The Health of Oregon Waters

Deschutes Basin Water Quality Status and Action Plan – Summary 2011

State of Oregon
Department of Environmental Quality

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DEQ is a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.

With headwaters in the Cascades and Ochoco Mountains, the rivers and streams of the Deschutes Basin flow north to form the Deschutes River, which flows into the Columbia River. The basin provides irrigation and drinking water for residents of the 6.8 million-acre area and its interconnected river system provides habitat for thousands of species, from steelhead and salmon to waterfowl, deer and elk. The same network of surface waters provides recreational activities for thousands of people who choose to live in the area and visit each year to fish, hunt, camp, raft, hike, run and enjoy the region's world-famous natural beauty.

Basin Facts

- Water quality is excellent in most of the Upper and Little Deschutes Subbasins, fair to good in the Lower Deschutes Subbasin and poor in the Crooked Subbasins.
- Water temperature is too high in many of the rivers and streams throughout the basin.
- Nitrate contamination of groundwater is one of the most widespread groundwater issues in the basin

The basin's people, economy and wildlife are connected through its waters, and everyone has a stake in keeping the Deschutes Basin healthy and clean.

With these facts in mind, the Oregon Department of Environmental Quality has undertaken a holistic approach to study the current state of the basin's waters and identify actions we all can take to reduce existing pollution where it's a problem and ensure that healthy streams stay that way. DEQ's "Watershed Approach" looks at all sources of pollution in the water system and connects those sources with solutions. This approach begins with an assessment of water quality across the basin and results in an action plan outlining steps to improve water quality.

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By: Bonnie Lamb
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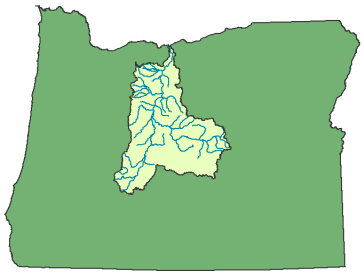
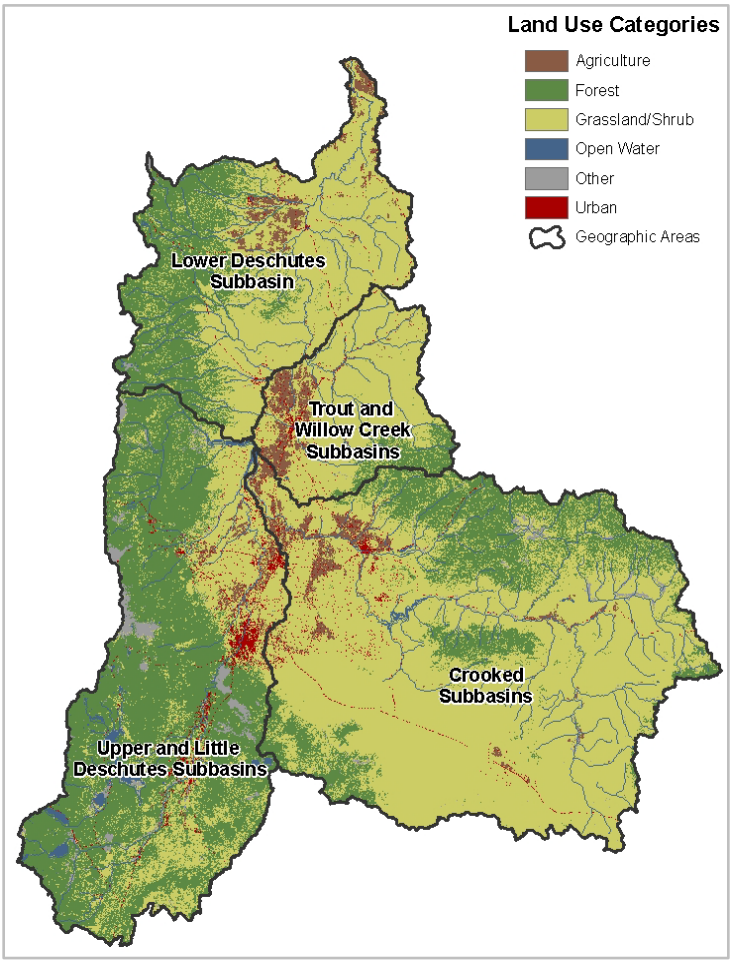
About this document

This document provides an overview of DEQ's work in the Deschutes Basin, including the data we gathered and potential solutions to the problems our research has uncovered. We developed this information with input from a wide range of DEQ staff and external stakeholders. We look forward to continued input and interaction with stakeholders as we update this report in the future.



Basin Characteristics



The Deschutes Basin is the second largest watershed in Oregon, covering 10,759 square miles (6,886,142 acres) in the north-central part of the state. The basin extends west to the crest of the Cascade Mountains, south to lava plateaus, east into the Ochoco Mountains, and north to its confluence with the Columbia River. The basin is approximately 59 percent grassland/shrub, 34 percent forested, 3 percent agriculture, 2 percent urban, with other uses accounting for the remaining 2 percent.

The headwaters of the Deschutes River and most major tributaries receive large amounts of precipitation, but much of the basin lies in the rain shadow of the Cascade Mountains, sheltered from western Oregon's heavy rainfall. Average annual precipitation amounts to more than 100 inches on the eastern slopes of the Cascades, mostly as snow, and drops to 40 inches in the Ochoco Mountains and 10 inches at lower central locations. Consequently, while the Metolius drainage receives up to 50 inches of precipitation annually, the Bakeoven drainage receives only 10-12 inches.

Land ownership in the Deschutes Basin is about 51 percent public, 7 percent Tribal, and 42 percent private. The federal government owns and manages most public land in the basin, including three national forests, one national grassland and one Bureau of Land Management district. Lands of the Warm Springs Tribal Reservation extend over approximately 641,000 acres and lie mostly in the Lower Deschutes Subbasin.

Pollution Sources

At the most general level, DEQ classifies water pollution sources into two categories: point sources and non-point sources. Point sources discharge pollution into the water at specific, identifiable places, such as a wastewater discharge pipe, while nonpoint sources are landscape-wide and include things like runoff from agriculture, residential properties and construction sites. Point and non-point sources can affect water quality, and the Deschutes Basin contains both.

DEQ regulates point sources in Oregon by requiring them to obtain water quality permits. Permits contain requirements that ensure that a source operates in compliance with all applicable water quality regulations. In early 2011, there were more than 160 permits in effect in the basin covering activities ranging from discharge from sewage treatment plants in Prineville, Maupin, and Black Butte Ranch, to fish hatchery operations on the Fall, Metolius and Lower Deschutes Rivers, to the return of water used to cool operations at the saw mill in Gilchrist.

Active Water Quality Permits: 2011
There were more than 160 water quality permits in effect last year covering activities including:

- Sewage treatment discharge
- Industrial cooling water discharge
- Stormwater disposal
- Land application of wastewater
- Fish hatcheries
- Herbicide application to canals
- Drywells
- Confined animal feeding operations
- Industrial sand and gravel mining

Nonpoint source pollution is generally associated with spatially dispersed land-use activities. There are many nonpoint sources of pollution in the Deschutes Basin, including agricultural practices, forestry practices, urban/suburban management practices (including stormwater and construction), recreation activities, reservoirs and diversions, roads and highways, invasive species, mining activities and others. The effects of these sources vary throughout the basin depending on how the land is used and managed.

The Watershed Approach and TMDLs
The watershed approach is a method to protect water quality that takes into account a broad range of information regarding the status of water quality, sources of pollution and other environmental factors in a basin. This approach strives to incorporate everyone, from private citizens and companies to nonprofits and government agencies, with a stake in the basin. It also combines the expertise of DEQ's 17 water quality subprograms to ensure that DEQ's resources and scientific information are put to use effectively.

One of DEQ's water quality tools is the Total Daily Maximum Load (TMDL). A "Total Daily Maximum Load" is the amount of pollution that a waterway can receive in one day without causing water quality drop below federal clean water standards. A TMDL identifies the maximum amount of pollution each source is allowed to add to a waterbody so that the combined quantity of pollution does not reach dangerous levels an areas rivers and streams. When all sources comply with the TMDL, water quality improves. Exceeding TMDL limits can lead to degradation of water quality.

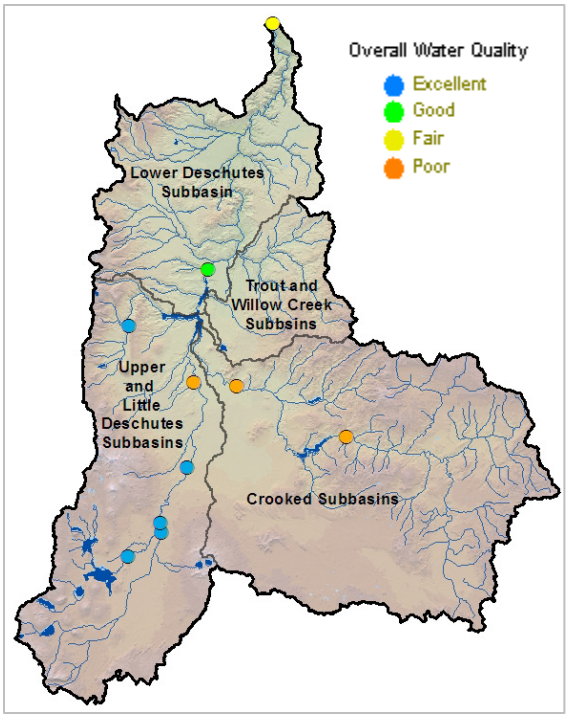
DEQ has begun work developing TMDLs for several portions of the Deschutes Basin to address the following pollutants:

- **Temperature**
- **Dissolved Oxygen**
- **pH**
- **Nutrients**
- **Chlorophyll *a***

See the next section for more details on these pollutants

Water Quality Status and Trends

One of the major goals of this project is to answer two questions about surface and groundwater in the basin: "How are things doing and why are they in that condition?" Our analysis is based on a wide range of data and stakeholders input.



General Water Quality

DEQ has 10 long-term monitoring sites in the Deschutes Basin (see adjacent map). Analysis of data from these sites indicates that water quality conditions in the basin range from "excellent" in most of the Upper and Little Deschutes Subbasins, to "poor" in the Crooked Subbasins. These assessments are based on evaluating levels of temperature, dissolved oxygen, pH, biochemical oxygen demand, total solids, nitrogen, phosphorus and bacteria at each site. Two sites showed changes in water quality over the past 10 years: Crooked River at Lone Pine Rd showed a slight improvement in water quality (nutrients, fine sediment and dissolved oxygen); Little Deschutes River at Road 42 showed a slight decrease in water quality (biochemical oxygen demand, dissolved oxygen). The sections below discuss some of these factors in more detail.

Temperature, Sedimentation, Flow and Habitat

Increases in temperature, deposition of sediments, changes in stream flow, and streamside habitat degredation can harm fish and other aquatic life. These issues have been identified as concerns throughout the basin. Stakeholders around the basin have embarked on activities to improve conditions including stream flow restoration, channel restoration, bank stabilization, riparian plantings and fencing, changes in livestock management, and upland conservation.

Harmful Algal Blooms

Seven lakes and reservoirs in the basin have received health advisories for algal blooms since 2004 and there are concerns about algae in 11 other lakes. Algal blooms can produce toxic substances which pose danger to people and animals that drink or come into contact with affected waters. There is a need to increase our monitoring and find the causes of these algal blooms.

Photo Credit: Joe Eilers

Total Dissolved Gas

We have found evidence of elevated total dissolved gas levels downstream from Prineville Reservoir on the Crooked River and Wickiup Reservoir on the Deschutes River. High dissolved gas levels can cause bubble gas disease in fish. This condition has been observed in fish in the Crooked River below the dam. We will work with the owners and operators of these dams to reduce total dissolved gas levels.

Bacteria

Bacteria in the basin's water pose risks to people who use the water for drinking and recreation. Our research found bacteria contamination in portions of the lower Trout and Willow Creek Subbasins, and in the lower Crooked River. Groundwater well testing indicates relatively widespread detections of bacteria, although sources of the bacteria have not been identified. Likely sources include agriculture (including irrigation return flows) and septic systems. Additional sampling is needed, particularly in the White River, Upper Crooked and Beaver-South Fork watersheds, and resort areas in the Upper and Little Deschutes Subbasins.

Dissolved Oxygen, pH, Nutrients and Chlorophyll *a*

Levels of dissolved oxygen, pH, nutrients and chlorophyll *a* are interconnected indicators of water quality. Dissolved oxygen is important because fish need adequate levels of oxygen dissolved in the water to breathe. Dissolved oxygen can be depleted by the growth and decay of algae and aquatic plants. When algae and plants grow, photosynthesis uses up hydrogen from the water, which leads to high pH levels that can be unhealthy for fish. High nutrient levels encourage algal and plant growth, and chlorophyll *a* is an indicator of such growth.

Several portions of rivers and streams in the basin, primarily in the Crooked and Upper and Little Deschutes Subbasins, have low dissolved oxygen, high pH and/or elevated chlorophyll *a* levels. Our research found that there is limited data available for much of the Lower Deschutes, Trout and Willow Creek Subbasins, indicating a need to collect additional information. The Jefferson Soil and Water Conservation District and Oregon Department of Agriculture are studying these issues in the Trout and Willow Creek Subbasins.

Photo Credit: Tom Davis

Toxics

Toxics, such as arsenic and mercury, have the potential to pollute both surface waters and groundwater in the Deschutes Basin. Some of these toxics, including arsenic can affect people through contamination of drinking water, while others, such as mercury, can harm people by accumulating in the fish people eat. We have limited information on toxics and our research found a need to monitor toxics including emerging contaminants, pharmaceuticals, personal care products and pesticides.

Nitrates in Groundwater

Nitrate contamination of groundwater is one of the most widespread groundwater issues in the Deschutes Basin. Well testing indicates elevated nitrate concentrations throughout the basin, with specific areas of concern in southern Deschutes County and northern Klamath County, around Prineville and Redmond, lower Trout Creek, Willow Creek, and in Sherman County. DEQ has initiated a groundwater protection program for southern Deschutes County and northern Klamath County area. More monitoring and analysis is needed to understand contamination in the basin.

Groundwater/Surface Water Interactions

Because surface water rights are no longer available in the basin, virtually all new development relies on groundwater. There is a strong link between groundwater levels and surface water flows. Our stakeholders have raised concerns that groundwater pumping and the lining of irrigation canals in the Upper Deschutes could reduce flows downstream.

Summary of Water Quality Concerns

DEQ and our stakeholders evaluated a range of specific locations where the issues discussed in this paper are a problem. This research included an assessment of level of concern or perceived risk of problems in each of these areas. The following charts summarizes those concerns. The charts will be updated in future versions of the water quality status report.

Status Summary for Surface and Groundwater Related Resources in the Deschutes Basin

Surface Water	Bacteria	Harmful Algae Blooms	Temperature	Total Dissolved Gas	Nutrients, DO, pH Chlorophyll *a*	Altered Hydrology	Habitat Modification	Sediment / Turbidity	Toxics: -Emerging Contaminants -Pharmaceuticals -Personal Care Products	Toxics: Metals	Toxics: Arsenic	Toxics: Mercury	Toxics: Pesticides
Little Deschutes													
Upper Deschutes													
Beaver-South Fork													
Lower Crooked													
Upper Crooked													
Trout Creek													
Willow Creek													
Lower Deschutes													

Ground Water	General Quality	Quantity	Nitrate	Bacteria	Pesticides	Volatile and Synthetic Organic Compounds	Arsenic	Nickel	Lead	Fluoride
Little Deschutes										
Upper Deschutes										
Beaver-South Fork										
Lower Crooked										
Upper Crooked										
Trout Creek										
Willow Creek										
Lower Deschutes										

Generally poor condition, substantial concern for water quality

Deteriorating condition, moderate concern for water quality

Generally good condition, not an urgent concern for water quality

Unknown condition or lack of data

Next Steps

Using the information collected as part of the watershed approach process and summarized in this paper, we developed an action plan to guide future research, protection and restoration projects in the basin. The plan includes on-the-ground work to improve water quality, monitoring and data assessment, and education, outreach and coordination between stakeholders. We expect some of the measures to result in rapid improvement in water quality while others will require more time. We look forward to refining this plan with increased stakeholder involvement in the future.

The Action Plan

Surface Water Actions

Reduce temperatures, improve flow volume and patterns, and improve habitat through:

- *Better land management and conservation*
- *Increasing native, streamside vegetation*
- *Improved water conservation*
- *Increased instream flows*
- *Channel restoration*
- *Juniper reduction*
- *Combating invasive weeds*

Reduce erosion and nutrient and pesticide levels in water through better land and crop management

Address toxic algal blooms

Assess permitted sources and closely study the effects of their discharges

Develop strategy to find and fix sedimentation issues

Groundwater Actions

Minimize nitrate contamination from septic systems, stormwater and agriculture

Assess effects of groundwater pumping and irrigation efficiency projects on stream flows

Assess cause, extent and magnitude of risks associated with bacteria and arsenic in groundwater

Address potential issues with drywells by:

- *Identifying and investigating area drywells*
- *Educating the public regarding drywells*

Update the Deschutes Groundwater Report

Monitoring and Research

Assess water quality conditions in areas including the Metolius watershed and the Deschutes River downstream from Lake Simtustus

Collect additional bacteria and nutrient data in potential problem areas identified by stakeholders

Collect and analyze toxics data in groundwater, surface water and fish tissue

Investigate groundwater-surface water interactions

Evaluate existing macroinvertebrate data and collect additional data as needed

Coordination and Outreach

Develop a Basin-wide Monitoring Council to help coordinate monitoring efforts, access to funding and data sharing

Develop an accessible, user friendly database to incorporate data from all agencies and stakeholders

Develop and maintain an interactive web tool to share information

Update DEQ databases to reflect current drywell program

Conclusions

Many of the streams and rivers in the Deschutes Basin are in good or excellent condition. We need to protect these waters to keep them healthy for all the ways that people, animals, agriculture and industry use them. For those waters that are not doing so well, we need to focus our efforts on activities that we know will have a direct and beneficial effect on water quality such as increasing streamside vegetation, reducing the amount of waste that gets into the water and increasing the amount of water left instream. In some areas, we do not know enough about the condition of the water to accurately assess its quality. This is the case for new and emerging contaminants, which we may not yet have the ability to measure, and for some locations in the basin where little or no data have been collected. In these areas, the top priority is gaining a better understanding.

Future collaboration

We aim our watershed approach to be as inclusive as possible, and look forward to working with our stakeholders in the future to implement the action plan, gather new information and improve our basin-wide practices over time. We would like to thank everyone that participated in the process to date and invite them to continue to assist us. We will strive to involve more stakeholders, more deeply as the project continues.

For more information, or to get involved, please contact:

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A copy of the detailed status report and action plan for the Deschutes Basin is available online. For a copy of the report and additional information about the Watershed Approach process for this or other basins, please visit us online at:
www.deq.state.or.us/wq/watershed/watershed.htm