Water Quality Division

Groundwater Quality Protection In Oregon

Submitted to:

Governor John Kitzhaber
Oregon Legislative Assembly
Oregon Environmental Quality Commission

By: Dick Pedersen, Director

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

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Executive Summary

Groundwater is an essential Oregon resource. It makes up 95 percent of available freshwater resources in Oregon. More than 70 percent of Oregon residents get their drinking water from groundwater, and over 90 percent of the state's public water systems get their drinking water from groundwater. 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 resource for present and future uses. The Oregon Department of Environmental Quality implements Oregon's groundwater protection program to monitor, assess, protect and restore Oregon's groundwater resources. Because the sources of groundwater contamination and consumers of groundwater cross all boundaries, DEQ also engages with other state agencies, federal agencies, private and public organizations and individuals to improve and protect groundwater quality.

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 immediately preceding year to protect, conserve and restore Oregon's groundwater resources, and grants awarded under ORS 468B.169. This report also includes an overview of program history from the late 1980s to the present. Program highlights for 2012-14 are noted below.

In the 2013-15 biennium, DEQ received funding from the legislature to start a new statewide groundwater monitoring program. The new program will focus on groundwater sampling in various regions within the state where groundwater contamination has been identified in previous studies, or where an area is considered vulnerable to contamination. DEQ identified two areas for sampling in the next biennium: the Rogue Basin in southern Oregon in spring 2015, and the Clatsop Plains area on the north coast in fall 2015.

DEQ's drinking water protection program provides information on public water systems and water quality to the interagency Water Quality Pesticide Management Team to help prioritize areas for Pesticide Stewardship Partnership implementation. Several waste pesticide collection events benefiting drinking water source areas occurred in 2014, including a project in Milton-Freewater that collected more than 15,000 pounds. The area served by the Milton-Freewater pesticide collection project includes the source area for Milton-Freewater's public supply wells, serving over 7,000 people.

DEQ designates groundwater management areas when groundwater in an area has elevated contaminant concentrations resulting from nonpoint sources such as farming, timber harvesting or other dispersed human activity. Oregon has three groundwater management areas: Northern Malheur County, Lower Umatilla Basin, and Southern Willamette Valley. In each area, DEQ monitors groundwater quality, provides technical assistance and engages communities to adopt best management practices to reduce groundwater contamination. Recent data analysis in the northern Malheur County area indicated that nitrate concentrations in most wells being monitored were decreasing. In the Lower Umatilla Basin area, DEQ engaged more than 700 adults and children in educational outreach. In the Southern Willamette Valley, DEQ collaborates with the Oregon Department of Agriculture to study fertilizer application and irrigation methods that best limit nitrate infiltration into the groundwater.

DEQ continues to 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. In July 2013, DEQ and a steering committee comprised of local citizens finalized recommendations on how to address nitrate contamination from traditional onsite septic wastewater treatment systems in a practical, cost-effective way.

Groundwater Quality Protection in Oregon

DEQ and the Oregon Department of Agriculture fund groundwater projects through various grant and loan programs. In 2013, DEQ awarded Clean Water Act "Section 319" grants to promote community involvement in groundwater protection in the Rogue Basin, northern Malheur County and southern Willamette Valley. Since 2010, DEQ has provided a total of $49 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 replacing stormwater dry wells with green infrastructure facilities. ODA's Fertilizer Grants Program funds studies of the interaction of fertilizers, agricultural amendments or agricultural minerals with groundwater. In 2014, ODA granted $20,000 towards research on fertilizer management practices in the Southern Willamette Valley Groundwater Management Area and $50,000 for an independent review of the monitoring program for the Lower Umatilla Basin Groundwater Management Area.

1. Introduction

Groundwater in Oregon has many valuable uses and functions:

- Groundwater makes up about 95 percent of available freshwater resources.
- As of 2005, groundwater uses accounted for 30 percent of all water used in Oregon.
- Groundwater is the primary source of drinking water and its use is increasing.
  - Over 70 percent of all Oregon residents rely solely or in part on groundwater for drinking water.
  - Over 90 percent of public water systems get their drinking water from groundwater.
  - An estimated 350,000 private drinking water wells exist in Oregon today.
- Oregon's 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 contamination can lead to severe negative consequences. In infants and developing fetuses, nitrate greater than 10 mg/L can interfere with the ability of blood to carry vital oxygen to body tissues resulting in methemoglobinemia or "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.

Groundwater is present beneath almost every land surface and is sometimes at very shallow depths. It is vulnerable to contamination from activities taking place on land as well as from discharges of wastes and pollutants at or below ground surface. Once groundwater becomes contaminated, it is very difficult to clean up. 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.

The Oregon Groundwater Quality Protection Act of 1989 (Oregon Revised Statute 468B.150-190) sets a broad goal for the state of Oregon – 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.

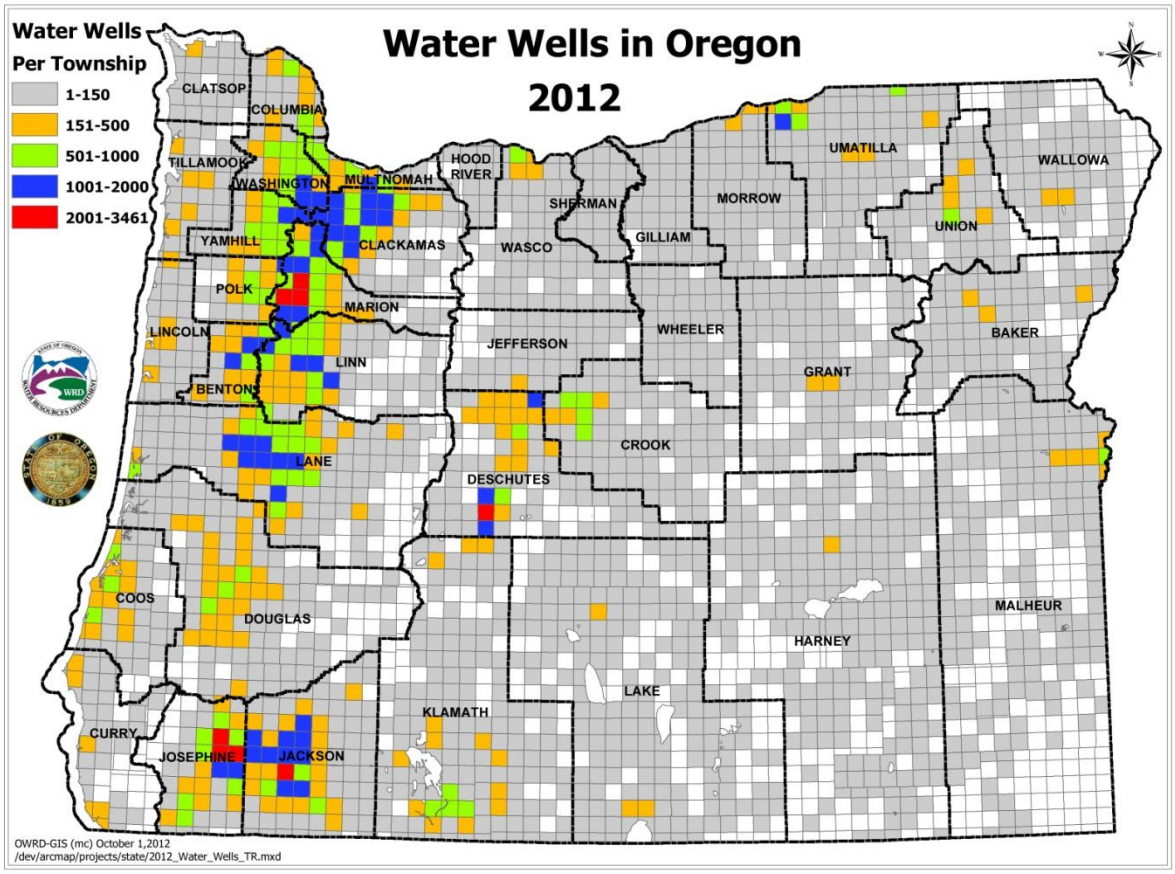
DEQ coordinates groundwater protection and restoration efforts with other state agencies which have overlapping responsibilities for regulation, involvement, or oversight. DEQ also implements some programs though partnerships with the Oregon Health Authority, Oregon Water Resources Department, Oregon 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:
Section 2: Assessing aquifer health and threats
Section 3: Reducing potential contaminant sources
Section 4: Engaging communities on impaired aquifer recovery
Section 5: Future directions for groundwater quality protection

Figure 1. Distribution of water wells in Oregon



2. Assessing Aquifer Health and Threats

2.1. 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 Oregon'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 Program collects data from water bodies across the state. Lab staff perform quality assurance, analysis, and quality checks on the data before entering the data into DEQ's water quality database. The water quality database is accessible to the public via 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 any level of these contaminants in groundwater indicates 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.

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.

The statewide ground water assessments revealed three impaired regional aquifers: Northern Malheur County, Lower Umatilla Basin and Southern Willamette Valley. DEQ designated these locations as groundwater management areas (GWMAs). DEQ conducts ongoing monitoring within the GWMAs to check for status and trends in impairments.

Recent Groundwater Monitoring Activities

Rogue Basin: DEQ staff and volunteers conducted the Rogue Basin Groundwater Investigation, which provided a snapshot of groundwater conditions in 52 selected wells in the Rogue Basin. The study found elevated nitrate concentrations (>3mg/L) in 35% of wells, arsenic was detected in 17% of wells, and low levels of fluoride were found in most wells. A final report was written in 2013 and can be found here: http://www.oregon.gov/deq/WQ/Documents/Groundwater/2013RogueGWReport.pdf

Fifteenmile Creek: In 2013, DEQ and the Oregon Water Resources Department (WRD) conducted a joint sampling effort in the Fifteenmile Creek area south of The Dalles. Samples were collected from surface water locations and twenty groundwater wells. WRD is using the data reported by DEQ to

evaluate the connection between surface water and groundwater in the area. One well had nitrate concentrations above the federal drinking water standard of 10 mg/L. Another well had nitrate concentrations just below the federal standard.

La Pine Area: In July 2014, DEQ sampled monitoring wells in the City of La Pine and surrounding area, now known as the South Deschutes / North Klamath Counties Groundwater Protection Area. Previous monitoring found that this area had nitrate levels that were elevated above background levels, but most samples were below the federal drinking water standard. The elevated nitrate levels are due to a shallow underlying aquifer and individual septic systems on small rural developed lots. The July 2014 study re-visited thirteen sample locations tested in previous studies. In addition to testing for nitrate, samples were collected for pesticides, pharmaceuticals and personal care products, to determine if these compounds are contaminants of concern. Results from this study are pending, awaiting release of the laboratory analytical report.

Southern Willamette Valley: A joint inter-agency project began 2013 in the Southern Willamette Valley Groundwater Management Area (SWV GWMA). EPA and the Benton Soil and Water Conservation Districts (SWCDs) were awarded two grants to collaborate on a project measuring nitrate losses from fields in areas with improved fertilizer management. Soil water samples from existing and newly placed lysimeters in the GWMA are being collected once a month for 2 years, and analyzed by the DEQ laboratory to determine levels of nitrate and phosphorus leaching below the crop rooting zones in fields using precision agriculture and other innovative fertilizer management practices. Ultimately, all these data will be used to validate a groundwater protection module of the Oregon-approved USDA-NRCS Nutrient Tracking Tool (NTT) for nutrient trading. In addition, these lysimeter data will allow the SWV GWMA Committee to obtain real-time data that can be used in management of the GWMA, and to compare current and innovative best management practices and new agricultural technologies for their effectiveness in reducing nutrient release below the rooting zone.

Corvallis Schools: DEQ conducted a groundwater study in the surrounding area as a follow-up to a 2012 USDA study which detected pesticides in groundwater wells supplying two Corvallis-area schools,. Thirty domestic wells and three irrigation wells were sampled in October 2013 for nitrate, pesticides, and common ions. Nitrate was detected at 26 of the 30 domestic wells and was over 7 mg/L at 9 of those wells. Pesticides were detected at 26 domestic wells and 2 of the 3 irrigation wells, and were often detected as mixtures. All the detected pesticides were well below the federal drinking water standards, where standards exist. DEQ shared the results with the homeowners by letter and public meeting in early 2014. The Southern Willamette Valley Groundwater Committee may incorporate this contamination issue into their action plan.

<u>Future Monitoring and Assessment Efforts</u>

In its 2013-2015 budget, DEQ received funding from the legislature to begin a statewide groundwater monitoring program. Monitoring efforts will focus on characterizing groundwater in various regions within the state where groundwater contamination has been identified in previous studies, or where the area is considered vulnerable to contamination. DEQ identified two initial areas for sampling: the Rogue Basin in southern Oregon in spring 2015 and the Clatsop Plains area on the north coast in fall 2015. Each area will have a second sampling event that will occur approximately six months after the first event to help identify seasonal variation in groundwater quality. The contaminants of concern will be determined for each study area prior to sampling.

2.2. 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 Supply Protection Program designed to protect distinct areas that supply public water wells. This program does not address private or domestic wells.

DEQ has one full-time equivalent position in the drinking water protection program dedicated to groundwater; the Safe Drinking Water Act funds the position through an interagency agreement between DEQ and OHA. The position provides technical assistance for groundwater protection for public water systems, and is funded to work on public water system groundwater protection issues.

Recent Activities

Source Water Assessments: Between 2000 and 2005, DEQ and OHA's Drinking Water Program assessed 2,460 public water systems. The assessment report provided to every system gave community officials detailed information on the watershed or recharge area that supplies the well, spring or surface water intake ("drinking water source area") and identified potential risks within the source area.

Susceptibility Analysis: In 2007, DEQ completed a statewide "susceptibility analysis" which used results of the source water assessments to determine the overall susceptibility of each drinking water source (well, spring or surface water intake). Each public water system was evaluated based on the number and type of potential contaminant sources within the drinking water source area and the source area's level of sensitivity. OHA and DEQ are using the analysis rankings to prioritize outreach and technical assistance, to evaluate cross-program opportunities, and to select toxic monitoring locations based on high potential risks.

Source Water Sampling: Between 2008 and 2014, DEQ's laboratory staff sampled source water serving wells at a total of 48 public water systems around the state. Funding for this work came from the federal Safe Drinking Water Act. Source water samples were analyzed for contaminants commonly found in personal care products and domestic wastewater, and also for new synthetic chemical compounds, strong microbial pathogens, and pharmaceuticals. Many of the parameters analyzed do not have federal drinking water standards and are not addressed in the Safe Drinking Water Act. The data show low levels for many of these "emerging contaminants." DEQ and OHA did not find individual contaminants in either of the sampling projects at levels of public health concern.

Information Sharing: The source water assessment data is 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 has been provided to several other state and federal agencies including Oregon Emergency Response System; Oregon Department of Transportation; Oregon Department of Forestry; Oregon Department of Agriculture; Department of Lands, Conservation and Development; U.S. Forest Service; and U.S. Bureau Land Management to facilitate incorporation of protection strategies into their respective programs. Maps and downloadable GIS shapefiles of drinking water source area coverages and identified potential sources of contamination are available to the public on DEQ's Drinking Water Protection webpage at http://www.deq.state.or.us/wq/dwp/dwp.htm.

DEQ drinking water protection staff also provide information on public water systems and water quality to the interagency WQ Pesticide Management Team to assist in prioritizing areas for Pesticide Stewardship Partnership (PSP) implementation. Several waste pesticide collection events benefiting drinking water source areas occurred in 2014, including a project in Milton-Freewater which collected over 15,000 pounds. The area served by the Milton-Freewater pesticide collection project includes the source area for Milton-Freewater's wells serving over 7,000 people.

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 2014, 331 groundwater systems have achieved partial or substantial implementation of source water protection. This represents a total of over 868,000 people served by public water systems that participate in active groundwater protection.

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 housing, septic systems, auto repair shops (e.g., drywells, drill holes, floor drains and sumps), gas stations, irrigated 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 (available at http://www.deq.state.or.us/wq/dwp/docs/BMPnResources.pdf). The database lists activities ranging from educational outreach to regulatory approaches that public water systems or communities can take to reduce their risk. The database can be used to pull the best management practices for a public water system or geographic area from GIS layers into a format that communities can use to choose their drinking water protection strategies for groundwater.

For example, the City of Irrigon developed new public water system groundwater wells in 2007 to replace wells lost due to nitrate contamination. Water quality tests on the new wells immediately showed the presence of nitrate and further monitoring indicated an increasing nitrate concentration. The City requested help from the Governor's Office and state agencies tasked with preventing groundwater contamination. DEQ and OHA collaborated on a new Source Water Assessment (SWA) document for the city in 2011. This served as a basis for understanding the risks of nitrate and other contaminants affecting the new wells. The City was awarded a Drinking Water Source Protection Fund grant in 2012 to develop strategies and implement protection within the groundwater source area. During 2014, DEQ continued to work with City officials and a local task force with other partners (including the County, SWCD, and Extension Service) to implement strategies for nitrate reduction. The County is taking the lead on initiatives to reduce the number of large animals on rural lands adjacent to the new supply wells. The City has developed and installed signs informing the public of the protection area. DEQ has provided customized educational materials about onsite systems and private wells to the City for distribution, and continues to provide technical assistance to the City as it implements nitrate reduction activities.

2.3. 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 Oregon Health Authority (OHA) Domestic Well Safety Program (DWSP) and the buyer within 90 days of receiving the test results. In 2014, the DWSP completed development of a database containing this information as well as other sources of domestic well data.

Between 1989 and now, more than 24,000 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 percent of the tests showed nitrate levels above background groundwater quality and about 1.5 percent of the wells tested were not within satisfactory 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 9,853 arsenic results from homeowners since 1989. Approximately 3.4% of arsenic test results exceed the federal standard (.010 mg/L). As DEQ initiates new groundwater assessments around the state, these data help identify areas of groundwater contamination or risk, and focus monitoring resources.

DEQ is working closely with OHA to communicate monitoring results to domestic well owners to ensure they understand any health risks to which they may be exposed.

3. Reducing Contaminant Sources

DEQ leads Oregon's groundwater quality protection and restoration efforts through its regulatory and funding programs. Many 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. Some of Oregon's groundwater contaminant sources are non-point sources from landscape-scale activities such as farming, transportation, and forestry. These can be addressed through funding support of treatment facilities, efficiency upgrades, and groundwater monitoring through DEQ's funding programs. DEQ's regulatory and funding programs work in concert to limit and reduce pollution to groundwater from point and nonpoint contamination sources.

3.1. 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 17 graywater permits. Recycled water and industrial process water reuse plans are incorporated into wastewater discharge permits issued by DEQ.

Biosolids Management: Almost all 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. As of December 2014, there are approximately 300 sites in Oregon authorized to land apply biosolids.

Hazardous Waste: The hazardous waste program regulates and permits the generation, storage, transportation, treatment and disposal of hazardous waste. There are 475 regulated generators of hazardous waste in Oregon as of October 2014.

Underground Storage Tanks (UST): The underground storage tank program helps protect groundwater by managing issues related to petroleum and home heating oil tanks. The UST program regulates tank registration, permits registered tanks, licenses service providers and investigates and remediates petroleum leaks. To date, Oregon has decommissioned more than 26,000 USTs with about 5,200 operating under permits.

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 296 permitted solid waste disposal facilities in Oregon.

Cleanup: The agency's cleanup program investigates and cleans up contaminated hazardous waste sites throughout Oregon. Many of these sites have historically contributed to groundwater contamination. Cleaning up these sites helps prevent future contamination of groundwater by chemicals or pollutants. In fiscal year 2013, DEQ completed 162 cleanup actions and added 82 sites to the more than 5000 contaminated or potentially contaminated sites list in Oregon.

Underground Injection Control (UIC): DEQ administers and implements Oregon's UIC program through delegation from EPA. Underground injection controls include drywells, sumps and other injection systems that discharge a variety of residential, commercial and industrial fluids below the ground. Many UICs are not registered. Federal regulation requires DEQ to inventory UICs and report them to EPA. The UIC program protects groundwater by locating, registering, and permitting existing UICs, and permitting and approving UIC design, installation, maintenance, and monitoring plans for new UICs. Most injection systems receive stormwater flow from streets, parking lots and areas associated with commercial and industrial sites. There are approximately 43,810 located UICs in Oregon.

On-Site: DEQ's onsite wastewater treatment system program administers the permitting of hundreds of thousands of onsite septic systems throughout Oregon. About one-third of all Oregonians rely on onsite 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 the use of Water Pollution Control Facility (WPCF) permits. DEQ's wastewater permitting program issues permits, performs inspections, and assures compliance for wastewater treatment facilities that discharge wastewater to land. There are 200 WPCF individual domestic and industrial permits and 1792 WPCF general permits as of December 2014.

3.2. Groundwater Project Funding Programs

DEQ and the Oregon Department of Agriculture have funding sources that can be used to provide grants or loans for projects that address groundwater contamination.

Appendix 3 summarizes recent groundwater related projects funded by DEQ and ODA grants and loans.

Oregon Department of Agriculture (ODA)

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 instituted 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 (CWSRF)

The Clean Water State Revolving Fund loan program provides low-cost loans to public agencies for the planning, design or construction of projects that prevent or mitigate water pollution. Since 2010, DEQ has provided a total of $49 million in low-interest loans to public agencies through the Clean Water State

Revolving 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.

EPA 319 Pass-through Fund

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. In the last biennium, DEQ disbursed over $71,000 in grant funds for groundwater-related projects.

4. Engaging Communities

On occasion, DEQ's regulatory programs and funding programs are unable to protect groundwater from significant non-point sources of contaminants. When this occurs, multi-stakeholder, collaborative solutions are needed.

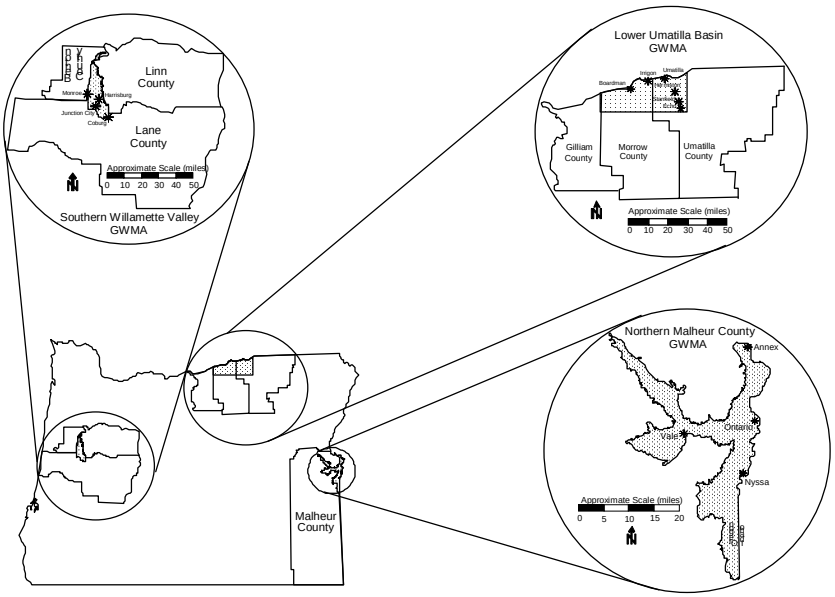
4.1. Groundwater Management Areas

Oregon revised statute 468B.180 requires DEQ to declare a Groundwater Management Area (GWMA) when DEQ groundwater assessments reveal area-wide groundwater contamination problems at consistently high levels. A GWMA declaration requires DEQ, Department of Agriculture, Water Resource Department, Department of Human Services and other state agencies to focus efforts to restore the groundwater quality. DEQ jumpstarts 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.

DEQ's role in GWMA committees includes participating on the groundwater management area committee; responding to questions regarding groundwater quality; sharing DEQ groundwater monitoring data; reaching out to stakeholders; and educating the public and school children; 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 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.

Figure 2. Location of Oregon's Groundwater Management Areas



4.2. 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 stepwise 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 water quality plans to address groundwater concerns. Alternative irrigation and fertilization management practices have been designed and recommended for the area.

Progress Toward Action Plan Goals

DEQ currently samples a network of about 38 wells four times per year for analysis of nitrate and Dacthal, and does a more complete analysis approximately once a year. 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 percent), increasing (28 percent) and statistically insignificant (19 percent) trends across the area. 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.

DEQ will conduct another trend analysis in early 2017 to determine if area-wide nitrate concentrations continue to decrease.

4.3. 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 LUB GWMA Action Plan in December 1997. 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 LUB GWMA. Perchlorate was detected near military facilities in the Lower Umatilla Basin 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.

In September 2012, DEQ began sampling for perchlorate at each of the four annual sampling events conducted in the LUB GWMA. To date, approximately eight samples from each well have been analyzed for perchlorate. The trend analysis showed no obvious trend or seasonality on this limited set of data. Long term data collection is needed to identify trends in perchlorate concentrations. Perchlorate is not currently addressed by the LUB GWMA Action Plan.

Recent Collaborative Efforts

Well Monitoring: Working with interested landowners, DEQ samples a network of about 38 wells four times per year for analysis of nitrate. Approximately once a year, these wells are sampled for a larger list of contaminants including major ions, metals and pesticides. DEQ uses these data to evaluate changes in groundwater quality over time in response to adoption of best management practices.

Information Sharing: DEQ shared information on the status of the LUB GWMA and best management practices to a variety of audiences including the public, local growers and agricultural businesses, agencies, watershed councils, and environmental groups.

- February 2012: Oregon Department of Agriculture Fertilizer Research Fund
- October 2013: Umatilla County Board of Commissioners
- October 2013: Umatilla County SWCD's 3 E's Workshop
- November 2013: John Day, Umatilla and Grande Ronde Water Monitoring Summit
- December 2013: Hermiston Farm Fair
- November 2013: Oregon Agricultural Chemicals & Fertilizers Association Safety & Stewardship Seminar
- February 2014: Tour of Knowledge, a non-profit citizen group that promotes protecting and preserving natural resources

Outdoor School: DEQ conducted outreach to Outdoor Schools involving 762 students from nine school districts in April, May, and June 2013, and to 656 students from nine school districts in April, May, and June 2014. These presentations involved several communities within the LUB GWMA (Hermiston, Echo, and Stanfield) and several nearby communities (Heppner, Ione, Condon, Arlington, Sherman County, and Pendleton). DEQ staff used a groundwater model and a surface water model to describe how groundwater and surface water are related, the difference between point sources and non-point sources of contamination, and how to minimize water pollution.

Classroom Visits: DEQ staff engaged over 50 fifth grade students in two Outdoor School-style presentations made in the classroom setting in June 2013 and 2014 at McKay Elementary School in Pendleton, Oregon.

Wal-Mart Safety Day: DEQ staff, along with local fire, weather, and law enforcement officials participated in Wal-Mart Safety Day in June 2013 and June 2014 in Pendleton, Oregon. The purpose of the event is to engage the public with fun and interesting ways to promote safety. DEQ staff used the opportunity to build "Edible Aquifers". An edible aquifer is basically an ice cream float used to illustrate the geologic formation of an aquifer, how pollution can get into ground water, and how easily this pollution can end up in drinking water wells. Each year over 50 edible aquifers were built and eaten by the public at these events.

Progress Towards Action Plan Goals

The LUB GWMA Action Plan measure of success calls for decreasing nitrate concentrations throughout the GWMA by the end of 2009. In February 2012, DEQ finalized the report that calculated nitrate trends at 201 of the 650 wells with nitrate data. The area-wide trend was increasing, although at a slowing rate. Half of the wells analyzed (51 percent) exhibited an increasing trend while 24 percent exhibited a decreasing trend, 1 percent exhibited a flat trend, and 24 percent showed statistically insignificant trends.[1] The primary conclusion of the assessment is that nitrate concentrations did not decrease throughout the management area by the end of 2009. The assessment report can be found at the following webpage: http://www.deq.state.or.us/wq/groundwater/docs/lubgwma/nitrate/NitrateReport.pdf

DEQ also analyzed the data to create a "snapshot" of the nitrate concentrations at the end of 2009. The snapshot revealed that about half of the wells (51%) exceeded the 10 mg/l drinking water standard and nearly two-thirds of the wells (64%) exceeded the 7 mg/l GWMA trigger level. Overall nitrate concentrations ranged from less than 0.005 mg/L to over 103 mg/L.

[1] A statistically insignificant trend in this report is one in which the confidence level in the calculated trend is less than 80%, regardless of the trend slope or nitrate concentrations.

Every four years, the LUB GWMA Committee evaluates Action Plan success. The third evaluation of Action Plan success was completed in January 2013. The evaluation included an assessment of both the 2009 goals and implementation of previous recommendations. Of the eight 2009 goals, three were met, two were partially met, and three were not met. Of the eighteen recommendations, five were implemented, seven were partially or largely implemented, and six were not implemented.

Conclusions in the document include:

- Area-wide nitrate concentrations are high and trends continue to increase 15 years after adopting the plan. However, the rate of increases are less than in past years.
- Our current understanding is that, due in large part to the high percentage of agricultural land in the area, a large amount of the nitrate being added to groundwater is coming from irrigated agriculture. Additional research is needed to identify what specific actions are needed to result in a decreasing nitrate trend that will ultimately lead to area-wide concentrations below the 7 mg/L GWMA trigger level.
- The next action plan should incorporate methods to increase the documentation of BMP implementation, including fertilization application practices and irrigation practices. The next action plan should also encourage and support BMP research so that a comparison can be made between what is happening on the ground and what is ultimately recommended by the research.
- Because measureable progress has been made towards the action plan goal using the criteria set within the action plan, the voluntary nature will continue for now. Many of the nitrate contributors have made great strides in reducing the amount of nitrate being added to the groundwater. However, the high nitrate concentrations and increasing trends suggest more work is needed by everyone.

The evaluation report can be found at the following webpage:
http://www.deq.state.or.us/wq/groundwater/docs/lubgwma/EvalActionPlanSuccess.pdf

4.4. Southern Willamette Valley Groundwater Management Area (SWV GWMA)

Declaration of Groundwater Management Area

In 2000 and 2001, DEQ's statewide monitoring and assessment program revealed groundwater contaminants in 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, Oregon State University Extension and the Environmental Protection Agency 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 GWMA encompasses a 230 square mile area 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 the "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 2 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 regularly updated. More information is at: http://gwma.oregonstate.edu/.

Recent Collaborative Outreach and Education Efforts

Focus Groups: DEQ and the Lane Council of Governments surveyed two focus groups in 2013 and 2014; one for rural residents and the second for large agricultural producers. These focus groups were designed to gain an understanding of what knowledge/perceptions/barriers people may have regarding groundwater quality. Participants for both focus groups were selected based on their proximity to two small schools in Northern Benton County. Both of these schools have public water systems with nitrate levels either at or near 10 mg/L. The results of these focus groups will inform a social marketing approach developed to facilitate behavior change about groundwater protection.

Daffodil Festival: In 2013 the management area's Outreach and Education team hosted a booth at the Daffodil Festival in Junction City. Children created an edible aquifer, pollute it with their land use of choice (fertilizer, manure, pet waste and/or pesticides – in edible replicate form), added rain to the system, and then drill a well (straw) to learn how easy groundwater (and their drinking water) can be polluted.

OSU Extension Service Classes: OSU's Extension Service holds approximately 20 outreach events per year throughout the groundwater management area, including, but not limited to: rural living basic classes (teaching rural landowners how to maintain their wells and septic system); free nitrate screening of well water at multiple venues; living on the land series of classes; and classroom education in the GWMA's public schools using a curriculum developed by OSU Extension for the SWV GWMA. These activities have been funded by DEQ's 319 Clean Water Grant program.

Lane County High School Chemistry Class: One Lane County high school has honor chemistry students that regularly participate with DEQ laboratory staff to collect 'split samples'. This allows their students to develop their own understanding of groundwater contamination. The students take their samples to the school laboratory and run nitrate tests. Results of those tests are compared with DEQ laboratory results, providing the students a check on their analytical Quality Assurance/Quality Control.

Recent Collaborative Monitoring Efforts

Public and Private Water Supply Analysis: As a follow-up to a 2012 USDA study which detected pesticides in groundwater wells supplying two Corvallis-area schools, DEQ conducted a groundwater study in the surrounding area. DEQ decided to focus resources towards getting a better understanding of the extent and nature of pesticide contamination of the groundwater used for drinking water in vicinity of the two SWV GWMA public water supply wells. The study targeted locations in northern Benton County and northwest Linn County. DEQ conducted sampling of 33 domestic wells in October 2013, and shared the results with the homeowners by letter and public meeting in early 2014. In addition to pesticides, DEQ also tested for nitrate, sulfate, chloride, iron and manganese. Nine pesticides were detected at very low levels. The most frequently found pesticide was desethylatrazine, which was in 67% of the wells tested. The average nitrate concentration was 4.5 mg/L.

Long-term Monitoring: DEQ continues to collect samples from 25 monitoring wells installed in the southern Willamette Valley, as well as subset of the 17 domestic wells that have been part of the long-term monitoring program. Based on the long term data, some wells were removed from the routine data collections, and several others were reduced in frequency.

Surface Water - Groundwater Interaction: EPA has provided free stable isotopic analyses on surface and groundwater samples collected by DEQ's laboratory. This information should lead to better understanding of surface water influence on groundwater quality.

Lysimeter Project: In 2013, the Oregon Department of Agriculture (ODA) Fertilizer Fund Grant and an EPA RARE grant funded a lysimeter project. The project is managed by Environmental Protection Agency's Western Ecology Division, based in Corvallis (EPA), and Benton Soil and Water Conservation District (SWCD). Lysimeters can monitor water below the root zone of crops, which then can provide indications of potential impacts from various crops and management practices. Some lysimeters were installed almost 20 years ago and still have integrity; others were installed in early 2014 so that specific crops and fertilizer and irrigation practices are captured in this study. All lysimeters are in actively managed agricultural fields and all of the growers/owners have given their permission for this study. DEQ conducts the nitrate and phosphorous analyses. This partnership (farmers, DEQ, EPA, SWCD and ODA) is truly unique in the nation and speaks loudly for the farmer's appreciation of voluntary compliance and the collaborative process.

Willamette Partnership: The Willamette Partnership is a local organization focusing on restoration effectiveness. The Partnership is using nitrate data to create a framework for nutrient credits, based on the use of innovative management practices that protect groundwater quality.

4.5. 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 (onsite 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 onsite 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.

Collaborative Efforts

Baseline Groundwater Sampling: DEQ and Deschutes County Environmental Health Division staff conducted baseline groundwater 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 USGS published several reports and papers on research conducted during the demonstration project and can be found at the following web page. http://or.water.usgs.gov/proj/or186/index.html

Pollution Reduction Credit Program: In 2005, the 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 5 years
- Identifying disadvantaged community financing solutions
- Continuing outreach and community education
- Considering alternative "Green" solutions

More information about the South Deschutes/North Klamath Groundwater Protection Project and the report can be found at the following web page: http://www.deq.state.or.us/wq/onsite/sdesch-nklam.htm

4.6. 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 pesticide entering surface waters and groundwater. The Pesticide Stewardship Partnership (PSP) encourages local stakeholders to adopt best management practices in applying, storing, and disposing of agricultural chemicals; and provides opportunities for local citizens to safely discard unused agricultural chemicals.

The PSP 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, the Pesticide Stewardship Partnership (PSP) Program has focused on reducing pesticides in surface water. However, the improved agricultural practices implemented as part of the program can benefit groundwater as well. In response to the success of the PSP in selected watersheds, the 2013 Oregon Legislature allocated funds to the program for the first time to support existing watershed partnerships and expand the program. Part of the expansion plans include conducting some groundwater

monitoring in PSP watersheds. Future groundwater data will further inform collaborative actions and provide another measure of program effectiveness.

The state agencies involved in the PSP include DEQ, Oregon Health Authority, Oregon Department of Agriculture and Oregon Department of Forestry. Typical stakeholders involved include watershed councils, soil and water conservation districts, Oregon State University Extension Service, irrigation districts, tribal governments, agricultural chemical suppliers, and local citizens.

Collaborative Efforts

Groundwater Monitoring: PSP staff are coordinating with watershed stakeholders on identifying possible groundwater monitoring locations. These efforts are just beginning.

Agricultural Pesticide Waste Collection Events: These events have been funded as part of the PSP legislative allocation. Since July 2014, nearly 84,000 pounds of unwanted pesticides have been removed from Oregon watersheds as a result of these collection events. More events are planned for 2015.

Outreach and Education: DEQ and ODA participate in multiple watershed-based events each year to create awareness about the PSP Program and present monitoring data findings. This outreach helps identify priorities for collaborative actions to improve water quality. Local partners, most notably watershed councils and soil and water conservation districts, also conduct similar outreach efforts to expand awareness about the data.

Technical Assistance: The PSP 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 were distributed to organizations (through a grant program) that will implement technical assistance activities in PSP watersheds.

5. Future Direction

DEQ plans to implement the following activities to protect groundwater quality during the 2015-17 biennium:

- **Northern Malheur County Groundwater Management Area**: Continue to implement action plans and evaluate the performance or success of the management plans in reducing groundwater contamination.
- **Lower Umatilla Basin Groundwater Management Area**: Work with the GWMA Committee to prepare a new action plan with future goals and milestones. Also, continue regional groundwater monitoring networks in these two management areas.
- **Southern Willamette Valley Groundwater Management Area:** Update the action plan. Coordinate with the Southern Willamette Valley groundwater management area committee and implement activities to reduce area-wide groundwater contamination. Continue monitoring a subset of the 42 long-term wells in the Southern Willamette Valley area to determine groundwater trends. Also, using the results of the focus groups in the Southern Willamette Valley, determine how to best incorporate a social marketing program that engages the public to protect groundwater quality as part of their everyday life.
- Continue to work on the **South Deschutes/North Klamath Groundwater Protection Project**. Work with stakeholders and other agencies to implement recommendations of the Groundwater Protection Project Steering Committee, particularly; application with Deschutes County for a Goal 11 exception to allow multiple residence sewer systems and establishment of a long-term ground water monitoring program. In 2014 DEQ sampled monitoring wells for a variety of emerging contaminants including personal care products, pharmaceuticals, and pesticides in the area to guide scoping of the latter program.
- **Drinking Water Supply Protection Program**: Complete additional drinking water source water assessments as new systems come online and provide technical assistance to communities developing drinking water protection plans; expand statewide analyses and collaborate with other agencies to reduce risks of contamination to public water system wells.
- **Statewide Groundwater Monitoring Program:** Evaluate groundwater quality in the Rogue Basin and the Clatsop Plains in 2014; determine best two locations for similar sampling to occur in 2015.
- **Clean Water Act Section 319 Grant Program, Fertilizer Research Grant Program, and Clean Water State Revolving Fund Loan Program:** Continue funding and support of research, education and implementation of best management practices for groundwater protection, as resources allow.
- **Laboratory and Environmental Assessment Program:** Work on making analytical results available through a web-based data repository. Currently, data is available by request from the Laboratory. Historical data (prior to 2013) is available online through the Laboratory's web page.
- **Pesticide Stewardship Partnership Program**: The PSP's inter-agency team will develop groundwater monitoring plans for 2015-17 in early 2015.

Appendix 1 - Groundwater Quality Assessment Projects

Summary as of November 2014

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
Malheur	Northern Malheur County GWMA[III]	Ongoing	39	4	Nitrate, Pesticides	Nitrate, Dacthal	Agriculture	2014
Umatilla	Lower Umatilla Basin GWMA	Ongoing	33	4	Nitrate, Pesticides	Nitrate, EDB, Atrazine, Dacthal, Dicamba, Picloram	Agriculture, Onsite Septic Systems, Industry	2014
Willamette	Southern Willamette Valley GWMA	Ongoing	40	2	Nitrate, Pesticides	Nitrate, Pesticides	Agriculture, CAFOs, Onsite Septic Systems	2014
Willamette	Pesticide Monitoring - Southern Willamette Valley GWMA	1	33	2	Nitrate, Pesticides	Nitrate, Pesticides	Agriculture, CAFOs, Onsite Septic Systems	2013
Deschutes	Southern Deschutes/Northern Klamath County Groundwater Study	1	13	IV	Nitrate, Pesticides, pharmaceuticals, personal care products	IV	Onsite Septic Systems	2014

Groundwater Quality Protection in Oregon

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
Statewide	Drinking Water Source Monitoring	1	12	1	Pesticides/herbicides/ fungicides, pharmaceuticals, organics, metals, bacteria	Nitrate, VOCs, steroids/hormones,	Sewage treatment plants, agriculture, industry, urbanization, industry, naturally occurring	2012

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.

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

III. **GWMA** = Groundwater Management Area

IV. Pending analysis results

Appendix 2 - Oregon Groundwater Protection Programs and Responsibilities

AGENCY	GROUNDWATER PROTECTION RESPONSIBILITIES
Department of Environmental Quality	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.
	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.
	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.

Groundwater Quality Protection in Oregon

AGENCY	GROUNDWATER PROTECTION RESPONSIBILITIES
	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.
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
Oregon Department of Agriculture – Groundwater Research Grant			
2012-2016	Benton Soil and Water Conservation District	$51,464	Making the case for implementing groundwater protection through fertilizer management (includes EPA matching funds)
2014-2016	GSI Water Solutions, Inc.	$100,000	Independent review of the Lower Umatilla Basin groundwater management area monitoring program
Federal Clean Water Act 319 Grants			
2013	Groundwater Protection Education to Promote Public Involvement in the Southern Willamette Valley and Electronic Well Water and Groundwater Stewardship Education to Domestic Well Owners	$47,766	Ongoing work. This grant agreement provides funding for the continuation of a multi-year process providing education and outreach to areas of the Southern Willamette Valley with groundwater contaminated by nitrate. The primary focus for this work targets parts of three counties, including five cities and a large rural area with both residential and agricultural land uses. This is a heavily populated area and nearly everyone living in this Valley relies solely on the groundwater for their drinking water source. Funding of this Project is allowing the Recipient, a long-term partner in the SWV GWMA, to continue to employ the successful outreach methods that have been designed by the OSU Extension Service, including well water clinics, classes for residents/youth, and answering client questions via phone and e-mail. The Recipient focuses programming of these tools in the Southern Willamette Valley Groundwater Management Area to enable rural residents to assess, manage and protect their drinking water supply and in doing so, safeguard Oregon's groundwater resources. This Recipient is using educational curriculum (developed during project W09729) with school age youth to understand groundwater principles and how to protect precious water resources. An assessment tool will be used with youth to determine groundwater protection knowledge gained from curriculum. Recipient's staff will also coordinate existing citizen volunteers to assist with efforts to provide outreach to the general public in a grass root effort of educating community groups, including events such as the Kid's Day for

			Conservation and the Daffodil Festival. In addition, the Recipient will maintain and update two websites: the Well Water site (wellwater.oregonstate.edu); and the Groundwater site (groundwater.oregonstate.edu.) These two websites provide valuable and current information and are unique technical resources for the residents of Oregon.
2013	Examining the Voluntary Adoption of Water Quality Improving Best Management Practices (BMPs) by Agricultural Producers in Northern. Malheur County	Technical Assistance	Study found that producers primarily consider practical characteristics of practices when making adoption decisions. Some of these concerns include the relative advantage of the practice (financial, conservation, water quality benefits), the compatibility of a practice with existing farm operations, the ease of implementing a practice, and the ability to observe the success of a practice prior to adoption. These factors vary widely across individual farms because of the diversity in farming practices and heterogeneous operations. Producer age and lack of agency over decision making emerged as barriers to adoption. Recommendations for change include enhancing education and outreach materials to focus on the practicality of water quality improving practices and increased use of field trials in farmer's fields or OSU research and extension.
2014	Targeted education to address nitrate to Groundwater in the Rogue Basin	$24,000	This project's aim is to reduce nitrate inputs to groundwater in order to reduce the concentrations of nitrate in groundwater over time in impacted areas. Side benefits of this project are better land and water stewardship, increased environmental awareness, and protection of groundwater not yet impacted by elevated nitrate. Another benefit to addressing nitrate inputs to groundwater is that other contaminant inputs related to the nitrate sources (i.e. pesticides) will also likely be reduced due to increased awareness in the area.)
Clean Water State Revolving Fund Loans			
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.
2012	Farmers Irrigation District	$15,000,000	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.
2013	Three Sisters Irrigation District	$2,000,000	Design and construction of approximately 5.3 miles of HDPE 42-inch pipe to remove irrigation water from open canals.

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 Columbia	$400,000	Sewer improvements project, including upgrade of the RCE Pump Station, new telemetry, manhole lining and steel septic tank replacement or abandonment.
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.