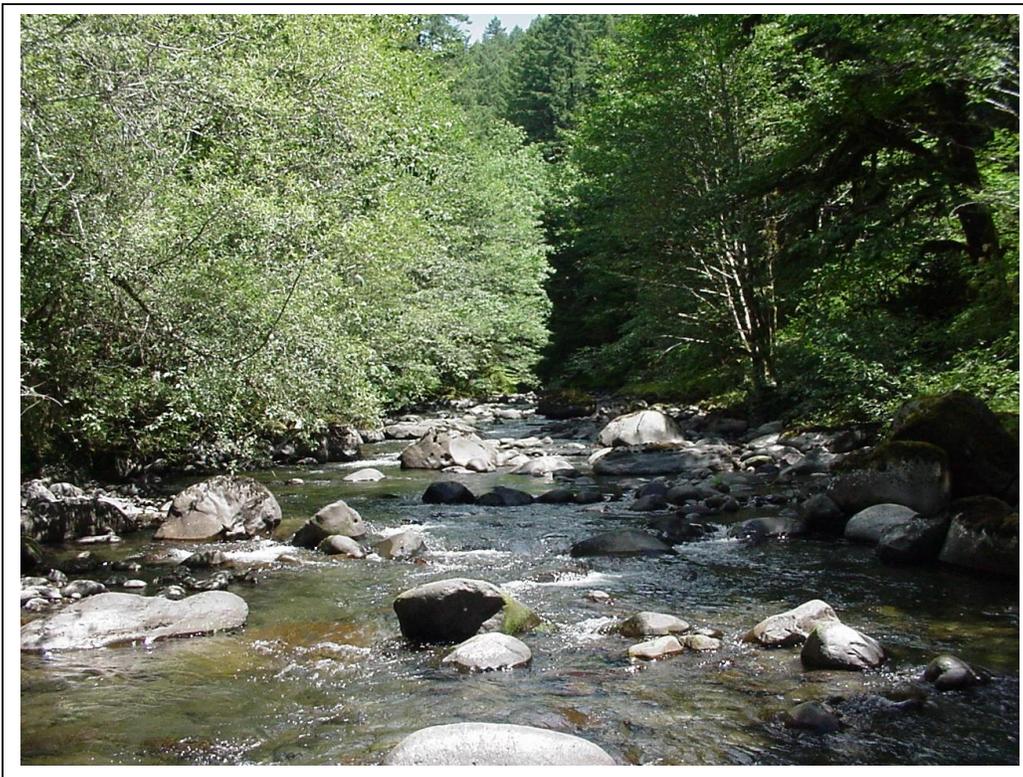




State of Oregon
Department of
Environmental
Quality

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

December 2008



Molalla-Pudding Subbasin TMDL & WQMP

December 2008

***Molalla-Pudding Subbasin
Total Maximum Daily Load (TMDL)
and
Water Quality Management Plan
(WQMP)***

Primary authors are:
Karen Font Williams, R.G. and James Bloom, P.E.

For more information:
<http://www.deq.state.or.us/wq/TMDLs/willamette.htm#mp>
Karen Font Williams, Basin Coordinator
Oregon Department of Environmental Quality
2020 SW 4th Ave. Suite 400
Portland, Oregon 97201
Phone 503-229-6254 • Fax 503-229-6957

Acknowledgments

In addition to the primary authors of this document, the following DEQ staff and managers provided substantial assistance and guidance:

Bob Dicksa, Permit Section, Western Region, Salem
Gene Foster, Watershed Management Section Manager
Greg Geist, Standards and Assessment, Headquarters
April Graybill, Permit Section, Western Region, Salem
Mark Hamlin, Permit Section, Western Region, Salem
Larry Marxer, Watershed Assessment, Laboratory and Environmental Assessment Division (LEAD)
LEAD Chemists, Quality Assurance, and Technical Services
Ryan Michie, Watershed Management, Headquarters
Sally Puent, TMDL Section Manager, Northwest Region
Andy Schaedel, TMDL Section Manager, Northwest Region (retired)

The following DEQ staff and managers provided thoughtful and helpful review of this document:

Don Butcher, TMDL Section, Eastern Region, Pendleton
Kevin Masterson, Toxics Coordinator, LEAD
Bill Meyers, TMDL Section, Western Region, Medford
Neil Mullane, Water Quality Division Administrator
Don Yon, Watershed Management, Headquarters

Administrative support was provided by Stephanie Astorino

Molalla-Pudding Subbasin Total Maximum Daily Load (TMDL) Outline of Contents

Executive Summary

Chapter 1 Overview

Chapter 2 Temperature TMDL

Chapter 3 Bacteria TMDL

Chapter 4 Pesticides TMDL (DDT, Dieldrin, Chlordane)

Chapter 5 Nitrate TMDL

Chapter 6 Metals TMDL (Iron, Manganese, Arsenic)

Chapter 7 Water Quality Management Plan

Technical Appendices:

Appendix A: Technical Basis for Temperature TMDL Analysis

Appendix B: Potential Near-Stream Land Cover in the Willamette Basin for Total Maximum Daily Loads (TMDLs)

Appendix C: Heat Source Model Analytical Framework

Appendix D: Example Effluent Temperatures and Discharges within Heat Load Allocations

Appendix E: Basis for Natural Thermal Potential Estimation for Allocations

Appendix F: Bacteria Analytical Methods

Appendix G: Bacteria Data Review

Appendix H: Wilcoxon-Mann-Whitney Rank Sum Test between two Pudding River Sites

Appendix I: Current use Pesticide Analysis and Discussion

Appendix J: Pesticides Technical Analysis

Appendix K: Model of TSS as a function of Turbidity

Appendix L: Nitrate Analysis

Appendix M: Metals Analysis

Executive Summary

Introduction

This document contains Total Maximum Daily Loads (TMDLs) for several types of water pollution causing impairment of waterbodies in the Molalla Pudding Subbasin. TMDLs are limits on pollution intended to bring rivers, lakes and streams into compliance with water quality standards designed to protect human health, aquatic life, and other beneficial uses of water. Development of TMDLs is required by the federal Clean Water Act of 1972, and the Oregon Department of Environmental Quality is the state agency authorized by federal and state law and regulation to develop these pollution limits.

Section 303(d) of the federal Clean Water Act requires states to periodically list waterbodies that do not meet water quality standards ("303(d) list"). The 2004-06 303(d) list identified 28 stream segments in the Molalla-Pudding Subbasin as water quality limited and needing TMDLs (including segments with multiple listings for the same parameter in different seasons). The 2002 303(d) list also included a reach of the Molalla River (listed for bacteria and temperature impairment) and a reach of the Pudding River (listed for summer bacteria impairment) that were not included on the 2004-06 list. The 2004 – 06 303(d) list as well as earlier lists are available online at <http://www.deq.state.or.us/wq/assessment/assessment.htm>. In addition to the impaired stream reaches from the 2004 – 06 and 2002 303(d) lists, DEQ addressed three stream reaches, not previously listed, impaired by pesticides: Zollner Creek and Little Pudding River for DDT and the Pudding River for dieldrin. A summary of the water quality impaired stream reaches addressed by the Molalla Pudding Subbasin TMDLs is included in Chapter 1, Overview (Table 1-1) and Chapter 7, Water Quality Management Plan (Table 7 -1). DEQ completed 30 TMDLs and proposed delisting three impaired stream reaches. In 1993, DEQ completed a TMDL to address dissolved oxygen impairment in the Pudding River. The 1993 TMDL was not reviewed or changed as part of this TMDL and the allocations established in that TMDL and incorporated into facility permits remain in effect.

The Molalla-Pudding Subbasin (approximately 878 square miles in area) is located in the north-eastern portion of the middle Willamette Basin. The Molalla River flows into the Willamette River between river miles 35 and 36 and the Pudding River is a tributary to the Molalla River less than a mile upstream of the Molalla River mouth. The subbasin is located within Clackamas and Marion Counties and includes the communities of Woodburn, Mt. Angel, Silverton, Canby, Molalla, Hubbard, Gervais, Aurora, Brooks, Barlow, Colton and Scotts Mills and portions of Salem, Keizer, Donald, and Wilsonville. Most land in the Molalla-Pudding Subbasin is privately owned, with the U.S. Bureau of Land Management (BLM) administering the largest portion of public land (67 square miles in the upper Molalla watershed), and the state managing Silver Falls State Park (approximately 13 square miles). Land use in the Molalla-Pudding Subbasin is 53% forestry and 40% agriculture, with the remaining percentage urban, residential, and industrial. Ecoregions range from high elevation Cascade Highlands to low elevation Prairie Terraces. Fish use includes a number of salmonid species, including winter and summer steelhead, spring and fall Chinook, and Coho, as well as resident cutthroat trout.

Fourteen stream reaches are listed as impaired by high stream temperature, which affects rearing and spawning habitat for salmonids. Two of those reaches are listed individually for spawning and non-spawning seasons. The temperature TMDL addresses all of these listings and applies basinwide.

There are seven stream reaches listed as impaired by bacteria contamination in the subbasin (including two reaches impaired both in summer and fall/winter/spring). Bacteria listings are based on standards for water-contact recreation. The TMDLs for bacteria address all bacteria listings on the 2004-06 and 2002 303(d) lists and apply basinwide year-round.

There is one listing in Zollner Creek for nitrate. The nitrate TMDL addresses that listing and applies to Zollner Creek and all its tributaries year-round. There are three stream reaches impaired by pesticides no longer in use: the Pudding River (DDT and dieldrin) and Zollner Creek (DDT, chlordane and dieldrin) and Little Pudding River (DDT). The TMDL addresses six impairments on these stream reaches and applies to the Pudding River, Little Pudding River and Zollner Creek and their tributaries.

Five stream reaches are listed for metals, specifically iron, manganese and arsenic. The TMDL addresses the two iron listings and applies to the Pudding River and Zollner Creek and their tributaries. DEQ proposes delisting manganese and arsenic and that a TMDL is not necessary because the in-stream concentrations appear to be natural.

One stream reach was listed on the 2004 – 06 list for dissolved oxygen violation. This parameter is not addressed with a TMDL at this time because the listing occurred after the data collection for this TMDL was complete.

TMDLs

Total Maximum Daily Loads have been developed for most of the types of pollution causing impairment of beneficial uses in the Molalla-Pudding Subbasin. These TMDLs determine the amount of a given pollutant (e.g., heat, fecal bacteria, nitrate) that a waterbody may receive without violating a water quality standard.

This amount of pollutant is called the Loading Capacity, which is allocated to various uses. The amount that current pollution exceeds the loading capacity is termed the Excess Load. The allocations for point source discharges are termed “waste load allocations,” and allocations for non-point sources of pollutants (e.g., urban, agricultural or forest runoff) are called “load allocations.” The sum of all allocations, plus a margin of safety for uncertainty, and a reserve capacity for future needs, is the TMDL.

The TMDLs in this document address 30 stream reaches impaired for a particular parameter. DEQ recommends delisting three stream reaches (one Zollner Creek arsenic and 2 Zollner Creek and Pudding River manganese listings). One listing (dissolved oxygen) will remain on 303(d) list until more data are collected to confirm whether or not dissolved oxygen criteria in the West Fork Little Pudding River are being met.

Temperature TMDL Summary

DEQ's water quality standards are applied to protect the most sensitive beneficial uses in a waterbody. Numeric criteria in the temperature standard were developed to protect different aspects of the life histories of salmon and trout: spawning, rearing and migration. During non-spawning periods, the criterion that applies to the Pudding River and the lower Molalla River is 18 °C for rearing and migration. The upper Molalla River, upper Molalla tributaries, and upper reaches of some tributaries to the Pudding River are considered core cold water habitat and the non-spawning temperature criterion that applies is 16 °C. During spawning season, variably from late summer or early fall through late spring, the temperature criterion that applies is 13 °C. The upper Molalla River and Table Rock Fork are listed for being warmer than the spawning criterion. All 14 of the temperature-impaired stream reaches, including the reaches listed for spawning season temperature violations, are addressed by this TMDL. The load allocations for the temperature TMDL apply year-round and basinwide. Explicit wasteload allocations to point sources on the Pudding River and its tributaries apply June 1 – September 30. Wasteload allocations to point sources on the Molalla River and its tributaries apply May 1 through October 31.

Continuous temperature data was collected between May and October 2004, at several locations in the subbasin, on the mainstem Pudding and Molalla Rivers and their tributaries. Thermal Infrared Radiometry (TIR) data, which measures surface water temperatures, was collected in the afternoon of July 26, 2004, along the length of the Molalla River and the afternoons of August 11 and 12, 2004, along the length of the Pudding River. The continuous temperature data and the TIR data were used to calibrate the temperature model, Heat Source. Once the model is calibrated for a stream system, the model can be used to simulate future conditions with changes in riparian vegetation, flows, channel width and other conditions.

The Molalla and Pudding Rivers were modeled to determine the “natural thermal potential” (NTP) of the systems. The NTP is the thermal profile of a water body determined with best available methods of analysis and the best available information on the system potential riparian vegetation, stream geomorphology, stream flows and other measures that reflect natural conditions with human-caused

influence minimized. The results of the modeling indicate that the NTP for both the Molalla and Pudding Rivers for several weeks between July and September is higher than the relevant numeric stream temperature criterion. When the NTP exceeds the numeric temperature criterion, the NTP replaces the numeric criterion for the modeled stream reaches.

For point sources of heat such as wastewater treatment plants, waste load allocations have been developed that limit the increase in temperature of the receiving stream (due to the point source effluent) to a portion of an allowance for "human use." The heat loads allocated to point sources in the Molalla-Pudding Subbasin are those loads that would cause no more than a 0.2°C increase when fully mixed in the stream above the applicable criterion (which may be the NTP). Available data indicated that existing discharges from point sources to the Molalla River caused less than a 0.2°C in-stream temperature increase, and they were allocated heat loads equivalent to the heat load from their current discharge. For non-point sources, the load allocation is the heat load that would result if system potential vegetation were allowed to develop in the riparian zone. Representation of system potential vegetation followed the methodology used in the Willamette Basin temperature TMDL, which takes into account factors such as soils, slope, elevation, historical vegetation, and geomorphology. Non-point sources are allocated a heat load equivalent to a 0.05°C increase in-stream above the applicable criterion. A heat load equivalent to the remaining 0.05°C increase allowed for human use is allocated to reserve capacity to accommodate for future growth.

Bacteria TMDL Summary

Oregon's bacteria water quality criteria protect human health and the beneficial use of water contact recreation. This TMDL addresses seven bacteria-impaired stream reaches from both the 2004-06 and 2002 303(d) lists. The 2002 bacteria listings for the Molalla River from river mile 0 to 25 and the summer (June 1 – September 30) listing for the Pudding River from river mile 0 to 35.4 had been removed from the 2004-06 303(d) list, but a review of data indicated that the bacteria criteria could be exceeded at the highest stream flows on the Molalla River and during the summer on the Pudding River. For those reasons, a bacteria TMDL was completed for the Molalla River and the summer season for the Pudding River. Wastewater treatment plants were given waste load allocations based on the numeric criteria of a logarithmic average of 126 *E.coli* organisms per 100 milliliters and no one sample exceeding 406 *E.coli* organisms per 100 milliliters. Analysis of bacteria data, stream flows, and precipitation indicates that the main sources of bacteria contamination in the Molalla and Pudding Rivers and their tributaries are non-point sources. Non-point sources include agricultural runoff and urban stormwater, though runoff from forestry land use does not appear to cause the bacteria criteria to be exceeded. Load allocations are expressed in terms of a surrogate measure – percent reduction in bacteria concentrations. Load allocations apply generally by land use, basin-wide, and year-round. Stream and season-specific load allocations were calculated for streams where sufficient stream flow data were available to calculate a loading capacity and excess load. Load allocations, as percent reductions, were reduced until no one sample (based on available data) exceeded the single sample criterion of 406 *E.coli* organisms per 100 milliliters.

Nitrate TMDL Summary

Zollner Creek is listed for nitrate impairment. The water quality criterion for nitrate is based on a drinking water standard for protection of human health. This TMDL addresses the nitrate listing and applies year round to Zollner Creek and its tributaries. Eventual attainment of the human health criterion (10 milligrams/liter) may not be sufficient to prevent future water quality problems from excessive algae growth, high pH or low dissolved oxygen. All likely sources of nitrate are non-point, as no permitted point sources are located on Zollner Creek and land use is 99% agricultural. The load allocation to non point sources in all sectors is the loading capacity minus 10% for a margin of safety.

Pesticides TMDL Summary

Three listings from the 2004-06 303(d) list for legacy pesticides (pesticides no longer in use) apply to the Pudding River and Zollner Creek. The Pudding River is listed for DDT and Zollner Creek for dieldrin and chlordane. DEQ's data review indicated that Zollner Creek and Little Pudding River were also impaired by DDT contamination and the Pudding River for dieldrin. The source for DDT in the Pudding River

appears to be eroded sediments from Zollner Creek and the Little Pudding River watersheds. Load allocations for DDT and dieldrin are expressed as percent reductions necessary to achieve the human health criteria based on water and fish ingestion. The load allocation for chlordane is expressed as a percent reduction necessary to meet the Oregon Department of Human Services -- Health Division (DHS) action level for fish tissue since DEQ's data review found that chlordane has not been detected in surface water in Zollner Creek. The TMDL also uses a surrogate measure of total suspended solids (TSS), which correlates strongly with DDT, to set targets that will achieve partial load allocations for non-point sources in all sectors. A 96-hour average TSS target of 15 mg/L for the Pudding River and Zollner Creek and 7 mg/L for the Little Pudding River will partially achieve the load allocations. Additional monitoring is needed in the Little Pudding River and Zollner Creek watersheds to identify "hot spots" or those areas where DDT concentrations are higher than surroundings. Land use and riparian management can then be tailored to reduce erosion and runoff from those areas. While dieldrin was not found to correlate as strongly with total suspended solids in-stream, DEQ's data review indicates that dieldrin concentrations and frequency of detection are decreasing in the subbasin. DEQ expects that significant TSS reductions in Zollner Creek, the Pudding River, and the Little Pudding River and ongoing decay of dieldrin over time should result in the achievement of both aquatic health chronic toxicity and human health based criteria for dieldrin.

Metals TMDL Summary

Two listings for metals are addressed by this TMDL, and DEQ recommends that the remaining three listings do not require a TMDL and should be delisted. Iron, manganese and arsenic are naturally occurring substances and particularly prevalent in soils deriving from eroded volcanic rocks. DEQ's data review and analysis of metals correlation with stream flow and precipitation supports the conclusion that manganese and arsenic are present in the Pudding River and Zollner Creek at natural concentrations and are not concentrated by human activities. Iron concentrations correlate with stream flow and precipitation and DEQ's conclusion is that human caused activities that lead to eroding stream banks and runoff may concentrate iron in surface water at higher than natural concentrations. A surrogate measure of percent reduction is used to set load allocations for non-point sources. The load allocation applies year round to the Pudding River, Zollner Creek, and their tributaries. Point sources are allocated their current conditions and will be required to monitor so DEQ can evaluate if point sources cause or contribute to iron water quality criterion exceedances.

Water Quality Management Plan

The TMDLs include a Water Quality Management Plan designed to identify strategies and approaches for implementing the TMDLs. The WQMP identifies the Designated Management Agencies (local, state and federal government agencies and other entities with responsibility for addressing pollution problems in their control). Example management strategies that could be implemented by DMAs to meet the allocations in each of the TMDLs are also included in the WQMP. The WQMP identifies currently available TMDL implementation plans, guidance for DMAs required to submit implementation plans, and the schedule for submitting those plans.

Public Process

The Molalla-Pudding TMDLs have been developed over a course of several years and have involved review by stakeholders throughout the process. A review committee representing basin stakeholders provided feedback and suggestions to DEQ over the last two years. These TMDLs were available for public review for 60 days, between August 29 and October 31, 2008. A public hearing was held in Silverton, Oregon on October 16, 2008. All comments received were considered before issuing this final TMDL. Responses to the public comments are available in a separate document located on DEQ's website.

Conclusion

The TMDLs address 30 impaired stream reaches in the Molalla-Pudding Subbasin. Implementation of the waste load allocations and load allocations is expected to bring those waterbodies into compliance with water quality standards so the beneficial uses will be protected.