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

Oregon law seeks to prevent contamination of groundwater resources, conserve and restore groundwater, and maintain the high quality of Oregon's groundwater resource for present and future uses. Groundwater makes up about 95 percent of available freshwater resources in Oregon. About 70 percent of all Oregon residents rely solely or in part on groundwater for drinking water. In rural Oregon, over 90 percent of residents rely on groundwater for drinking water. DEQ implements a groundwater protection program that includes monitoring, assessment, restoration and protection. DEQ also works with the Oregon Health Authority to implement a program designed to protect groundwater resources that supply source water for public water wells.

Oregon revised statute 468B.162(3) requires DEQ to prepare a biennial report to the Legislative Assembly. 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 includes an overview of program history from the late 1980s to the present. Program highlights for 2010-2012 are noted below.

In 2012, the DEQ Laboratory and Environmental Assessment Division sampled source water serving wells at six systems around the state. This was a continuation of a monitoring study focusing on "emerging contaminants" such as personal care products and pharmaceuticals. The results will help DEQ and OHA prioritize resources to prevent contamination of source waters used for public systems.

DEQ laboratory staff participated in two multi-agency efforts addressing local concerns about potential health and environmental concerns related to pesticide use. One project took place in northern Klamath County concerning use of the pesticide picloram. In Lane County, DEQ also participated in the Triangle Lake Forestry Pesticides Project, an inter-agency effort led by the Agency for Toxic Substances and Disease Registry, a division of the US Department of Health and Human Services, and OHA to determine whether pesticide residues can be found in drinking water, vegetation, garden produce, eggs, milk or soil.

DEQ designates groundwater management areas when groundwater in an area has elevated contaminant concentrations resulting, at least in part, from nonpoint sources such as farming, timber harvesting or other human activity on the landscape. During the past two years, DEQ continued its monitoring and technical assistance work in the state's three groundwater management areas: Northern Malheur County, Lower Umatilla Basin and Southern Willamette Valley. Recent data analysis in the northern Malheur County area indicated that nitrate concentrations in numerous wells was decreasing. Recent data analysis in the Lower Umatilla Basin area indicates that nitrate concentrations aren't decreasing. DEQ monitors 25 monitoring wells DEQ installed in the southern Willamette Valley area, as well as 17 domestic wells that are part of the long-term monitoring program. DEQ continues to monitor groundwater quality and work with interested parties to update and implement action plans that address groundwater quality concerns in these areas. The action plans, developed by DEQ and a local groundwater management committee, may include recommendations related to agriculture, residential, commercial/industrial/municipal, and public water systems to reduce nitrate contributions and prevent further groundwater contamination.

DEQ continues to work with local groups on the South Deschutes/North Klamath Groundwater Protection Project (formerly known as the LaPine National Demonstration Project), to identify and implement measures to protect groundwater quality. DEQ and a steering committee comprised of local citizens has been meeting every month for over two years and is now drafting final recommendations to address nitrate contamination from traditional onsite septic wastewater treatment systems and how groundwater can be protected.

Groundwater Quality Protection in Oregon

DEQ and Oregon Department of Agriculture fund groundwater projects through various grant and loan programs. For example, in 2011 DEQ awarded Clean Water Act "Section 319" grants to promote community involvement in groundwater protection in Umatilla County and the southern Willamette Valley. Since 2008, DEQ has provided a total of $29.5 million through Clean Water State Revolving Fund loans to public agencies to address groundwater protection projects such as installing sanitary sewer collection systems to replace failing onsite disposal systems and decommissioning or modifying stormwater dry wells with green infrastructure facilities.

Introduction

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 protection in Oregon. However, because of limited budget resources and other water quality priorities, DEQ's groundwater quality protection efforts have decreased significantly in the past two decades and are fragmented among multiple programs administered out of multiple offices. In the early 1990s, DEQ had 12 staff dedicated to its groundwater program, and by the early 2000s program staff had been reduced to five. DEQ does not have the resources to provide a coordinated groundwater quality protection program or to provide continuing groundwater monitoring and assessment. With this level of staffing, DEQ's groundwater program consists of technical assistance, minimal statewide coordination, and implementation of groundwater monitoring and restoration activities in the three groundwater management areas. DEQ uses a combination of water quality and land quality programs to help prevent groundwater contamination from point and non-point sources of pollution, to clean up pollution sources, and to monitor and assess groundwater and drinking water quality. These programs include the Water Pollution Control Facilities and National Pollutant Discharge Elimination System permitting, Onsite Wastewater Treatment, Drinking Water Source Water Assessment and Protection, Underground Injection Control, Solid and Hazardous Waste Management, Resource Conservation and Recovery Act, Underground Storage Tank, and Environmental Cleanup.

Based on limited resources dedicated to the groundwater protection program over the past 20 years, DEQ strives to work with other state agencies that also address groundwater activities. DEQ implements some programs though partnerships with the Oregon Health Authority, Oregon Water Resources Department, Oregon Department of Agriculture, Oregon Department of Geology and Mineral Industries, Oregon State University, and other state, local and private organizations, businesses and individuals.

Groundwater's importance

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.
    - About 70 percent of all Oregon residents rely solely or in part on groundwater for drinking water.
    - Over 90 percent of rural Oregonians rely on groundwater for drinking water.
    - An estimated 230,000 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.

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

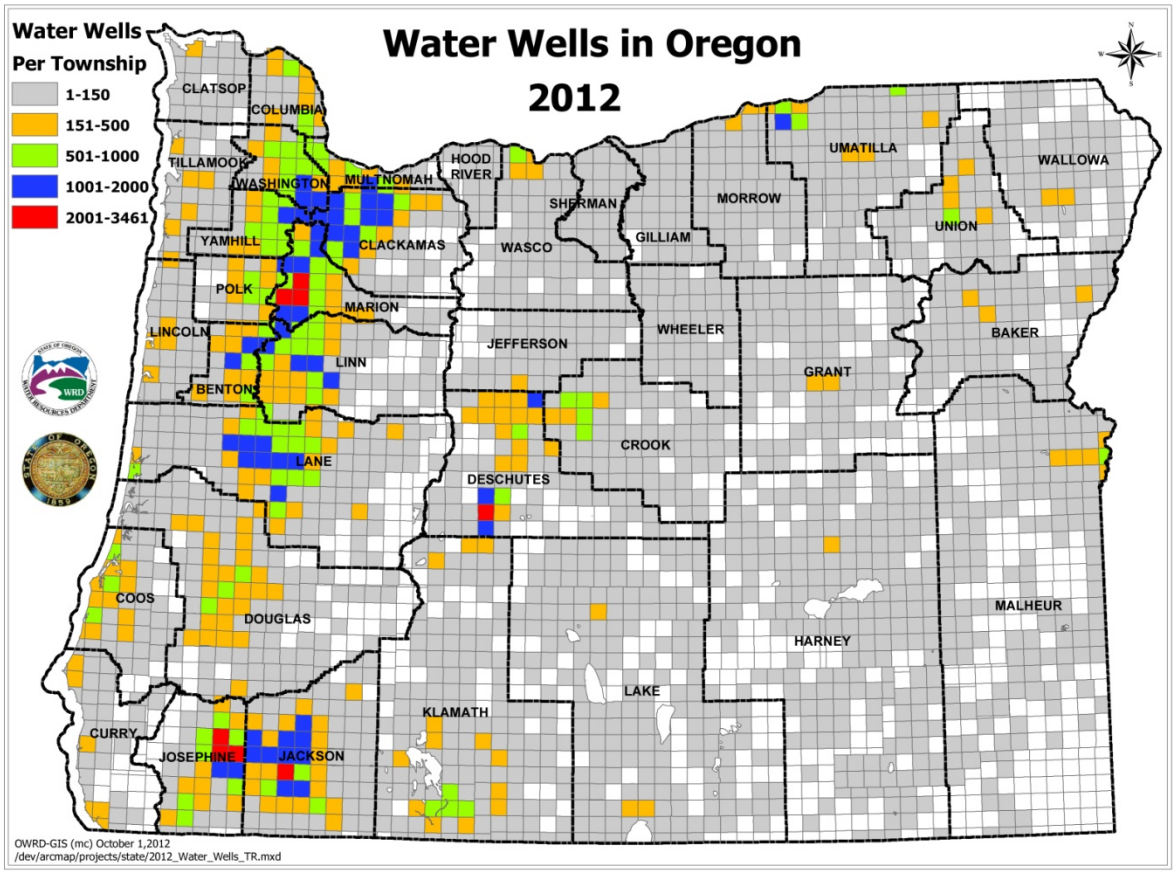
Groundwater Quality Protection in Oregon

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:

- Groundwater assessment and monitoring activities in Oregon
- Groundwater restoration activities in three groundwater management areas
- Groundwater protection activities by DEQ and other agencies
- Funding for groundwater quality projects in Oregon
- Future directions for groundwater quality protection

Figure 1. Distribution of water wells in Oregon



Groundwater Assessment in Oregon

DEQ's Groundwater Monitoring and Assessment Program

Groundwater Management Area Assessments

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. Since DEQ does not have the resources to conduct a statewide groundwater assessment and monitoring program, it conducts monitoring only within the three existing groundwater management areas – Northern Malheur County, Lower Umatilla Basin and Southern Willamette Valley. Specific monitoring and assessment requirements of the act identify:

- 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 continues to collect samples and perform analysis for the state's three groundwater management areas (**Appendix 1**). The areas are routinely sampled several times a year to track nitrate levels in the groundwater. Generally, each summer, DEQ laboratory staff collects an additional suite of analytes from the Lower Umatilla Basin and Northern Malheur County groundwater management areas for pesticide analysis by the ODA laboratory. This pesticide sampling and analysis was completed in the summer of 2011 but ODA hasn't yet reported results. The Lower Umatilla Basin Groundwater Management Area was not sampled for pesticides in 2012. The Northern Malheur County Groundwater Management Area was sampled for pesticides in August 2012 for analysis by the DEQ laboratory. This report discusses the three groundwater management areas in more detail later on.

Past Groundwater Assessments

Between 1980 and 2000, DEQ conducted 45 groundwater quality assessments. These assessments covered about 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 provide a general rating of the overall quality of the groundwater resource available in Oregon for use as drinking water. The data show nitrate is the most commonly detected contaminant, followed by pesticides, volatile organic compounds and bacteria. DEQ evaluates impairment by comparing levels of detected contaminants to the federal drinking water standards. However, many organic chemicals, pesticides and herbicides don't have drinking water standards and the detection of any level of these contaminants in groundwater indicates a potential concern. In 35 of the 45 studies completed, results show some impairment or reason for 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, can be the basis for declaring a groundwater management area.

Drinking Water Source Monitoring

DEQ and OHA jointly implement a program designed to protect distinct areas that supply public water wells. As part of this program, DEQ's laboratory division sampled source water serving wells at seven public water systems around the state in spring 2008 and at another eight systems in 2010. Six additional systems were tested in 2012 and these results are pending. 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, domestic wastewater, new synthetic chemical compounds, strong microbial pathogens, and pharmaceuticals. Many of the parameters analyzed don't have federal drinking water standards and are not addressed in the Safe Drinking Water Act. The data shows low levels for many of these "emerging contaminants," although DEQ and OHA did not find contaminants in either of the sampling projects at levels of public health concern. Results from this study provide state agencies with information on where to focus resources for preventing contamination of source waters used for public systems.

Other Groundwater Activities

DEQ sampled the Rogue Basin in southwest Oregon for groundwater contaminants in July 2011. Fifty two domestic wells were sampled for nitrate, fluoride, boron and arsenic analysis. Arsenic, boron and fluoride come from natural sources. Nitrate contamination can be from human activities such as farming and sewage disposal. Forty-seven percent of wells sampled in Jackson County have elevated nitrate concentrations (>3 mg/L) and 8 percent have concentrations above the drinking water standard of 10 mg/L. Only 6 percent of wells sampled in Josephine County had elevated nitrate concentrations in this study. The combined results from Jackson and Josephine counties (35 percent of wells with elevated nitrate) are similar to results from studies conducted by the U.S. Geological Survey in the 1970s (31 percent) and by DEQ in the 1990s (33 percent), indicating that the distribution of nitrate in groundwater in the basin may have slightly increased over the years. Arsenic was detected in 19 out of the 52 wells tested (17 percent). Three wells had arsenic levels above the drinking water standard of 10 parts per billion. This is significant since arsenic is considered a carcinogen and a safe concentration for consumption has not been determined. Fluoride was detected in many of the wells but most wells had very low, barely detectable levels. Elevated boron levels were detected in only two wells in the study area.

In Lane County, residents of the Triangle Lake/Highway 36 area raised concerns about the health effects of aerial and manual applications of herbicides on coastal mountain forest lands. DEQ laboratory staff assisted EPA staff to sample drinking water, vegetation, garden produce, eggs, milk and soil as part of the Triangle Lake Forestry Pesticides Project, an inter-agency effort in Lane County led by the Agency for Toxic Substances and Disease Registry (a division of the US Department of Health and Human Services) and the OHA. The DEQ laboratory analyzed drinking water samples for pesticide contamination. Drinking water sources included wells and springs.

Another inter-agency effort involved sampling in northern Klamath County for the pesticide picloram. In response to local residents' concerns about pesticide use, 57 domestic wells were sampled by staff from DEQ, ODA and Klamath County. The wells were sampled for picloram, other pesticides and nitrates. DEQ's laboratory conducted pesticide analysis and found picloram in seven wells, with all recorded levels well within the state drinking water standard. DEQ did not find evidence of other pesticides in the samples. The tests also found nitrates in all the private wells with 27 above background levels of 1.0 mg/l, and one private well that was above the state's drinking water standard for nitrates of 10.0 mg/l. With the exception of the one well with nitrates over 10 mg/L, OHA concluded that the private well water is safe for drinking and all other domestic purposes.

Other Groundwater Monitoring and Assessment Activities

Private drinking water supply wells are not routinely tested by DEQ for water quality, although state law requires testing at the time of a real estate transaction. A homeowner selling a property with a drinking water well must test the water for nitrate and total coliform bacteria. The 2009 Oregon Legislature

amended a state law (ORS 448.271(1)) that requires a property owner to also test the well water for arsenic. The seller must submit the test results within 90 days to the real estate buyer and the OHA Drinking Water Program after the seller receives test results. Between 1989 and 2003, homeowners performed 24,633 nitrate tests. These data are not routinely evaluated due to a lack of resources. However, in 2004, DEQ obtained an EPA grant to create a database and summarize the real estate transaction data received through December 2003. These data provided a broad overview of groundwater quality in the state. Most of the domestic well tests (82 percent) show nitrate levels below 2 mg/L and reflect background groundwater quality. About 14 percent of the tests showed nitrate levels above background groundwater quality and about 1.7 percent of the wells tested were not within satisfactory levels (the federal drinking water standard of 10 mg/L).

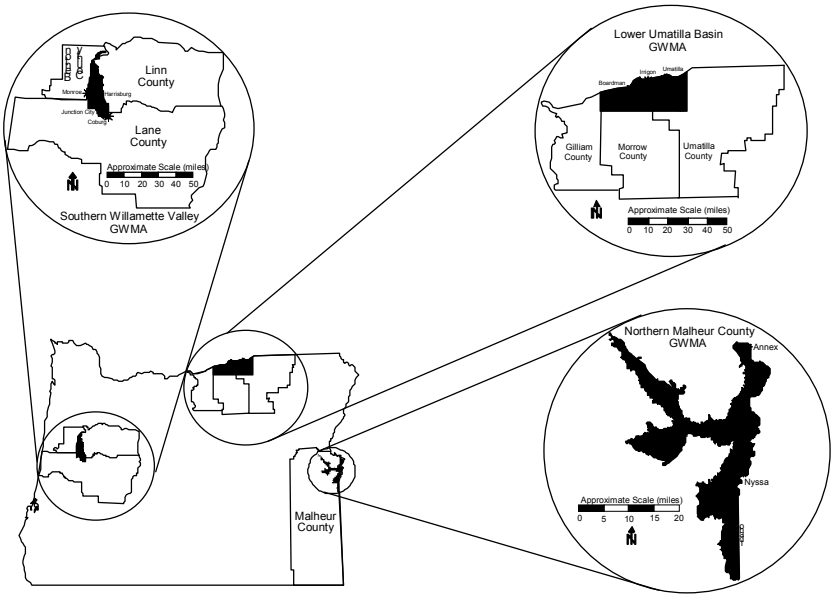
Groundwater Restoration in Oregon

Groundwater Management Areas

DEQ used data from past groundwater assessments to identify localized or area-wide groundwater contamination problems. If area-wide contamination is found at consistently high enough levels, an area shall be declared a groundwater management area under Oregon law.[1] When this situation occurs, the Groundwater Quality Protection Act requires the establishment of 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.

Oregon currently has three groundwater management areas (Figure 2) including Northern Malheur County, Lower Umatilla Basin, and Southern Willamette Valley. All three areas were so designated for widespread nitrate contamination. 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. There are other health risks also linked to high levels of nitrate in drinking water. DEQ is currently assisting with implementation of the management area action plans, which include maintaining groundwater quality monitoring networks, reviewing existing data to assess groundwater quality trends, and supporting local efforts to implement best management practices to maintain and restore groundwater quality.

Figure 2. Location of Oregon's Groundwater Management Areas



[1] ORS 468B.180. The Department of Environmental Quality shall declare a groundwater management area if, as a result of information provided to the department or from its statewide monitoring and assessment activities under ORS 468B.190, the department confirms that, as a result of suspected nonpoint source activities, there is present in the groundwater:
(a) Nitrate contaminants at levels greater than 70 percent of the levels established pursuant to ORS 468B.165; or
(b) Any other contaminants at levels greater than 50 percent of the levels established pursuant to ORS 468B.165.

Northern Malheur County Groundwater Management Area

The Northern Malheur County groundwater management area was declared in 1989 after DEQ identified significant groundwater contamination in the county's northeastern portion. ORS 468B.180 requires DEQ declare a GWMA if nitrate concentrations exceed the maximum measureable level of 7 mg/L. 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.

The Northern Malheur Action Plan, dated December 1991, includes recommendations that allow farmers to customize best management practices to their farm's needs. 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.

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.

DEQ currently samples a network of about 40 wells every other month 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 2010 using 18 years of data since implementation of the action plan (1991 through 2009). The analysis indicated that the area-wide nitrate trend was slightly decreasing. Individual wells showed a mix of decreasing (58 percent), increasing (22 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 2013 to determine if area-wide nitrate concentrations continue to decrease.

Lower Umatilla Basin 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. Groundwater samples from private wells identified nitrate contamination above the 10 mg/L drinking water standard in 33 percent of samples. 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

The Lower Umatilla Basin Committee finalized the LUB 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.

Similar to its efforts in northern Malheur County, DEQ samples a network of about 30 wells every other month 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. Implementation of the Lower Umatilla Basin action plan also includes community outreach and education efforts highlighting groundwater quality concerns and solutions.

From September 2009 to January 2010, the DEQ laboratory collected samples at domestic and monitoring wells in this groundwater management area to improve understanding of groundwater quality by local stakeholders and DEQ hydrogeologists. Wells previously sampled during prior synoptic events were revisited and sampled to enhance the nitrate dataset. The data showed that 63 sites (58 percent of wells sampled) exceeded the nitrate action level (7 mg/L) for declaring a groundwater management area. Forty-nine sites (45 percent of wells sampled) were over the drinking water standard for nitrate (10 mg/L). An analysis of nitrate concentrations indicates that nitrate concentrations in the area are increasing, which could adversely affect groundwater quality.

To evaluate the Lower Umatilla Basin's action plan measure of success calling for decreasing nitrate concentrations throughout the management area by the end of 2009, DEQ assessed nitrate concentrations from about 650 wells and calculated nitrate trends at 201 of these wells. Results indicated nitrate concentrations exceeded the 7 mg/l groundwater management area trigger level in at least 40 percent of the wells.[2] The area-wide trend (calculated using the 31-well network designed for the project) continues to increase, although at a slower and slower rate. Half of 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.[3] Although not a calculated trend, a comparison of nitrate concentrations at 98 wells tested in 1992 and 2009 showed 54 percent increased, 24 percent decreased, and 22 percent did not change. The primary conclusion of the assessment is that nitrate concentrations didn't 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

The basin area's current action plan contains milestones and goals through December 2009. The Lower Umatilla Basin groundwater management area committee is in the process of completing the "Third Four-Year Evaluation of Action Plan Success" and beginning to prepare a new action plan with milestones and future goals.

Perchlorate in the Lower Umatilla Basin Groundwater Management Area

Perchlorate is a chemical contaminant found nationwide at low levels in the environment. It can occur through human activity but also occurs naturally. Currently there is no federal or Oregon drinking water

[2] The percentage of wells exceeding 7 mg/l is 64% if data from the real estate transaction database are not included. These data may be skewed low because the aquifer tapped by these wells is unknown, and some people sample treated water rather than untreated water.
[3] 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.

standard for perchlorate. EPA has adopted a reference dose that translates to 24.5 parts per billion, if all exposure comes through drinking water.

Perchlorate was detected near military facilities in the Lower Umatilla Basin in 2001 and 2003. DEQ, EPA, the U.S. Navy and private companies have conducted multiple, subsequent sampling events. Concentrations were generally low and don't appear to represent a single contaminant plume. In late 2009 and early 2010, DEQ sampled again. Data indicated wells that showed the largest perchlorate increases also showed increased nitrate concentrations. The wells showing the largest perchlorate decreases also showed decreased nitrate concentrations.

DEQ has not yet determined the full geographic extent of perchlorate in groundwater although it is clear that it occurs at low levels over a wide area. The source(s) of perchlorate in the Lower Umatilla Basin remains unknown and additional research is needed to identify specific source(s). It is possible that both naturally occurring and manufactured sources of perchlorate are contributors. Beginning in 2013, DEQ plans to add perchlorate to the analyte list for all four sampling events conducted in this groundwater management area each year. Barring future budget constraints, perchlorate is expected to remain on the analyte list for future sampling events.

Southern Willamette Valley Groundwater Management Area

Over the past 20 years, many studies and sampling programs, conducted by DEQ, US Geological Survey, Oregon State University Extension and the Environmental Protection Agency have focused on groundwater quality in the southern Willamette Valley. 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.

More than 20 percent of 476 wells sampled by DEQ in 2000 and 2001 had nitrate concentrations exceeding 7 mg/L nitrate-N. The highest level detected within the study area was 23 mg/l. In 2002, DEQ resampled those wells that tested greater than 7 mg/L during the 2000-2001 study. In addition to the nitrate analyses, DEQ included testing for pesticides, bacteria and a variety of other geochemical parameters and potential contaminants. Nitrate was confirmed at levels significantly above 7 mg/L, with a maximum value of 28 mg/L. The nitrate data from this and previous groundwater studies in the area document a regional groundwater quality concern. The pesticide data did not provide adequate information to characterize the entire study area. However, results were sufficient to conclude that pesticides are present although they are below any health advisory standard and below 30 percent of any applicable standard.

On May 10, 2004, DEQ declared a groundwater management area for portions of the southern Willamette Valley (Figure 3). DEQ was designated the "lead agency" and a groundwater management area committee formed to develop an action plan to address solutions. The committee met regularly and worked with many stakeholders for almost 20 months to produce a draft action plan. The committee approved a final plan at its Nov. 9, 2006 meeting. The voluntary action plan provides 60 recommendations related to agriculture, residential, commercial/industrial/municipal and public water system use to reduce nitrate contributions and prevent further groundwater contamination.

The plan's agriculture section was the focus of efforts by the southern Willamette Valley growers, Oregon Department of Agriculture, the local soil and water conservation district Oregon State University Extension Service and DEQ. Between 2011 and 2012 a final revised chapter for the plan was produced; it will become part of the revised action plan (expected to be completed in 2013).

Groundwater Quality Protection in Oregon

In 2012, the Benton Soil and Water Conservation District and EPA's Western Ecology Division, based in Corvallis, secured two grants that allowed partners working on the southern Willamette Valley's groundwater management plan to collaborate on evaluation of fertilizer management practices that translate to groundwater quality improvements. The Willamette Partnership, a local organization focusing on restoration effectiveness, will contribute to this work by developing a groundwater protection module for a nutrient tracking/trading project.

DEQ and the Lane Council of Governments are preparing to conduct focus groups with the neighbors of 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 nitrate-N. These focus groups, to be held in early 2013, will help determine how to incorporate groundwater protection into the daily life of those residents. A social marketing approach will then be developed to facilitate neighborhood behavior change about groundwater protection.

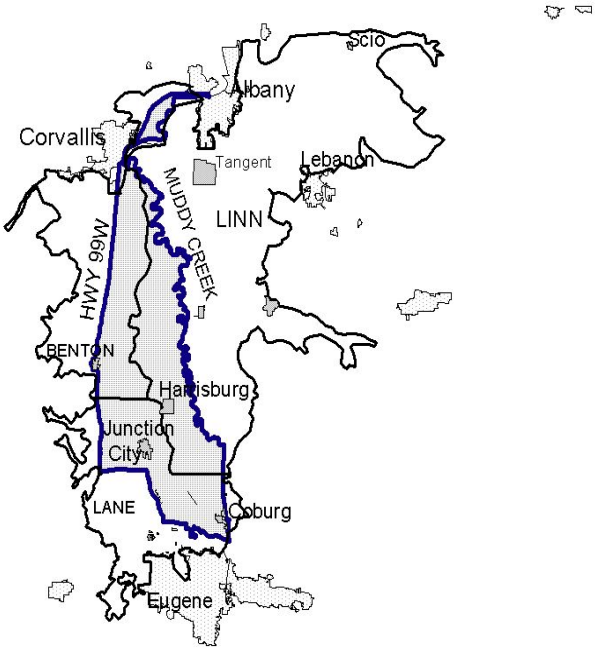
Education and outreach continue to be key components of the management area's action plan. In 2011 and 2012, the management area's booth was well-received at the *Kids Day for Conservation* event in Corvallis. Each year more than 500 children created an edible aquifer, polluted it with their land use of choice (fertilizer, manure, pet waste and/or pesticides – in edible replicate form), added rain to the system, and then drilled a well (straw) to learn how easy groundwater (and their drinking water) can be polluted. OSU's Extension Service holds similar events throughout the groundwater management area, such as at the Daffodil Festival in Junction City, as well as rural living basic classes, which teach rural landowners how to maintain their wells and septic systems. Free nitrate screening of well water is always offered at these events and continues to be a big draw.

DEQ's laboratory collected samples from 42 domestic and monitoring wells in the area on a quarterly basis from September 2009 to November 2012. Results from the domestic well samples are mailed to the owners and, when applicable, occupants as well. Recently, students from a Lane County high school participated with DEQ laboratory staff to collect 'split samples' to allow the students to build 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 to allow students to check on their analytical Quality Assurance/Quality Control.

DEQ continues to monitor the 25 monitoring wells it installed in the southern Willamette Valley, as well as the 17 domestic wells that are a part of the long-term monitoring program. The 2009 "synoptic event" (including one-time sampling of just over 100 additional wells) brought new understanding to the depth of nitrate impacts in some areas of the groundwater management area. DEQ has added a few wells to the long-term monitoring program in order to better assess this concern. In addition, EPA has volunteered to run 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 results.

Finally, the management area's committee continues to meet several times a year to address and assess issues. These meetings draw extensive public interest, and attendance alone demonstrates that the groundwater protection theme resonates with many of the valley's residents. More information is at: http://gwma.oregonstate.edu/.

Figure 3. Southern Willamette Valley Groundwater Management Area



Groundwater Protection in Oregon

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's 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.

Appendix 2 summarizes the state's various groundwater protection programs and identifies the primary responsible agency. A few of projects and programs are highlighted here.

La Pine National Demonstration Project

The La Pine area of central Oregon is a rural residential area that is experiencing rapid development and population growth. In the 1960s, large tracts of land were subdivided into 15,000 lots as small as one-half acre. The primary source of drinking water for the area's 12,000 residents is shallow groundwater tapped by more than 4,000 individual domestic wells that are typically less than 50 feet deep. In addition, there are about 100 community public water system wells serving small-scale subdivisions, schools and businesses in the region. Most homes in the area use individual onsite wastewater treatment systems (onsite septic systems). The porous and permeable pumice soils, shallow groundwater table and relatively high development densities in the region created a threat to shallow groundwater.

Groundwater assessments 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. The Deschutes and Little Deschutes Rivers, both listed as water-quality limited streams by DEQ, flow through the region and potentially receive discharge from the shallow aquifer. In the mid-1990s, Deschutes County and DEQ assessed the potential impact of residential development in the La Pine region on groundwater quality. Preliminary studies and two-dimensional groundwater modeling at that time 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.

In 1999, the U.S. Congress 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 objective of the study was to protect the La Pine area groundwater quality because it is the region's sole source of drinking water. The study evaluated innovative nitrogen-reducing onsite septic system technologies, and developed and used a three-dimensional groundwater flow and contaminant transport model to determine a comprehensive groundwater protection strategy.

The local study included elements to:

- Install and monitor (system effluent and monitoring well samples) up to 50 innovative nitrogen reducing systems
- Initiate a septic system maintenance program

- Conduct three-dimensional groundwater flow modeling and nitrogen contaminant fate and transport modeling and assess optimum lot density and treatment standards based on model results
- Establish a low-interest loan fund for septic system repair or replacement

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 continued in 2001 and 2002. Results show 10 percent of the wells sampled had nitrate concentrations above background levels of nitrate. 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.

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 don't 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. Some data was collected to evaluate groundwater and surface water interaction along the Deschutes and Little Deschutes Rivers within the study area, although a full evaluation was beyond this project's scope. The USGS published several reports and papers on research conducted during the demonstration project:

- Hinkle SR, Weick RJ, Johnson JM, Cahill JD, Smith SG, Rich BJ, 2005. *Organic Wastewater Compounds, Pharmaceuticals, and Coliphage in Ground Water Receiving Discharge from Onsite Wastewater Treatment Systems near La Pine, Oregon: Occurrence and Implications for Transport.* U.S. Geological Survey Scientific Investigations Report 05-5055, 98 p.
- Hinkle SR, Bohlke, JK, Fisher, LH, 2008. *Mass balance and isotope effects during nitrogen transport through septic tank systems with packed-bed (sand) filters*. Sci Total Environ, doi:10.1016/j.scitotenv.2008.08.036
- Hinkle SR, Bohlke, JK, Duff, JH, Morgan DS, Weick RJ, 2007. *Aquifer-scale controls on the distribution of nitrate and ammonium in ground water near La Pine, Oregon, USA.* Journal of Hydrology, 333, 486-503.
- Hinkle, S.R., Morgan, D.S., Orzol, LL, and Polette, DJ. *Ground water redox zonation near La Pine, Oregon – Relation to River Position within the Aquifer-Riparian Zone Continuum.* U.S. Geological Survey Scientific Investigations Report 2007-5239, 30 p.
- Morgan, DS, Hinkle, SR, and Weick, RJ, 2007. *Evaluation of approaches for managing nitrate loading from on-site wastewater systems near La Pine, Oregon.* U.S. Geological Survey Scientific Investigations Report 2007-5237, 66 p.
- Williams, JS, Morgan, DS, and Hinkle, SR. *Questions and Answers about the Effects of Septic Systems on Waste Quality in the La Pine Area, Oregon.* U.S. Geological Survey Fact Sheet 2007-3103, 6 p.

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 onsite wastewater treatment systems that provide increased protection for groundwater quality. The Deschutes Board of County Commissioners adopted the new code on July 23, 2008, and it went into effect Oct. 23, 2008; however, opponents of the code submitted a petition to refer the code to a county-wide vote. In a special election on March 10, 2009, county voters overturned the local ordinance.

As result of the vote, in July 2009 Deschutes County Commissioners asked DEQ to lead efforts to resolve the issue. At a July 2009 meeting, the public raised many questions about how to best approach the issue and decried a lack of an effective public process. Many questions and comments made at the meeting touched on a variety of issues and, depending on the questions, different agencies in attendance responded. DEQ decided the first step in moving forward was to address concerns for 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 has been meeting for more than two years and is drafting final recommendations. The project is now known as the South Deschutes/North Klamath Groundwater Protection Project and information can be found at the following web page:
http://www.deq.state.or.us/wq/onsite/sdesch-nklam.htm

Source Water Assessments and Drinking Water Protection Programs

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 implement this program in Oregon. Between 2000 and 2005, DEQ and OHA assessed 2,460 public water systems using groundwater sources. 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.

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.

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 to communities as they develop and implement strategies to protect their local public drinking water sources.

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, ODA, 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 statewide 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. Drinking water source areas can also be identified (and selected as a search criteria) for both DEQ's Facility Profiler (a location-based system showing DEQ permit holders and cleanup sites) and LASAR (DEQ's database for storing and retrieving air and water quality monitoring data).

Contaminant source inventories in the delineated wellhead protection 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 under "technical assistance" on DEQ's Drinking Water Program webpage). 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.

In 2010, DEQ initiated a technical analysis for groundwater nitrate and toxic chemicals detected in public water systems. The project includes a soil nitrate sensitivity analysis involving eight to 10 public water systems with high nitrate levels, and research for technical information on nitrate sources. The nitrate data for each well was statistically analyzed and plans will be developed to reduce the loading within the two- and five-year times of travel to the individual wells. DEQ posted a final report and action plan on its website in spring 2011.

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 only on public water system groundwater protection issues.

Other Groundwater Protection Efforts

DEQ administers several programs that contribute to groundwater protection through implementation of regulations, standards and permitting activities. These programs include underground storage tanks, solid waste landfills, remediation sites, underground injection control systems, onsite wastewater treatment systems, and permitting of industrial, municipal and domestic wastewater treatment facilities that discharge wastewater to land. DEQ's laboratory provides sampling and logistical support for DEQ's underground storage tank program, and sampling support has also been provided by DEQ's solid waste program through split sampling events at 26 landfills statewide.

The underground storage tank program helps protect groundwater by managing issues related to regulated tank registration, testing and compliance and cleanup of releases from leaking petroleum tanks including releases from home heating oil tanks. Compliance and prevention requires tank registration and specifies technical requirements for new and existing UST systems. Service provider and supervisor licensing requires companies (service providers) and individuals (supervisors) to obtain a license before

performing UST work. Cleanup activities within this program require the timely reporting of petroleum releases, and the investigation and remediation of soil and groundwater contamination resulting from leaks and spills of petroleum products. To date, Oregon has decommissioned more than 26,000 USTs, with about 5,200 operating under permits.

DEQ's solid waste program permits several different types of solid waste disposal facilities including municipal solid waste landfills, petroleum-contaminated remediation facilities and compost operations. These permitting activities help protect groundwater resources by requiring liners and adherence to other standards to control liquids leaching from these facilities.

The agency's site response 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.

DEQ administers and implements Oregon's Underground Injection Control program through delegation from EPA. The UIC program is charged with protecting groundwater through approval and permitting of drywells, sumps and other injection systems that discharge a variety of residential, commercial and industrial fluids below the ground. DEQ requires injection systems to be designed, installed, maintained and, in many cases, monitored so they're protective of groundwater resources. Federal regulation requires DEQ to update its inventory of all injection wells and report them to EPA. In Oregon, the majority of injection systems are associated with stormwater discharge and industrial process/wastewater. Oregon has more than 43,000 injection systems recorded in DEQ's UIC database. Most injection systems receive stormwater flow from streets, parking lots and areas associated with commercial and industrial sites. The 2007 Legislature approved new fees under House Bill 2118 to fund new program positions (staffing total of 5.5 full time equivalents). However, due to the economic downturn and lack of housing development that began in 2008, program revenue has been inadequate to cover costs of three FTE, which were subsequently lost due to budget cuts. DEQ is currently administering the program with two FTE.

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.

DEQ regulates domestic, municipal and industrial wastewater and stormwater discharge activities (such as lagoons and land application systems) to protect groundwater resources through the use of Water Pollution Control Facility and National Pollutant Discharge Elimination System permits. The wastewater permitting program regulates thousands of industrial, municipal and domestic wastewater treatment facilities in Oregon. Municipal and domestic facilities generally collect and treat sewage from residences and commercial facilities, while industrial facilities treat manufacturing and processing wastewater they generate.

Funding Groundwater Quality Projects in Oregon

The 1989 Groundwater Protection Act authorized DEQ to fund research and development projects related to groundwater quality, particularly in groundwater management areas. However, the act dedicated no funding source for this purpose. 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 administers the grant fund. In previous biennia, the grant fund was used for research projects in the first two declared groundwater management areas (Northerm 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.

DEQ has allocated federal grants available through Clean Water Act Section 319 to groundwater projects in limited areas. Funding as low-interest loans to public agencies is also available through the Clean Water State Revolving Fund. A summary of groundwater- related projects funded by DEQ and ODA from 2010 through 2012 is included in **Appendix 3**.

Future Direction

DEQ plans to implement the following activities to protect groundwater quality during the 2013-15 biennium:

- Continue to implement the Lower Umatilla Basin and Northern Malheur County groundwater management area action plans and evaluate the performance or success of the management plans in reducing groundwater contamination. Work with the Lower Umatilla Basin Groundwater Management Area Committee to prepare a new action plan with future goals and milestones. Also, continue regional groundwater monitoring networks in these two management areas.
- Update the Southern Willamette Valley groundwater management area action plan. Coordinate with the Southern Willamette Valley groundwater management area committee and implement activities to reduce area-wide groundwater contamination.
- Continue monitoring 42 wells in the Southern Willamette Valley area to determine groundwater trends.
- Conduct focus groups to determine how to best incorporate groundwater protection into the daily life of residents living within the Southern Willamette Valley groundwater management area.
- Continue to work on the South Deschutes/North Klamath Groundwater Protection Project.
- 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.
- Continue funding and support of research, education and implementation of best management practices for groundwater protection, as funding allows.

Appendix 1 - Groundwater Quality Assessment Projects

Summary as of November 2012

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	2012
Umatilla	Lower Umatilla Basin GWMA	Ongoing	32 (198 synoptic)	4	Nitrate, Pesticides	Nitrate, EDB, Atrazine, Dacthal, Dicamba, Picloram	Agriculture, Onsite Septic Systems, Industry	2012
Willamette	Southern Willamette Valley GWMA	Ongoing	42 (105 synoptic)	2	Nitrate, Pesticides	Nitrate, Pesticides	Agriculture, CAFOs, Onsite Septic Systems	2012
Umpqua	Sutherlin Arsenic Study	2	114	3	Nitrate, Arsenic	Arsenic	Naturally occurring	2008
Rogue	Rogue Basin Groundwater Study	1	52	1	Nitrate, Arsenic, Fluoride, Boron	Nitrate, Arsenic, Fluoride, Boron	Agriculture, onsite septic systems, naturally occurring	2011
Mid-Coast	Triangle Lake Forestry Pesticides Project	1	38	2	Pesticides	Fluridone, Hexazinone, N,N-Diethyl-meta-toluamide (DEET),	Forestry	2011
Deschutes	Northern Klamath County Groundwater Study	1	57	2	Pesticides	Picloram	Roadside application	2012
Statewide	Drinking	3	22	1	Pesticides/herbicides/	Nitrate, VOCs,	Sewage treatment	2010/2012

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
	Water Source Monitoring				fungicides, pharmaceuticals, organics, metals, bacteria	steroids/hormones,	plants, agriculture, industry, urbanization, industry, naturally occurring	

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

Appendix 2 - Oregon Groundwater Protection Programs and Responsibilities

AGENCY	GROUNDWATER PROTECTION RESPONSIBILITIES
Department of Environmental Quality (**Due to lack of resources and staff, DEQ no longer, wholly or in part, performs these responsibilities.)	**Coordinates interagency management of groundwater to achieve state goal to prevent groundwater contamination.
	**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.

Groundwater Quality Protection in Oregon

AGENCY	GROUNDWATER PROTECTION RESPONSIBILITIES
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.
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.

AGENCY	GROUNDWATER PROTECTION RESPONSIBILITIES
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			
2012-2015	Benton Soil and Water Conservation District	$51,464	Making the case for implementing groundwater protection through fertilizer management
2012-2013	GSI Water Solutions, Inc.	$50,000	Independent review of the Lower Umatilla Basin groundwater management area monitoring program
Federal Clean Water Act 319 Grants			
2011-2012	Preserving Umatilla's natural resources through education	$59,300	**Umatilla County Fair booth and presentations**- Provide information on water quality and quantity concerns. The booth must have at least two staff members or partners in attendance throughout the fair to answer questions, with an emphasis on encouraging an awareness of groundwater quality. **OACD Poster Contest-** Provides kindergarten through twelfth grade students an opportunity to convey their thoughts about soil, water, and related natural resource issues **Small Acreage Workshops –** The District will host a minimum of 2 landowner workshops focusing on issues related to water quality in the LUB GWMA area. **Naturescaping for Water Resources Sustainability**- This workshop focuses on creating backyard landscapes that conserve water, reduce contaminate runoff, and create pollinator and wildlife habitat through emphasizing the use of native plants and environmentally friendly gardening practices.
2011-2012	Groundwater Protection Education to Promote Community Involvement in the Southern Willamette Valley	$48,800	This project will employ the successful outreach methods that have been designed by the OSU Extension Service Small Farms program and Well Water program, including offering well water clinics, teaching classes for rural residents and others, and answering client questions via phone and e-mail. Newer outreach methods developed with a focus on youth education will be continued and evaluated to measure their short term impact. Groundwater protection programming will be focused in the Southern Willamette Valley

Date	Project	Amount	Description
			Groundwater Management Area located in portions of Benton, Lane and Linn counties, because of the declared Groundwater Management Area.
2009-2011	Groundwater Protection Education to Promote Citizen Involvement in the Southern Willamette Valley	$67,985	Provide assistance to residents in the GWMA through education and promoting citizen involvement. Develop educational curriculum for school age children that focuses on groundwater principles and protection. Coordinate existing citizen volunteers to assist with outreach and education to the general public, including community groups.
2010-2012	Southern Willamette Valley Groundwater Management Area Action Plan Analysis, Marketing, and Implementation	$72,480	The six work tasks in this grant will build on the accomplishments from previous water resource work with federal, state, and local partners, thus accomplishing the goals and objectives described below. • Identify and prioritize stressors, problems, or gaps preventing attainment of strategies outlined in the GWMA Action Plan. • Build individual and community awareness, readiness and motivation to change behaviors to improve groundwater quality and reduce nitrate contamination. • Build community capacity and momentum among project partners to spread the word in their communities about groundwater and nitrate contributions. • Reduce nitrate contributions in a comprehensive and stakeholder-based approach, working with residents, farmers, agencies, and organizations to consider and apply a variety of strategies that will protect and restore groundwater quality.
Clean Water State Revolving Fund Loans			
2010	City of Gresham	$5,000,000	Stormwater drywells decommissioned or modified with green infrastructure facilities to reduce stormwater and groundwater impacts.
2010	City of Athena	$1,543,900	Construction of artificial wetland will reduce the level of effluent application to agronomic rates.
2010	Clackamas County Sewer District	$5,000,000	Extension of sanitary sewer collection to eliminate onsite and cesspool threatening groundwater.
2011	City of Irrigon	$1,810,000	Replace septic systems with sewer collection and treatment
2011	Clackamas County SWCD	$250,000	Repair and replacement of failing septic systems