Final Report

Protection of Groundwater Resources in the Upper Deschutes River Basin, Oregon

Assistance ID No. X5-96007801-0

Deschutes County
Community Development Department
Bend, Oregon

www.deschutes.org/cdd/gpp

The Groundwater Protection Project for Southern Deschutes County was funded by a grant from the US Environmental Protection Agency, Region 10

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Executive Summary

Deschutes County, Oregon, developed, with US Environmental Protection Agency concurrence, a two-part project in 2005 to protect water resources in the Upper Deschutes River watershed (Figure 1) by using onsite wastewater treatment systems (onsite systems). These systems would provide advanced treatment in a rural residential setting spanning a 125 square mile corridor in Central Oregon. The county originally focused the work program on the use of onsite systems because of:

- the county's permitting authority is limited to onsite systems;
- documented public opinion directing the county to avoid using new sewers;
- dispersed, rural patterns of development in the region;
- existing models developed by the U.S. Geological Survey (USGS) showed that groundwater quality can be protected by using onsite systems providing higher levels of wastewater treatment; and
- new state rules (effective March 2005) allowed the county to issue permits for nitrogen reducing onsite systems for the first time.

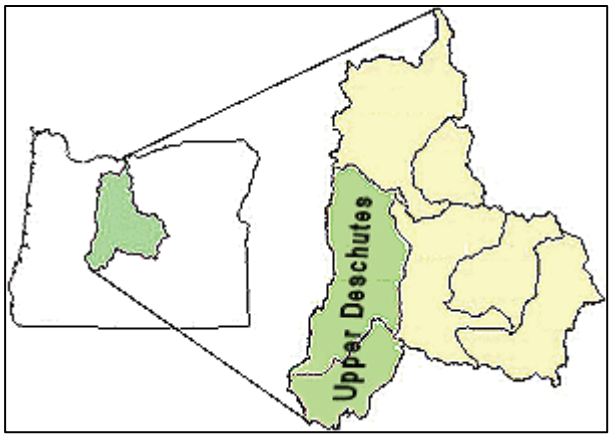

Figure 1: Deschutes River Watershed, Oregon

The grant program described a multi-pronged approach to protecting and improving the aquifer's water quality using performance standards, pollution credits and other incentive programs, and updates to administrative procedures.

The first part of the project was designed to establish the foundation of the groundwater protection program and included:

- using the existing nitrate loading management model (NLMM) developed by the USGS to identify maximum nitrate loading rates for sub regions/neighborhoods that will provide long term compliance with Oregon's groundwater quality standards;
- developing onsite system (onsite system) performance standards;
- researching incentive strategies (financial and regulatory) to retrofit or replace existing onsite systems;
- performing cost / benefit analyses to understand the opportunity costs for selecting different types of denitrifying onsite systems; and
- public outreach.

The second part of the project used the products of the first part to develop policy and regulatory approaches and defined the organizational capacity required to administer program. Identified needs for organizational capacity included:

- operation and maintenance program for new and existing onsite systems,
- designing a groundwater monitoring program, and
- developing financial approaches for providing pollution credits and low-interest loan programs that enable existing property owners to retrofit or replace underperforming systems.

This report also compared the accomplishments of the grant program with an evaluation of those areas where work plan tasks were not attempted or completed. Overall, because of the increased emphasis on the public process related to the Local Rule, slippages in the work program did not have a significant effect on the overall project outcome.

Finally, this report provides an overview of all the accomplishments and products of the Groundwater Protection Project for South Deschutes County. The project website (www.deschutes.org/cdd/gpp/) provides more detail on individual aspects of the project.

Definitions and Acronyms

Board ..... Deschutes County Board of Commissioners

La Pine NDP ..... La Pine National Demonstration Project

NLMM ..... Nitrate Loading Management Model

ODEQ ..... Oregon Department of Environmental Quality

Onsite systems ..... Onsite wastewater treatment systems, formerly called septic systems

PRC ..... Pollution Reduction Credit

TDC..... Transferable Development Credit

USGS..... United State Geological Survey

Background

The La Pine sub-basin of the Upper Deschutes River is underlain by a shallow aquifer that currently supplies the primary source of drinking water for approximately 18,000 people. The soils in the region are highly porous and permeable with no impervious layer that protects the aquifer from pollution sources. In addition, the region's soils are young, pumice-based (volcanic), and relatively low in organic matter. Recharge from natural (precipitation) or human (residential onsite system discharges or irrigation) sources moves rapidly down through surface soils to the aquifer.

The water table ranges in depth from less than two feet to about thirty feet below land surface. Recharge (precipitation that reaches groundwater) from infiltration of precipitation averages 2.0 inches per year; the balance of water from precipitation evaporates, transpires, or discharges via surface runoff to rivers. Groundwater discharges in the basin include baseflow contributions to the Deschutes and Little Deschutes Rivers, evapotranspiration by vegetation, and water pumped from wells.

Regional groundwater characteristics include temperatures that are among the lowest in the state, generally 42.5 ˚F (6 ˚C) to 48.2 ˚F (9 ˚C) and high dissolved oxygen content (3 mg/L to 6 mg/L). Groundwater velocities are low and, at the water table, groundwater is generally oxic (oxygen rich conditions); however, at depths ranging from near zero to more than fifty feet below the water table it becomes suboxic (depleted oxygen conditions) and natural nitrate reduction (denitrification) can occur. Denitrification thus keeps deeper portions of the La Pine aquifer essentially nitrate-free, but the oxic portions remain vulnerable to nitrate contamination from onsite systems, the primary anthropogenic source. Nitrate contamination of the oxic groundwater is a concern in this region because the shallow oxic aquifer is the desired drinking water supply for individual domestic wells and because of the potential for nitrogen-enriched groundwater to discharge to the nitrogen-limited rivers in the region.

Development in rural areas threatens groundwater quality in southern Deschutes County through onsite system discharges. About fifteen thousand lots of one-half to one-acre in size were platted prior to enactment of Oregon's land use planning laws in the 1960s and 1970s. These lots are located within a 125 square mile corridor near the scenic Deschutes River and the Little Deschutes River. Subdivision developers marketed these lots nationally with no promise of infrastructure improvements and without an understanding of the region's high water table or the aquifer's vulnerability. Currently, about 6,400 improved lots in the La Pine region study area use conventional onsite systems and individually owned drinking water wells. Most of these wells draw from the most vulnerable upper 100 feet of the aquifer.

At least 5,000 lots are likely to develop in the coming years based on the county's population projections. Deschutes County had the highest percent change in population of all the Oregon counties – almost 54 percent – between the 1990 Census and 2000 Census. Projected buildout will occur within twenty years if the 1990 to 1999 building rate of 250 homes per year continues. Based on these projections, there will be 26,000 people occupying approximately 9,700 homes served by onsite systems by 2025.

Incorporating the development projections provided above, the U.S. Geological Survey (USGS) produced a three-dimensional groundwater and nitrate fate and transport model that estimated average nitrate concentrations would triple within forty years if all new homes continue using standard or sand-filter systems (Morgan, et al, 2007). Continual reliance on conventional onsite systems would cause nitrate concentrations to exceed federal drinking water (10 mg/L nitrate as N) and state groundwater protection standards (7 mg/L nitrate as N) over large areas within the community.

An extensive public process in the late 1990s used studies completed in the region and resulted in feedback from area residents stating that centralized sewer or water systems were socially and economically infeasible in the La Pine sub-basin. Existing state laws limit centralized wastewater treatment systems in unincorporated areas and most residents in the La Pine region are of low or fixed incomes. Other community values articulated at this time emphasized the desire for comprehensive land use planning to ensure the region retains its rural character. According to March 1998 economic data for the La Pine region, 49.7% of the population is below the low to moderate-income threshold.

Purpose and Goals

Deschutes County implemented a groundwater protection program in recognition of the potential for conventional wastewater management practices and additional future growth to pollute groundwater resources in the region and create negative effects on surface water quality. Currently, the region produces high quality drinking water but groundwater investigations have shown water quality declines within the region. The groundwater protection program recognizes four main goals:

- Prevent groundwater pollution levels from triggering a moratorium on future development on legal lots of record;
- Protect the aquifer that provides the only source of drinking water to the residents in south Deschutes County by maintaining compliance with State groundwater quality standards (7 mg/L) and Federal drinking water standards (10 mg/L) for nitrate-nitrogen concentrations;
- Use results from an existing model to create a watershed-scale management system for existing and future wastewater treatment systems; and
- Document decision-making processes, tools and lessons learned as resources for other communities pursuing watershed-scale management of wastewater treatment systems.

Summary of Achievements and Products

The main achievements of the project are summarized here with detail on the tasks provided below.

A. Creation of the Pollution Reduction Credit Program

The Pollution Reduction Credit Program (PRC) is a financial incentive program that benefits property owners responsible for upgrading their existing onsite systems. This program directs financial resources generated by development of specific county-owned property to owners with existing onsite systems with the goal of reducing the total quantity of nitrate discharged to groundwater serving as drinking water supply for the region.

B. Local rule to require groundwater protection action added to Deschutes County Code

Deschutes County Code Chapter 13.14, adopted July 23, 2008 and effective October 23, 2008, requires all property owners in unsewered areas of southern Deschutes County to take action to protect groundwater quality by November 2022. The county's permitting jurisdiction is limited to onsite systems, which is the reason the county code focuses primarily on upgrades. However, the code also specifies that other approaches may be

used to meet groundwater protection goals, including connection to sewer and innovative techniques that are either not onsite or sewer systems or that have not yet been invented.

C. Recommendations on development of a Financial Assistance Program

The Deschutes County Board of Commissioners convened an advisory committee to provide feedback on community values related to how financial assistance should be provided to homeowners. The Board provided a specific charter for the advisory committee to focus discussions and gain specific feedback on community values. County staff, in the document entitled "Financial Assistance Overview," provided background on basic demographics, county financial assets, projected costs of meeting groundwater protection goals, and proposed financial assistance programs (including loans and grants).

D. Operation and Maintenance Program

The Deschutes County Community Development Department upgraded the permit tracking database to help the county and homeowners comply with state rule. The new features allow the Environmental Health Division to track systems with required maintenance activities, generate automatic reminders to homeowners and maintenance service providers, and maintain records for long term public use.

E. Implementation Plans

An important component of any work program is how products are put to use. In this project, the adoption of a significant piece of local legislation requires a series of short-term administrative actions. In addition, many long-term plans, programs or actions need to be started or established to ensure groundwater protection goals are addressed into the future in a coordinated manner. Deschutes County developed a short-term implementation plan for actions needed following adoption of the county code for onsite system upgrades. The county also developed a long-range implementation plan for regional groundwater protection actions that include the financial assistance program, environmental monitoring, interagency/public coordination, pursuit of grant opportunities, and public information and involvement.

Tasks

The county used a project team approach (Figure 2) for project planning and action items to benefit from diverse backgrounds and perspectives available from different departmental programs. For example, while both the TDC/PRC amendment and the Local Rule are not land use issues, the project team decided to use the land use public involvement process as a model for these legislative actions. This approach allowed for multiple public hearings and extensive public comment periods. The fact that the team approach included managers in addition to staff level professionals meant that interdepartmental communications and priority setting actions were streamlined. The team approach also helped distribute the workload during public meetings and events because all team members were able to speak knowledgeably about the project.

Project team members included interdisciplinary professionals from the Deschutes County Community Development Department. The team included the Deschutes County Community Development Department Director, Planning (Land Use) Director, Environmental Health Director, Senior Analyst, Senior Environmental Health Planner, Principal Planner, and

Registered Environmental Health Specialist. Specific individuals had assigned project administration duties (primarily budget tracking & reporting).

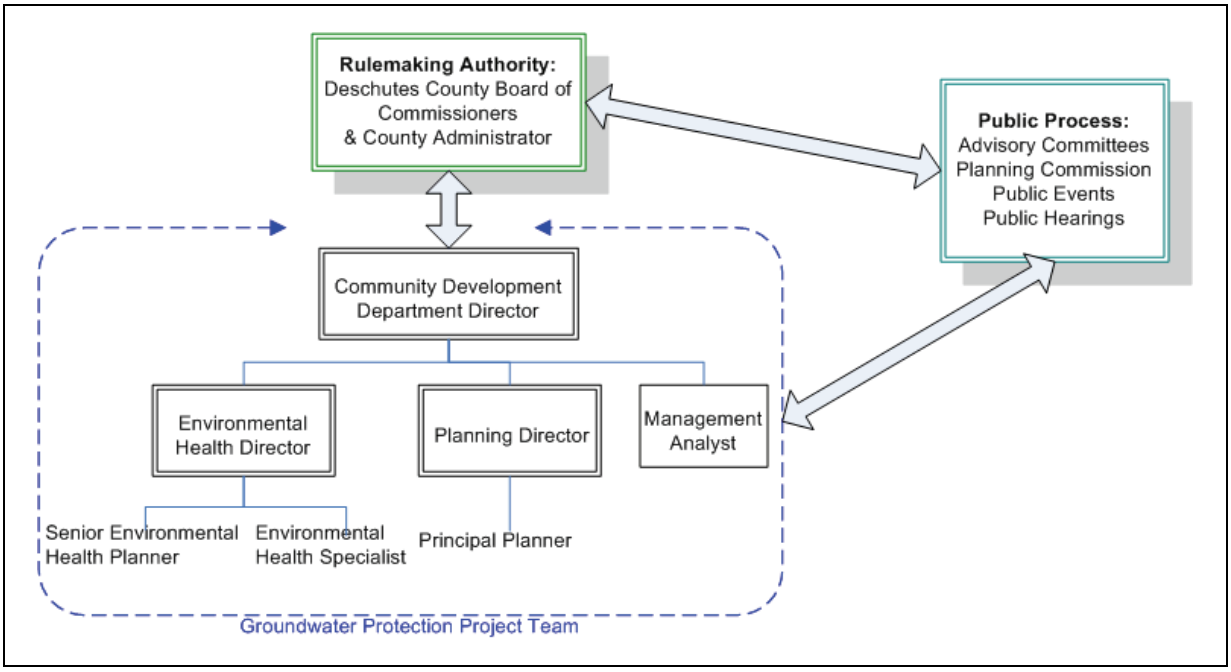

Figure 2: Groundwater Protection Project Team

Task A. Transferable Development Credit Program Amendment

Background and Purpose

Deschutes County adopted the original Transferable Development Credit (TDC) Program in 2002 as one part of the solution to the groundwater pollution problem in the upper Deschutes basin. Originally, a TDC was defined as the development right attached to eligible properties in southern Deschutes County. The goal of the original TDC program was to reduce the total number of onsite systems in rural areas (sending area) by transferring development to a receiving area served by community sewer and water systems.

The receiving area is approximately 500 acres purchased by the county from the Bureau of Land Management (Figure 3). Proceeds from the development of this land are dedicated to helping with groundwater pollution from rural residential development in the sending area. Residential development occurring within this neighborhood (the Neighborhood Planning Area, now included within the city limits of La Pine) is required to obtain TDCs as part of the approval process for new subdivisions.

This project proposed to investigate potential changes to the TDC program to enhance its ability to promote groundwater protection by using the development market to help reduce pollution discharged by existing rural residential development.

Public process

1. Transferable Development Credit Technical Advisory Committee

Deschutes County Community Development Department works with an advisory committee to obtain feedback and recommendations for changes to the TDC program. The county convened the advisory committee in July 2005 to help define how the pollution reduction capability of TDC program could be expanded.

The advisory committee met monthly between July and December 2005. By the end of this working period, the committee agreed on basic recommendations on the TDC program and provided preliminary input on a county code that requires the use of nitrogen reducing systems.

The following recommendations were developed by the committee:

a) All Neighborhood Planning Area funds should be targeted at retrofitting existing systems.

b) New development installs best available technology (treats to highest standard achievable with currently approved systems).

c) The level of treatment for existing development will be based on the Optimization model, which is the science based decision making tool to:

- Identify the average performance standards for existing systems by management area;
- Identify the high priority areas to target first for retrofits; and
- Help measure the success of the program over time.

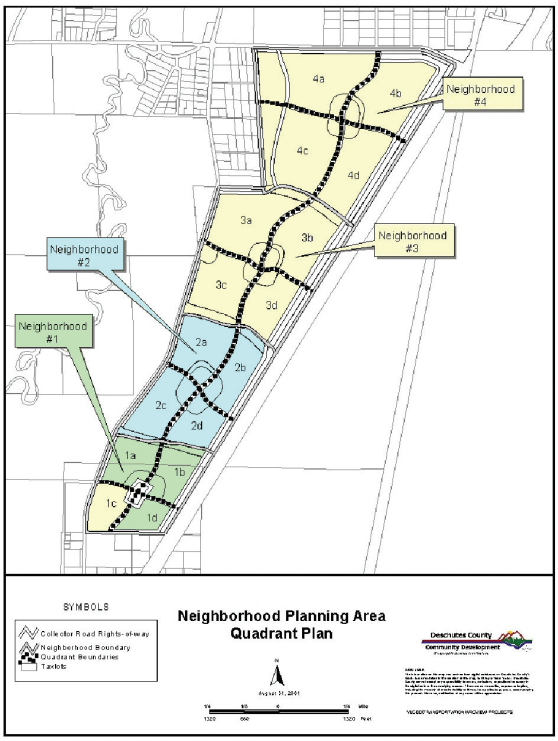

Figure 3: Neighborhood Planning Area, the receiving area for TDCs

The county recognized at this time that amendments to the TDC program would only be successfully implemented if a separate county code was adopted that required the use of nitrogen reducing system to protect groundwater quality. Without this groundwater protection rule, the county would have to rely on voluntary upgrades to existing onsite systems.

Using the advisory committee recommendations, staff developed the Pollution Reduction Credit program and related code amendments and materials for the public process. The amendments create Pollution Reduction Credits (PRCs) that can be used alone or in combination with Transferable Development Credits (TDCs). PRCs are created when residents retrofit existing onsite systems to reduce pollution from existing development. This is in contrast with TDCs that eliminate the potential for future development, and therefore, future pollution. Like TDCs, specific numbers of PRCs are required for development in the Neighborhood Planning Area. Neighborhood Planning Area

developers can work directly with homeowners to retrofit existing onsite systems with nitrogen-reducing technologies or designs or pay into the "Partnership Fund" that would then be used for financial assistance to property owners interested in retrofitting their existing onsite systems.

These revisions were presented to the advisory committee in April 2006 before proceeding to the Deschutes County Planning Commission.

2. Deschutes County Planning Commission

Staff presented the work of the advisory committee and the Pollution Reduction Credit code amendments to the Deschutes County Planning Commission during public work sessions and a hearing held in April and May 2006. Public testimony received during this process was unanimously in favor of the proposed amendments. The planning commission forwarded a recommendation to approve the amendments to the Board of County Commissioners.

3. Board of County Commissioners

The Board of County Commissioners held public work sessions and a hearing during May 2006. Testimony received during the public hearing was unanimously in favor of the proposed amendments. On June 5, 2006, the Deschutes County Board of Commissioners adopted the amendments to the county Transferable Development Credit Program in Deschutes County Code Chapter 11.12. The adopted amendments to the Transferable Development Credit Program (DCC 11.12) and supporting documents are provided in Appendix A.

4. Product / outcome / measures of success

The primary product of this portion of the work program is the adopted change to Deschutes County Code (Appendix A). Another measure of success is the number of PRCs created since the code became effective. Up to the time of this report there have been 17 nitrogen reducing system permits applied for or installed. This number of upgrades compared with the nearly 300 permits issued for conventional systems since the PRC program went into effect, is a measure of the effectiveness of the financial incentive provided by the PRC program in the absence of any regulatory requirement to upgrade systems.

The creation of PRCs will be tracked over time through the electronic permit tracking database used by the Community Development Department. The existing permit database has been modified as part of this project to account for PRCs. This system will track PRCs as they are created, sold, and transferred to developments in the Neighborhood Planning Area.

Task B. Local Rule for Groundwater Protection in Southern Deschutes County

The following provides an overview of public involvement actions and the development of the new Deschutes County Code requiring groundwater protection actions. Appendix B provides more detailed information, including the adopted code.

1. Background and Purpose

Extensive field research and study by the Oregon Department of Environmental Quality and the US Geological Survey has shown that the groundwater underlying southern Deschutes County is threatened by pollution from continued use of traditional onsite systems (standard, pressure distribution and sand filter systems).

The EPA funded the Oregon Department of Environmental Quality (DEQ) to undertake the La Pine National Demonstration Project (La Pine NDP), in partnership with Deschutes County, to test denitrifying onsite systems. The La Pine NDP found that several systems can substantially reduce nitrogen (and other pollutant) loading and protect the groundwater in a manner that meets adopted Comprehensive Plan goals and policies for Regional Problem Solving for South Deschutes County.

The demonstration project led the DEQ to draft and ultimately adopt rule changes to Oregon Administrative Rules pertaining to onsite wastewater treatment. These new rules, which became effective on March 1, 2005, make it easier for property owners in Oregon to use alternative treatment technologies by simplifying the permitting process and requiring the certification of installers and maintenance providers.

Discussions about actions needed to protect and enhance water quality in southern Deschutes County began with a working group that recommended a specific rule for south Deschutes County (Recommendation for Action and Consideration of a Geographic Rule, 1999) and culminated with the recommendation of an advisory committee (TDC Technical Advisory Committee) that met between July 2005 and April 2006. Public feedback (gained during the Regional Problem Solving Project and while working with specific groups or committees) and new statewide rules, Deschutes County drafted the Local Rule, now adopted as Deschutes County Code Chapter 13.14, to protect and improve the drinking water source for the region.

Potential benefits to this approach include:

- Cost of implementation is incurred over a long timeframe (14 years)
- The long implementation period provides a significant amount of time during which the county's financial assistance program can develop additional funding sources
- Groundwater protection begins immediately upon upgrade of an existing system
- Natural groundwater and surface water recharge patterns are maintained
- Innovations in technologies or system designs can be incorporated over time for improvements in costs and/or treatment capability
- Use of soil based systems provides significant environmental protection from pharmaceuticals and other emerging contaminants discharged in residential sewage (Hinkle, et al, 2005)

2. Performance standards

After preliminary work with the USGS to understand how the Nitrate Loading Management Model (NLMM) can be used, including understanding the limitations of the model, county staff developed a series of scenarios to illustrate how the model produces area specific treatment standards that change in response to water quality protection goals. For example, the treatment standard required for a particular area may change if the maximum level of nitrate allowed in the groundwater changes from 10 mg/L to 7 mg/L (7 mg/L nitrate as N is the Oregon Groundwater Protection standard that trigger state action). Also, the treatment standard may change depending on the minimum performance standard established for future development. A requirement that all future development installs systems that achieve at least 79% nitrogen reduction can lower the performance standards for existing development as compared to the effect of a requirement that all future development installs systems that achieve a minimum of 58% reduction.

Staff presented a range of scenarios to the TDC Technical Advisory Committee to obtain feedback on the various approaches. By December 2005, when the advisory committee produced draft recommendations, they recommended that because everyone contributes to the groundwater pollution problem, then everyone should contribute to the solution. In addition, because owners who are developing vacant land have financing opportunities that may not be available to existing residents, the committee recommended that new development should meet the highest performance standard achievable with available technologies.

Based on onsite system performance capabilities, the direction to have all property owners contribute to groundwater protection translated into a minimum of 35% reduction or approximately 30 mg/L nitrate as N in the effluent. This standard was used because, in 2005, several systems that participated in the La Pine NDP could meet this standard. In addition, the demonstration project systems capable of meeting a 35% reduction standard tended to cost less than better performing systems. The NLMM provided the final test by showing that groundwater quality could be maintained using 35% reduction as the lowest standard. This standard is about equal to a maximum of 30 mg/L nitrate as N in the effluent.

At the other end of the range, the best performing system in the demonstration project was able to achieve at least 96% reduction. However, in order to reflect a larger category of systems, and therefore increase homeowner choices, the NLMM scenarios were developed using a minimum of 79% reduction for the highest treatment standard. This allowed the highest treatment standard to promote a variety of systems rather than create a monopoly for the one system that could achieve the standard. Again, the NLMM results showed that groundwater quality could be protected using 79% reduction (roughly equal to a maximum of 10 mg/L nitrate as N in the effluent) as the maximum performance standard.

By the time the Board of County Commissioners adopted the new county code to require the use of nitrogen reducing onsite systems, the population of existing onsite systems needing upgrades had increased to about 6,500 systems. Approximately 2000-3,000 lots remain that have development potential (the number of potential lots is uncertain because many of these lots are tentatively mapped as high groundwater lots (less than 24 inches to groundwater). Development potential on these lots cannot be finally determined until a site-specific evaluation is completed.

The staff team discussed the capability of the NLMM to define the highest priority areas to target with upgrades. Target areas were not established as part of the retrofit program because:

- Hydrogeologic interconnections between areas in the region result in situations where the groundwater pollution problem in a specific area cannot be solved unless pollution from adjacent areas is reduced at the same time. This result is caused by regional groundwater flow patterns that carry pollution from one area into the groundwater underlying down-gradient or “downstream” areas. In other words, high concentrations in one area may be caused by pollution sources from that specific area plus developed areas that are up gradient or “up-stream.”
- Targeting areas with higher levels of existing contamination ignores the opportunity to prevent groundwater pollution in other areas. Groundwater sampling and modeling show that most pollution currently lies above the level of the aquifer that is typically used for drinking water supply. However, pollution, as it continues over time, is moving to deeper levels of the aquifer where drinking

water wells are screened. The only way that this portion of the aquifer can cleanse itself is to stop or slow incoming pollution and allow the nitrate-enriched water to move out of the groundwater system by discharging to streams or to be naturally denitrified at depth in the anoxic portions of the aquifer.

Using the information and experience gained from the discussions described above, staff used the NLMM to produce the performance standards for existing development shown in Figure 4. The performance standard for new development is not mapped because it is a minimum standard (79% reduction) regardless of location. This figure reproduces the exhibit adopted with the county code adopted July 23, 2008 and is provided in larger format in Appendix B.

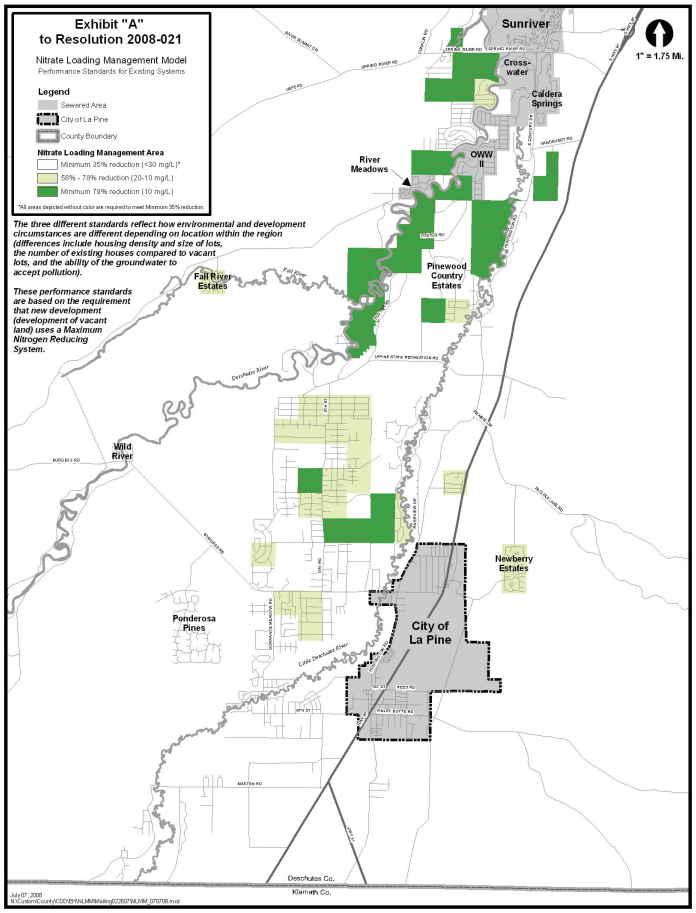

Figure 4: Performance standards produced by the NLMM

Constraint:

1. Oregon groundwater quality standard of 7 mg/L nitrate as N in the shallow aquifer
2. Future development achieves at least 79% reduction (at most 10 mg/L nitrate as N in the effluent)
3. Existing development achieves a minimum 35% nitrogen reduction (Figure 2 shows that minimum performance standards in some areas need to be greater than 35% reduction to meet the Oregon groundwater quality standard)

3. Cost / benefit analysis

Public opinion obtained in 1998 following publication of a feasibility study for community and regional sewers directed the county to pursue onsite systems as a potentially less expensive and more sustainable way of solving the groundwater problem. The county, as part of the original work plan for this project, proposed to compare the status quo approach (conventional onsite systems) with other development scenarios that include a variety of treatment standards for nitrogen reducing onsite systems. In addition to what was proposed in the work plan, the county compared the onsite system approach with information available from existing sources about the cost of community and/or regional sewers.

Table 1: Onsite System Costs

	2000-2001 **La Pine National Demonstration Project**	**2008**
Standard	$3,500	$4,000
Bottomless sand filter	$8,000	$11,000
Nitrogen reducing (New installations)	$8,900 - $19,000	$8,800 - $15,200
Nitrogen reducing (Retrofits)	$3,500 - $18,900	$10,700 - $17,200
Maintenance provider costs	$200 - $250/year $17 - $21/month	$300 - $420/year $25 - $35/month

A direct comparison of the costs of nitrogen reducing systems used during the La Pine NDP is not a good representation of how costs have changed over time because of the research nature of these systems and the installers were not familiar with installation requirements. In addition, not many of the manufacturers that participated in the demonstration project have applied for approval in Oregon, which means current costs are unavailable for these products.

In general, it appears that, particularly for new installations, the upper end of the cost range is currently lower than the costs seen during the demonstration project. The low costs at the bottom of the retrofit cost range during the demonstration project resulted from the use of a product that is not yet available in Oregon.

Retrofit costs vary as a result of the type of technology chosen for installation and whether the existing system (or components thereof) can be used for the nitrogen reducing system. New installation costs vary based on the type of dispersal area (drainfield or sand filter) needed. These costs are provided in the table below:

Table 2: Variations in Costs of Onsite Systems

	Uses existing tank and drainfield or existing sand filter	**Needs new tank and drainfield**	**Needs new sand filter and tank**
Nitrogen Reducing (Retrofit)	$8,800 - $10,200	$10,800 - $12,200	$12,200 - $15,200
		Uses standard drainfield	**Uses bottomless sand filter**
Nitrogen Reducing (New installations)		$10,700 - $12,200	$16,600 - $17,200

Using the information provided in the table above, the marginal costs (the difference in cost) of installing nitrogen reducing systems versus conventional systems for new development ranges between $6,700 and $8,200 for a site using a standard drainfield for dispersal and between $5,600 and $6,200 for a site using a bottomless sand filter for dispersal.

Variations in costs of retrofit systems are caused primarily by the condition of the existing system and other structural constraints on the property. For example, an older system with a steel tank and an undersized drainfield costs more to retrofit than a recently installed system. Similarly, properties with limited space due to outbuildings or other developed features will be more difficult to work with, and therefore more expensive to retrofit, than properties where the existing system and other affected areas are easily accessed. In the worst-case scenario, the existing system needs to be abandoned completely. In these cases, the marginal cost of retrofitting the system would be the cost of the retrofit versus the cost of a new conventional system. The standard system marginal costs would vary between $6,800 and $8,200 and the sand filter marginal costs would vary between $8,200 and $11,200.

The hydrogeologic character of the subareas has less of an impact on the cost (whether for retrofits or new installations) than the physical constraints on individual properties. This is due more to the market as it exists at the time of this writing because the systems that are currently available have similar costs regardless of the level of nitrogen reduction achieved. This is expected to change over time as the market develops for nitrogen reducing systems in Oregon.

In either situation, the marginal costs represent a significant increase over the cost of conventional systems. An increase in costs to the homeowner was expected from the start of the project; however, this information will be useful as the financial assistance program is implemented.

The work plan, as originally submitted, did not include any kind of cost comparison or marginal cost analysis of using centralized sewer systems for groundwater protection actions. However, given the public comment related to sewers received during the Local Rule process, existing information on the cost of sewers was summarized for the public. This historic information is provided here in addition to recently generated cost estimates for extension of an existing sewer.

A consultant report to the county, completed in 1997, estimated that sewers (for either community or regional systems) would cost between $19,000 and $28,000 per household or amortized at $1,275 to $1,880 per household per year (KCM, 1997). The amortized estimate assumed a 20-year payback period at 3% interest. The cost estimates also assumed that land for the treatment site would be available at $3,000 per acre. In addition to the capital investment for constructing the treatment plant and installing the pipes and pump stations for transporting sewage, monthly charges would typically be charged to generate revenue for ongoing operation and maintenance of the sewer system. Commonly, the debt service on construction loans and long term operating costs are paid through connection fees and monthly service charges. The KCM report did not speculate how a district or municipality might structure fees to cover loan and operating cost payments.

Other more current cost estimates are available. For example, the City of Bend charges about $28,000 to hook up to the existing system (not including the physical connection of the house to the collection pipe) and monthly charges range between $20 and $30. Oregon Water Wonderland, a subdivision in southern Deschutes County, recently estimated (Tye Engineering, personal communication) that an extension of their sewer system to serve a new area including approximately 200 homes would cost about $2.6 million for construction. The expansion would include the construction costs of extending the collection system to the new area. This expansion would not require any changes to the existing treatment plant such as changes to treatment process or the

amount of land needed for final treatment and dispersal. The sewer district, in order to pay the costs of the construction loan, would charge $9,500 to hook up to the system. Homeowners would incur an additional cost of an average of $2,500 to physically connect to the service line, and $42 per month service charge ($504 per year). The cost estimates from the KCM report and the cost estimate from the expansion of the existing treatment system are compared to the quoted costs of onsite system retrofits in Table 3 below.

Table 3: Comparison of sewer and onsite system costs

	Low end of cost range	Upper end of cost range
KCM, 1997, new systems, range of housing densities	$19,000	$28,000
OWW2 expansion of existing sewer (no expansion of plant capacity needed)	$12,000 (hook up fee & connection) $504, annual service charges	
Nitrogen reducing onsite systems	$8,800 (retrofit existing site) $300 - $420, annual maintenance provider costs	$17,200 (highest cost new installation) $300 - $420, annual maintenance provider costs
Difference between KCM costs & nitrogen reducing onsite systems	$10,200	$10,800
Difference between OWW2 expansion & nitrogen reducing onsite systems	$3,200 $84 - $204 difference in annual costs	-$5,200 Similar difference in annual costs

Costs for sewers and onsite systems are significantly affected by site specific factors and choices made for system type and components. Given that variability, the cost estimates provided above do illustrate the large range of actual and marginal costs of centralized sewers and individual onsite systems and the range of costs between expanding existing systems and developing new sewers.

4. Public process

The public process for the proposed local rule formally began in October 2006 with the inclusion of an informational sheet with the tax bills. This mailer went to all owners of property in southern Deschutes County. The mailing targeted properties that used onsite systems and avoided properties that were served by sewer.

Then, in November 2006, staff began holding or attending a series of public events to provide information and answer questions about the groundwater issues in the region. These events culminated with the first public hearing held in March 2007. This hearing, conducted over three nights on three consecutive weeks, included:

- March 13: scientific presentations by US Geological Survey personnel, policy based presentations by county staff, and a question and answer session using questions submitted by members of the public.
- March 20: completion of the question and answer session, public testimony

- March 27: public testimony

Following the close of verbal testimony, the Board of County Commissioners (Board) left the written record open to allow additional public testimony to be submitted. They did not set a time limit on the written record.

Over the next 12 months, the Board held a series of public meetings to continue discussions about the rule proposal. In March 2008 the Board held another public hearing to take verbal testimony on the proposed rule, recognizing it had been revised based on public comment received on the first draft. Substantive changes to the rule at this time included:

- **Sewer:** include sewer systems as a way to meet groundwater protection goals. To ensure that the proposed rule did not inadvertently eliminate the possibility of using existing state processes related to the expansion or creation of sewers, the new language identified the state rules that guide the process for expanding or creating sewers in rural areas as a way to meet groundwater protection goals. The county is working actively with DEQ/DLCD to:
    - Streamline land use review for the Goal 11 process
    - Create public information materials to make the sewer creation/expansion process understandable
    - Draft policies and language to establish a Health Hazard Sewer Overlay Zone
- **Provision for other wastewater treatment approaches:** other techniques or technologies may exist or be invented that could be used to meet groundwater protection goals. New language was added to allow other approaches (one example is composting toilets) that are shown to meet the groundwater protection goal but are not defined as an onsite system or a sewer system.
- **High groundwater lots/Sunset clause:** the county should change its existing policy of restricting development of properties where the groundwater comes closer than 24 inches to ground surface. The new language included a sunset clause for siting standards (specifically the requirement for 24 inches separation from the bottom of the onsite system trench to groundwater). This inclusion is intended to state the county's commitment to investigating the potential for increasing development in high groundwater areas.

Following the March hearing, the Board continued to accept written testimony and, on July 7, 2008, the Board re-opened the public hearing for verbal testimony on the changes to the proposed rule incorporated since March 2008. These changes included:

- **Compliance Date:** the Board changed the grace period before the compliance date from 10 years to 14 years to provide additional time for residents to pursue other methods of protecting groundwater.
- **Definition of Maximum Nitrogen Reducing System:** clarify this definition to ensure that a monopoly is not created for one system achieving the highest reduction possible. Instead, the definition ensures that property owners have a choice of any system that is shown to achieve a minimum of 79% reduction.
- **Variance:** create a way to allow a variance in the event that a failing system is located in an area where a sewer is being established.

- **Ordinance 2008-012:** define “Pollution” and “Public Health Hazard.” These definition were inserted into the ordinance and not rule language because these terms are not used in the rule.

Proposed changes that received significant comment and discussion that were not included in the proposed rule:

- **Time of Sale Upgrade:** The Board of County Commissioners discussed the feasibility of requiring upgrades at the time that property ownership changes. Because of issues related to putting this concept into practice, the proposal was rejected.

5. Product / outcome / measures of success

The primary product of this task is the unanimous vote by the Board to adopt the Local Rule (Deschutes County Code Chapter 13.14, provided in Appendix B). This effort dominated the overall work program of the Groundwater Protection Project because the county devoted over two years to developing drafts of the rule and collecting public comments and suggestions. The Board of County Commissioners gained a thorough understanding of the groundwater issues specific to the region and different wastewater treatment approaches that can be used to solve the pollution problem. In addition, the Board recognized the fact that the largest part of the pollution problem is coming from existing development and acknowledged that the problem could not be solved by “grandfathering” existing development and trying to protect drinking water supplies through regulations on new development alone.

An outcome of the adoption of the Local Rule is the need to plan implementation of the rule in order to ensure a smooth transition to the new regulatory requirements. In many ways, the county began building the administrative structure needed to support the rule with the adoption of the Pollution Reduction Credit Program. This program required updates to the county’s permit processing software to track nitrogen reducing systems specifically.

Other implementation tasks related to adoption of the Local Rule are identified in the outline provided in Appendix B.

Task C. Financial Assistance for Groundwater Protection Actions

Funds from the sale of land in the Neighborhood Planning Area (Figure 3), the Pollution Reduction Credit Program, and other sources will provide long-term support for a county financial assistance program for property owners taking action to protect the drinking water supply.

The Board of County Commissioners appointed an advisory committee of community members to assist with the development of recommendations about financial assistance programs. The community members were intended to provide geographical representation of the southern Deschutes County region. The Board provided the advisory committee with the Financial Assistance Overview document (drafted by staff) and a charter (Appendix C) to guide their discussions.

The “Financial Assistance Overview,” provided in Appendix C, summarizes the estimated financial assistance need and funding sources and identifies potential programs.

The advisory committee met every other week for 5 months and produced a final report on their recommendations. These recommendations were presented to the Board after the

grant period ended; however, the final report is included in Appendix C as the bulk of the activity of this advisory committee took place during the grant period.

Based on feedback from the Financial Assistance Advisory Committee, actions financed by the program will primarily use a loan structure with an emphasis on long term, cost-deferred loans for homeowners who cannot afford monthly loan payments. There are at least two existing organizations in Central Oregon that have an existing administrative structure to work with homeowners needed to complete home improvements (including onsite system improvements) and the county expects one of these organizations to be the third party administrator for county funds.

The Financial Assistance Overview and the advisory committee recommendations are the primary products of this task. Implementation of the financial assistance program was postponed pending completion of advisory committee work.

Task D. Operation and Maintenance for Onsite Systems

Purpose

The US Environmental Protection Agency, in 1997, reported to Congress that onsite systems are a viable alternative to centralized sewer systems if they are properly installed, operated, and maintained.

During this portion of the work program, county staff reviewed state rules pertaining to operation and maintenance requirements for onsite systems and discussed:

- What, if any, added requirements should be adopted at the county level

  Staff discussions resulted in a decision to focus on the requirements specified in state rule for nitrogen reducing onsite systems in order to evaluate the effectiveness of the program on a limited population of systems before evaluating the need to expand the program to all onsite systems.

- What changes would be needed to the county's permit tracking database to help keep records of maintenance activities in accordance with state rule and with any additional county requirements

  The county's electronic permit processing system, being a system specifically designed for Deschutes County, was well suited for modifications for tracking maintenance actions and compliance on specific properties.

- What fee should be charged

  State rules establish a $50 annual reporting fee that must be submitted annually with required reports. County staff decided to implement the program using this fee with the intent of reassessing fees on a periodic basis in the future as the program develops.

- What action should be required at the time of sale in addition to state rule requirements

  State rule requires that alternative treatment technologies be inspected at the time of sale; however, no enforcement actions are available that would help the counties ensure that this occurs. Deschutes County reviewed the manner in which property sale information is recorded in county records to see if there was a trigger point at which the Community Development Department (CDD) would be notified. Staff found that the earliest notification would be received weeks after the sale was

closed. This meant that any reminder issued by CDD would get to the new property owner well after they had taken possession of the property.

Public process

Because of the initial county decision to use existing state rule requirements for proper operation and maintenance of nitrogen reducing systems, there were no county code requirements proposed in the Local Rule language. Comments from the public focused on concern about the cost of maintenance contracts (the costs quoted by maintenance providers ranged between $25 and $35 per month or $350 to $420 per year depending on the type of system). The county informally surveyed sewer district fees and found that current fees assessed for sewer services in various parts of Oregon ranged from $20/month to $60 (including Bend, Redmond, La Pine, Oregon Water Wonderland, Tualatin, and Portland). Annually, this would equate to a range between $240 and $720.

Products / outcomes / measures of success

The primary product of this task was the modification of the county's permit processing system to generate reminders of required reports, keep records of maintenance activities, and track individual systems compliance history.

A significant measure of the success of this task is the high compliance rate of maintenance providers filing reports of maintenance activities.

As the grant period ended, county staff developed long range plans to make the report filing procedure easier for maintenance providers by providing a web based service. Additionally, the county plans to make the compliance history of individual systems available to the public in a similar manner that other onsite system information is publicly available and used extensively by real estate professionals.

Slippages in the Work Program

Grant program time extension

The most significant slippage experienced by the project was the one-year extension of the grant period. The county did not request nor did the US Environmental Protection Agency award additional funds to cover the expenses incurred by this extension. This slippage was caused by the extended timeline of the public involvement process related to the Local Rule. After the March 2007 hearing (held over three nights), the Board delayed a decision on the proposed code in order to allow the Oregon Department of Environmental Quality (ODEQ) to review and comment on the USGS publication cited here:

> *Morgan, DS, Hinkle, SR, and Weick, RJ, 2007. Evaluation of approaches for managing nitrate loading from on-site wastewater systems near La Pine, Oregon. US Geological Survey Scientific Investigations Report 2007-5237, 66 p.*

Because county staff was unsure of when ODEQ's comments would be forthcoming, the county applied for and received a one-year no-cost extension to the grant period. As events occurred, significant movement towards a decision on the proposed code did not occur until early 2008, with a final Board decision to adopt on July 23, 2008.

The slippage in the timeline for decision on the Local Rule caused slippages in other aspects of the work program either because of timing issues or because funds were applied towards the

Local Rule process that would have been used for other tasks if a decision on the code had made at an earlier date.

Staff and financial resources required to achieve the work incurred by this slippage was provided by Deschutes County and is included as match for the federal funds invested in this project.

Monitoring program design

The main task that was deleted from the work program was the design of a long-term monitoring plan to provide a means of measuring performance of the groundwater protection program. This task included an evaluation of existing monitoring and drinking water wells located in the sub-basin to identify a network of wells that would provide appropriate long-term monitoring points.

This task included a contract with the USGS to use the 3-dimensional fate and transport simulation model to identify well locations with the goal of monitoring the long-term effect of regulatory measures on water quality. Public comments received during the Local Rule process suggested that significant monitoring efforts should be devoted to proving that the groundwater tapped by drinking water wells is becoming polluted and "truthing" the USGS 3-dimensional model results. This is a different task than what was proposed in the work program. Additional discussions will be needed to define how this task will move forward.

Financial assistance

Another slippage caused by the lengthy public involvement process was the loss of potential funds to apply to the financial assistance program. Staff had proposed to apply any funds not used on other tasks in the work program to assist homeowners. Because of the slippage described under item A above, all funds not used for other tasks within the work program were applied to the public involvement process related to the Local Rule.