



Groundwater Quality Protection in Oregon

2021-2022 Report

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Governor Tina Kotek
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Oregon Environmental Quality Commission



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Executive Summary

Groundwater is an essential Oregon resource. It makes up 95 percent of Oregon's available fresh water. About 45% of Oregonians rely on groundwater from private wells (23%) or public water systems (22%) as their primary drinking water source, according to the Oregon Health Authority. A total of 80% of Oregon residents rely on groundwater for at least a portion of their drinking water sourced from public water supplies. To protect this valuable resource, Oregon passed laws to prevent groundwater contamination, conserve and restore groundwater, and maintain the high quality of Oregon's groundwater resources. The Oregon Department of Environmental Quality implements Oregon's groundwater protection program to monitor, assess, protect and restore Oregon's groundwater resources. Because sources of groundwater contamination and consumers of groundwater cross many boundaries, DEQ also works with other federal, state and local governments, as private and public organizations and individuals to improve and protect groundwater.

Oregon Revised Statute [468B.162 \(3\)](#) requires DEQ to prepare a biennial report to the Oregon Legislature. The report includes the status of groundwater in Oregon, efforts made in the preceding two years to protect, conserve and restore Oregon's groundwater, and grants awarded under ORS 468B.169. This report highlights program activities from 2021-2022, and includes an overview of program history from the late 1980s to the present.

In 2021, DEQ completed and published a final report analyzing groundwater data collected in Harney County. Full summary reports of past and recent published studies are available [here](#). In spring 2022, DEQ completed a groundwater study in the Klamath Basin to identify areas of groundwater contamination and provide information to the public regarding potential risks to human health. Individual laboratory reports have also been provided to the private well users participating in that study. Throughout the remainder of 2022, planning and outreach for a groundwater study in southern Deschutes County has been under development in collaboration with DEQ and Deschutes County. That monitoring will occur in spring and fall of 2023.

In 2021 and 2022 the DEQ Laboratory coordinated the sampling and analysis of 150 small Public Water Systems identified by Oregon Health Authority and DEQ's Drinking Water Protection Program to be at risk for per- and polyfluoroalkyl substances, also known as PFAS. Of these, 130 samples were from groundwater sources. In 2021, DEQ's laboratory developed an analytical method for detecting 33 types of PFAS in drinking



water to accommodate the analysis of these emerging contaminants of concern. With the U.S. Environmental Protection Agency's issuance of lower health advisory levels (HALs) in 2022, this sampling at select water systems will be ongoing in 2023.

DEQ designates groundwater management areas when groundwater in an area has elevated levels of contaminants. Oregon has three such areas: northern Malheur County, Lower Umatilla Basin, and southern Willamette Valley. In each area, DEQ monitors groundwater quality, provides technical assistance and engages communities through a local advisory committee to adopt best management practices to reduce groundwater contamination. Highlights of recent groundwater management area activities are noted below:

- Northern Malheur County:
 - In 2021 and 2022, DEQ continued sampling the existing well network of about 35 wells once a year for nitrate.

- Lower Umatilla Basin GWMA:
 - In 2021 and 2022, DEQ continued sampling the existing well network of about 30 wells several times per year for nitrate. DEQ continues to engage the public in educational outreach and has provided 2022 nitrate results and educational explanations back to well users in the well sampling network. Those letters were also translated into Spanish.

 - On Jan. 16, 2020, a petition was sent to EPA for emergency action to address nitrate in north Central Oregon on behalf of Food and Water Watch, Friends of Family Farmers, Water Watch of Oregon, Columbia Riverkeeper, Humane Voters Oregon, the Animal Legal Defense Fund, Center for Food Safety, Center for Biological Diversity and Eileen Laramore, a resident of Hermiston. Among the requests, the petition asks the federal government to ban any new confined animal feeding operations, or CAFOs, in the basin. Currently there are 10 permitted CAFOs in the area.

 - In December 2021, state agencies responded to EPA's request for information on the petition with a state agency work plan to help address nitrate contamination in the basin. In July 2022, state agencies provided additional supporting information and datasets to EPA and updated the status of voluntary actions. EPA and state agencies are currently conducting quarterly meetings to assess strategies and response actions.

 - In January and September 2022, DEQ took enforcement actions against large land application water quality permittees for overapplying nitrogen-rich wastewater to agricultural fields within the basin, which has contributed to nitrate contamination in the groundwater.

 - Morrow County declared a local state of emergency on June 8, 2022, after private well testing showed high levels of nitrate contamination. Groundwater is used as a drinking water source by residents in the basin, which spans northern Morrow and Umatilla counties and is part of the basin's footprint. High levels of nitrate in drinking water is linked with serious health concerns, particularly for infants and pregnant women. Relative to the state average, the population in the basin has a high percentage of people who meet factors related to environmental justice, as defined by EPA.

- Southern Willamette Valley GWMA:
 - DEQ continues to work with the local planning committee while it collaborates with the various interested parties and others to better understand community needs, create the appropriate communication tools, and encourage beneficial practices. In 2021 and 2022, DEQ continued sampling the existing well network of about 12 wells once a year for nitrate. Nitrate results and educational explanations, as well as Spanish translations, were provided to well users in the well sampling network in 2022.

DEQ continues to assist Deschutes County and work with local groups on the South Deschutes/North Klamath Groundwater Protection Project, an area with elevated nitrate concentrations, to identify and implement measures to protect groundwater quality. The southern Deschutes area was selected as the 2023 study area for the Statewide Groundwater Quality Monitoring Program. This program will collect samples from around 100 wells and analyze for over 200 chemicals that could potentially be found in groundwater.

The Pesticide Stewardship Partnership program continues to monitor for more than 130 pesticide and pesticide residuals in surface water and sediment. DEQ and Oregon Department of Agriculture present the results to local stewardship partners and the public and participate in multiple watershed-based events each year to create awareness about the program and identify priorities for collaborative actions to improve protection of water quality. A small amount of funding is available for technical assistance and for hosting waste pesticide collection events which average about four collection events per year. Since 2006, more than 730,000 pounds of pesticides have been collected – thereby preventing potential release and contamination to ground and surface waters.

DEQ and ODA fund groundwater projects through various grant and loan programs. In the past, DEQ has awarded Clean Water Act Section 319 grants to promote community involvement in groundwater protection. Since 2009, DEQ has provided over \$61 million through Clean Water State Revolving Fund loans to public agencies for groundwater protection projects such as replacing failing onsite disposal systems with sanitary sewer collection systems and piping open irrigation canals. ODA's Fertilizer Grants Program funds studies of the interaction of fertilizers, agricultural amendments or agricultural minerals with groundwater. In the past, ODA has granted funding towards research on fertilizer management practices in the several of the management areas.

Despite the COVID-19 pandemic conditions during 2020-22, DEQ's various programs, including those related to groundwater, adapted to the circumstances to operate and function to best meet the needs of Oregon. Program activities included continued interaction with the public and other interested parties for day-to-day business needs, and ongoing policy and program development work. The pandemic did impact DEQ's ability to conduct some fieldwork and sampling efforts, especially on private properties. In most instances, the work was postponed or delayed with an expectation that improving conditions will allow the work to be completed in the 2023-25 biennium.

The increased scope and magnitude of wildfires represents an ongoing threat to water resources in Oregon, including groundwater and surface water. This includes impacts to drinking water wells and other water infrastructure systems, as well as near- and long-term concerns regarding erosion and water quality issues in wildfire affected watersheds. DEQ programs including the revolving loans and the drinking water protection program, in conjunction with local, state, tribal, and federal agencies or stakeholders, will be collectively working on these issues in 2023 and beyond.

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Introduction

Groundwater in Oregon has many valuable uses and functions:

- Groundwater makes up about 95 percent of available freshwater resources.
- According to the [2017 Groundwater Resource Guide](#), groundwater uses account for 30 percent of all water used in Oregon.
- Groundwater is the primary source of drinking water for Oregonians and its use is increasing.
 - An estimated 350,000 private drinking water wells exist in Oregon today (Figure 1) providing 23% of Oregon's residents with potable water.
 - An estimated 22% of Oregon residents rely on public water systems that solely depend on groundwater.
 - Around 80% of Oregon residents rely on groundwater for at least a portion of their drinking water sourced from public water supplies.
- Oregon businesses require clean groundwater for industries such as food processing, dairies, manufacturing and computer chip production.
- Groundwater provides irrigation water for Oregon agriculture and water for livestock.
- Groundwater supplies base flow for most of the state's rivers, lakes, streams and wetlands. In many streams, the inflow of cool groundwater may be essential to reduce stream temperatures to the range required by sensitive fish species.

Groundwater is present beneath almost every land surface and sometimes occurs at very shallow depths. It is vulnerable to contamination from activities taking place on land as well as from discharges of waste and pollutants at or below ground surface. Once groundwater becomes contaminated, it is very difficult to restore. Because groundwater moves slowly, contamination may persist for tens, hundreds or even thousands of years. Likewise, groundwater currently being contaminated may not affect beneficial uses until sometime far into the future. This contamination may impair groundwater for use as drinking water and may affect the quality of surface waters where it comes to the surface.

Contamination of groundwater resources can lead to severe negative human health consequences. In infants and developing fetuses, nitrate concentrations greater than 10 mg/L can interfere with the ability of blood to carry vital oxygen to body tissues resulting in methemoglobinemia (aka "blue baby") syndrome. The condition can progress rapidly to coma and death if not treated properly. There are other health risks linked to even lower levels of nitrate in drinking water and other contaminants such as pesticides, volatile organic compounds, and bacteria. Additional information is available on OHA's [Nitrate in drinking water](#) information website.

The Oregon Groundwater Quality Protection Act of 1989 (Oregon Revised Statute 468B.150-190) sets broad goals – to prevent contamination of Oregon's groundwater resource, to conserve and restore this resource, and to maintain the high quality of this resource for present and future uses. The act established a policy that all state agencies' rules and programs are to be consistent with the goal of protecting drinking water resources and public health.

DEQ has primary responsibility for implementing groundwater quality protection in Oregon. DEQ has a suite of programs and responsibilities to help prevent groundwater contamination from point and non-point sources of pollution, to clean up pollution sources, and to monitor and assess groundwater quality.

DEQ coordinates groundwater protection and restoration efforts with other state agencies that have overlapping responsibilities for groundwater regulation, involvement, or oversight. DEQ also implements some programs through partnerships with the OHA, Oregon Water Resources Department, and Oregon Department of Agriculture.

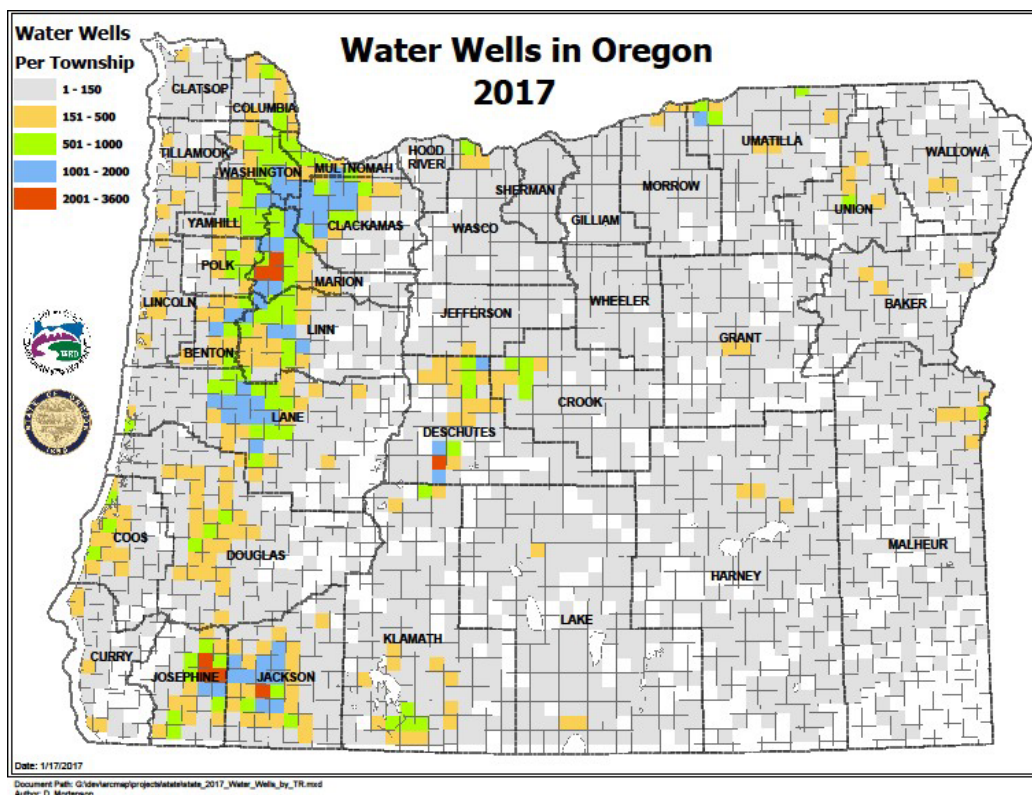
DEQ also works collaboratively with interested parties to assess the situation, share information, identify funding sources, and find common-ground solutions. Partners include state, local and private organizations, businesses and individuals.

As surface water resources are used to capacity, Oregonians are becoming more dependent on groundwater resources and they expect those resources to remain clean, available and usable. As Oregon's population grows, the importance of groundwater to meet the demands of that population will increase. Figure 1 shows the distribution of water wells in the state that tap groundwater resources for drinking water, irrigation and industrial uses.

This report presents information on:

- Assessing aquifer health and threats (Section 2)
- Reducing potential contaminant sources (Section 3)
- Engaging communities on impaired aquifer recovery (Section 4)

Figure 1. Distribution of water wells in Oregon



Assessing Aquifer Health and Threats

Groundwater monitoring and assessment

Oregon's Groundwater Quality Protection Act of 1989 requires DEQ to conduct a statewide monitoring and assessment program to identify and characterize the quality of the state's groundwater resources.

Specific monitoring and assessment requirements of the act include identifying:

- Areas of the state that are especially vulnerable to contamination
- Long-term trends in groundwater quality
- Ambient quality of groundwater resources
- Emerging groundwater quality problems

DEQ's Laboratory and Environmental Assessment Division collects water quality data from water bodies across the state, including limited information on groundwater. Lab staff perform quality assurance, analysis, and quality checks on the data before entering the data into DEQ's water quality database. [Visit the Water Quality Database](#) accessible to the public on DEQ's website.

DEQ evaluates water quality in aquifers by comparing levels of detected contaminants to federal drinking water standards. However, many organic chemicals, pesticides and herbicides do not have drinking water standards and the detection of contaminants in groundwater may indicate a potential concern. In Oregon, detection of contaminants in groundwater at one half the drinking water standard, or at 70 percent of the nitrate drinking water standard (7.0 mg/L), can be the basis for declaring a groundwater management area (ORS 468B.180).

Between 1980 and 2000, DEQ conducted 45 groundwater quality assessments that covered 6.4 percent of the state's total land area and 30.8 percent of the area in Oregon where groundwater is used. The assessment data provided a general rating of the overall quality of the groundwater resource available in Oregon for use as drinking water. In 35 of the 45 studies completed, results showed some impairment or reason for concern. Nitrate was the most commonly detected contaminant, followed by pesticides, volatile organic compounds and bacteria. A list of representative assessments is presented in Appendix 1.

The statewide groundwater assessments revealed three impaired regional aquifers: northern Malheur County, Lower Umatilla Basin and southern Willamette Valley. DEQ designated these locations as groundwater management areas. These GWMA's are discussed in Chapter 4 of this report. DEQ conducts ongoing monitoring within the GWMA's to check for status and trends in impairments.

Recent groundwater monitoring activities

DEQ's Statewide Groundwater Quality Monitoring Program began collecting samples again in 2015 after being inactive for about 10 years. The purpose is to identify areas where there are groundwater risks, detect emerging groundwater quality problems, establishing long-term data on groundwater conditions over time, and inform groundwater users of potential risks. While DEQ doesn't regulate drinking water wells, the testing can help DEQ understand the condition of aquifers and the information gathered can be a resource for public organizations and help well users learn more about their water.

Between 2015 and 2017, DEQ conducted two regional groundwater studies per year, rotating among different regions of the state. Funding since the 2017-19 biennium has allowed DEQ to continue studies, but at a reduced rate of one study per year. Each study includes two sampling events to study seasonal and climatic difference in groundwater quality. The study areas are selected based on a variety of screening criteria including past studies as well as nitrate data collected during real estate transactions. To date, study areas have included the Mid-Rogue Valley Basin in 2015, the North Coast Basin in 2015-2016, the Walla Walla Basin in 2016, the Mid-Willamette Basin in 2017, Harney County in 2018, the Klamath Basin in 2019-22, and the Southern Deschutes County study is underway for 2023. The Walla Walla Basin Report was published in December 2020, and the Harney County Report in 2021. A final report from the Mid-Willamette Basin is expected in early 2024. Completed study reports are available on DEQ's [Groundwater Protection page](#).

Public drinking water source assessment

In 1996, the federal Safe Drinking Water Act required states to develop source water assessments for public water supply systems (surface water and groundwater sources). DEQ and OHA's Drinking Water Program jointly implement the Drinking Water Protection Program designed to protect distinct areas that supply public water wells. This program does not address private domestic wells.

DEQ's staff provide technical assistance for groundwater protection for public water systems. The Safe Drinking Water Act funds these positions through an interagency agreement between DEQ and OHA.

Program activities

Over the last biennium, DEQ assisted OHA in completing a significant number of new "Updated Source Water Assessments" for groundwater systems in Oregon. The assessments provide public water systems information on the recharge area that supplies the well or spring, the geographic setting, and point and non-point pollution risks to drinking water supplies. OHA and DEQ encourage and assist public water systems and local communities to use the information in the assessments to voluntarily develop place-based plans and implement local drinking water protection strategies so that they can continue to have high quality sources of drinking water. Contaminant source inventories in the delineated source areas provide useful information as

communities or agencies evaluate risks and prioritize protection strategies. Typical contaminant sources identified in groundwater source areas include high-density and rural housing, septic systems, auto repair shops (e.g., drywells, drill holes, floor drains and sumps), gas stations, crops, managed forest land, grazing animals, and transportation corridors. DEQ developed a database referencing [best management practices for the 88 most common potential contaminant sources](#) in Oregon. In addition, DEQ's [Groundwater Resource Guide](#) for public water systems provides information and strategies for place-based planning to protect groundwater supplies.

Source water protection planning

Information in the source water assessments provides the basis for a community to voluntarily develop strategies or a plan to protect the source area supplying their drinking water. Drinking water protection strategies generally focus on reducing the impact of one or two high-priority pollutants within the source area. The primary incentive for local communities to develop and implement drinking water protection is the benefit of a more secure source of high-quality water. Other incentives may include a reduction in public water supply monitoring requirements and the reduced likelihood of costs for replacement and/or treatment of contaminated drinking water. DEQ and OHA provide direct technical assistance and/or grant funding to communities as they develop and implement strategies to protect their local public drinking water sources. As of June 30, 2020, a total of 156 community water systems using groundwater (24% of Oregon's community water systems) have "substantially implemented" a strategy to protect their drinking water. These water systems serve approximately 355,000 Oregonians and account for 62% of the community water system population served by groundwater.

The DEQ Lab assisted OHA in post-wildfire sampling at public water systems to understand the impacts of wildfires on drinking water quality and drinking water infrastructure. As part of the response to the 2020 wildfires in Oregon, OHA Drinking Water Services immediately recognized the public health risk of contamination from volatile organic compounds, including the known carcinogen benzene, in drinking water systems. OHA notified water systems damaged by the 2020 wildfires of the risks associated with VOC contamination and began an organized effort to have impacted systems damaged by fire and that lost pressure collect and analyze samples to determine the extent of VOC contamination. OHA received emergency funding from the state legislature to develop a VOC testing program and collaborated with the DEQ Lab and operators of impacted water systems to collect water samples at no cost to water systems with service populations of 3,300 people or fewer. The results from the laboratory analysis are published in [OHA-DWS Data Online](#), a public data access site where visitors can find water system information like coliform and chemical monitoring results, system contact information, and basic water system information.

Information sharing

The source water assessment data are readily accessible electronically and in hard copy. Other DEQ programs use the assessment data to prioritize areas for permit modifications, inspections, technical assistance and cleanup. The data have been provided to several other state and

federal agencies including Oregon Emergency Response System; Oregon Department of Transportation; Oregon Department of Forestry; ODA; Department of Land Conservation and Development; Natural Resource Conservation Service, U.S. Forest Service; and U.S. Bureau Land Management to facilitate incorporation of protection strategies into their respective programs. An interactive mapping program as well as maps and downloadable geographic information system layers of drinking water source area coverages and identified potential sources of contamination are available to the public on [DEQ's Drinking Water Protection web page](#).

Non-point source coordination

Through work with public water systems, DEQ regularly addresses nonpoint sources of contaminants that can impact both public and domestic supplies of drinking water. Activities completed by DEQ in 2021 and 2022 included:

- Engaging local partners to implement management practices for rural landowners, septic systems, forestry, agriculture, and stormwater that are likely to be protective of drinking water quality.
- Assisting local communities with questions on pesticide applications within drinking water source areas.
- Managing the 319 grant agreements for “A Tiered Approach for Assessing Pesticide Use and Groundwater Vulnerability for Drinking Water Protection in Oregon Watersheds: Phase 1-3” (Applicant: Oregon State University Extension); and “Polk County Drinking Water Protection Education and Outreach” (nitrate education and landowner assistance project).
- Assisting the state’s Water Quality Pesticide Management Team with understanding drinking water protection efforts, drinking water source area delineation, and drinking water regulations and provided assistance in prioritizing areas for Pesticide Stewardship Partnership implementation.
- Providing data on drinking water sources, drinking water quality issues, potential contaminant sources, and recommendations for action for ODA’s Agricultural Water Quality Management Plans throughout Oregon.
- Assisting water systems with funding questions as they pursue purchase of recharge areas.
- Coordinating with soil and water conservation districts and watershed councils to partner with public water suppliers for technical assistance on lands in the source area.
- Developing and implementing an outreach process to build the capacity of small public water system operators and reliant communities to protect their drinking water source areas through education, technical assistance, and relationship building. As part of this project, DEQ contacted over 100 small water systems that are Manufactured Home Communities using groundwater as their drinking water source. Through this process approximately 50 small public water systems have initiated some protection activities and 8 Manufactured Home Community PWSs reached substantial implementation.
- Coordinating with Oregon NRCS on National Water Quality Initiative projects addressing agricultural lands within watersheds used for drinking water.

Assessing emerging chemicals of concern

In 2019-20 the leadership teams at DEQ, OHA and other state agencies initiated a workgroup to address and share information related to PFAS (per- and poly- fluoro alkyl substances), as part of a broader effort to evaluate emerging chemicals of concern in Oregon. PFAS are a group of toxic chemicals of growing concern for human health risks. As part of the interagency workgroup, the OHA and DEQ drinking water programs developed a PFAS Screening and Assessment Project Plan to determine if and where PFAS may be present in Oregon's public water system drinking water sources. In conjunction with this plan, DEQ's laboratory began to develop analytical methods for testing capability.

One of the goals of the assessment is to address equity issues by evaluating potential risk to all public water systems. The 2013-2015 unregulated contaminant monitoring rule (UCMR) analysis of PFAS previously focused on large water systems (serving over 10,000) and a handful of randomly selected smaller water systems. Evaluating potential PFAS sources and public health implications will complement and support other ongoing agency programs including DEQ's Toxics and Cleanup Programs. Although the primary focus of the Screening and Assessment is to address potential risk to public water systems, other potentially impacted drinking water sources, including areas served by domestic wells, will also be identified for informational purposes and follow-up by other authorities or programs.

During 2019 to 2020, DEQ began collecting available GIS mapping data to evaluate potential sources of PFAS in the environment. This included collaborating with multiple programs at DEQ and other agencies to develop GIS layers of areas with potential direct application of PFAS containing materials to the environment (e.g., airports, defense sites, fire stations, and other facilities with emergency response capabilities) and environmental management facilities that may receive PFAS waste from consumers and business sources (e.g., landfill leachate and wastewater treatment plants). In addition, DEQ and OHA are using source water assessment data to prioritize water system groundwater sources based on sensitivity to infiltration of potential contaminants.

In 2021 and 2022 the DEQ Lab coordinated the sampling and analysis of 150 small PWS identified by the OHA and DEQ to be at risk for PFAS contamination. Of these, 130 samples were from groundwater sources. In 2021, the laboratory developed an analytical method for detecting 33 PFAS in drinking water to accommodate the analysis of these emerging contaminants. With the development of EPA's lower HALs in 2022, this sampling at select PWSs will be ongoing in 2023.

Private drinking water source assessment

Private domestic wells used for drinking water are not routinely tested by DEQ for water quality. However, state law requires testing at the time of a real estate transaction (ORS 448.271). A homeowner selling a property with a private domestic well must test the water for arsenic, nitrate and total coliform bacteria, using an accredited laboratory, and provide those results to the OHA Domestic Well Safety Program and the buyer within 90 days of receiving the test

results. In 2014, OHA's well safety program completed development of a database containing this information as well as other sources of domestic well data.

Between 1989 and July 2020, more than 25,115 nitrate tests have been reported to OHA. These data provided a broad overview of groundwater quality in the state. Most of the domestic well tests (82.5 percent) show nitrate levels below 2 mg/L and reflect background groundwater quality. About 16% of the tests showed nitrate levels above background groundwater quality and about 1.6% of the wells tested were not within safe drinking water levels (the federal drinking water standard of 10 mg/L).

In 2009, the Oregon Legislature amended the real estate transaction law (ORS 448.271(1)) to require property owners to test for arsenic in well water. Although arsenic testing was not required until 2009, OHA has received 3,328 arsenic results from homeowners, as of July 2020. Approximately 9.7% of arsenic test results exceed the federal standard (.010 mg/L), and about 2% could be considered very high concentrations (more than 0.050 mg/L).

As DEQ initiates new groundwater assessments around the state as part of many of the programs implemented by DEQ, this data from private wells can help identify areas of groundwater contamination or risk and focus monitoring resources. DEQ is working closely with OHA, ODA, Oregon Water Resources Department, and other agencies to communicate monitoring results to domestic well owners to ensure they understand any health risks to which they may be exposed. These communications have been translated into Spanish in areas with Hispanic communities.

Recent studies have indicated that a significant proportion of the sampling results associated with real-estate transaction testing are not being submitted to OHA and made available to the state for purposes of identifying areas of potential concern. DEQ and OHA jointly put forth a legislative concept for consideration by the 2023 Legislature that would revise the requirements by which testing results are transmitted to the state in order to improve data reporting rates.

Reducing Contaminant Sources

DEQ leads Oregon's groundwater quality protection and restoration efforts through its regulatory and funding programs. Some of Oregon's groundwater contaminant sources are point sources from piped discharges. These can be regulated through the registering, permitting, licensing, inspecting, and enforcement activities of DEQ's regulatory programs. Other groundwater contaminant sources in Oregon are non-point sources from landscape-scale activities such as farming, transportation, and forestry. These can be addressed through other regulatory and primarily non-regulatory programs.

Groundwater regulatory programs

DEQ administers several programs that contribute to groundwater protection through registering, permitting, licensing, inspecting, and enforcement activities. A few of the programs are highlighted here.

Appendix 2 summarizes the state's various groundwater protection programs and identifies the primary responsible agency.

Water reuse: The reuse program prescribes treatment and monitoring requirements for the beneficial use of wastewater. DEQ currently administers 64 residential graywater permits. Recycled water and industrial process water reuse plans are incorporated into wastewater discharge permits issued by DEQ.

Biosolids management: Seventy-six percent of biosolids derived from domestic wastewater treatment facilities in Oregon are applied to the land for agricultural purposes. The biosolids program encourages the beneficial use of biosolids while protecting public health and the environment. Land application of biosolids is regulated through biosolids management plans that are reviewed and approved by DEQ, and through detailed site authorization letters issued by DEQ. There are over 800 sites in Oregon authorized to receive biosolids.

Hazardous waste: The hazardous waste program regulates and permits the generation, storage, transportation, treatment and disposal of hazardous waste. In 2019 there was a total of 531 regulated generators of hazardous waste in Oregon.

Underground storage tanks: The underground storage tank program helps protect groundwater by managing issues related to petroleum and home heating oil tanks. The program regulates tank registration, permits registered tanks, licenses service providers and investigates and remediates petroleum leaks. To date, Oregon has decommissioned more than 27,106 tanks with about 5,342 operating under permits. Over 6,966 regulated tank sites contaminated with petroleum have been cleaned up.

Solid waste: DEQ's solid waste program permits several different types of solid waste disposal facilities including 27 municipal solid waste landfills, 16 petroleum-contaminated remediation facilities and 55 compost operations. These permitting activities help protect groundwater

resources by requiring liners and adherence to other standards to control liquids leaching from these facilities. There are currently 287 permitted solid waste disposal facilities in Oregon.

Cleanup: The agency's cleanup program investigates and cleans up historical releases of hazardous substances at sites throughout Oregon. Many of these sites have historically contributed to groundwater contamination. Cleaning these sites protects the current and future beneficial use of groundwater and prevents further release of chemicals or pollutants that would affect those uses. In fiscal year 2019, DEQ completed 94 cleanup actions and added 63 sites to the more than 6000 contaminated or potentially contaminated sites list in Oregon. Some key cleanup program projects designed to protect groundwater resources in Oregon include leaking underground storage tank and Solid Waste Orphan Site Account prioritization of sites, a groundwater vulnerability model to help Site Assessment in determining leaching in areas of concern and working with the Oregon Military Department on their properties to help with a determination of potential PFAS impacts.

Underground Injection Control: This program is responsible for regulating the construction, operation, permitting, and closure of injection wells that place fluids underground for storage or disposal. An underground injection control system places fluids (mainly stormwater, but also septic effluent, treated drinking water and other fluids) below the ground. The most common systems in Oregon are stormwater drywells, which are usually found at large parking lot surfaces. DEQ operates Oregon's UIC program through authorization from EPA. There are over 46,000 registered UICs throughout Oregon.

Onsite: DEQ's onsite wastewater treatment system program administers the permitting of hundreds of thousands of septic systems throughout Oregon. DEQ delegates authority for regulation of onsite septic small systems to 31 contract counties and retains regulatory authority in five counties. In addition, DEQ is responsible for developing and issuing permits required for large or high waste strength systems on water pollution control facilities permits for all counties. About one-third of all Oregonians rely on septic systems to treat residential wastewater. This program helps protect groundwater resources by requiring systems to be designed and installed according to state regulations that include prescriptive siting and performance standards.

Wastewater permitting: Many domestic, municipal and industrial wastewater and stormwater facilities discharge wastewater to land using lagoons, land application, or other systems. Municipal and domestic facilities generally collect and treat sewage from residences and commercial facilities, while industrial facilities treat manufacturing and processing wastewater they generate. DEQ protects groundwater resources through Water Pollution Control Facility permits. DEQ's wastewater permitting program issues permits, performs inspections, and assures compliance for wastewater treatment facilities that discharge wastewater to land. There are 245 individual domestic and industrial permits and 689 general permits as of December 2020. In January and September 2022 DEQ took enforcement actions against large land application water quality permittees for overapplying nitrogen-rich wastewater to agricultural fields within the Lower Umatilla Basin which has contributed to nitrate contamination in the groundwater.

Groundwater protection funding programs

DEQ and ODA have funding sources that can be used to provide grants or loans for projects that address groundwater contamination. Appendix 3 summarizes some recent representative groundwater related protection projects funded by DEQ, ODA, and OHA grants and loans.

Oregon Department of Agriculture

The 1989 Groundwater Protection Act authorized DEQ to fund research and development projects related to groundwater quality. A fee on fertilizer products purchased in Oregon was implemented as part of the act to fund groundwater quality research associated with the interaction of pesticides or fertilizer and groundwater. ODA now administers the grant fund. In previous biennia, the grant fund was used for research projects in the first two declared groundwater management areas (Northern Malheur County and Lower Umatilla Basin) in the state. Revisions to the fertilizer law in 2001 expanded use of the fund to include research related to the interaction of fertilizer, agricultural mineral or agricultural amendment products and groundwater or surface water, eliminated research on pesticides and groundwater, and established a committee to advise ODA research grant funding.

Clean Water State Revolving Fund

The loan program offers below-market rate loans and bond purchases to public agencies for planning, design, construction and implementation of water quality improvement projects including wastewater collection, treatment, water reuse and disposal systems, nonpoint source water pollution control projects, and development and implementation of management plans for federally designated estuaries in Oregon. Since 2010, DEQ has provided over \$61 million in low-interest loans to public agencies through the fund for groundwater protection projects such as replacing failing onsite disposal systems with sanitary sewer collection systems and replacing stormwater dry wells with green infrastructure facilities. Additional program information is available on DEQ's [Clean Water State Revolving Fund web page](#).

The most recent projects, including those with improvements or impacts to groundwater, are included in the [Intended Use Plan](#), which is updated during the state fiscal year, and includes all projects for which applications have been received and the amount of loan funds available to the program.

Drinking water source protection funding

DEQ and OHA continue to promote the use of the [Drinking Water Source Protection Fund](#) for drinking water source protection grants and loans. These grants and loans are available to fund public water system projects directed at activities such as drinking water source area delineations, enhanced potential contaminant source inventory and/or evaluation, drinking water source protection planning, implementation of protection strategies, and implementing security strategies for highly sensitive aquifer/watershed areas near drinking water intakes and/or wells.

In 2019 and 2020, the following projects were approved for water systems to reduce the risk to their groundwater supply:

- North Ashland Drinking Water Protection Plan (2019) for Bear Creek MHP, Jackson Well Springs, Nauvoo Mobile Estates, and other small water systems. Address regional elevated nitrate concentrations and coliform detections by developing a preliminary drinking water protection plan.
- City of Lakeview (2019) Underground Storage Tank Survey and Mitigation Planning
- Jackson Creek Water Association (2020) - Decommission an inadequately constructed well that is within two-year time-of-travel zone.

Non-Point Source Funding

While DEQ and other agencies have direct oversight of point sources which typically require either individual permits or are regulated under a general permit, DEQ and other state and local agencies rely on a combination of regulatory, voluntary and funding programs to evaluate, define, and control impacts from non-point sources which rely more on best management practices, guidance, and rules of thumb to evaluate impacts to water quality. The current [nonpoint source management plan](#) was updated in September 2022.

DEQ's 319 grant program supports community-driven planning and implementation projects that address water quality problems in surface and groundwater resources resulting from non-point source pollution. The program is wholly funded by EPA pass-through funds from Section 319 of the Clean Water Act. Additional program information is available from the [319 program website](#). Some examples outlined in this document include awards to Oregon State University Extension to support the southern Willamette Valley for public outreach, education and landowner assistance including free well water nitrate testing and a 2018 Harney County planning grant.

Engaging Communities

DEQ's regulatory programs and funding programs are not sufficient in scope or resources to protect all groundwater from all significant non-point sources of contaminants. When this occurs, multi-stakeholder, collaborative solutions are needed.

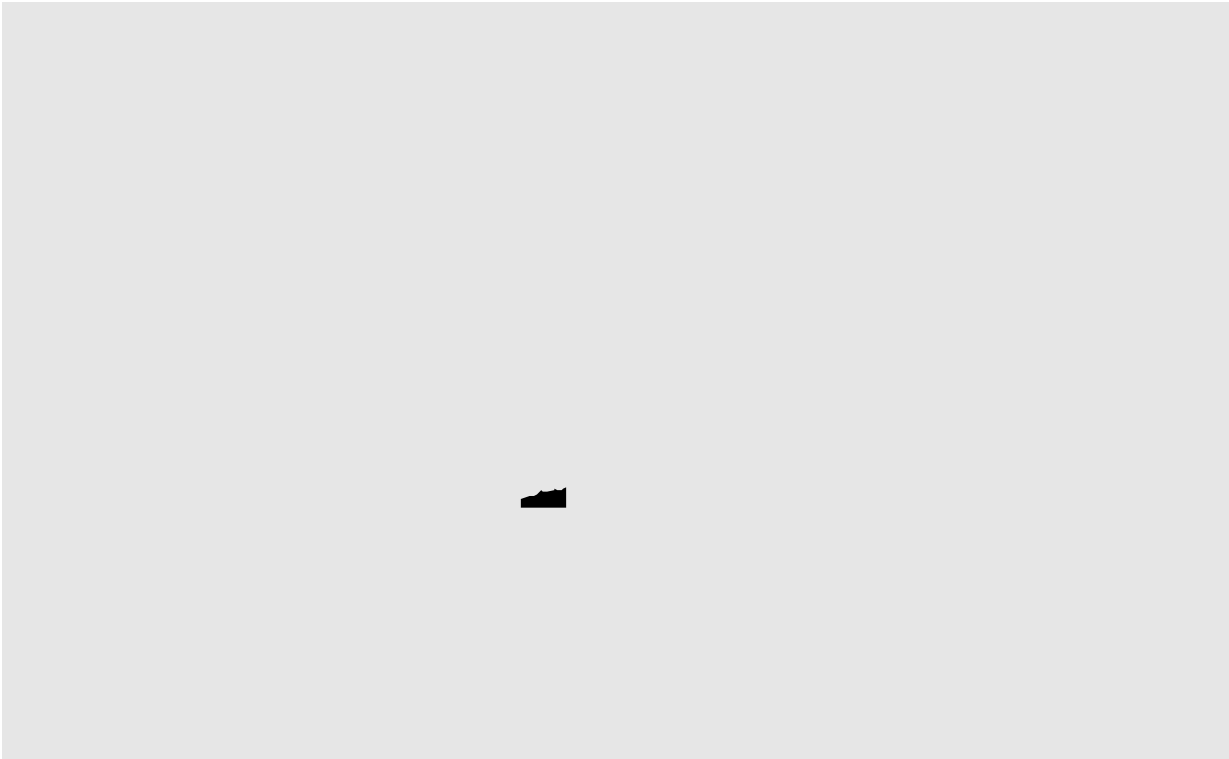
Groundwater Management Areas

Oregon revised statute (ORS) 468B.180 requires DEQ to declare a GWMA when DEQ groundwater assessments reveal area-wide groundwater contamination problems at consistently high levels. A GWMA declaration requires DEQ, Department of Agriculture, Water Resources Department, Oregon Health Authority and other state agencies to focus efforts to restore the groundwater quality through adopting rules necessary to carry out the agencies' duties under ORS 468B.187 (2), establishing best practicable management programs for groundwater protection under ORS 468B.160 (4), requiring amendments to affected city or county comprehensive plans and land use regulations to address identified groundwater protection under ORS 468B.184 (1)(f), and other actions. DEQ leads the effort by convening a local groundwater management area committee comprised of affected and interested parties. This committee works with state agencies to develop and implement an action plan to reduce groundwater contamination originating from point and non-point source activities in the area. This action plan is reviewed and either accepted by DEQ or remanded to the committee for further revision (ORS 468B.187).

DEQ supports the GWMA committees by setting up meetings, forming agendas, participating on the groundwater management area committee; responding to questions regarding groundwater quality; sharing DEQ groundwater monitoring data; reaching out to stakeholders and interagency coordination; and educating the public; assisting with implementation of the management area action plans; maintaining groundwater quality monitoring networks; reviewing existing data to assess groundwater quality trends; helping to secure funding; and supporting local efforts to implement regulatory and best management practices to maintain and restore groundwater quality.

Oregon currently has three groundwater management areas (Figure 2): Northern Malheur County, Lower Umatilla Basin, and Southern Willamette Valley. All three areas were designated for widespread nitrate contamination. More information on the groundwater management areas can be found on [DEQ's website](#).

Figure 2. Location of Oregon's Groundwater Management Areas



Northern Malheur County Groundwater Management Area

Declaration of Groundwater Management Area

The Northern Malheur County groundwater management area was declared in 1989 after DEQ identified significant groundwater contamination in the county's 115,000-acre northeastern portion. In 1985, DEQ sampled 107 wells in northern Malheur County. Thirty-four percent of the wells sampled had nitrate levels above the drinking water standard of 10 mg/L. The presence of the pesticide Dacthal raised additional concerns. Sampling confirmed that most of the contaminated groundwater is present in the shallow alluvial sand and gravel aquifer, which receives a large proportion of its recharge from infiltration of irrigation canal leakage and irrigation water. Agriculture dominates land use in this groundwater management area.

Formation of committee and action plan

In August 1989, the Oregon Strategic Water Management Group selected the members of the Northern Malheur GWMA Committee from local organizations and private citizens and state agency representatives. After two years of meetings, DEQ finalized the NMC GWMA Action Plan, dated December 1991. The goal of the action plan is to:

- Identify and evaluate management practices that contribute to contamination
- Consider reasonable alternative practices to reduce contamination
- Recommend mandatory actions to reduce contamination
- Create an implementation schedule to reduce contaminants to below GWMA trigger levels
- Amend local comprehensive plans and land use plans to be consistent with the action plan

The committee chose to implement the action plan on a voluntary basis recognizing that individuals, businesses, organizations and governments will, if given adequate information and encouragement, take positive actions and adopt or modify practices and activities to reduce contaminant loading to groundwater. The success of the action plan is gauged by both adoption of best management practices and improved water quality within the management area.

Recent collaborative efforts

The Natural Resources Conservation Service and the local Soil and Water Conservation District are working with farmers to develop and implement water quality plans to address groundwater concerns. Alternative irrigation and fertilization management practices have been designed for the area.

Progress toward action plan goals

DEQ currently samples a network of about 35 wells once per year for analysis of nitrate. In 2021 and 2022, only nitrate samples were collected. Dacthal is normally analyzed using the ODA laboratory but was not analyzed due to budget issues and lab coordination due to COVID.

DEQ has conducted five nitrate contaminant trend analyses since 2003. DEQ conducted a formal trend analysis of nitrate concentrations in 2014 using 21 years of data since implementation of the action plan (1991 through 2012). The analysis indicated that the area-wide nitrate trend was slightly decreasing.

Individual wells showed a mix of decreasing (53%), increasing (28%) and statistically insignificant (19%) trends across the area.

DEQ conducted another [trend analysis](#) in early 2020 to determine trends in area-wide nitrate concentrations. The trend analysis determined that the area-wide trend of groundwater nitrate concentrations continues to decrease slightly, and the rate decrease may be slowing. Progress is being made on the land surface through implementation of best management practices. However, it may take years or even decades for groundwater quality to return to natural background levels.

More information is [available here](#).

Lower Umatilla Basin Groundwater Management Area

Declaration of Groundwater Management Area

DEQ declared the Lower Umatilla Basin groundwater management area in 1990 after nitrate contamination was identified in the northern portions of Umatilla and Morrow counties. Between 1990 and 1993, DEQ sampled 252 wells in the basin's study area and found that 33% of samples had nitrate concentrations above 10mg/L. DEQ worked with the Oregon Water Resources Department and Department of Human Services Drinking Water Program in the early 1990s on a comprehensive study of the area that identified five sources of nitrate loading to groundwater:

- Irrigated agriculture
- Land application of food processing water
- Septic systems (rural residential areas)
- Confined animal feeding operations
- Washout lagoons at the Umatilla Chemical Depot

Formation of committee and action plan

The Lower Umatilla Basin Committee was convened in 1996 and finalized the first LUBGWMA Action Plan in December 1997; a second action plan was approved by DEQ in November 2020. This voluntary plan focuses on education and outreach, identifying and encouraging adoption of appropriate best management practices and making soil sampling and groundwater nitrate testing equipment and supplies available for local use. In addition, over 90 percent of the total acres in this basin's groundwater management area are covered by individual farm-specific irrigation water management plans.

Perchlorate in the Lower Umatilla Basin: In the early 2000s a second contaminant of concern was detected in the basin. Perchlorate was detected near military facilities in 2001 and 2003. Subsequently, DEQ, EPA, the U.S. Navy and private companies conducted multiple sampling events. Concentrations were generally low and widespread and did not appear to represent a single contaminant plume. Perchlorate is a chemical contaminant found nationwide at low levels in the environment from human and natural sources. It is possible that both naturally occurring and manufactured sources of perchlorate are contributors. Currently there are neither federal nor Oregon drinking water standards for perchlorate.

Recent collaborative efforts

Well Monitoring: Working with interested landowners, DEQ samples a network of about 30 wells quarterly for analysis of nitrate. Approximately once a year, these wells are sampled for a larger list of contaminants including major ions, metals and pesticides. Samples were collected quarterly in 2021 and 2022. DEQ uses these data to evaluate changes in groundwater quality over time in response to adoption of best management practices. DEQ also periodically informs the well owners of their well water data. This data is mailed and delivered to well owners and tenants in form of letters that provide explanations of the detections and educational resources for water treatment systems and suggestions to find technical assistance. These letters are also translated into Spanish and other translation services are offered.

On Jan. 16, 2020, a petition was sent to EPA for Emergency Action Pursuant to Safe Drinking Water Act Section 1431 to Address Nitrate in LUBGWMA in North Central Oregon on behalf of Food and Water Watch, Friends of Family Farmers, WaterWatch of Oregon, Columbia Riverkeeper, Humane Voters Oregon, the Animal Legal Defense Fund, Center for Food Safety, Center for Biological Diversity and Eileen Laramore, a resident of Hermiston. Among the requests, the petition asks the federal government to ban any new confined animal feeding operations, or CAFOs, in the basin. Currently there are 10 permitted CAFOs in the area.

In December 2021, state agencies responded to EPA's request for information on the petition with a state agency work plan to help address nitrate contamination in the basin. In July 2022, state agencies provided additional supporting information and datasets to EPA and updated the status of voluntary actions. EPA and state agencies are currently conducting quarterly meetings to discuss and identify current and planned strategies and response actions.

Morrow County declared a local state of emergency on June 8, 2022, after private well testing showed high levels of nitrate contamination. Groundwater is used as a drinking water source by residents in the basin, which spans northern Morrow and Umatilla counties and is part of the basin's footprint. High levels of nitrate in drinking water are linked to serious health concerns, particularly for infants and pregnant women. Relative to the state average, the population in the basin has a high percentage of people who meet factors related to environmental justice, as defined by the EPA.

In September 2022, DEQ participated in a restructuring of the LUBGWMA committee including appointing a new Chair from Oregon State University for a two-year period. DEQ, in conjunction with discussions with local agencies, defined seven voting membership categories as part of the

LUBGWMA committee. These categories include OSU, Science/Research, Production Agriculture, Business/Industry, Environmental, Public, and Morrow and Umatilla counties.

Oregon state agencies are not voting members, rather acting as an advisory and supporting role in the LUBGWMA, while other interested parties and individuals will be assigned by the agencies and the Chair to represent the membership categories and subcommittees.

An OSU post doctorate was hired by ODA in fall of 2022 to help manage and begin a renewed process of harmonizing all of the LUBGWMA data, prioritize and help facilitate recommendations outlined in the Second Action Plan.

Second Action Plan goals

DEQ, in partnership with local stakeholders and ODA, OSU, OHA, OWRD, Morrow & Umatilla County Soil and Water Conservation Districts and city and county planning agencies finalized the Second Lower Umatilla Basin Groundwater Management Area Local Action Plan in November 2020 to replace the previous action plan and augment ongoing efforts to reduce nitrate concentrations in area groundwater. The updated action plan includes:

1. Recommendations of actions that, if and when implemented, will reduce the contamination to below the level requiring the declaration of a ground water management area
2. Public and periodic review and update of the plan
3. Actions to explore requirements for amendments of affected city or county comprehensive plans and land use regulations to address the identified ground water protection and management concerns
4. Establishment of programs to prevent ground water quality degradation through the use of best practicable management practices

The newly restructured committee and the Post Doc position will be evaluating LUBGWMA data and the Second Action Plan recommendations and making recommendations on a path forward in 2023. More information is available at the [Lower Umatilla Basin Groundwater Management Area website](#).

Southern Willamette Valley Groundwater Management Area

Declaration of Groundwater Management Area

In 2000 and 2001, DEQ's statewide monitoring and assessment program revealed groundwater contaminants at levels that exceeded state standards in the southern Willamette Valley. Nitrate concentrations in 20 percent of 476 wells sampled were found to be above 7 mg/L or 70 percent of the federal standard. Pesticide data were sufficient to conclude that pesticides were present. However, pesticide concentrations were below any health advisory standard and below 30 percent of any applicable standard. Also, pesticide data did not provide adequate information to characterize the entire study area. Other monitoring activities by DEQ, US Geological Survey, OSU Extension and EPA have confirmed the elevated concentration of contaminants and documented the regional nature of the groundwater quality concern. Although low levels of

nitrate may be naturally present, probable causes of nitrate contamination in this area are from sources related to human activity such as use of fertilizers, industrial and municipal wastewater facilities, animal waste, and septic systems.

In May 2004, DEQ declared the Southern Willamette Valley Groundwater Management Area. The area encompasses 230 square miles of elevated nitrate contamination in the southern Willamette Valley including portions of Lane, Linn, and Benton counties and five cities (Corvallis, Harrisburg, Monroe, Junction City, and Coburg).

Formation of committee and action plan

As the designated lead agency, DEQ convened a groundwater management area committee to develop an action plan. The committee meets three to four times a year to assess and address groundwater issues. These meetings draw extensive public interest with an attendance of 35-40 people at each meeting in the last two years. In November 2006, after 20 months of regular meetings and the involvement of many stakeholders, the committee approved a final action plan. This voluntary plan outlines 60 recommendations to reduce nitrate contributions and prevent further groundwater contamination related to agricultural, residential, commercial, industrial and municipal land uses and public water systems. The plan is currently being updated in order to identify high priority work that can be accomplished despite a recent reduction in staff and lab resources. The program continues to educate residents in the area about local contamination issues and continues to work with partners to identify nitrate contamination sources and provide effective and focused methods of technical assistance to landowners to address these sources. More information is at the [Oregon State University Groundwater Management Area web page](#).

Recent collaborative outreach and education efforts

Story map: In collaboration with the EPA and OSU, DEQ released a new interactive resource to educate the public about groundwater nitrate in the area. The story map includes photos, charts, and maps that show visitors the extensive network of monitoring locations where DEQ tests groundwater nitrate. Users can explore the maps to see how nitrate levels vary throughout the area and where researchers detected trends in the data. The [story map](#) features a twenty-year history of the area, highlighted with excerpts from the action plan, descriptions of contaminant sources, and resources for well owners.

Information sharing: DEQ continues to coordinate stakeholder initiatives and share information about groundwater nitrate levels in the area. From 2019-2022, DEQ hosted meetings, participated in the Partnership to Improve Nutrient Efficiency project expert panel meeting, and attended ODA's Middle Willamette Local Advisory Committee meeting. During the meetings EPA updated stakeholders on groundwater nitrate monitoring research, the Benton SWCD announced that they will focus upcoming efforts in the Benton County portion of the GWMA, and the advisory committee decided that the next biennial meeting should include a tour of the area. DEQ also revived the semi-annual newsletter to keep members and partners informed during the COVID-19 pandemic. This newsletter provides updates such as EPA groundwater research, OSU Extension's rural outreach program, retiring committee members,

and modified monitoring well locations. OSU Extension updated the [Southern Willamette Valley Groundwater Management Area web page](#).

Monitoring data is mailed and delivered to well owners and tenants in form of letters that provide explanations of the detections and educational resources for water treatment systems and suggestions to find technical assistance. These letters are also translated into Spanish and other translation services are offered.

OSU Extension outreach: OSU Extension launched the first wave of outreach for nitrate testing beginning in 2020. OSU Extension had to modify their approach to adhere to state social distancing guidelines. While past outreach efforts centered on community events and field testing, OSU Extension is currently using targeted postcards and newsletter articles to generate interest. They are asking interested residents to schedule individual appointments before bringing samples in for testing. This project is funded by a DEQ 319 nonpoint source pollution grant.

Recent collaborative monitoring and research

Long-term monitoring: DEQ continues to collect and analyze samples to track changes in groundwater nitrate levels over time. The current monitoring network consists of 15 domestic wells, 22 monitoring wells, and six surface water locations. DEQ monitors 11 wells on a quarterly schedule and the entire network of 37 wells and six surface locations each May. In collaboration with DEQ, EPA is analyzing DEQ's well water samples for stable isotopes. EPA is using the isotope data to identify sources and processes responsible for groundwater nitrogen.

A Trend Analysis of Nitrate in the SWV GWMA: As part of a [MS thesis](#) in OSU's Environmental Science Graduate Program, Cody Piscitelli recently analyzed DEQ's monitoring data (Piscitelli 2019). He found that nitrate levels in 57% of the wells in the SWV GWMA increased over the 2016-2019 sample period. The findings indicate that despite the greater public awareness of groundwater nitrate contamination, concentrations are increasing.

Stable isotope research: Tracking changes in nitrate concentrations over time has shown that wells behave somewhat independently. In collaboration with the DEQ laboratory, EPA is studying stable isotopes of water to better understand the source and processing of nitrogen within the soil and groundwater. EPA will use the isotopes to identify sources and transformations of nitrogen in groundwater, ultimately providing an effective means for classifying wells based on unique patterns associated with water and nitrogen source and processing. The results (publication in review) suggest that managing groundwater nitrate in the region will require integration of different approaches, such as controlling nitrate sources and/or enhancing nitrate sinks across the landscape.

PINE project update: In 2013, a team of researchers from EPA, DEQ, Oregon Department of Agriculture, local soil and water conservation districts, and USDA-NRCS were funded to study nutrient management in production agriculture. This study, called "Partnership to Improve Nutrient Efficiency" or PINE, examined 14 fields over a four-year period (2014-2017), providing over 50 sets of annual, field-level performance metrics related to nitrogen (N) from agricultural crops in the southern Willamette Valley.

EPA has evaluated metrics including N inputs, crop outputs, N use efficiency (NUE), nitrate leaching and surplus N remaining after crop harvest. Across the study area, leaching varied widely; crop-specific average nitrate-N leaching ranged from 10 kg N/ha/yr in hazelnuts, to over 200 kg N/ha/yr in peppermint. Most of the nitrate leaching occurred during the fall. The research team used a graphical approach to explore the relationships among N surplus, crop N output, and NUE, which allowed for examination of crop differences. For example, blueberry crops had high N inputs and N surplus, peppermint crops had high N inputs, but also high crop N removal and NUE, and thus lower N surplus; and most wheat crops had high NUE and evidence of soil N mining. Annual N inputs and surplus generally were not well correlated with nitrate leaching losses, suggesting that leaching varied more with specific crop type than fertilizer rate alone. Grass seed and hazelnuts, the dominant crop types in the southern Willamette Valley, were intermediate in terms of NUE, nitrate leaching, and N surplus. While the overall NUE across all fields was 57%, variation between fields was substantial, and, thus, consideration of multiple metrics (nitrate leaching, crop N harvest, NUE, and N surplus) will best inform efforts to improve groundwater quality and agricultural sustainability. A second publication analyzing the soil N testing metric (pre-fertilization and post-harvest) and how it compares with both nitrate leaching and fertilizer N surplus after crop harvest, is forthcoming.

The PINE Project would not be possible without the farmers in the southern Willamette Valley who provided researchers access, knowledge and data about their crops and management practices on their production farmland for four years. Several of these farmers also participated in the 1994-1997 OSU study thus reflecting their long-standing interest in understanding the connections between crop dynamics and water quality. The PINE project was funded largely by US EPA and a grant from the Oregon Department of Agriculture's Fertilizer Fund to Benton Soil and Water Conservation District.

Fertilizer Project: Portland State University, OSU, and EPA recently completed a two-part study to examine how fertilizer applications in tall fescue fields can impact crop yields, groundwater, and air quality in the SWV GWMA. Part of the study measured how enhanced efficiency fertilizers (slow-release pellets) affected seed yield and nitrate leaching to groundwater. The research, funded by an Oregon Department of Agriculture fertilizer grant, showed no consistent effect of the slow-release fertilizer on nitrogen leaching or seed yield. Researchers concluded that continued analysis of the data at a systems level will provide more insights into the best practices for application of N fertilizers in order to mitigate their environmental and human health impacts.

Part two of the study assessed the air and water quality impacts of reduced fertilizer application on grass seed production in the SWV GWMA to reduce nitrate leaching below the root zone and nitrous oxide emissions. They found direct benefits in water quality and reductions of greenhouse gasses by reducing N applications, but no greater benefit at the highest rates that farmers applied. They concluded that effective timing, product choice and application rate can save money, maximize yields, and reduce greenhouse gas emissions and nitrate contamination of groundwater. The study was funded by a USDA NRCS Oregon Conservation Innovation Grant. [PSU produced a short video on their research.](#)

The fertilizer project builds on ongoing efforts and pre-existing partnerships with industry, farmers, and local management districts to provide tools and information to reduce nitrate leaching below the root zone and greenhouse gas emissions from fields in the SWV GWMA.

South Deschutes/North Klamath Groundwater Protection Project

In some situations, groundwater contaminant levels are elevated but do not yet meet the criteria for a groundwater management area declaration. Rather than wait until contamination exceeds the groundwater management area trigger levels, DEQ proactively identifies the area as a groundwater protection project. This identification allows DEQ to focus staff efforts and engage the community on protecting drinking water sources and reducing groundwater contamination in the area immediately.

Identification of the problem

The southern Deschutes County and northern Klamath County area near La Pine in central Oregon has porous and permeable pumice soils, a shallow groundwater table, and little rainfall. This rural residential area of 12,000 residents relies on the shallow groundwater to supply water to more than 4,000 individual domestic wells that are typically less than 50 feet deep, and to about 100 community public water system wells serving small-scale subdivisions, schools and businesses in the region. Most homes in this rural area also discharge partially treated sewage to the shallow groundwater from their individual onsite wastewater treatment systems (septic systems). Prior to adoption of current planning goals, large tracts of land were subdivided into 15,000 lots as small as one-half acre, resulting in areas of concentrated septic discharges. The distributed water supply demand and relatively high development densities in the region created a threat to public health.

Groundwater sampling in the late 1970s and early 1980s revealed very high concentrations of nitrate in the core area of the City of La Pine. This contamination resulted from septic disposal and has diminished since a wastewater treatment system was constructed to serve the city. Groundwater assessments of the unincorporated residential areas of Southern Deschutes and Northern Klamath Counties in the 1990s found nitrate concentrations in drinking water wells that approached unsafe levels (10 mg/L) in several of the oldest and most densely developed areas. In the mid-1990s, Deschutes County and DEQ assessed the potential impact of new residential development in the La Pine region on groundwater quality. Preliminary studies predicted nitrate levels in groundwater would exceed 10 mg/L within 20 years. These preliminary findings were based on best available information at the time on groundwater recharge and flow velocities.

Due to the problems identified above and a history of data collection in this area described below, Southern Deschutes County was selected as the 2023 Study Area for the Statewide Groundwater Quality Monitoring Program. This program will collect samples from around 100 wells and analyze for over 200 chemicals that could potentially be found in groundwater. This

sampling will occur in the spring and fall of 2023 and will be collected from volunteered private wells, monitoring wells, and any public water systems that would like to participate. Resamples from private wells included in previous studies could potentially contribute to trending data in this area. More information about this program can be found at [DEQ's Groundwater Protection web page](#).

Collaborative efforts

Baseline groundwater sampling: DEQ and Deschutes County Environmental Health Division staff conducted sampling of 199 domestic and public water supply wells in 2000. Similar data collection and evaluation was repeated in 2001 and 2002 and again in 2011. Results show 10 percent of the wells sampled had nitrate concentrations above background levels of nitrate and there has been a modest increase in overall concentrations during this period. These results and other data from the study show that groundwater moves slowly in the area, and that nitrate from onsite septic systems are in the early stages of creating groundwater contamination. Onsite septic systems have been discharging nitrate for 40 to 50 years, but contamination has only begun to reach the groundwater tapped for drinking water supplies in the past 15 to 20 years. The predicted quantity of nitrogen contributed to groundwater is high as contaminants continue to move into the groundwater from an ever-increasing population of existing systems. The contaminant load to the aquifer will increase with the population as the remaining vacant buildable lots are developed.

La Pine Demonstration Project: In 1999, the Environmental Protection Agency awarded a \$5.5 million, five-year grant to DEQ, Deschutes County, and the U.S. Geological Survey as part of the National Decentralized Wastewater Treatment and Disposal Demonstration Project. The grant funded a study to evaluate innovative nitrogen-reducing onsite septic system technologies and develop a three-dimensional groundwater flow and contaminant transport model to inform a groundwater protection strategy. The project resulted in:

- Installing and monitoring fifty nitrogen reducing systems
- Initiating a septic system maintenance program
- Conducting 3D groundwater flow modeling and nitrogen contaminant fate and transport modeling
- Assessing optimum lot density and treatment standards based on model results
- Establishing a low-interest loan fund for septic system repair or replacement

Fifteen types of innovative onsite septic systems and three types of control (standard, pressure distribution and sand filter systems) onsite systems were installed. The La Pine project monitored a total of 49 onsite systems from 2000 through December 2004. The effect of these systems on groundwater quality was monitored through a network of nearly 200 shallow monitoring wells and several extensive sampling events involving public and private domestic water wells. Data from the shallow monitoring wells capturing the influence of onsite systems drainfields indicate significant impacts from those systems, particularly systems that do not reduce nitrogen. Conventional systems, including standard tank and gravity drainfield, pressure distribution systems and sand filters, provide minimal nitrogen reduction and therefore minimal

protection for groundwater in this area. The United States Geologic Survey published several reports and papers on research conducted during the demonstration project which can be found [online](#).

Pollution Reduction Credit Program: In 2005, EPA awarded Deschutes County a grant to implement findings from the La Pine National Demonstration Project on a local level. The new project allowed the county to create a Pollution Reduction Credit Program as part of a financial assistance program to help pay for groundwater protection measures. The county also developed, as part of this project, a new county code to require use of alternative treatment technology nitrogen-reducing onsite wastewater treatment systems that provide increased protection for groundwater quality. The Deschutes Board of County Commissioners adopted the new code in July 2008, and it went into effect in October 2008; however, opponents of the code submitted a petition to refer the code to a county-wide vote. In a special election in March 2009, county voters overturned the local ordinance.

South Deschutes / North Klamath Groundwater Protection Project: As result of the vote overturning the new county code requiring expensive onsite treatment systems, Deschutes County Commissioners asked DEQ to lead efforts to resolve the issue. DEQ hosted a public meeting in July 2009 with various agencies in attendance. Many questions were raised about how to best approach the contamination issue and how to create an effective public process. DEQ decided that the first step was to address concerns related to an effective public involvement process. In 2010 DEQ sent out over 10,500 notices to area property owners, held two public meetings and established a steering committee comprised of local citizens. The steering committee completed a report of recommendations on groundwater protection for the project area in 2013. In the report, the committee recommended:

- Allowing an exception to Oregon’s Statewide Planning Goal 11
- Continuing groundwater monitoring
- Creating a local sanitation authority
- Limiting the number of livestock per acre
- Investigating point sources and requiring permits
- Placing a moratorium on requiring alternative treatment technologies for at least five years
- Identifying disadvantaged community financing solutions
- Continuing outreach and community education
- Considering alternative “green” solutions

Seeking an area wide exception to land use Goal 11 had unanimous support from the group. An exception would allow establishment of sewers within the area of concern and the development of a Sanitary Authority for the area. The Sanitary Authority that would be responsible for planning the development of these systems. The intention was to offer the greatest number of options for wastewater treatment and disposal that would go beyond individual onsite systems.

DEQ, DLCD, and Deschutes County Planning Department jointly prepared an application for consideration by the Deschutes County Planning Commission and the Board of Commissioners.

The application made the case that groundwater was being contaminated by ongoing reliance on individual onsite wastewater systems that an exception to Goal 11 would allow various scales of wastewater treatment appropriate to the diverse nature of residential development in Southern Deschutes County. After public hearings held by both boards, both approved the application and concept.

On Nov. 23, 2015 the Board of Commissioners held a public hearing on Ordinance 2015-007, to amend the Deschutes County Comprehensive Plan to add an exception to Goal 11 to allow sewers in unincorporated lands in southern Deschutes County. On Feb. 10, 2016 the Board of County Commissioners held the second reading of Ordinance 2016-007 and approved a Goal 11 exception. Ordinance 2016-007 was to take effect on May 10, 2016, unless appealed.

On March 1, 2016, Central Oregon LandWatch filed a Notice of Intent to Appeal the County's approval of the Goal 11 Exception for southern Deschutes County with the State of Oregon Land Use Board of Appeals. On November 1, 2016, LUBA issued Final Opinion and Order 2016-020 remanding the application back to the Board of Commissioners. Among the shortcomings in the exception were the large area proposed for the exception, the inclusion of areas that LUBA believed did not require higher treatment to protect groundwater, and that there was no requirement for construction of wastewater treatment facilities; rather this would be voluntary.

More information about the South Deschutes/North Klamath Groundwater Protection Project and the report can be found at the following web pages:

- [DEQ's South Deschutes/North Klamath Groundwater Protection Project page](#)
- [Deschutes County South Deschutes/North Klamath Groundwater Protection Project page](#)

Pesticide Stewardship Partnership

Groundwater management areas and groundwater protection projects are declared when contaminants are known to have reached an elevated level. Monitoring for pesticides, however, is not widespread and many pesticides do not have water quality standards to measure against. Yet, pesticides are known to be hazardous to human health. DEQ and other state agencies have formed a partnership to proactively reduce pesticide use and promote proper pesticide disposal to limit the amount of pesticides entering surface waters and groundwater. Developed as an alternative to regulatory programs for protecting water quality from pesticide impacts, the Pesticide Stewardship Partnership approach encourages pesticide users to adopt best management practices in applying, storing, and disposing of pesticides and provides free opportunities for local community members to safely discard unused or waste pesticide products.

The program uses water quality monitoring data to inform voluntary, collaborative actions to reduce pesticides. These practices include Integrated Pest Management activities, pesticide spray efficiency measures, and use of less toxic pesticides. Thus far, partnerships have largely focused on reducing pesticides in surface water. However, the improved practices implemented

as part of the program can benefit groundwater as well. In the future, the program may consider groundwater monitoring for pesticides to further inform collaborative actions and provide another measure of program effectiveness.

The state agencies involved in the program include DEQ, OHA, Oregon Department of Agriculture and Oregon Department of Forestry. Typical stakeholders involved include watershed councils, soil and water conservation districts, OSU Extension Service, irrigation districts, tribal governments, agricultural chemical suppliers, and local community members.

Collaborative efforts

Groundwater monitoring: Pesticide Stewardship Partnership staff are coordinating with watershed stakeholders on identifying possible groundwater monitoring locations.

Agricultural pesticide waste collection events: Since 2015, over 325,203 pounds of pesticides have been collected from pesticide collection events, in coordination with Pesticide Stewardship Partnership projects and other collaborative water quality improvement programs.

Outreach and education: DEQ and ODA participate in multiple watershed-based events each year to create awareness about the program and present monitoring data findings. This outreach helps identify priorities for collaborative actions to improve water quality. Local stewardship partners, most commonly watershed councils and soil and water conservation districts, also conduct similar outreach efforts to expand awareness about the data and to encourage the adoption of practices to keep pesticides on site and reduce or eliminate their transport into the environment.

Technical assistance: The program received funding from the Legislature in 2013 to support direct technical assistance to pesticide users. Some of these funds were used to purchase pesticide spray optimization equipment and new innovative spray application technology to reduce off-target drift that can impact water resources. The remaining funds are distributed to organizations (through a grant program administered by ODA) that will implement technical assistance activities in stewardship watersheds.

Future Direction

DEQ groundwater program funding and staffing resources have declined in recent years. However, DEQ plans to implement the following more limited activities related to protecting Oregon groundwater quality during the 2023-24 time period:

- DEQ will continue to facilitate local implementation of the LUB, NMC, and SWV GWMA action plans and evaluate the performance or success of the management plans in reducing groundwater contamination. This will include working with the LUBGWMA Committee to implement the new updated action plan and with the Southern Willamette community on door-to-door, domestic well sampling and technical outreach on point-of-use treatment.
- DEQ will also continue to conduct routine groundwater monitoring of the well networks in these three management areas.
- DEQ will continue to conduct drinking water source water assessments as new systems come online and provide technical assistance to communities developing drinking water protection plans. The program anticipates expanding state-wide analyses while collaborating with other agencies to reduce risks of contamination to public drinking water systems.
- Look to support local initiatives and solutions for areas on septic systems and shallow drinking water systems. DEQ is actively implementing the new Onsite Septic Financial Aid Program based on \$15M in American Rescue Plan Act funding appropriated in 2022, as well as the Onsite Loan Program that has been administered in partnership with Craft3, a non-profit community development financial institution, since 2017.
- Continue to work with state and federal agencies to ensure that CAFOs are appropriately evaluated, permitted and protective of Oregon's water resources.
- Provide timely review of new water quality permits and renewals for land application sites that may impact groundwater quality.
- DEQ will continue to look for and use new and existing funding sources to support research, education and implementation of best management practices for groundwater protection, including support of voluntary groundwater protection education, certification and technical advisory program for irrigated agriculture best management practices.
- DEQ will continue to plan, conduct, and report on monitoring of priority groundwater basins as part of the State wide Groundwater Quality Monitoring Program. Continued reporting on the work conducted in the Walla Walla, Mid-Willamette, Harney, and Klamath Basins by DEQ's Groundwater Technical Advisory Team will aim to help identify and inform on emerging groundwater problems in the future. A future focus on identifying new areas of study, as well as a need to maintain sampling efforts in currently monitored basin, will help determine long term and historical trends of water quality and aid in climate change evaluations.
- DEQ will continue to seek opportunities to collaborate with federal, state, and local partners -including WRD, ODA, OHA, OSU, EPA, and USGS - to further the groundwater needs of Oregon including funding and prioritization of work including water quality, water quantity, farming and development needs, hydrogeological modeling, and evaluate potential climate change impacts.

- Almost a quarter of Oregonian's get their drinking water from domestic wells and measuring and protecting the quality of groundwater from contamination is essential for meeting our future water needs. While DEQ has three designated groundwater management areas, the success of mitigating groundwater quality in those areas is mixed. In addition, other parts of the state like the Southern Deschutes and Northern Klamath county areas have known groundwater contamination problems that are not being addressed. Oregon needs additional resources to adequately address groundwater issues in these areas and to coordinate groundwater activities statewide.
- DEQ staff available for oversight, review, and management of water quality permitting for CAFOs, large On-Site septic systems, land application, and Aquifer Storage/Aquifer Storage and Recovery programs is needed. This includes addressing and evaluating impacts from non-point sources including irrigated agriculture and other sources and impacts resulting from climate change, drought and wildfire. An important part of staff duties includes support of other natural resource agency review and input on CAFO permits, DOGAMI exploration permits, place-based water planning efforts, water rights, evaluation of Environmental Justice impacts, equitable water access and community water needs, and tribal engagement activities.
- Public drinking water systems must monitor and maintain safe drinking water, but the same regulations do not apply to privately owned wells in Oregon. Private well users are responsible for monitoring and maintaining their own drinking water. While some programs exist to track testing of wells during real estate transactions, they are inadequate to fully evaluate impacts to human health, environmental justice concerns and sensitive communities. Consistent well testing as part of Oregon's GWMA's and DEQ's regional aquifer studies help to provide broader scale evaluations of water quality impacts, trends, and evaluation of emerging chemicals.
- For the 2023-25 biennium, pending Governor and legislative approval, DEQ has requested additional resources related to groundwater protection efforts and staffing capacity, as well as proposed legislative concepts aimed at improving groundwater quality management efforts. These include resources that would provide additional staffing capacity for groundwater coordination and soil science assessment related to permitting, as well as legislation that has been introduced to improve data reporting from domestic well testing associated with real-estate transactions.

Appendix 1 - Groundwater Quality Assessment Projects

Summary as of January 2023

Basin	Project Name	No. of Sample Events	No. of Wells Sampled	Groundwater Quality Rating ⁽¹⁾	Contaminants Of Concern	Contaminants Found ⁽¹⁾	Suspected Contaminant Sources	Date Last Monitored
Southern Deschutes County	Statewide Program: Southern Deschutes Groundwater Study	2	Estimated 100	TBD	Nitrate, arsenic, bacteria	TBD	Naturally occurring, onsite wastewater treatment, agriculture	2023
Klamath Basin	Statewide Program: Klamath Basin Groundwater Study	2	86	2	Nitrates, Arsenic, Bacteria	bacteria, nitrate, arsenic, lead, boron, manganese, pesticides, VOCs, (did not sample for pharmaceuticals)	Naturally occurring, agriculture, industry	2019-2022
Harney County	Statewide Program: Harney County Groundwater Study	2	91	4	Arsenic, Boron, Alkalinity, Pesticides	Arsenic, bacteria, boron, manganese, pesticides, VOCs, (did not sample for pharmaceuticals)	Naturally Occurring, Agriculture	2018
Mid-Willamette	Statewide Program: Mid-Willamette Groundwater Study	2	100	2	Nitrate, Arsenic, Pesticides and Pharmaceuticals, Volatile Organic Compounds	Arsenic, Manganese, Pesticides, Pharmaceuticals, Lead, VOCs, Bacteria	Agriculture, Industry, Naturally Occurring, Onsite Septic Systems	2017

Basin	Project Name	No. of Sample Events	No. of Wells Sampled	Groundwater Quality Rating ^(I)	Contaminants Of Concern	Contaminants Found ^(II)	Suspected Contaminant Sources	Date Last Monitored
Walla Walla	Statewide Program: Walla Walla Basin Groundwater Study	2	100	2	Nitrate, Arsenic, Pesticides, Perchlorate	Nitrate, Lead, Pesticides, Perchlorate, Bacteria	Agriculture, Naturally Occurring	2016
North Coast	Statewide Program: North Coast Groundwater Study	2	69	2	Nitrate, Pesticides and Pharmaceuticals	Nitrate, Arsenic, Lead, Manganese, Pesticides, Pharmaceuticals, Bacteria	Agriculture, Onsite Septic Systems, Naturally Occurring	2016
Rogue	Statewide Program: Mid-Rogue Basin Groundwater Study	2	107	2	Nitrate, Arsenic	Nitrate, Arsenic, Manganese, Pesticides, Pharmaceuticals, Bacteria	Agriculture, Naturally Occurring	2015
Malheur	Northern Malheur County GWMA ^{III}	Ongoing	35 annually	4	Nitrate, Pesticides	Nitrate, Dacthal	Agriculture	2022
Umatilla	Lower Umatilla Basin GWMA	Ongoing	32 quarterly	4	Nitrate, Pesticides, and Perchlorate	Nitrate, EDB, Atrazine, Dacthal, Dicamba, Picloram	Agriculture, Process Wastewater Land Application, CAFOs, Onsite Septic Systems, Industry	2022
Willamette	Southern Willamette Valley GWMA	Ongoing	37 annually 12 quarterly	2	Nitrate, Pesticides	Nitrate, Pesticides	Agriculture, CAFOs, Onsite Septic Systems	2022

Notes:

I. Groundwater Quality Rating:

1 = Means less than 10 percent of wells had a contaminant level over the drinking water standard.

2 = Means 25 percent or more of wells had nitrate levels between 5 to 10 mg/L, or any well had an organic compound detected. 3 = Means 10 percent to 25 percent of wells had a contaminant level over the drinking water standard.

4 = Means more than 25 percent of wells had a contaminant level over the drinking water standard.

Note: Bacteria levels detected in wells sampled in the Statewide Groundwater Monitoring Program often exceeded the percentages of other contaminants found and were not considered in the above ratings.

II. Contaminants: EDB = Ethylene dibromide; VOC = Volatile organic compound.

III. GWMA = Groundwater Management Area

Appendix 2: Oregon Groundwater Protection Programs and Responsibilities

AGENCY	GROUNDWATER PROTECTION RESPONSIBILITIES
<p style="text-align: center;">Department of Environmental Quality (DEQ)</p>	Designs and conducts targeted groundwater quality investigations statewide.
	Maintains a groundwater quality database and data repository.
	Responds to area-wide groundwater contamination by working with agencies and local citizens to develop an action plan to address sources and adopt rules necessary to carry out the agency's duties under the action plan.
	Promotes public education and community involvement in groundwater protection programs and citizen monitoring.
	Establishes groundwater quality reference levels and concentration limits.
	Issues water quality and underground injection control WPCF permits that include groundwater protection requirements.
	Administers federal NPDES program and issues wastewater discharge permits that include groundwater protection requirements.
	Administers onsite sewage system program, contracting with some counties.
	Shares implementation of the drinking water source water assessment and protection program with OHA.
	Certifies drinking water protection plans for public water supply systems.
	Administers federal Underground Injection Control program.
	Administers a federally funded (Clean Water Act 319) nonpoint source grant program.
	Administers solid waste and hazardous waste management programs.
	Administers and implements federal Resource Conservation and Recovery Act program.
Administers Underground Storage Tank program.	

AGENCY	GROUNDWATER PROTECTION RESPONSIBILITIES
	Administers state environmental cleanup program.
	Administers Oregon Dry Cleaner program.
Water Resources Department (WRD)	Characterizes aquifers and groundwater availability.
	Approves water right applications for withdrawals of groundwater.
	Implements regulations regarding well construction and decommissioning.
	Maintains database of location and construction of wells.
	Coordinates reviews issues permits for aquifer storage and recovery projects.
Oregon Health Authority (OHA)	Administers public water system monitoring programs.
	Administers real estate transaction well-testing program.
	Administers and shares implementation of the drinking water source water assessment program with DEQ.
	Certifies delineation of wellhead protection areas.
	Provides technical assistance to public water systems on well construction issues.
Oregon Department of Agriculture (ODA)	Administers programs regulating farming practices to protect groundwater, wellhead protection, groundwater management areas, and areas of groundwater concern.
	Develops and implements water quality management plans for groundwater protection.
	Administers a fertilizer and groundwater research grant program funded by fee on fertilizer product distribution.
	Develops and implements a pesticide management program.
	Implements Confined Animal Feeding Operations regulations.
	Develops or assists in development of management plans for agricultural areas per ORS 468B.184.
	Provides pesticide analytical services for groundwater assessments.

AGENCY	GROUNDWATER PROTECTION RESPONSIBILITIES
Oregon State University (OSU), Agricultural Extension Service and Experimental Stations	Assists with identification of areas vulnerable to groundwater contamination and conducts nitrate testing of local wells.
	Conducts research regarding soil and groundwater contamination and BMPs to prevent contamination.
Department of Land Conservation & Development (DLCD)	Reviews comprehensive plans for communities to ensure they are consistent with goal of the Groundwater Quality Protection Act (ORS 468B.155).
Oregon Department of Transportation (ODOT)	Ensures that the goals of the Groundwater Protection Act are incorporated in all aspects of highway and road design and construction.
Department of Geology and Mineral Industries (DOGAMI)	Ensures that the goals of the Groundwater Protection Act are incorporated.
	Regulates drilling and permitting of geothermal wells.

Appendix 3 - Funding for Groundwater Projects

DATE	PROJECT	AMOUNT	DESCRIPTION
<i>Oregon Department of Agriculture – Groundwater Research Grant</i>			
2012-2016	Benton Soil and Water Conservation District	\$17,1555	Making the case for implementing groundwater protection through fertilizer management (includes EPA matching funds)
2012-2016	GSI Water Solutions, Inc.	\$150,000	Independent review of the Lower Umatilla Basin groundwater management area monitoring program
2017-2020	Portland State University	\$52,261	Precision Agriculture in Grass Seed Production: The Right Bang for your Buck in Protecting Groundwater?
2018-	Hermiston Agricultural Research and Extension Center OSU	N/A	Several projects targeted for the Lower Umatilla Basin Groundwater Management Area were awarded funding for future research work.
<i>Federal Clean Water Act 319 Grants</i>			
2017	Oregon Coast Community Forest Initiative	\$9,000	DEQ funded Sustainable NW for groundwater/drinking water activities
2017-18	A Tiered Approach for Assessing Pesticide Use and GW Vulnerability for DWP in Oregon WS	\$20,000	DEQ funded OSU Phase 1, 2, and 3 activities in the SWV GWMA.
2018	Harney County	N/A	Harney County Planning Grant
2020	OSU Extension	N/A	Southern Willamette Valley GWMA nitrate testing planning grant
<u><i>Clean Water State Revolving Fund Loans</i></u>			
2012	City of Adair Village	\$150,000	Repairs and seals manholes, installs cured-in-place piping in select piping sections, and replaces others that are beyond rehabilitation. All address reduction of inflow and infiltration.

2009 to 2016	Farmers Irrigation District	\$17,473,079	Continuance of the District's projects to remove irrigation water from open ditches and convey it through pipe.
2013	City of Cove	\$1,523,300	Designs and constructs a treatment wetland, a disposal wetland and a pump station and pipeline to carry treated effluent from the treatment wetland to the disposal wetland.
2009 to 2017	Three Sisters Irrigation District	\$5,034,662	Design and construction of the District's projects to remove irrigation water from open ditches and convey it through pipe.
2014	City of Ashland	\$4,549,691	New oxidation ditch and pipeline improvements to provide sufficient treatment during high flows. This project includes a sponsorship option in the amount of \$1,300,000 to partially replace an irrigation canal with a pipeline
2014	Central Oregon Irrigation District	\$3,250,000	4500 feet of new pipeline to carry irrigation water currently in open canal.
2014	City of Newport	\$8,906,800	The age and condition of existing collection lines is contributing to inflow and infiltration in this area of the system.
2014	City of Prineville	\$1,888,464	Stormwater collection system improvements that include abandoning and/or retrofitting existing drywells close to drinking water wells and groundwater.
2015	City of Myrtle Point	\$1,099,868	Overflows are much-reduced or eliminated, manholes have been replaced; and the location of the treatment plant has been moved to a higher location, thus removing it from a location subject to flooding.
2015	City of Gold Hill	\$1,334,200	I&I correction work to include pipeline replacement and manholes repair.
2015	City of Dallas	\$1,750,000	Land purchase for drinking water source protection.

2016	Clackamas Soil and Water Conservation District	\$12,500	The District has a local community loan program that makes loans to private entities for the repair and replacement of failing septic systems impacting groundwater.
2017	City of Madras	\$1,115,000	Municipal sewer extension to Herzberg Heights and Bel Air Estates with failing septic's and drill that contaminate the groundwater supply.
2014 and 2018	City of Columbia City	\$876,000	Sewer improvements project, including upgrade of the RCE Pump Station, new telemetry, manhole lining and steel septic tank replacement or abandonment.
2018	Wasco County	\$299,987	Mosier Deep Well Project to improve aquifer and Mosier Creek conditions
2020	City of Madras	\$2,313,231	Sewer improvements in three areas to be able to connect to sewer for failing septic and protect groundwater