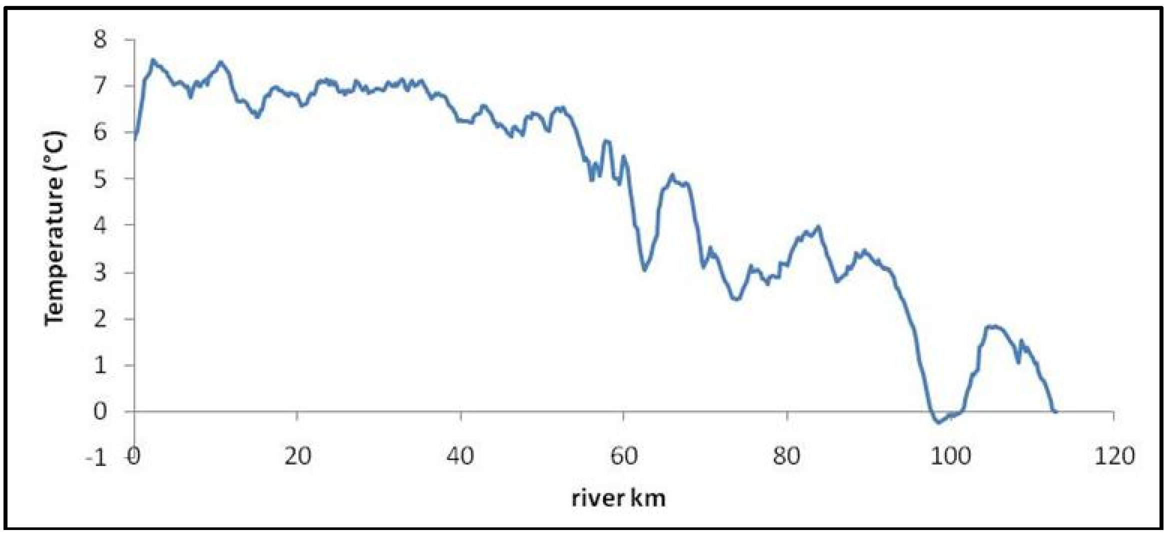
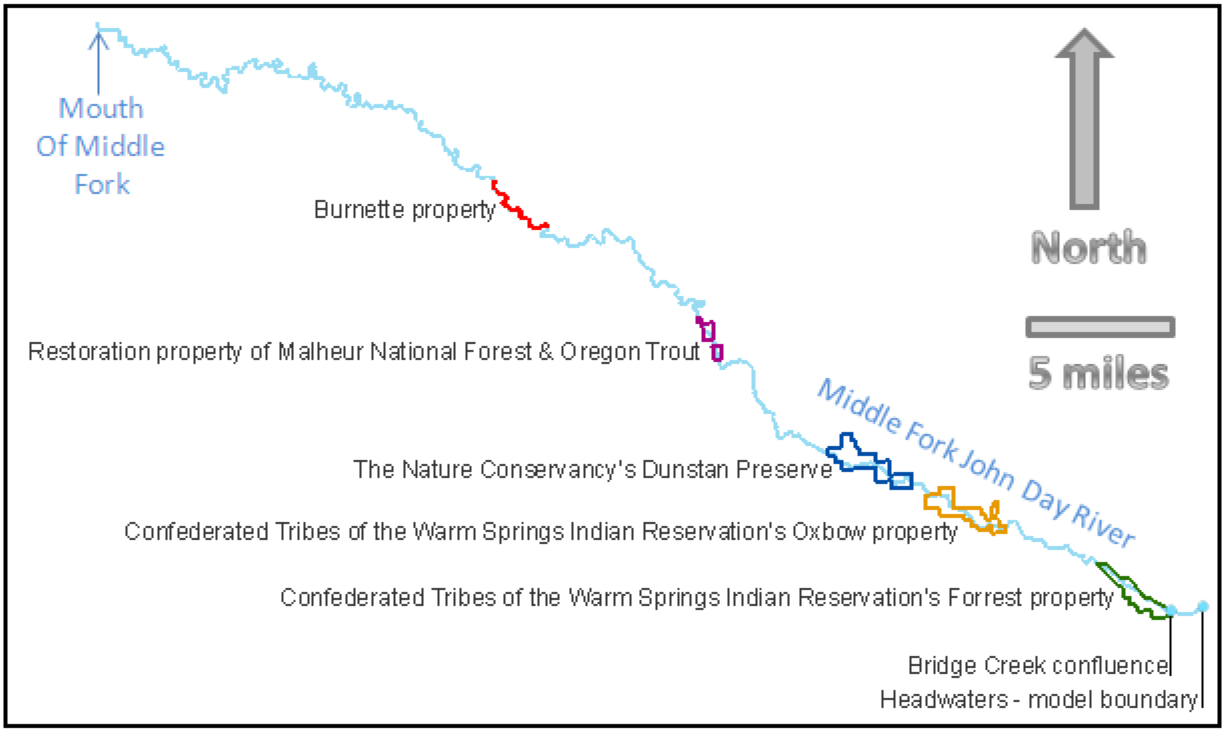


Figure 2.1-19. Differences between existing and NTP temperature, Middle Fork (in terms of maximum 7DADM, recall of Figure B-44, Appendix B)



In order to further elucidate the capability streams to decrease in temperature, the Department simulated the thermal effects of restoration on the Middle Fork John Day. The "Restoration" scenarios account for several major restoration efforts currently underway in the Middle Fork John Day River. The spatial extent of this scenario's restoration efforts are illustrated in **Figure 2.1-20**. The effect these efforts will have on the Middle Fork temperature was estimated by comparing the temperature influence of restoration activities and land use decisions on the specified land parcels 20-40 years before and after the current conditions. It was assumed that 20-40 years ago, the land parcels were bare of vegetation. It was projected that 20-40 years in the future, these land parcels would be approaching natural thermal potential conditions. In addition, planned flow and morphologic restoration were simulated, along with increased hyporheic exchange. The aggregate restoration scenario is detailed in **Appendix B**, **Section 6.3**.

Figure 2.1-20. Spatial extent of properties represented in the modeled restoration scenario (recall of Figure B-46, Appendix B)



The modeled restoration efforts currently underway are expected to improve instream warm season water temperatures as indicated in **Figure 2.1-21**. Compared to the current condition, the pre-restoration scenario showed that before restoration was undertaken on the five parcels with re-vegetation projects, the instream temperatures were higher, particularly around the mid-lower properties. Substantial temperature reduction is predicted from the combination of increased vegetation, instream flow and hyporheic exchange and a lower channel width/depth. This is particularly noteworthy given that these parcels only occupy roughly 20 percent of the length of the Middle Fork.

As encouraging as this is, we also note that this scale and type of restoration is not typical of Basin capacity. These restoration efforts are being accomplished through large-organization funding (BPA, USBR, CTWSIR, TNC, OWEB and others) not applicable on the Basin scale. In discussion with the Basin community, we were encouraged to caveat that these landscapes exhibit expensive, targeted restoration and do not represent normal economically productive private lands. We recognize the existence of economic and social impediments, and that passive restoration is often the more available mechanism. That said, in the same discussion it was pointed out that there may be other areas of substantial restoration, such as the upper mainstem drainage, that are more representative of what can be accomplished through the efforts of private landowners with support of entities such as the Grant Soil and Water Conservation District and the Oregon Watershed Enhancement Board. We affirm that restoration and conservation activities are widespread in the Basin. Attempts are underway to better understand protection and recovery occurrence and potential on the Basin scale. Various projects are recorded in institutional databases (**Figure 2.1-22**). However, this does not address much of basin restoration efforts and the changes in management that have emerged through increased understanding of the importance of intact riparian vegetation and natural channel form.

Figure 2.1-21. Longitudinal temperatures from restoration scenarios, Middle Fork (in terms of maximum 7DADM, recall of Figure B-47, Appendix B)

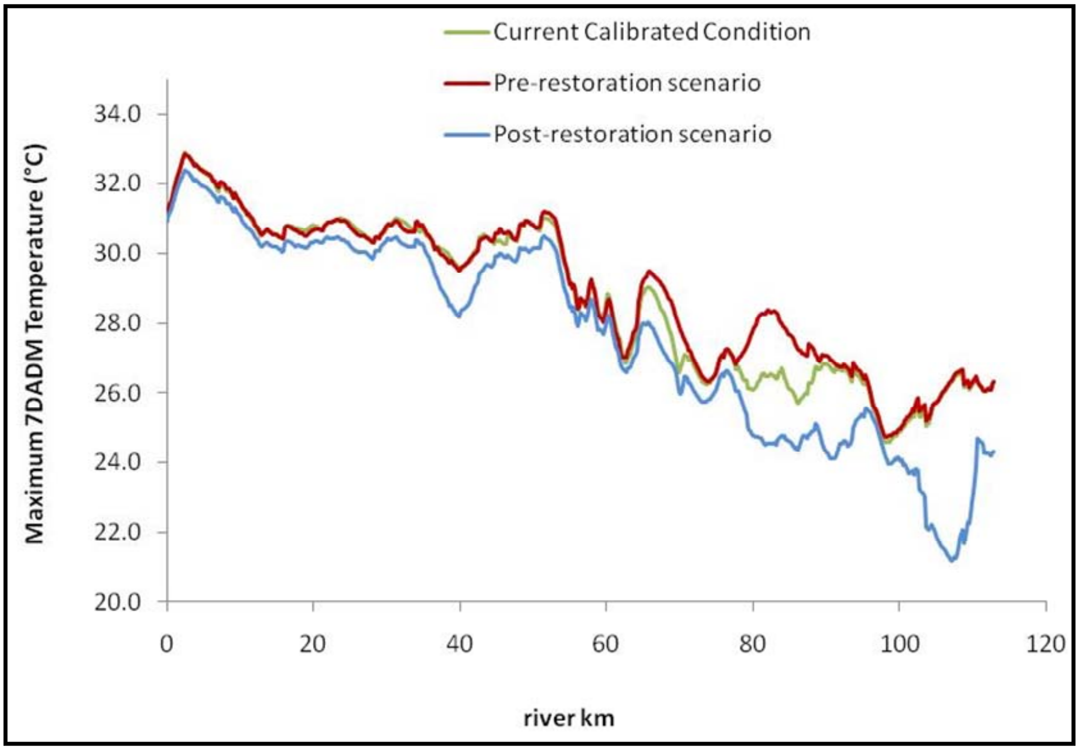
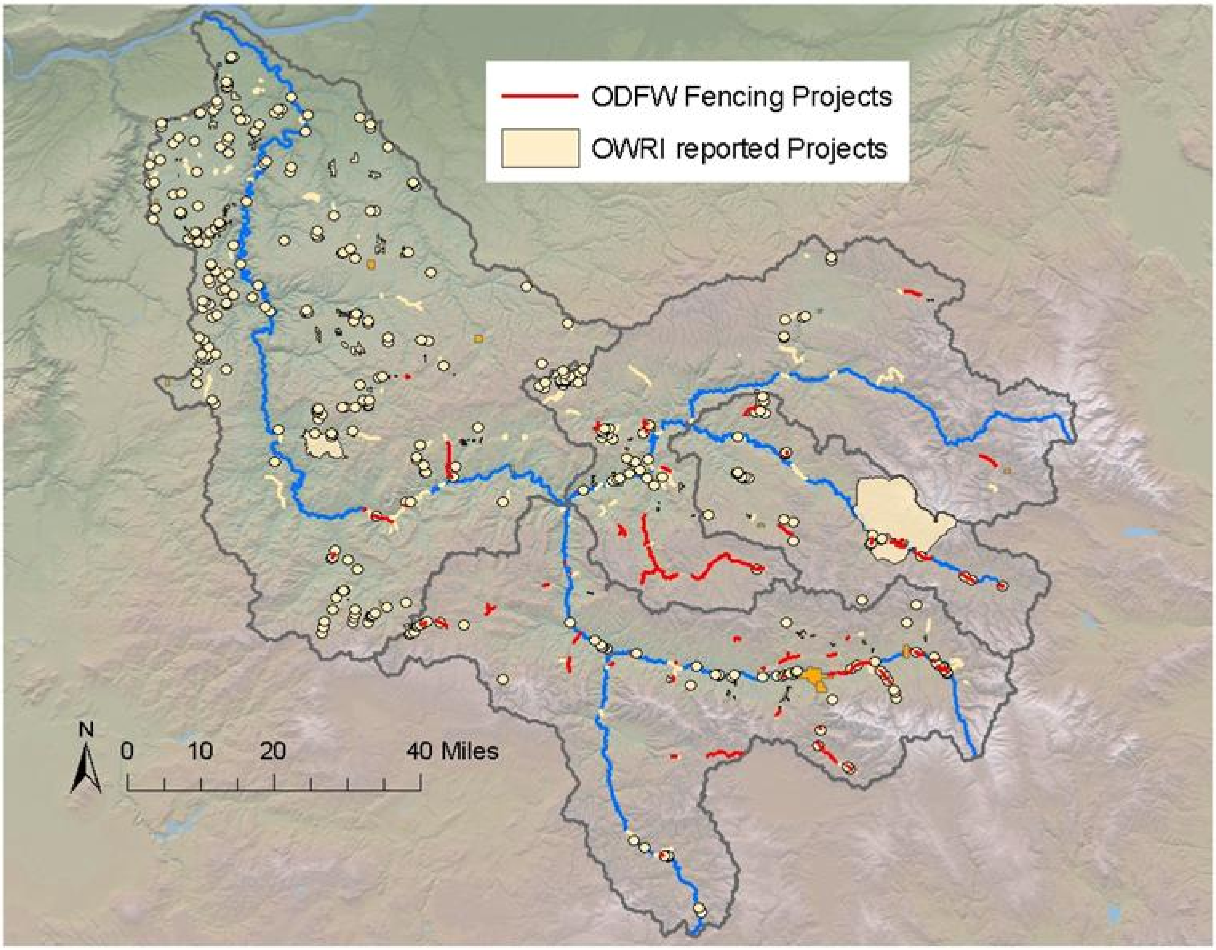


Figure 2.1-22. Restoration projects recorded in the OWRI and ODFW fencing projects (OWRI -Oregon Watershed Restoration Inventory, Oregon Watershed Enhancement Board database; ODFW – Oregon Department of Fish and Wildlife, information provided by Grant SWCD)



2.2 Bacteria TMDL

This Chapter describes the elements of the bacteria TMDL for the John Day Basin. The bacteria allocations herein address streams and rivers throughout much of the basin, based on Basin-scale monitoring. This is the first bacteria TMDL established for the John Day Basin. The bacteria TMDL is summarized in **Table 2.2-1**.

Table 2.2-1. Bacteria TMDL summary information

Water body	Loading capacities are established at various stations along the **John Day River** and at the **mouths of the North and South Forks** of the John Day River. A load allocation surrogate (percent reduction) applies to streams and sources throughout the **upper and lower John Day Subbasins**.
Water Quality Standard	OAR 340-041-0009 (Bacteria)
Applicable Water Quality Standard Criteria	Both freshwater criteria (not to exceed): 30-day log mean of 126 organisms/100 ml (minimum of five samples) and 406 organisms/100 ml for individual samples
Target Pollutant	*E. coli*
Loading Capacity	Number of organisms per day, variable based on flow. Applies year round.
Wasteload Allocation	Direct targeting of criteria in lieu of loading
Load Allocation/Surrogate	Percent reductions are established as surrogates
Existing Pollutant Sources	Livestock, rural residential, septic, sewer systems, urban, wildlife
Margin of Safety	Implicit
Reserve Capacity	Implicit

The primary data sets for this TMDL assessment stem from bacteria monitoring carried out by DEQ since the 1970s and long-term flow gaging stations maintained by the OWRD and USGS. Bacteria samples are collected at five sites in the Basin on a quarterly basis, since the 1970's (**Figure 2.2-1**). Monitoring was intensified in 2004-2006, expanding the network to thirteen sites with focus on the upper mainstem. For the load duration curve assessment of loading capacities and allocations, bacteria data collected since 1993 are used, paralleling the most recent 303(d) assessment. In order to keep with contemporary flow patterns, flow data prior to 30 years ago was not used.

This TMDL is based on the assessment reported in **Appendix E**. Bacteria data stations locations are depicted in **Figure 2.2-1** and listed in **Table 2.2-2**.

Figure 2.2-1. Locations of stations used in the TMDL with bacteria data. Note that all are mainstem sites except for 11017 and 11020, at the mouths of the North and South Forks. The five long-term monitoring sites in the Basin are circled – three on the mainstem, one each at the mouths of the North and South Forks.

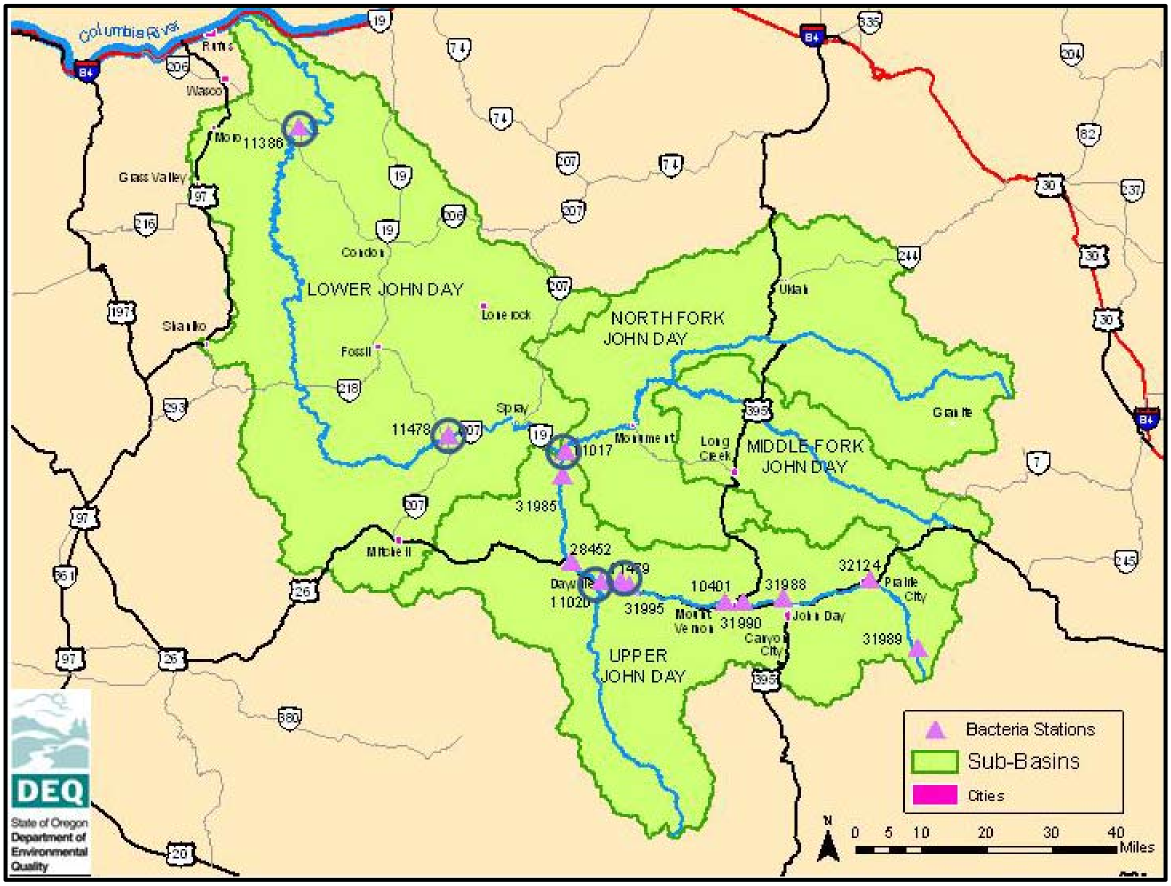


Table 2.2-2. Stations used in bacteria TMDL

Station ID	Water Body	Description	Mainstem River Mile	Date Begin	Date End[1]	Number of Samples[2] FC/EC[3]	Ambient Station	Sub-Basin[4]
11386	John Day River	Cottonwood Bridge	39.0	2/24/1993	6/26/2008	54/74	Yes	Lower
11478	John Day River		154.5	2/24/1993	6/26/2008	54/74	Yes	Lower
11017	North Fork John Day River	Mouth at Kimberly	181.5	2/24/1993	6/26/2008	54/75	Yes	North
31985	John Day River	Near Service Creek	189.0	6/14/2005	4/27/2006	0/19	No	Upper
28452	John Day River	Picture Gorge	205.0	6/14/2005	4/27/2006	0/20	No	Upper
11020	South Fork John Day River	Dayville near mouth	212.0	2/24/1993	6/26/2008	55/75	Yes	Upper
11479	John Day River	3 miles above Dayville	215.0	2/24/1993	6/26/2008	55/94	Yes	Upper
31995	John Day River	7 miles above Dayville	218.5	6/14/2005	4/27/2006	0/20	No	Upper
10401	John Day River	Below Mt Vernon	238.0	6/14/205	4/27/206	0/20	No	Upper
31990	John Day River	Clyde Holliday State Park	241.0	6/14/2005	4/27/2006	0/20	No	Upper
31988	John Day River	City of John Day (below WWTP)	247.0	6/14/2005	4/27/2006	0/20	No	Upper
32124	John Day River	Above Prairie City	258.0	6/14/2005	4/27/2006	0/20	No	Upper
31989	John Day River	USFS Trout Farm Campground above Prairie City	279.0	6/14/2005	4/27/2006	0/19	No	Upper

[1] As off 10/7/2008
[2] Daily values of QA/QC Status B or better
[3] FC – Number of Fecal Coliform samples and EC – Number of *E. coli* samples
[4] North Fork – North Fork John Day Sub-Basin (HUC 17070202), Upper – Upper John Day Sub-Basin (HUC 17070201), Lower – Lower John Day Sub-Basin (HUC 17070204)

2.2.1 (a) Waterbody Names, Locations and 303(d) Listings

Oregon's 2004/2006 303(d) list classifies the upper John Day River as 'water quality limited and a TMDL is needed' (Category 5), for bacteria. The listed segment extends from river mile 182 to 265, from the North Fork confluence to near Prairie City (**Figure 1.2-4**). This segment is listed for fecal coliform bacteria (carried over from the 1998 list) and *E. coli* (added in the 2004/2006 list), both as summer concerns. There are no other bacteria listings in the Basin. **Section 1.2.2** includes a John Day Basin excerpt of the list and maps of listed segments. Additional data has been collected since the release of the 2004/2006 303(d) list and a review of that data was included in the development of the John Day Bacteria TMDL. In addition to the 303(d) listings, this evaluation indicates other areas of concern as well.

This bacteria TMDL applies throughout the John Day Basin (HUC 170702), year round, including the 303(d) listed segment. This TMDL will address the listed segment and segments of recent and future impairment identification. The spatial and temporal applicability of the loading capacities and the load allocation surrogate (percent reduction) are described in **Sections 2.2.4.3** and **2.2.8.1**.

2.2.2 (b) Pollutant and Target Identification

The pollutant addressed in this TMDL is *E. coli* bacteria. The numeric targets are the fresh water criteria of Oregon's bacteria standard (next section), not to exceed:

- A 30-day log mean of 126 *E. coli* organisms per 100 milliliters
- An individual sample concentration of 406 organisms per 100 milliliters.

When referring to bacteria, *E. coli* is used as the indicator bacteria of the standard and is the term used generally in this chapter when discussing bacteria. Throughout this chapter and Appendix E, the 406 *E. coli*/100ml criterion may be referred to as the "single sample criterion" or "maximum criterion."

2.2.2.1 Use of Fecal Coliform Data

While the TMDLs targets *E. coli*, Fecal coliform data collected in the Basin were also used in this bacteria assessment. Prior to 1996, the bacteria water quality standard used fecal coliform as the indicator bacteria. The current standard uses *E. coli*. For the stations in the John Day Basin, there were no *E. coli* data collected before February of 1996. From 1996 through 2002, both fecal coliform and *E. coli* data were collected. After June 2002, only *E. coli* data were collected in the John Day River Basin. Rather than excluding the fecal coliform data from this analysis, the fecal coliform data were converted to equivalent *E. coli* concentrations using a regression equation. The following regression equation was developed specifically for Oregon (Cude, 2005):

$$FC = 1.82 \times EC^{0.946}$$

Where:
FC is the Fecal Coliform concentration (organisms / 100 ml) and,
EC is the *E. coli* concentration (organisms / 100 ml)

The fecal coliform concentrations collected from 1993 through 1995 were also converted to the equivalent *E. coli* concentrations, using the same equation. This was done to provide continuity of the data for longer-term conditions across the entire assessment period. For clarity, we note here that exceedance of the current standard by the estimated *E. coli* concentrations prior to 1996 would not be considered violations of the standard. The bacteria standard prior to 1996 targeted fecal coliform concentrations of 200 organisms/100 ml as a 30-day geometric mean (log mean) and a single sample criterion of 400 organisms/100 ml.

2.2.3 (c) Water Quality Standards and Beneficial Uses

Oregon's bacteria standard, as applied to freshwater, includes the text that is inset below, grayed-out where not applicable to the John Day Basin. In addition, the standard includes prescriptions with regard to raw sewage, animal waste, bacterial pollution in general, effluent limitations, sewer overflows, storm sewers and water quality limited streams. The freshwater criteria of the bacteria standard are based on water contact recreation as the most sensitive beneficial use.

Freshwater numeric Criteria excerpt from standard (gray-shaded where inapplicable)

> 340-041-0009 Bacteria
>
> (1) Numeric Criteria: Organisms of the coliform group commonly associated with fecal sources (MPN or equivalent membrane filtration using a representative number of samples) may not exceed the criteria described in paragraphs (a) and (b) of this paragraph:
>
> (a) Freshwaters and Estuarine Waters Other than Shellfish Growing Waters:
>
> (A) A 30-day log mean of 126 *E. coli* organisms per 100 milliliters, based on a minimum of five (5) samples;
>
> (B) No single sample may exceed 406 *E. coli* organisms per 100 milliliters.
>
> (b) Marine Waters and Estuarine Shellfish Growing Waters: A fecal coliform median concentration of 14 organisms per 100 milliliters, with not more than ten percent of the samples exceeding 43 organisms per 100 ml.

The effluent limitation provision [340-041-0009(5)] of the standard is quoted here:

> (5) Effluent Limitations for Bacteria: Except as allowed in subsection (c) of this section, upon NPDES permit renewal or issuance, or upon request for a permit modification by the Permittee at an earlier date, effluent discharges to freshwaters, and estuarine waters other than shellfish growing waters may not exceed a monthly log mean of 126 *E. coli* organisms per 100 ml. No single sample may exceed 406 *E. coli* organisms per 100 ml. However, no violation will be found, for an exceedance if the Permittee takes at least five consecutive re-samples at four-hour intervals beginning as soon as practicable (preferably within 28 hours) after the original sample was taken and the log mean of the five re-samples is less than or equal to 126 *E. coli*. The following conditions apply:
>
> (a) If the Department finds that re-sampling within the timeframe outlined in this section would pose an undue hardship on a treatment facility, a more convenient schedule may be negotiated in the permit, provided that the Permittee demonstrates that the sampling delay will result in no increase in the risk to water contact recreation in waters affected by the discharge;
>
> (b) The in-stream criterion for chlorine listed in Table 20 must be met at all times outside the assigned mixing zone;
>
> (c) For sewage treatment plants that are authorized to use recycled water pursuant to OAR 340, division 55, and that also use a storage pond as a means to de-chlorinate their effluent prior to discharge to public waters, effluent limitations for bacteria may, upon request by the Permittee, be based upon appropriate total coliform limits as required by OAR 340, division 55:
>
> (i) Class C limitations: No two consecutive samples may exceed 240 total coliform per 100 milliliters.

(ii) Class A and Class B limitations: No single sample may exceed 23 total coliform per 100 milliliters.

(iii) No violation will be found for an exceedance under this paragraph if the Permittee takes at least five consecutive re-samples at four hour intervals beginning as soon as practicable (preferably within 28 hours) after the original sample(s) were taken; and in the case of Class C recycled water, the log mean of the five re-samples is less than or equal to 23 total coliform per 100 milliliters or, in the case of Class A and Class B recycled water, if the log mean of the five re-samples is less than or equal to 2.2 total coliform per 100 milliliters.

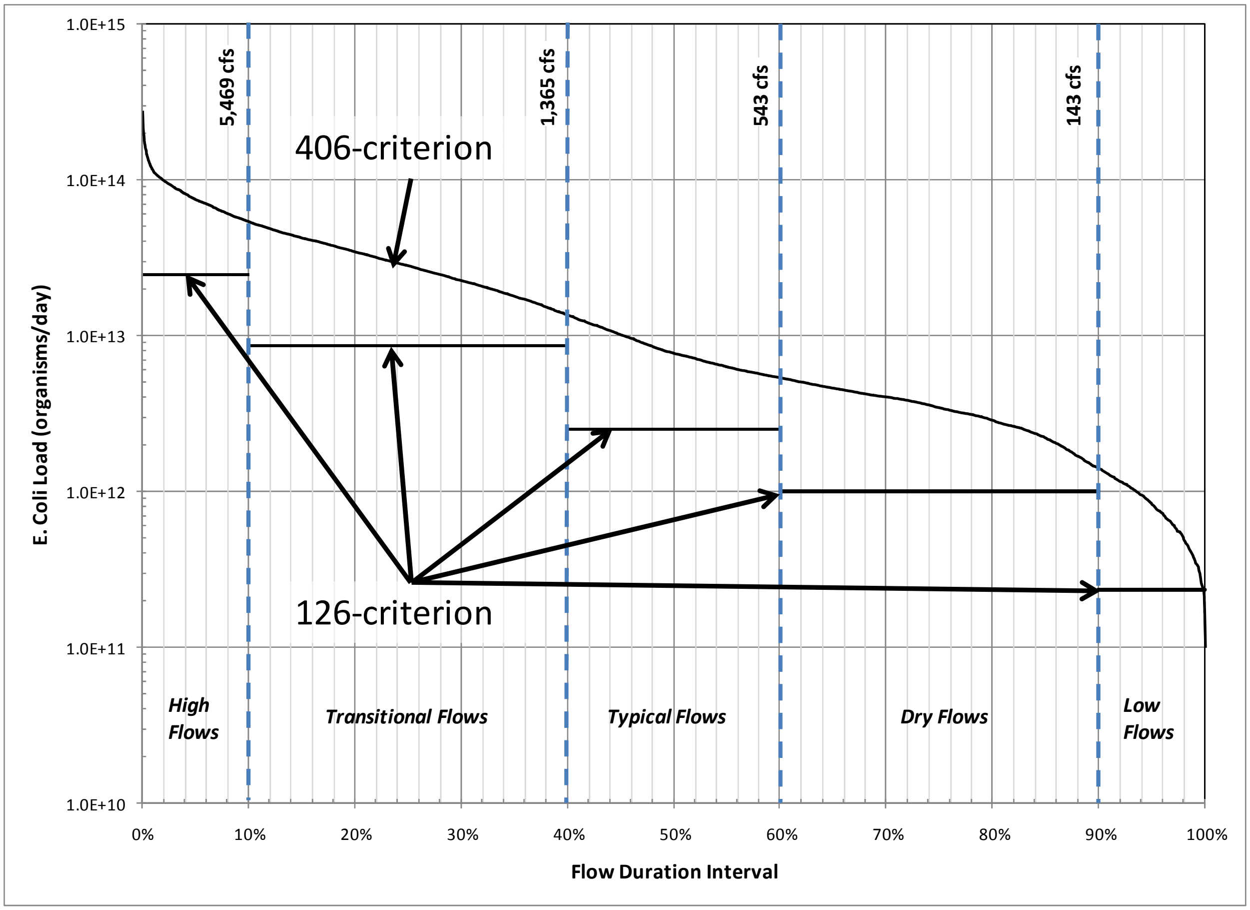
2.2.4 (d) Loading Capacity

2.2.4.1 Method of Determination

Loading capacities are based on load duration curves (LDC). LDC are described in **Appendix E**. The bacteria loading capacities for this TMDL are determined by multiplying the applicable criteria (126 *E. coli* /100 ml or 406 *E. coli* /100 ml) by daily flow, expressed in terms of number of organisms per day. The loading capacities are calculated by flow regime. An example illustrating the loading capacity for the two criteria is shown in **Figure 2.2-2** (below). The loading capacity for each criterion are defined for this TMDL as follows:

- Single sample criterion: The continuous curve in **Figure 2.2-2** comprises the loading capacities associated with the 406 *E. coli*/100 ml criterion. Target loads are assessed for each daily flow value within each flow regime interval (discharge times 406 organisms/100ml). The loading capacities are defined as this array of load targets, spanning the flow record.
- Log mean criterion: The loading capacity for this criterion are the step-wise black lines of **Figure 2.2-2** (below). Target loads are assessed for each daily flow value within each flow regime interval (discharge multiplied by 126 organisms/100ml). The loading capacity is defined as the log mean of all the load targets within each interval.

Figure 2.2-2. Loading capacity illustration for both freshwater bacteria criteria (recall of Figure 7, Appendix E)



As illustrated in **Figure 2.2-2**, the range of observed flows for each station LDC was separated into five categories based on flow percentiles: high (<10%), transitional (10-40%), typical (40-60%), dry (60-90%), and low (>90%). These flow ranges were delineated by DEQ staff and have been applied in other TMDLs (DEQ 2003; DEQ 2006a; DEQ 2006b).

Not all bacteria sample collection sites were at stream gaging stations and not all gaging stations had complete records. Flow was estimated at un-gaged sites by drainage area proportion. Data gaps in gage records were addressed through regression estimation as described in **Appendix E**.

Loading capacities are established for several stations. Stations exhibiting digressions of either criterion (**Table 2.2-3**) were selected for assignment of loading capacities addressing the Upper and Lower Subbasins (HUC 17070201 and 17070204). The North and Middle Fork Subbasins (HUC 17070202 and 17070203), are addressed via the lower North Fork station. While no digressions were observed for the North Fork, the Department recognizes that bacterial issues are not unlikely in this large and relatively un-sampled landscape. This single-station set of gross loading capacities is expected to assist in addressing unidentified digressions.

For additional information, **Appendix E** contains graphical data summaries as load duration curves for all stations (**Appendix E, Figures 27 through 31**) and in terms of concentrations (**Appendix E, Figures 10 through 26**). The concentration data are portrayed by various seasonal classes as well as longitudinally.

Table 2.2-3. Stations exhibiting digressions
(Number of observations and digressions of criteria by station)

Station	Station Description	Number of Observations	Number of Digressions of Max Criterion	Number of Digressions of Log mean Criterion[1]
11386	John Day R. at Cottonwood Bridge (ambient)	90	4	0
11020	South Fork John Day River at Dayville (ambient)	91	2	0
11479	John Day River, above Dayville (ambient)	110	9	1
31990	John Day River at Clyde Holliday State Park	20	1	0
31988	John Day River below John Day WWTP	19	2	0
32124	John Day River above Prairie City	20	3	2

[1] Maximum number of digressions of log mean criterion is 5 because there are only 5 flow regimes considered.

2.2.4.2 Loading Capacities

Example loading capacities for the single-sample criteria (406 *E. coli* /100 ml) are listed in **Table 9** of **Appendix E**. These examples are the minimum LC for each flow regime. The loading capacities for the log mean criteria (126 *E. coli* /100 ml) are listed in **Table 10** of **Appendix E**. Both tables are **recalled** below as **Table 2.2-4** and **Table 2.2-5**. For each station, the flows for each interval are noted in **Figures 32-38** of **Appendix E**.

2.2.4.3 Applicability

The loading capacities apply year round, varying based on instream discharge. Geographically, each applies to all contributing drainage area above each site. This addresses the entire basin above mainstem river mile 39.5, at Cottonwood Bridge on the Condon-Wasco Highway (Hwy 206). Below this point and throughout the lower and upper John Day subbasins, the percent reduction surrogate LA applies, as stated in **Section 2.2.8.1**.

Table 2.2-4. Minimum LC for maximum criteria (for stations needing load reductions, and the North Fork) (recall of Table 9, Appendix E)

Flow Range/Station	Loading capacity (*E. coli*/day)						
	11386	**11020**	**11479**	**31990**	**31988**	**32124**	**11017**
Low Flows (90-100%)	9.9×10^{10}	6.9×10^{10}	3.0×10^{10}	2.0×10^{10}	2.0×10^{10}	9.9×10^{9}	6.9×10^{10}
Dry Flows (60-90%)	1.4×10^{12}	2.0×10^{11}	3.1×10^{11}	1.8×10^{11}	1.7×10^{11}	5.0×10^{10}	1.9×10^{11}
Typical Flows (40-60%)	5.4×10^{12}	4.3×10^{11}	1.4×10^{12}	8.2×10^{11}	7.5×10^{11}	2.4×10^{11}	4.2×10^{11}
Transitional Flows (10-40%)	1.4×10^{13}	7.4×10^{11}	2.5×10^{12}	1.5×10^{12}	1.3×10^{12}	4.3×10^{11}	7.3×10^{11}
High Flows (0-10%)	5.4×10^{13}	3.9×10^{12}	9.3×10^{12}	5.6×10^{12}	5.1×10^{12}	1.7×10^{12}	3.9×10^{12}

Table 2.2-5. Loading capacities for log mean criteria (for stations needing load reductions, and the North Fork) (recall of Table 10, Appendix E)

Flow Range/Station	Loading capacity (*E. coli*/day)						
	11386	**11020**	**11479**	**31990**	**31988**	**32124**	**11017**
Low Flows (90-100%)	2.3×10^{11}	4.8×10^{10}	4.5×10^{10}	2.6×10^{10}	2.4×10^{10}	7.3×10^{9}	2.7×10^{11}
Dry Flows (60-90%)	1.0×10^{12}	9.1×10^{10}	2.6×10^{11}	1.6×10^{11}	1.4×10^{11}	4.4×10^{10}	5.9×10^{11}
Typical Flows (40-60%)	2.5×10^{12}	1.7×10^{11}	5.5×10^{11}	3.3×10^{11}	3.0×10^{11}	9.6×10^{10}	1.5×10^{12}
Transitional Flows (10-40%)	8.6×10^{12}	4.7×10^{11}	1.4×10^{12}	8.2×10^{11}	7.5×10^{11}	2.4×10^{11}	6.2×10^{12}
High Flows (0-10%)	2.5×10^{13}	2.0×10^{12}	4.1×10^{12}	2.5×10^{12}	2.3×10^{12}	7.3×10^{11}	1.9×10^{13}

2.2.5 (e) Excess Load

Observed and target loads (loading capacities) have been assessed as the basis for this TMDL. The excess load is the difference between the two. Excess loads are reported in various forms:

- The load duration curves of **Figures 32 through 38** (**Appendix E**) illustrate the patterns of individual and log mean excess load at each station. These LDC are for stations where digressions have been documented.
- The amount of load decrease needed to meet the loading capacity, for each station and each flow regime, is reported as a percent reduction in **Section 2.2.8 (h)** - **Table 2.2-9**.
- Eighty-three percent is the maximum reduction needed to meet the *E. coli* criteria at all flow regimes and stations, based on the maximum concentration sampled at station 31988. Sixty-nine percent is the corresponding amount needed at the station with the greatest *E. coli* concentrations in terms of frequency and magnitude (11479).

2.2.6 (f) Pollutant Sources and Jurisdictions

The most likely sources of *E. coli* in the upper Basin, above natural levels, are assessed based on general knowledge of basin land use patterns and potential sources. Other than wildlife, the potential sources are livestock, pets, rural and residential septic/disposal systems, recreational use and city sewer systems. Crop and pasture manure and biosolids are included in this list. City sewer systems are not considered a source of concern because their releases are addressed through permit requirements for treatment and disposition. Urban and rural residential activities are probable sources, but in small volumes due to the low population in the Basin. Livestock presence is widespread in the Basin and provides substantial potential for direct deposition, potential storage and inputs through runoff. For additional discussion of pollutant sources and land use, refer to **Sections 1.4.4, 1.4.5, 1.4.6** and **1.4.7**. Designated participants in TMDL implementation are specified in **Chapter 3**. Jurisdictional land use and pollution control for bacterial pollution include:

- **Incorporated Cities** – pet and human waste, storm water, runoff control
- **Oregon Department of Environmental Quality**– onsite rural residential septic systems
- **Oregon Department of Agriculture** – livestock, farming, rural residential associated with agriculture
- **Oregon Department of Parks and Recreation** – State Parks, State Scenic Water ways, recreation use/access
- **Oregon Department of State Lands** – Navigable water ways, recreation/access/development
- **Counties** – unincorporated development, hydrologic control via roads and utility corridors
- **US Forest Service (four National Forests)** – recreation areas/access, livestock management
- **US Bureau of Land Management** – Wild and Scenic Rivers, recreation use/access, livestock management
- **US Park Service** – recreation use/access

2.2.7 (g) Wasteload Allocations

Load or concentration limits are established in this TMDL for permitted point source discharges. Two types of NPDES permits are addressed: Individual facility permits and Confined Animal Feeding Operations (CAFOs). Oregon's Water Pollution Control Facility (WPCF) permits are also considered. For permitted facilities other than CAFOs, the criteria of the bacteria standard take the place of a load limit or WLA. This is applied in accordance with OAR 340-041-0009(5) – refer to **Section 2.2.3 (c)** for the text of the standard. For permitted facilities other than CAFOs, WLA are defined herein for bacteria as the maximum amount of loading that would not cause digression of either freshwater criteria of the bacteria standard, assessed prior to entering waters of the state.

For the municipal NPDES permits, an explicit load is not calculated for permitted discharges. The current and future NPDES permits are required to meet maximum and log mean criteria at end-of-pipe discharge, as stated in the standard. Discharges below these criteria ensure that the water quality standard will be met.

The CAFO NPDES permits are for the management of agricultural animal waste, so as not to contaminate ground or surface water (OAR 603-074-0005). CAFO permits are established with zero discharge requirements. Wasteload allocations of zero are established herein, for these facilities.

Generally, the WPCF permits are for minor discharges of waste onto or beneath the ground surface with no direct discharge to surface waters (OAR 340-045-0015). Some of the industrial activities covered by WPCF general permits are off stream placer mining, gravel mining, seasonal food processing, petroleum hydrocarbons cleanup, and vehicle wash water. Bacteria wasteload allocations are not established for these facilities. However, one WPCF facility, the John Day WWTP, is a potential concern, and is addressed in the following text of this section. There are 18 WPCF permits active in the John Day River Basin.

Descriptions of facilities, permit requirements and allowed discharge periods and lists of permitted facilities are available in **Section 1.4.6**.

2.2.7.1 Applicability

The load (for CAFOs) and concentration limits (for municipal NPDES sources) established in this section are applicable year round to the facilities identified in the following text and tables, as well as to future NPDES facilities. The limits allocated in this section are further restricted to the time frame of allowable discharge established in NPDES permits.

2.2.7.2 Individual NPDES Permits for Municipal WWTP

As stated above, the WLA is set to the criteria concentration and an explicit load was not calculated directly from permitted discharges. The current and future NPDES facilities, other than CAFOs, are required to meet maximum and log mean criteria at end-of-pipe discharge. The WLA for these facilities are listed in **Table 2.2-6**.

Table 2.2-6. Individual NPDES permit WLAs

Permit	Permittee	Water body	WLA
23560	City of Dayville WWTP	John Day River	Discharge at or below criteria
51180	Long Creek WWTP	Long Creek	Discharge at or below criteria
59065	Mt Vernon WWTP	John Day River	Discharge at or below criteria

2.2.7.3 Confined Animal Feeding Operations

There are two current CAFO permits and one pending in the John Day River Basin (**Table 2.2-7**). These are medium-sized NPDES general permit facilities. The CAFO permits prohibit discharge to waters of the state except in relatively extreme circumstances, and receive a WLA of zero. The zero WLA will also apply to any new CAFO permits issued in the John Day River Basin.

Table 2.2-7. CAFO permits in John Day River Basin

Facility (County)	Permit Number
Holliday Land and Livestock (Grant Co.)	AG-P0174438CAFG
Bridge Creek Ranch, LLC. (Wheeler Co.)	NA*
Reitmann Ranch (Gilliam Co.)	AG-P0172429CAFG

* This facility is in the process of permit issuance at the time of TMDL development.

2.2.7.4 City of John Day WWTP

As discussed previously (**Sections 1.4.6.1** and **2.1.7**), the Department believes that the City of John Day WWTP Lagoon wastewater interacts with the John Day River. In this TMDL, the Department is allocating a bacteria load as reserve capacity for the City of John Day equivalent to other existing and potential future point sources, set at the criteria (**Table 2.2-8**).

Table 2.2-8. City of John Day WWTP WLA

WPCF Permit	Permittee	Water body	Reserved Capacity Load
43569	City of John Day	John Day River	Discharge at or below criteria

2.2.8 (h) Load Allocations and Surrogates

In the John Day Basin, the bulk of the bacteria loading capacity is attributable to nonpoint sources. This can be stated generally because high bacteria loads occur above point sources and at times when point sources are not discharging. In addition, some sources eliminate bacteria through chlorination and point source flow rates are generally low in comparison to receiving waters. To illustrate this point, we consider the upper Basin during the summer. The only area of plural permitted discharges is the upper mainstem. Here there are three permitted sources – WWTP of the Cities of John Day, Mt Vernon and Dayville. During the summer, Dayville is not permitted to discharge. The Mt Vernon WWTP does not discharge directly and the John Day WWTP, though connected to the river, treats effluent through chlorination prior to discharge to its lagoons. Accordingly, there is little potential for introduction of bacteria from point sources during the time of least instream dilution. The only other non-zero discharge NPDES facility in the Basin is the WWTP of the City of Long Creek, where bacteria concerns have not been identified, and in fact, the City of Long Creek WWTP does not discharge to surface water, though it is permitted to do so, pending certain conditions. Given the paucity of point source input, and an implicit MOS and RC – in essence load allocations would be nearly a repetition of the LC.

Rather than estimating LA directly, a percent reduction surrogate measure is established. Loading capacities were estimated for both criteria and used to identify percent reductions for each station (**Appendix E Table 8**, recalled below). The maximum percent reduction among the stations of either criterion was determined. ***The maximum percent reduction of 83% (for maximum criterion at station 31988) is applied as a surrogate load allocation. An interim percent load reduction of 69% (for the maximum criterion at station 11479) serves as an initial target for implementation.*** This interim target was selected based on the larger amount of data available at station 11479 (N = 110) compared to the amount of data available at station 31988 (N = 20). Also, the period covered at station 11479 (greater than 15 years) was larger than the period covered by data collection at station 31988 (approximately 2 years).

The Department deems it appropriate to apply a uniform reduction of 69%, then if needed, 83%, across all flow regimes and all stations, or reduced loading until the bacteria standard is met. These reductions would lead to larger reductions than necessary for some flow regimes and for some stations, providing for an implicit margin of safety.

2.2.8.1 Applicability

The percent reduction surrogate applies uniformly throughout the Upper and Lower John Day Subbasins (HUC 17070201 and 17070204). No reduction is needed for the combined North and Middle Fork drainage areas (HUC 17070202 and 17070203), based on the station at the mouth of the North Fork. The Department recognizes that un-identified bacteria issues may exist in the North Fork drainage (including the Middle Fork Basin). For the purpose of this TMDL, this potential is addressed through the LC set at the mouth of the North Fork and direct application of the bacteria freshwater criteria.

The percent reduction surrogate is applied to the baseline of current loading (not concentrations). This has been assessed for post 1993 data as portrayed in the LDC of **Appendix E, Figures 32 through 38**. As the target is based on multi-year sites across the basin, attainment would be evaluated through analysis of a subsequent substantial data set integrated over space and time. That is, instead of a daily, monthly or annual compliance objective; the percent reduction LA surrogate serves as a level-of-effort guideline for TMDL implementation plans. The Department envisions that implementation will be guided by assessment of land use and management practices in relation to the location and timing of digressions reflected in the LDC.

Table 2.2-9. Load reductions for bacteria TMDL by station (recall of Table 8, Appendix E)

	Log mean					Max					
Station/Flow Regime	0-10%	10-40%	40-60%	60-90%	90-100%	0-10%	10-40%	40-60%	60-90%	90-100%	Reduction
11386	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**79.6%**	0.0%	**69.3%**	0.0%	**79.6%**
11020	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**69.3%**	**69.3%**
11479	0.0%	**3.1%**	0.0%	0.0%	0.0%	0.0%	**51.7%**	**44.8%**	**29.9%**	**69.3%**	**69.3%**
31990	0.0%	No Data	0.0%	0.0%	0.0%	0.0%	No Data	0.0%	**37.4%**	0.0%	**37.4%**
31988	0.0%	No Data	0.0%	0.0%	0.0%	0.0%	No Data	0.0%	**83.2%**	0.0%	**83.2%**
32124[1]	0.0%	No Data	**65.8%**	**6.7%**	0.0%	0.0%	No Data	**47.3%**	**37.4%**	0.0%	**47.3%**

[1] Log mean was based on only two load estimates and was not considered to represent conditions at the station well. The next largest percent reduction was select as the percent reduction for station 32124

2.2.8.2 Demonstration of Criteria Attainment

In theory, a uniform reduction of a log mean data set will not necessarily meet the single sample criteria and vice versa. However, given the current bacteria data distribution in the Basin, it can be demonstrated that the 83% surrogate will lead to attainment of both criteria. Two examples follow, where the 83% reduction is applied to all observed loads. The current conditions for station 31988 are shown in **Figure 2.2-3**. When the 83% reduction is applied to all observed loads, the resultant condition is shown in **Figure 2.2-4**. As seen in **Figure 2.2-4**, the observed loads and the log mean of the observed loads meet the target loads for each criterion. The reduced loads shown in **Figure 2.2-3** are below the LC for both criteria across the flow regimes.

Figure 2.2-3. LDC for station 31988
(labeled with maximum reduction needed to meet the loading capacity)
(recall of Figure 39, Appendix E)

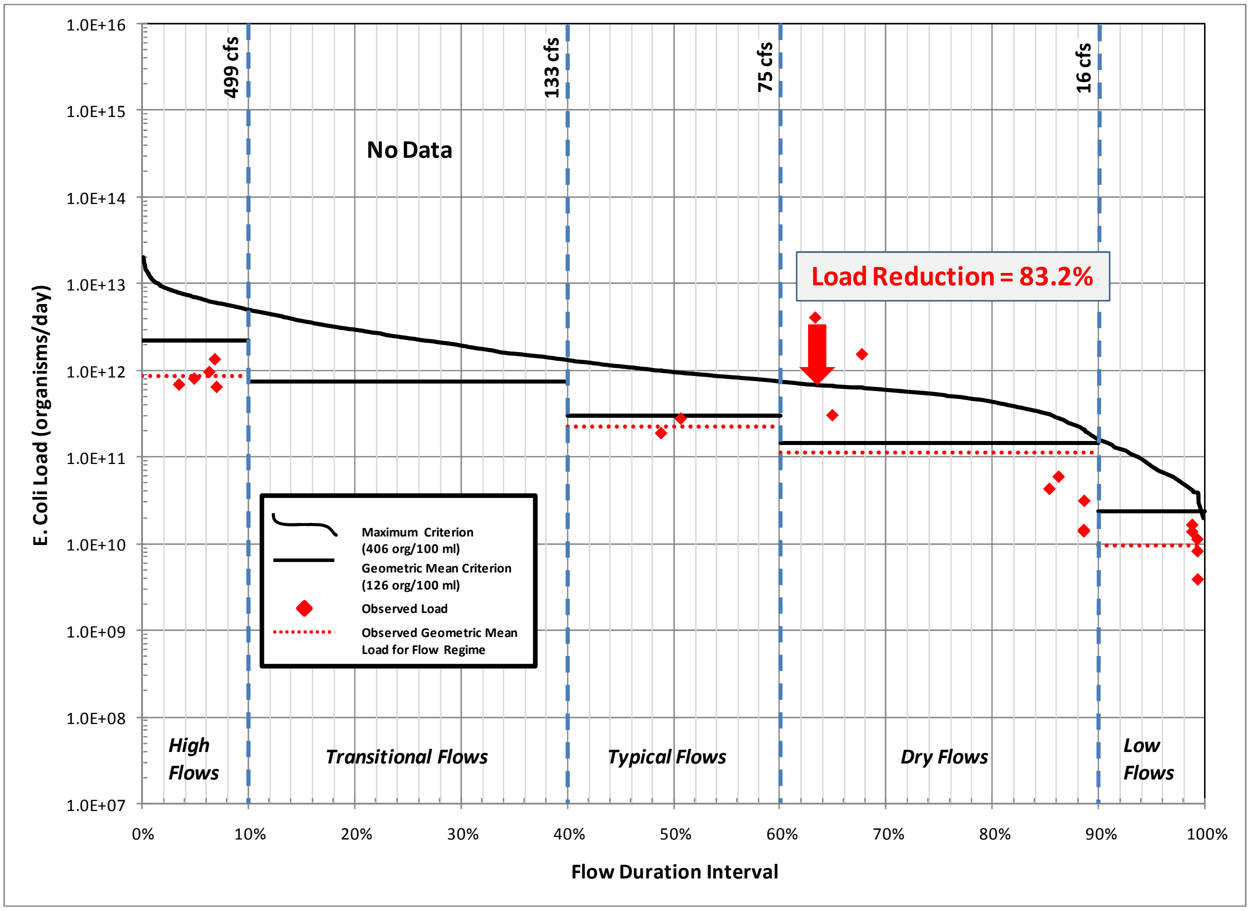
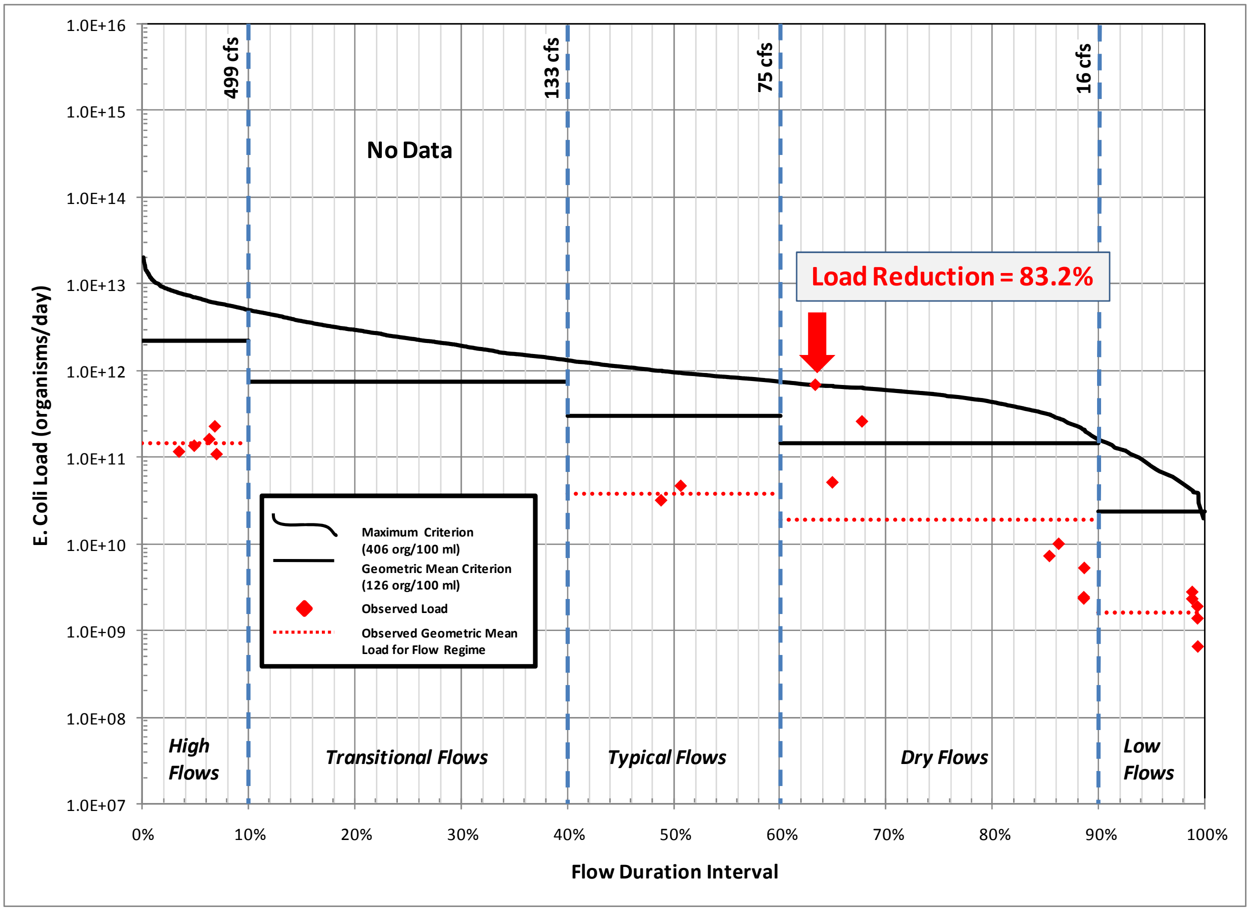


Figure 2.2-4. LDC for station 31988 with 83.2% reduction applied (recall of Figure 40, Appendix E)



Since the 83% is the largest of all the reductions among the stations and between the criteria, the loads at the other stations should satisfy both criteria. Station 11479 serves as another example. The current conditions are shown in **Figure 2.2-5**. The largest reduction was 69% for station 11479. The 83% reduction is applied to all loads at station 11479 and both criteria are met (**Figure 2.2-6**).

The load reductions will be achieved through source reductions and transport controls. The TMDL participants in the Basin are called on to develop strategies to reduce bacteria loading by 83%. By doing this, the Department assumes that if the sources are reduced by 83%, then in-stream loads will be reduced at least by the same percentage and both criteria will be met.

Figure 2.2-5. LDC for station 11479, current conditions (prior to 83.2% reduction) (recall of Figure 41, Appendix E)

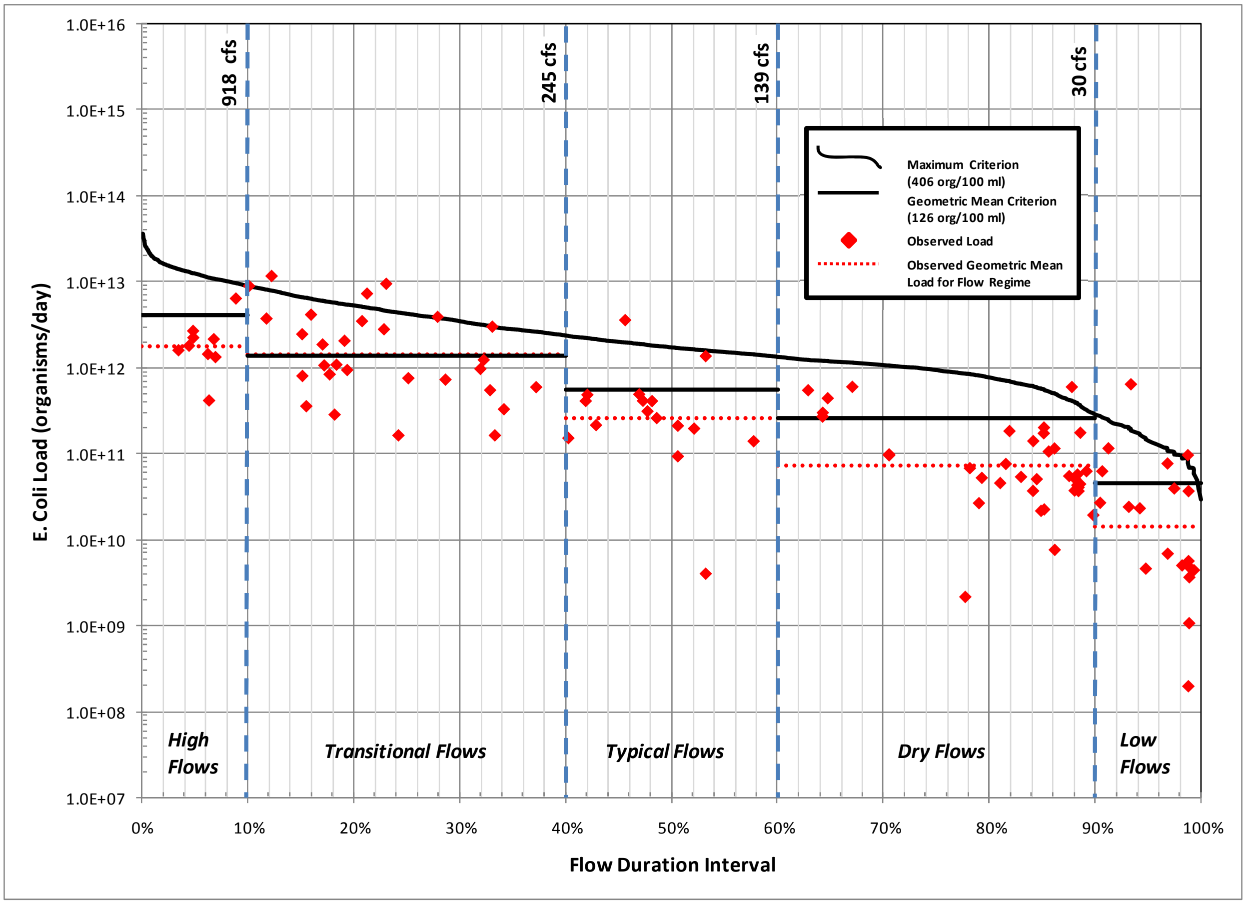
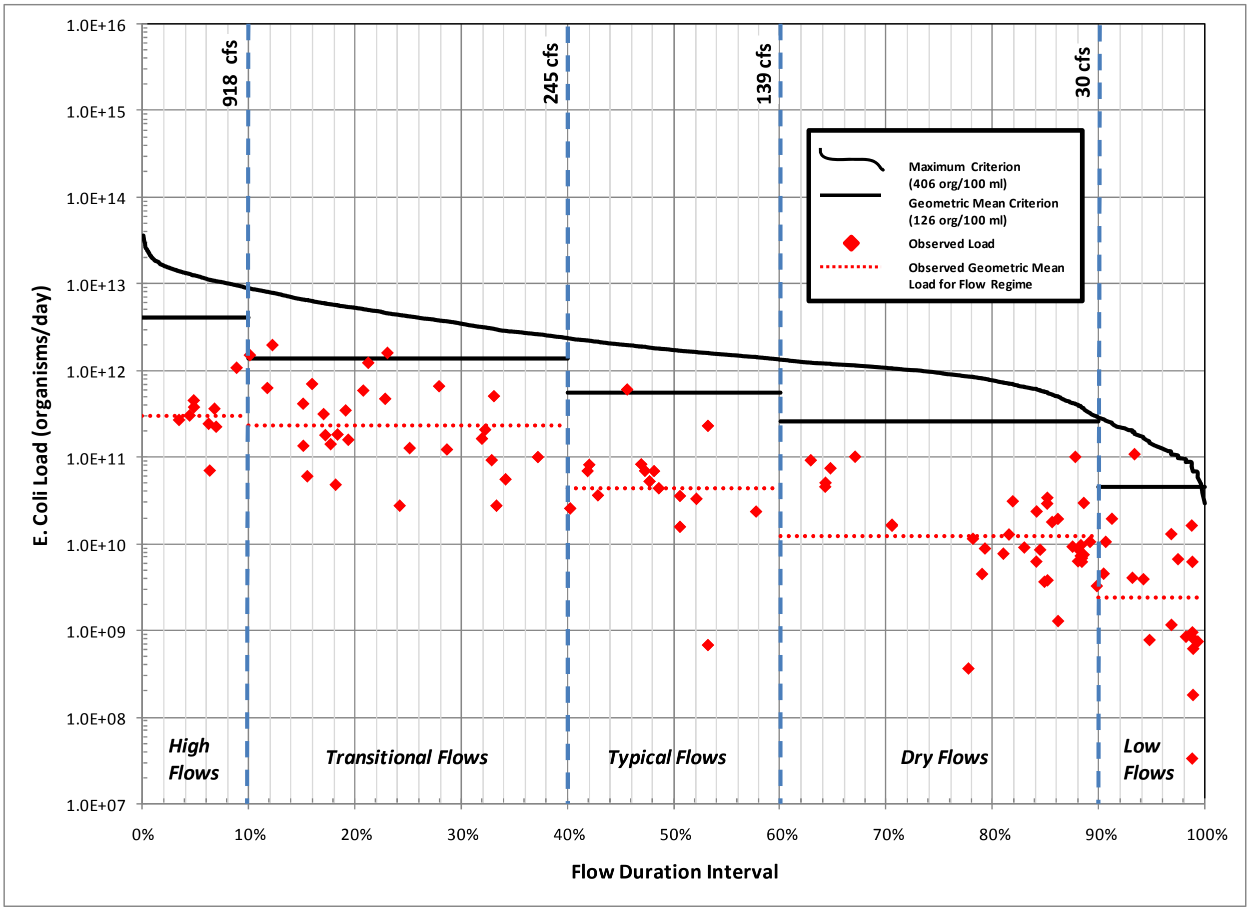


Figure 2.2-6. LDC for station 11479 with 83.2% reduction applied (recall of Figure 42, Appendix E)



2.2.9 (i) Margin of Safety

The margin of safety (MOS) accounts for the uncertainty related to the TMDL and, where feasible, quantifies uncertainties associated with estimating pollutant loads, modeling and monitoring water quality (OAR 340-042-0040(4)(i). These are two types of MOS, explicit and implicit. An explicit MOS sets numeric targets at more conservative levels than analytical results indicate, to add a safety factor to pollutant loading estimates. The numeric load represented by an explicit MOS is not available for allocation to pollutant sources or sectors and is reserved. An implicit MOS uses conservative estimations of factors that would affect bacteria loadings in the basin.

An implicit MOS is employed in the John Day River Basin bacteria TMDL, based on the following:

- The TMDL calculations conservatively assumed no bacteria die off
- The criteria are directly targeted as the form of the WLA, hence eliminating model assumptions and uncertainty
- The surrogate load allocation targets the maximum percent load reduction across all sites and all flow ranges. Load reductions for each flow range are based on the maximum observed digression.

2.2.10 (j) Seasonal Variation and TMDL Time Frame

The John Day bacteria TMDL applies year round. Because the LA surrogate percent reductions apply at all seasons and the LCs are flow based, water quality is addressed on a year round basis, with regard to nonpoint source of stream heating. The WLA apply at all times of discharge.

Seasonal variation is assessed in this TMDL. *E. coli* concentrations are generally highest in the summer (**Appendix E**, **Figures 10 and 12**). Instream load reductions are evaluated as a function of flow range, capturing the annual pattern of flow variability.

The Department recognizes that source activity and instream *E. coli* concentrations and loads do not correlate well in time, due to the irregularity of sources, storage, delivery mechanisms and management influencing these factors. That said, flow- and time-patterns of excess load may inform as to causes of high instream concentrations. Accordingly, while the LA surrogate addresses aggregate improvement over time, the TMDL analysis and the loading capacities collectively identify daily, seasonal, and flow-based patterns.

2.2.11 (k) Reserve Capacity

The RC is an allocation for increases in pollutant loads from future growth and new or expanded sources. An explicit value was not assigned for reserve capacity. Rather, future and current point sources in the John Day River are required to meet water quality criteria at the end-of-pipe discharge (OAR 340-042-0040(4)(k)), before entering waters of the state. Therefore, any additional point sources will not contribute to digressions from the criteria.

2.2.12 Water Quality Standard Attainment Analysis

Oregon Administrative Rule 340-042-0040(4)(I)(F) calls for the WQMP to include a timeline for attainment of water quality standards. For point sources, attainment is addressed through DEQ's NPDES permitting program. For receiving waters, attainment is approached through an adaptive process, wherein TMDL implementation plans include milestones and strategies that are revised as capacity for and mechanisms of improvement are better understood.

Clearly the excess *E. coli* loading in the John Day Basin is related to nonpoint sources of pollution. Point sources effluent volumes are small in comparison to Basin-scale runoff, and the timing of high bacteria concentrations does not correspond to point source discharge intervals. Until Basin *E. coli* sources and reduction measures are better understood, it is difficult to estimate when criteria may be attained. We defer this assessment to implementation plans and until more information is available, except to point out that bacteria source and delivery reduction typically has potential to occur on a smaller time scale than is necessary for nonpoint source pollution in relation to temperature and sedimentation.

2.2.13 References

Cude Curtis G., 2005. Accommodating Change of Bacterial Indicators in Long Term Water Quality Datasets Journal of American Water Resources Association. 1 : Vol. 41. - pp. 47-54.

2.3 Dissolved Oxygen TMDL

This Chapter describes the elements of the dissolved oxygen (DO) TMDL for the upper John Day River. The allocations herein address the upper John Day River, extending from the North Fork confluence to the City of John Day. This is the first dissolved oxygen TMDL established for the John Day Basin. The dissolved oxygen TMDL is summarized in **Table 2.3-1**.

Table 2.3-1. Dissolved oxygen TMDL summary information

Water body	John Day River, river mile 182 to 243.7 (North Fork confluence to Canyon Creek confluence)
Water Quality Standard	OAR 340-041-0016 (dissolved oxygen)
Applicable Water Quality Standard Criteria	Cool water criteria: "…the dissolved oxygen may not be less than 6.5 mg/l as an absolute minimum."
Target Pollutant	Heat (temperature TMDL)
Loading Capacity	Temperature TMDL loading capacity
Wasteload Allocation	Temperature TMDL wasteload allocation
Load Allocation	Temperature TMDL load allocation
Load Allocation Surrogate	Temperature TMDL load allocation surrogate
Existing Pollutant Sources	Refer to temperature TMDL
Margin of Safety	Implicit
Reserve Capacity	Temperature TMDL reserve capacity

The primary data sets for this TMDL assessment stem from monitoring carried out by DEQ since the 1970s and long-term flow gaging stations maintained by the USGS. Dissolved oxygen samples are collected at five sites in the Basin on a quarterly basis, since the 1970's (**Figure 2.3-1**). In addition to the long-term monitoring, DEQ monitored dissolved oxygen in association with the John Day Basin bacteria monitoring events of 2004 through 2006. This expanded the network to thirteen sites with focus on the upper mainstem. Continuous monitors were deployed, typically for 7-day intervals, during four selected months at a subset of these sites. All sites are shown in **Figure 2.3-1** and listed in **Table 2.3-2** with relevant information. In the dissolved oxygen analysis (**Appendix D**) for the John Day Basin TMDL, data collected since 1993 are used, paralleling the most recent 303(d) assessment. In order to keep with contemporary flow patterns, flow data prior to 30 years ago were not used.

As described subsequently in this Chapter and in **Appendix D**, statistical analysis has shown that temperature TMDL attainment will provide improvement in dissolved oxygen conditions, sufficient to meet the dissolved oxygen water quality standard. Accordingly, no additional allocations are developed for dissolved oxygen. Instead, the dissolved oxygen TMDL is an application of the temperature TMDL.

Dissolved Oxygen Screening and Assessment

In 2008, the Basin-wide dissolved oxygen concentration and percent saturation data were compiled and evaluated. The data were systematically examined for compliance with the dissolved oxygen standard. A screening process mirroring the 303(d) assessment eliminated data with insufficient QA, sites with few samples, and older data (pre 1994) that may not represent current conditions. This narrowed the site selection to those listed in **Table 2.3-2**. Digressions (data not meeting the standard) were assessed, revealing the following: some stations had no digressions, some had a low percentage of digressions (e.g., the North Fork), some digressions occurred during spawning and some during rearing times. In some cases, digressions were identified where there was little information with which to evaluate cause. Additionally, earlier data were reviewed to specifically evaluate two 303(d) listed segments not associated with long-term datasets – Utley Creek and Corral Creek. Through this screening and evaluation process, the Department has decided to address, through this TMDL, the upper John Day River listing identified in

Section 2.3.1. Other listings and newly identified DO-impaired segments will be de-listed, re-classified or deferred for later study or TMDL development. As described in **Appendix D**, the current or potential listings are addressed as follows:

- Corral Creek will be re-evaluated or deferred for additional study
- The Utley Creek prior-assessment listing will be classified as Category 3, reflecting insufficient data to evaluate compliance with the dissolved oxygen standard
- Mainstem spawning impairments will be deferred for additional study
- The North Fork spawning listing will be re-classified from Category 5 to Category 2, reflecting general attainment of the dissolved oxygen standard
- The upper mainstem cold water criterion listing will be eliminated, as it is effectively replaced by the upper mainstem cool water criterion listing

Given these outcomes, the dissolved oxygen analysis for this TMDL is focused on the upper mainstem. Based on data availability and best professional judgment, the selected approach is regression analysis of water quality data from the mainstem ambient site (DEQ long term quarterly monitoring site) above the City of Dayville (LASAR ID #11479) and the USGS stream-flow gaging station in nearby Picture Gorge (**Figure 2.3-1**). Flow record adjustments were made based on drainage area, and data gap-filling if needed, as described in **Appendix E** (*Derived Flow Data* section). Station 11479 was represented by 119 samples at the time of data compilation for TMDL assessment, and this is furthered narrowed by seasonal selection, as described in **Appendix D**, ***Time-Period Selection***.

Quantile Regression Method Summary

The regression analysis employed herein is a statistical model developed to represent the influence of physical, chemical, and biological processes on the DO conditions in the John Day River. The specific model used is a linear model. An example of a linear model is: DO = slope × Flow + intercept. In this example, the slope and intercept relate DO concentrations to instream flow. We estimated the slope and intercept using regression analysis. This analysis not only provides estimates of the slope and intercept, but also provides information about the uncertainty of estimates. The information about the uncertainty of the slope and intercept estimates was used to select the specific observed data (flow data in the example) used in the model. In order to use the most amount of information provided by the observed data, we used quantile-regression. Unlike most regression methods that provide a single pair of slope and intercept estimates, quantile-regression estimates multiple pairs of slopes and intercepts (one pair for each selected quantile), These estimates cover the entire distribution of the data; thus using the maximum amount of information contained in the observed data. We then selected a single pair of slope and intercept estimates from those provided by quantile-regression to use in setting the load allocation for the pollution target. The steps we used in the estimate selection process were: 1) estimate pairs of slopes and intercepts using quantile regression; 2) keep pairs with estimate uncertainty below an acceptable level and use them to model DO; 3) keep models with inputs that could be controlled by human activities (like flow in the example); 4) compare estimated DO from models to current conditions; 5) select model that represented the current conditions the best based on several measures of performance. We based the load allocation on the selected model. We then used this model to determine the amount of the pollutant that could be present in the water when DO concentrations meet the DO water quality standard.

Relationship between Temperature and Dissolved Oxygen

In general, the cause of depleted dissolved oxygen in streams is oxygen consumption through chemical and biological processes. These processes include decomposition of organic material in the water column and in streambed sediment, and inputs of oxygen-depleted water or oxygen demand from point sources. In the John Day River, point sources are small and infrequent. Regarding the warm season DO concerns being addressed in this TMDL, the most probable cause of low DO concentrations, which occur in the early morning, is excess algae. The growth and die-off of algae and related bacteria produce a distinct daily cycling of DO concentrations, with the highest concentrations occurring in the afternoon when oxygen release from photosynthesis is at a maximum. In the early morning, bacterial die-off and decomposition depletes the water column of DO. Continuous DO monitoring in the John Day River produces data that are consistent with this pattern of daily cycling.

Algal growth is controlled by light, heat and nutrients, which in turn are related to flow and temperature. The assessment documented in Appendix D analyzed a range of nutrients and algae-associated indicators, for the upper John Day River during the period in which the cool water DO criterion applies. Of the most feasible controls, temperature has a stronger relationship with dissolved oxygen than other constituents.

Figure 2.3-1. Locations of stations with dissolved oxygen data.
Note that all are mainstem sites except for 11017 and 32143 (North Fork) and 11020 and 32567 (South Fork). The five long-term monitoring sites in the Basin (solid triangle) – three on the mainstem, one each at the mouths of the North and South Forks. The indicated gage station, USGS ID 14040500, provided the flow data used in this DO TMDL.

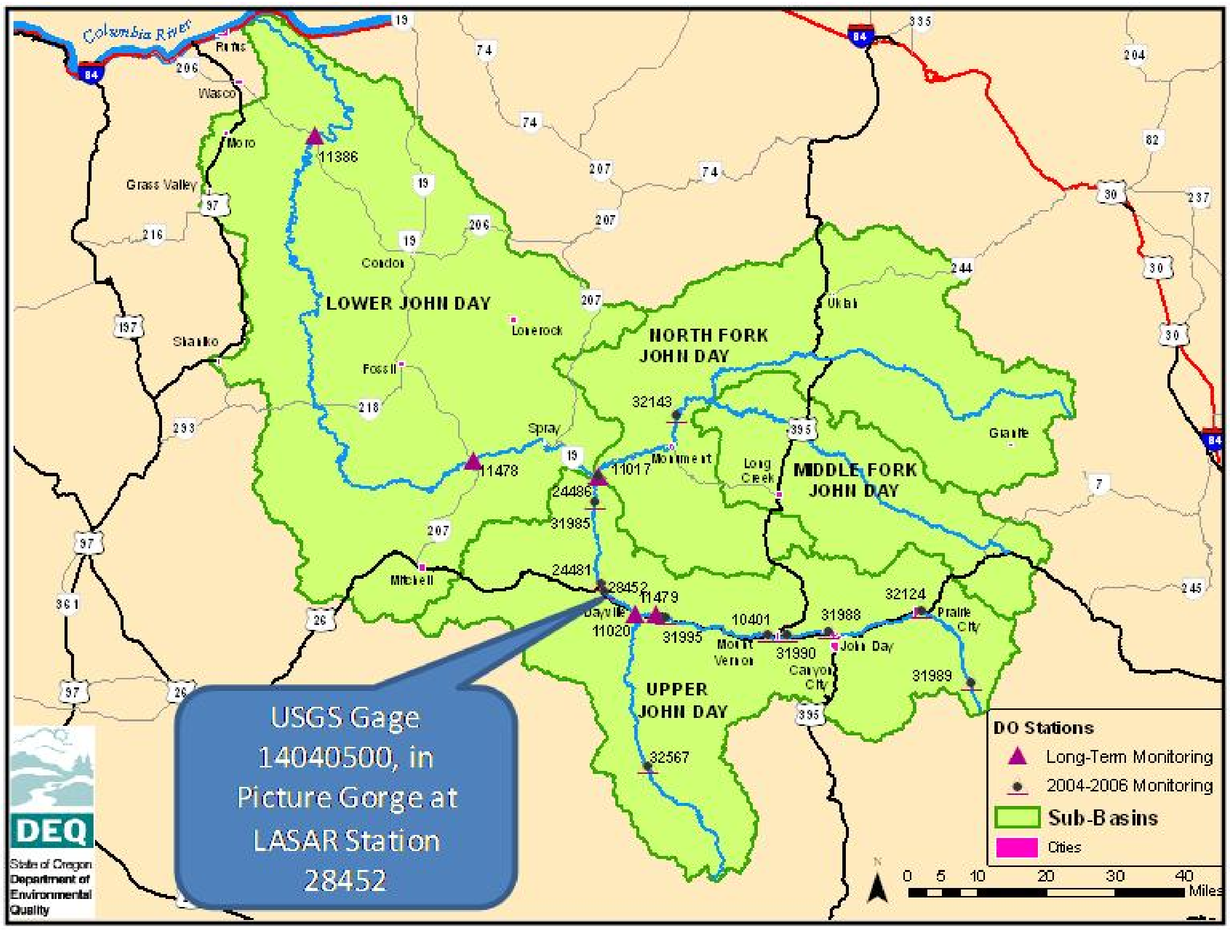


Table 2.3-2. Stations considered in dissolved oxygen TMDL development

Station ID	Water Body	Description	Mainstem River Mile	Elevation (ft)	Date Begin	Date End[1]	Number of Samples[2]	Ambient Station	Sub-Basin[3]
11386	John Day River	Cottonwood Bridge	39	524	2/24/1993	6/26/2008	90	Yes	Lower
11478	John Day River	Near Service Creek	154.5	1645	2/24/1993	6/26/2008	90	Yes	Lower
11017	North Fork John Day River	Mouth at Kimberly	181.5	1891	2/24/1993	6/26/2008	89	Yes	North Fork
32143	North Fork John Day River	5 miles above Monument	181.5	2056	8/30/2005	5/1/2006	5	No	North Fork
31985	John Day River	Near Service Creek	189	1965	6/14/2005	4/26/2006	19	No	Upper
28452	John Day River	Picture Gorge	205	2241	6/14/2005	4/26/2006	29	No	Upper
24481	John Day River	Picture Gorge	206	2219	8/5/1999	2/29/2000	6	No	Upper
11020	South Fork John Day River	Dayville near mouth	212	2352	2/24/1993	6/26/2008	98	Yes	Upper
32567	South Fork John Day River	0.6 miles below Indian Creek	212	3815	8/30/2005	9/6/2005	8	No	Upper
11479	John Day River	3 miles above Dayville	215	2396	2/24/1993	6/26/2008	119	Yes	Upper
31995	John Day River	7 miles above Dayville	218.5	2442	6/14/2005	4/27/2006	26	No	Upper
10401	John Day River	Below Mt Vernon	238	2787	6/14/2005	4/26/2006	19	No	Upper
31990	John Day River	Clyde Holliday State Park	241	2875	6/14/2005	4/26/2006	19	No	Upper
31988	John Day River	City of John Day (below WWTP)	247	3057	6/14/2005	4/25/2006	21	No	Upper
32124	John Day River	Above Prairie City	258	3552	6/14/2005	4/26/2006	19	No	Upper
31989	John Day River	USFS Trout Farm Campground above Prairie City	279	4882	6/14/2005	4/26/2006	26	No	Upper

[1] As off 10/7/2008
[2] Daily values of QA/QC Status B or better and could be the aggregate of continuous data (continuous data were represented by the daily minimum, yellow shading indicates sites with continuous monitors)
[3] North Fork – North Fork John Day Subbasin, Upper – Upper John Day Subbasin, Lower – Lower John Day Subbasin

2.3.1 a) Waterbody Names, Locations and 303(d) Listings

This Chapter defines the dissolved oxygen TMDL for the upper John Day River. The allocations herein address the 303(d) listed segment extending from the North Fork to the City of John Day, identified as:

- Oregon 303(d) database record ID 1538
- River miles 243.7-265

There are three other 303(d) listings for dissolved oxygen in the John Day Basin. All identified DO-impaired segments are tabulated in **Chapter 1**, **Table 1.2-3**. The current and potential listings not addressed through this TMDL are being deferred or considered for de-listing or re-categorization as described in the preceding section and **Appendix D** (introductory sections entitled *Impaired Segments for DO Water Quality Standard* and *Impairments Addressed in this TMDL*).

2.3.2 (b) Pollutant Identification

The pollutant targeted in this upper John Day River dissolved oxygen TMDL is heat. Through the statistical analysis described in **Appendix D**, temperature is selected as the DO-limiting variable that both reflects human modification and manifests the most influence over dissolved oxygen concentrations.

2.3.3 (c) Water Quality Standards, Beneficial Uses and TMDL Target

The Oregon dissolved oxygen standard is stated in OAR 340-041-0016. The standard is based primarily on various aquatic communities including fish and other organisms. Of the designated beneficial uses for Basin waters (**Chapter 1**, **Table 1.4-2**), the sensitive use the dissolved oxygen standard targets is ‘Fish and Aquatic Life.’ The 303(d) stream segment addressed in this TMDL is listed for the cool water DO criterion (fresh water). Through this TMDL assessment, spawning concerns have been identified in this same segment. However, insufficient information is available to fully evaluate the cause of low dissolved oxygen during the spawning period (January 1- May 15). The Department will defer addressing spawning concerns until after the next 303(d) list update. The cool water criterion of the dissolved oxygen standard is (OAR 340-041-0016):

> “(3) For water bodies identified by the Department as providing cool-water aquatic life, the dissolved oxygen may not be less than 6.5 mg/l as an absolute minimum. At the discretion of the Department, when the Department determines that adequate information exists, the dissolved oxygen may not fall below 6.5 mg/l as a 30-day mean minimum, 5.0 mg/l as a seven-day minimum mean, and may not fall below 4.0 mg/l as an absolute minimum (Table 21);”

This TMDL targets a dissolved oxygen concentration of 6.5 milligrams per liter (mg/l). The pollutant parameter target assessed to achieve this is described in the following.

2.3.3.1 Pollutant Parameter target

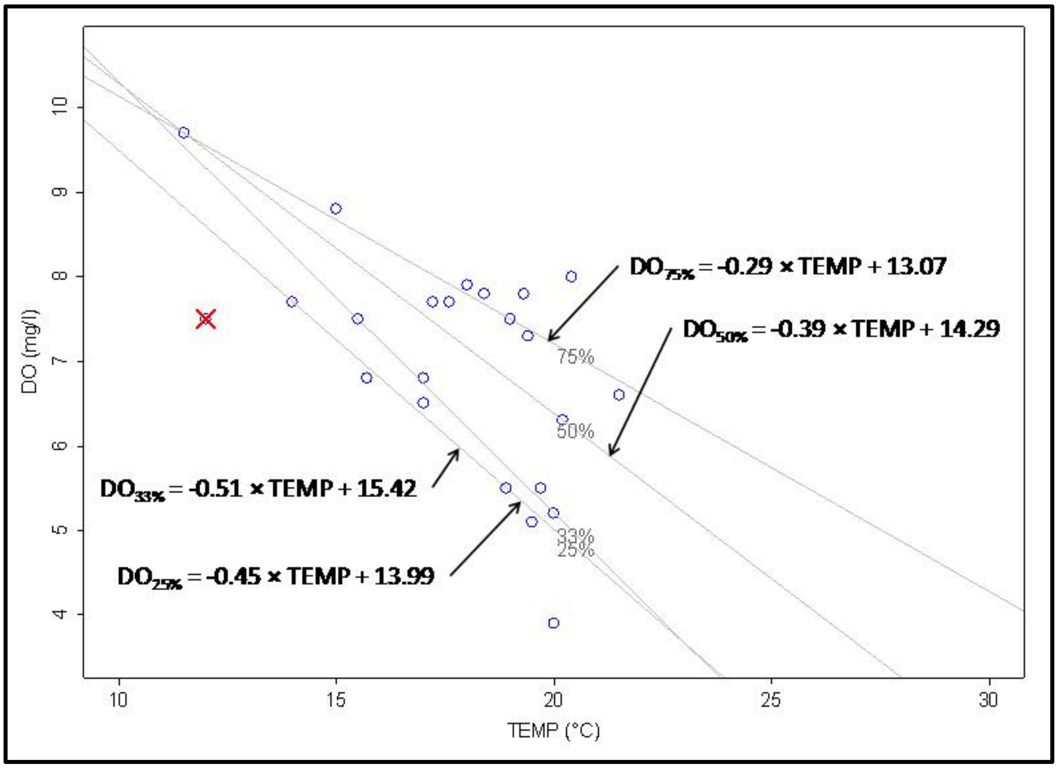
After selecting the season that best represents the conditions of dissolved oxygen standard violations, controlling variables were statistically assessed (**Appendix D**). Focusing on the warm season, twenty-one samples are available for analysis. Twenty-one parameters that related physical, chemical and biological state to dissolved oxygen conditions along with water quantity were used in a quantile regression (QR) analysis. This method is summarized in the introduction to this Chapter (**Chapter 2.3**). A more detailed explanation of, and reasons for using, a QR approach are provided in **Appendix D,** in the ***Quantile Regression – Method Background*** section. The twenty-one parameters are identified in **Table 4** of **Appendix D**. This list was narrowed through an elimination process employing statistical performance measures, the controllability of the variable through stream restoration/management and the physical consistency of its relationship to dissolved oxygen. All but temperature were eliminated. Next, as described in **Appendix D**, the quantile equation that best represented the dissolved oxygen controlling processes was selected. The 75^{th} percentile QR equation was chosen (**Appendix D**, ***Selection of QR Equation to Model DO***). This selection is based on the equation that (1) is thought to best characterize the DO-controlling processes, (2) exhibits the best statistical performance measures and (3) most closely matches theoretical outcomes. Equations for each statistically significant QR relationship are shown in **Figure 2.3-2**. The 75th percentile equation is the target for the upper John Day River cool water dissolved oxygen TMDL:

Equation 2.3-1. $DO_{75\%} = -0.29 \times TEMP + 13.07$

where,

$DO_{75\%}$ is the DO concentration estimated using the QR equation for the 75th percentile of the DO-TEMP pairs.
TEMP is temperature

Figure 2.3-2. Dissolved oxygen versus temperature quantile regression.
The red data point with red cross-out is considered an outlier (Recall of Figure 10, Appendix D)



The dissolved oxygen TMDL temperature target is applicable at the location that the 303(d) listing is based on, LASAR Station 11479 upstream from Dayville on the mainstem. The target is based on July through September data. Restricting the analysis to these months provided for increased statistical power (**Appendix D**). However, because the DO-temperature relationship is likely to be similar throughout the warm season, the target will be applied from June 1 through September 30, fully addressing 'summer' as defined in OAR 340-041-0002(63).

2.3.4 (d) Loading Capacity

The temperature TMDL loading capacities (**Chapter 2.1**) are sufficient to achieve the dissolved oxygen TMDL target (**Appendix D**).

2.3.5 (e) Excess Load

Quantification of excess load is provided in **Section 2.1.5** of the temperature TMDL. The following discussion shows that removal of excess thermal load will result in dissolved oxygen concentrations above the target criterion. To that end, temperature and dissolved oxygen concentration are discussed here, rather than loads.

The John Day River model developed for the temperature TMDL was run to simulate a temperature time-series at river kilometer 333 – the location of LASAR station 11479. This was carried out for both the calibrated current condition and natural thermal potential (NTP) scenarios (**Figure 2.3-3**). Next, **Equation 2.3-1** was applied to both time series, resulting in simulated dissolved oxygen concentrations corresponding to current and NTP conditions (**Figure 2.3-4**). As is apparent in **Figure 2.3-4**, implementation of the NTP target of the temperature TMDL should readily achieve the dissolved oxygen target of 6.5 mg/l.

Figure 2.3-3. Temperature calculation of current and NTP conditions at Station 11479 [(Recall of Figure 11 Appendix D), based on summer 2004 model calibration]

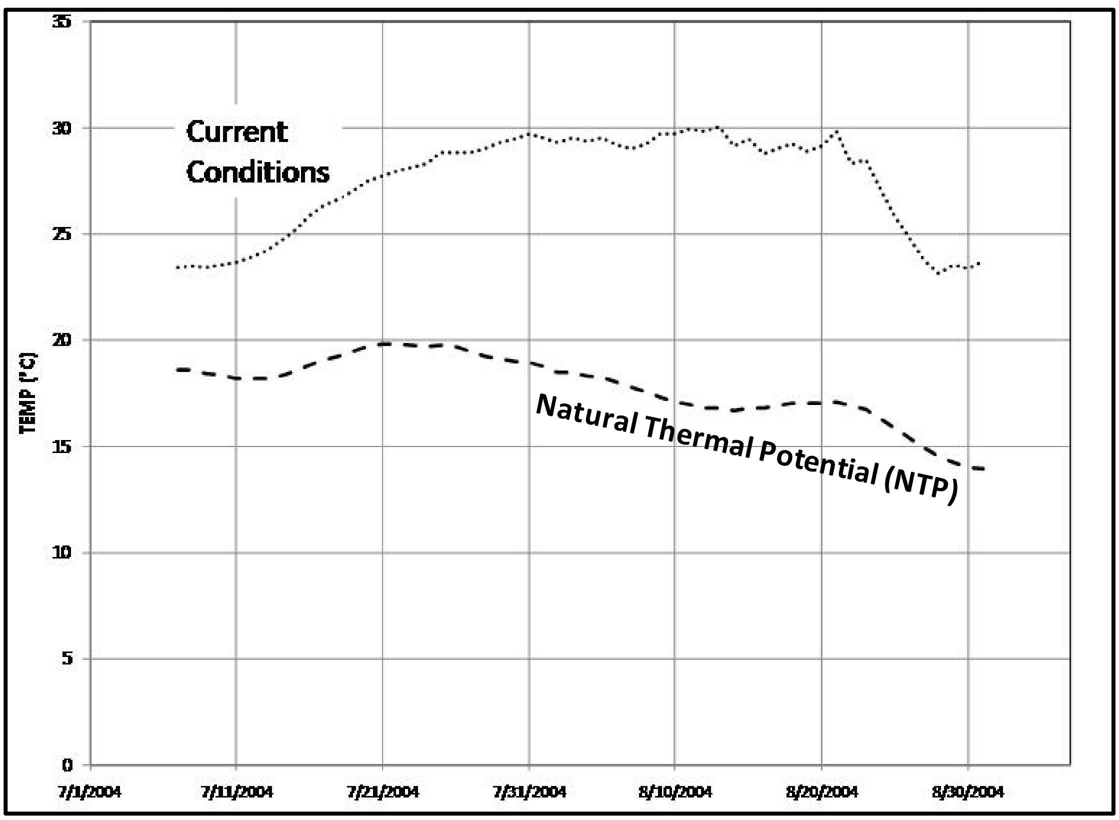
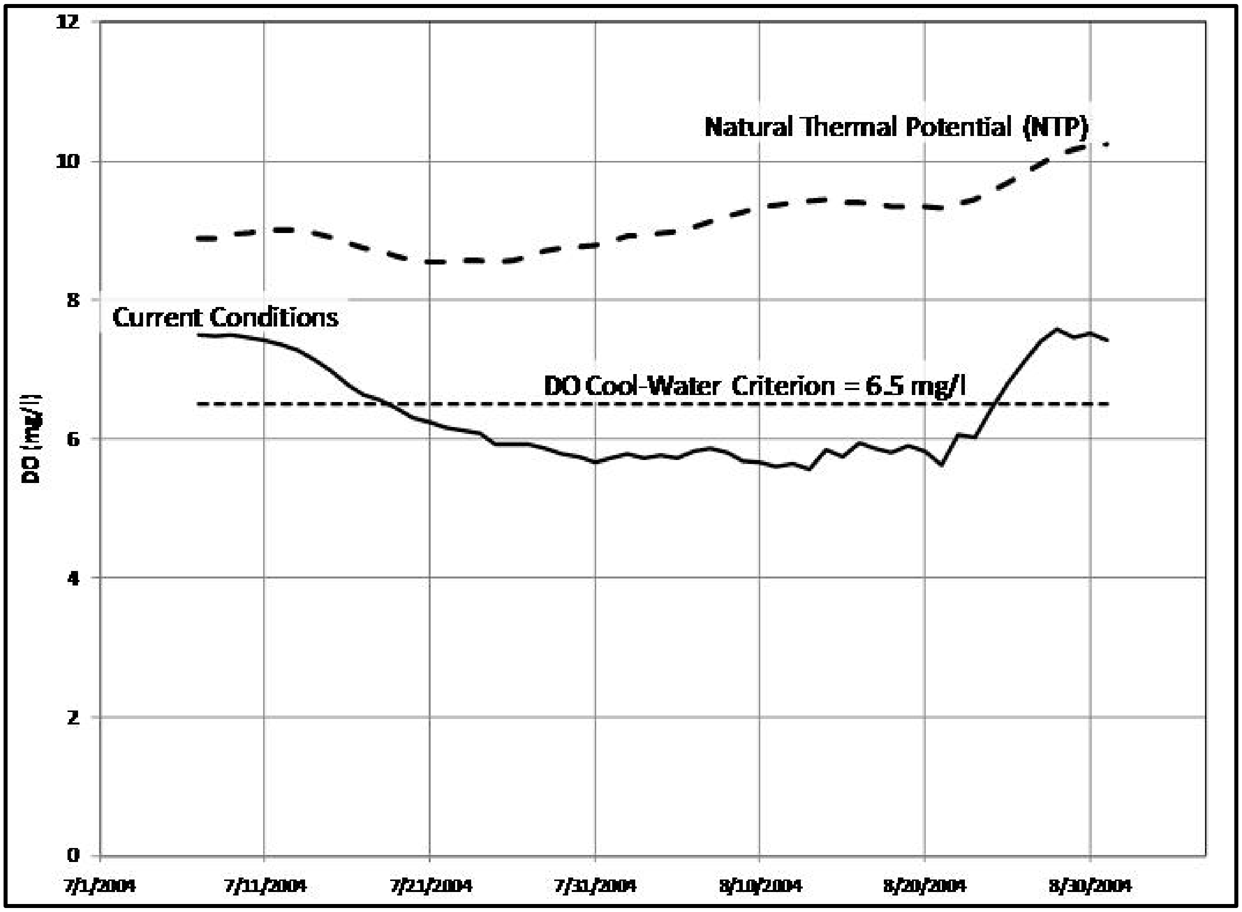


Figure 2.3-4. DO calculation of current and NTP conditions at Station 11479 [(Recall of Figure 15, Appendix D), based on summer 2004 model calibration]



2.3.6 (f) Pollutant Sources and Jurisdictions

Heat and light are the pollutants of concern for dissolved oxygen impairment of the cool water dissolved oxygen criteria. They are addressed through the temperature TMDL. For information regarding sources and jurisdictions for these pollutants in the John Day River refer to **Section 2.1.6** in the Temperature TMDL section of this document.

2.3.7 (g) Wasteload Allocations

The temperature TMDL wasteload allocations (**Chapter 2.1**) are sufficient to achieve the dissolved oxygen TMDL target (**Appendix D**). We also note that each municipal WWTP addressed in the temperature TMDL has permit limits for biological oxygen demand.

2.3.8 (h) Load Allocations

The temperature TMDL load allocations (**Chapter 2.1**) are sufficient to achieve the dissolved oxygen TMDL target (**Appendix D**).

2.3.9 (i) Margin of Safety

The margin of safety for this dissolved oxygen TMDL is implicit. The margin of safety is provided for in the temperature TMDL, **Section 2.1.9**. For dissolved oxygen, additional margin of safety is provided in the conservative assumptions of the DO-temperature regression analysis, as well as the temperature TMDL targeting temperatures below that needed for cool water dissolved oxygen criterion attainment (**Figure 2.3-4**). The conservative assumptions, from ***DO TMDL Target*** section of **Appendix D**, are:

- DO and TEMP continuous data used daily minimum and maximum to aggregate data (worst-case representation of continuous data)
- Focused on the driest and warmest part of year (when the targeted dissolved oxygen concentration is the most difficult to achieve)
- Integrated the margin of safety of the temperature TMDL into the DO TMDL

2.3.10 (j) Seasonal Variation and TMDL Time Frame

The reader is referred to the temperature TMDL (**Chapter 2.1**) for a description of its applicable time frame. In addition, seasonal variation is illustrated in boxplots in **Appendix D** in the section entitled ***Time-Period Selection***.

The upper John Day River dissolved oxygen TMDL is applicable from June 1 through September 30, fully addressing ‘summer’ as defined in OAR 340-041-0002(63). The regression analysis developed a target equation for the critical period (July through August) within this time frame, and further, because most temperature TMDL implementation measures are perennial landscape changes, this TMDL is expected to provide benefits throughout the months of impairment, including spawning times.

2.3.11 (k) Reserve Capacity

Refer to the temperature TMDL (**Chapter 2.1**).

2.3.12 Water Quality Standard Attainment Analysis

The analysis of **Appendix D** is consistent with the hypothesis that if the temperature TMDL is implemented, the dissolved oxygen target will be achieved. Moreover, the analysis demonstrates the dissolved oxygen concentrations above the target criterion will be attained with temperature TMDL implementation (**Figure 2.3-4**).

For discussion of temperature TMDL implementation timing, and hence dissolved oxygen TMDL attainment, the reader is referred to the temperature TMDL standard attainment section (**Chapter 2.1.12**).

2.4 Biological Criterion

This Chapter addresses the existing John Day biological criterion 303(d) listings. Biological impairment is addressed through the temperature TMDL. Existing biological criterion impairment will fall under Category 4A of Oregon's water quality assessment. This is based on the Basin-wide and year round applicability of the temperature TMDL. The biological assessment discussed in this Chapter (**Section 2.4.2**) links biological impairment to temperature. Temperature is assessed as the leading cause of impairment in terms of geographic extent, and has significant ranking with regard to relative risk (*extent* and *relative risk* are elaborated upon in **Section 2.4.2**). While stressors other than temperature are identified as causes of biological impairment in the Basin, they are addressed directly or indirectly through temperature TMDL implementation measures.

This document includes the first TMDLs established for the John Day Basin, and hence the first TMDL addressing biological criterion in the Basin. The biological criterion TMDL context is summarized in **Table 2.4-1**.

Table 2.4-1. Summary – addressing biological impairment via the temperature TMDL

Water body	Currently listed 303(d) streams throughout the John Day Basin (5 segments)
Water Quality Standard	OAR 340-041-0011 (biological criteria)
Applicable Water Quality Standard Criteria	Narrative: "Waters of the State must be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities"
Applicable TMDL	Temperature TMDL
Applicability of temperature TMDL to stream segments with biological criterion impairment	• Temporal: year round • Spatial: 303(d) listed streams through the John Day Basin

A combination of temperature and sedimentation TMDLs would perhaps be the most obvious path to pollution reduction in support of biological criterion attainment. However, as noted in **Section 1.2.3**, the current TMDL development effort does not include sedimentation. And while there has been assessment in support of future sedimentation TMDL development, the associated source assessment and load quantification is limited to a small fraction of the Basin area.

In contrast with the paucity of sedimentation assessment, Basin-wide applications of recent advances in temperature and biological analytical capabilities are striking (Boyd and Kasper, 2003a; Boyd and Kasper, 2003b; Hubler, 2008). John Day Basin stream network temperature simulation, probabilistic monitoring (physical habitat and biology) and biological analysis have been carried out at the basin-scale. Biological community potential (macroinvertebrates and fish) has been estimated and the type and severity of stressors have been inferred from current-community monitoring data. This has been carried out through an initial biological assessment, based on USEPA's Environmental Monitoring and Assessment Protocol—Western Pilot (WEMAP). This initial assessment is included as **Appendix F** and summarized below in **Section 2.4.2**.

Given the quality and scale of temperature and biologic assessment in the John Day Basin, the Department has reviewed the array of biological stressors in the context of temperature and the various conditions that will be associated with temperature TMDL implementation. The temperature TMDL calls for Basin-wide minimization of heating from point sources, natural potential stream shading and natural channel form. To achieve this, the following conditions will be necessary: (1) point source controls through NPDES permits, (2) more natural riparian vegetation conditions and quantities of in-channel large woody debris, (3) minimization of stream channel and upland erosion, and (4) increased sinuosity, channel complexity, floodplain extent and groundwater interaction. In addition, the ultimate aim of the temperature TMDL is natural stream temperatures, which will require water conservation and strategic controls on water resources in order to approach a more natural flow regime. These thermally moderating conditions are related to the assessed biological stressors.

Biologic stressors that have large geographic extent and relative risk include, in order of extent (**Appendix F**, **Figure 1A**):

1. biologically inferred temperature
2. biologically inferred fine sediment
3. total suspended solids
4. fast water habitat
5. chloride
6. total nitrogen
7. turbidity
8. total phosphorus
9. large woody debris
10. canopy cover

These same stressors can be ranked in order of risk: (**Appendix F**, **Figure 1B**):

1. biologically inferred fine sediment
2. biologically inferred temperature
3. total suspended solids
4. canopy cover
5. large woody debris
6. fast water habitat
7. turbidity
8. total phosphorus
9. chloride
10. total nitrogen

In addition to lower stream temperature, fine sediment reduction would be associated with temperature TMDL implementation, given the need for geomorphic improvement. Increased canopy cover and large woody debris are specifically addressed as well, through the temperature TMDL. Physical habitat improvement would follow from increased vegetation cover, large wood and channel form naturalization. Nutrient and suspended solids reduction would follow from increases in riparian buffering and reduction in upland erosion. In summary, we believe that temperature TMDL implementation will largely improve stream conditions with regard to the biological criterion, and the existing listings are effectively addressed via the temperature TMDL (**Chapter 2.1**).

We additionally note that this approach, for the biological criterion listings, is not intended to suggest that a TMDL for sedimentation is not needed. At this point in time, pending further evaluation, the Department is deferring development of a sedimentation TMDL. In the interim, sedimentation listings will remain as Category 5 in Oregon's water quality assessment.

Future 303(d) listings for biological criterion will be evaluated as to whether existing or further TMDL development is needed. The Department would review upstream land uses and 303(d) listings in order to evaluate whether impairment is due to factors not addressed by existing TMDLs. With regard to the existing [2004/2006 303(d)] listings, each segment is in an area of agricultural, roadway and/or forestry upstream land use. The sources of water quality impairment are due to disturbance of vegetation and channel conditions that would be addressed through temperature TMDL implementation.

2.4.1 Waterbody Names, Locations and 303(d) Listings

This Chapter addresses biological criterion impairment for the existing 303(d) listed segments in the John Day Basin. (HUC 170702, **Figure 1.2-6**, **Table 1.2-6**). Future listings will not be addressed via this TMDL without further evaluation.

2.4.2 Summary of Appendix F Biological Assessment

Department Laboratory staff have carried out an assessment of the biological condition in the John Day Basin, as follows (**Appendix F**):

> The Oregon Department of Environmental Quality (DEQ) surveyed streams in the John Day and Lower Deschutes basins in the summer months of 2000 – 2003. These surveys were part of USEPA's Environmental Monitoring and Assessment—Western Pilot (WEMAP). Information was collected for biological, chemical, and habitat conditions of perennial and wadeable streams. The sites were selected randomly, allowing results to be summarized as the percent of perennial wadeable stream miles in the two basins. (See Hubler 2007 for more details on the WEMAP sampling in Oregon.)
>
> The results were based on surveys of 76 randomly selected streams in the John Day and Lower Deschutes basins. However, only nine sites were surveyed in the Lower Deschutes. Additionally, access was denied to the majority of privately owned lands. Thus, the results presented here are largely representative of perennial, wadeable, and publicly owned streams in the John Day basin.

Both the geographic extent and relative risk of stressors were evaluated. The former addresses how pervasive a stressor is across the landscape. The latter measures the likelihood that a biological indicator is in poor condition when a stressor is also in poor condition (Van Sickle et al. 2006). The most pervasive stressor to the biology (the stressors with the greatest extent in most disturbed condition) is high summer maximum water temperature (56% of stream miles).

The stressor with the highest risk to overall biological condition is Total Suspended Solids (TSS). As stated in **Appendix F**, if TSS in a stream is in poor condition, biological condition is 3.7 times more likely to also be in most disturbed condition. Turbidity, another indicator of suspended sediments, also shows a significant risk to the macroinvertebrate assemblages (risk = 2.9). Lack of canopy cover in the riparian and lack of large woody debris each has low percentages of stream miles in poor condition, but poses among the highest relative risks. Other significant stressors, in terms of relative risk, include excess nutrients (Total Phosphorus and Total Nitrogen), high chloride concentrations, and lack of fast water habitat.

Temperature and fine sediment are also assessed, based on biological inference. Two Stressor ID models (Temperature Stress and Fine Sediment Stress) utilize weighted averaging to infer temperature and fine sediment conditions in a stream based on the macroinvertebrates collected (Huff et al. 2006). The biological inferences of temperature and fine sediment showed the highest risks associated with biological conditions. If a site was considered most disturbed for Temperature Stress, the site was 4.5 times more likely to have lost a significant amount of common reference bugs. Similarly, there was a 5.0 times greater chance of poor biologic condition if the Fine Sediment Stress at a site was most disturbed.

References

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Huff D.D., S. Hubler, Y. Pan, and D. Drake. (2006). Detecting Shifts in Macroinvertebrate Community Requirements: Implicating Causes of Impairment in Streams. Oregon Department of Environmental Quality. DEQ06-LAB-0068-TR.

OAR 340-041-0011**.** "Waters of the State must be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities." http://arcweb.sos.state.or.us/rules/OARs_300/OAR_340/340_041.html

Van Sickle, J., J.L. Stoddard, S.G. Paulsen, A.R Olsen. (2006). Using Relative Risk to Compare the Effects of Aquatic Stressors at a Regional Scale. Environ. Manage. 38: 1020-1030.

2.5 Public Participation

The Department recognizes the importance of involving the John Day Basin community and the larger public in the preparation of this TMDL and during its implementation. During the eight years of TMDL development (2002-2010), we have actively engaged the Basin community and interested parties outside of the Basin. This took place prior to and during each phase of monitoring, analysis and document development. Outreach methods have included: presentations, stakeholder discussions, 'coffee hour' radio, newspaper articles and ads, resource fairs, website information/interaction, email, technical meetings, public participation in monitoring and a community discussion series. Throughout, we maintained interaction with Watershed Councils, Soil and Water Conservation Districts, natural resource agencies, resource and interest groups, the Confederated Tribes of the Umatilla and Warm Springs Indian Reservations, researchers, agricultural water quality management area plan committees, and officials in County and City government. We have participated in Subbasin Plan development, Intensively Monitored Watershed design and implementation, educational outreach and watershed assessments. We have presented TMDL information at over fifty different gatherings, and participated in many more.

We update our communication process for the John Day Basin periodically. The following summarizes the most recent plan:

Principals guiding DEQ's outreach and planning efforts in the John Day Basin.

- *Provide several ways for stakeholders and citizens to comment.*
- *Use a variety of methods to get the word out, to address the widespread rural population as well as the urban centers.*
- *Consider the needs of various audiences in our communication. Respect the time and availability of interested community members.*
- *Recognize water quality successes in the Basin and be sensitive to local concerns.*
- *Minimize duplication of monitoring and planning outcomes, given the presence of many natural resource organizations.*

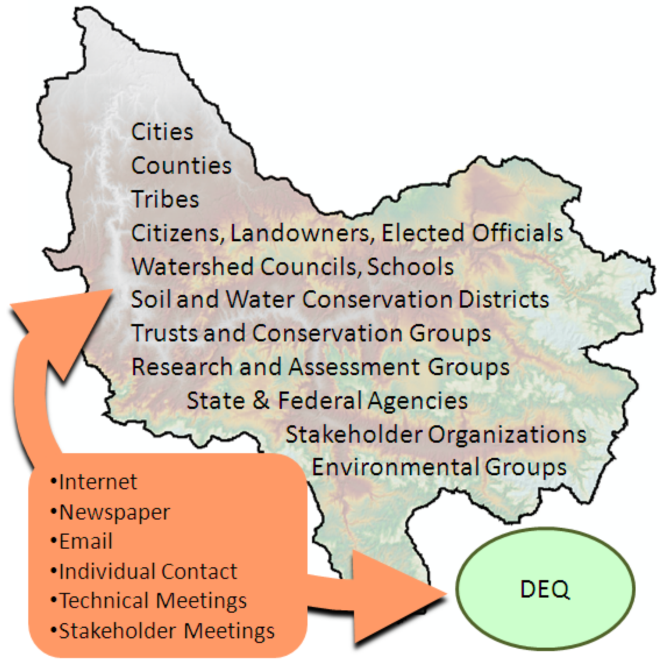
Outreach Approach

Addressing recommendations from local residents, the John Day outreach program includes:

(1) A regularly updated Internet website featuring an ongoing log of the emerging water quality developments, with links for your comments (either individually or to be included in the log).
(2) Routine emails from the DEQ John Day Basin Coordinator, with updates and input requests.
(3) Continued networking with the existing natural resource technical and policy groups.
(4) A discussion forum for goals and plan development, rotating across the basin for accessibility.
(5) A formal public comment period, including hearings on a draft document.

For those who do not have Internet or email access, we encourage you to work with nearby natural resource organizations or libraries to convey input to us or gain Internet access. We welcome telephone conversations as well.

In addition to communication within the Basin, DEQ is seeking statewide input. Notice of the formal public comment period will occur through mailings via established lists of interested parties and notices in local Newspapers and email.



The final phase of communication during TMDL development is a formal public comment period, open for two months beginning in early July of 2010. The public comment period is advertised through newspaper, email, and the Government Delivery System to a wide audience, including over one hundred parties who have expressed interest.

In our attempts to reach out to the many stakeholders in and outside of the Basin, we have contacted and or met with the following groups and individuals, some continuously through the process, some occasionally based on their availability and interest: Citizens, County Commissioners, City officials, farmers, ranchers, Agricultural Planning Local Management Agencies, the Confederated Tribes of the Umatilla and Warm Springs Indian Reservations, Burns-Paiute Tribe, For the Sake of the Salmon, Grant County Farm Bureau, the Oregon Farm Bureau, the Oregon Wheat League, Wild Salmon Center, Friends of Bates, the Oregon Cattlemen's Association, Watershed Councils, Soil and Water Conservation Districts, Oregon Natural Desert Association, Eastern Oregon Mining Association, Oregon State University, Lower John Day Basin Work Group, Salmon Stronghold, Upper Middle Fork Working Group, Oregon Trout, Native Fish Society, Oregon Water Trust (the Freshwater Trust); Oregon Paleo Lands Institute, Blue Mountain Resource, Conservation and Development Area; Mid-Columbia Economic Development District, National Policy Consensus Center, The Sonoran Group, the Nature Conservancy, the John Day Basin Trust. We have worked closely with Federal agencies, including: the four National Forests in the Basin (Ochoco, Umatilla, Malheur and Wallowa-Whitman National Forests), Prineville District Bureau of Land Management, US Environmental Protection Agency, NOAA Fisheries, US Department of Fish and Wildlife, US Bureau of Reclamation, John Day Fossil Beds National Monument, and Natural Resource Conservation Service. In addition, we have interacted extensively with our State counterparts, including Oregon Departments of Agriculture, Water Resources, Fish and Wildlife, Parks and Recreation, Transportation, Forestry, Geology and Mineral Industries, Department of State Lands and Oregon Watershed Enhancement Board.

3.0 WATER QUALITY MANAGEMENT PLAN

Background

A Total Maximum Daily Load (TMDL) defines the amount of a pollutant that can be present in a water body while meeting water quality standards. A Water Quality Management Plan (WQMP – this Chapter) is developed by DEQ (also referred to herein as 'the Department') as a broad strategy for implementing TMDL allocations. TMDLs, WQMPs and associated planning work together to protect designated beneficial uses, such as aquatic life, drinking water supplies, and water contact recreation.

The primary focus of this Chapter is nonpoint source pollution. John Day Basin point sources are identified and described, and waste load allocations are established, in **Chapter 2** and, for completeness and context, mentioned in **Chapter 3**. Rules, authority and permitting processes and details for point sources are fully addressed in documentation through DEQs water quality permitting program (http://www.deq.state.or.us/wq/wqpermit/permits.htm).

In December of 2002, the State of Oregon's Environmental Quality Commission (EQC) adopted a rule commonly referred to as the "TMDL rule" (OAR 340-042). The TMDL rule defines DEQ's responsibilities for developing, issuing, and implementing TMDLs as required by the federal Clean Water Act (CWA). The WQMP is one of the twelve TMDL elements specified in the TMDL rule. Oregon Administrative Rule 340-042-0040-(4)(l) states the following:

> *(l) Water quality management plan (WQMP). This element provides the framework of management strategies to attain and maintain water quality standards. The framework is designed to work in conjunction with detailed plans and analyses provided in sector-specific or source-specific Implementation Plans.*

Terminology note: Throughout this Chapter, the terms *Implementation Plan* or *Implementation Planning* are used as meant in OAR 340-042; the planning documentation that fulfills "'sector-specific or source-specific implementation plans" of this rule. Unless otherwise stated in Oregon Statutes, Administrative rules, or policies, these plans are submitted to DEQ for approval as part of the WQMP framework. The *Implementation Plan* can be a TMDL-specific document or parts of existing plans or programs that contain the essential elements of TMDL planning as specified in the rule and in the Chapter. The term *designated management agency* is defined in the rule and refers to government agencies that submit Implementation Plans. Because assignment of implementation responsibility can include non-governmental participants as well, the term *designated participant* is also employed in thisis, as shorthand for an entity with the same responsibility as a DMA.

Introduction

This WQMP lays out strategies for implementing the John Day Basin TMDLs of **Chapter 2**. As indicated above, two scales of planning are addressed. The WQMP itself serves as a multi-sector framework plan for the entire Basin. It guides and references various plans and programs. The WQMP identifies specific land use or management sectors responsible for TMDL planning and implementation. These sector-specific plans, or ***TMDL Implementation Plans***, comprise a second tier of planning prepared by land use or water quality authorities or responsible participants [typically Designated Management Agencies (DMA)]. A DMA is defined in the TMDL Rule as "a federal, state or local governmental agency that has legal authority over a sector or source contributing pollutants, and is identified as such by the Department of Environmental Quality in a TMDL." This organizational process is diagramed in **Figure 3-1**.

Implementation Approach

The following explanation of TMDL mechanisms is recalled from **Section 1.3** and included here:

> TMDLs require reasonable assurance of implementation (EPA, 1998). DEQ envisions that substantial initiative exists to achieve water quality goals in Oregon. Should the need for additional effort emerge, the responsible agency will work with land managers to overcome impediments through education, technical assistance, funding, enforcement or other incentives and support. The implementation of TMDLs and the associated plans are enforceable by the DMAs such as state agencies, federal land managers, local government, or ODEQ. For example, Agricultural Water Quality Management Area Plans or Rules for agricultural areas and Forest Practices Act for nonfederal forests are TMDL implementation tools. DMAs or sources specifically named in the TMDL or WQMP as needing to submit a TMDL Implementation Plan may be subject to DEQ enforcement action for failure to submit or receive approval of a TMDL Implementation Plan that was required in the TMDL or WQMP or for failure to implement an approved TMDL Implementation Plan.

Scope and Schedule

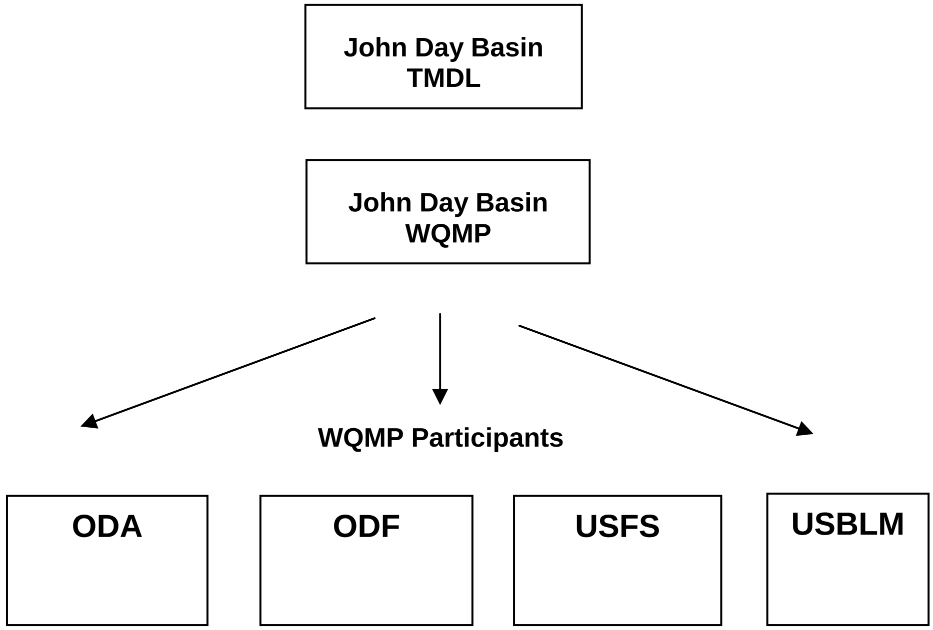
The geographic scope of the TMDL is the entire John Day Basin, where load allocations and waste load allocations apply. Accordingly, this WQMP addresses the entire John Day Basin. The Department recognizes that this scale of resource protection and recovery is a long-term process. This WQMP establishes timelines to develop first edition TMDL Implementation Plans, and broadly discusses implementation time frames. If the Department identifies other responsible participants at a later time, then the WQMP will be updated.

Continuous Planning Process

The TMDL Implementation Plans ultimately are expected to fully describe the efforts of responsible participants to achieve their applicable TMDL allocations. Because it will require some time to fully develop Implementation Plans once TMDLs are finalized, the first iterations of the Implementation Plans are not expected to completely describe management efforts. On an ongoing basis, DEQ will work collaboratively with planning entities to assure that the WQMP and TMDL Implementation Plans collectively address the elements described below under "**TMDL Water Quality Management & Implementation Plan Guidance**". *It should be noted that individual Implementation Plans are only referenced in this document; they are not attached as appendices.*

Figure 3-1. TMDL/WQMP/Implementation Plan schematic

[This schematic example addresses the four DMAs that address much of the Basin land area. The other DMAs, several in number, are listed in Section G. (Agency abbreviations are for: Oregon Departments of Agriculture and Forestry, US Forest Service and US Bureau of Land Management)]



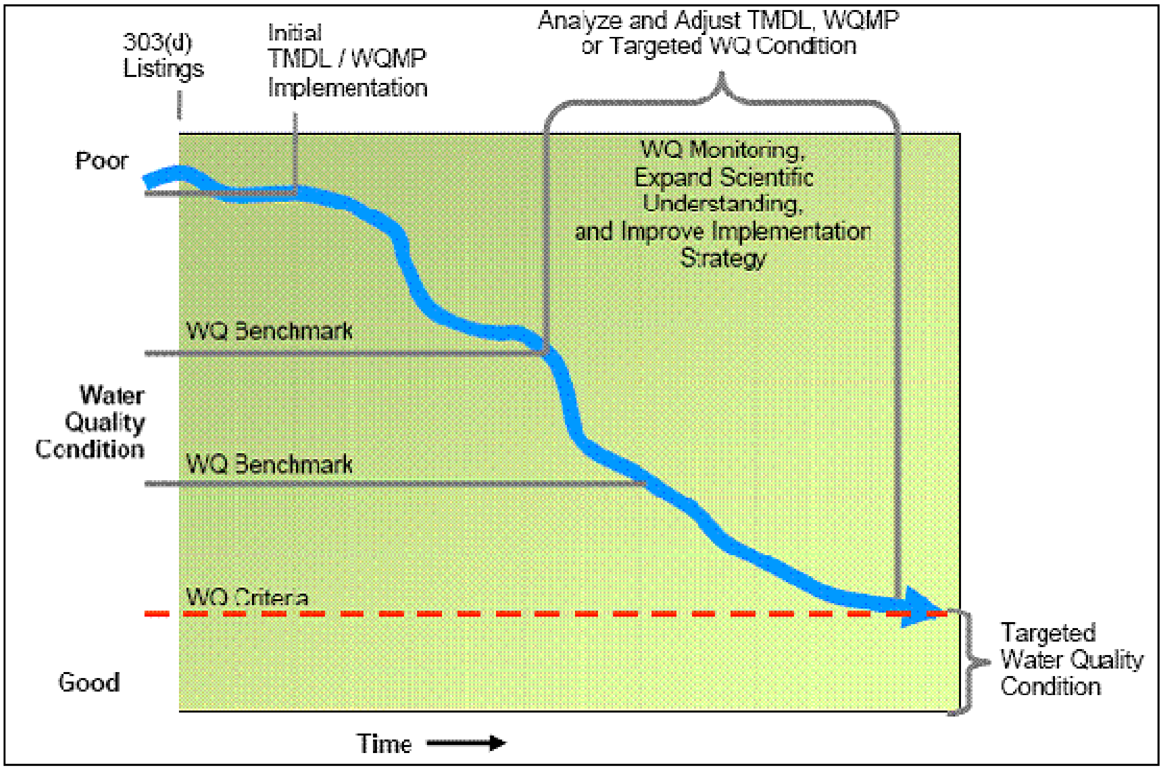
Adaptive Management

DEQ recognizes that the relationship between management actions and pollutant load reductions is often not precisely quantifiable. An ***adaptive management*** approach is encouraged, including interim objectives and feedback through monitoring. Adaptive management can be defined as a *systematic process for continually improving management policies and practices by learning from the outcomes of operational programs* (**Figure 3-2**). In employing adaptive management to the TMDL and the WQMP, the following strategy is employed:

- In conducting its review DEQ will evaluate progress towards achieving the TMDL (and water quality standards) and the success of implementing the WQMP.
- DEQ expects that each designated organization will also monitor and document its progress in carrying out the provisions of its Implementation Plan. This information should be provided to DEQ for its use in reviewing the TMDL.
- As implementation of the WQMP and the associated Implementation Plans proceeds, DEQ expects that planners will develop benchmarks for attainment of TMDL surrogates that can then be used to measure progress.
- Where performance of the Implementation Plans or effectiveness of management techniques is found to be inadequate, DEQ expects designated participants to revise their plan components to address the deficiencies.
- When DEQ in consultation with the DMAs and other parties, concludes that all feasible steps have been taken to meet the TMDL, its associated surrogates and water quality standards, and that the TMDL or the associated surrogates and standards are not practicable, the TMDL may be reopened and revised as appropriate.
- DEQ will consider reopening the TMDL should new information become available indicating that the TMDL or its associated surrogates need revision.

- Additional TMDL implementation issues are identified in **Chapter 1** of this document.

Figure 3-2. **Graphical representation of the adaptive management concept**



Water Quality Management & Implementation Plan Guidance

Oregon Administrative Rule *OAR 340-042* addresses developing, issuing and implementing TMDLs. This TMDL rule includes a list of elements to be addressed by a WQMP. This WQMP is intended to fulfill the requirements of the rule. These elements, identified below, serve as the outline for this WQMP.

WQMP Elements

A. Condition assessment and problem description
B. Goals and objectives
C. Proposed management strategies
D. Timeline for implementing management strategies
E. Relationship of management strategies to attainment of water quality standards
F. Timeline for attainment of water quality standards
G. Identification of responsible participants
H. Established TMDL implementation planning processes
I. Timeline & expectations for additional specified implementation planning
J. Reasonable assurance
K. Monitoring and evaluation
L. Public involvement
M. Planned efforts to maintain management strategies over time
N. Costs and funding
O. Citation to legal authorities

The following **Sections A-O** provide further discussion of each of these WQMP elements. A final section, **TMDL-Related Programs, Incentives and Voluntary Efforts**, recognizes the importance of related programs and initiative-based efforts in watershed restoration.

TMDL Implementation Plan – Expected Components

Some of the elements listed above are sufficiently addressed in the WQMP and others are partly or largely deferred to the DMA programs. The Oregon Administrative Rules in OAR 340-042 clarify DEQ's expectation of TMDL Implementation Plan content, as follows:

> 340-042-0080(2): "The Oregon Department of Forestry will develop and enforce implementation plans addressing state and private forestry sources as authorized by ORS 527.610 through 527.992 and according to OAR chapter 629, divisions 600 through 665. The Oregon Department of Agriculture will develop implementation plans for agricultural activities and soil erosion and enforce associated rules as authorized by ORS 568.900 through 568.933 and according to OAR chapter 603, divisions 90 and 95."
>
> 340-042-0080(3): "Persons, including DMAs other than the Oregon Department of Forestry or the Oregon Department of Agriculture, identified in a WQMP as responsible for developing and revising sector-specific or source-specific implementation plans must:
>
> (a) Prepare an implementation plan and submit the plan to the Department for review and approval according to the schedule specified in the WQMP. The implementation plan must:
>
>> (A) Identify the management strategies the DMA or other responsible person will use to achieve load allocations and reduce pollutant loading;
>>
>> (B) Provide a timeline for implementing management strategies and a schedule for completing measurable milestones;
>>
>> (C) Provide for performance monitoring with a plan for periodic review and revision of the Implementation Plan;

(D) To the extent required by ORS 197.180 and OAR chapter 340, division 18, provide evidence of compliance with applicable statewide land use requirements; and

(E) Provide any other analyses or information specified in the WQMP.

(b) Implement and revise the plan as needed.

In addition to the information in this WQMP, discussion of the expected content of TMDL Implementation Plans can be found in *TMDL Implementation Plan Guidance* (DEQ, 2007a). This and other TMDL Implementation guidelines, nonpoint source pollution information, and example Implementation Plans can be found at (http://www.deq.state.or.us/wq/TMDLs/implementation.htm). Many Federal and State natural resource agencies publish watershed planning guidance as well.

(A) Condition Assessment and Problem Description

A detailed condition assessment and problem description are provided in **Chapter 2**. In brief, the issue of concern is that the water quality standards are not being met in much of the Basin stream network, for certain indicators during parts of the year. The temperature standard is exceeded during the summer in much of the John Day Basin stream network. Dissolved oxygen levels are low at times, particularly in the Upper John Day Subbasin during summer and spring. *E. coli* concentrations well in exceedance of the bacteria standard have been documented in the Upper Subbasin as well. Excess fine streambed sedimentation and reduced diversity of macroinvertebrates has been identified, though the limited monitoring for these has focused on the North Fork drainage. **Chapter 2** describes the assessed causes of excess stream heating, paraphrased here:

- Riparian vegetation disturbance that decreases stream shading through reduced vegetation height and abundance;
- Channel widening (increased width to depth ratios) due to loss of riparian vegetation, stream straightening, reduction in larger woody debris, increased sediment loading and decreased floodplain availability;
- Reduced warm season instream flow volumes (resultant primarily from irrigation withdrawals);
- High temperature discharges;
- Ponds and reservoirs can cause stream heating.

These factors and disturbance of upland ground cover contribute to excess fine sediment loading as well. Restoration and best management practices that address these causes of impairment will provide improvements with regard to the invertebrate diversity and bacteria reduction as well as improving conditions in relation to temperature and sedimentation.

Dissolved oxygen patterns and controls are discussed in **Chapter 2**. Improvements in oxygen concentrations result from decreased temperature, light and nutrients – the three primary factors that control algal growth. In addition, decreased temperature and possibly nutrients are needed to address low dissolved oxygen in the Upper John Day Subbasin.

Bacteria distribution and sources are described in **Chapter 2**. The indicator of pathogenic bacteria concern is *E. coli* concentration. While *E. coli* concentrations are highest in the summer, bacteria inputs during other times of the year contribute to the problem. For instance, *E. coli* deposition in the spring may persist in livestock manure and sediment that streams are exposed to in the summer when the there is little flow to dilute the bacteria. In general, bacteria sources include: livestock, pets, wildlife and septic and sewage systems.

In addition to nonpoint source pollution, NPDES permitted facilities are potential sources and will be addressed such that they do not lead to criteria exceedances with regard to dissolved oxygen, bacteria and temperature.

(B) Goals and Objectives

The overarching goal of this WQMP is to implement the TMDLs of **Chapter 2** in order to address the 303(d) listings and related water quality impairment in John Day Basin streams. This will be achieved by:

- Restoration of riparian vegetation and channel morphology, including floodplain area and connectivity, targeting natural conditions
- Bacterial source reduction, management and controls
- Instream flow restoration, where flow has been artificially reduced
- Modifications to reservoir and pond configuration or operation, where needed
- NPDES limits for permitted discharge facilities

Chapter 2 provides information regarding the amount and location of efforts needed to improve Basin water quality. For example, comparison of existing and targeted stream-side shade informs where there is most opportunity for improvement. In addition, the temperature simulations of Appendix B can guide managers in determining whether the greatest temperature reductions result from (1) increased discharge, (2) increased riparian vegetation or (3) natural channel form; or other factors.

(C) Proposed Management Strategies

The Department appreciates that restoration, conservation planning and efforts have been ongoing for decades in the John Day Basin, in a manner supportive of TMDL attainment. This is occurring through the efforts of landowners, Tribes, Watershed Councils, Soil and Water Conservation Districts, Trusts, local government, and others. And more restoration is needed in much of the Basin. Long term planning should provide for maintenance of effort over time, including protection of areas where load allocations are currently being met. As described previously, for nonpoint sources of pollution, DEQ is reliant on the DMAs and the Basin community for programs and projects providing strategies to minimize stream heating. Management strategies should include outreach, effectiveness monitoring; and inventory and tracking of water quality management practices. Implementation Plans, submitted by designated participants, should identify targeted TMDL allocations and the sources of water quality impairment addressed by proposed measures.

Management Categories

A list of management categories is provided below for TMDL implementation, although this list is not exhaustive. Many of these restoration strategies are identified in existing plans, for example: the Agricultural Water Quality Management Area Plan (AgWQMAP), the John Day Subbasin Plan (NWPCC, 2000), US Forest Service and US Bureau of Land Management plans and guidelines.

- Riparian Restoration. Healthy riparian vegetation is needed, including shade producing types. There is potential for continuous stands of riparian trees and herbaceous vegetation along most of the Basin's streams, though in some situations this will require considerable evolution in channel configuration. Potential shade producing vegetation is described and referenced in **Appendix C** of this document. Although DEQ does not specify required vegetation types, for overall ecological benefits and consistency with programs directed to fish and wildlife habitat restoration, native vegetation is generally optimal. Passive or active restoration of riparian vegetation could be applied. In some cases, the necessary riparian vegetation may already be present, but more time is needed for the vegetation to mature, or to keep pace with channel recovery. In other cases, active vegetation planting and/or stream fencing may be required.

- Channel Condition. A stable and natural channel form will generally be narrower and/or more complex than the existing condition. Passive or active restoration could be applied. Increased sinuosity will lead to attainment of a more natural channel width/depth, as will recovery of the complexity of the stream channel. Removal of levees, dikes, berms, weirs or other water control structures can support channel and floodplain recovery. Recovering quantities of in-channel large woody debris supports channel restoration as well. In addition, channel maintenance flows are important, as described in the following paragraph.

- Stream Flow. Increased instream flow, where depleted, will ultimately be needed to achieve the water quality standard for temperature. Increasing stream flow can be achieved by a variety of specific management measures, including: improving irrigation efficiency and allowing conserved water to be used for instream purposes, leasing instream water during minimum flow times, and reducing diversions. Irrigators are encouraged to participate in the OWRD Allocation of Conserved Water Program, which provides incentives and protection for instream flow restoration. In addition, protection of channel maintenance flows is important for maintaining channel condition. These are the near-peak flows, or bankfull flows – the highest flows to recur roughly on 1-3 year cycles. Implementation mechanisms, and DEQ's role with regard to flow restoration, are described in the TMDL temperature chapter of this document, **Section 2.1.3.5**.

- Upland Management. Upland management that reduces erosion and sediment runoff, such as continued adoption of minimal tillage farming or road BMPs, will support attainment of a more natural channel form. Retaining adequate watershed vegetation can also reduce rapid surface runoff and promote infiltration and aquifer recharge, which can increase spring flows into some streams.

- Irrigation Return Flows. Limiting irrigation surface return-flows of warm water can also help meet the heat reduction called for in the TMDL.

- Bacteria management. Substantial reduction of bacteria loading is needed, particularly in the Upper John Day Subbasin. Bacteria can be reduced at its source by waste management and cleanup, treatment and through limiting near- or in-stream timing and proximity of livestock and other sources. Mechanisms of bacteria conveyance and storage should be addressed as well. This includes run-off control, storm water management, irrigation management, elimination of conditions that sustain bacteria in situ, and other measures.

- Nutrient Reduction. Efforts to reduce instream temperature and *E. coli* are the same as those needed to reduce nutrients input to streams. In addition, fertilizer management should be planned to decreased nutrient availability, depending on its level of use in the Basin. This is mentioned here because the cause of low dissolved oxygen in the spring time is still in question and nutrients may lead to oxygen depletion.

- Ponds and Reservoirs. An examination of infrared flight imagery along the mainstem, the North Fork and Middle Fork indicates that some in-channel irrigation pools cause downstream heating whereas many do not. Generally, push-up dams are thought to be more of an issue with regard to fish passage, than temperature. There is data to indicate that at least one impoundment (Bates pond on the upper Middle Fork’s Bridge Creek) does increase downstream temperature. The TMDL requires minimization of streams to natural or near-natural conditions.

- NPDES Permits. DEQ is the designated agency for the NPDES permit program, which includes issuing permits and conducting the compliance and monitoring for the permits. DEQ directly administers municipal NPDES individual permits, as well as most general NPDES permits. Under a Memorandum of Understanding, ODA and DEQ jointly issue NPDES individual and general permits for the CAFO permit program. ODA assigns the permits and conducts the compliance and monitoring under this same agreement. The NPDES program will apply the controls to ensure that water quality standards are met.

With regard to TMDL implementation, another available management strategy is water quality trading. Trading allows a DMA to earn pollution reduction credit. This credit can be applied in situations where TMDL compliance might otherwise be difficult. For instance, a City treatment plant may have difficulty reducing heat loads to required levels. Rather than reducing the outfall temperature, the City could compensate by enabling upstream temperature reduction. This could occur through channel and riparian restoration efforts or funding directed to upstream heat reduction. DEQ has prepared documentation describing trading possibilities (http://www.deq.state.or.us/wq/trading/trading.htm).

Implementation Prioritization

Recognizing that funding for restoration in the basin is limited, the Department has drawn on the TMDL assessment to support Basin partners in prioritizing future conservation efforts. As stated earlier, the Department appreciates the long history of conservation planning and implementation efforts through partnerships in the Basin. The following maps (**Figure 3-3** through **Figure 3-5**) show analyses DEQ has done to identify, on major Basin rivers, the magnitude of change needed to meet the temperature standard. The same data are expressed as charts in **Section 2.1.12**. Temperature is focused on because it is the best understood and the most widespread issue. Also, temperature reduction measures provide improvements with regard to other parameters. Reaches that are furthest from attainment could be priority areas. This is one of many ways that could be used to prioritize water quality actions.

Figure 3-3. Current temperature (ºC) impact compared to natural thermal potential

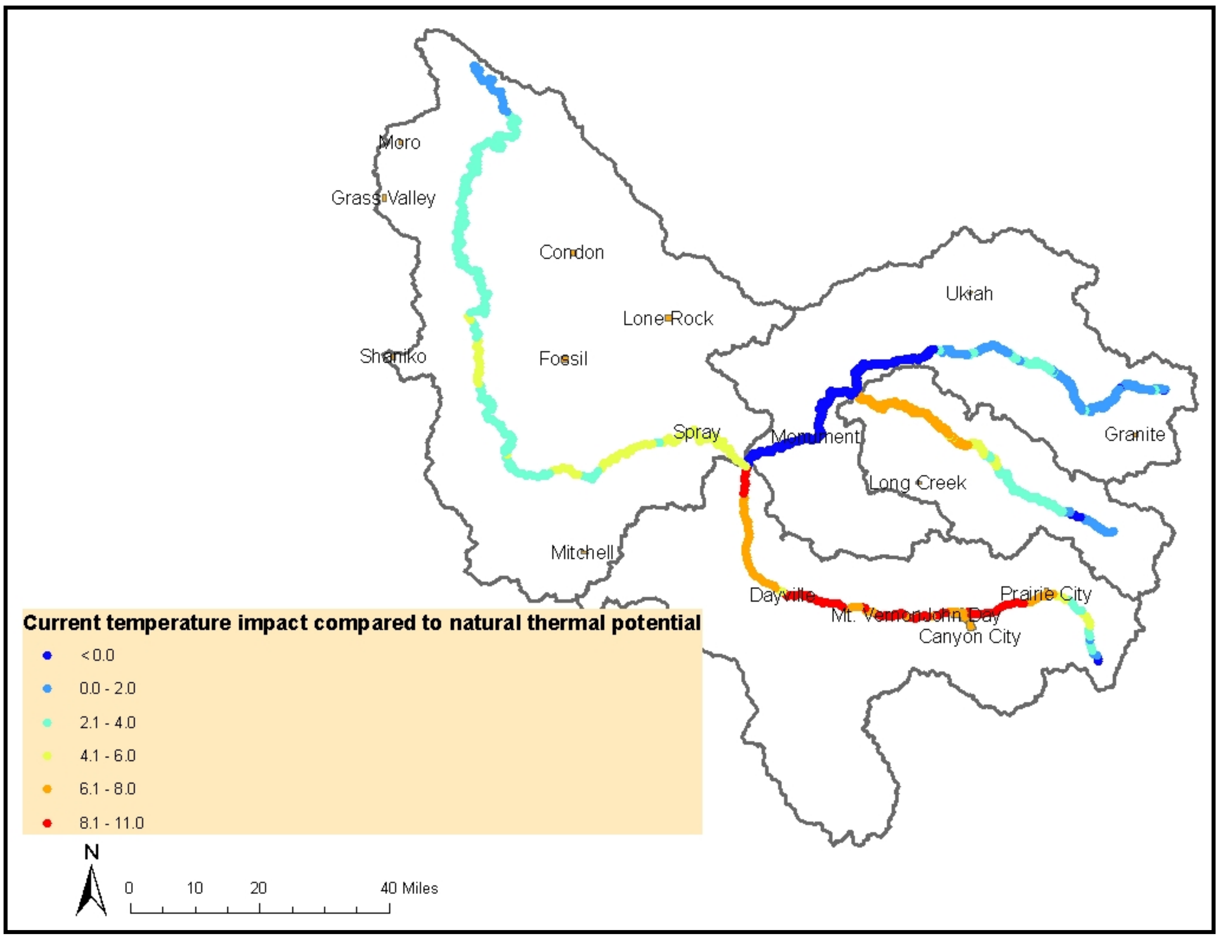


Figure 3-4. Current effective shade compared to natural vegetation condition

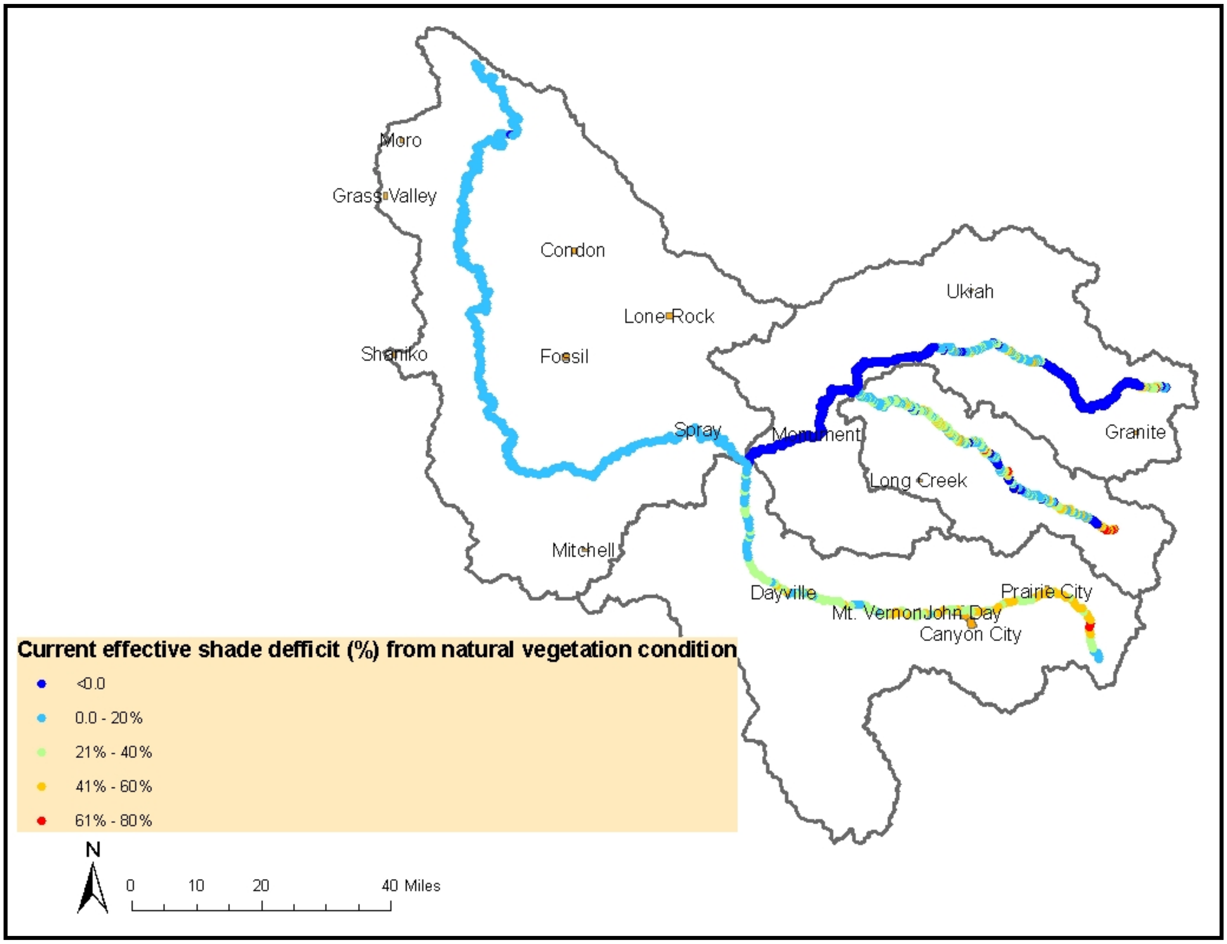
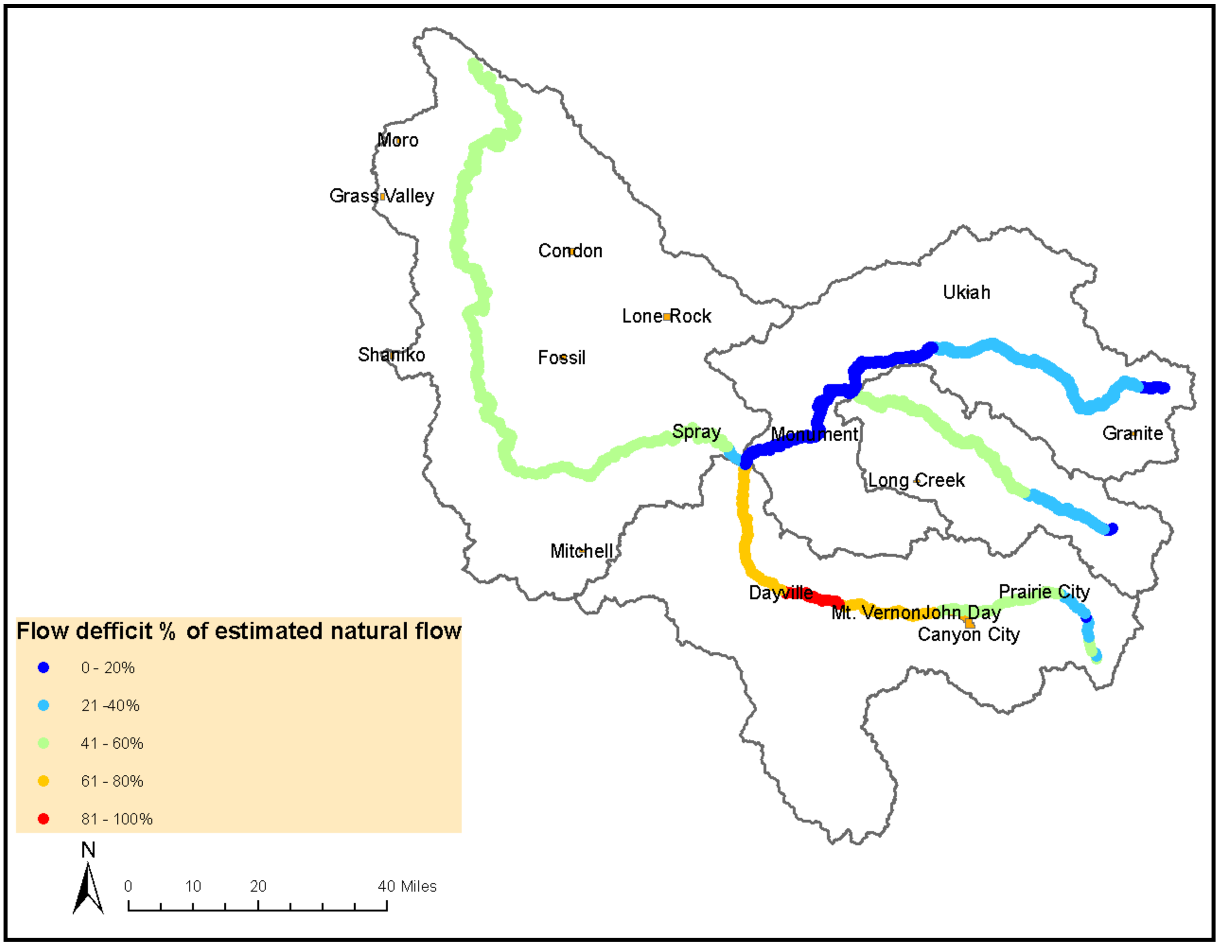


Figure 3-5. Current flow compared to estimated natural flow



(D) Timeline for Implementing Management Strategies

Individual TMDL Implementation Plans will provide timelines for completing measurable milestones as appropriate. Timelines should be as specific as possible and should include a schedule for BMP installation and/or evaluation, monitoring schedules, reporting dates and milestones for evaluating progress. Time frames for TMDL attainment and Implementation Plan submittal are discussed in **Sections F, H** and **I** of **Chapter 3**. NPDES permits are scheduled for re-evaluation/issuance each five years. New or renewed permits will incorporate the TMDL wasteload allocations of **Chapter 2** (for temperature and bacteria).

DEQ recognizes that natural resource organizations, local jurisdictions and landowners have been active in watershed restoration both directly and through outreach. This report does not attempt a timeline addressing the many ongoing and voluntary efforts.

(E) Relationship of Management Strategies to Attainment of Water Quality Standards

For point sources of pollution, DEQ will issue permits that include specific discharge limitations and compliance schedules that ensure water quality standards are met or will be attained within a reasonable timeline. Permits are reviewed and renewed on a 5-year cycle.

Water quality standards (natural condition criteria) will be met as load allocations are attained, if sufficient stream flow restoration occurs. This is demonstrated via the analysis of **Chapter 2** and the associated technical appendices.

For nonpoint sources of pollution, sector-specific Implementation Plans will include specific management strategies and timelines. Management strategies should be clearly linked to the load allocations and their surrogates. Designated participants are expected to prepare an annual report and undertake an evaluation of the effectiveness of their plans every five years to gauge progress toward attaining water quality standards. If it is determined that an Implementation Plan is not sufficient to achieve the load allocation, the planning entity will be required to revise the plan accordingly. All of these actions, taken together, will target attainment of water quality standards.

(F) Timeline for Attainment of Water Quality Standards

As stated in **Section E**, for point sources of pollution, DEQ will issue permits that include specific discharge limitations and compliance schedules that ensure water quality standards are met or will be attained within a reasonable timeline. Permits are reviewed and renewed on a 5-year cycle.

For nonpoint sources, refer to **Chapter 2, Water Quality Standard Attainment Analysis**, for further discussion of time-lines. The Department expects that water quality standards will be attained as soon as feasible. The timeline for attainment is not explicit and will vary across the Basin and by pollutant. In the headwaters, conditions are currently at or near the targeted natural condition (e.g., North Fork Wilderness, Mainstem above Trout Farm campground). DEQ recognizes that where implementation involves significant channel evolution and riparian restoration, such as along much of the mainstem, water quality standards may not be met for many decades. In contrast, where vegetation alone is limiting, substantial improvement can take place in one to three decades. For flow, dramatic improvements could be seen within a single year's time with the restoration of instream flow volumes.

Designated participants are expected to provide time-lines for TMDL implementation efforts. In subsequent TMDL and Implementation Plan reviews, this should enable estimation of time frames for water quality standard attainment.

(G) Identification of Responsible Participants

The purpose of this section is to identify the organizations responsible for John Day Basin TMDL implementation, including development and revision of sector- or source-specific Implementation Plans. The Plans are expected to cover all lands and activities that lead to stream heating throughout the basin, as well as addressing the spatial and temporal coverage of the other pollutant allocations of **Chapter 2**.

With regard to TMDL responsibilities, DEQ recognizes that designated participants are not responsible for land use activities or load allocations outside of their area of jurisdictional authority. Nor are they responsible for controlling stream heating resultant from natural disturbance.

This list of participants herein does not include every party bearing some responsibility for improving water quality in the Basin. Because this is a community wide effort, a complete listing would include virtually every organization and individual in the Basin. We all influence water quality and we must all participate in water quality protection and improvement.

In view of load allocation applicability, the Department has reviewed Basin land use, ownership and management. **Table 3-1** is a preliminary list of the entities, primarily governmental, which have oversight or direct management where load allocations apply.

Table 3-1. Potential TMDL implementation designated participants

Category	Parent Organization or County	Organization	Topic of Implementation Plan
County		Crook County	County area
County		Gilliam County	County area
County		Grant County	County area
County		Harney County	County area
County		Jefferson County	County area
County		Morrow County	County area
County		Sherman County	County area
County		Umatilla County	County area
County		Union County	County area
County		Wasco County	County area
County		Wheeler County	County area
Federal	USDI	US Bureau of Indian Affairs	US BIA lands
Federal	USDOD	US Army Corps of Engineers	US COE lands
Federal	US Forest Service	Malheur National Forest	USFS lands
Federal	US Forest Service	Umatilla National Forest	USFS lands
Federal	US National Park Service	Fossil Beds National Monument	National Monument lands
Federal	USDA Forest Service	Ochoco National Forest	USFS lands
Federal	USDA Forest Service	Wallowa-Whitman National Forest	USFS lands
Federal	USDI BLM	Prineville District	BLM lands
Incorporated Cities	Gilliam County	Condon	City area
Incorporated Cities	Gilliam County	Lone Rock	City area
Incorporated Cities	Grant County	Canyon City	City area
Incorporated Cities	Grant County	Dayville	City area
Incorporated Cities	Grant County	Granite	City area
Incorporated Cities	Grant County	John Day	City area
Incorporated Cities	Grant County	Long Creek	City area
Incorporated Cities	Grant County	Monument	City area
Incorporated Cities	Grant County	Mt Vernon	City area
Incorporated	Grant County	Prairie City	City area

Cities			
Incorporated Cities	Sherman County	Grass Valley	City area
Incorporated Cities	Sherman County	Moro	City area
Incorporated Cities	Umatilla County	Ukiah	City area
Incorporated Cities	Wasco County	Shaniko	City area
Incorporated Cities	Wheeler County	Fossil	City area
Incorporated Cities	Wheeler County	Mitchell	City area
Incorporated Cities	Wheeler County	Spray	City area
Local	Not applicable	Ditch Companies	Pollutant conveyance
Local	Not applicable	Irrigation Districts (currently there are no irrigation districts in the John Day Basin)	Pollutant conveyance
State	State of Oregon	Department of Agriculture	Agriculture and rural residential activities, CAFOs
State	State of Oregon	Department of Forestry	Forest practices on non-federal lands
State	State of Oregon	Department of Geology and Mineral Industries	Mines and quarries
State	State of Oregon	Department of Environmental Quality	Point sources, septic, general permits
State	State of Oregon	Department of State Lands	Navigable waterways, remove and fill
State	State of Oregon	Department of Fish and Wildlife	State Conservation & Wildlife Management lands
State	State of Oregon	Department of Parks and Recreation	State Parks, State Scenic Waterways
State	State of Oregon	Department of Transportation	State transportation corridors
Utility corridors		Counties, State	Utility corridors
Conservation	Not applicable	The Nature Conservancy	TNC lands

In order to strategically address TMDL implementation, the Department has separated the list into various categories that relate to expected responses to TMDL issuance:

- Agencies with established TMDL planning processes, generally through administrative rule and inter-agency agreements. These DMAs submit specified forms of TMDL plans or approaches, e.g., the Agricultural Water Quality Management Area Plans issued by the ODA and Water Quality Restoration Plans issued by the USFS.
- Other DMAs who are expected to submit TMDL Implementation Plans.
- Parties who are not required to submit Implementation Plans at this time. This includes:
    - Entities who have no apparent influence on identified water quality issues in the Basin. For example, this can be assumed for Counties with little land in the Basin, where specific concerns have not been identified.
    - Entities who, due there small size, have no real capacity to produce and maintain an implementation program. These entities, though not required to submit Implementation Plans at this time, should self-assess for potential water quality problems and solutions and take advantage of regional assistance programs and Basin-wide evaluations. Small towns are an example of this category.
    - Non-governmental organizations. This includes conservation organizations and ditch associations. The Department recognizes that for conservation/restoration properties such as those held by The Nature Conservancy, Oregon Trout and others, TMDL implementation is underway, as is true for many designated participants.

Regarding the last major category, 'not required to submit Implementation Plans at this time,' it is not the intent of the Department to neglect TMDL implementation in these areas. Local water quality is important and temperature load allocations apply throughout the Basin stream network due to the cumulative nature of thermal impacts. In order to address water quality throughout the Basin, the Department relies on voluntary efforts, public funding (e.g., 319 and OWEB), Watershed Councils, Soil and Water Conservation Districts, regional planning efforts (e.g., Comprehensive plans, Subbasin planning); and direct support from DEQ, other agencies and local government. Where load allocations apply, throughout the Basin, all jurisdictions and sources are encouraged to assess their role in pollution inputs and controls.

Counties have an important role in TMDL implementation, on non-Federal lands in particular, through broad-based land use and management policies. However, some Counties have little land area in the Basin and of that, some proportion is in Federal management. Non-federal land in Morrow County and Umatilla County occupies **1.9** and **3.0** percent of the Basin area, respectively. The combined non-federal land of Union, Harney and Crook Counties makes up less than 0.1 percent of the Basin area. These five Counties are not asked to submit Implementation Plans specific to the John Day TMDL. In contrast, Grant County, Wheeler County and Gilliam County occupy **46, 21** and **12** percent of the Basin land area, respectively, and are expected to submit Implementation Plans, as discussed subsequently. Sherman, Wasco and Jefferson Counties occupy the remaining basin area (**5.9**, **2.2** and **2.3** percent, respectively), and include mainstem reaches. Much of the area of these three Counties lies in the Deschutes Basin. The Department expects that they will submit TMDL Implementation Plans, ultimately addressing both Basins. Wasco County is currently called to prepare an Implementation Plan to address the eastern Hood River Subbasin TMDLs. In the interim, large tracts of these County areas in the John Day Basin are addressed through the Agricultural Water Quality Management Area Plans.

Municipalities in the John Day Basin are relatively small in population and land area. All are under 1000 in population except for the Cities of John Day and Prairie City (Oregon Blue Book, most recent census). **Table 3-2** lists all of the incorporated cities in the John Day Basin, along with their population.

Table 3-2. Incorporated Cities in the John Day Basin

City	City Population	County
Condon	775	Gilliam County
Lone Rock	20	Gilliam County
Canyon City	670	Grant County
Dayville	175	Grant County
Granite	30	Grant County
John Day	1850	Grant County
Long Creek	220	Grant County
Monument	135	Grant County
Mt Vernon	600	Grant County
Prairie City	1100	Grant County
Grass Valley	170	Sherman County
Moro	380	Sherman County
Ukiah	260	Umatilla County
Shaniko	40	Wasco County
Fossil	465	Wheeler County
Mitchell	175	Wheeler County
Spray	160	Wheeler County

Table 3-3 lists the organizations that will be called to submit Implementation Plans. This list is a subset of the organizations listed in **Table 3-1**, based on the application of the screening approach discussed in this section. These organizations meet the definition of DMA in OAR 340-042 and will prepare and maintain Implementation Plans, conduct monitoring and reporting, and carry out the planned strategies in accordance with OAR 340-042-0080. During the course of TMDL implementation, this list could be expanded as more is learned about pollutant processes and responsibilities. DEQ may issue additional orders for DMA/participant plan submittals or program development. All potential pollutant sources are encouraged to assess their role and work with existing DMAs and with DEQ, to develop monitoring and/or implementation planning.

Table 3-3. List of DMAs who will provide TMDL implementation planning

Category	Parent Organization or County	Organization	Topic of Implementation Plan
County		Wheeler County	County area
County		Gilliam County	County area
County		Grant County	County area
County		Sherman County	County area
County		Wasco County	County area
County		Jefferson County	County area
Federal	USDI National Park Service	Fossil Beds National Monument	National Monument lands
Federal	USDI BLM	Prineville District	BLM lands
Federal	USDA Forest Service	Malheur National Forest	USFS lands
Federal	USDA Forest Service	Ochoco National Forest	USFS lands
Federal	USDA Forest Service	Umatilla National Forest	USFS lands
Federal	USDA Forest Service	Wallowa-Whitman National Forest	USFS lands
Incorporated Cities	Grant County	John Day	City area
Incorporated Cities	Grant County	Prairie City	City area
State	State of Oregon	Department of Agriculture	Agriculture and rural residential activities, CAFOs
State	State of Oregon	Department of Fish and Wildlife	State Conservation lands
State	State of Oregon	Department of Forestry	Forest practices on non-federal lands
State	State of Oregon	Department of Geology and Mineral Industries	Mines and quarries
State	State of Oregon	Department of Parks and Recreation	State Park lands, State Scenic Water Ways
State	State of Oregon	Department of State Lands	Navigable waterways, remove and fill
State	State of Oregon	Department of Transportation	State transportation corridors
Utility corridors		Counties, State	Utility corridors

Table Note: The Cities of Long Creek, Mt Vernon and Dayville are DMAs as well, with regard to NPDES permits for waste water treatment plants, but are not expected to submit Implementation Plans for load allocations.

(H) Established TMDL Implementation Planning Processes

This section addresses implementation planning that has been coordinated with TMDLs through interagency discussion and documentation, generally on a state-wide basis.

Parties Responsible for Planning and Assessment

Several organizations utilize existing mechanisms as TMDL Implementation Plans or alternative programs, and typically coordinate with DEQ within a Memorandum of Agreement or Understanding. These DMAs are as follows:

- Oregon Department of Agriculture
- Oregon Department of Forestry
- Oregon Department of Transportation
- US Forest Service (in the John Day Basin: Umatilla, Malheur, Wallowa-Whitman and Ochoco National Forests)
- US Bureau of Land Management (Prineville District)

Form of Response to TMDL

Based on existing and evolving inter-agency programs and agreements, the expected form of planning is listed below for the DMAs identified in this section. DEQ expects that planning mechanisms will be updated in response to TMDL issuance and periodically thereafter, as needed to layout all feasible steps toward meeting the TMDL. Expected elements of TMDL Implementation Plans are listed previously in the section entitled **Water Quality Management & Implementation Plan Guidance**.

Oregon Department of Agriculture: ***Agricultural Water Quality Management Area Plan*** (Water Quality Restoration Plan (DEQ-ODA Memorandum of Agreement 1998)

Oregon Department of Forestry: ***Oregon Forest Practices Act***, with provisions for basin-specific rules if existing rules are not sufficient (DEQ-ODF Memorandum of Understanding 1998)

Oregon Department of Transportation: DEQ recognizes the ongoing implementation of ***Routine Road Maintenance, Water Quality and Habitat Guide Best Management Practices*** (ODOT 1999) as well as the ODOT erosion, sediment and pollution control plans. These plans do not specifically address temperature load allocation implementation - further evaluation is needed.

US Forest Service (in the John Day Basin: Umatilla, Malheur, Wallowa-Whitman and Ochoco National Forests): ***Water Quality Restoration Plans*** (DEQ-USFS Memorandum of Understanding 2003)

US Bureau of Land Management (Prineville District): ***Water Quality Restoration Plan*** (DEQ-USBLM Memorandum of Agreement 2003, to be replaced by an updated MOA, in process, expected Dec 2010)

Planning Preparation Time Line

The Department will issue formal letters specifying time frames for planning responses, as identified below. In terms of plan implementation, for each listed DMA except the Oregon Department of Transportation, standard monitoring and reporting schedules apply, as discussed in DEQ's 2007 Internal Management Directive *TMDL Implementation Plan Guidance – for State and Local Government Designated Management Agencies* (DEQ 2007).

Oregon Department of Agriculture: These plans are programmatically updated once each two years. Plans have been developed and are being implemented in the Basin and will be updated as needed after the TMDL is issued, through the ***biennial schedule*** of ODA.

Oregon Department of Forestry: The DEQ and ODF are expected to review whether current forest practices are sufficient within ***18 months*** of TMDL issuance.

Oregon Department of Transportation: TMDL implementation time lines have not been developed. DEQ and ODOT are expected to review potential transportation related water quality conditions, in relation to the load allocations of **Chapter 2**, within ***18 months*** of TMDL issuance. At that time corrective or planning strategies, monitoring and reporting would be visited.

US Forest Service (in the John Day Basin (Umatilla, Malheur, Wallowa-Whitman and Ochoco National Forests): WQRPs from each National Forest in the Basin are expected within ***18 months*** of TMDL issuance.

US Bureau of Land Management (Prineville District): a WQRP is expected within ***18 months*** of TMDL issuance.

The DEQ's review and approval of TMDL Implementation Plans is called for in OAR 340-042. Following Implementation Plan submittal, DEQ will work closely with designated participants to ensure a successful and timely review/approval process. The approval process with regard to USBLM and USFS is detailed in the interagency memoranda of understanding or agreement. In accordance with the existing memoranda, once an Implementation Plan or WQRP is received, DEQ will provide a letter of approval (USFS) or acknowledgement (USBLM) within 60 days with any appropriate requirements for revision.

Also as indicated in the previous section, the Implementation Plans, this WQMP and the TMDLs are part of an adaptive management process. Review of the TMDLs, WQMP and Implementation Plans will target a 5-year cycle, subject to available staff time and varying levels of priorities within and outside of DEQ. Evaluations that trigger revision of the Implementation Plans will include, but not be limited to, consideration of: participant recommendations, the periodic evaluation called for in **Section M**, new 303(d) listings, TMDL revision and other BMP effectiveness and water quality trend evaluations.

Information and Expectations

All Implementation Plans will target TMDL attainment by addressing the following: Documentation of measures to implement the load allocations of **Chapter 2** or their surrogates, including monitoring and reporting. The temperature load allocations or surrogates apply throughout the Basin. Where bacteria load allocations and surrogates apply, they should be targeted as well; particularly in the Upper John Day Subbasin where the bacteria problem is most apparent. Because nutrients may contribute to the low dissolved oxygen concentrations in the John Day River above Picture Gorge, nutrient reduction best management practices should be considered. In addition, because of the influence of channel and floodplain morphology on temperature; erosion reduction measures are important throughout the stream network, as well as minimizations of unnatural channel and floodplain constriction. Erosion reduction measures and riparian vegetation enhancement will lead to reduced nutrient input as well.

In general, implementation planning should establish a trend toward load allocation attainment. This would entail strategies that protect and improve riparian conditions and stream flow, as well as reducing pollution proximity, sources and conveyance. DEQ strongly encourages a focus on protection and restoration of riparian vegetation, in order to address the most prevalent and widespread problem (temperature) and because riparian vegetation supports reduction of a broad array of pollutants as well as improving habitat conditions and channel stability.

As well as the organization-specific expectations of this **Section**, implementation plans shall address the various planning elements and objectives of the **Section** entitled TMDL ***Implementation Plan – Expected Components*** and **Sections B**, **C**, **D**, **G, F, H or I, J, K, L, M and N** of this **Chapter**.

Agricultural Lands

The Oregon Department of Agriculture (ODA) is the DMA responsible for regulating agricultural activities that affect water quality. ODA employs *Agricultural Water Quality Management Area Plans* (AgWQMAP) and associated rules to implement TMDLs throughout the state. Periodic review of the progress of AgWQMAP implementation is called for in rule (OAR 603-090-0020). The AgWQMAP are reviewed every two years.

DEQ and ODA coordinate TMDLs and agricultural planning through a 1998 Memorandum of Agreement (MOA). The MOA states that *"Load allocations for agricultural nonpoint sources will be provided by DEQ to ODA which will then begin developing an AgWQMAP, or modifying an existing AgWQMAP, to address the load allocation"* and, specific to situations where AgWQMAP development has proceeded a TMDL: *"At the time that DEQ develops load allocations for agricultural nonpoint sources or groups of sources, ODA will evaluate the AgWQMAP previously developed plan to assure the attainment of DEQ's load allocations for agriculture."*

Local Management Agencies (LMA) are funded to conduct outreach and education, develop individual farm plans for operations in the planning area, work with landowners to implement management practices, and help landowners secure funding to cost-share water quality improvement practices. There are four AgWQMAP areas in the John Day Basin with each having its own plan.

Progress reports, which are submitted to the Board of Agriculture after the biennial review process, are developed based on data collected by Local Management Agencies and ODA on progress of implementation of the plans and rules. Reports to the Board of Agriculture and Director will include statistics on numbers of farm plans developed and types of management practices being employed. These reports are available to DEQ for review in assessing implementation progress.

Biennial reviews have been conducted in the John Day Basin by the ODA and the Local Advisory Committees (LAC). The AgWQMAP and Rules are available from ODA's website at: http://www.oda.state.or.us/nrd/water_quality/areapr.html

DEQ Expectations. DEQ expects that the next biennial reviews for the four AgWQMAPs within the John Day Basin will address the TMDLs and include "pollution prevention and control measures deemed necessary by the department to achieve the goal, a schedule for implementation of the necessary measures that is adequate to meet applicable dates established by law, guidelines for public participation, and a strategy for ensuring that the necessary measures are implemented." (OAR 603-090-030)

DEQ expects that the next biennial review and revision as needed, will ensure implementation of temperature load allocations and surrogate measures throughout the Basin including identifying how progress will be approached and assessed. In addition, the AgWQMAP should reflect special focus on the bacteria and dissolved oxygen load allocations in the Upper John Day Subbasin including source assessment, and on how load allocation attainment will be targeted. Ponds and impoundments should be included in planning to address load allocations applicable to impoundments. The AgWQMAP should identify priorities for source identification monitoring, as well as areas for restoration, outreach, and if appropriate, rule compliance for each biennium. Timelines should be included, for management strategies targeting TMDL attainment.

Basin wide, ODA and LMAs within the John Day Basin should prioritize stream reaches and outreach activities based on existing information including the TMDLs [**Chapters 2** and **Chapter 3 - Section (c)**], and other relevant information for implementation such as rule compliance and monitoring sites for measuring effectiveness of implementation efforts.

Strategy for ensuring that the necessary measures are implemented

	Source Assess-ment for Bacteria	Source Assess-ment for DO	Stream reach Priorities for Temperature	Outreach priorities	Schedule for Implementation And Load attainment	Implementation tracking and effectiveness Monitoring	Rule Compliance
Upper John Day	x	x	x	x	x	x	x
Lower John Day			x	x	x	x	x
Middle John Day			x	x	x	x	x
North and Middle Forks John Day			x	x	x	x	x

Non Federal Forest Lands

The Oregon Department of Forestry is the DMA for water quality protection from non-point source discharges or pollution resulting from forestlands on non-federal forestlands in Oregon.

The Forest Practices Act (FPA) applies regional rules to forestlands and provides for watershed specific protection rules. Watershed-specific protection rules are a mechanism for basin-specific TMDL implementation in non-Federal forest land where water quality impairment is attributable to current forest practices. Legacy issues are addressed through management planning with ODF as a participant. Coordination between ODF and DEQ is guided by a Memorandum of Understanding (MOU) signed in April of 1998. This MOU was designed to improve the coordination between the ODF and the DEQ in evaluating and proposing possible changes to the forest practice rules as part of the TMDL process.

The primary TMDL that applies in forest lands is the temperature load allocation. Sedimentation, erosion and channel morphology should be addressed as well.

Next steps. Inter-Departmental discussion and evaluation is needed to determine, in the non-Federal forested area of the Basin: (1) whether unnaturally increased stream heating is occurring and (2) if so, is the excess heating related to current or past forest practices, or practices unrelated to forestry. Once these questions are answered, a strategy needs to be produced to address any deviations from the natural condition criteria of the Oregon temperature standard.

US Forest Service and US Bureau of Land Management

The US Forest Service (USFS) is the DMA for federal forest land in the Basin. In July 2003, the USFS signed a memorandum of understanding (MOU) with DEQ defining how water quality rules and regulations regarding TMDLs will be met. The USBLM is the DMA for USBLM lands in the Basin. The USBLM and DEQ coordinate through a Memorandum of Agreement (MOA) similar to that of USFS-DEQ. This Memorandum is being updated and is expected to be signed before the end of 2010. The draft DEQ-USBLM MOA calls for a 5 year review cycle of the MOA. The agencies generally respond to TMDLs by developing and implementing Water Quality Restoration Plans (WQRPs) which will be the equivalent of TMDL Implementation Plans. The USFS and USBLM have developed a protocol to be used to guide the development of WQRPs (USFS 1999). The WQRPs are revised as needed in order to implement TMDLs.

The primary TMDL that applies in forest lands is for temperature. Load allocations for temperature and bacteria apply on USBLM lands.

Both the USFS and USBLM have been preparing WQRPs in the John Day Basin. This includes USFS Watershed Action Plans (2010 drafts), addressing priority areas such as the Wall and Granite Creek watersheds and the USBLM Riparian Management Plan (2001) for the lower 150 miles of the John Day River. Both agencies have completed several other planning and assessment documents that can be brought in to TMDL planning.

DEQ Expectations. DEQ expects submission of WQRPs reflecting evaluation of conditions relative to the temperature load allocations and planning to address deviations from natural thermal potential and long term maintenance of natural thermal conditions. This is applicable throughout the stream network in Federal lands. In the mid and lower Basin the USBLM WQRP should address bacteria as well. Sedimentation, erosion and channel morphology should be addressed as well, throughout the Basin. Ponds and impoundments should be included in planning to address load allocations applicable to impoundments. The USFS has agreed to address sedimentation as well, in advance of TMDL development, and assessment and planning for that is underway.

Oregon Department of Transportation

Oregon Department of Transportation has developed and is implementing guidance for routine road maintenance and construction. The agency has developed procedures for implementing NPDES General Stormwater Permits including erosion, sediment and pollution control plans. Habitat and fish passage are addressed as well. And in order to address the load allocations of this document, TMDL-specific evaluation and planning for the John Day Basin is needed. Oregon’s road system is provides fundamental infrastructure in relation to safety, commerce, resources and lifestyle, and DEQ envisions that transportation-related water quality hot spots can be corrected and that through time, as transportation corridors are maintained, re-constructed and developed, that these activities will be carried out with attention to reducing channel and floodplain constriction and riparian disturbance.

DEQ Expectations. DEQ and ODOT are expected to review potential transportation related water quality conditions, in relation to the load allocations of **Chapter 2**, within ***18 months*** of TMDL issuance. At that time corrective or planning strategies, monitoring and reporting would be visited.

(I) Timeline & Expectations for Additional Specified Implementation Planning

Several organizations are called on to submit TMDL Implementation Plans targeting the John Day Basin TMDLs of **Chapter 2**. Unlike the DMAs of the **Section H**, these entities do not yet have TMDL Implementation Plans that have been coordinated with DEQ. Within twenty days of TMDL issuance, the DEQ will "notify all affected NPDES permittees, nonpoint source DMAs identified in the TMDL and persons who provided formal public comment on the draft TMDL that the order has been issued and the summary of response to comments is available" [OAR 340-042 (0060)].

Parties Responsible for Planning or Assessment

The entities listed below are formally designated as DMAs pursuant to OAR 340-042. Each is expected to prepare and submit, for DEQ approval, TMDL Implementation Plans or programming addressing the TMDLs of **Chapter 2**. Guidance is provided by this Chapter and through DEQ's 2007 Internal Management Directive *TMDL Implementation Plan Guidance – for State and Local Government Designated Management Agencies.*

- Wheeler County
- Gilliam County
- Grant County
- Sherman County
- Wasco County
- Jefferson County
- US National Park Service (Fossil Beds National Monument)
- City of John Day
- City of Prairie City
- Oregon Department of Fish and Wildlife
- Oregon Department of Geology and Mineral Industries
- Oregon Department of Parks and Recreation
- Oregon Department of State Lands

Form of Response to TMDL

The DMAs listed above in this section will be notified to submit Implementation Plans and carry out monitoring and reporting as described in the DEQ guidance (2007) and OAR 340-042. As stated previously, these DMAs may submit Implementation Plans that are specific to the John Day TMDL, or utilize existing programs such as County or City Comprehensive plans, or other natural resource planning, updated as needed to address the load allocations of **Chapter 2** and fulfill the essential content of TMDL implementation planning.

The Department recognizes that some designated participants have minimal resources to apply to Implementation Plan development. DEQ will provide assistance in meeting the requirements of OAR 340-042.

Planning Preparation Time Line

The Department calls for each Implementation Plan or related submittal to be transmitted to DEQ within ***18 months*** of TMDL issuance. For Counties overlapping more than one TMDL basin, the Department will work with them to determine a time-line that will provide the best planning outcomes [as mentioned previously, Wasco, Sherman and Jefferson Counties overlap both the Deschutes (TMDL pending after 2010) and John Day Basins. Wasco County overlaps the Middle Columbia-Hood (Miles Creeks) Subbasin as well, with an Implementation Plan due in June, 2010]. At the latest, John Day Basin Implementation Plan submittals for Wasco, Sherman and Jefferson Counties, would be based on the schedule in the Deschutes WQMP.

As stated in the previous section, DEQ review and approval of TMDL Implementation Plans is called for in OAR 340-042. Following Implementation Plan submittal, DEQ will work closely with implementing organizations to ensure a successful and timely review/approval process.

Also as indicated in the previous section, the Implementation Plans, this WQMP and the TMDLs are part of an adaptive management process. Review of the TMDLs, WQMP and Implementation Plans will tentatively target a 5-year cycle, but this is subject to available staff time and varying levels of priorities within and outside of DEQ. Evaluations that trigger revision of the Implementation Plans will include, but not be limited to, consideration of: participant recommendations, the periodic evaluation called for in **Section M**, new 303(d) listings, TMDL revision and other BMP effectiveness and water quality trend evaluations.

Information and Expectations

The following text is applicable here and repeated from the previous section:

All Implementation Plans will target TMDL attainment by addressing the following: Documentation of measures to implement the load allocations of **Chapter 2** or their surrogates, including monitoring and reporting. The temperature load allocations or surrogates apply throughout the Basin. Where bacteria load allocations and surrogates apply, they should be targeted as well; particularly in the Upper John Day Subbasin where the bacteria problem is most apparent. Because nutrients may contribute to the low dissolved oxygen concentrations in the John Day River above Picture Gorge, nutrient reduction best management practices should be considered. In addition, because of the influence of channel and floodplain morphology on temperature; erosion reduction measures are important throughout the stream network, as well as minimizations of unnatural channel and floodplain constriction. Erosion reduction measures and riparian vegetation enhancement will lead to reduced nutrient input as well.

In general, implementation planning should establish a trend toward load allocation attainment. This would entail strategies that protect and improve riparian conditions and stream flow, as well as reducing pollution proximity, sources and conveyance. DEQ strongly encourages a focus on protection and restoration of riparian vegetation, in order to address the most prevalent and widespread problem (temperature) and because riparian vegetation supports reduction of a broad array of pollutants as well as improving habitat conditions and channel stability.

As well as the organization-specific expectations of this **Section**, implementation plans shall address the various planning elements and objectives of the **Section** entitled TMDL ***Implementation Plan – Expected Components*** and **Sections B**, **C**, **D**, **G, F, H or I, J, K, L, M and N** of this **Chapter**.

Counties

Various Counties have been identified previously in this section, as DMAs. Generally, increased stream heating results directly (e.g., reduced shade) or indirectly (e.g., changes in channel shape due to sediment load), from development under County jurisdiction that includes: roads, utility corridors, industry, airports, golf courses, OHV parks, recreation areas, unincorporated cities and rural residential where not addressed through agricultural planning.

DEQ Expectations. An Implementation Plan is expected. Counties should review existing policies and implement measures to produce and protect riparian buffers and promote development that does not constrict channel and floodplain form and function. As well, the Counties are encouraged to work with DEQ, Watershed Councils, Soil and Water Conservation Districts and other natural resource groups to evaluate high impact areas and restoration project opportunities.

US National Park Service (Fossil Beds National Monument)

Restoration, ecological protection and resource inventory are established in the mission and guidelines of Fossil Beds National Monument. DEQ and Monument staff will work together to review mutual goals and objectives and NPS assessment and planning, in order to evaluate the efficacy of current and planned efforts in addressing load allocations for temperature and bacteria.

DEQ Expectations. As a starting point, either a TMDL Implementation Plan or existing management plans should be submitted for DEQ review. Any additional or modified measures regarding management strategies, monitoring and reporting would follow based upon that review and discussion. Ultimately, DEQ expects documentation that load allocations are being addressed.

Cities

The Cities of John Day and Prairie City are considered DMAs. As with any populated area, potential nonpoint source bacteria input is a concern, depending on stormwater paths and other conveyance of yard and road runoff. City structures and management normally influence stream morphology and riparian vegetation as well, with the potential for thermal effects.

DEQ Expectations. An Implementation Plan is expected. The potential for nonpoint bacteria sources and runoff/conduits should be reviewed and best management practices applied as appropriate. Opportunities to improve channel morphology and riparian vegetation should be considered, on the mainstem and Canyon Creek, within the City boundaries, to address temperature. Measures to prevent illegal discharges should be documented.

> In addition, the City of John Day must ensure that water quality standard violations are not caused by waste water treatment plant discharges, and continue to implement DEQ permit requirements applicable to the WWTP.

Oregon Department of Fish and Wildlife

Restoration, ecological protection and resource inventory are established in the purpose and ODFW guidelines applicable to these state lands protected for Wildlife. DEQ and ODFW staff will work together to review mutual goals and objectives and ODFW assessment and planning, in order to evaluate the efficacy of current and planned efforts in addressing load allocations for temperature and, where applicable, bacteria and dissolved oxygen.

DEQ Expectations. As a starting point, either a TMDL Implementation Plan or existing management plans should be submitted for DEQ review. Any additional or modified measures regarding management strategies, monitoring and reporting would follow based upon that review and discussion. Ultimately, DEQ expects documentation that load allocations are being addressed.

Oregon Department of Geology and Mineral Industries

The DOGAMI regulates mining and quarrying operations. Extraction operations are commonly located in or near floodplains. This can lead directly or indirectly to channel morphology and vegetation disturbance leading to increased stream heating. Many of the elements required in an implementation plan may be met through the implementation of the 1200A General Permit and through DOGAMI's Best Management Practices Manual.

DEQ Expectations. As with other state agencies that have been identified as DMAs, DOGAMI at some point may be call on to submit an implementation plan, which could be addressed through state-wide planning. Many of the elements required in an implementation plan will likely be met through the implementation of the 1200A General Permit and through DOGAMI's Best Management Practices Manual. As a starting point, DEQ will work with DOGAMI to identify whether existing and planned regulated operations have potential adverse water quality impacts.

Oregon Department of State Lands

DSL holds public-owned lands in trust and manages these lands in the public's best interests. DSL administers the State's remove-fill permits and is responsible for leasing range and agricultural land and waterways for a variety of business activities. In addition, DSL administers land along navigable waterways, including much of the John Day River below Kimberly.

> DSL's proprietary interest in the John Day River stems from the 2005 State Land Board navigability declaration, which asserts that the State of Oregon has owned the bed and the banks of the John Day River from R.M. 10 to R.M. 184 up to the ordinary high water mark since Statehood. DSL authorizes various structural uses of the river such as docks, boat ramps, power line crossings and bridges or any private or commercial use of the river for that matter that is tied to a structure on the river with in DSL's ownership. DSL recently conducted an inventory of the river identifying all of the uses on the River, with the exception of about 35 miles of State owned river has been inventoried (2/4/2010 email from DSL to DEQ staff).
>
> DSL is currently working to attain compliance with regard to non-exempt structures under authorization with DSL.

DSL uplands classified as forest use are under the authority of the Forest Practices Act administered by ODF as DMA. DSL uplands classified as agricultural or rangeland use are under the authority of the Agricultural Water Quality Management Act administered by ODA as DMA.

DEQ Expectations. The Department expects a TMDL Implementation Plan or other documentation that demonstrates load allocations implementation on State Lands, where applicable, and that permitting, leasing and management activities do not deter the implementation of load allocations.

All forest activities on DSL uplands will comply with the FPA. All range and agricultural activities on DSL uplands will comply with the applicable Agricultural Water Quality Management Area Plan.

Oregon Department of Parks and Recreation

OPRD holds public-owned lands and manages these lands as State Parks and for conservation and recreation purposes. Lands for future State Parks have been acquired as well including the Bates Pond area in the upper Middle Fork John Day River drainage and the Cottonwood Canyon property on the lower mainstem. Bates Pond is being assessed in terms of thermal impacts to Bridge Creek and the Middle Fork and potential restoration opportunities. Existing park lands outside of city boundaries include the Bates and Cottonwood Canyon acquisitions, and JS Burres State Park and Clyde Holliday State Park.

In addition, OPRD administers the Oregon Scenic Waterways Act. Parts of the John Day River mainstem and the North, South and Middle Forks of the John Day River have been designated Scenic Waterways and are addressed through this act. In accordance with OAR 736-040-0020, "primary emphasis shall be given to protecting the scenic beauty, fish and wildlife, scientific and recreation features, based on the special attributes of each area."

DEQ Expectations. An Implementation Plan is expected. This plan should address load allocations applicable to state park lands, scenic waterways and Bates Pond.

(J) Reasonable Assurance

This element of the WQMP is intended to provide reasonable assurance that the WQMP (along with the associated DMA-specific Implementation Plans) will be implemented and that the TMDL and associated allocations will be met.

Several programs either are already in place or will be put in place to help assure that this WQMP will be implemented. Some of these are traditional regulatory programs such as specific requirements under NPDES discharge permits. Other programs address nonpoint sources under the auspices of state law (for forested and agricultural lands) and voluntary efforts. The status of these different programs in the Subbasin was summarized in **Element H** above.

Should any responsible participant fail to comply with their obligations under this WQMP, DEQ will take all necessary action to seek compliance. Such action will first include negotiation, but could evolve to issuance of DEQ or Commission Orders and other enforcement mechanisms. *Implementation plan authors are called on to provide reasonable assurance of implementation, and a process for evaluating degree and efficacy of implementation.*

(K) Monitoring and Evaluation

Monitoring and evaluation has three basic components: 1) implementation of TMDL Implementation Plans identified in this document; 2) management practice effectiveness monitoring and, 3) assessment of water quality improvement. DEQ generally expects that *designated participants will monitor implementation efforts* and that DEQ and various natural resource organizations including DMAs will participate in effectiveness and water quality monitoring.

The information generated by each of these organizations will be pooled and used to determine whether management actions are having the desired effects or if changes in management actions and/or TMDLs are needed. This detailed evaluation (refer to **Section M**) will be planned, as feasible, roughly on a five year cycle. Monitoring and feedback mechanism are fundamental to TMDL implementation.

Although collaborative monitoring capabilities and plans have not yet been developed in response to an approved TMDL, it is anticipated that monitoring efforts will consist of some of the following types of activities:

- Reports on the numbers, types and locations of projects, BMPs and educational activities completed
- BMP efficacy evaluation
- In-stream monitoring to track progress towards achieving water quality numeric criteria
- Monitoring riparian vegetation communities, shade and channel conditions to assess progress towards achieving NTP targets established in the temperature TMDL

Ongoing in-stream monitoring of landscape, project and water quality attributes is taking place in the John Day Basin. Examples include USFS stream and project monitoring, the upper Middle Fork Work group and the associated research through the Integrated Status and Effectiveness Monitoring Protocol effort of NOAA Fisheries, OSU, EPA, USBR, ODFW and others. As available, DEQ will participate in such efforts.

Implementation Tracking

In order to evaluate the progress made in the Basin, it is important to record information about what, where, and how many management measures are implemented in a watershed in an accessible database. If a DMA does not have its own database to contain implementation information for others to access, the DMA is encouraged to report its projects to Oregon Watershed Restoration Inventory (OWRI: http://www.oregon.gov/OWEB/MONITOR/OWRI.shtml). The database is set up as a state repository for restoration projects done and funded by anyone, and will allow agencies to measure implementation progress on the Basin scale, evaluate water quality improvement milestones, perform cost/benefit analyses, and provide feedback to local partners. See the simulated thermal effects of restoration projects (**Chapter 2** page 92) as a potential use for the information that will be collected,

(L) Public Involvement

Refer to the **Public Participation** section of **Chapter 2**, for public involvement during TMDL development. Public involvement in implementation planning will be important as well. *Each designated participant, including DMAs, will be responsible for outreach efforts relating to their ongoing land management and TMDL implementation*. DEQ will also promote public involvement through interaction with existing public groups that work toward restoration and environmental protection in the Basin. Many of these entities have substantial community participation, and the combined public involvement from linking organizations and topics is often more effective than the efforts of an individual organization. Example organizations include Watershed Councils and Soil and Water Conservation Districts.

(M) Maintaining Management Strategies over Time

DEQ administers a TMDL implementation program that will oversee the combined efforts of implementing organizations and DEQ permitting programs. As addressed in **Elements E** and **H**, each DMA will develop and/or review their TMDL Implementation Plan for its effectiveness in addressing load allocations. *Each planning entity will submit an annual report describing the implementation efforts underway and noting changes in water quality*. DEQ will review these submittals and recommend changes to individual Implementation Plans if necessary. The 303(d) listing and TMDL process and the management planning associated with WQRP, forest practices, agricultural and transportation planning are ongoing by design. Taken together, these efforts should ensure that management strategies are maintained over time.

(N) Costs and Funding

One purpose of this element is to demonstrate there is sufficient funding available to begin WQMP implementation. Another purpose is to identify potential future funding sources for project implementation. The cost of restoration projects varies considerably and can range from zero cost, or even profit due to improvements, to full channel reconstruction and land acquisition that can cost hundreds of thousands of dollars per river mile. Restoration can be passive or active. Passive restoration results from removing stresses to the channel, vegetation and floodplain and allowing the river system to naturally recover. Passive restoration can be accomplished through measures such as fencing, livestock rotation, or other means of allowing natural riparian conditions. Active restoration involves channel construction, installation of structures to capture sediment or re-direct water, etc., and tends to cost more than passive. Different measures are appropriate for different management styles, land uses, and types of geomorphic or vegetative impairment. Given these complexities and uncertainties, a cost analysis is not attempted here. *Designated participants will be expected to provide a fiscal analysis of the resources needed to develop, execute and maintain the programs described in their Implementation Plans*.

DMAs and other parties are already implementing numerous natural resource enhancement efforts and projects in the Basin, which are relevant to the goals of the plan, through a variety of funding sources. 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 the sources of their funding, have specific qualifying factors and priorities. **Table 3-4** shows a partial list of assistance programs available in the Basin.

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. For private landowners, the recipient and administrator of these grants is generally the local Soil and Water Conservation District or watershed council.

Table 3-4. Partial list of funding sources for natural resource enhancement projects

Program	Agency/Source
Oregon Plan for Salmon and Watersheds	OWEB
Environmental Quality Incentives Program	USDA-NRCS
Wetland Reserve Program	USDA-NRCS
Conservation Reserve Enhancement Program	USDA-NRCS
Stewardship Incentive Program	ODF
Access and Habitat Program	ODFW
Partners for Wildlife Program	USFWS
Conservation Implementation Grants	ODA
Allocation of Conserved Water Program (ORS 537.455)	OWRD
Nonpoint Source Water Quality Control (EPA 319)	DEQ/USEPA
Statewide Planning Goals Technical Assistance Grants	DLCD
Watershed Initiative Grants	USEPA
Clean Water State Revolving Funds (SRF) Low Interest Loans	DEQ/USEPA
Bonneville Power Administration	BPA

(O) Citation of Legal Authorities

The implementation of TMDL waste load and load allocations and the associated Implementation Plans are generally enforceable by DEQ, other state and federal agencies, or local governments. 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 DEQ. The latter may be based on departmental orders to implement management strategies leading to attainment of water quality standards.

Clean Water Act Section 303(d)

Section 303(d) of the 1972 Federal Clean Water Act as amended requires states to develop a list of rivers, streams and lakes that cannot meet water quality standards without application of additional pollution controls beyond the existing requirements on industrial sources and sewage treatment plants. Such water bodies are referred to as “water quality limited”. Water quality limited water bodies must be identified by the Environmental Protection Agency (EPA) or by a state agency that has been delegated this responsibility by EPA. In Oregon, this responsibility rests with DEQ. DEQ generally updates the list of water quality limited waters every two years. The list is commonly known as the 303(d) list. Section 303 of the Clean Water Act further requires that Total Maximum Daily Loads (TMDLs) be developed for all waters on the 303(d) list. DEQ also has this responsibility.

Oregon Revised Statute

The DEQ is authorized by law to prevent and abate water pollution within the State of Oregon pursuant to the following statute:

ORS 468B.020.
(1) Pollution of any of the waters of the state is declared to be not a reasonable or natural use of such waters and to be contrary to the public policy of the State or Oregon, as set forth in ORS 468B.015.

(2) In order to carry out the public policy set forth in ORS 468B.015, ODEQ shall take such action as is necessary for the prevention of new pollution and the abatement of existing pollution by:
(a) Fostering and encouraging the cooperation of the people, industry, cities and counties, in order to prevent, control and reduce pollution of the waters of the state; and
(b) Requiring the use of all available and reasonable methods necessary to achieve the purposes of ORS 468B.015 and to conform to the standards of water quality and purity established under ORS 468B.048.

ORS 468B.025 No person shall cause pollution of any waters of the state or place or cause to be placed any wastes in a location where such wastes are likely to escape or be carried into the waters of the state by any means.

NPDES and WPCF Permit Programs

DEQ administers two different types of wastewater permits in implementing Oregon Revised Statute (ORS) 468B.050. These are: the National Pollution 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 and is required under the Clean Water Act. The WPCF permit is a state program. As permits are renewed, they will be revised to insure that all 303(d) related issues are addressed in the permit.

Oregon Administrative Rules

OAR 340-042 contains Department rules for TMDL establishment, issuance, implementation, and public participation. OAR 340-041-0028 provides numeric and narrative criteria for temperature.

Oregon Forest Practices Act

The Oregon Forest Practices Act (FPA) was enacted in 1971. The Oregon Department of Forestry (ODF) is the designated management agency for regulation of water quality on non-federal forest lands. The Board of Forestry has adopted water protection rules, including but not limited to OAR Chapter 629, Divisions 635-660, which describes BMPs for forest operations. The Environmental Quality Commission (EQC), Board of Forestry, DEQ and ODF have agreed that these pollution control measures will be relied upon to result in achievement of state water quality standards. Forest operators conducting operations in accordance with the Forest Practices Act (FPA) are considered to be in compliance with water quality standards. A 1998 Memorandum of Understanding between both agencies guides the implementation of this agreement, as described in **Element H**.

ODF and DEQ 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.

Oregon Agriculture Water Quality Management Act

The Oregon Department of Agriculture has primary responsibility for water pollution control from agriculture sources. This is accomplished through the Agriculture Water Quality Management program authorities granted ODA under the Agriculture Water Quality Management Act adopted by the Oregon State Legislature in 1993 (ORS 569.000 through 568.933) and Senate Bill 502 adopted 1995 (ORS 561.191).

SB1010 directs ODA to work with local communities, including farmers, ranchers, and environmental representatives, to develop Agricultural Water Quality Management Area Plans (AgWQMAP) and rules throughout the State. SB502 stipulates that ODA "*shall develop and implement any program or rules that directly regulate farming practices that are for the purpose of protecting water quality and that are applicable to areas of the state designated as exclusive farm use zones or other agricultural lands*." The plans are accompanied by regulations in OAR 603-90 and portions of OAR 603-95, which are enforceable by ODA. As discussed in **Element H**, TMDL implementation coordination between ODA and DEQ is guided by an MOA signed in 1998.

Local Ordinances

TMDL Implementation Plans are expected to specify legal authorities relevant to planning and implementation. Legal authority to enforce the provisions of a City's NPDES permit would be a specific example of legal authority to carry out management measures.

USFS and US BLM

As discussed in **Section H**, DEQ maintains Memorandums of Agreement with the USFS and USBLM, and these are currently being updated. The Memoranda defines processes by which the agency will work with DEQ to meet State and Federal water quality rules and regulations. This agreement recognizes the USFS as the DMA for the lands they administer in Oregon, and clarifies that WQRPs are the TMDL Implementation Plans for this agency.

TMDL-Related Programs, Incentives and Voluntary Efforts

TMDLs in Oregon are designed to coordinate with and support other watershed protection and restoration efforts. Watershed enhancement in the Basin is ongoing and is, for the most part, consistent with or directly implements the load allocations of the TMDL. While regional programs are in place, much of the restoration is locally based. Collectively these programs and organizations produce technical assistance, financial assistance, restoration opportunities, outreach, discussion forums, incentives and planning. The following is a list of several of the watershed assessment, planning and action programs now in place guiding watershed restoration efforts in the Basin:

The Oregon Plan for Salmon and Watersheds

The Oregon Plan for Salmon and Watersheds represents a major process, unique to Oregon, to improve watersheds and restore endangered fish species. The Plan consists of several essential elements:

(1) Coordinated Agency Programs
Many state and federal agencies administer laws, policies, and management programs that have an impact on salmonids and water quality. 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. Water quality and salmon suffered because they were affected by the actions of all the agencies, but no single agency was responsible for comprehensive, life-cycle management. Under the Oregon 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 local people will do the bulk of the work to conserve and restore watersheds. Education is a fundamental part of the community based action. People must understand the

needs of fish and wildlife, and how rivers function, in order to make informed decisions about how to make changes to their way of life that will accommodate clean water and the needs of fish.

(3) Monitoring
The monitoring program combines an annual appraisal of work accomplished and results achieved. Work plans will be used to determine whether agencies meet their goals as promised. Biological and physical sampling will be conducted to determine whether water quality and salmon habitats and populations 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 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 benefits for salmon.

Landowner Assistance Programs

A variety of grants and incentive programs are available to landowners in the 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. This assistance is administered by several organizations, including but not limited to: the several Soil and Water Conservation Districts and Watershed Councils in the Basin, the Oregon Department of Forestry, the Oregon Department of Agriculture, the Oregon Department of Fish and Wildlife, DEQ, and the National Resources Conservation Service. These services include on-site evaluations, technical project design, stewardship/conservation planning, and referrals for funding. This assistance and funding is further assurance of implementation of the TMDL WQMP. A list of funding sources or programs is provided in **Section N**.

Tribes

The Confederated Tribes of the Warm Springs and Umatilla Indian Reservation are actively carrying out restoration in the John Day Basin (**Sections 1.2.5** and **1.4.4.3**).

Natural Resource Agencies

Several Natural Resource Agencies have active restoration, protection and monitoring programs in the Basin, including: OWRD, ODFW, ODA, ODF, DEQ, Umatilla National Forest, Malheur National Forest, Wallowa-Whitman National Forest, Ochoco National Forest, Prineville District USBLM..

Voluntary Measures

There are voluntary, non-regulatory, watershed improvements and programs that are active and addressing water quality concerns in the County. Landowners carry out watershed stewardship, restoration and protection on a regular basis. These programs provide both technical expertise and partial funding. Examples of activities promoted and accomplished through these programs include: planting of conifers, hardwoods, shrubs, grasses and forbs along streams; relocating legacy roads that may be detrimental to water quality; replacing problem culverts with adequately sized structures, and improvement/ maintenance of 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 legacy water quality issues. For coordination and funding, individuals can contact Watershed Councils, Soil and Water Conservation Districts, state agencies, local government and others.

References

The citations here are specific to **Chapter 3**.

DEQ. (2007). *TMDL Implementation Plan Guidance – for State and Local Government Designated Management Agencies.* Internal Management Directive.

ODOT. (1999). Routine Road Maintenance, Water Quality and Habitat Guide Best Management Practices

USDA Forest Service, USDI Bureau of Land Management, Environmental Protection Agency. (1999). Forest Service and Bureau of Land Management Protocol for Addressing Clean Water Act Section 303(d) Listed Waters.

The Oregon Plan for Salmon and Watersheds. (1999). Water Quality Monitoring, Technical Guide Book. Version 2.0.