Chapter 2: Executive Summary

The region encompassed by southern Deschutes County and northern Klamath County in Central Oregon has seen significant increases in development pressures over the last twenty years. Part of the pressure stems from the platting of large subdivisions prior to the development of land use regulations in Oregon. The subdivisions consist of small one-half to one-acre lots that were originally marketed nationally with no promise of basic services like improved roads, fire protection, or assurance that wastewater could be treated on site. The mere platting of these lots has created unrealistic expectations about the intensity or type of development that can be supported by the physical environment of the region.

Deschutes County Community Development Department recognized the issues facing the region and initiated an in-depth planning process, the Regional Problem Solving Project (RPS), in 1996. One of the issues discussed and investigated during this time was the issue of onsite wastewater treatment and the effects of development on the high quality drinking water aquifer (shallow and unconfined) underlying the region. During this process, public opinion clearly stated that onsite wastewater treatment options should be pursued instead of centralized sewers because of economic, social and environmental reasons. Further, in 1997, the US Environmental Protection Agency stated in a report to the US Congress that, "adequately managed decentralized wastewater treatment systems can be a cost-effective and long-term option for meeting public health and water quality goals, particularly for small towns and rural areas." (US EPA, 1997) As a result, the Oregon Department of Environmental Quality, Deschutes County, and the US Geological Survey developed the work program that became the La Pine National Decentralized Wastewater Treatment Demonstration Project. The US Environmental Protection Agency funded the project with $5.5 million in 1999 to undertake four main tasks:

1. field test denitrifying onsite wastewater treatment systems;
2. develop an onsite system maintenance structure;
3. perform groundwater investigations and develop a three-dimensional groundwater and nutrient fate and transport model; and
4. establish a loan program to replace or retrofit failing or inappropriately located onsite systems.

The project's final report includes findings of the tasks listed above in addition to detailing the organizational and administrative work involved in completing the tasks. Describing the organizational and administrative work was seen as potentially beneficial to other organizations or agencies wishing to undertake similar activities in other areas.

The Problem

The La Pine Project study is located in an area where nitrogen contamination is a concern because of rapidly draining soils overlying a shallow, unconfined aquifer that is the only source of drinking water for the region. To further study the effects of onsite systems on groundwater quality, monitoring well networks of three to four wells were installed around each onsite system participating in the field test. The Oregon Department of Environmental Quality monitored these wells monthly for a year and then quarterly for the remaining two years of the test period. The monitoring well network associated with the field test system included almost 200 wells. The information provided by these wells was augmented by data from a drinking water well monitoring network that was slightly over 200 wells during the largest sampling event. The wells in the drinking water network were sampled between two and four times during the project.

The groundwater investigation showed that groundwater in the region is becoming contaminated by discharges from residential onsite systems and, particularly, that nitrate levels in the groundwater are increasing and that the source of nitrate is human residential sewage. (Hinkle, 2007)

Groundwater investigations have shown that by 2005 the amount of nitrogen loaded to groundwater by the existing population of conventional onsite systems already exceeded the sustainable loading for a maximum nitrate concentration of 10 mg/L NO_3-N. In other words, by 2005, there was already enough pollution in the groundwater that drinking water wells will exceed 10 mg/L NO_3-N in many portions of the region. The 3-D model developed for the region has shown that contamination of the aquifer will continue to increase over time. The model also predicted that, based on the field performance of denitrifying systems in the project, contamination could be slowed or stopped using onsite wastewater treatment technologies, and that, as the region is retrofitted with denitrifying technologies, the existing contamination would be flushed from the groundwater system via existing natural discharge points or attenuation mechanisms. (Morgan, 2007)

A Solution

The innovative system field test program comprised one of the largest efforts of the La Pine Project in terms of funds, personnel and time. The program ultimately included 49 sites that were sampled monthly for a year and bimonthly or quarterly for an additional two years. Sample parameters for the field test included field and analytical parameters with a focus on nitrogen species. Therefore, the sampling plan included total Kjeldahl nitrogen, ammonium, and nitrate-nitrite. The separate nitrogen species show how well the treatment system accomplishes the different stages of the primary treatment and nitrification/denitrification processes.

The 5-day bio-chemical oxygen demand (BOD_5), total suspended solids (TSS) and bacteria analyses provide a basic characterization of wastewater quality. The chloride analysis provided a way to account for dilution (from precipitation or irrigation) or concentration (by evaporation) in systems that are open to the atmosphere. Chloride data can also provide an indication that residential sewage is the source of the nitrogen because humans are a significant source of chloride. Chloride's utility may be limited in those areas near saltwater bodies or where roadway salting is common in the winter. Total alkalinity is a useful diagnostic parameter because the nitrification process for a milligram (mg) of ammonia consumes a maximum of 7.14 mg of alkalinity. (Crites and Tchobanoglous, 1998; Burks and Minnis, 1994)

Fats, oils and grease samples were taken from septic tanks but no other location in the treatment stream because the project team used this parameter primarily in the evaluation of septic tank effluent against the definition of residential waste strength that was currently in the Oregon regulations (Oregon DEQ, 2000). This parameter was also used when troubleshooting systems' performance, however, the advanced treatment systems were not required to reduce fats, oils and grease as part of the demonstration project.

Performance data from the field test of conventional systems illustrate that sand filter systems are not capable of reducing total nitrogen in septic tank effluent more than about 25%. Several innovative systems tested during the La Pine Project showed significant nitrogen reducing capabilities, including one system that achieved a maximum reduction of about 95% from septic tank effluent.

The sampling program included a small demonstration of the efficacy of sampling from the collection chamber following treatment units versus the discharge pipe of the units themselves. The findings of this portion of the sampling program indicate that the nitrogen species taken from the pump chamber following a treatment unit are representative of the effluent sampled directly from the treatment unit effluent pipe.

On average, the waste strength from twenty households falls within the Oregon definition for residential septic tank effluent on all parameters except oil and grease (O&G). The maximum concentrations recorded, however, greatly exceed the definition and the magnitude of the mean concentrations for BOD_5 and TSS indicate that a significant number of samples exceed Oregon's residential waste strength definition. The statistics for the different tank designs indicates that two-compartment tanks perform significantly better (99% confidence level) than single-compartment tanks for TSS reduction. BOD_5 reduction in two-compartment tanks is slightly better than single compartment tanks but only to the 70% confidence level. The O&G concentrations in the two compartment tanks are actually significantly higher than in single compartment tanks.

Insurance for the Onsite Solution

The maintenance program structure developed by the county/state appointed advisory committee appeared to be similar to the EPA's level 3 program from the voluntary national decentralized system management guidelines. As a result, critics may question the need to engage in such a lengthy process to develop a structure that had already been imagined. In this case, the value of the public process is in reaching and engaging a set of stakeholders that will ultimately help support concepts and ideals of the structure as it moves forward to rulemaking and then implementation.

During the demonstration project, the development of a robust maintenance program was identified as an important component of any water quality protection program using advanced treatment systems to achieve environmental goals. The maintenance program not only serves to ensure that program goals are met over the long term but also as an insurance policy for the homeowner to help protect their significant investment in an essential household service.

The maintenance program, while the structure was identified and portions placed into rule, is not a holistic program at the local level. One of the primary gaps is the lack of required maintenance for all onsite systems. For example, sand filters and pressure distribution systems have been left out of the maintenance program, which creates a disincentive for homeowners to use systems with added treatment capabilities. This also makes it difficult for potential service providers to enter the profession because the population of systems that they would serve has been limited by not requiring maintenance on these systems, even though the control panels and pumps are similar to what are commonly used in advanced treatment systems.

One Way to Make the Solution Viable

The development of a loan program was dependent upon all of the preceding tasks. The field test identified systems that were capable of solving groundwater problems. One way to encourage homeowners to protect groundwater is to create financial incentives, including low-interest loans, to use advanced treatment systems. Two factors delayed the implementation of the loan program. First, widespread use and access to advanced treatment systems did not begin until implementation amendments to the statewide onsite rules beginning in 2005. Since that time, the market for advanced treatment systems providing nitrogen reduction has developed slowly, and currently, Deschutes County has listed two proprietary and one non-proprietary systems as nitrogen-reducing systems. Second, Deschutes County undertook a work program in 2005 to adopt a county rule to require the use of nitrogen-reducing systems in the region. This effort diverted significant staff time that would otherwise have established the loan program. The county is currently planning to establish the loan program in coordination with a third party administrator that also uses Community Development Block Grants to fund low-income housing rehabilitation. This existing program also issues loans for onsite system repairs and upgrades and was seen as a natural partner for the county in issuing low interest loans in keeping with the La Pine Project goals and objectives.

Conclusion

Overall, the La Pine National Decentralized Demonstration Project experienced tremendous success from the work undertaken. Project staff have received positive feedback from the numerous presentations on the project and its findings at venues around the country. Future work planned for the region includes further work with the groundwater/optimization model as a planning/management tool, implementation of a pollution credit trading program, development of local maintenance program, and expansion of the loan program. Information from this project contributed to allowing more innovative onsite systems, maintenance requirements, and certification of service providers by state rule in December 2004. In addition, this project will continue to provide critical information that may affect regulatory standards in the future. The region and the variety of issues involved warrant continued observation and attention as the tools and experience gained from the national demonstration project are applied locally.

References

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