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UPDATE OF THE ADVANCED ON-SITE WASTEWATER TREATMENT AND MANAGEMENT MARKET STUDY: STATE REPORTS

by:

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Any errors of fact and interpretation are those of the authors: the opinions expressed do not necessarily reflect the official position of any supporting agency.

ABSTRACT

Abstract:

An update of a study of the market for distributed wastewater technologies and management, originally completed between 1997 and 2000, was conducted to provide updated information about the status of regulations, management, technology use, funding, training programs, and research and demonstration projects in each of the fifty states. A state-by-state literature review was completed and reports were updated for each of the 50 states.

This document includes the State Reports and annotated references for each state. For analysis of this research, please reference the other reports for this project, which are available at http://www.ndwrcdp.org.

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CHAPTER 1.0

INTRODUCTION AND ORIGINAL SURVEY QUESTIONS

This is a companion volume to the project entitled *Update of the Advanced On-Site Wastewater Treatment and Management Market Study*. The fundamental purpose of the study was to update the information for each of the fifty states, and update the analysis and recommendations of the original Market Study. The methods and results of the study, its sponsorship, and its ultimate conclusions, are described fully in the companion volumes, titled *State Reports Summary* and *Advanced Decentralized Wastewater Systems: Updated Strategies for Expanded Use*. The *State Reports Summary* volume describes information that was updated from or added to the database used to compile state and regional risk maps concerning onsite disposal of wastewater, and includes the maps. This volume also contains assessment of activities at the state and federal levels, focusing particularly on documented changes which have occurred since the publication of the original *Market Study.* The *Advanced Decentralized Wastewater Systems: Updated Strategies for Expanded Use* volume uses that information, as well as that from other sources, to draw the assessments that it does.

The information contained in the *State Reports* volume consists of individual state reports compiled originally from responses to a questionnaire sent to regulators and experts from around the nation, and updated based on the gray and white literature published since 1999.

Details of the methodology used to update the State Reports are described in the *State Reports Summary* volume. However, the questions that were asked in the original *Market Study*, and added to slightly for the *Market Study Update*, are reproduced below for the reader's convenience in interpreting the individual State Reports.

In addition to the nine major categories of questions posed in the surveys conducted for the original *Market Study*, a tenth question was added to qualitatively capture underlying drivers, patterns, and other information that was relevant to decentralized wastewater issues and reflected in the literature, but did not necessarily fit well into the categories formed by the original survey questions. At the end of each State Report is an annotated list of the references which were used to update that individual State Report. As explained further in the companion *State Reports Summary* volume, if a piece of information in any of the State Reports is not immediately followed by a citation, that piece of information has remained unchanged from the information contained in the original *Market Study*.

The original State Reports, as published in 2000, may be accessed at http://www.ndwrcdp.org/publications/.

Q1. NUMERICAL INFORMATION REGARDING ONSITE SYSTEMS
To the extent that you are able, please provide numerical or percentage answers to the questions that follow.

1(a) How many onsite systems exist in your state?

1(b) How many systems are installed each year?

1(c) How is onsite system failure defined in your state?

1(d) How many (total) of these systems are presently failing by your state's criteria?

1(e) How many systems are REPAIRED annually?

1(f) How many systems are REPLACED annually?
1(g) How many of the replacements involve ALTERNATIVE treatment technology (such as sand filters, mounds, pressure dosing, or home aerobic systems)? Please provide numerical breakdowns on these technologies if they are available.

1(h) How many of the replacements involve ADVANCED treatment technology (such as disinfection or nutrient removal)? Please provide numerical breakdowns on these technologies if they are available.

1(i) What is the current, average household cost of a conventional SEPTIC SYSTEM INSTALLATION?

1(j) What is the current, average household cost of a CENTRALIZED SEWER TIE-IN (INCLUDING ALL CONNECTION FEES AND CONSTRUCTION COST OF THE SEWER LATERAL)?

Q2. PRESENT STATUS OF ONSITE CONDITIONS, DEVELOPMENT PRESSURE, AND WATER QUALITY IN THE STATE

Many states (or localities) anticipate growth in housing, but not necessarily in areas that will be sewered. At the same time, cesspools, or other antiquated technologies in older subdivisions, are aging. In either situation, surface and groundwater can be in jeopardy; thus development may be curtailed or constrained. Please characterize the situation in your state (or particular localities within it) by answering the questions that follow WITH RESPECT TO UNSEWERED AREAS. Check all that apply, and expand, when helpful, with separate narrative answers or annotations on the enclosed map.

2(a) How extensive are these kinds of problems in your state?

- ♦ Not very extensive for any reason or region
- ♦ There are presently (check which one:) a few isolated [], some [], many or large [] problem areas because of ANTIQUATED SYSTEMS, SMALL LOTS, OR DENSE DEVELOPMENT

- ♦ There are presently (check which one:) a few isolated [], some [], many or large [] problem areas because of CRITICAL RESOURCE ISSUES; OR PHYSIOGRAPHIC OR HYDROLOGICAL CONDITIONS
- ♦ There are (check which one:) a few [], some [], many or large [] areas that will become problems with FUTURE DEVELOPMENT

2(b) What is the nature of the predominant water quality or natural resource problems in (2a) above?

2(c) Continuing from (2a) and (2b) above, are there very large, bounded areas that are thought to have water quality problems in part because of ANTIQUATED SYSTEMS, SMALL LOTS, OR DENSE DEVELOPMENT?

- ♦ No, or Yes, I've noted and described them on the map

2(d) Are there very large bounded areas of the state which are under development pressure that are unsuitable for conventional systems because of CRITICAL RESOURCE ISSUES, OR PHYSIOGRAPHIC OR HYDROLOGICAL CONDITIONS?

- ♦ No, or Yes, I've noted and described them on the map

2(e) Are there municipalities under enforcement actions or consent decrees concerning water pollution abatement?

- ♦ No, or Yes, I've noted them on the map

2(f) Generally, is the extension or creation of central facilities supported or resisted in the state?

Q3. ANTICIPATED CHANGES IN ONSITE REGULATION AND MANAGEMENT

In some states (or localities) where water quality problems are thought to be related to, or aggravated by, onsite systems, there are plans to address these problems through remediation which (if centralization is not an option) may require: (a) the use of alternative or advanced systems, and/or (b) stipulations for regular inspection, maintenance and oversight. Please characterize the situation in your state (or particular localities within it) by answering the questions that follow, expanding, when helpful, with separate narrative answers or annotations on the enclosed map.

3(a) When were onsite codes last revised?

3(b) Are new revisions in progress?

- ♦ Yes, or No

3(c) If yes, when is adoption targeted?

3(d) Under what circumstances is legislative adoption required? Is code-revision supported or resisted politically, and why? If the latter, could this interfere with adoption? (Please explain below.)

3(e) Does the state see any need, anywhere, either to systematically remediate older systems, or to systematically manage and maintain systems (whether aging, conventional, or advanced), through, e.g., SPECIAL REGULATION OR TARGETED ENFORCEMENT?

- No, or Yes, I've noted where on the map

3(f) Is there a need to place special ONSITE MANAGEMENT OR WASTEWATER PLANNING requirements on any of the following (please identify these areas on the enclosed map as well):

- New development: (Yes, or No)
- Older, densely developed areas: (Yes, or No)
- Critical resource areas: (Yes, or No)

3(g) Is/are (check which ones:) the state [], or particular counties [],or communities [] starting to require the creation of onsite wastewater MANAGEMENT DISTRICTS OR UTILITIES to provide assurance that onsite systems are functioning properly, by, e.g., issuing renewable operating permits with conditions attached to them?

- No, or
- Yes, here are their names and the reasons for their establishment (please locate them on the map as well):

3(h) What agency or agencies administer and enforce onsite code in the state?

Q4. ALTERNATIVE, ADVANCED AND BEST AVAILABLE TECHNOLOGIES

Interest in onsite wastewater treatment is increasing because of groundwater recharge and cost-effectiveness arguments. This is sometimes made possible only by alternative or advanced onsite technology. Please characterize the situation in your state (or particular localities within it) by answering the questions that follow, expanding, when helpful, with separate narrative answers.

4(a) Does the present code [] or will the revised code [] ACCOMMODATE alternative or advanced systems in any particular areas or situations?

- No, or Yes (also check one or both boxes above)

4(b) Does the present code [] or will the revised code [] SOMETIMES REQUIRE alternative or advanced systems in any particular areas or situations?

- No, or Yes (also check one or both boxes above)

4(c) Is [] or will [] development (be) permitted on sites that would otherwise be unsuitable for conventional systems when effective alternative technologies are employed?

- No, or Yes (also check one or both boxes above)

4(d) For (4a-4c) above, what level and manner of oversight and management is required of these technologies?

4(e) Have any particular alternative or advanced technologies been linked to particular environmental or physiographic niches in the state? (Please explain below.)

4(f) Are there [] or will there be [] requirements for the remediation of older systems with "Best Available Technology?"

- ♦ No, or Yes, (also check one or both boxes above)

4(g) Are there [] or will there be [] mechanisms to test and authorize new technologies at either state [] or county [] levels?

- ♦ No, or Yes, (also check the boxes above that apply)

4(h) If alternative or advanced technology were similar in cost to either conventional systems or central tie-ins, would state regulators be inclined to more widely specify or stipulate the use of such technologies in appropriate circumstances?

Q5. ONSITE FUNDING

5(a) Are there any types of betterment loan, or similar programs, in (check which one): the state [] or localities within it [] to help homeowners repair or upgrade onsite systems?

- ♦ Yes, or No

5(b) Are there plans to make state or EPA funds available for onsite remediation or upgrades?

- ♦ Yes, or No

5(c) Does the political climate favor or hinder financial help for onsite remediation. (Please explain below.)

Q6. LEADERSHIP WITHIN THE STATE

Please detail any onsite initiatives in your state, including names and addresses.

6(a) What official STATE-LEVEL agencies or task forces are examining onsite issues, or considering revisions to law or code regarding onsite disposal?

6(b) What LOCAL governmental agencies or task forces are examining onsite issues, or considering revisions to law or code regarding onsite disposal?

6(c) Is there research within STATE AGENCIES on onsite technology or management?

- ♦ No, or Yes, details below:

6(d) Is there research within UNIVERSITIES on onsite technology or management?

- ♦ No, or Yes, details below (how involved are they?):

6(e) Are there (check which one/s): state-level [] or local [] training and certification programs for onsite professionals (designers, contractors, inspectors, etc.)

- ♦ No, or Yes, details below:

6(f) Are there onsite demonstration projects in the state?

- ♦ No, or Yes, details below:

6(g) Are there citizen-action groups involved in onsite issues, or related matters such as water reuse or watershed planning?

- ♦ No, or Yes, details below:

6(h) Are there newsletters, bulletin board systems, listserves, websites, conferences, or forums within the state concerned with onsite issues?

- ♦ No, or Yes, details below:

Q7. ENFORCEMENT

7(a) Is onsite enforcement of present code regarded as adequate or not (please explain)?

Q8. CLUSTER SYSTEMS AND PACKAGE PLANTS

8(a) What role (large, medium or small) are cluster systems and package plants expected to play in the future?

Q9. POTENTIAL MANAGEMENT ENTITY INVOLVEMENT

9(a) Are rural electric (or other) cooperatives looking at the possibility of starting O/M programs for household sewage disposal?

CHAPTER 2.0

STATE REPORTS

2.1 Alabama

2.1.1 Summary

Alabama has about 750,000 onsite systems in the ground, installs about 25,000 systems annually, and repairs or replaces about 3500 annually. Problem areas are fairly widespread and aggravated by development outside sewered districts. Karst topography and slopes in the northern Appalachian area, low-permeability soils of a central “Black Belt,” and coastal areas are all a focus of concern. Many kinds of alternatives are permitted; these allow development otherwise not possible. Current code accommodates advanced technology, with expanded state testing under performance permits for larger systems. The Department of Public Health must stay attuned to the mood of the Legislature, and there are no betterment loan programs for upgrades. Nevertheless, there is onsite research progressing at several universities, several demonstration projects, state training and certification, and fairly active private involvement in onsite issues.

2.1.2 Numerical Information

Total number of onsite systems: 750,000 approximately; roughly 47% of the state.

Number of new systems installed each year: Over 25,000 new systems are installed annually.

Failure definition: Malfunction in any part of a system as evidenced by surfacing or ponding of effluent, backing up of sewage within the dwelling or establishment as a result of a malfunction, or contamination of ground or surface waters by an onsite system.

Number or proportion of systems presently failing: : 20%; failure numbers are especially high in Dale, Jefferson, Mobile and Tuscaloosa counties, where 200-1000 systems are replaced annually. The Alabama Department of Public Health has reported that 50% of all conventional, onsite septic systems are currently failing or are expected to fail in the future. In the Black Belt region of West Alabama, the anticipated failure rate is 90% (AOWTC, 2008).

Number or proportion *repaired* annually: 3200-3700 repaired or replaced.

Number or proportion *replaced* annually: See above.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): About 10%.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): About 5%.

Cost of a conventional *septic system* installation: $1500, range $750-$18,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $800-$1000; in some jurisdictions, none of this would accrue to the homeowner.

2.1.3 Present Onsite Status (Answers 2a-2f Summarized)

Throughout the state there are areas that presently have problems, or that with more development will have problems, particularly Autauga, Baldwin, Cullman, DeKalb, Elmore, Jefferson, Madison, Mobile, Shelby and St. Clair counties where dense development and/or rapid growth are increasingly a problem. Causes of failure include hydraulic overloading, poor maintenance, poor soils, age, and undersized leaching fields. It is reported that out-migration from the cities to rural areas beyond sewer mains continues, with new development being forced onto poor sites. Regions under development pressure that are not well suited to onsite conditions, and which already have problems with failing systems, include the "Black Belt," because of poor soils, Appalachia because of topography, and coastal regions because of hydrology. There is hope that if development is to continue in these areas that the large central systems managed by certified management entities will solve some of these problems (Coles 2009).

Water quality concerns in the coastal area include polluted runoff, sandy soils, and a high water table. After Hurricane Katrina, county Health Departments refused to approve inadequate systems serving hurricane-battered houses, meaning that water and electrical power could not be reconnected (Henderson, 2007). The Black Belt is characterized by low-permeability soils. There, 60-70% of freshwater wells test positive for bacteria. In Appalachia and the northern counties karst topography, fractured rock, and steep slopes are problems. Related resources in jeopardy include shellfish beds and beaches on the coast; and inland, freshwater fisheries.

2.1.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Code is made at state level and administered by counties.

Code was last revised in: 2006 (Alabama Board of Health 2006).

New revisions in progress? To be adopted when? Onsite regulations for the State of Alabama were last updated in November 2006. Another revision is expected in 2009 which will clarify questions raised during implementation of the new regulations.

Role of legislature, regulatory agency, and politics: Administrative code revisions have sometimes caused friction with the legislature, but the 2006 rule revisions were widely supported. Recent legislation mandating management entities brought by manufacturers rather than by PH staff, though staff were actively involved in the process (Coles, pers. comm., 2008).

2.1.5 Management Programs (Answers 3e-3g Summarized)

The state of Alabama recognizes management programs/contracts or management districts to monitor and maintain onsite systems or individual dispersal systems. Management entities are established by state law and are required for all systems with two or more owners (NSFC, 2006). Several demonstration projects have been established (see below). Inspection is not required at the time of construction—a shortcoming that efforts are being made to change (Coles 2009).

2.1.6 New Technology (Answers 4a-4h Summarized)

The current code accommodates and at times requires advanced or alternative technology, along with stricter management requirements for such systems (ADPH, 2006). All systems are permitted either through a state-issued Performance Permit issued to an individual system or through a Product Permit issued to the manufacturer of a proprietary ATS, listing the type and model ATS sold in the state (ADPH, 2006). Small systems (under 1200 gpd) are permitted through the traditional prescriptive permits; advanced treatment components used in these systems are pre-approved through a Product Permit issued to the manufacturer (required before such components can be used in the state) (ADPH 2006). Larger systems are permitted through an individual Performance Permit issued to the system owner, which requires effluent monitoring and reporting.

Alternative/experimental/innovative technologies do not require a different permit (NSFC, 2006). I/A processes that are permitted under the regulations include sand filters, mound systems, drip and spray irrigation, chamber systems, aerobic systems, peat biofilters, constructed wetlands, low pressure pipe, shallow placement, alternating fields, and raised beds, as well as PuraFlo and Infiltrator proprietary systems.

2.1.7 Onsite Funding (Answers 5a-5c Summarized)

In Alabama, State Revolving Funds (SRF) monies are administered by the Alabama Department of Environmental Management (NSFC, 2006). There are no plans for onsite betterment loan programs, though such programs have been discussed (AOSMC, 2006).

2.1.8 Leadership and Information

State-level agencies, task forces:

- Alabama Department of Public Health; (contact: James Coles, jmcoles@adph.state.al.us; Mr. Thad Pittman, thadpittman@adph.state.al.us, 334-206-5373).
- Alabama Dept of Environmental Management; (contact: Ms. Sonja Massey, 334-271-7700).
- Alabama Dept of Economic and Community Affairs.
- An interagency Alabama Onsite Sewage Management Committee coordinates current code revision; the agencies listed above, as well as others, participate (see http://adph.org/onsite/Default.asp?id=1166).

Local governmental agencies, task forces: NA

Research within governmental agencies: By arrangement with universities.

Research within universities:

- Various facets of design and monitoring of onsite performance are being carried out at Alabama A&M and Auburn universities, and the universities of Alabama–Birmingham, South Alabama, and West Alabama.

Onsite demonstration programs:

- Mobile and Tuscaloosa counties both operate demonstration sites, as do the following watershed programs: Sand Mountain/Lake Guntersville; Flint Creek; Weeks Bay; Pea River; and Choctawhatchee River. The Mobile project was funded by Congress as a National Community Decentralized Wastewater Demonstration Project.
- Information regarding demonstrations and/or research that is currently ongoing within the state of Alabama can be acquired by contacting Dr. Kevin White, University of South Alabama (tel 251-460-6174; eml kwhite@usouthal.edu) (NSFC, 2006).

Training or certification programs:

- The Alabama Onsite Wastewater Board was created in 1999 to examine, license, and regulate persons engaged in the manufacture, installation or servicing of onsite wastewater systems in Alabama (AOWB, 2008). In 2000, the state of Alabama passed legislation requiring all onsite professionals to have special licenses before performing work in the field (AOWATC website, 2008.)
- The State of Alabama requires onsite professionals to be certified. Soil Engineers, Surveyors, Geologists, Soil Scientists, Installers, Pumpers, and Septic Tank Manufacturers must be licensed. Each profession has their own state certification board and certifications may be renewable or permanent. Site evaluations are conducted by Soils Professionals prior to installation. New regulations allow a choice of percolation test, soil morphology, or Unified Soil Classification System. All permits for onsite systems are issued by the County Health Department. (NSFC, 2006)
- There is a state training center where most continuing education programs are conducted: Alabama Onsite Training Center, University of West Alabama, West Alabama Environmental Service Center, Station 7, Livingston, AL 35470; (contact: Lesley Garner, Director, tel 205-652-3803; eml lcg@uwamail.westal.edu). http://aowatc.uwa.edu/

Citizen action, private groups:

- Various watershed steering committees and forums.

Newsletters, forums, other sources of information:

- Onsite Sewage online discussion forum: http://adph.org/forum/login.asp?target=active.asp
- Annual Onsite Sewage Conference, Auburn.
- Annual Nonpoint Source Seminar, Montgomery.
- Interstate Environmental Health Seminar.
- Alabama Environmental Health Association.
- Alabama Onsite Wastewater Association (which publishes a newsletter).

2.1.9 Enforcement (Q7)

For onsite systems, enforcement is limited to inspections during the permitting process. Local health departments are empowered by Code of Alabama, Title 22, Chapter 26 to investigate reports of failing or inadequate onsite sewage systems; the LHD may require the owner or responsible entity to abate an unsanitary condition caused by a failing OSS or an unapproved sewage discharge (ADPH, 2006). Health departments do not have administrative penalty authority, and use the local judicial system to enforce regulations.

2.1.10 Role of Cluster Systems and Package Plants (Q8)

Cluster systems are being increasingly used by developers to provide wastewater services in developing / exurban areas (Coles, pers. comm., 2008) and by at least one water and wastewater utility (the Mobile Area Water & Sewer System (MAWSS) (Pinkham et al., 2004).

2.1.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

A variety of management entities, including cooperatives, municipal utilities, and private utilities (of which there are seven at present), are active in Alabama. Alabama's recent rules, mandate the fiscal parameters under which privately owned decentralized wastewater RME must operate, but do not necessarily grant other rights (Coles, pers. comm., 2008)

2.1.12 What's Changed

Patterns

[ANM notes] Since the original market study, there have been strong increases in accountability/licensing of professionals; in (at least fiscal) oversight of management entities for cluster systems, and in acceptance of advanced technology.

Drivers

[ANM notes] Overall, development pressure expanding outward from urban areas into areas with environmental limitations seems to be driving needs for greater accountability for installers and management entities. In some cases (e.g., oversight of management entities) manufacturers have been the primary instigators of regulatory reform.

2.1.13 References

Alabama Onsite Sewage Management Committee. 2006. 2006 Alabama Onsite Sewage Management Plan. Accessed at http://adph.org/onsite/assets/Draftmanagementplan2006.pdf on October 28, 2008.

Alabama Onsite Wastewater Board. 2008. State of Alabama Onsite Wastewater Board website. Accessed at http://aowb.state.al.us/ on October 28, 2008. *Website of the Board, with information about licensing, exam schedules, directory of licensed professionals, etc.*

Alabama State Board of Health, Bureau of Environmental Services, Division of Community Environmental Protection. 2006. Chapter 420-3-1: Onsite Sewage Treatment and Disposal, effective March 19, 2006, amended effective November 23, 2006. Accessed at http://adph.org/onsite/assets/rules11-23-06.pdf on October 28, 2008. *Current regulations governing onsite systems in Alabama.*

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National Small Flows Clearinghouse. 2006. Alabama Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/Alabama.pdf on October 28, 2008. *This short document summarizes onsite wastewater system regulations and activities in Alabama.*

Pinkham, R. D., J. Magliaro, and M. Kinsley. 2004. Case Studies of Economic Analysis and Community Decision Making for Decentralized Wastewater Systems. Project No. WU-HT-02-03. Prepared for the National Decentralized Water Resources Capacity Development Project, Washington University, St. Louis, MO, by Rocky Mountain Institute, Snowmass, CO. Accessed at http://www.ndwrcdp.org/userfiles/WUHT0203_RMI.pdf on October 28, 2008. *The case study of the Mobile Area Water and Sewer System (MAWSS) in this report contains extensive information about how the organization came to use decentralized/cluster systems to provide 'sewer service' outside their centralized sewer service area.*

2.2 Alaska

2.2.1 Summary

About 35% of Alaskan households use onsite systems; absolute numbers were not tracked by the state. Some 1200-1500 new systems go in every year, and it is reported that approximately 3000 systems are replaced or repaired annually. As of 2002, 66% of rural Alaska Native villages were served by some form of wastewater system, up from 40% a decade earlier (Eddy. 2004) Problems are described as few and isolated; they can be associated with aging developments, or with permafrost and harsh winter conditions, where the use of alternatives is common. Such technologies are approved directly by the Alaska Dept of Environmental Conservation (ADEC). There are no plans for systematic remediation or management districts. There is a loan program for remediation or replacements. The state has overall wastewater authority, but has delegated it to the cities of Anchorage and Valdez. The code was most recently revised in 2006 (DEC, 2006). There is a certification program for installers, run by the University of Alaska. Alternative systems must be designed, and installation overseen, by registered engineers.

2.2.2 Numerical Information

Total number of onsite systems: 30-40% of households; further details NA.

Number of new systems installed each year: 1200-1500 estimated.

Failure definition: Improper disposal; sewage on the ground; lending institutions may require an "adequacy test" as well.

Number or proportion of systems presently failing: NA

Number or proportion *repaired* annually: NA

Number or proportion *replaced* annually: Approximately 3000.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Actual numbers NA; varies widely across the state, but alternatives are estimated to account for 15-20% of systems.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): (See above.)

Cost of a conventional *septic system* installation: $3000-$4000 estimated for accessible areas, otherwise higher.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $10,000, but varies widely because of weather and accessibility considerations.

2.2.3 Present Onsite Status (Answers 2a-2f Summarized)

Alaska reports only few and isolated problems due to both dense development and antiquated systems, or because resources are in jeopardy. When concerns do exist they have to do with nitrate contamination of groundwater, and drinking water protection. The creation or extension of central facilities is generally resisted unless there is a well-documented pollution problem.

2.2.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? The state has overall wastewater authority, and oversees or audits communities to whom authority is delegated. These include the municipalities of Anchorage and Valdez.

Code was last revised in: 2006 (ADEC, 2006).

New revisions in progress? To be adopted when? As of March 2006, the State of Alaska had just completed a revision of the Plan Review Checklists and Certified Installers Manual. These revisions were expected to become effective in 2007 (NSFC, 2006). No further revisions have been announced.

Role of legislature, regulatory agency, and politics: ADEC has authority to make rules without legislative clearance, but the potential for political interference exists.

2.2.5 Management Programs (Answers 3e-3g Summarized)

Management programs/contracts are recognized in the State of Alaska to monitor and maintain onsite systems or individual septic dispersal systems. Local governments are able to request and be delegated authority to manage the individual onsite disposal program. Currently existing management programs in operation include the Municipality of Anchorage and Juneau (NSFC, 2006; City of Juneau, 2005). Anchorage issues permits and essentially operates a time-of-transfer inspection program: the municipal code requires that a home with a septic system or well must have a certificate prior to the transfer of ownership (City of Anchorage, 2004). Juneau also recently enacted a maintenance program for onsite systems in major subdivisions (City of Juneau, 2005)

The newly formed Alaska Rural Utilities Collaborative (ARUC) is responsible for water and sewer management in rural Alaska Native communities (ANTHC, 2008). ARUC is expected to increase compliance and efficiency in the operation of rural water and wastewater facilities.

2.2.6 New Technology (Answers 4a-4h Summarized)

Present code accommodates alternative systems, and may require them depending on individual site conditions. Performance based codes are followed in the selection of minimum treatment technologies (NSFC, 2006). Surface discharge must receive secondary treatment and subsurface must receive primary treatment and discharge to a soil absorption system. Failed systems are upgraded by the simplest system that meets design needs. ADEC only approves alternative systems on a case-by-case basis. Any new technology must undergo plan review and approval, and applicants must show that the system has a history of meeting the minimum treatment and permit requirement of the state's regulation, 18 AAC 72 (NSFC, 2006). In some cases a technology plan may require review from the Technology Review Committee (see below). The basic position of ADEC is that the simplest system which meets standards is best, but that systems requiring operation and maintenance will be permitted when conditions warrant. The use of advanced systems can be common in areas with permafrost and harsh winters.

2.2.7 Onsite Funding (Answers 5a-5c Summarized)

Funding is available to Alaska Native villages from either the Village Safe Water program or the Alaska Native Tribal Health Consortium (Eddy, 2004).

In Alaska, SRF monies can be used to assist individual homeowners to: repair a failing or malfunctioning system; replace a failing or malfunctioning system; or construct a new onsite wastewater treatment system. Contact Dan Garner for more information at telephone number (907) 465-5144 (NSFC, 2006).

2.2.8 Leadership and Information

State-level agencies, task forces:

- Alaska Dept of Environmental Conservation, Bill Smyth, Acting OSDS Section Manager, Division of Water Department of Environmental Conservation, 610 University Avenue, Fairbanks, AK 99709; tel 907-451-2177, eml bill.smyth@alaska.gov
- Village Safe Water Program, http://www.dec.state.ak.us/water/vsw/index.htm. Greg Magee, Program Director, tel 907-269-7613.
- A Technical Review Committee to review new technologies. The committee can include private engineers, communities, the University of Alaska, the United States Public Health Service, and the Alaska Science and Technology Foundation, with the purpose of obtaining recommendations regarding provisional approval for use of new technology (ADEC, 2006).

Local governmental agencies, task forces:

- Municipality of Anchorage, Development Services, On-Site Water & Wastewater Program, 4700 Elmore Rd, Anchorage, AK 99507; tel (907) 343-7904.
- Alaska Village Initiatives (Anchorage) has a Technical Review Board concerned with drinking water and wastewater management.

Research within governmental agencies: None.

Research within universities: NA

Onsite demonstration programs: NA

Training or certification programs:

- The State of Alaska requires certification of onsite professionals. Professionals must attend a certification class and complete an examination; a refresher course is also required every two years. Site evaluations are conducted by Certified Installers, Registered Engineers and Certified Homeowner Builders, prior to the installation (NSFC, 2006).

- Certified Installers can rate typical soil types; a sample of the soil can be taken to a soil lab for analysis and rating using the Uniform Soils Classification. An engineer can also rate the soil visually as well as perform a percolation test (NSFC, 2006).
- Onsite systems that are conventional, septic tank soil absorption system, do not require a permit to be installed; however, the engineer or Certified Installer must submit a documentation of construction form after the system has been completed (NSFC, 2006).
- ADEC contracts installer training to the University of Alaska, where the program is sponsored by the Mining and Petroleum Training Service: MAPTS/UUA, P.O. Box 3050, Soldonta, AK 99669; tel (907) 262-0200 fax (907) 262-0288.

Citizen action, private groups:

- Alaska Native Tribal Health Consortium, Division of Environmental Health & Engineering, Tribal Utility Support, 1901 Bragaw St., Ste. 200, Anchorage, AK 99508-3440.
- Alaska Rural Utilities Collaborative, John Nichols, Manager (905) 729-5695.

Newsletters, forums, other sources of information:

- ADEC runs a website with information on onsite systems, a list of Certified Installers, etc. http://www.dec.state.ak.us/water/wwdp/onsite/onsite.htm

2.2.9 Enforcement (Q7)

Compliance with regulations appears to be largely in the hands of the engineers, installers, and homeowners that are creating, installing and using onsite systems, particularly in rural areas. Even where management programs are in place, full enforcement is difficult due to budget and staffing limitations (Municipality of Anchorage, 2007).

2.2.10 Role of Cluster Systems and Package Plants (Q8)

"Community" systems are defined by regulation as any system having two or more connections (e.g., one multi-family dwelling; two or more single-family homes, businesses, or institutions; a trailer park, etc.) (ADEC, 2006). The regulation does not appear to specify management requirements for community systems or package plants with soil adsorption systems. Further details NA.

2.2.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

The Alaska Rural Utility Collaborative (ARUC), managed and operated statewide by the Alaskan Native Tribal Health Consortium (ANTHC), was created in October 2007 by the creation of a partnership between the Yukon Kuskokwim Health Corporation Rural Utility Cooperative (YKHC/RUC) and ANTHC. ARUC provides water and wastewater utility management services to 15 Alaskan Native communities (ANTHC, 2007); further details NA.

2.2.12 What's Changed

Patterns

[ANM notes] Increased professionalism through certification programs/requirements.

Drivers
The desire to move past “honeybuckets” (large buckets with toilet seat lids) as the dominant wastewater system in rural villages has driven improvements in roughly 3% of rural homes each year (Eddy, 2004).

2.2.13 References

Alaska Native Tribal Health Consortium (ANTHC). 2007. Letter to the Regulatory Commission of Alaska re: Transition of the YKHC RUC's provisional certificate of public convenience and necessity to the ANTHC Alaska RUC, dated November 29, 2007.

Alaska Native Tribal Health Consortium (ANTHC). 2008. *Pumphouse Pipeline*, newsletter of The Division of Environmental Health and Engineering, ANTHC. March, 2008.

Alaska Department of Environmental Conservation. 2006. 18 AAC 72, Wastewater Disposal. July 29, 2006. Accessed at http://www.dec.state.ak.us/regulations/pdfs/18%20AAC%2072%20As%20amended%20through%20July%2029,%202006.pdf on November 13, 2008. *Current regulations governing onsite systems.*

City of Juneau, Alaska. 2005. Residential Onsite Wastewater Treatment System Maintenance Program for Major Subdivisions. Accessed at http://www.juneau.org/pubworks/wastewater/documents/OnsiteWWTrtSystemMaintProgram_000.pdf on November 13, 2008. *Regulation enacting OWTS maintenance program for new subdivisions in Juneau.*

Eddy, N. 2004. Wastewater treatment in Alaska Native villages. *Small Flows Quarterly* 5 (2): 14-19. Accessed at http://www.nesc.wvu.edu/old_website/nsfc/Articles/SFQ/SFQ_sp04_PDF/SFQ_sp04.pdf on November 13, 2008. *Information about wastewater treatment improvements in isolated rural areas of Alaska.*

Municipality of Anchorage, Alaska, Development Services. 2004. On-site Water and Waste Water Program: What We Do. Accessed online at http://www.muni.org/onsite/whatwedo1.cfm on November 13, 2008. *Web page for the municipality’s onsite water and wastewater permitting program.*

Municipality of Anchorage, Alaska. 2007. Hillside District Plan--White Paper, On-site Regulations and Approval Processes. Draft paper dated September 14, 2007. Accessed at http://www.hillsidedistrictplan.com/pdf/WHITEPAPERS/WHITEPAPER_ONSITE_2-Regulations_9-27-07.pdf on November 13, 2008. *Technical paper summarizing the Municipality’s current onsite wastewater management activities, current issues, and future plans.*

National Small Flows Clearinghouse. 2006. Alaska Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/Alaska.pdf on November 13, 2008. *This short document summarizes onsite wastewater system regulations and activities in Alaska.*

2.3 Arizona

2.3.1 Summary

Arizona had approximately 325,000 systems in the ground in 1990, installs another 11,000-16,000 annually, and annually repairs or replaces an estimated 25,000, although not typically with alternative technology. Septic systems serve approximately 18% of the state's homes (Dayton, 2007). Arizona's problems date to older subdivision rules that permitted small lot development along rivers, particularly the Colorado River, and along railroad rights-of-way. In such areas, antiquated systems and densely developed pockets jeopardize surface- and ground waters. At the same time, very few areas in the state really have good site conditions, and rapid development compounds the situation. A number of communities face enforcement actions, and generally the state promotes gravity sewers as the solution. However, Arizona values its aquifers, and many alternative and advanced technologies are in widespread use for new development throughout the state. In many areas individual aquifer protection permits stipulate drinking water standards for nitrate discharges. Moreover, there is increasing recognition of the need for ongoing inspection of systems, both old and new, although overworked county health departments do not always have the resources for routine and effective enforcement. Although there is no state-level training or certification requirement, Northern Arizona University is establishing a research, development and training program, and there is an established Onsite Wastewater Association. Proactive onsite management is presently inadequate; however, there seems little question that alternative and advanced onsite technologies will play a big role in the state's future.

2.3.2 Numerical Information

Total number of onsite systems: About 325,000 (1990 U.S. census reports approx 283,000).

Number of new systems installed each year: About 11,000-16,000.

Failure definition: Surfacing on ground, long-term backup, direct discharge to surface water or groundwater which leads to a standards violation or direct public health problem.

Number or proportion of systems presently failing: About 0.5% (of which authorities are aware), but the figure could be as high as 1%; by another report, approximately 2000.

Number or proportion *repaired* annually: About 0.5%; by another report, approximately 5000.

Number or proportion *replaced* annually: About 0.25%; by another report, approximately 1000.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Virtually none by one report; about half (500) by another; and about 10% by still another; clearly the word "alternative" has been interpreted in different ways.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Virtually none by one report; about one-third by another; and about 5% by still another; clearly the word "advanced" has been interpreted in different ways.

Cost of a conventional *septic system* installation: $1200-$4000, perhaps $3000 on average, but up to $12,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $750-$5000; but up to $15,000 in difficult situations.

2.3.3 Present Onsite Status (Answers 2a-2f Summarized)

There are many and/or large problem areas due to antiquated systems, small lots or dense development, as well as many and/or large problem areas due to critical resource issues or physiographic conditions. Some areas are expected to become problems with future development. The problems in Arizona can be traced to the old subdivision rules and how subdivisions were approved. Along the Colorado River subdivisions with very small lots were permitted for the weekend fisherman or recreationist. At that time, small lot subdivisions were created from land along the railroad corridors which were sold to capitalize the railroads. Arizona's population has rapidly increased over the last decade, especially in rural counties, compounding the problems.

All this is aggravated by the fact that the state has very few areas with adequate soil at all, or soils with very low permeability, thereby restricting percolation. Other areas have fast percolation rates, and/or shallow depth to groundwater; steep slopes; or limited soil depth above impermeable layers. Arizona does not take into account the treatment capabilities of soils; the permit system is based on disposal density, not on treatment conditions.

The entirety of the Colorado River corridor is problematic, especially the communities of Bullhead City, Golden Shores, Lake Havasu City, Buckskin area (Parker), Quartzsite, and Yuma. The problem, mostly nitrate contamination of aquifers, is a result of systems on small lots, highly permeable soils, and/or systems which utilize deep disposal trenches. The Buckskin area also has bacteriological problems. A large, central, multicounty area (running northwesterly) marks a high growth area with low-permeability shallow soils, and shallow groundwater. Maricopa County is marked by high growth and the use of deep disposal pits. Santa Cruz County has nitrate problems and soils with high permeability. Navajo County is problematic with many areas marked by shallow soils and rock. Coconino, Gila, Apache and Navajo counties experience shallow groundwater and/or seasonally saturated soils. Other areas with dense development problems and/or onsite issues include the Virgin River area, Pinetop-Lakeside, Alpine, Nogales, Prescott, Rio Rico, and Oak Creek Canyon.

The state ADEQ continues to promote the conventional gravity sewer as the top choice for all areas, but doesn't often implement moratoria on additional ISDSs. There is insufficient funding to support construction and expansion of central sewers. Many communities are looking for alternatives due to the cost of centralization; and onsite systems, small cluster systems, and alternative collection systems will continue to increase over the years and play an important role in Arizona's future growth.

2.3.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? The Arizona Department of Environmental Quality (ADEQ) is the statutory authority; it delegates the onsite programs to the fifteen county boards of health. Previously, nonconventional systems were permitted and overseen directly by ADEQ. However, beginning in 1996 ADEQ began delegating this responsibility to the counties, a process still underway. (ADEQ still oversees such systems in the least populated counties.) Enforcement is reported as problematic with only obvious public health nuisances being addressed.

Code was last revised in: 2005 (ADEQ, 2005). The revisions discussed in the original Market Study were implemented in January 2001. Prior to the 2001 revisions, Arizona had no formally adopted onsite code, instead relying on ADEQ's "Bulletin #12" (titled *Minimum Requirements for Design and Installation of Septic Tank Systems and Alternative On-site Disposal Systems (1989).* The 2001 revisions were focused on conventional systems, with major refinements in terms of site suitability, soil evaluation, and allowances for soil treatment in aerobic zones.

New revisions in progress? To be adopted when? No revisions are reported to be in progress (ADEQ, 2008).

Role of legislature, regulatory agency, and politics: Some resistance to the 2001 revisions was expected; but generally it was recognized by officials and professionals, that the time for revisions was overdue.

2.3.5 Management Programs (Answers 3e-3g Summarized)

Beginning July 1, 2006, a statewide program became effective which requires septic system inspections during property transfers (Dayton, 2007). The Arizona Department of Environmental Quality estimates filings from between 40,000 and 80,000 properties per year (2007). Some counties, in particular Gila and Yavapai, require a renewable permit for alternative systems. The state as a whole requires site, construction and final inspections during the permitting process. No interest by utilities in O/M programs was reported.

2.3.6 New Technology (Answers 4a-4h Summarized)

Current regulations accommodate and sometimes require alternative or advanced systems (ADEQ, 2005). Development currently is allowed with alternative technologies where conventional systems are not suitable or allowed.

Arizona classifies all aquifers as potential sources of drinking water; thus once a water quality standard is violated, the systems must meet stringent requirements if they are to be installed at all. The state classifies discharges as either qualifying for a general aquifer protection permit, or needing an individual aquifer protection permit. Onsite systems are classified under the general aquifer protection permit program most of the time. But this is not always the case. The Colorado River corridor has a large problem with nitrate contamination of aquifers. There are similar situations elsewhere, such as in the Oak Creek Canyon corridor. In such areas, systems must meet the drinking water standard for nitrate discharge. Other areas of the state must utilize higher technology due to lack of space, too quickly or slowly permeable soils, depth of soil, or depth to groundwater. A list of all currently allowed alternate or advanced systems is available at ADEQ's website (ADEQ, 2005b).

Particular technologies have been linked to particular areas. In Mohave County, the RUCK System and the OSI Trickle Filter are used in the nitrate-sensitive areas. In areas around the state with slowly permeable soils or shallow soil depth, mounds, intermittent sand filters, and aerobic plants are typically used. Other permitted systems include gravelless trench, low pressure, evapotranspiration, and wetlands. Remediation by best available technology is not the rule. Typically the ADEQ requires that an area be sewered once it is found to have groundwater contamination from onsite systems. BAT can be required in cases of failing systems.
There are, and will continue to be, mechanisms for adding and permitting alternative systems, which require annual inspections. In more progressive counties, it could be anticipated that as the cost of alternative technology diminished, it would be more widely prescribed. As it is, alternative systems are often prescribed, regardless of cost. Cluster systems and package plants play only a moderate role; however, there is a growing awareness of these systems as alternatives to sewering.

2.3.7 Onsite Funding (Answers 5a-5c Summarized)

There is no state loan program to assist individual homeowners, although some communities with extensive problems have local banks or lending institutions willing to help out with low-interest loans. The state has many "hot spots" with chronic problems, and there is a state loan program for qualifying communities.

2.3.8 Leadership and Information

State-level agencies, task forces:

- Arizona Department of Environmental Quality, 1110 W Washington St, Phoenix, AZ 85007; (contact Ed Swanson, tel 602-771-4100, eml eks@azdeq.gov).

Local governmental agencies, task forces:

- The Arizona County Directors of Environmental Health Services Association (contact Dan Smith, 520-774-8941).
- Arizona Ad Hoc Task Force (contact Paul Miller, email: pfm@watermasters.com)

Research within governmental agencies: NA

Research within universities:

- University of Arizona Cooperative Extension, Onsite Wastewater Education (OWE) Program. Kitt Farrell-Poe, Ph.D., University of Arizona, Yuma Agricultural Center,6425 W. 8th Street, Yuma, AZ 85364, tel 928-782-3836, fax 928-782-1940, eml kittfp@ag.arizona.edu.
- University of Arizona, Arid Studies Department, does some research; details NA.

Onsite demonstration programs:

- Northern Arizona University received one million dollars over five years from ADEQ to do research, development, pilot projects and training at: Onsite Wastewater Demonstration Facility, College of Engineering and Technology, Northern Arizona

University, Campus Box 15600, Flagstaff, AZ 86011 (contact: Paul Trotta, Ph.D., P.E.; tel 520-523-4330, eml paul.trotta@nau.edu).
- Also: Mohave County Health Dept; further details NA.

Training or certification programs:
- State-certified operators must be retained by system owners; and all systems must be designed by PEs.
- Agricultural Extension at the University of Arizona, operates a training center at the Maricopa Agricultural Center in Maricopa, 37860 W. Smith-Enke Road, Maricopa, Arizona.

Citizen action, private groups:
- Arizona Onsite Wastewater Recycling Association (AzOWRA), P.O. Box 10866, Prescott, AZ 86304, suzanne.ehrlich@co.yavapai.az.us, http://www.azonsite.org.
- Arizona County Directors of Environmental Health Services Assn; (contact Dr. John Power, Maricopa County Dept of Environmental Services, 1001 N. Central Ave, Ste 150, Phoenix, AZ 85004).
- The Oak Creek Canyon Property Owners Association deals with planning issues along Oak Creek Canyon. Oak Creek Canyon Task Force, P.O. Box 732 Sedona AZ 86339, eml info @ Oak Creek Canyon Task Force.org.

Newsletters, forums, other sources of information:
- Newsletter of the Arizona Onsite Wastewater Recycling Association (see above).

2.3.9 What's Changed

Patterns
Support for the Onsite Demonstration Program at Northern Arizona University faltered after 2004, and the project was moth-balled. In the summer of 2007, renewed interest in furthering the program resulted in a conference and, potentially, the re-emergence of the program (Smith, 2007).

Drivers
The updated septic system regulations which expanded the Notice of Transfer inspection program were seen as an appropriate vehicle for property owners and qualified professionals to deal with septic system management and repairs with a minimum amount of government involvement (Swanson and Graf, 2003).

Public awareness of the problems associated with Arizona's limited water resources and rapid housing development seem to be increasing the focus on septic systems as a sustainable solution. New onsite wastewater treatment and reuse technologies are increasingly being showcased in venues like Northern Arizona University's demonstration project (see above) and the University of Arizona's new Scottsdale Water Campus (Smith, 2007).

2.3.10 References

Arizona Department of Environmental Quality (ADEQ). 2005. A.A.C. Title 18, Chapter 9 (Department of Environmental Quality, Water Pollution Control). Articles 1, 2, 3, 4 (Aquifer

Protection Permits). http://www.azdeq.gov/environ/water/permits/wastewater.html#onsiterules. *This document is the current regulation governing wastewater treatment in Arizona.*

ADEQ. 2005b. List of Proprietary Treatment Products For On-site Wastewater Systems in Arizona, Revised October 11, 2005. http://www.azdeq.gov/environ/water/permits/download/listpro.pdf. *This document is a list of proprietary treatment products that are deemed to comply with the technology definition and treatment performance criteria specified in the current Arizona regulations for Type 4 General Aquifer Protection Permits for residential onsite wastewater treatment facilities.*

ADEQ. 2007. Onsite (Septic) System Permit Transfers. Publication No. C 07-02. February 2007. http://www.azdeq.gov/environ/water/permits/download/septicbro.pdf. *A short brochure that provides information about Arizona's 2006 rule change, which required new property owners to file a Notice of Transfer application when purchasing property served by an on-site wastewater treatment system.*

ADEQ. 2008. ADEQ Regulatory Agenda for 2008. http://www.azdeq.gov/function/laws/download/reg_agenda.pdf. *This document shows that no activity on the regulations governing onsite systems is expected in 2008.*

Dayton, S. 2007. Arizona Tightens Reporting and Permit Requirements. *Onsite Installer*. June 2007. *A short news article that provides information on the property transfer inspection provision enacted with the 2006 revisions to Arizona's wastewater system regulations.*

Smith, D. 2007. Reuse "U". *Onsite Water Treatment*, November/December 2007. *A feature-length magazine article on water reuse in Arizona. A lot of information about reverse osmosis, but also provides information about the Onsite Wastewater Demonstration Project, ongoing at Northern Arizona University, and AzOWRA's role in increasing interest in the demo center.*

Swanson, E., and C. Graf. 2003. Arizona's Regulatory Inspection Program for Onsite Systems. Paper from the State Onsite Wastewater Regulators and Captains of Industry Conference. Updated March 11, 2003. *Provides information about the time-of-transfer inspection regulation, and some discussion of how implementation of the inspections was working and how it was perceived in the industry.*

2.4 Arkansas

2.4.1 Summary

Arkansas has about 400,000 onsite systems in the ground, and installs about 10,000 new systems yearly. No figures were available on the number of replacements or repairs. There are distinct and sizable areas of the state with problems or potential problems. The northwest quadrant of the state is marked by fractured rock and karst geomorphology; to the east, the Mississippi River watershed is prone to seasonal shallow groundwater and wetness. Problems in Arkansas are aggravated by population pressures, and by the fact that prior to 1977 there was no onsite wastewater regulation in the state (major revisions were enacted in 1999 and 2006). New technologies are allowed, first by variance, and with experience, for general use. Their use is not strongly favored by the state, but enjoys support in localities that have problems. Cluster systems and effluent sewers are tightly managed, but individual systems are not. There are no loan programs, but onsite professionals have recently come under state certification requirements. The University of Arkansas ran a field-scale demonstration project of new technologies, but no current information about that project is available.

2.4.2 Numerical Information

Total number of onsite systems: About 400,000; 1990 U.S. census reports about 380,000.

Number of new systems installed each year: 10,000 estimated.

Failure definition: Surface expression, backup into building, or contamination of groundwater.

Number or proportion of systems presently failing: NA (no state records are kept).

Number or proportion *repaired* annually: NA

Number or proportion *replaced* annually: NA

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): NA (see above)

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Very few, probably less than 1%, but see above.

Cost of a conventional *septic system* installation: $2750; range, $1200-$6000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): About $7000.

2.4.3 Present Onsite Status (Answers 2a-2f Summarized)

There are scattered areas, some large and distinctly bounded, that have problems because of dense development and antiquated systems, poor conditions, or endangerment of resources.

High-hydraulic-conductivity soils over fractured rock and karst geomorphology mark the northwest sector of the state; there is also rapid development in the very northwest corner, around Fayetteville, some of which is being served by cluster systems (LWVBC, 2007). The Mississippi River watershed, marking the eastern half of the state (running north-south) is marked by low-conductivity soils and high seasonal (perched) groundwater. Groundwater (and surface water) pollution is aggravated by agricultural runoff from chicken and hog farms, as well as by herbicides and pesticides. Permits have been denied because of clayey or otherwise unsuitable soils, high water table, shallow depth to bedrock, and lots situated in the floodplain. Failures have been attributed to seasonally high water tables, insufficient size, hydraulic overloading, improper installation, and damage. The majority of failing systems were installed prior to 1977, when no regulations governed ISDSs, and many systems were installed in marginal areas with perched water tables, impermeable soils, or undersized lots.

Other areas in the state are expected to pose problems with future development. Many counties report population increases and migration to rural areas outside of central services. In particular, there are very high growth rates in the northwestern corner of the state around Fayetteville, as well as exurban sprawl from Memphis (Tennessee) in the northeast. The creation or extension of central services is strongly supported at the regulatory level, and the onsite rules mandate connection if a centralized sewer is within 300 feet of a property (ADEQ, 2006). Still, centralization tends to be resisted in smaller communities and by property owner associations because of costs.

2.4.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? The Arkansas Department of Health (ADH) makes regulations at state level. Administration and enforcement is left to county health departments. Enforcement varies from county to county, and person to person, as well as with interpretation of the code.

Code was last revised in: The first code ever was in 1977; the last major revision was in 2006.

New revisions in progress? To be adopted when? Major revisions are made approximately every ten years; no revisions are currently in process.

Role of legislature, regulatory agency, and politics: Additions to the regulations are controlled by the ADH.

2.4.5 Management Programs (Answers 3e-3g Summarized)

Inspections are required on installation of new systems. Property Owners Associations “that desire to exercise general supervision and authority over the treatment of wastewater within and for the subdivided area over which their authority extends, may request the Department or in the case of onsite wastewater systems, or Engineering, in the case of community wastewater treatment systems, to delegate such parts of its authority as the Property Owners' Association wishes to exercise” (ADEQ, 2006). This provision applies to both onsite and community wastewater treatment systems.

There are no reports of utility interest in managing O/M programs.

2.4.6 New Technology (Answers 4a-4h Summarized)

Present code accommodates and sometimes requires the use of alternative technology, particularly on sites where conventional systems are inadequate. Where conventional systems are adequate, alternative systems are prohibited. There can be requirements to use Best Available Technology for remediation or repair.

With the 2006 rule revisions, standard and alternate systems are both covered in the onsite wastewater system rules. Permitted systems include sand filters, mounds, package plants, aerobic systems, rock plant filters, constructed wetlands, lagoons, and low pressure pipe. Sand-lined trenches are commonly used in the high conductivity conditions to the north, and there are other technologies identified with particular areas in the state.

There is no requirement for systematic oversight and management in the case of conventional ISDSs. Owners of alternate systems are required by rule to maintain a maintenance and monitoring contract with maintenance personnel certified by the department for the life of the system, with monitoring reports submitted to the owner, local health unit, and ADEQ (ADEQ, 2006). Strong requirements exist for ongoing management of cluster systems and effluent sewers. The state does not test new technologies, although the University of Arkansas does. Alternative technology is generally supported as an option for individual homes but, other than the "Ten-State Standard," does not enjoy much regulatory support for multi-user systems. Cluster systems and package plants are expected to continue to play a moderate role in the future.

2.4.7 Onsite Funding (Answers 5a-5c Summarized)

There are no betterment loan programs for system upgrades, and none are anticipated.

2.4.8 Leadership and Information

State-level agencies, task forces:

- Arkansas Dept of Health, Div of Environmental Health Protection, 4815 W. Markham St, Slot H-46, Little Rock, AR 72205 (contact Carl J. Graves or Terry Brumbelow, tel 501-661-2584; cgraves@healthyarkansas.com; fax 501-661-2572).
- (The Div of Environmental Health Protection deals with ISDSs; the Division of Engineering with subdivision effluent sewers, cluster systems and commercial systems; the Arkansas Dept of Pollution Control handles all surface discharging systems (including individual homes).
- The Individual Sewage Disposal Advisory Committee (to the ADH).
- The Technical Review Committee (to the ADH) for Onsite Regulations.

Local governmental agencies, task forces: None

Research within governmental agencies: NA

Research within universities:

- University of Arkansas ran an "Onsite Wastewater Renovation Project," which had field-scale (full size) experimental systems in place, and provided "technology transfer" education opportunities for sanitarians and regulators. Current information about the project NA.

Onsite demonstration programs: NA

Training or certification programs:

- Septic tank manufacturers must be licensed through ADEQ. Pumpers are required to pass a test and pay an annual fee of $25.00 per vehicle in order to be licensed; an annual inspection of their pumping vehicle/vehicles is required as well as current documentation of the legal sites they have permission to dispose of septage (ADEQ, 2006).
- Installers must be licensed, maintain a minimum $10,000 surety bond, and receive an annual training course (ADEQ, 2006).
- Designated Representatives (persons certified by ADEQ to make percolation tests, system designs and inspections subject to the authorized agent's final approval) must be licensed and undergo annual training. (ADEQ, 2006)
- Maintenance providers must also complete and annual training requirement. (ADEQ, 2008)

Citizen action, private groups:

- League of Women Voters of Washington County, AR: http://www.lwvarwc.org/

Newsletters, forums, other sources of information:

- ADH publishes a newsletter.

2.4.9 Enforcement (Q7)

Administration and enforcement is left to county health departments. Enforcement varies from county to county, and person to person, as well as with interpretation of the code.

2.4.10 Role of Cluster Systems and Package Plants (Q8)

See above.

2.4.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

No interest from electric or other cooperatives in managing onsite systems was noted.

2.4.12 What's Changed

Patterns

[ANM notes] Increased professionalism through institution of certification programs; theoretically increased accountability for HOA management of clustered systems though it is not clear how the 2006 regulations are being implemented or whether HOAs are using the rule provisions.

Drivers

Development pressure as described above; also water quality issues caused by straight pipes and failing systems in resort areas (see Eddy, 2000).

2.4.13 References

Arkansas Department of Environmental Quality, No Discharge Permits Section. 2008. No Discharge Permits Section website. Accessed at http://www.adeq.state.ar.us/water/branch_permits/nodischarge_permits/default.htm#subsurface_permits on November 14, 2008. *Information about permitting for subsurface wastewater disposal systems over 5,000 gpd and those with non-domestic wastewater discharges.*

Arkansas Department of Health and Human Services. 2006. Rules and Regulations Pertaining to Onsite Wastewater Systems, Designated Representatives, and Installers. Effective December 16, 2006. Accessed at http://www.healthyarkansas.com/rules_regs/sewage_disposal_systems.pdf on November 14, 2008. *Current regulations for onsite wastewater systems in Arkansas.*

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Eddy, N. 2000. Arkansas Sanitarian uses Infrared Technology to Track down Sewage. *Small Flows Quarterly* 1(2): 22-24. Accessed at http://www.nesc.wvu.edu/pdf/ww/publications/smallflows/magazine/SFQ_SP00.pdf on November 14, 2008. *Article about an innovative use of infrared technology to locate failing systems and straight pipes around a large man-made lake in Arkansas.*

League of Women Voters of Washington County, Arkansas. ND. Ground Water and Surface Water Management: study to update the Statement of Position for the League of Women Voters of the State of Arkansas. Accessed at http://www.lwvarwc.org/wastewaterreport.pdf on November 14, 2008. *A short report on questions about small community wastewater management, with some examples of distributed management and reuse currently operating in Arkansas.*

2.5 California

2.5.1 Summary

California has about 1.3 million systems in the ground, installs about 10,000 new systems annually, and repairs another 4000 (20-30% described as "alternative"). Septic system problems occur along the coast, and on the steep slopes of the Coast Range and the Sierra Nevada. Dense development on the outskirts of the cities also poses problems. In the southern interior, shallow aquifers are in jeopardy due to poor soils. The first statewide regulations for onsite systems were published in draft form in November 2008. Currently, however, wastewater laws and regulations are made at county level, subject to approval by the appropriate regional water quality control board. There is strong receptivity to alternative and advanced technology as well as to management entities, called "zones," or "county service areas." Although these had existed prior to 1978, California Senate Bill 430 ("the onsite wastewater disposal zone law") discourages the creation or extension of sewers when suitable alternatives can be found; and it authorizes 17 types of governmental institutions to establish onsite management programs. Several of them, including Georgetown Divide, Stinson Beach, and Paradise, have come to national attention. There is a limited statewide loan program for onsite betterments, and several counties have programs for households of limited means. There is a training center at California State University/Chico, but no active research or demonstration projects. There is no training or certification requirement at state level; programs and requirements among the counties vary. Many citizens groups are active in California and there is a California Onsite Wastewater Association.

2.5.2 Numerical Information

The State of California does not keep track of the number of permits issued state wide for new construction; the repair of existing systems; or for upgrade or modification on the onsite system (NSFC, 2006).

Total number of onsite systems: 1.2 to 1.3 million, estimated; 1990 U.S. census reports approximately 1.1 million.

Number of new systems installed each year: 5000-10,000, estimated.

Failure definition: Varies by county; but typically, the surfacing of effluent.

Number or proportion of systems presently failing: 10,000-50,000, estimated.

Number or proportion *repaired* annually: Approximately 3000-4000 are repaired or replaced annually.

Number or proportion *replaced* annually: See above.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): It is estimated that 20-30% of repairs and replacements are alternative in some sense. Pressure dosing accounts for an estimated 16%, sand filters 8%, mounds, 5%, aerobic treatment, <2%.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Less than 1%.

Cost of a conventional *septic system* installation: Average, \$3000-\$5000; range \$2000 to \$30,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): \$2500-\$8500, estimated.

2.5.3 Present Onsite Status (Answers 2a-2f Summarized)

There are large, sometimes well-bounded problem areas scattered throughout the state due to dense development and antiquated systems or poor onsite hydrology. Some of these presently, or will in the future, threaten resources. The chief concerns are nitrates in the groundwater, and fecal coliform contamination of surface waters. Onsite system permits have been denied because of shallow groundwater, slow percolation, steep slopes, poor soils, thin soils, and fractured rock. Some specifics: There is high-density coastal development in the Bay Area; coastal resources are in jeopardy. Mendocino and Marin counties both have undertaken special management measures. (The Stinson Beach program is located in Marin County.) There is also high-density development in the central area that includes Sacramento, which, along with the communities of Auburn and Chico, has identified wastewater problems. Special management measures are being taken in Chico. Further south in the valley, nitrates are becoming a major issue, although the chief source is agriculture. On the coast, Malibu, Ventura, and Santa Barbara counties have restrictive, expansive clays and shallow soils causing large numbers of failures. Malibu and Los Osos have taken special onsite management measures. In the very southern interior, the majority of systems are seepage pits or deep trench systems installed in alluvium; shallow aquifers are jeopardized.

Failures have been attributed to hydraulic overloading, poor maintenance, poor soils, inadequate design or construction, saturation of leach fields, and age. Most counties are experiencing continued population growth, with new development occurring in more marginal areas. Several communities are under enforcement orders. Central sewering is often not popular both because of the expense and its anticipated effects on development. Moreover, California's Senate Bill 470, passed in 1978, discourages the construction of sewers when suitable alternatives, including the creation of onsite wastewater management zones, exist. (See more below.)

2.5.4 Anticipated Changes in Regulations

Who administers, enforces onsite code?
Onsite wastewater regulations in California are not uniform across the state. There is a model code, but at the State level, each of the nine Regional Water Quality Control Boards (RWQCB) have different policies that require different approaches to siting and design with a wide variation. Local agencies (counties and cities) generally administer their own regulations for siting, design, and construction of onsite wastewater treatment systems, which must be in accord with the appropriate RWQCB policies but also vary widely across the State.

The State Water Quality Control Board has been developing statewide regulations governing onsite systems for almost a decade; the regulations have been delayed due to persistent controversy (NSFC, 2006).

Once effective, the statewide rules in California will be administered through the State's Regional Water Quality Control Boards (RWQCBs). Those boards will work with local governments (city or county health boards and/or management entities) to ensure the statewide regulations are complied with for all new and repaired onsite wastewater treatment systems (OWTS).

Code was last revised in: See above; revisions are continual among the counties.

New revisions in progress? To be adopted when? The draft model code, AB885, was released for comment in November 2008 (California WQCB, 2008).

Role of legislature, regulatory agency, and politics: See above.

2.5.5 Management Programs (Answers 3e-3g Summarized)

California has been a pioneer in the development of onsite wastewater management entities. For example, the Auburn Lake Trails Wastewater Management Zone, created in 1971 (and part of the Georgetown Divide Public Utility District of El Dorado County), is often credited with being the first fully comprehensive, "cradle-to-grave," management program in the U.S. The Stinson Beach Onsite Wastewater Program, in Marin County on the coast, is another oft-cited California program. Both programs oversee design, siting, construction, inspection, maintenance, repair and monitoring of systems and groundwater, much of the time with district personnel and services. These programs are each responsible for several hundred systems, many of them alternative. Eventually these isolated practices were codified by Senate Bill 430, the "onsite wastewater disposal zone law," which went into effect in 1978. The law specifically provides that central treatment plants will no longer be approved where existing onsite systems can be rehabilitated, or where less costly alternatives to centralization exist. It modified the powers of 17 types of institution previously authorized to operate central facilities, enabling them to alternatively establish special districts, called "zones," for onsite management programs. The agencies that manage these zones do so as wholly accountable public utilities operating under a permit or authority parallel to that of a point-of-discharge NPDES permit. The permits, which are issued by the regional water quality control boards, stipulate monitoring and reporting requirements, which can be tightened or loosened. Other management zones include Sea Ranch and Paradise. Entire counties have also enacted county-wide management measures; these include Mendocino, El Sonoma, Marin, Santa Cruz, and Nevada. Counties may also create "County Service Areas," of which there are several. Other communities where special management measures are in place include Chico in the densely developed north-central section of the state, and Los Osos and Malibu on the southern California coast. Both the Malibu and Los Osos programs, however, also have histories of significant contention with their respective RWQCBs (CCRWQCB, 2007; LARWQCB, 2008).

2.5.6 New Technology (Answers 4a-4h Summarized)

The draft AB885 regulations do have a component of performance-based practice (NSCF, 2006 and California SWQCB, 2008). The approach allows any technology to be used provided it is ‘certified’ by an engineer or, in the case of proprietary technology, by a third party independent testing or data validation process (NSFC, 2006). Prescriptive requirements are associated with some siting issues (such as minimum soil depth requirements) (California SWQCB, 2008).

The present county codes vary, but typically accommodate and sometimes require the use of alternative or advanced technology, which may then allow development on otherwise undevelopable sites. Best Available Technology is sometimes required of upgrades. Mechanisms for testing new technology mainly fall to the counties, who tend to initially permit a few experimental systems of a given type and, if satisfied by the body of experience, more generally permit them. Permitted systems among the counties include sand filters, mounds, aerobic, package plants, shallow trench, pressure distribution, evapotranspiration, “Cap-n-Fill,” sand trenches and drip irrigation. Intermittent sand filters and mound systems are in fairly widespread use in areas with shallow soils and shallow groundwater. Management and maintenance requirements vary with county and type of system, and may be left to the homeowner, perhaps with suitable documentation, or may be delegated to management agencies or programs. Communal systems, for example, are permitted in some counties if a management and maintenance entity is created.

2.5.7 Onsite Funding (Answers 5a-5c Summarized)

California provides funding or financing options for individual homeowners for repair or replacement of a failing or malfunctioning system, but not for new construction of onsite wastewater treatment systems (NSFC, 2006).

Depending on the county, there can also be limited funds at that level for qualifying families.

2.5.8 Leadership and Information

State-level agencies, task forces:

- California State Water Resources Control Board.
- California Conference of the Directors of Environmental Health.
- Technical Advisory Committee for Onsite Sewage Disposal Systems.

Local governmental agencies, task forces:

- Regional water quality control boards.
- County departments of environmental health.
- There are several Wastewater Management Zones in California. The two listed below are among the oldest of them, and among the more comprehensive. The section on management programs mentions several other counties and zones that have adopted special management measures.
    - *Auburn Lake Trails Wastewater Management Zone*, Georgetown Divide Public Utility District/El Dorado County, Box 4240, Georgetown, CA 95634 (contact: Marie E. Davis, General Manager, tel 916-333-4356).
    - *Stinson Beach Onsite Wastewater Management Program*, Stinson Beach County Water District, 3765 Shoreline Hwy. Box 245, Stinson Beach, CA 94970

(contacts: Bonnie M. Jones, Program Manager, tel 415-868-1333; Richard Dinges, General Manager, tel is the same).

Research within governmental agencies: At present, very little.
Research within universities:

- In the past there had been an active program at the University of California at Davis, under the leadership of Prof. George Tchobanoglous.
- There was a research initiative at California State University/Chico, but the Center now focuses on training (see below).

Onsite demonstration programs: None currently known.

Training or certification programs:

- The State of California does not require onsite professionals to be certified (NSFC, 2006).
- The draft provisions of AB 885 do require a "qualified professional" to perform soil and site evaluations, design new or replacement OWTS, and that a licensed General Engineering Contractor (Class A), General Building Contractor (Class B), Sanitation System Contractor (Specialty Class C-42), or Plumbing Contractor (Specialty Class C-36) install new or replacement OWTS (California SWQCB, 2008).
- There is a California Wastewater Training and Research Center, California State University/Chico, Chico, CA 95929; (contact: Tibor Banathy, Director, tel 530-898-6027; eml tbanathy@csuchico.edu, http://www.csuchico.edu/cwtrc/index.html)
- Training is also available from the California Environmental Health Assn. (CEHA) and the California Onsite Wastewater Association.

Citizen action, private groups:

- Integrated Systems and Control, Inc., 2045 Indian Trail, Cool, CA 95614; (contact: Bill Cagle, Division Manager/Wastewater Control, tel 916-663-3464, fax 916-663-2580, eml bcagle@quiknet.com).
- California Onsite Wastewater Association (COWA).
- California Environmental Health Association (CEHA).
- Many citizen groups and homeowner associations with wastewater interests are active in California; for instance, the Surfrider Foundation and Heal the Bay.

Newsletters, forums, other sources of information:

- Both COWRA and CEHA publish newsletters.

2.5.9 Enforcement (Q7)

Strong and well-established oversight and enforcement procedures exist for larger OWTS through the Regional WQCBs (California SWQCB, 2008a); for smaller systems, enforcement is often left to the counties or local wastewater management zones.

2.5.10 Role of Cluster Systems and Package Plants (Q8)

Cluster systems are allowed in some areas, with appropriate management (see Management Programs and New Technology, above).

2.5.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

See Management Programs, above. Most, if not all, management programs are operated by municipalities, utility districts, or county health authorities, rather than cooperatives.

2.5.12 What's Changed

Patterns
None noted in references utilized.

Drivers
In some environmentally sensitive areas, strict water quality regulations and recently implemented TMDLs are leading to replacement of existing OWTS with state-of-the-art systems, producing up to Title 22 (unrestricted water reuse) quality effluent (COWA, 2008 and Lombardo, 2008).

2.5.13 References

California Onsite Wastewater Association. 2008. Unique Malibu Project Sets Standard for OWTS in Environmentally Sensitive Areas. COWA News, Winter 2008 Newsletter, p. 3. Accessed at http://www.cowa.org/Newsletters/2008_winter-spring_newsletter.pdf on November 26, 2008. *Article about the technical details of a recently installed cluster system in Malibu, CA.*

California Wastewater Training and Research Center. 2003. Training and Certification Programs – A Necessary Part of Onsite/Decentralized Wastewater Treatment. Discussion paper prepared for U.S.EPA, Region IX, June 2003. Accessed at http://www.csuchico.edu/cwtrc/PDFFILES/draftcertreportprint.pdf on November 26, 2008.

California State Water Resources Control Board. 2008. Septic Tanks – AB 885. Accessed at http://www.waterboards.ca.gov/water_issues/programs/septic_tanks/ on November 24, 2008. *Proposed state-level regulations for systems with design flows less than 3,000 gallons per day, along with supporting information.*

California SWQCB, 2008a. Enforcement. Accessed at http://www.waterboards.ca.gov/losangeles/water_issues/programs/enforcement/ on November 26, 2008. *Information about enforcement authority and ongoing activities.*

CCRWQCB, 2007. Los Osos Individual Cease and Desist Orders. Accessed at http://www.waterboards.ca.gov/centralcoast/water_issues/programs/los_osos/index.shtml on November 26, 2008. *Information about recent disagreements about onsite wastewater management issues in Los Osos.*

LARWQCB, 2008. Consideration of Termination of Malibu Memorandum of Understanding (MOU) for Onsite Wastewater Treatment Systems (OWTS). Accessed at http://www.waterboards.ca.gov/losangeles/board_decisions/tentative_orders/individual/non-npdes/resolutions/malibu/index.shtml on November 26, 2008. *Regional Board documentation of recent disagreements about onsite wastewater management issues in the City of Malibu.*

Lombardo, p. 2008. Cost Effective Cluster Treatment and Dispersal System to Achieve Total Nitrogen of < 10 mg/L in an Environmentally Sensitive Area of Malibu, CA. Proceedings of the Nitrogen Symposium, NOWRA 17th Annual Technical Conference and Exposition, Memphis, Tennessee, April 6, 2008. *Information about the treatment process and effluent quality of a state-of-the-art OWTS recently installed in Malibu, CA.*

National Small Flows Clearinghouse. 2006. California Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/California.pdf on November 26, 2008. *This short document summarizes onsite wastewater system regulations and activities in California.*

2.6 Colorado

2.6.1 Summary

Colorado has over 260,000 systems in the ground, and issues about 8,000 permits a year for either new systems or upgrades/repairs. Problems are described as isolated. Areas of shallow bedrock or high water tables are widespread, but have only caused problems in platted areas and older mining towns, both with very small lots. The chief concern in those circumstances is contamination of groundwater. As development has progressed rapidly in the 1990s and into the current decade, concerns for and instances of groundwater contamination have increased. Generally the state favors the extension of sewers; nevertheless, much new construction is happening outside of sewer service areas. Most control, aside from minimum standards specified by the State Board of Health, is left with local entities. When the state board approves an alternative, it tends not to specify maintenance requirements, although local entities may stipulate them. Permits to install alternatives are issued locally, but are not particularly encouraged. Several counties have implemented time-of-transfer inspection and permitting programs for onsite management, and there is one local loan program for remediation or replacement. Training and licensing requirements are set locally, and most training is provided locally. The Colorado Professionals in Onsite Wastewater hold an annual educational conference.. There is an energetic research program at the Colorado School of Mines, and one at Colorado State University. There appears to be significant energy around increasing state-level involvement in regulations and policy involving onsite wastewater systems.

2.6.2 Numerical Information

Total number of onsite systems: NA; 1990 U.S. census reports about 185,000 systems in the ground. Scheffe et al., 2006, report 259,570 systems in the ground based on a 2005 survey of health departments. CDPHE estimates 600,000 systems in the state, with 7,000-8,000 permits issued a year (CDPHE, 2008).

Number of new systems installed each year: A total of 10,000 new and repair permits were issued last year. 8421 permits issued in 2004 (6887 new, 1542 repair); about 45% of these permits were for engineered anaerobic or advanced, aerobic systems. Less than 5% (272) permits were for advanced, aerobic systems (Scheffe et al., 2006). CDPHE estimates 7,000-8,000 permits issued a year (CDPHE, 2008).

Failure definition: NA

Number or proportion of systems presently failing: NA

Number or proportion *repaired* annually: (See above.)

Number or proportion *replaced* annually: (See above.)

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): NA

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): NA, but "very few if any."

Cost of a conventional *septic system* installation: $3000-$7000; range, $1500-$18,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): NA

2.6.3 Present Onsite Status (Answers 2a-2f Summarized)

Some areas of the state are reported to have problems because of antiquated development, site conditions, or jeopardy of resources. Shallow bedrock, fractured bedrock and shallow groundwater are fairly common occurrences. When these conditions exist in platted areas or mining towns with extremely small lots, there can be local contamination of groundwater. Permits have been denied because of lot size, adverse soil conditions, high water table, or location within a flood plain. Reasons cited for failure include age, poor maintenance, saturated leachfields, questionable percolation, small size, or change in use, and damage to leachfields by farm equipment. Rural construction is increasing, much of it outside of projected sewer extensions.

The state does not keep records, so the magnitude of such problems was NA. Generally the state supports centralization, and, in the past, has maintained a grant program directed specifically at small community wastewater systems.

Rapid development and population growth has occurred in Colorado through the 1990s and into the current decade, particularly in resort areas like Park County (near Breckenridge and Pikes Peak) and near urban areas such as Jefferson County, near Denver. The degradation of water quality has become a pressing issue, and research at the governmental and university levels has been conducted to investigate the role of ISDS effluent in water quality degradation at the individual system and watershed scales (Miller and Ortiz, 2007; Dano et al., 2004)

2.6.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Minimum standards are adopted by the State Board of Health. Local regulations are approved by county, with some regional (multi-county) and occasional municipal administration (NSFC, 2004). The minimum standards apply statewide but can be made more stringent at the local level (NSFC, 2004). The state's involvement is minimal; all permitting, record-keeping, inspections, and enforcement are done locally. Local regulations must be submitted to the state for review and approval, but there are few areas in which local regulations cannot be made more stringent (NSFC, 2004).

Code was last revised in: 2004. A new $20 permit surcharge to support staffing for an OWTS program at the state level was instituted in 2007 (CDPHE, 2008).

New revisions in progress? To be adopted when? Approximately every 4-6 years, but revisions are not in progress at this time.

Role of legislature, regulatory agency, and politics: There is no legislative involvement in the minimum standards set by the State Board of Health.

2.6.5 Management Programs (Answers 3e-3g Summarized)

There is no state involvement in such programs. State Code does not recognize or require management programs/contracts or management districts to monitor and maintain onsite systems or individual septic disposal systems, nor are there plans to develop such programs (NSFC, 2004). There is no perpetual maintenance on mechanical systems that have surface discharge required by the state (NSFC, 2004).

Colorado does not have a pre-sale inspection protocol for onsite wastewater systems during property transfers (NSCF, 2004). There is no state-wide licensing for who may perform such inspections (NSFC, 2004). Site evaluations can be performed by local health department staff or by a Registered Professional Engineer (NSFC, 2004). The state does require percolation tests or soil characterization as part of the site evaluation (NSFC, 2004).

Crystal Lakes, Colorado has had a management program as part of its water augmentation plan since 1974 (McKenzie, 2001); this program was reviewed as part of the National Onsite Demonstration Program, Phase 4 and detailed information on this program is available in Pinkham et al., 2004 and Yeager et al., 2006. Jefferson County Health and Environment initiated a time of sale inspection and permit program in 2004 (see http://jeffco.us/health/health_T111_R54.htm). In September 2008, Boulder County initiated a comprehensive time-of-transfer program (see http://www.bouldercounty.org/health/environ/water/septicsmart/), and Summit County has enacted a program that will begin in January 2009 (see http://www.co.summit.co.us/Ehealth/ISDS/UsePermits.html).

2.6.6 New Technology (Answers 4a-4h Summarized)

Alternatives are in use and the code does accommodate them, but their use is not meant to open up otherwise undevelopable land, nor are there are large sections of the state where their use predominates because of local conditions. Mounds and shallow drip systems are both used in cases of shallow bedrock, or high water tables. Other permitted technologies include evapotranspiration beds, aerobic units, gravelless systems, sand filters, chamber systems, constructed wetlands, and composting and incinerating toilets (NSFC, 2004). Colorado Code allows a maximum drainfield area/size reduction of 50% for gravelless absorption field systems, permanently installed low-flow fixtures, and dosing systems (NSFC, 2004).

There are no requirements for the use of BAT in remediation or repair. Alternatives are certified for use by the State Board of Health, generally by virtue of NSF certification. Once certified, they are not treated differently from any other system, unless there is surface application of effluent. In that case, there are several discharge standards, and mandatory sampling programs. Permits for alternative systems are granted locally on a case-by-case basis.

2.6.7 Onsite Funding (Answers 5a-5c Summarized)

A program in Boulder County provides low interest loans up to $25,000 for the repair of systems, if certain economic eligibility requirements are met (see http://www.boulder.co.us/cs/ho/weatherization).

2.6.8 Leadership and Information

State-level agencies, task forces:

- Colorado Dept of Public Health and Environment, Water Quality Control Division, 4300 Cherry Creek Drive South, Denver, Colorado; (contact: Kent Kuster, Environmental Protection Specialist, tel 303-692-3574, fax 303-782-0390, eml Kent.Kuster@state.co.us).
- There is a Technical Advisory Committee to the State Board of Health that reviews new products and technologies, and makes recommendations to the Board. The group also considers revisions to regulations.

Local governmental agencies, task forces:

- Regulations are enacted and enforced at the county or municipal level.

Research within governmental agencies:

- In 2000, the U.S. Geological Survey, in cooperation with Park County, Colorado, began a study to evaluate ground-water quality in the various aquifers in Park County that supply water to domestic wells. In addition, the potential effects of individual sewage disposal system (ISDS) effluent on ground-water quality were evaluated (Miller and Ortiz, 2007).

Research within universities:

- Colorado School of Mines, Dept of Environmental Science and Engineering, 112 Coolbaugh Hall, Golden, CO 80401; (contact: Dr. Robert Siegrist, tel 303-273-3490, eml rsiegris@mines.edu).; also see http://inside.mines.edu/research/smallQ/
- Colorado State University; (contact: Dr. Robert Ward).

Onsite demonstration programs: NA

Training or certification programs:

- The Tri-County Health Dept (which includes Denver) has done periodic training sessions; (contact: Warren Brown, tel 303-220-9200).
- Dr. Robert Siegrist (see above) is also listed as a training contact; further details, NA.
- Colorado Professionals in Onsite Wastewater (http://www.cpow.net/) holds an annual educational conference.

Citizen action, private groups:

- Clear Creek Watershed is looking at onsite issues (contact: Carl Norbeck, tel 303-692-3513).
- Colorado Professionals in Onsite Wastewater (see above) is active in increasing professionalism in the state's onsite industry.

Newsletters, forums, other sources of information: NA

2.6.9 Enforcement (Q7)

In Colorado, a failed system is not defined in either statute or regulation. There is no reporting of system failures, or causes, to the state. Oversight of systems is done at the local health agency level. No reporting to the state is required (NSFC, 2004).

2.6.10 Role of Cluster Systems and Package Plants (Q8)

No relevant information noted, though Crystal Lakes does manage at least one cluster system.

2.6.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

Most successful management programs are happening in homeowners' associations (e.g., Crystal Lakes) or as time-of-transfer use permit programs at the County health departments (see above).

2.6.12 What's Changed

Patterns
Currently the onsite wastewater regulations in Colorado are more affected and influenced by industry than they are by public policy, as it is easy to observe in the adoption of leach field reductions with chamber systems. These approvals were granted county-by-county per request of a manufacturer (Scheffe et al., 2006).

Drivers
A lack of commonality between county regulations is attributed in part to differing geography throughout the state, but also to the lack of state guidance in the rapidly changing onsite wastewater industry (Scheffe et al., 2006).

"It is the opinion of [Scheffe et al.], based upon the information collected and the interpretation of those data that the current procedures and practices in the onsite wastewater industry in Colorado are not conducive to providing the best available technology to environmentally sensitive areas. The proceeding phases II-IV of the Colorado Onsite Research and Evaluation (CORE) study will provide suggested guidelines for action, based upon data collected."

2.6.13 References

Colorado Department of Public Health and Environment. 2004. State Board of Health Guidelines on Individual Sewage Disposal Systems, 5 CCR 1003-6, effective November 30, 2004. Accessed at http://www.cdphe.state.co.us/regulations/wqccregs/100306individualsewagedisposalsystems.pdf on December 15, 2008. *Onsite system guidelines for the state of Colorado*.

CDPHE. 2008. Local Permit Surcharge for Statewide ISDS Program Support. Accessed at http://www.cdphe.state.co.us/regulations/wqccregs/ISDSFactsheetforLocalPartners.pdf on December 16, 2008. *Memo to local health departments about funding to increase state-level staffing and support of the ISDS program.*

Dano, Kathy, Eileen Poeter, and Geoff Thyne. 2004. Investigation of the fate of individual sewage disposal system effluent in the Turkey Creek basin, Colorado, May 2004, Completion Report 200, Colorado Water Resources Research Institute, Colorado State University, Fort Collins, Colorado. Accessed at http://www.cwi.colostate.edu/publications/cr/200.pdf on December 15, 2008. *With rapid development and population growth in the Turkey Creek Basin (TCB) of Jefferson County, Colorado, the degradation of water quality has become a pressing issue. This study investigates the role of ISDS effluent in the degradation of the basin's water quality by investigating the flow path and chemical evolution of ISDS effluent after it leaves the infiltration area of one individual sewage treatment system.*

McKenzie, C. 2001. Onsite Systems Management in the Rockies. *Small Flows Quarterly* 2(2): 16-18. Accessed at http://www.nesc.wvu.edu/old_website/nsfc/pdf/SFQ/SFQsp01.pdf on December 16, 2008. *Article about the policies and practices that enabled success for this long-running management program.*

Miller, L.D., and Ortiz, R.F., 2007, Ground-water quality and potential effects of individual sewage disposal system effluent on ground-water quality in Park County, Colorado, 2001–2004: U.S. Geological Survey Scientific Investigations Report 2007–5220, 48 p. Accessed at http://pubs.usgs.gov/sir/2007/5220/pdf/SIR07-5220.pdf on December 15, 2008. *Park County is one of the fastest-growing areas of Colorado, with development of commuter communities and vacation homes increasing throughout the 1990s. This development has increased demand on water resources and the potential for contamination of ground water. The purpose of this report is to provide relevant data and interpretations needed by water managers and planners to assess ground-water quality in Park County. Specifically, the report provides (1) a general assessment of the quality of ground water by locale and aquifer type, and (2) an assessment of the potential effects from ISDS's on ground-water quality in the county.*

National Small Flows Clearinghouse. 2004. Colorado Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/Colorado.pdf on December 16, 2008. *This short document summarizes onsite wastewater system regulations and activities in Colorado.*

Pinkham, R. D., J. Magliaro, and M. Kinsley. 2004. Case Studies of Economic Analysis and Community Decision Making for Decentralized Wastewater Systems. Project No. WU-HT-02-03. Prepared for the National Decentralized Water Resources Capacity Development Project, Washington University, St. Louis, MO, by Rocky Mountain Institute, Snowmass, CO. Accessed at http://www.ndwrcdp.org/userfiles/WUHT0203_RMI.pdf on December 16, 2008. *An extensive and detailed series of case studies, including one of the Crystal Lakes onsite wastewater management program*.

Scheffe, B.L., Jatcko, J.D., Gallaudet, S.. 2006. A Comprehensive State-Wide Survey and Evaluation of the Onsite Wastewater Industry and Regulations in Colorado, Phase I. Survey and report by Front Range Precast Concrete, Inc., Boulder, Colorado. Accessed at http://www.cpow.net on December 16, 2008. *Report detailing methods and results of a survey of county health departments' regulations, permitting practices, and opinions about onsite wastewater management and state-side policy.*

Scheffe, B.L., Jatcko, J.D., Gallaudet, S. 2008. Colorado Onsite Research and Evaluation Study, Phase II/III, Options for a Self-Sustaining Onsite Wastewater Treatment Improvement Program for the State of Colorado. Report by Front Range Precast Concrete, Inc., Boulder, Colorado. Accessed at http://www.cpow.net/pdf/stEPP%20phase%20II_III.pdf on December 16, 2008. *This document lays out results to date, comparisons with and information about onsite programs in other states, and recommendations for state-level policy and staffing for an onsite wastewater permitting program.*

2.7 Connecticut

2.7.1 Summary

Connecticut has approximately 400,000 systems in the ground. No information is available on how many systems are replaced, repaired, or installed annually. A handful of commercial or multi-user systems are permitted each year and regulated directly by the state. The main septic system problem in Connecticut is along the coast, where several communities are under long-standing enforcement actions. The problem is aggravated by very dense pockets of development, and the conversion of household use from seasonal to year-round. Regulators strongly support the creation and extension of sewer lines—however, most of the areas that are under enforcement orders cannot be sewered because of restrictions on outfalls into Long Island Sound.

While decentralized wastewater management districts are now allowed within which alternative systems can be constructed, and several such districts are being developed, none have yet been approved and implemented. .Several communities, under the guidance of local Wastewater Pollution Control Agencies, have developed “sewer avoidance plans,” which entail the creation of satisfactory management measures for conventional systems. Some “sewer avoidance plans” will require the use of alternative systems to meet water quality objectives, and at least one such plan, in Old Saybrook, is nearing local approval. Changes in code may more readily accommodate alternative technology when management measures and entities are in place. The Department of Public Health (DPH) administers an onsite certification program, and there is a Connecticut Onsite Wastewater Recycling Association.

2.7.2 Numerical Information

Total number of onsite systems: Approx 380,000 according to 1990 U.S. census. Connecticut does not track the number of permits issued per year for new construction or for system repair or replacement; an annual survey of towns is required, but data are not always tallied and records are maintained at the local level (NSFC, 2004).

Number of new systems installed each year: NA

Failure definition: “Subsurface sewage disposal systems that discharge sewage onto the ground surface, into an open watercourse, or otherwise cause health hazards or nuisance conditions should be identified as ‘failing’” (CT DPH, 2007). Larger systems, regulated by the DEP, are subject to NPDES limits.

Number or proportion of systems presently failing: NA

Number or proportion *repaired* annually: NA

Number or proportion *replaced* annually: NA

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): The use of alternative or advanced systems is permitted primarily for commercial or communal sites, and is regulated by the DEP rather than the DPH. However, certain technologies considered “alternative” in this document are considered conventional under Connecticut code; those are under DPH jurisdiction.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): See above.

Cost of a conventional *septic system* installation: $4000-15,000; range $1000-30,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): NA

2.7.3 Present Onsite Status (Answers 2a-2f Summarized)

There are large problem areas in Connecticut in densely developed, older beach front developments on Long Island Sound, with much of the housing being converted to year-round use. These areas cannot be sewered because of restrictions on outfalls into Long Island Sound. The coastal zone is marked by a high water table with rapidly permeable soils; nitrogen reduction is a concern, and pathogen transfer may also be a problem. The coastal area, particularly around New London and Groton, has the greatest problems, which are aggravated by high-density development. Dense or over-development around inland lakes has also posed problems. Permits have been denied because of unsuitable soils, seasonal high water, shallow water tables or ledges, and steep slopes. Onsite system failures have been attributed to age, shallow groundwater, poor soils, and poor construction or design.

Perhaps a dozen communities, including Saybrook, Westbrook, Madison, and Old Lyme have been under enforcement actions within the last decade over onsite wastewater management issues. While the DEP favors sewers where possible, central facilities tend to be vehemently opposed by the public because they are thought to be growth inducing. The alternative to centralization is the creation of local Water Pollution Control Authorities acceptable to the state. Several communities are investigating this route, and at least one (the Town of Old Saybrook) is nearing implementation of a comprehensive program (OS WPCA, 2008).

New development is not thought to pose a large problem, given that most critical areas, particularly along the coast, are already highly developed.

2.7.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? The Connecticut Department of Health regulates conventional, individual septic systems; regulations are administered by town or multi-town health departments. Larger systems, and all alternative or innovative systems, are regulated by the Connecticut Department of Environmental Protection, and require operating permits and regular inspections and maintenance.

Code was last revised in: January, 2007.

New revisions in progress? To be adopted when? Updates can occur yearly, if needed. Major updates occur every 3-4 years.

Role of legislature, regulatory agency, and politics: NA

2.7.5 Management Programs (Answers 3e-3g Summarized)

Prior to October 1, 2003, Connecticut did not recognize management programs/contracts or management districts to monitor and maintain onsite systems or individual septic dispersal systems (NSFC, 2004). However, new legislation has allowing municipalities to establish decentralized wastewater management districts by ordinance, and stipulates conditions that must be met before a town can create a district (NSFC, 2004 and CT DEP, 2008).

There is a strong need in coastal communities, and on the banks of the Connecticut River, for systematic remediation. Several towns have passed ordinances requiring regular inspection and pumping as part of their "sewer avoidance plans," which involve the creation of a local Water Pollution Control Authority. At least one community, Old Saybrook, is nearing the establishment of a Decentralized Wastewater Management District (Luckett 2002). If successful, this will allow the Town to take delegation of DEP's permitting and approval process for advanced treatment systems (Old Saybrook WPCA, 2008), Essex and Old Lyme are also considering establishing similar management programs. Many of the unsewered coastal communities have long histories of contention with CT DEP over wastewater management. All new systems require inspection at the time of construction, as well as the recording of an "as built" plan.

2.7.6 New Technology (Answers 4a-4h Summarized)

Connecticut's policy is to require conventional systems whenever possible. The state is generally opposed to the use of alternative systems except in commercial establishments or multiuser systems, although several different types of "conventional" systems are in general use. Currently, about 100 alternative systems serve small communities, schools, malls, developments or restaurants. They are permitted and regulated directly by the state's DEP. All are non-surface-discharging systems that remove nitrogen. Processes include activated sludge, RBCs, one SBR, Sycon, Zenon, and many recirculating sand filters. The state reviews applications for 5 or 6 such systems per year, with 1 or 2 of them going into construction. Nevertheless, it is anticipated that revised code may accommodate, or sometimes require, domestic alternative systems in limited situations, provided that suitable management protocols can be developed, which, at the least, will demand regular inspection and maintenance by a certified professional, with regulatory oversight, and penalties for violations. It is also anticipated that Best Available Technology will be required for the remediation of older systems. The DEP collects data on the large, alternative systems that it oversees.

2.7.7 Onsite Funding (Answers 5a-5c Summarized)

The state has supported funding for onsite repairs in the past, although are currently no programs. It is anticipated that with approved management plans, loan funding for upgrades will again become available. The Town of Old Saybrook recently applied for CDBG funds to be used for repairs and replacements for low-income residents (Sipe, 2007).

2.7.8 Leadership and Information

State-level agencies, task forces:

- The Connecticut Dept of Public Health regulates individual, conventional onsite systems: Connecticut Dept of Public Health, 410 Capital Avenue, MS #51 SEW, Hartford, CT 06134 (contact Mr. Bob Scully, tel 860-509-7296).
- There is a Code Advisory Committee that meets periodically to discuss policy, changes to regulations, training and management initiatives, and other topics (see, for example, http://www.ct.gov/dph/lib/dph/environmental_health/environmental_engineering/pdf/Agenda_Oct_08.pdf).
- Larger systems as well as alternative technologies are regulated by the Dept of Environmental Protection: Connecticut Dept of Environmental Protection, Bureau of Water Management, 79 Elm St, Hartford, CT 06106 (contact Warren Herzig, Supervising Engineer, tel 860-424-3801; see also http://www.ct.gov/dep/cwp/view.asp?a=2721&q=325706&depNav_GID=1654).

Local governmental agencies, task forces:

- Local "Water Pollution Control Agencies" at town level are charged with developing and implementing sewer avoidance plans. See above.

Research within governmental agencies: None.

Research within universities: None.

Onsite demonstration programs: No.

Training or certification programs:

- The DPH administers an onsite certification program to enforce codes from the local county health departments (see http://www.ct.gov/dph/lib/dph/environmental_health/environmental_engineering/pdf/1_Phase_1_Introduction.pdf).
- Southern Connecticut State University offers ongoing training courses for sanitarians (see http://www.southernct.edu/public_health/environmentalhealthtrainingprogram/)
- Connecticut DPH is currently offering soils training workshops funded in part with Section 319 grants (see http://www.ct.gov/dph/lib/dph/environmental_health/environmental_engineering/pdf/cir_2008-25_soils_training.pdf)
- COWRA runs installer and pumper/cleaner training courses (see http://cowra-online.org/cowratraining.html).

Citizen action, private groups:

- Connecticut Onsite Wastewater Recycling Association (formerly the Connecticut Sewage Disposal Association), P.O. Box 116, East Hampton, CT 06424 (860-267-1057, fax 860-267-1557, eml info@cowra-online.org; http://cowra-online.org/home.html).

Newsletters, forums, other sources of information:

- COWRA (see above) publishes a newsletter.

2.7.9 Enforcement (Q7)

Most enforcement actions for individual, conventional systems happen through municipal health department programs under local ordinances, while enforcement for alternative systems, cluster systems, and large-flow systems is conducted through CT DEP (see above).

2.7.10 Role of Cluster Systems and Package Plants (Q8)

Package plants are regulated by CT DEP, as are all alternative systems (see above). No information was available from the sources searched about cluster systems in CT.

2.7.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

O&M programs are generally implemented by municipalities in CT (see above).

2.7.12 What's Changed

Patterns/Drivers: None additional to those noted above.

2.7.13 References

Connecticut Department of Environmental Protection. 2008 Connecticut DEP. 2008. The Municipal Primer – Your Guide to Creating a "Green and Growing" Community. Accessed at http://www.ct.gov/dep/lib/dep/land_resources_and_planning/primer/themunicipalprimer.pdf on December 16, 2008. *Includes general information about planning for and implementing decentralized wastewater management districts in Connecticut municipalities.*

Connecticut Department of Public Health. 2007. Regulations and Technical Standards for Subsurface Sewage Disposal Systems, Discharges 5,000 Gallons per Day or Less, Connecticut Public Health Code, Section 19-13-B103, effective January 1, 2007. Accessed at http://www.ct.gov/dph/lib/dph/environmental_health/environmental_engineering/pdf/techstd_07.pdf on December 16, 2008. *The current regulation governing onsite systems in Connecticut.*

Connecticut Department of Public Health. 1998. Design of Subsurface Sewage Disposal Systems for Households and Small Commercial Buildings. Accessed at http://www.dph.state.ct.us/BRS/Sewage/sewage_manual.htm on December 16, 2008. *Current design manual (general design principles for conventional systems and sand filters in Connecticut.*

Luckett, Stephen. 2002. A case study: decentralized wastewater management in Old Saybrook, Connecticut. In *The First Northeast Onsite Wastewater Treatment Short Course & Equipment Exhibition Conference Proceedings*, Newport, Rhode Island, March 24-26, 2002. Short c*ase study on the development of a wastewater management plan for Old Saybrook which includes a significant focus on management of onsite systems, including some advanced treatment units, and a few small community systems—rather than a single centralized collection system and discharge to the Connecticut River, which was originally proposed.*

National Small Flows Clearinghouse. 2005. Connecticut Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/Connecticut.pdf on December 16, 2008. *This short document summarizes onsite wastewater system regulations and activities in Connecticut.*

Old Lyme Water Pollution Control Authority. 2008. Old Lyme Water Pollution Control Authority web page. Accessed at http://www.oldlyme-ct.gov/Pages/OldLymeCT_BComm/wpca on December 16, 2008. *Informational website with ordinances and meeting minutes for the Town's Authority.*

Old Saybrook Water Pollution Control Authority. 2008. Old Saybrook Water Pollution Control Authority Homepage. Accessed at http://www.oswpca.org/index.html on December 16, 2008. *Informational website for the Authority, containing legal documents, public educational information, meeting minutes and materials, and draft program information for public review.*

Sipe, C. Connecticut Town Seeks Federal Grant to Improve Septic System. Published October 7, 2007. Accessed at http://www.associatedcontent.com/article/406217/connecticut_town_seeks_federal_grant.html?cat=5 on December 16, 2008. *Newspaper article about Old Saybrook's application for grant funding to be used for repairs.*

2.8 Delaware

2.8.1 Summary

Delaware has 80,000-90,000 systems in the ground, issues about 3,000 permits annually, and repairs or replaces about 600 annually (over a third of which are alternative in some sense). It is coastal areas that are most in jeopardy, and much of the coast is aggressively protected. Centralization is the solution of choice in Delaware, and all communities of more than 500 are in fact serviced centrally. Delaware has a statewide comprehensive wastewater plan as part of its statewide development plan that steers growth toward particular (and largely sewered) areas. However, alternative and advanced systems are permitted under the code, first experimentally and then, with experience, more generally. No particular areas of the state have been singled out for special treatment, but as part of the statewide plan all systems are to come under appropriate and enforced management measures. Toward this end, an inspection program is under development within the Inland Bays watershed. There is a statewide betterment program for system upgrades. There is no university research at this time. However, the DNREC has installed elevated sand mounds and constructed wetlands as demonstration projects. Several classes of onsite professionals are tested and licensed at state level, and a community college has developed an onsite wastewater training center. There is a Delaware Onsite Wastewater Recycling Association.

2.8.2 Numerical Information

Total number of onsite systems: Approximately 80,000-90,000 (Wyatt, 2003; DNREC, 2006); 1990 U.S. census reports approximately 75,000.

Number of new systems installed each year: Approx 3,000 (2,928 in FY 2005, the latest for which data are available; DNREC, 2006).

Failure definition: Surfacing effluent, backup into the structure, or inadequate renovation of effluent on reaching the water table.

Number or proportion of systems presently failing: NA, but it is thought that failing systems are now replaced promptly.

Number or proportion *repaired* annually: Approximately 200.

Number or proportion *replaced* annually: Approximately 400.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): In 1997: pressure-dosed systems, 607; elevated sand mounds, 216; Wisconsin-at-grade, 3; and subsurface micro-irrigation, 2; other alternative systems, 80 (all this is in contrast to 1514 conventional gravity systems). These numbers apply to both new installations and replacements. More recent information not available.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Five rotating biological contactors were installed as replacement systems in 1997. More recent information not available.

Cost of a conventional *septic system* installation: For a standard gravity system, $2500-$3500; for pressure dosing, $3500-$5000; for elevated sand mounds, $8000-$12,000; for advanced treatment, $12,000+.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): NA, varies greatly.

2.8.3 Present Onsite Status (Answers 2a-2f Summarized)

Various noncontiguous areas in the state have problems because of antiquated systems and/or dense development. Failures have been attributed to age, poor design or installation, and inadequate soils. A few of these areas may pose jeopardy to resources. Obviously, the coast and its estuaries are the resources most in need of protection. Much of the Delaware coast (except the northern portion of New Castle County) is protected as a resource area. Development cautions apply to much of Sussex County, much of which is also being incorporated into sewer districts. In northernmost New Castle County growth is encouraged, Central Kent County has several towns on the outskirts of Dover with problems; nevertheless, growth is encouraged in and around Dover.

Much of the state could pose problems with future development, except for Delaware's planning efforts. Under the leadership of the Clean Water Advisory Council (formerly the Wastewater Facilities Advisory Council, established 1995), Delaware completes a comprehensive statewide wastewater facilities, needs, and financial assessment for both sewered and unsewered communities once every five years, with the latest such assessment completed in 2005 (Gulbronson, 2006). With one exception, all communities of over 500 dwellings are presently served by central facilities. Centralization is regarded as the optimal solution for densely developed areas in the state, and basically enjoys political support aside from homeowner resistance to fees associated with hookups. However, the latest survey identifies major funding gaps associated with sewer extensions to support rapid growth, treatment plant upgrades to meet TMDL limits, and for correction of I&I issues in existing collection systems (Gulbronson, 2006). The trend to centralization is reinforced by Delaware's Growth and Development System, which essentially is a state comprehensive plan that directs growth away from, and toward, specific areas. (One goal of the plan is to encourage "revitalization of existing water and wastewater systems as well as the construction of new systems.")

2.8.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Code is set at state level by the Department of Natural Resources and Environmental Control. Administration and system permitting is handled by local DNREC offices, which review and approve site plans and designs. Enforcement is reported to be adequate; 51 enforcement actions were undertaken in FY 2005, the latest year for which information is available (DNREC, 2006).

Code was last revised in: 2005 (DNREC, 2005).

New revisions in progress? To be adopted when? No rule revisions have been announced.

Role of legislature, regulatory agency, and politics: Any regulatory changes require legislative approval, which is typically forthcoming when revision is properly justified.

2.8.5 Management Programs (Answers 3e-3g Summarized)

All individual systems are regarded as needing proper and effective management, starting with a pre-cover inspection and the filing of as-built plans. A Pilot Compliance Program for septic systems is underway in the Inland Bays watershed (Wyatt, 2003). Nearly 19,000 small onsite systems contribute an estimated 11 percent of the Inland Bays region's total nitrogen load (Dayton and Day, 2008). A major goal of the program is to establish a basic three-year inspection protocol which could eventually be translated to the entire state. In 2003, the program included inspection of 94 septic systems and two public service announcements run on a local television station (U.S. EPA, 2005). The DNREC is now working to clarify the costs and financing needs of low-income households and identify financing opportunities to address those needs (Dayton and Day, 2008). A report on the matter is available (University of Maryland Environmental Finance Center, 2008). There are no reports of public utility interest in running O/M programs.

2.8.6 New Technology (Answers 4a-4h Summarized)

Present code accommodates and sometimes requires the use of alternative or advanced systems, and may thus allow development on otherwise undevelopable sites. Performance based codes are followed for some cases involving marginal lots (NSFC, 2004). Upcoming pollution control strategies in certain watersheds (e.g. Inland Bays) will require more use of performance based codes (NSFC, 2004). I/A technologies are listed under subsections, and are continuously added through procedures and criteria specified in the "alternative design" section of the code. Permits for such systems are granted with varying provisions for installation, operation, maintenance, monitoring, sample collection, and laboratory testing. The systems may also be monitored directly by DNREC. Sand filters, aerobic and mound systems, RBCs, low pressure pipe, Wisconsin-at-grade, and subsurface micro-irrigation systems have all been permitted. The level and manner of oversight for these systems depends on the technology involved. No particular kinds of systems have been linked to particular physiographies in the state; nor is Best Available Technology automatically required of upgrades. Whether the use of alternative or advanced systems would be more widespread as costs diminished is reported as problematical (dependent on many other factors). Package plants and/or cluster systems are likely to be used only to remediate areas for which there is no other remedy.

2.8.7 Onsite Funding (Answers 5a-5c Summarized)

There is a state-funded betterment program for upgrades and replacement of failing systems, and EPA SRF funds are employed to seed this effort. SRF funds are matched by the state's 21st Century Fund (Wyatt, 2003). A 319 Grant provided funding for the Inland Bays Pilot Compliance Program (see above). Delaware's 6217 program funds cost share for pump outs (Wyatt, 2003). The interest rate on loans from the Septic Rehabilitation Loan Program is 3-6%. Qualifying households can borrow as much $15,000, while up to $250,000 is available for community systems (State of Delaware). (Contact for this office is Carla Waller, Financial Assistance Branch, DNREC, tel 302-739-9941, eml carla.waller@state.de.us.)

2.8.8 Leadership and Information

State-level agencies, task forces:

- Dept of Natural Resources and Environmental Control (DNREC), Groundwater Discharges Section, 89 Kings Hwy, Dover, DE 19901; (contacts: Rodney L. Wyatt, Environmental Program Manager, tel 302-739-4762, fax 302-739-7764, eml rodney.wyatt@state.de.us; or Dave Schepens, Environmental Control Supervisor, tel 302-739-9948, fax 302-739-3491, dave.schepens@dnrec.state.de.us).
- Wastewater Facilities Advisory Council (to the Governor, General Assembly and the DNREC), Box 1401, Dover, DE 19903.
- Cabinet Committee on State Planning Issues.

Local governmental agencies, task forces:

- Center for the Inland Bays, 39375 Inlet Rd, Rehobeth Beach, DE 19971, tel (302) 226-8105, fax (302) 226-8109, outreach@inlandbays.org, http://www.inlandbays.org.

Research within governmental agencies:

- DNREC performs research with experimental systems (as outlined in the regulations); also, see below.

Research within universities:

- Not at present.

Onsite demonstration programs:

- DNREC installed an elevated sand mound as a demonstration for contractors, designers, and inspectors. It has also installed two alternative wetlands treatment facilities.

Training or certification programs:

- Several classes of professional (percolation testers, system designers, engineers, site evaluators, system contractors and waste haulers) are tested and licensed at state level. Environmental training is available at Delaware Technical & Community College, Jack P Owens Campus, PO Box 610, Georgetown, MD 19947. See http://www.dtcc.edu/owens/ccp/environmental/ for more information.

Citizen action, private groups:

- Delaware On-Site Wastewater Recycling Association, DOWRA, founded 1996 (Box 1696, Dover, DE 19903; Ken Walsh, President, tel (302) 436-8822, fax (302) 436-2264, eml mks1@aol.com.

Newsletters, forums, other sources of information:

- DNREC web site: http://www.dnrec.state.de.us.
- DOWRA publishes a newsletter: http://www.dowra.org.

2.8.9 Enforcement (Q7)

Since DNREC is in charge of all onsite system permitting, enforcement activities are conducted by the agency rather than by counties or municipalities (see above).

2.8.10 Role of Cluster Systems and Package Plants (Q8)

Package plants and/or cluster systems are likely to be used only to remediate areas for which there is no other remedy (see above).

2.8.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

No utilities or cooperatives have expressed interest in onsite system management programs (see above).

2.8.12 What's Changed

Patterns / Drivers
Public awareness of water quality problems in the state's environmentally sensitive watersheds is driving increased scrutiny of all potential sources of pollution. As of 2003, 15 of the state's 45 watersheds have established TMDLs. The Inland Bays TMDL calls for a 40%-65% phosphorus reduction and a 40%-85% nitrogen reduction from all non-point sources (Wyatt, 2003).

2.8.13 References

Delaware Department of Natural Resources and Environmental Control. 2005. The Regulations Governing the Design, Installation and Operation of On-Site Wastewater Treatment and Disposal Systems. Amended April 11, 2005. Accessed at http://www.dnrec.state.de.us/water2000/Sections/GroundWat/Library/Regs/regsfinal.pdf on December 17, 2008. *Current state regulations governing design and installation for onsite systems.*

Delaware Department of Natural Resources and Environmental Control. 2006. Enforcement and Compliance Annual Report for State Fiscal Year 2005 (7/1/04 to 6/30/05). Report Issued: February 28, 2006. Accessed at http://www.dnrec.delaware.gov/Info/Documents/d28e1b74004a4ec999cb7faa1b62a2e3FY05AnnualReportFinal.pdf on December 17, 2008. *Annual report, including permitting statistics for groundwater discharge permits (onsite and alternative systems).*

Dayton, S. and D. Day. 2008. Targeting Nutrients. *Onsite Installer* April, 2008:14. Accessed at http://www.onsiteinstaller.com/editorial/798/2008/04 on December 17, 2008. *A short status update about the Inland Bays onsite management initiative.*

Gulbronson, K. 2006. Delaware Statewide Wastewater Facilities Assessment, 2006-2011. Presentation read at August 2006 Clean Water Council workshop. Accessed at http://www.dnrec.state.de.us/DNREC2000/Library/CWAC/7-Gulbronson_URS%20Statewide%20Assessment.pdf on December 17, 2008. *PowerPoint* *presentation that summarizes findings from the most recent state-wide survey of wastewater infrastructure status and funding needs.*

National Small Flows Clearinghouse. 2004. Delaware Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/Delaware.pdf on December 17, 2008. *This short document summarizes onsite wastewater system regulations and activities in Delaware.*

State of Delaware. Rules, Regulations, Laws, Policies, and Guidelines. Accessed at http://www.dnrec.delaware.gov/Info/Pages/Rules.aspx on April 4, 2008. *Website for both current regulations and those under review, at the time accessed showing no proposed changes to regulations governing onsite systems.*

State of Delaware. Septic Rehabilitation Loan Program. Accessed at http://www.dnrec.state.de.us/water2000/Sections/FAB/FABSepticRehab.htm on April 4, 2008. *Information about loan programs for onsite system repairs.*

U. S. Environmental Protection Agency. 2005. Inland Bays, Delaware – Nonpoint Source Success Story. May, 2005. Accessed at http://www.epa.gov/reg3wapd/nps/success/de_inland_bays.htm on April 4, 2008.*A short report (now slightly dated) about the Inland Bays onsite wastewater management initiative.*

University of Maryland, Environmental Finance Center. 2008. Community Financing for Septic System Management in the Inland Bays Watershed: A White Paper Report Prepared for Delaware Department of Natural Resources and Environmental Control. Accessed at www.efc.umd.edu/pdf/DE_Septic_Report.pdf on December 17, 2008. *A white paper about strategies for financing septic system management programs in the Inland Bays area, including strategies and recommendations for implementation.*

Wyatt, R. 2003. Delaware's Approach to the Management of Onsite Wastewater Use... A Public/Private Partnership. Presentation to the State Onsite Wastewater Regulators and Captains of Industry Conference. March 28, 2003. *PowerPoint presentation from a state regulator about onsite wastewater management in Delaware.*

2.9 Florida

2.9.1 Summary

Florida has about 2.3 million septic systems in the ground. Some 25,000 are repaired or replaced annually. Florida's population continues to grow, but with few exceptions the counties have conditions that severely limit the use of conventional septic systems. Wetness, shallow bedrock, karst topography, and nutrient enrichment along the coast and in the Keys are all problems or potential problems. About a quarter of ISDS replacements involve some form of alternative technology, which are accommodated and sometimes required. Most require particularized operation and maintenance protocols. There are systematic procedures for testing and authorizing new technologies, research programs at several colleges or universities, several demonstration projects, and a broad training and certification program for several categories of professionals. Florida has revised state code to reflect performance-based standards. Systematic remediation and management programs exist in three counties, others are considering similar programs, and the state is weighing the costs of mandatory inspections and pumpouts for all conventional ISDS. Aggressively addressing onsite pollution has a strong and continuing legislative mandate. A revolving fund pool for system upgrades has been approved, but procedures for accessing the funding have not been formalized.

2.9.2 Numerical Information

Total number of onsite systems: 2.3 million (FDOH, 2008a)

Number of new systems installed each year: About 35,000 (FDOH, 2008)

Failure definition: Conditions which prohibit the system from functioning in a sanitary manner, and which result in plumbing failure, or in the discharge of insufficiently treated water onto the ground, or into surface or ground waters.

Number or proportion of systems presently failing: NA, see below for annual estimates.

Number or proportion *repaired* annually: About 20,000 repaired/replaced and 5,000 modified annually (FDOH, 2008).

Number or proportion *replaced* annually: See above.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Many types of alternative or advanced technology are employed, but no percentages were provided. As to leaching areas, over half the systems are either conventional trench or bed systems. However, fill systems account for 20%, mound systems for almost 25%, and gravelless systems for about 1.5% of current installations. Of the 16,701 onsite systems with operating permits, approximately 54% are ATU, 34% are located in industrial or manufacturing zones, 8% are designed to treat commercial sewage waste and 5% are for performance-based treatment systems (FDOH, 2008a).

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): No breakout was provided; see above.

Cost of a conventional *septic system* installation: $2500; range $2000-$25,000. About half the installations require mounds or fill; were this not the case, the typical cost would be more like $1500. The average repair cost for conventional systems is estimated to range from $1,988 to $4,088 with an average cost of $3,038 for a standard gravity system (FDOH, 2008a).

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $3000 to $12,000.

2.9.3 Present Onsite Status (Answers 2a-2f Summarized)

Florida's population continues to grow, but with few exceptions its counties have conditions that significantly limit the use of ISDSs. Large areas of the state are unsuitable to conventional systems because of wetness, flooding, shallow bedrock, or slow permeability. These include the Central and South Florida Flatwoods, the Florida Everglades, and the North Florida Flatwoods, where wetness and related conditions are pervasive. The Central Florida Ridge and the Southern Coastal Plain also have wetness-related problems affecting a significant fraction of these areas; permeability is an additional problem in the Southern Coastal Plain. There are imminent problems in Monroe County and the Florida Keys because of failing systems, high coliform counts, and coastal nutrient enrichment (with the potential for eutrophication); in some cases, innovative solutions are being implemented, particularly for remote campgrounds (Leposky 2005). An extensive study in Sarasota County determined enteric virus contamination. Barrier islands on the Gulf Coast have marginal conditions and strong development pressure.

2.9.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Law and code are made at state level and administered and enforced at county level. County health departments are extensions of the state Department of Health. Enforcement is considered adequate; new and repaired systems are inspected, and electrical hookups require system approval; there are occasional complaints of unauthorized repairs.

Code was last revised in: 2006 (FDOH, 2006); the 1998 revisions used performance-based standards for the first time.

New revisions in progress? To be adopted when? As required; revisions occur approximately annually (NSFC, 2004).

Role of legislature, regulatory agency, and politics: The code revisions have been driven by statutory mandate.

2.9.5 Management Programs (Answers 3e-3g Summarized)

Management programs/contracts are recognized in code for aerobic treatment units, and maintenance contracts are required for performance based treatment systems and industrial manufacturing zone systems (NSFC, 2004). A list of certified maintenance entities can be obtained from FDOH. Florida has implemented management programs in several areas throughout the state in connection with the performance-based standards. Aerobic and commercial units are inspected at least annually by DOH and must have additional maintenance performed by a certified provider (FDOH, 2006 and 2008). In the late 1990s, Charlotte County began a program of targeted sewer extensions, onsite system replacements with advanced treatment, and maintenance/monitoring using certified contractors; this program has since been included in the NODP Phase IV database (McKenzie, 2001) and has been used as a national case study (e.g., Pinkham et al., 2004). Pre-cover inspections are required of all construction or repair; any special system requiring an operating permit is inspected at least once during the term of the permit.

The state is considering implementing a pumpout and inspection program for conventional systems (FDOH, 2008a). Three counties (Charlotte, Escambia, and Santa Rosa) have already implemented local management and maintenance programs (FDOH, 2008a). Talquin Electric Cooperative provides water and wastewater services to over 4,000 customers in northwest Florida around the Tallahassee metropolitan area; though its customers currently all utilize facilities with surface discharge, it reportedly has expressed interest in the possibility of starting a decentralized O/M program (Yeager et al., 2006).

2.9.6 New Technology (Answers 4a-4h Summarized)

Performance based codes exist for technology selection; any technology that has third-party testing data from NSF is eligible for approval (NSFC, 2004). An innovative system approval process exists for technologies not listed in the state code; this can be reviewed in Chapter 64E-6EAC. Advanced and alternative systems are and will be permitted on sites that are otherwise undevelopable. Waterless, incinerating, and composting toilets; aerobic systems, sand filters, mounds, chamber, and Infiltrator (proprietary) systems, as well as alternative distribution and drainfield systems (such as low pressure injection and drip irrigation), are handled as subsection amendments to the code(NSFC, 2004; FDOH, 2006). In the Florida Keys (Monroe County) new development is highly regulated, and advanced wastewater treatment is mandatory; remediation of older systems must use "best available technology' (FDOH, 2006). A recent performance evaluation of aerobic treatment systems in the Keys, however, showed that about a quarter of the systems sampled were exceeding performance standards (Roeder and Brookman 2005). Cluster systems are permitted, and considered important, in areas with small lots. There are mechanisms to test and authorize new technology at regional levels. Demonstration sites and individuals may test innovative and experimental technologies under state-issued innovative system permits.

2.9.7 Onsite Funding (Answers 5a-5c Summarized)

SRF monies can be used to assist homeowners in the repair of a failing or malfunctioning system, replacement of a failing or malfunctioning system, or for new construction of an onsite wastewater treatment system; however, this process is not yet formally established (NSFC, 2004). There are no other betterment loan programs.

2.9.8 Leadership and Information

State-level agencies, task forces:

- ♦ Florida Dept of Health, Bureau of Onsite Sewage Programs, 1317 Winewood Blvd, Tallahassee, FL 32399; tel 850-488-4070.

- ♦ There is a statutorily designated Technical Review and Advisory Panel; further information NA.

Local governmental agencies, task forces: NA

Research within governmental agencies:

- ♦ The Dept of Health funds both university and several private research efforts (see below).
- ♦ The 2004 Wekiva Parkway and Protection Act authorized building the Wekiva Parkway and provided protection to the Wekiva River system. The Act required a comprehensive approach to protecting the Wekiva River system involving local governments, state agencies, and the St. Johns River Management District—and required the Department of Health to address nitrogen reduction through appropriate onsite disposal standards. As part of this effort, FDOH contracted a study to assess whether OWTS are a significant source of nitrogen to the underlying groundwater relative to other sources and recommend a range of possible cost-effective OWTS nitrogen reduction strategies if contributions are significant. See http://www.doh.state.fl.us/environment/ostds/wekiva/ for documents and reports regarding this effort.

Research within universities:

- ♦ Currently there are research programs at University of Florida, Florida State University, and University of South Florida (Dept of Environmental and Occupational Health); also see the next heading.
- ♦ Ayers Associates conducted research programs in the 1990s, including involvement in the Big Pine Key and University of South Florida efforts described below.

Onsite demonstration programs:

- ♦ Big Pine Key: Florida Keys Onsite Wastewater Nutrient Reduction System Demonstration Project examined the effectiveness of alternative systems.
- ♦ The University of South Florida (in Tampa) is testing (and demonstrating) the capacity of fine, sandy soils to treat effluent through the use of an in-situ soil infiltration cell (lysimeter).

Training or certification programs:

- ♦ There are state-level training and certification programs for Septic Contractors (6 hr/yr), Master Septic Contractor (12 hr/yr), and Septic Inspectors (24 hr/2 yr); contact: Ed Barranco, Florida Dept of Public Health, 4052 Bald Cypress Way, Bin 808, Tallahassee, FL 32399-1713; tel 850-488-3842.
- ♦ The Florida Onsite Wastewater Association and Florida Environmental Health Association both provide training; FOWA has an annual conference and operates a training center with classrooms, a research facility, and demonstration systems (see below).

Citizen action, private groups:

- Florida Onsite Wastewater Association (formerly Florida Septic Tank Association) , contact Roxanne Groover, (863) 956-5540, fax (863) 956-0937, eml rgroover@fowaonsite.com; http://www.fowaonsite.org)
- Sarasota County, the Phillipi Creek Task Force; plus several active groups in the Florida Keys (further information NA).

Newsletters, forums, other sources of information:

- The Florida Dept of Health has a bulletin board system.
- There is also a FOWA newsletter, annual conference and trade show.

2.9.9 Enforcement (Q7)

Generally considered adequate at the county and state levels; see above.

2.9.10 Role of Cluster Systems and Package Plants (Q8)

Generally considered important, particularly in areas with very small lots; on-lot advanced treatment more commonly implemented, however. See above.

2.9.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

At least one entity, Talquin Electric Cooperative, is providing wastewater management services and is reportedly considering providing decentralized O&M services (see above).

2.9.12 What's Changed

Patterns
[ANM notes that] Trends toward bringing all systems under management are supported by legislature and encouraged by FOWA and environmental health organizations.

Drivers
[ANM notes that] Both evidence of environmental problems and development pressure appear to be drivers towards increased regulation and long-term management of OWTS in this state.

2.9.13 References

Florida Department of Health. 2006. Chapter 64e-6, Florida Administrative Code, Standards for Onsite Sewage Treatment and Disposal Systems. Effective November 26, 2006. Accessed at http://www.doh.state.fl.us/environment/ostds/pdfiles/forms/64e6.pdf on December 17, 2008. *Current version of Florida's onsite wastewater treatment system regulations.*

Florida Department of Health. 2008. About the Bureau of Onsite Sewage Programs. Accessed at http://www.doh.state.fl.us/environment/ostds/index.html on December 17, 2008. *Informational website about onsite sewage systems programs, rules, research, and management in Florida.*

Florida Department of Health. 2008a. Report on Range of Costs to Implement a Mandatory Statewide 5-Year Septic Tank Inspection Program. Accessed at http://www.doh.state.fl.us/environment/ostds/pdfiles/forms/MSIP.pdf on December 17, 2008.

Report from FDOH staff on costs to implement a mandatory inspection program for all OWTS over the next 10 years.
Leposky, Rosalie. 2005. Fresh thinking keeps Scouts prepared. *Onsite Water Treatment*, September-October 2005. Accessed at http://www.onsitewater.com/ow_0509_fresh.html on March 26, 2009. *Case study on a graywater system installed to handle dishwashing waste at a primitive Boy Scout camp in the Florida Keys.*

McKenzie, C. 2001. Charlotte County, Florida: A Case Study. *Small Flows Quarterly* 2(3): 28-29. Accessed at http://www.nesc.wvu.edu/pdf/ww/publications/smallflows/magazine/SFQ_SU01.pdf on December 17, 2008. *Short article on Charlotte County's onsite sewage systems management program.*

National Small Flows Clearinghouse. 2004. Florida Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/Florida.pdf on December 17, 2008. *This short document summarizes onsite wastewater system regulations and activities in Florida.*
Roeder , Eberhard, and William Brookman. 2005. How Well Do Aerobic Treatment Units Work? Data from the Florida Keys. In NEHA 69th Annual Educational Conference (AEC) & Exhibition, Providence, Rhode Island, June 26-29, 2005. *PowerPoint presentation describing the methods and results for a performance evaluation of ATUs installed in the Florida Keys; results showed that about 25% of the time, on average, the systems were not meeting performance standards.*

Sherman, Kevin. 2007. The Benefits of a Variance Procedure in Onsite Wastewater Regulations. In Eleventh Individual and Small Community Sewage Systems Conference Proceedings, Warwick, Rhode Island, 20-24 October 2007. Accessed at http://asae.frymulti.com/azdez.asp?JID=1&AID=24006&CID=icss2007&T=2 on March 26, 2009.

Yeager, T., R. Eberhard and J. Murphy. 2006. Business Attributes of Successful Responsible Management Entities. Report prepared for the National Decentralized Wastewater Resources Capacity Development Project by Kennedy Jenks Consultants, Inc., project no. 04-DEC-SG. Accessed at http://www.ndwrcdp.org/userfiles/04DEC4SG.pdf on December 17, 2008. *Extensive report including a case study on Talquin Electric Cooperative.*

2.10 Georgia

2.10.1 Summary

Georgia has between 600,000 and 1 million onsite systems in the ground. About 9000 systems are repaired or replaced annually. Numbers were not available on how many new systems are installed yearly. Problems are scattered throughout the state, with many stream segments believed to be contaminated by sewage. State regulations were updated in 2007. New technology is accommodated through experimental protocols that may result in more general use. No management entities are contemplated, and no funding is available for onsite betterments. No research or demonstration programs are currently underway.

2.10.2 Numerical Information

Total number of onsite systems: At least 600,000; 1990 U.S. census data implied a number closer to 1 million.

Number of new systems installed each year: NA

Failure definition: Must constitute a public hazard, either by inadequate treatment or disposal (Georgia DHR, 2007).

Number or proportion of systems presently failing: Over 10,000.

Number or proportion *repaired* annually: 9000+ repairs or replacements.

Number or proportion *replaced* annually: See above.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): NA

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): NA

Cost of a conventional *septic system* installation: $2500 (range $750-$10,000).

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): NA. Centralized sewer connections are required when the service is within 200 feet of the property (Georgia DHR, 2007).

2.10.3 Present Onsite Status (Answers 2a-2f Summarized)

There are areas in the state where more development will lead to problems, and there are presently watersheds with known or imminent problems because of dense development, failing systems, or poor conditions, which include steep slopes, shallow rock ledges, high water tables or flood plains. Many stream segments are believed to be contaminated by fecal coliform, some undoubtedly sewage-related. Georgia is currently being required to develop and implement total maximum daily loads (TMDLs) for stream impairments, caused mostly by non-point sources (Grenoble, 2007). Reasons cited for failures include system age, undersized systems, poor soils or sites, lack of maintenance, and seasonally high water tables. Most new development is outside centrally sewered areas; and, increasingly, it is situated in less suitable areas for onsite systems. Every county has at least one central sewer system, and it can be expected some of them will extend service areas, as can it be expected that new plants will be built, although public funding is increasingly a problem. Resistance to centralization is not centered on cost or principle, but reportedly on the "NIMBY" syndrome. There are probably enforcement actions in progress, but no state-level actions. Details of local actions were not reported.

2.10.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Georgia has state-level onsite legislation, regulations, and a technical reference manual (Georgia DHR, 2007). Enforcement is handled at county or municipal levels with some coordination through nineteen regional health districts. The county or municipal agency may add amendments to the state regulations (Douglas County Board of Health, 2008). At state level, enforcement is considered inadequate due to lack of training and personnel shortages.

Code was last revised in: State regulations were updated in 2007 (Georgia DHR, 2007).

New revisions in progress? To be adopted when? No upcoming revisions have been announced.

Role of legislature, regulatory agency, and politics: There is support in the legislature.

2.10.5 Management Programs (Answers 3e-3g Summarized)

New legislation has mandated the management and maintenance of all systems more actively, although no critical areas have been designated. County regulators routinely carry out performance evaluations of existing systems; guidance for these evaluations is provided by the state in the Manual for On-Site Sewage Management Systems (2007). In Douglas County, the Douglasville-Douglas County Water and Sewer Authority tracks septic systems within its jurisdiction, requiring proof of septic tank pumping every five years (DDCWSA, 2008). The City of Berkeley Lake in Gwinnett County passed an ordinance requiring septic tanks to be pumped out and inspected every 5 years by a locally registered pumper (City of Berkeley Lake).

2.10.6 New Technology (Answers 4a-4h Summarized)

The current code accommodates, and at times requires, the use of alternative or advanced technology with periodic oversight or management, cleared by testing programs. Such systems will allow for development on presently undevelopable sites. Best Available Technology will be mandated for failing systems. Alternative systems currently in use include sand filters, mounds, aerobic treatment, emitter, chamber and drip systems, Infiltrator, aquatic treatment, and Wisconsin-at-grade. Cluster systems are expected to play a moderate role in the future; there is a trend among developers to install them. The Technical Review Committee makes recommendations to the state DHR regarding new technology approvals, updates to technology regulations and standards, and revisions to the Manual for On-Site Sewage Management Systems (Georgia DHR website).

2.10.7 Onsite Funding (Answers 5a-5c Summarized)

None.

2.10.8 Leadership and Information

State-level agencies, task forces:

- Mr. Ade Oke, Principal Engineer, Dept of Human Resources, Div of Environmental Health, 2 Peachtree St, 5th Floor Annex, Atlanta, GA 30334; tel 404-657-6534.
- Mr. Ernest U. Earn, Environmental Protection Division, 4220 International Parkway, Ste. 101, Atlanta, GA 30354; eml ernie_earn@mail.dnr.state.ga.us.

Local governmental agencies, task forces: NA

Research within governmental agencies: Not at present.

Research within universities: NA

Onsite demonstration programs: None.

Training or certification programs:

- Onsite Sewage Certification Review Committee
- Soil Classifiers Certification Advisory Committee.

Citizen action, private groups:

- Georgia Onsite Wastewater Association (GOWA), P.O. Box 1928, Duluth, GA 30096; www.onsitewastewater.org, tel 770-817-4692, fax 678-646-0379, eml info@onsitewastewater.org. The association provides training, conferences, and newsletters.

Newsletters, forums, other sources of information:

- GOWA newsletter (see above).

2.10.9 What's Changed

Patterns

There appears to be an increasingly long-term outlook on water quality and availability issues, especially in the metropolitan regions of the state. Due to predicted population growth that promised to outpace water capacity, the Metropolitan North Georgia Planning District was created in 2001 for "the purpose of coordinating long-term water, wastewater, water conservation, and watershed management planning" (Grenoble, 2007). Emphasis seems to be on improving centralized wastewater system treatment, with some potential for reuse. However, recommendations are being made for increased septic system tracking and management (Grenoble, 2007).

Drivers

Much of the state is increasingly experiencing sustained periods of drought, while demand for water resources increases with the growing population (Lovely, 2007). By some estimates, Georgia is currently in the middle of the worst drought on record for the southeast (Vetter, 2008). In this context, large-scale water reuse is increasingly being considered as part of the solution (Yari, 2005). By contrast, onsite wastewater treatment is seen by some as being part of the problem because the treated effluent does not end up in surface waters for indirect reuse by downstream users (Lovely, 2007). The creation of onsite wastewater management programs are in response to inadequate environmental water quality, which is believed to stem from failing onsite systems (DDCWSA; Grenoble, 2007).

An early draft of Georgia's Draft Comprehensive Statewide Water Plan, released in June 2007, characterized septic systems as a "consumptive" water use, meaning that water used by properties served by septic systems is not returned to surface stream flows, and as such is not available for downstream use (Georgia EPD, 2007a). Representatives of the Georgia Onsite Wastewater Association, supported by the National Onsite Wastewater Recycling Association, submitted comments on the draft plan contesting this characterization of decentralized systems and offering more balanced language (Georgia EPD, 2007b; GOWA, 2007). These comments and those of others in the decentralized wastewater field working in Georgia were incorporated into the final water management plan (Georgia EPD, 2008).

2.10.10 References

City of Berkeley website. http://www.berkeley-lake.com/content/view/60/79/1/12/. Accessed April 28, 2008. *Information about the City's onsite system inspection program.*

Douglas County Board of Health. 2008. Rule and Regulations for Onsite Sewage Management Systems, Chapter 290-5-26, Amendments I and II. Approved March 5, 2008. *An example of the kinds of additional specifications that county boards of health may add to the state regulations.*

Douglasville-Douglas County Water and Sewer Authority website. http://www.ddcwsa.com/main.html . Accessed April 28, 2008. *The website of a water and sewer authority that tracks pumpouts for onsite systems within its service area, and requires that owners submit documentation of pumpout once every 5 years.*

Georgia Department of Human Resources (DHR). 2007. Rules of Department of Human Resources, Public Health, Chapter 290-5-26, On-Site Sewage Management Systems. Effective April 1, 2007. *The current state regulation governing onsite wastewater treatment systems in Georgia.*

Georgia DHR, Division of Public Health. 2007. Manual for On-Site Sewage Management Systems. Revised April 2007. *The current design manual for onsite wastewater treatment systems in Georgia; intended to serve as a technical reference and a source of information for professionals and individuals interested in the on-site sewage management program.*

Georgia DHR, Division of Public Health website. Accessed at http://health.state.ga.us/programs/envservices/landuse.asp on April 28, 2008. *The main web site for the Land Use Program within the Division of Public Health, which provides additional information about rules, outreach information for homeowners, and information about committee activities.*

Georgia Department of Natural Resources, Environmental Protection Division, 2007a. Georgia's Water Resources: A Blueprint for the Future, June 28th Draft. http://www.georgiawatercouncil.com/Files_PDF/plan_6-28-07_entire.pdf. *The early draft of this document, meant to provide comprehensive water policy for the state of Georgia, reflects the view that onsite wastewater treatment systems are a "consumptive" use of water, meaning that water treated by these systems does not immediately return to a water body for downstream use*.

Georgia EPD. 2007b. Comprehensive Statewide Water Plan Responses to Comments Submitted through the Water Council's Web Site. http://www.georgiawatercouncil.com/Documents/previous_drafts.html. *A summary of comments submitted regarding the draft water policy described above, and responses to the comments. Includes testimony from Gwinnett County officials, GOWA, and others that contradicts the view of onsite wastewater treatment systems as consumptive users of water.*

Georgia EPD. 2008. Georgia Comprehensive State-wide Water Management Plan. Approved January 8, 2008. http://www.georgiawatercouncil.org/Files_PDF/water_plan_20080109.pdf. *The final version of the water policy document described above.*

Georgia Onsite Wastewater Association. 2007. The Septic Times, Summer 2007 newsletter. http://www.onsitewastewater.org/content/images/documents/Summer 2007.pdf. *This issue contains GOWA's response to the statewide water plan as it was submitted during the public comment process.*

Grenoble, P. 2007. The Fine Art of Wastewater Planning. *Onsite Wastewater Treatment*. September/October 2007. *Part of the article is a discussion about the completion of the North Georgia Long-Term Wastewater Plan, which recommended that local governments establish additional requirements for onsite systems including minimum lot size, that onsite systems be pumped every five years, and that management and performance of individual systems be tracked through the establishment of a septic system database.*

Lovely, L. 2007. Well Manor-ed. *Onsite Wastewater Treatment*. July/August 2007. *Part of the article is a case study on a cluster system for a subdivision in northern Georgia with MBR treatment and reuse on a golf course, common areas, and residential landscaping.*

Small Flows Quarterly. 2000. Compliance Date Approaches for Georgia Onsite Regulations. 1(1):9. *Short article on changes to Georgia's regulations, including banning of single-compartment septic tanks for new construction and new requirements for certification of all inspection personnel, installers, and pumpers.*

Vetter, J. 2008. Are We Running Out of Water? *Reader's Digest*. May 2008. *Includes nation-wide examples, not just from Georgia, about water shortages, drought, and population growth; written for the lay audience.*

Yari, P. 2005. Water Reuse – A Water Supply Option in the Metropolitan Atlanta Area? Proceedings of the 2003 Georgia Water Resources Conference. April 25-27, 2005. *This paper summarizes information presented in the Metropolitan North Georgia Water Planning District*

(District) Water Supply and Water Conservation Plan (Plan), in which the feasibility of using highly treated wastewater effluent (reclaimed water) as a water supply option, through direct potable reuse, indirect potable reuse, or non-potable reuse, was investigated. The final Plan recommends including 67 MGD-AAD of indirect potable reuse through reclamation in Lake Lanier as a water supply resource.

2.11 Hawaii

2.11.1 Summary

Hawaii has about 75,000 systems in the ground, installs another 1500-4000 annually, but annually repairs or replaces only a few dozen, of which only a small number require alternative or advanced technology. The state Dept of Health directly administers the onsite code. Many kinds of alternative technology are permitted under the code, the only major stipulation being that they are designed by a PE; they are allowed for use on otherwise undevelopable sites. There are isolated problem areas, chiefly on the coast, but the solution of choice is to sewer as soon as conditions warrant it. Onsite code revision is not popular, and is reflected in the limited resources provided to the Dept of Health. No betterment loan programs, targeted remediation efforts, management districts, state or university research, or onsite demonstration programs presently exist.

2.11.2 Numerical Information

Total number of onsite systems: 1990 U.S. census reports about 73,000. 12,000 systems were registered with DOH in 2006 (Tuden, 2007).

Number of new systems installed each year: 1000-1500 per year in 1992- 2001; number of approvals increased in recent years, to over 4,000 approvals in 2006; most new construction on the Big Island (Hawaii DOH, 2007).

Failure definition: Improper construction or wastewater overflow (not defined in regulation as of 2004 revisions).

Number or proportion of systems presently failing: 15% to 35% estimated, including cesspools and other substandard systems.

Number or proportion *repaired* annually: 25.

Number or proportion *replaced* annually: 25; note, this does not count replacement of cesspools, all considered substandard.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Very few, probably less than 10/year.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Even fewer, probably less than 5 per year.

Cost of a conventional *septic system* installation: $6500; range, $5000-$8500.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $10,000 to $15,000.

2.11.3 Present Onsite Status (Answers 2a-2f Summarized)

Many unsewered areas have problems because of antiquated systems, dense development, unsuitable conditions or jeopardized ground- or coastal waters. Chiefly, these problems arise in very close, near-shore developments, and other areas with clayey soils and/or shallow groundwater. Cesspools are reportedly common, as are improper design or construction. The U.S. EPA has worked with state agencies and individual owners to bring the state into compliance with the federal Safe Drinking Water Act's Underground Injection Program, which prohibited large capacity cesspools in 2005 (U.S. EPA, 2006); however, this prohibition does not extend to cesspools serving individual residences. Onsite system permit requests in the State almost quadrupled between 2002 and 2006, indicating increasing development in areas—primarily rural areas—not served by public or private sewer systems (WRRI and Engineering Solutions Inc. 2008). Until January of 2008, no official guidance existed regarding the selection of an appropriate onsite wastewater system for a given site in Hawaii (WRRI and Engineering Solutions Inc. 2008). Problems are reported to be greater on the islands of Oahu and Maui. The extension or creation of central facilities is strongly supported by the state, but resisted locally because of costs.

2.11.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Code is written and administered directly by the state Department of Health. With its limited resources, it is reported that there is "room for improvement" when it comes to enforcement. Wastewater regulations can become more stringent on the local level if approved by the state (NSFC, 2005).

Code was last revised in: 2004 (Hawaii DOH, 2004).

New revisions in progress? To be adopted when? Updates occur about every 3-4 years.

Role of legislature, regulatory agency, and politics: Administrative rules do not require legislative adoption. Wastewater code revisions are typically not supported politically due to increased costs to owners. It has not been a major factor in rule revision, but it has been in terms of funding for DOH programs.

2.11.5 Management Programs (Answers 3e-3g Summarized)

State Code does not require management programs or contracts except for aerobic treatment units, for which an ongoing maintenance/service contract/agreement is required (NSFC, 2005). The only management requirement of the rules is that systems (conventional and alternative) be designed by PEs and administratively reviewed (Hawaii DOH, 2004). Perpetual maintenance on mechanical systems that discharge onto the surface or into surface bodies of water is required; however, the rules do not allow onsite wastewater systems to discharge onto the surface or into surface bodies of water (NSFC, 2005).

There is a need for targeted, systematic remediation or enforcement, or special planning or management, but little political or fiscal support. Current rules allow for the creation of Critical Wastewater Disposal Areas with additional system requirements based on environmental factors (Hawaii DOH, 2004), but no management districts are planned. No interest from electric cooperatives or utilities in O/M management programs was reported.

2.11.6 New Technology (Answers 4a-4h Summarized)

Code does accommodate, but in no case requires, alternative technology. It does permit development on otherwise undevelopable sites; however, BAT is not required of remediation or repair. I/A technologies are covered in the regulations by subsections that can be amended. The state's rule allows the Department to review innovative and or alternative technologies on a case-by-case experimental basis, and a process exists for the Director of Health to allow other innovative and alternative technologies (NSFC, 2005). Experimental systems must have both state and local Board of Health approval and a dedicated site for replacement with conventional or alternative systems (NSFC, 2005). Technologies approved for use in Hawaii include evapotranspiration beds, aerobic treatment, sand filters, mounds, gravelless chamber systems, constructed wetlands, incinerating and composting toilets, and package plants (Hawaii DOH, 2004). No particular technologies have been linked to particular environmental conditions, although large package plants play a considerable role in Hawaii's small communities.

2.11.7 Onsite Funding (Answers 5a-5c Summarized)

There are no widespread betterment loan programs for remediation, and none are planned, although constituents would probably favor such programs. There is a limited loan program for native Hawaiians.

2.11.8 Leadership and Information

State-level agencies, task forces:

- Hawaii Dept of Health, Wastewater Branch, Planning and Design Section Engineer, 919 Ala Moana Blvd, Room 309, Honolulu, HI 96814 (contact Harold Yee, Supervisor, Planning and Design Section; tel 808-586-4294, fax 808-586-4370; eml harold.yee@doh.hawaii.gov)

Local governmental agencies, task forces: None; the matter is left entirely to the state.

Research within governmental agencies: No

Research within universities: No

Onsite demonstration programs: No

Training or certification programs:

- Not at present.
- The Hawaii Water Environment Association has an annual conference that sometimes includes sessions about topics of interest to onsite wastewater professionals; see http://www.hwea.org/.

Citizen action, private groups:

- Hawaii Water Environment Association (see above).

Newsletters, forums, other sources of information: No

2.11.9 Enforcement (Q7)

With the Hawaii DOH's limited resources, it is reported that there is "room for improvement" when it comes to enforcement (see above).

2.11.10 Role of Cluster Systems and Package Plants (Q8)

No particular technologies have been linked to particular environmental conditions, although large package plants play a considerable role in Hawaii's small communities (see above).

2.11.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

No interest from electric cooperatives or utilities in O/M management programs was reported.

2.11.12 What's Changed

Patterns / Drivers
The EPA has set deadlines for Hawaii to replace its large capacity cesspools, those serving multiple residences or non-residential systems serving 20 or more people (SFQ, 2003). In 2006, the EPA estimated that more than 4,000 systems would be affected by the cesspool closure requirements (U.S. EPA, 2006).

2.11.13 References

Anonymous. 2003. EPA Closure Deadline for Large Capacity Cesspools in Hawaii. Small Flows Quarterly 4(3):8. Accessed at http://www.nesc.wvu.edu/pdf/ww/publications/smallflows/magazine/SFQ_SU03.pdf on January 5, 2009. *Information about ongoing efforts to close large-capacity cesspools in Hawaii.*

Hawaii Department of Health. 2004. Hawaii Administrative Rules, Title 11, Department of Health, Chapter 62, Wastewater Systems. Effective January 14, 2004. Accessed at http://gen.doh.hawaii.gov/sites/har/AdmRules1/11-62.pdf on January 5, 2009. *Current regulations governing wastewater treatment systems in the state of Hawaii.*

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U.S. EPA. 2006. EPA announces large capacity cesspool agreement with Hawai'i Department of Education. EPA press release. Accessed at http://yosemite.epa.gov/opa/admpress.nsf/a883dc3da7094f97852572a00065d7d8/53a98cc6fd6c014f85257131007e440b!OpenDocument on February 5, 2008. *News release about agreement to eliminate large capacity cesspools in the state; the news release also provides a hyperlink to EPA Region 9's web page on this topic.*

2.12 Idaho

2.12.1 Summary

Idaho has about 145,000 systems in the ground, installs about 7000 new systems annually, and repairs or replaces about 1000 systems annually. While much of the state is rugged and marked by poor soils, population densities are sufficiently small that problems occur only in pockets. Nutrient and pathogen loading of lake shores is the biggest problem. Central facilities are promoted, but are not always feasible. Alternative technologies are added to the Technical Guidance Manual on the recommendation of the Technical Guidance Committee, and are in fairly common use (approximately 10%) to overcome site deficits. Ongoing management is required for advanced systems on individual lots, through owners' membership in non-profit management corporations. Several areas are contemplating the establishment of management entities for all onsite systems, but so far only one county has implemented a program. There are no betterment programs for upgrades, no demonstration programs, and only limited university research programs. Designers, installers, inspectors, environmental health specialists, operators/O&M providers, and pumpers, are all licensed.

2.12.2 Numerical Information

Total number of onsite systems: 1990 U.S. census reports 143,000, said to be about 36% of households.

Number of new systems installed each year: 7000.

Failure definition: Any system that fails to accept black waste or wastewater, that discharges wastewater into waters of the State or onto the ground surface, or that does not meet the intent of the regulations.

Number or proportion of systems presently failing: About 15%.

Number or proportion *repaired* annually: 5-15% of systems are either repaired or replaced annually.

Number or proportion *replaced* annually: See above.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Approximately 10%.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Very few, if any.

Cost of a conventional *septic system* installation: $2000-2600 (range $1000-$20,000, the low applying only to drainfield replacement, the high to recirculating sand filters with pressure-dosed drainfields).

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $1000-$4000.

2.12.3 Present Onsite Status (Answers 2a-2f Summarized)

There are some areas of the state that have problems with antiquated systems, small lots, or dense development, and others where there are poor physiographic conditions, or where resources are threatened. A few areas are thought to pose problems with future development, particularly because population growth is mainly in rural areas not presently served by sewers.

The northern Panhandle, around Coeur d'Alene, contains a sole source aquifer in an area of projected high density. Just southwest of there, around Lewiston and Orofino, there are areas with tight clay soils and poor drainage. North of Boise is an area marked by high water tables.

Permits have been denied, or alternative systems stipulated, because of small lot sizes, soil type and depth, shallow groundwater and steep slopes. Chiefly, concern lies with nitrates released to groundwater, and nitrogen or pathogen loading on lakeshores.

2.12.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Regulations are made at state level by the Idaho Dept of Environmental Quality, and administered by seven district health departments. Enforcement of subsurface sewage regulations is reported to be adequate.

Code was last revised in: May, 1993; revisions to the Technical Guidance Manual are ongoing (Idaho DEQ, 2009).

New revisions in progress? To be adopted when? Revisions are done on an "as needed" basis, although new technologies can be added on the recommendation of a Technical Guidance Committee. A rule change that provides a revised method for estimating wastewater flow from single family dwellings (particularly large dwellings) was adopted and will become effective July 1, 2009 if approved by the Legislature (Idaho DEQ, 2008a). A more stringent rule change along these lines was overturned in 2007 after developers and homeowners mounted a last-minute campaign against the legislation (Howell, 2007).

Role of legislature, regulatory agency, and politics: The legislature has a strong role, approving the regulations afresh each year, and can modify them unilaterally.

2.12.5 Management Programs (Answers 3e-3g Summarized)

The State of Idaho does recognize management programs/contracts or management districts to monitor and maintain onsite systems or individual septic dispersal systems (NSFC, 2006). All individual onsite wastewater systems that are manufactured and transported to the service site (e.g., Orenco Advantex, BioMicrobics FAST) are required to be maintained by a contracted service provider (Idaho DEQ, 2009). The Idaho DEQ has caused Non-Profit Operations & Maintenance (O&M) Corporations to form, which each property owner must join upon purchasing an advanced system (NSFC, 2006). The homeowner pays annual membership dues to the corporation, and the corporation contracts with service providers to maintain the systems, collect/analyze samples, and submit results to the O&M Corporation. The O&M Corporation then provides this information to DEQ and the Health Districts in annual reports (NSFC, 2006). Systems that are not complying with individual permit maximums are flagged for additional maintenance and sampling.

Blaine County passed an ordinance in 2007 establishing an Onsite Wastewater Management Program for all systems in its jurisdiction (Blaine County, 2007).The program will require annual inspections of complex alternative systems, and all other onsite wastewater systems will be inspected every three years (Blaine County, 2007). As part of an aquifer protection program, the Panhandle Health District has implemented ordinances and programs that go beyond state minimums. Other areas in the state are considering the establishment of management entities (see below).

2.12.6 New Technology (Answers 4a-4h Summarized)

Present code is prescriptive for conventional septic tank/drainfield systems, but also both accommodates and sometimes requires the use of alternative or advanced systems, enabling the development of otherwise undevelopable areas. Permits are based on the characteristics of the individual site, and may stipulate particular types of systems. For example, sand mound or sand filters may be stipulated to address shallow groundwater, and recirculating sand filters or advanced treatment may be required to reduce nitrogen loading. Other systems permitted include mound systems, extended treatment package systems, evapotranspiration, lagoon, gravelless trench, pressure distribution, and capping fills. Permits can be conditioned with maintenance requirements. Communal or package plants must be maintained by an authorized management entity, either governmental or private. Large soil absorption systems and extended treatment package plants are expected to play a small role in the future; if advanced technologies are to be used for cluster systems, additional engineering evaluation and supporting documentation is required (NSFC, 2006). Best available technology can be required for remediating failing systems. There is no systematic mechanism to test new technologies, but they may be added to the Technical Guidance Manual by the Technical Guidance Committee, based on research or reports from elsewhere.

The Technical Guidance Manual has performance based criteria for Extended Treatment Package Systems (NSFC, 2006), defined as advanced treatment systems in this report. These systems are required to perform to the generally accepted BOD5/TSS discharge level of 30 /30 ppm, and may also. In areas of concern (shallow groundwater, nitrate priority areas, etc.) total nitrogen may also be limited in the installation permit (NSFC, 2006).

2.12.7 Onsite Funding (Answers 5a-5c Summarized)

There are no financing programs for the remediation of failing systems.

2.12.8 Leadership and Information

State-level agencies, task forces:

- Idaho Dept of Environmental Quality, 1410 North Hilton, 2nd Fl, Boise, ID 83706 (contact: A.J. Maupin, P.E.; tel (208) 373-0167, eml aj.maupin@deq.idaho.gov).
- Technical Guidance Committee for Individual and Subsurface Sewage Disposal (consisting of three staff from local health departments, an installer, a PE, and the state onsite coordinator); address c/o the DEQ.

Local governmental agencies, task forces: The following are independently examining onsite issues:

- Jerome County, County Courthouse, Jerome, ID (contact, Art Brown).
- Canyon County, County Courthouse, Caldwell, ID (contact, Larry Bledso).
- Blaine County already has an inspection ordinance (see above).
- Panhandle Health District has also implemented local ordinances going beyond those required of the state as part of a large-scale aquifer protection program.

Research within governmental agencies: Not at present.

Research within universities:

- Research performed through faculty at the University of Idaho has led to the development of a phosphorus reduction technology that is currently scaled for large package treatment systems up to centralized treatment plants (UI, 2006). The technology is being tested at the Hayden Wastewater Research Facility in Hayden, Idaho (Blue Water Technologies, 2008).

Onsite demonstration programs: None.

Training or certification programs:

- Installers are trained and licensed by local district health departments; they must attend a training session sponsored or provided by the district health departments. Licenses are renewable annually, and licensees must attend an 8-hour training course once every 3 years (NSFC, 2006).
- Inspectors and Environmental Health Specialists are licensed by the Bureau of Occupational Licenses, but employed by local departments.
- Design of cluster systems and LSAS must be performed and documented by a Professional Engineer licensed in Idaho (NSFC, 2006).
- Maintenance for individual advanced treatment systems must be performed by a service provider who is knowledgeable and/or trained in the particular manufacturer's product (NSFC, 2006).
- All cluster system owners must contract with a suitably licensed Wastewater Operator (NSFC, 2006).
- All septage haulers must be licensed; a current list of licensed haulers is maintained on the Idaho DEQ website.

Citizen action, private groups:

- Watershed Advisory Groups (various), http://www.deq.state.id.us/water/data_reports/surface_water/tmdls/WAGs.cfm. (contact Marti Bridges, DEQ TMDL Program Manager, Water Quality Division, DEQ State Office, 1410 N. Hilton, Boise, ID 83706; tel (208) 373-0382; fax (208) 373-0417; eml marti.bridges@deq.idaho.gov

Newsletters, forums, other sources of information: NA

2.12.9 Enforcement (Q7)

Enforcement of subsurface sewage regulations is reported to be adequate.

2.12.10 Role of Cluster Systems and Package Plants (Q8)

All cluster systems employing advanced technology are required to provide a contracted service provider (NSFC, 2006; Idaho DEQ, 2008). Simple Large Soil Absorption Systems (LSAS), with pressure dosing of wastewater flows from 2,500 gpd to 10,000 gpd, are also required to contract with at least a level 1 Wastewater Operator to maintain the pressurization system (NSFC, 2006).

2.12.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

The contemplated model for their formation at this time is nonprofit corporations; and there is no reported public utility interest in O/M schemes.

2.12.12 What's Changed

Patterns
Many in Idaho see the states rules as being "the most lax in the nation", with officials being "aware of damage by the high failure rate of septic systems…" (Howell, 2007a). The South Central Health District of Idaho reports that of the Alternative Onsite Sewer Systems (AOSS) inspected as part of the existing Blaine County management program since 1996, approximately 75% required maintenance or corrective action (Blaine County, 2007).

Drivers
High growth rates, pressures on water quality, and high system failure rates appear to be propelling efforts to modify the rules and establish management programs. In 2007 the Panhandle Health District attempted to mandate larger tanks and drainfield for some homes, focusing on the construction of larger lakefront homes and their impact on water quality. After stiff opposition from homeowners and builders, the rules were shelved by a resolution of the state legislature (Howell, 2007b).

2.12.13 References

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Blue Water Technologies. 2008. Introducing the Hayden Wastewater Research Facility. Accessed at http://www.blueh2o.net/docs/Hayden_Water_Reclamation_Facility.pdf on April 29, 2008. *Web page that describes the Hayden Wastewater Research Facility, a full-scale wastewater research facility located in Hayden, Idaho. This facility is used by Blue Water, the University of Idaho (UI), and other academic, government, and corporate entities.*

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Idaho DEQ. 2008a. Rules and Policies: Current DEQ Rulemaking Activity . Accessed at http://www.deq.idaho.gov/rules/deq_rulemaking.cfm#subsurface on January 6, 2009. *Listing of current rule-making activities and status of pending rule changes.*

Idaho DEQ. 2009. Wastewater Management: Technical Guidance Manual for Individual and Subsurface Sewage Disposal Systems. Accessed at http://www.deq.idaho.gov/water/assist_business/septic/tech_manual_updates.cfm on January 6, 2009. *Web page with the current technical manual and updates, including lists of approved technologies and non-profit O&M providers for extended package treatment systems.*

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University of Idaho (UI), College of Engineering. 2006. UI Students Analyze Prototype Phosphorus Removal System. February 21, 2006. Accessed at http://www.engr.uidaho.edu/bluepro2006/ on April 29, 2008. *News release regarding a phosphorus removal technology being tested at the Hayden Wastewater Research Facility.*

2.13 Illinois

2.13.1 Summary

Illinois has approximately 700,000 onsite systems in the ground, and installs about 13,000 more annually. Figures on repair or replacement were not available. Although conditions in much of the state are good, there are shallow bedrock areas in the northeast, which are also marked by the heaviest population density; in the south and southwest karst topography abounds. Alternative technology is readily accommodated through an experimental protocol and the recommendations of the Private Sewage Disposal Advisory Commission. The Governor's Rural Wastewater Treatment Needs Committee is also offering smaller communities the opportunity and incentives to build alternative central systems. Buried sand filters, lagoons, mounds, and, particularly, aerobic systems are in widespread use (accounting for up to 45% or more of new installations in some areas). Approved management programs are required for all multi-user systems, and several counties demand demonstrated maintenance contracts for aerobic systems, but no management entities are being considered and there are indications that management is not currently adequate for surface discharging, aerobic systems. Recent attempts to increase management of these systems have not been successful. There are no betterment programs and no government or university research programs at this time. Installers and pumpers are licensed by the state.

2.13.2 Numerical Information

Total number of onsite systems: 1990 U.S. census reports about 600,000; 79,281 additional installed 1996-2001 (Ebelherr, 2003).

Number of new systems installed each year: About 13,000 (1996-2001) (Ebelherr, 2003)

Failure definition: NA

Number or proportion of systems presently failing: NA

Number or proportion *repaired* annually: NA

Number or proportion *replaced* annually: NA

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): In 1996, more than 1200 buried sand filters, 250 lagoons, 125 mounds, and 4300 aerobic treatment plants were installed.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): About 5300-5900 surface discharging systems (typically aerobic treatment plants with disinfection) were installed each year from 1996-2001, for a total of 33,861 systems (Ebelherr, 2003).

Cost of a conventional *septic system* installation: $4000; range, $800-$20,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): NA

2.13.3 Present Onsite Status (Answers 2a-2f Summarized)

There are some areas in state that currently have problems with dense development and/or antiquated systems; and other areas, some large or bounded, that have poor onsite conditions that jeopardize resources. Some specifics: there are areas in the north and northeast marked by shallow bedrock; in Lake County, e.g., mound systems are often installed. The southwest corner of the state is marked by karst topography and sinkholes. More generally, the southern area of the state, in particular, is marked by poor soils. Likewise, further development in some areas is expected to lead to future problems. Reasons given for onsite failures include age, improper maintenance, high water and poor soils. Present code both accommodates, and sometimes requires, alternative or advanced technology, including their potential application as BAT for remediation. Likewise, alternative systems can be used on sites unsuitable for conventional systems. Aerobic systems, in particular, are in widespread use—despite evidence that these systems are not being adequately maintained, resulting in environmental impacts (McKenzie, 2001; Ebelharr, 2003). Lake County has requested a National Pollution Discharge Elimination System (NPDES) permit specifically for the county in response to citizen concerns about environmental impacts (see below).

2.13.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Onsite wastewater regulations are administered across the state by Illinois Department of Health, Division of Environmental Health. The Department consists of a central office, which oversees six regional offices. The six regional offices oversee the local (city, county, or multi-county) health departments within their region, which have established delegation agreements with the Department (NSFC, 2006). All regulations apply statewide and can be made more stringent locally if approved by the State.

Code was last revised in: 2003.

New revisions in progress? To be adopted when? Revised regulations, published in 2007, were withdrawn in November 2008 in order to reopen discussions and incorporate legislative changes since the proposed amendments were drafted. "Preparing a new draft rulemaking at this juncture will allow the Department to properly address issues related to alternative technology, sub-surface drip irrigation, portable sanitation requirements and National Pollutant Discharge Elimination System (NPDES) requirements that will result in compliance with state and federal laws" (Illinois DOH, 2008).

Role of legislature, regulatory agency, and politics: Revisions must be approved by the legislature's Joint Committee on Administrative Rules. New technologies can be added by amendments, based on successful outcomes with experimental systems. A Private Sewage Disposal Advisory Commission makes recommendations, including rules changes, to the Dept of Public Health.

2.13.5 Management Programs (Answers 3e-3g Summarized)

Under the code, all ISDSs require systematic management and maintenance. Approved management programs are mandatory for treatment systems used by more than one household.

The state has not mandated any onsite management programs specific to particular communities or regions .Several counties demand demonstrated maintenance of aerobic systems, but ultimate responsibility lies with the homeowner. Citizens in Lake County have expressed concern about questionable discharges into or surrounding lakes in the county, and the county health department is now requesting a National Pollution Discharge Elimination System (NPDES) permit specifically for the county (Lake County Health Department, 2008).

2.13.6 New Technology (Answers 4a-4h Summarized)

I/A technologies are covered under an "experimental use" section of the code; approval is based on a two-year evaluation period. Well over half the systems in the southern portion of the state involve aerobic treatment, where there are also several hundred functioning lagoon systems. Individual counties that determine the level and manner of oversight these systems require. Other systems employed include low pressure pipe, at-grade, gravelless/chamber, and oxidation or waste-stabilization ponds. There is some evidence that, particularly for aerobic treatment systems with disinfection, the level of maintenance being provided is not adequate to ensure performance (McKenzie, 2001; Ebelharr, 2003)

The Governor's Rural Affairs Council offered to support alternative collection/treatment demonstration facilities in rural communities, four of which embraced the idea and have participated (Illinois Community Action Association, n.d.). No record was found of other communities implementing similar approaches since the completion of projects in the four demonstration communities. There are mechanisms at state level to test and authorize new technologies, but only within the I/A provisions of the code.

2.13.7 Onsite Funding (Answers 5a-5c Summarized)

There are no loan or betterment programs for onsite remediation.

2.13.8 Leadership and Information

State-level agencies, task forces:

- Illinois Dept of Public Health, Division of Environmental Health, 525 W Jefferson/3rd Fl, Springfield, IL 62761 (contact Robert Cowles, Program Manager; tel 217-782-5830, fax 217-785-0253; eml rcowles@idph.state.il.us).
- Private Sewage Disposal Advisory Commission.
- Rural Wastewater Treatment Needs Committee of the Governor's Rural Affairs Council.

Local governmental agencies, task forces: None.

Research within governmental agencies: No systematic research.

Research within universities: None.

Onsite demonstration programs: None current. There has apparently been no further implementation of the demonstration program described above.

Training or certification programs:

- Installers and pumpers are licensed by the state. In some counties, designers and soil scientists are also licensed (for example, see Lake County HD, 2008.)
- Three conferences within the State of Illinois are dedicated to onsite education and training. These conferences are hosted by: Illinois Environmental Health Association, Illinois Association of Environmental Health Administrators, and OWPI (NSFC, 2006).
- Numerous local and regional training classes are reportedly available (NSFC, 2006); further details NA.

Citizen action, private groups: None.

Newsletters, forums, other sources of information:
- The Illinois Environmental Health Association publishes a quarterly newsletter (see http://iehaonline.org/index_files/Page621.htm).

2.13.9 Enforcement (Q7)

Enforcement is left to the local health departments. It is reported to be adequate through system installation (NSFC, 2006).

2.13.10 Role of Cluster Systems and Package Plants (Q8)

Cluster systems appear to have only a limited role at this time (see above). Individual surface discharge systems, often aerobic treatment units, have been used increasingly for new construction, but maintenance of these systems is often inadequate (see above).

2.13.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

None noted.

2.13.12 What's Changed

Patterns / Drivers

While the Illinois Environmental Protection Agency has proposed rule changes to bring state standards in line with long-standing federal laws for surface discharging septic tanks, concerns from citizens, lawmakers, and even some local health departments have prevented implementation of any such changes (Thomas, 2007; Illinois Department of Health, 2008). However, this leaves the state out of compliance with the federal Clean Water Act (Thomas, 2007) and puts the state's federal Clean Water funding at risk.

2.13.13 References

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Lake County, Illinois Health Department. 2008. Septic Designers List, Updated August 28, 2008. Accessed at http://www.lakecountyil.gov/Health/want/Documents/ISDdesign.pdf on January 6, 2009. *Current list of approved septic system designers in Lake County*.

Lake County Health Department. 2008. Cover Letter and General (NPDES) Permit for Individual Sewage Treatment Systems. Accessed at http://lakecounty.legistar.com/LegislationDetail.aspx?ID=258699&GUID=5B2BD40B-52E7-460F-8BC8-F2CAF8F4359F&Search=&Options= on January 6, 2009. *Letter describing the situation which has led the Lake County Health Department to request that the Illinois EPA grant a General NPDES permit for management of surface discharging systems in Lake County.*

McKenzie, C. 2001. DuPage County Illinois Health Department: An Unconventional Approach to Onsite Systems Management. Small Flows Quarterly 2(2):22-23. Accessed at http://www.nesc.wvu.edu/pdf/ww/publications/smallflows/magazine/SFQ_SP01.pdf on January 6, 2009. *A short article about ongoing sampling and management efforts in DuPage County.*

National Small Flows Clearinghouse. 2006. Illinois Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/Illinois.pdf on January 6, 2009. *This short document summarizes onsite wastewater system regulations and activities in Illinois.*

Thomas, B. 2007. Critics say state's new septic - tank plan stinks. The Pantagraph (Bloomington, Illinois), February 06, 2007. *Newspaper article about then-proposed changes to the state's rules concerning surface discharging systems—the rule changes have since been withdrawn.*

2.14 Indiana

2.14.1 Summary

Indiana has about 800,000 onsite systems in the ground, and installs another 15,000 annually; about 6,000 repairs or replacements are completed annually. Permits are generally tracked at the county level, and aggregate numbers are not readily available. Wide areas of the state have problems associated with dense development and straight pipes; this is compounded by wetness, seasonally high water tables, and any number of hydrologically poor soil types and geomorphologies. The state code accommodates alternative systems, but not readily. Mounds, pressure dosing, and constructed wetlands (for new developments) are in fairly common use. Approval for some alternate disposal field technologies (chambers, subsurface drip, etc.) has been delegated to the local level, but most pre-treatment technologies are approved by the state Department of Health on a project-by-project basis. Communal systems of any kind require management plans, but there are no maintenance requirements for ISDSs. Individual county commissions vary widely in their enforcement approaches; at least one county has developed an onsite wastewater management district. Purdue University conducts research on experimental technologies. There are no betterment loan programs. Soil scientists are required to be certified, and some counties require installers to be certified. There is an active state onsite wastewater professionals' association.

2.14.2 Numerical Information

Total number of onsite systems: over 800,000 (Indiana DOH, 2008); 1990 U.S. census reports 700,000.

Number of new systems installed each year: over 15,000 (Indiana DOH, 2008)

Failure definition: Surfacing effluent or backed-up plumbing; contamination of potable water supply, ground water, or surface water; absence of a system also defined as failure in the code (many houses have straight pipes to ditches or field tiles).

Number or proportion of systems presently failing: NA

Number or proportion *repaired* annually: more than 6,000 repair permits issued annually (Indiana DOH, 2008); not differentiated from replacements.

Number or proportion *replaced* annually: NA

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Hard numbers are not available; mounds and pressure dosing are routinely permitted; other technologies are permitted experimentally on a very limited basis.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Essentially, none; all residential systems must drain to an absorption field, and there are no requirements for nutrient reduction.

Cost of a conventional *septic system* installation: $3500-$4000; range, $1200-$20,000; estimate from Jay County Indiana was $8,500 in 2007; see Ohio state report (Ohio DOH 2008).

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): NA

2.14.3 Present Onsite Status (Answers 2a-2f Summarized)

There are many and/or large areas with problems because of dense development and antiquated systems, some of which presently impact resources. Other areas are anticipated to become problems with further development. A survey conducted by Purdue University indicated that 85% of counties listed a seasonally high water table as a primary limitation for onsite systems, and over 95% listed wetness problems as a major contributing factor in failures. Indiana also has a large number of homes with straight pipes. Specifics include a high growth area around South Bend with unconfined, shallow aquifers; a high growth area around Fort Wayne with very slowly permeable soils and seasonally high water table; a very high growth area around Indianapolis with slow permeability and seasonally high water table; and a high growth area around Madison with steep slopes, shallow bedrock, and fragipan soils. Karst topography marks southern portions of the state.

Reasons for permit denials include poor soils, steep slopes, floodplain situations, seasonally high water table, and bedrock. Well-bounded problematical areas exist; although sometimes it is difficult to separate out the groundwater problems related to agriculture. Critical resource areas include the northern lakes district, and the Ohio and Wabash rivers. Northern Indiana also has very sandy soils, and shallow, unconfined aquifers. Central Indiana has compact glacial till with low permeabilities. Southern Indiana has fragipan and karst topographies. If any municipalities are under enforcement actions, it was not reported. The extension or creation of central facilities is not supported in the smaller counties because of the associated costs, although it is probably the Indiana DEM's preferred solution.

2.14.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Indiana State Department of Health regulates residential and commercial onsite systems which discharge to soil absorption fields. Administration is transferred to local county or city health departments. Enforcement is described as varying from excellent to barely adequate, depending on county capabilities.

Code was last revised in: 1990 (Re-adopted in 2007; see Indiana DOH, 1990).

New revisions in progress? To be adopted when? None.

Role of legislature, regulatory agency, and politics: Revision occurs with some, but not overwhelming, resistance.

2.14.5 Management Programs (Answers 3e-3g Summarized)

There is a need to systematically remediate older individual systems. While some work is being done to improve record keeping, there appears to be little support for systematic repair programs for straight pipes or other issues. Individual county planning commissions vary enormously in their activity and interest.

Indiana Code grants the authority to counties to form onsite management districts, but the code does not mandate the formation of management districts, nor does it dictate which types of systems must be managed if a management district is formed (NSFC, 2006). Thus far, only Allen County (Fort Wayne area) has created an onsite wastewater management district. This District was created to allow Allen County to utilize legislation permitting surface discharge systems for existing homes with no other options, as well as to enforce regular maintenance on all newly installed systems (Allen County, 2005). A state law, unique for this county, allows surface discharging systems under the management program (McKenzie, 2005). Additionally, concerned property owners in the Cordry Sweetwater Conservancy District (Brown County) have formed a committee to promote onsite maintenance (Dayton, 2008)

2.14.6 New Technology (Answers 4a-4h Summarized)

Technologies that are not listed within the Indiana Code may be used following Rule 410 IAC 6-8.1- Section 31 (g) allows for the "development of new or more efficient sewage treatment or disposal processes". Protocols have been developed to outline the standards and minimum requirements for the use of "experimental" equipment, and the process for new technologies to gain approval for conditional or general use (Indiana DOH, 2008a). Permits are issued at the local/county level, but plan review must occur at the state level until approval is delegated to the local level (NSFC, 2006). Technologies included in the state code include subsurface aggregate trench systems using gravity flow, alternating fields, flood dosing and pressure distribution; elevated sand mound systems; and aerobic treatment units discharging to an approved absorption field (NSFC, 2006; Indiana DOH, 1990). Current experimental approvals include subsurface trench systems using chambers and corrugated tubing with a fabric sock, at-grade systems, subsurface drip irrigation, and packed bed filters using sand and gravel media, textile media, foam cube media, and peat (NSFC, 2006; Indiana DOH, 2008a).

Indiana has no maintenance requirements for onsite systems. If systems are failing, or nonexistent, they must be repaired with an approved, but not necessarily "best available," technology. There is no targeted program to accomplish such upgrades. No particular areas of the state are identified with particular types of alternative technologies.

2.14.7 Onsite Funding (Answers 5a-5c Summarized)

There is no program for individual homeowners, although some degree of SRF funding may become available for communities seeking to improve water quality through onsite remediation.

2.14.8 Leadership and Information

State-level agencies, task forces:

- Indiana Dept of Health, Div Sanitary Engineering, 1330 W. Michigan St, POB 1964, Indianapolis, IN 46206.
- The Septic Systems Subcommittee of the Environmental Quality Service Council formed in 2000 to review onsite issues (see http://www.in.gov/legislative/interim/committee/2000/committees/eqsc.html).

Local governmental agencies, task forces: NA

Research within governmental agencies: No.

Research within universities:

- Purdue University has short-term funding to assess experimental technologies and coordinate the installation and monitoring of several of them; Indiana DOH would be responsible for their long term monitoring. (Contact: Dr. Don Jones, Dept of Agricultural and Biological Engineering, Purdue University, West Lafayette, IN 47907; tel 765-494-1178, fax 765-496-1356; eml jonesd@ecn.purdue.edu). There is no indication in the literature that this effort has been continued.
- The Indiana Water Resources Research Council, also at Purdue, has created a spatial database for tracking onsite system locations (Lee and Theller, 2003 and 2005).

Onsite demonstration programs:

- Arrowhead County received Section 319 funding to develop a demonstration site for innovative technologies (contact Randy Moore, tel 219-946-3022), and there is some indication that IOWPA, Purdue University, and ISDH are working to set up an onsite wastewater training center (McKenzie, 2005).

Training or certification programs:

- Indiana requires certifications for Soil Scientists (NSFC, 2006; see http://www.isco.purdue.edu/irss/roster.html for current registry).
- Installers are often certified at the county level for system construction and repair; IOWPA offers an "onsite professional" certification that accepted by 41 counties and is renewable via exam every 3 years; see http://www.iowpa.org/Certified_Professionals.html.
- IOWPA holds an annual conference, and the IEHA holds an annual conference that includes a session for wastewater management (see below).

Citizen action, private groups:

- Indiana Onsite Wastewater Professionals Association (IOWPA) (http://www.iowpa.org/)
- Indiana Capacity Center for Management of Onsite/Decentralized Systems, Inc. was formed in 2003 to promote best management practices of onsite/decentralized wastewater systems that would solve small, rural community wastewater problems (McKenzie, 2005). However, it is not clear that this organization still exists.
- The Indiana Environmental Health Association (IEHA) (http://www.iehaind.org/conference.html)

Newsletters, forums, other sources of information:

- IOWPA and IEHA both publish quarterly newsletters.

2.14.9 Enforcement (Q7)

Enforcement is described as varying from excellent to barely adequate, depending on county capabilities.

2.14.10 Role of Cluster Systems and Package Plants (Q8)

Cluster systems require management plans. There appear to be a few efforts to increase the visibility and implementation of these approaches (e.g. McKenzie, 2005).

2.14.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

At this time, no utilities have expressed interest in system management.

2.14.12 What's Changed

Patterns / Drivers

In Allen County, "New onsite systems were failing in less than one year in this county. Based on fieldwork through Purdue University, the state health department, and soil scientists, Allen County was identified as one of several recessional glacial moraine counties. Soil characteristics were very tight, not allowing water to flow through the soil." (McKenzie, 2005)

"The groundwater and other permitting sections of IDEM still have reservations about the viability of onsite systems and their long-term impacts to groundwaters of the state…The issue of groundwater contamination by onsite systems is such a volatile environmental and public health issue that recent Indiana legislation, (HEA 1017)IC 13-18-17-5, effective March 16, 2004, exempted certain onsite systems from nitrate groundwater standards, prohibited ISDH from adopting nitrate numerical criteria from Indiana's groundwater standards, voided any ISDH rules in affect that may apply such standards, and required ISDH and IDEM to study the environmental and health effects, fiscal impacts, and mitigation barriers of nitrate in groundwater." (McKenzie, 2005)

2.14.13 References

Dayton, S. 2008. Association News. *Onsite Installer*, November 2008 (page 38). Accessed at http://www.onsiteinstaller.com/editorial/1229/2008/11 on January 9, 2009. *Information from an IOWPA article about current association activities and news*

Indiana Department of Health. 1990. Residential Sewage Disposal Systems, Rule 410 IAC 6-8.1. Effective December 1990. Accessed at http://www.in.gov/isdh/files/410_IAC_6_8_1.pdf on January 9, 2009. *The current regulation governing residential onsite systems in Indiana.*

Indiana Department of Health. 1996. Commercial Onsite Wastewater Disposal, Rule 410 IAC 6-10. Effective July 1, 1996. Accessed at http://www.in.gov/isdh/21965.htm on January 9, 2009. *Current regulation governing the construction, installation and modification of commercial on-site wastewater disposal facilities in Indiana.*

Indiana Department of Health. 2008. Onsite Sewage Disposal Program website. Accessed at http://www.in.gov/isdh/23283.htm on January 9, 2009. *Contains general information about the state's onsite systems regulatory program, including numbers of systems in the ground, permits issued per year, rules and policies, and information about new technologies.*

Indiana Department of Health. 2008a. New Technologies. Accessed at http://www.in.gov/isdh/20404.htm on January 9, 2009. *Web page with information about approval processes for technology new to Indiana, and lists of current approvals and products under review.*

Lee, Brad, and Larry Theller. 2003, Project Highlight: Septic System Permit Database. Accessed at http://wrri.nmsu.edu/niwr/program03/IN.pdf on January 9, 2009. *Short summary of a project to develop a septic system permit database that utilizes a GIS, global positioning systems (GPS), and field computers to improve the accuracy and efficiency of current septic system permit databases.*

Lee, Brad, and Larry Theller. 2005. Spatial Septic System Permit Database: Utility of a Statewide Approach. Presented by Brad Lee at the State Onsite Wastewater Regulators and Captains of Industry Conference, New Orleans, Louisiana, March 7 - 11, 2005. *Presentation about efforts to create and implement improved tracking of system locations and permit status in Indiana.*

McKenzie, C. 2005. The High Price of Ignorance. Small Flows Quarterly 6(3): 27-31. *Provides information about the state of rural small community wastewater management efforts in Indiana, including information about Allen County's onsite management district.*

National Small Flows Clearinghouse. 2006. Indiana Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/Indiana.pdf on January 9, 2009. *This short document summarizes onsite wastewater system regulations and activities in Indiana.*

2.15 Iowa

2.15.1 Summary

Iowa has about 265,000 systems in the ground; over 100,000 of these predate any kind of permitting and are considered sub-standard. An estimated 5000 new systems are installed annually; no figures were available on repairs or replacements. Septic problems are spotty and isolated, although poorly percolating clay soils in the southeast often favor alternative systems. Approval of I/A systems lies mainly with county sanitarians, and may be added to the code on recommendation of the same. About 10% of new systems (and a higher percentage of replacements) are reported to be alternative. Maintenance contracts and effluent monitoring are required of alternative systems, though enforcing compliance has proven difficult. There are several successful management programs in Iowa, and state regulators have embarked on a systematic attempt to improve wastewater service in small, unsewered communities. There is no research in government or academic institutions, but there is a demonstration and training site, and there is a state-level loan program for system repairs. Certification for septic haulers is required at state level, but all other training and certification programs are local and voluntary.

2.15.2 Numerical Information

Total number of onsite systems: Estimated as 100,000 permitted and 100,000 that predate permitting; U.S. census reports 265,000. Systems and permits are not currently tracked, but the IOWA DNR is implementing a state-wide web-based database to track all onsite systems in the state (Olson et al., 2008).

Number of new systems installed each year: 5000 estimated.

Failure definition: For conventional systems, surfacing of effluent; for alternative systems, failure is based on effluent testing for CBOD.

Number or proportion of systems presently failing: NA

Number or proportion *repaired* annually: NA

Number or proportion *replaced* annually: NA

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): The overall proportion of alternative systems is estimated at about 10%; this proportion could be higher for replacements, and is definitely higher for new systems.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Very few.

Cost of a conventional *septic system* installation: \$3500-\$4000; range, \$1000-\$12,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $8000 to $15,000; this figure is based on the per unit cost of a new system, not on the tie-in cost to an existing system.

2.15.3 Present Onsite Status (Answers 2a-2f Summarized)

Several urban areas in the state are thought to have problems with dense, antiquated systems, and there are other areas where resources are jeopardized. These problems are expected to increase with future development. The concern is chiefly with contamination of surface waters and public health threats. Moving east to west across the center of the state, areas around the cities of Davenport, Cedar Rapids, Iowa City and Des Moines are marked by high-density rural subdivisions without sewers. Over half of Iowa's onsite systems are now located in suburban subdivisions (IOWWA, 2008). Southern parts of the state are marked by poor clay soils where alternative systems are commonly employed. Permits have been denied because of shallow groundwater, soil limitations, shallow bedrock, or floodplain situations. Failures have been attributed to poor or inadequate design or construction, and high water table. For the most part the problems are isolated, however, and no large areas in the state have been indicated as having severe problems. The creation or extension of sewers is generally supported by the state, but is not always technically or economically feasible; a lot of recent development is outside of sewer service areas.

2.15.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Code is developed at state level, but enforced by county or city health departments or boards of health, which have considerable freedom. Enforcement is reported to be spotty, ranging from good to nonexistent, depending on the county.

Code was last revised in: 2006 (Iowa DNR, 2008). A *Septic Design and Reference Manual* was developed in 2003 with extensive collaboration between regulators, U.S.DA Rural Development, rural water associations, universities, and others (Iowa DNR, 2003).

New revisions in progress? To be adopted when? No notice of proposed changes to the regulations was announced by the Iowa Department of Natural Resources.

Role of legislature, regulatory agency, and politics: The last round of revisions did not experience significant political resistance.

2.15.5 Management Programs (Answers 3e-3g Summarized)

Maintenance contracts are required, with twice-annual sampling completed by a qualified sampler, for ATUs, sand filters, constructed wetlands, and other alternative technologies (NSFC, 2006; Iowa DNR, 2008). Onsite systems with surface discharge (sand filters, peat filters, etc.) and systems with more than 4 connections or design flows over 1,500 gpd are permitted through the IOWA DNR Wastewater Engineering and NPDES (Iowa DNR, 2008).

At least two well-known management programs exist in Iowa. The Lake Panorama On-site Wastewater Management District has served over 1,000 homes in Guthrie County since 1980, and the Southern Iowa Regional Water Authority has operated a decentralized system (including peat filters and conventional onsite systems) in Shannon City, IA under EPA management model 5 since 2004 (Yeager et al., 2006). Scott County conducts sampling of private systems and issues annual operating permits (Scott County Health Department, 2009). Additionally, inspection at time of title transfer is often required by banks, and is also required by some counties.

Iowa DNR is working to systematically identify and prioritize community wastewater treatment services and management for small, unsewered communities throughout the state (Parker, 2006); existing rural water associations, multi-county utility districts, and individual county health departments are all potential management entities, and existing entities can serve about 2/3 of the state (Parker, 2006). The DNR (through SRF) and EPA Region 4 are providing start-up funds for management entities (Parker, 2006).

2.15.6 New Technology (Answers 4a-4h Summarized)

Present code accommodates, but does not in any circumstance require, the use of alternative technology, although it may be employed on otherwise undevelopable lots. Approval of I/A technology lies mainly with the county sanitarian. Addition of new technologies is authorized through amendment to the regulations on the recommendation of county sanitarians and approval by the state. Likewise, allowances for enhanced treatment lie chiefly with the county sanitarians. The use of I/A technologies is not encouraged because maintenance and upkeep are difficult to ensure, though maintenance contracts and effluent monitoring are required of alternative systems. Sand filters, mounds, pressure dosing and aerobic systems are all used in Iowa; such alternatives account for about 10% of ISDSs. Sand filters are in fairly widespread use in a southerly and easterly belt. Pressure dosing, aerobic systems, and peat filters are also becoming more common. State regulators indicate that compliance with the general NPDES permit for individual surface discharging systems is problematic, and unreported failures are common (Parker, 2003). Use of mound systems is minimal. Best Available Technology may be but is not automatically required of upgrades. The role of package plants and particularly cluster systems is reported to be small but increasing, especially in small but unsewered communities with demonstrable problems.

2.15.7 Onsite Funding (Answers 5a-5c Summarized)

Iowa's Onsite Wastewater Systems Assistance Program (OWSAP) makes low-interest loans available to Iowans with failing or inadequate septic systems (Iowa DNR, 2008). Homeowners can receive loans from $2,000 to $10,000 for ten years at an interest rate of 3%. This program is funded through the Clean Water State Revolving Funds (SRF) program of the U.S. EPA. (contact Daniel Olson, Iowa DNR Wastewater Operations (NPDES) Section; tel 515-725-0346).

2.15.8 Leadership and Information

State-level agencies, task forces:

- Iowa Dept of Natural Resources, 502 E 9th St, Des Moines, IA 50319 (contact: Brent Parker, Environmental Engineer; tel 515-725-0337, eml brent.parker@dnr.state.ia.us).
- Midwest Assistance Program, P.O. Box 261, Fort Madison, IA 52627 (contact: H.B. Calvert, Rural Development Specialist; tel 319-372-1898, fax 319-372-0850; eml hcalvert@map-inc.org).

Local governmental agencies, task forces:

- Several counties are looking at the possibility of management entities (Parker, 2006)
- Scott County charges an annual Operation Permit fee of $35.00 (Scott County, 2008) for surface discharge systems. There are currently no plans to expand management to conventional septic systems (pers. comm. Environmental Health Services Section, Scott County, IA, May 22, 2008).

Research within governmental agencies: None.

Research within universities: None.

Onsite demonstration programs:

- A demonstration program is associated with the Iowa Onsite Wastewater Training Center (see below).The Iowa Onsite Waste Water Association (IOWWA) has established the Iowa Onsite Wastewater Training Center (IOWTC) in central Iowa on the campus of Des Moines Area Community College in Ankeny. The facilities include classroom space and an outdoor space for hands-on experience with different technologies (http://www.iowwa.com/trainingcenter.asp).

Training or certification programs:

- The Iowa Onsite Waste Water Association (IOWWA) has established the Iowa Onsite Wastewater Training Center (IOWTC) in central Iowa on the campus of Des Moines Area Community College in Ankeny. The facilities include classroom space and an outdoor space for hands-on experience with different technologies (http://www.iowwa.com/trainingcenter.asp).
- There are voluntary training programs for sanitarians at community colleges and at the annual meeting of the Iowa Environmental Health Association.
- Certification is required at state level for septic haulers.

Citizen action, private groups:

- Iowa Onsite Waste Water Association (IOWWA), 10927 Lincoln Ave, Des Moines, IA 50325; eml info@iowwa.com, www.iowwa.com

Newsletters, forums, other sources of information:

- The Iowa Onsite Waste Water Association (see above) prints a regular newsletter (IOWWA, 2008).

2.15.9 Enforcement (Q7)

Enforcement efforts for onsite systems are carried out at the county level, and the quality of enforcement varies widely (see above).

2.15.10 Role of Cluster Systems and Package Plants (Q8)

The role of package plants and particularly cluster systems is reported to be small but increasing, especially in small but unsewered communities with demonstrable problems. At least one regional water authority is now managing decentralized systems (see above).

2.15.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

See above.

2.15.12 What's Changed

Patterns

[ANM notes that] Increased use of alternative technologies with surface discharge, but without adequate compliance monitoring or enforcement resources, is a problem but state regulators are clearly aware of the problem and are trying to remedy it.

Drivers

[ANM notes that] State regulators are clearly engaged and interested in improving the state of professionalism and management in the onsite wastewater field in Iowa. Although it does not come through in the references cited, interviews and discussions completed during the ongoing WERF project "Guidance for Establishing Successful RMEs" have highlighted USDA Rural Development staff in Iowa as valuable advocates for RME formation and increased management of onsite and cluster systems in the state.

2.15.13 References

Department of Natural Resources. 2003. Iowa 2003 Onsite Sewage Design and Reference Manual. Accessed at http://www.iowadnr.com/water/septic/manual.html on January 14, 2009. *Website for the design manual, including acknowledgements and general information as well as links to the chapters of the manual itself.*

Department of Natural Resources (Iowa). 2005. Residential Onsite Wastewater Treatment, An Overview. Accessed at http://www.iowadnr.com/water/septic/files/treatoverview.pdf on January 14, 2009. *Booklet with information for homeowners or potential homeowners, real estate agents and lenders about residential on-site wastewater treatment systems in Iowa.*

Department of Natural Resources. 2008. Chapter 69, Onsite Wastewater Treatment and Disposal Systems. Accessed at http://www.legis.state.ia.us/aspx/ACODocs/DOCS/11-19-2008.567.69.pdf on January 14, 2009. C*urrent regulations governing onsite systems in Iowa.*

Department of Natural Resources. 2008. Iowa's Onsite Wastewater Loan Program. Accessed at http://www.iowadnr.com/water/septic/program.html on May 22, 2008. *Website with information about the state's loan program for onsite system repairs and replacements.*

Iowa Onsite Waste Water Association (IOWWA). 2008. *The Iowa Septic News*. Spring 2008. Accessed at http://www.iowwa.com/08NewsSpring.pdf on January 14, 2009. *Most recent newsletter for the organization, including regulatory updates and summaries of current association activities, including an annual conference.*

National Small Flows Clearinghouse. 2006. Iowa Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/Iowa.pdf on January 14, 2009. *This short document summarizes onsite wastewater system regulations and activities in Iowa.*

Olson, Daniel, Brent Parker, Craig Gilbertson, Kevin Meech, and Richard Otis. 2008. Onsite Treatment System Record Keeping: Implementation of a Statewide Inventory and Permit Tracking Database in Iowa. Presented at the NOWRA 17th Annual Technical Education Conference & Exposition, Memphis, Tennessee, April 2008. *Conference paper describing the development and status of the state of Iowa's onsite system and permit information tracking database.*

Parker, B. 2003. Iowa's Experience with Effluent Monitoring: Compliance Enforcement of Surface Discharging Onsite Wastewater Treatment and Dispersal Systems. Presented at the State Onsite Wastewater Regulators and Captains of Industry Conferences, North Las Vegas, Nevada, March 28, 2003. *PowerPoint presentation about Iowa's experience and issues with regulating ATUs, sand filters, and other advanced onsite systems under a general NPDES permit, particularly with assuring ATUs were performing adequately and with tracking compliance.*

Parker, B. 2006. Wastewater Management for Iowa's Unsewered Communities. Presented at the National Environmental Health Association 70th Annual Educational Conference & Exhibition, San Antonio, Texas on June 28, 2006. *Presentation about Iowa DNR's unsewered communities prioritization efforts, initiatives to start new RMEs to manage systems in unincorporated communities, and remaining issues.*

Scott County Health Department. 2008. Environmental Health Services section. Accessed at http://www.scottcountyiowa.com/health/water_OWTS.php on January 14, 2009. *Website with information about Environmental Health services provided by the county.*

Yeager, T., R Erhard, and J. Murphy. 2006. Business Attributes of Successful Responsible Management Entities. Prepared for the Water Environment Research Foundation under the National Decentralized Water Resources Capacity Development Project, Project No. 04DEC4SG. Accessed at http://www.ndwrcdp.org/userfiles/04DEC4SG.pdf on January 14, 2009. *Includes detailed case studies on two RMEs located in Iowa (Lake Panorama and the Southeast Iowa Regional Water Authority (SIRWA).*

2.16 Kansas

2.16.1 Summary

Kansas has over 200,000 systems in the ground, installs about 2,500 new systems annually, and repairs or replaces about 3,500 systems annually. About 10% of the latter involve alternative technology, but very few involve advanced technology. There are many and large problem areas, often associated with the widespread distribution of cesspools, and much current development is occurring outside of sewer districts. Poor onsite conditions include floodplains, shallow water table, tight soils, steep slopes, and shallow bedrock. Generally the state supports the creation or extension of sewers when problems develop. There are limited provisions for I/A technologies in the code, and they can be used on otherwise undevelopable sites. They are treated as variances, and variously conditioned locally. While there is a need to systematically remediate onsite systems in some areas, any initiatives to do so are local. Several jurisdictions have established onsite districts, or at least requirements for renewable operating permits for advanced treatment systems. There is not a well developed protocol for testing and authorizing new technologies, although Kansas State University is conducting demonstration and research projects with constructed wetlands, sand filters and aerobic units. Training is offered, but not required, by the state, although several counties require training and certification. A small flows professional association was formed in 1998.

2.16.2 Numerical Information

Total number of onsite systems: About 250,000, 1990 U.S. Census reports about 195,000.

Number of new systems installed each year: 2,410 in 2007 (KDHE, 2007).

Failure definition: Surface expression of wastewater, nuisance conditions, failure to meet separation distances.

Number or proportion of systems presently failing: For systems installed before 1980, probably 75%; systems installed since then probably have a failure rate of 10-15%. Failure rates are highest in the east, and lowest in the west.

Number or proportion *repaired* annually: 3,508 repair permits issued in 2007; repairs and replacements not tracked separately (KDHE, 2007).

Number or proportion *replaced* annually: see above.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Varies--about 10% overall, but in some counties over half of all permits issued are for either lagoons or alternative technologies (KDHE, 2007).

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Less than 1%.

Cost of a conventional *septic system* installation: $3500; range, $850-$15,000

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $7000-$15,000.

2.16.3 Present Onsite Status (Answers 2a-2f Summarized)

There are many scattered and sometimes large problem areas due to antiquated systems (including many cesspools) or dense development, and several problem areas where there are poor soils or critical resource issues. Some of these areas are fairly well bounded geographically. Small lake developments have posed problems. Future development is expected to aggravate the problems, as most growth is occurring outside of sewered areas. Some specifics: In the western two-thirds of the state, there are groundwater quality problems. In the eastern third, surface water quality is the problem. On the eastern border, the area surrounding Kansas City is marked by development pressure and has poor soils and surface water problems. To the south, development pressure, with groundwater problems and a high portion of private wells, marks the surrounds of Wichita. Onsite systems are implicated as a contributing factor in several TMDLs that have been developed in Kansas (Hargrove et al., 2002; U.S. EPA Region 7, 2007).

Reasons for failing systems include cesspools, small lots, age, shallow groundwater, improper construction or size, and poor maintenance. Reasons for denying permits include tight soils, high water tables, shallow bedrock, and floodplains. Chief concerns include bacteria, nitrate levels in groundwater, and vulnerable surface- and groundwater resources. These are aggravated by wet weather and flooding. Generally, the extension or creation of central facilities is supported by the Kansas Department of Health and Environment (KDHE). Onsite systems are not permitted if sewer tie-ins are available. However, costs in problem areas tend to be relatively high; and many remaining unsewered communities have low income and low property values.

2.16.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? The state sets minimum onsite standards, which are codified and enforced by city, city/county, or multi-county health departments. Four counties have no health department, in which case the KDHE assumes responsibility for enforcement. Counties, as well as smaller communities, have the option to adopt more stringent regulations. In general, enforcement is variable, depending on county; complaints and enforcement actions are tracked at the county level and reported to the state (KDHE, 2007).

Code was last revised in: March, 1997 (minimum state standards, not a full code).

New revisions in progress? To be adopted when? They are not currently under revision, and there are no plans to do so (NSFC, 2006). Code revisions in the counties are ongoing (KDHE, 2007).

Role of legislature, regulatory agency, and politics: KDHE makes minimum standards for the state; counties, through sanitary codes, do most of the permitting, inspecting and enforcing. Legislative approval is required of state revisions; but stricter minimum standards do not enjoy widespread legislative support. At the county level, affluent counties are more supportive of code upgrades than rural counties with declining populations.

2.16.5 Management Programs (Answers 3e-3g Summarized)

In most counties, construction inspection and inspections at title transfer are required. An operation/maintenance agreement for aerobic treatment units and other so-called 'enhanced' treatment systems is "strongly recommended to ensure system performance", and is required in some counties (NSFC, 2006). While the state sees the need to systematically remediate older systems in some areas, there is presently no active effort to so. Likewise, there clearly is a need for better wastewater planning and/or active onsite management in certain older, densely developed areas, critical resource areas, and new developments. However, such initiatives would have to come locally. Some jurisdictions are considering the establishment of management districts, or, at the least, requiring annual operating permits for alternative systems, but no such provisions have yet been established. There is, reportedly, some interest on the part of electric cooperatives or other utilities in managing O/M programs.

Other state regulations and policies require that a sewer district must be created for onsite systems that collect/treat waste from more than one source (home/business/etc.) (NSFC, 2006). KDHE has also published a guidebook detailing wastewater options for small communities (KDHE, 1999).

2.16.6 New Technology (Answers 4a-4h Summarized)

Present code accommodates, but only in the future may sometimes require, the use of alternative systems. There are currently no requirements to use Best Available Technology for remediation or repair. Alternative or advanced systems may be used on otherwise undevelopable sites through limited provision for I/A technologies in county codes, which are treated as variances to be approved locally. Sand filters, mound systems, aerobic systems, lagoons, chambered systems, constructed wetlands, low-pressure pipe, stabilization ponds, drip irrigation, and incinerating or composting toilets have all been permitted locally (Powell et al, 2004). At present there is no systematic method to test and approve new technologies, although that may come with revisions to the code. There is a state review committee that provides guidance for the counties, but most sanitarians and contractors are not experienced with alternatives. Package plants and cluster systems have only a limited role, but it is thought that they will play a larger role in the future.

2.16.7 Onsite Funding (Answers 5a-5c Summarized)

There is limited support through EPA nonpoint pollution control funds, but no betterment programs per se. Some nonpoint funding also flows through the state's Conservation Commission to county conservation districts (see, for example, the Shawnee County Conservation District's program at http://www.sccdistrict.com/finnps.htm).

2.16.8 Leadership and Information

State-level agencies, task forces:

- Kansas Dept of Health and Environment, Bureau of Water, Non-Point Source Section, 1000 S.W. Jackson St., Suite 420, Topeka, Kansas 66612-1237 (contact Don Snethen, Chief; tel (785) 296-5567, fax 785-296-5509; eml Dsnethen@kdhe.state.ks.us).
- The KDHE's Local Environmental Protection Program encourage local code adoption, provides base and targeted grant funding, and tracks permits and other activities by county (http://www.kdheks.gov/nps/lepp/).
- The Kansas Small Flows Association advises the state and counties, see http://www.ksfa.org/.
- Kansas Water Office.
- Kansas State Conservation Commission.

Local governmental agencies, task forces: NA

Research within governmental agencies: Through university and county contracts.

Research within universities:
- Kansas State University is conducting demonstration and research projects with constructed wetlands, sand filters, and aerobic units: Kansas State University, Biological and Agricultural Engineering, 237 Seaton Hall, Manhattan, KS 66506; (contact: Barbara Dallemand, Assistant Extension Specialist/Onsite Wastewater, tel 785-532-2934, fax 785-532-6944, eml bdallem@bae.ksu.edu).

Onsite demonstration programs: See above.
- Also, a few counties (Sedgwick and Reno Counties, for example) have built specific demonstration and pilot projects (NSFC, 2006).

Training or certification programs:
- There are no specific state requirements for training or certification, although training is offered by the state. Some counties require training for installers and others through continuing education courses and proficiency exams (see, for example, Sedgwick County's requirements at http://www.sedgwickcounty.org/code_enforcement/wastewater_permits.html#Septic%20Systems).
- Kansas State University provides training (contact Barbara Dallemand, see above).
- Septic tank manufacturers are required to be certified; see http://www.kdheks.gov/nps/lepp/Approvedtanks-WebsiteList.pdf for the current list of approved manufacturers.

Citizen action, private groups:
- Kansas Environmental Health Organization, http://www.e-keha.org/.
- Kansas Small Flows Association (KSFA) (see above)

Newsletters, forums, other sources of information:
- KDHE publishes a water quality newsletter that covers nonpoint pollution, and also has a website that covers onsite issues.

- ♦ KSFA publishes an intermittent newsletter (see http://www.ksfa.org/news.htm) and holds an annual conference.
- ♦ Several counties publish newsletters concerning onsite issues, further information, NA.
- ♦ KEHA publishes a newsletter and holds an annual conference.

2.16.9 Enforcement (Q7)

In general, enforcement is variable, depending on county; complaints and enforcement actions are tracked at the county level and reported to the state (KDHE, 2007).

2.16.10 Role of Cluster Systems and Package Plants (Q8)

Package plants and cluster systems have only a limited role, but it is thought that they will play a larger role in the future. KDHE and several collaborators published a manual detailing wastewater treatment options for small communities which emphasized consideration of the entire range of treatment options (KDHE, 1999).

2.16.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

None noted.

2.16.12 What's Changed

Patterns/Drivers: None additional to those noted above.

2.16.13 References

Hargrove, W.L. D. Snethen, D. Buchholz, and D. Devlin. 2002. Implementing TMDLs in Kansas. In Total Maximum Daily Load (TMDL) Environmental Regulations: Proceedings of the March 11-13, 2002 Conference, (Fort Worth, Texas, USA), pp. 516-524. Accessed at http://asae.frymulti.com/abstract.asp?aid=7605&t=2 on January 14, 2009. *Conference article about Kansas' voluntary TMDL compliance strategy for fecal coliform-impaired streams.*

Kansas Department of Health and Environment. 1973. Kansas Administrative Regulations, Chapter 28, Article 5: Sewage and Excreta Disposal. Effective January 1973. Accessed at http://www.kdheks.gov/pdf/regs/28-5t9.pdf on January 14, 2009. *Legal authority for state's regulation of onsite systems.*

Kansas Department of Health and Environment. 1997. Minimum Design Standards for Design, Construction, and Operation of Onsite Wastewater Systems, Bulletin 4-2, effective March 1997. Accessed at http://www.kdheks.gov/nps/resources/mf2214.pdf on January 14, 2009. *Current state-level minimum standards for onsite systems.*

Kansas Department of Health and Environment. 1999. Assessing Wastewater Options For Small Communities In Kansas. Guidebook prepared by Kansas Department of Health & Environment, K-State Research & Extension, Midwest Assistance Program, and Crawford County Health Department, November 1999. Accessed at http://www.kdheks.gov/nps/ww_options_manual/index.html on January 14, 2009. *A manual for community leaders, environmental health specialists and concerned citizens assisting*

communities having inadequate wastewater treatment facilities. All potential solutions are encouraged, from homeowner education about system maintenance and water conservation; the potential of clustering wastewater treatment for several homes into a common system; and centralized collection and treatment. Management of all systems, from onsite to centralized, is emphasized.
Kansas Department of Health and Environment. 2007. Local Environmental Protection Program State Fiscal Year 2007 Annual Report - July 1, 2006 to June 30, 2007. Accessed at http://www.kdheks.gov/nps/lepp/Annual_report_2007.pdf on January 14, 2009. *Annual program report for fiscal year 2007, including a summary of activities completed and extensive permitting statistics.*

National Small Flows Clearinghouse. 2006. Kansas Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/Kansas.pdf on January 14, 2009. *This short document summarizes onsite wastewater system regulations and activities in Kansas.*

Powell, G. Morgan, Barbara Dallemand, and Judith Willingham. 2004. Selecting an Onsite Wastewater or Septic System. Kansas State University Agricultural Experiment Station and Cooperative Extension Service, Fact Sheet MF2542, August 2004. Accessed at http://www.oznet.ksu.edu/library/h20ql2/mf2542.pdf on January 14, 2009. *Information about the various wastewater treatment technologies available for use in Kansas, written for homeowners.*

U.S. Environmental Protection Agency, Region 7. 2007. EPA Region 7 TMDL Review, Anthony City Lake, January 9, 2007. Accessed at http://www.epa.gov/region07/water/pdf/anthony_lake_review_dec.pdf on January 14, 2009. *EPA's review of KDHE TMDL submittal; includes discussion of potential sources of nutrient impairment, including onsite systems.*

U.S. Environmental Protection Agency, Region 7. 2007. EPA Region 7 TMDL Review, Anthony City Lake, August 3, 2007. Accessed at http://www.epa.gov/region07/water/pdf/shunganunga_creek_review_dec.pdf on January 14, 2009. *EPA's review of KDHE TMDL submittal; includes discussion of potential sources of nutrient and sediment impairment, including onsite systems.*

2.17 Kentucky

2.17.1 Summary

Kentucky has over 800,000 systems in the ground, and installs another 20,000 per year. No numbers were available on repairs or replacements. Poor physiographic conditions are scattered throughout the state and include mountainous terrain, karst topography, clayey soils, and shallow water tables. Many systems predate permitting requirements. There is a need for systematic remediation or special management measures in some areas, and in eastern Kentucky such a program has been implemented. Alternative technology is permitted under tight variances granted directly by the state, and requires a management plan. It accounts for less than 5% of systems, and its use is not widely promoted. There are limited loan programs for onsite upgrades, research programs at three colleges or universities, at least two demonstration projects, and a Kentucky Onsite Wastewater Association. The state runs a certification program for installers and inspectors. Electrical cooperatives are playing an increasing role in managing cluster systems for previously underserved rural communities.

2.17.2 Numerical Information

Total number of onsite systems: Over 800,000, some 44% of the state; 1990 U.S. census reports 600,000 systems.

Number of new systems installed each year: 16,000-17,000; 22,000 permits issued in FY1998-99, up from ~17,000 in each of the two previous years (Kentucky Environmental Quality Commission, 1999)

Failure definition: Surfacing sewage, groundwater contamination, or noxious odor.

Number or proportion of systems presently failing: NA, but there are many unapproved systems, including straight pipes.

Number or proportion *repaired* annually: NA

Number or proportion *replaced* annually: NA

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Less than 5%, mostly wetlands or drip irrigation; there are a few (of the order of 100/yr) mound and aerobic systems.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Very few, essentially zero.

Cost of a conventional *septic system* installation: $2500-$3500; range, $1500-$10,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $5000-$7000, but highly variable, in the full range of $1000-$10,000.

2.17.3 Present Onsite Status (Answers 2a-2f Summarized)

There are many, occasionally large or bounded, areas posing problems due to dense development and antiquated systems, and more areas are expected to become problematical with future development. (Most counties report population increases outside of sewered areas.) Much of southwestern Kentucky is marked by a shallow water table, as well as by small lots. Central and north-central areas of the state are marked by karst topography, tight soils, or shallow fragipan clays. Steep slopes, shallow rock, and many antiquated or unapproved systems mark the eastern Appalachian area. Permits have been denied because of excessive slopes, high water tables, and floodplain situations. Failures have been attributed to clogged leach fields, age, damage, poor design or construction, and wet weather. Generally, the extension or creation of central facilities is supported; when it is opposed, it is because of annexation/taxation fears.

2.17.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Code is created at state level by the Kentucky Dept. for Public Health, and enforced by local county, city or district health departments. Many of those interviewed in a 1999 evaluation of Kentucky's onsite sewage program believe that onsite sewage rules are not being consistently implemented and enforced among local health departments (Kentucky Environmental Quality Commission, 1999).

Code was last revised in: 2002 (Kentucky Department of Health, 2002).

New revisions in progress? To be adopted when? No revisions currently in process.

Role of legislature, regulatory agency, and politics: Major changes require legislative review; the legislature is thought to support revisions.

2.17.5 Management Programs (Answers 3e-3g Summarized)

Presently enforcement is complaint driven, with cases rather routinely dismissed; enforcement is not considered to be adequate. It is thought that there is a need for special onsite planning and management in certain older developments as well as in new ones where conditions are poor. Over the last decade, there have been efforts to improve the state of onsite wastewater management, including passage of a law in 1998 that required proper sewage treatment before electricity could be connected to new residences, and a program to inventory and eliminate straight pipes in the southern and eastern portions of the state (Kentucky Environmental Quality Commission, 1999). The Personal Responsibility in a Desired Environment (PRIDE) program in the Appalachian area of eastern Kentucky has been particularly effective in addressing that region's unique problems over the last 10 years. As part of this program, several small community cluster systems have been constructed and are in some cases being managed by electric co-operatives (e.g., the "Preston Project" described in U.S. EPA Region 4, 2002). Cluster systems do require a management plan, and all onsite systems installed, constructed, altered or repaired shall be inspected by a Certified Inspector.

All alternative technology systems are only approved with an O&M agreement in place in the county of approval, and the county must adopt an O&M ordinance (NSFC, 2006).

2.17.6 New Technology (Answers 4a-4h Summarized)

Present code accommodates, and sometimes requires, alternative technology, which can be used on otherwise undevelopable lots. Alternative technology is approved at state level; and when employed is granted variances on a case-by-case basis. Such systems are tracked and evaluated periodically. Some types of systems require maintenance contracts. Experimental permits are also allowed, and with a successful track record may be allowed for more general use; their employment requires a management plan. Best Available Technology is not necessarily required of remediations, but may be. The most common alternatives are drip irrigation and constructed wetlands; but leaching chambers, mounds, gravelless pipe, evapotranspiration lagoons, package plants, peat or other media filters, and aerobic systems have also been employed (NSFC, 2006). Alternative technology is not widely promoted because of the higher degree of expertise required to install and maintain such systems, but as its cost and complexity diminishes, it could be expected to see more widespread use because of development pressure in areas not well suited to conventional treatment.

2.17.7 Onsite Funding (Answers 5a-5c Summarized)

State Revolving Funds (SRFs) cannot be used to assist individual homeowners to repair a failing or malfunctioning system; replace a failing or malfunctioning system; or for new construction (NSFC, 2006).

PRIDE (see below), in association with the local Area Development District (ADD) and Resource Conservation and Development District (RC&D), has established a grant program for low-income homeowners to hook onto an existing sewage treatment line or to install a septic system (U.S. EPA Region 4, 2002).

2.17.8 Leadership and Information

State-level agencies, task forces:

- Kentucky Cabinet for Health and Family Services, Dept for Public Health, Environmental Management Branch, 275 East Main Street, Frankfort, KY 40621, (502) 564-4856
- Environmental Quality Commission (http://www.eqc.ky.gov/)
- Personal Responsibility In a Desired Environment (PRIDE), see http://pride.uky.edu/. The PRIDE initiative was formed to provide the first comprehensive, region wide, state/local/federal funding to clean-up of the region’s rivers and streams of sewage and garbage while ending illegal trash dumps, promoting environmental education, and renewing pride in southern and eastern Kentucky (U.S. EPA Region 4, 2002).

Local governmental agencies, task forces:

- Some counties are beginning to systematically gather data on the performance of experimental systems, further information NA.

Research within governmental agencies: See below.

Research within universities:

- Wetlands studies are in progress at Kentucky State University, the University of Kentucky, and Morehead State University.

Onsite demonstration programs:

- Letcher County, in eastern Kentucky, hosts a demonstration program.
- KOWA has constructed a demonstration site and training center (see below).
- The "Preston Project" in Bath County (Mike Mattox, Gateway District Health Department, (606) 674-6396)--a cluster system replacing straight pipes, now managed by a rural electric cooperative

Training or certification programs:

- The state provides certification programs for installers and inspectors.
- Site evaluations are performed by registered sanitarians or licensed P.E.s (NSFC, 2006)
- Kentucky technical vocational schools provide CEUs for Certified Installers.
- KOWA (see below) runs the Kentucky Onsite Training Center.

Citizen action, private groups:

- Kentucky Onsite Wastewater Association (KOWA), P.O. Box 1424 Bowling Green, KY 42104, tel (270)715-0043. http://www.kentuckyonsite.org/
- Matthew E. Byers, Onsite Research/Development Manager, Zoeller Pump Company, POB 16347, Louisville, KY; tel 800-928-7867 x163, fax 502-774-3624m eml mattb@zoeller.com.

Newsletters, forums, other sources of information:

- KOWA publishes a newsletter and holds an annual conference (see http://www.kentuckyonsite.org/conference.htm).

2.17.9 Enforcement (Q7)

Enforcement was generally thought to be inadequate in the late 1990s (e.g., Kentucky Environmental Commission, 1999); it is not clear whether improvements recommended at that time have been implemented.

2.17.10 Role of Cluster Systems and Package Plants (Q8)

Inadequately maintained package plants have been recognized as a significant problem in Kentucky (e.g., Kentucky Environmental Commission, 1999 and U.S. EPA Region 4, 2002); however, properly installed and operated cluster systems are becoming more common as a solution for small, unsewered communities, particularly in the eastern part of the state (see below).

2.17.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

Particularly in the eastern portion of Kentucky, rural electric cooperatives have been instrumental in enabling implementation of small-community scale cluster systems for unsewered existing communities (U.S. EPA Region 4, 2002; Clark Energy Cooperative, 2003; Eastern Kentucky Power Cooperative, 2004).

2.17.12 What's Changed

Patterns/Drivers: None additional to those noted above.

2.17.13 References

Clark Energy Cooperative. 2003. Co-ops providing wastewater services. *Current Energy* newsletter, June 2003. Accessed at http://www.clarkenergy.com/documents/Clark%200603.pdf on January 15, 2009. *Short article about Clark Energy and East Kentucky Power Cooperatives' efforts to own and maintain cluster systems in rural communities.*

East Kentucky Power Cooperative. 2004. Inter-County Energy Tackles Wastewater Project. News release dated July 6, 2004. Accessed at http://www.ekpc.com/news/2004/news21.html on January 15, 2009. *Press release describing another cooperative-based cluster system construction and operation effort.*

Kentucky Department for Public Health. 1996. 902 KAR 10:170: Septic tank servicing. Effective August 1, 2996. Accessed at http://www.lrc.ky.gov/kar/902/010/170.htm on January 15, 2009. *Kentucky's current regulations governing septage haulers and septic tank pumping.*

Kentucky Department for Public Health. 2000. 902 KAR 10:085: Kentucky on-site sewage disposal systems. Effective August 12, 2002. Accessed at http://www.lrc.state.ky.us/kar/902/010/085.htm on January 15, 2009. *Kentucky's current onsite system regulations.*

Kentucky Department for Public Health, Environmental Management Branch. 2008. Kentucky Environmental Management Branch website. Last updated December 16, 2008. Accessed at http://chfs.ky.gov/dph/info/phps/enviromgmt.htm on January 15, 2009. *General information about Kentucky's regulations and services related on onsite systems permitting and management.*

Kentucky Environmental Quality Commission. 1999. Onsite Sewage in Kentucky: An assessment of issues and policy options to improve onsite sewage management in Kentucky. Commission report dated November 15, 1999. Accessed at http://www.eqc.ky.gov/NR/rdonlyres/1ACF891E-95E5-4C36-A962-A3E363820218/0/onsite.pdf on January 15, 2009. *A comprehensive survey of policies, department activities, and recommendations related to the state of onsite systems and management in Kentucky. Some of the recommendations have since been implemented.*

Kentucky Onsite Wastewater Association. 2008. Kentucky Onsite Wastewater Association website. Last updated December 2008. Accessed at http://www.kentuckyonsite.org/ on January 15, 2009. *Information about the state onsite wastewater professionals' association, including conference agendas/highlights and training center information.*

MacKenzie, C. 2005. Eradicating Straight Pipes and Failed Systems in Kentucky. *Small Flows Quarterly* 6(3): 22-26. Accessed at http://www.nesc.wvu.edu/smart/pdf/sourcewater/SFQ_S05_straightpipes.pdf on January 15,

2009. *Article about a pilot program to eliminate straight pipes and malfunctioning systems concurrent with extension of municipal water service in Estil County. The assessment and monitoring portions of the program were very successful and have been replicated in several other counties, often with PRIDE funding.*
National Small Flows Clearinghouse. 2006. Kentucky Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/Kentucky.pdf on January 14, 2009. *This short document summarizes onsite wastewater system regulations and activities in Kentucky.*

U.S. Environmental Protection Agency, Region 4. 2002. Kentucky Straight Pipes Report: Harlan, Martin, and Bath Counties. Agency report dated December, 2002. Accessed at http://www.epa.gov/region04//sesd/reports/2002-1107/2002-1107.pdf on January 15, 2009. *A summary of the problem of straight pipes in four Eastern Kentucky counties, an evaluation of possible solutions, and how straight pipes were removed in each area.*

2.18 Louisiana

2.18.1 Summary

Louisiana has about 405,000 permitted systems in the ground, as well as approximately half again that many unpermitted cesspools or straight pipes. Some 18,000 new systems are installed annually, and some 10,000 are repaired or replaced annually. Problems are widespread due to the low elevation of much of the state, and corresponding wetness and high water tables. Contamination of both surface and ground waters is of concern. Following Hurricanes Katrina and Rita in 2005, new development or reconstruction in unsewered areas has resulted in a dramatic increase in the number of new permits issued, while the number of repairs/replacements has declined. Alternative technology is in widespread use (following NSF standards), and may account for up to 95% of replacement systems. All alternatives require management plans; communal and surface discharging systems are overseen directly by the state. Several parishes have provisions for periodic inspection of all systems. There are no loan programs for upgrades or demonstration projects, and only limited academic research at this time. Installers are required to attend a one-day training course every five years to maintain certification. Septage haulers and manufacturers are also licensed.

2.18.2 Numerical Information

Total number of onsite systems: 405,000 permitted systems, an unknown number of unpermitted systems; 1990 U.S. census reported 440,000 systems or cesspools.

Number of new systems installed each year: 17,000-19,000 per year from 1999-2005; increased to 23,247 in 2006 and 32,394 in 2007 (LA Office of Planning and Budget, 2008).

Failure definition: One that is not meeting the requirements set forth in the Louisiana State Sanitary Code (Part 13) (NSFC, 2005).
Number or proportion of systems presently failing: Virtually all of the unapproved systems; information NA for approved systems.

Number or proportion *repaired* annually: About 5500.

Number or proportion *replaced* annually: About 3,900 systems discharging raw or partially treated sewage replaced annually (LA Office of Planning and Budget, 2008); the number of replacements was increasing steadily until 2005 (Hurricanes Katrina and Rita), and has declined since then (LA Office of Planning and Budget, 2008).

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Estimated to be 95%. Aerobic treatment units are reportedly the most common system installed in Louisiana (NSFC, 2005).

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Very few.

Cost of a conventional *septic system* installation: $1500-$2500; range, $1000-$5000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): NA

2.18.3 Present Onsite Status (Answers 2a-2f Summarized)

There are presently many and/or large problem areas associated with dense development and antiquated systems, some of which are affecting the quality of surface- and groundwater, and some of which are physiographically well-bounded, although no map was provided. More areas are expected to become problematical because much new development is outside of sewer service areas. Permits have been denied because of poor soils, poor drainage, and flood zone situations. In addition to failure by definition (cesspools or straight pipes), failures have been attributed to high water tables, age, improper design or construction, and poor soils. Generally, the state supports the creation or extension of central services when feasible. The number of new systems permitted increased dramatically in 2006-2007, as families moving out of areas affected by hurricanes Katrina and Rita settled outside of sewered areas; reconstruction of existing residences by families in hurricane damaged areas also accounts for some of the increase (LA Office of Planning and Budget, 2008).

2.18.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Code is created at state level, and voluntarily adopted by parish health departments, or by local offices of the state Department of Health and Hospitals (DHH). Individual parishes have considerable latitude to strengthen state minimum code. Enforcement is reported to be adequate in only those parishes which have enacted a permit system requiring pre-cover inspections.

Code was last revised in: June, 2002 (LA Dept. of Health and Hospitals, 2002).

New revisions in progress? To be adopted when? Revisions are made as needed. No revisions were expected as of May, 2005 (NSFC, 2005).

Role of legislature, regulatory agency, and politics: Legislative adoption of code is required.

2.18.5 Management Programs (Answers 3e-3g Summarized)

The state does not perceive of the need to systematically remediate systems, or to impose special planning or management requirements, in any locale. Parish rules vary, but most have an ordinance requiring that a permit be secured from the local offices of the state DHH. Fifty-three of the 64 parishes in the state have adopted onsite sewage ordinances (LA Dept. of Health and Hospitals, 2006). Some parishes have periodic inspection requirements for all systems. There is no reported interest on the part of utilities for running O/M programs.

There is a time-of-sale inspection protocol for onsite wastewater systems during property transfers, where parish offices check for permits and type of system installed; if no permit is found, then the system must be replaced or brought up to code before closing (NSFC, 2005). Regular inspections are not required after initial construction, but if requested by the homeowner, a licensed installer/maintenance provider and a sanitarian perform the inspection (NSFC, 2005).

A Section 319-funded project to inventory onsite systems and implement a cost-share program for upgrades and repairs of malfunctioning systems is underway in the Sibley Lake watershed; the lake is the drinking water supply for the City of Natchitoches, the Village of Clarence, and the community of Hagewood, but since it is outside city limits residences around the lake are served by onsite systems in varying states of repair (Louisiana DEQ 2008).

2.18.6 New Technology (Answers 4a-4h Summarized)

Present code accommodates, and may require, alternative or advanced systems in particular situations; and development may be permitted on otherwise unsuitable sites when effective alternatives are employed. No areas in the state are linked to particular technologies. I/A technologies are treated as "mechanical systems." They, as well as communal systems, require a management program. The latter are overseen directly by the state DHH. Alternative, or advanced, systems must meet NSF standards. Systems in use include sand filters, mounds, package plants, aerobic systems, oxidation ponds, rock reed filters and lagoons. There is no requirement to remediate failing systems using Best Available Technology. There are mechanisms to test and authorize new technologies described in the rules (LA Dept. of Health and Hospitals, 2002). Package plants and cluster systems reportedly play a large role in the state because of historically small lot sizes, soil conditions, and high ground water.

2.18.7 Onsite Funding (Answers 5a-5c Summarized)

There are no local or state-level loan programs for remediation, and it appears there are few prospects for such programs because of a very limited state budget.

2.18.8 Leadership and Information

State-level agencies, task forces:

- Louisiana Dept of Health and Hospitals, Office of Public Health, Onsite Wastewater Program, 628 North Fourth Street, Baton Rouge, LA 70802 (contact: Stanley Clause, Onsite Wastewater Program Administrator, tel (225) 342-7653, fax (225) 342-7552, eml sclause@dhh.la.gov).
- Governor's Task Force, a committee of industry and public health officials; further information NA.

Local governmental agencies, task forces: NA

Research within governmental agencies: None

Research within universities:

- Research on "marshland upwelling systems" to treat wastewater from coastal dwellings is ongoing at Louisiana State University; contact Kelly Rusch for more information (http://www.cee.lsu.edu/people/Bios/Kelly_Rusch.aspx) (see also review in Clark et al., 2007).

Onsite demonstration programs: None

Training or certification programs:

- State-level rules require installers to attend an 8-hr training course given by the Office of Public Health and the University of Southwestern Louisiana; this course must be repeated every five years (NSFC, 2005). See http://www.ce.louisiana.edu/index.cfm for current courses.
- Inspectors must be certified by the state board of sanitarians (NSFC, 2005)
- Septage haulers, sub-manufacturers, and manufacturers of wastewater systems are also licensed (LA Dept. of Health and Hospitals, 2006).

Citizen action, private groups:

- Barataria Estuary Program in association with Nicholls State University (http://www.btnep.org/home.asp).
- Louisiana Onsite Wastewater Recycling Association (http://www.laowra.org/)

Newsletters, forums, other sources of information: NA

2.18.9 Enforcement (Q7)

Enforcement is reported to be adequate in only those parishes which have enacted a permit system requiring pre-cover inspections.

2.18.10 Role of Cluster Systems and Package Plants (Q8)

Package plants and cluster systems reportedly play a large role in the state because of historically small lot sizes, soil conditions, and high ground water; most of the

2.18.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

No information noted.

2.18.12 What's Changed

Patterns/Drivers:
Notes: Though there is little information about their activities in the water/wastewater sector, there is a Louisiana CleanTech organization: http://www.lacleantech.net/cleantech.htm#top
[ANM notes that] although Louisiana does not have much apparent momentum towards increasing quality of management of their onsite systems, the state has one of the most transparent means for accessing numerical information about permitting activities encountered to date.

2.18.13 References

Clark, Mary, Scott Johnstone, Amy Macrellis, Doug Sarno, Crystal Sarno, Kristie Bergeron-Hale. 2007. Long-Range Planning For Decentralized Wastewater and Stormwater Treatment Research: Workshop Summary and Literature Review. Accessed at http://www.ndwrcdp.org/userfiles/04DEC8W.pdf on January 19, 2009. *Report on outcomes of a workshop held in 2007 to define priorities for continuing research in the decentralized wastewater field. Includes a literature review on environmental science and engineering developments from approximately 2002-2006, and has a small section on the Marshland Upwelling System developed by LSU researchers.*

Louisiana Department of Environmental Quality. 2008. Sibley Lake Watershed Individual Sewage Treatment System Improvement Project. Accessed at http://www.deq.louisiana.gov/portal/Portals/0/evaluation/aeps/DWPP/Sibley%20Lake%20Watershed%20Individual%20Sewage%20Treatment%20System%20Improvement%20Project.doc on March 26, 2009. *Project description and progress reports for a project in the Sibley Lake watershed. The lake is the drinking water supply for the City of Natchitoches, the Village of Clarence, and the community of Hagewood, but since it is outside city limits residences around the lake are served by onsite systems in varying states of repair. The current project has inventoried and inspected all onsite systems within half a mile of the lake, and systems that were identified as failing are now being repaired.*

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Louisiana Office of Planning and Budget. 2008. Louisiana Performance Accountability System. Accessed at http://doa.louisiana.gov/opb/lapas/lapas.htm on January 19, 2009. *The Louisiana Performance Accountability System (LaPAS) is an electronic database that tracks performance standards, interim quarterly performance targets, and actual performance information for Louisiana's Executive Branch departments and agencies. Performance targets and actual performance against targets can be viewed by the public through this web-based system. The Onsite Wastewater program reports several performance measures in this database, including new installations and number of repairs.*

National Small Flows Clearinghouse. 2005. Louisiana Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/Louisiana.pdf on January 19, 2009. *This short document summarizes onsite wastewater system regulations and activities in Louisiana.*

2.19 Maine

2.19.1 Summary

There are an estimated 500,000 onsite systems installed in the state of Maine. Though problem areas are scattered and sparse, there is concern with increasingly sprawling land use patterns. Maine's onsite code accommodates alternative systems, but such designs require state approval on a case-by-case basis. No areas of the state are thought to require targeted remediation or special management measures, with the exception of continuing efforts to eliminate wastewater discharges to surface waters, particularly in coastal areas. State grant funding is available to towns for the replacement of malfunctioning systems, though income limitations apply for funding recipients. There is little state or academic research, and no demonstration projects. State certification is required of site evaluators, designers and pumpers. A voluntary program training and certification has been established for installers and inspectors. There is a Maine Association of Site Evaluators, and individuals in Maine are active in the Yankee Onsite Wastewater Association.

2.19.2 Numerical Information

Total number of onsite systems: 500,000+; 127,045 new systems were installed, and 64,152 existing systems replaced, between 1984 and 2003 (Martin, 2004).

Number of new systems installed each year: On average, 6,350 per year between 1984-2003 (Martin, 2004); though more recent numbers are not available, the Subsurface Wastewater Program has experienced declining permit fee revenues in each of the last four fiscal years (2005-2008), with a 16% decline in FY 2008 alone (Maine DHE, 2008a)

Failure definition: Effluent outbreak, ponding, plumbing backup; contamination of nearby wells. Definition in code is for "malfunction", not "failure" (Maine DHE, 2005).

Number or proportion of systems presently failing: NA

Number or proportion *repaired* annually: NA

Number or proportion *replaced* annually: On average, 3,207 per year between 1984 and 2003; expanded and replacement systems were grouped together in this analysis (Martin, 2004)

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): NA

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Very few, <1%

Cost of a conventional *septic system* installation: $7,000-$25,000 (Schmitt, 2008)

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): NA

2.19.3 Present Onsite Status (Answers 2a-2f Summarized)

A 1993 study of the performance of subsurface systems indicates that the maximum projected life of all systems installed in Maine is 65-70 years, with about half of them failing in the first 50 years. Stone bed systems fare slightly better than chamber systems, which are installed in more difficult situations involving shallow bedrock or poorly drained soils. The use of chamber-type systems has increased to 35-40% of new installations, perhaps reflecting the diminution of more suitable sites.

In 2000, regulatory officials conducted another study utilizing a database of over 145,000 permits to evaluate OWTS performance (Dix and Hoxie, 2001). An average failure rate of less than 0.5% was observed during each of the first 10 years after new system installation, with a noticeable increase in replacements after 15 years. Over 80% of the systems provided more than 20 years of service, with homeowners responsible for system operation and maintenance.

Efforts continue to reduce the number of "overboard discharges" (discharges of treated residential, commercial, or municipal effluent) to Maine's surface waters, particularly in coastal areas (Maine DEP, 2003).

2.19.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Maine Dept of Human Services, Division of Health Engineering (DHE) promulgates regulations, which are enforced by municipally appointed plumbing inspectors. Enforcement is reported to be variable, with some communities doing an excellent job; others are lax with respect to violations, if not permitting. An enforcement manual was recently published to aid local plumbing inspectors in properly enforcing the subsurface wastewater portion of the plumbing code (Maine DHE, 2003).

Code was last revised in: 2005 (Maine DHE, 2005). Revisions to 144 CMR 245 Rules for Site Evaluators of Subsurface Wastewater Disposal Systems were updated in 2006 (Maine DHE, 2006).

New revisions in progress? To be adopted when? The state holds public hearings every year to determine whether updates or revisions need to be made. Revisions recommended by a task force of site evaluators, local plumbing inspectors, system installers, system inspectors, equipment suppliers and manufacturers; as well as changes recommended by the Department, are currently under consideration (Maine DHE, 2009).
Role of legislature, regulatory agency, and politics: NA

2.19.5 Management Programs (Answers 3e-3g Summarized)

At present systems are inspected at the time of construction. There may be a need for special management measures in both old and new developments, but no such measures are presently contemplated. No management districts are being considered, and there are no reports of utility or rural cooperative interest in O/M management. The concept of management may have been considered by the Task Force in 2005-2007 (NSFC, 2005), but is not mandated in currently proposed revisions to the onsite code (Maine DHE, 2008).

2.19.6 New Technology (Answers 4a-4h Summarized)

Present code accommodates, but does not ever require, alternative systems; current rules are entirely prescriptive (NSFC, 2005). Alternative or I/A designs (so-called "engineered" systems) require state-level DHE review and approval (Maine DHE, 2005). Operation and maintenance stipulations are made on an individual basis. Depending on the information collected or on external approval such as NSF Standard 40, such systems may be upgraded to general use (Maine DHE, 2005). No alternatives have been linked to physiographic provinces in the state, and BAT is not required of upgrades. Cluster systems and package plants play only a small role. Though that role was expected to increase in the initial Market Study, there is only one well-documented instance of a managed decentralized system in the state, serving the villages of Brownville and Brownville Junction (Stone Environmental, Inc. 2004; Town of Brownville n.d.).

2.19.7 Onsite Funding (Answers 5a-5c Summarized)

Funding is available to towns through the Small Community Grant Program to assist limited-income homeowners or small businesses in replacing malfunctioning systems that are polluting a water body or causing a public nuisance. Contact: Mr. Richard Green, Maine Dept. of Environmental Protection, tel (207) 287-7765, eml richard.green@maine.gov or see http://www.maine.gov/dep/blwq/docgrant/scgpara2.htm.

2.19.8 Leadership and Information

State-level agencies, task forces:

- Maine Dept of Human Services, Bureau of Health, Division of Health Engineering (DHE) (contact: Russell G. Martin, Program Manager, Wastewater and Plumbing Control; tel 207-287-4735, fax 207-287-3165; eml russell.martin@maine.gov).
- Maine Land Use Regulation Commission; http://www.maine.gov/doc/lurc/index.shtml, tel 207-287-2631.
- Maine Dept of Environmental Protection (DEP).

Local governmental agencies, task forces: NA

Research within governmental agencies: None.

Research within universities: None.

Onsite demonstration programs: None.

Training or certification programs:

- DHE licenses Site Evaluators (system designers).
- DHE and the State Planning Office certify Local Plumbing Inspectors.
- Certification is also required of pumpers.
- Installers and inspectors have a voluntary certification through DHE, which is renewable every five years (NSFC 2005).
- The Maine Joint Environmental Coordinating Committee (JETCC) offers continuing education classes: http://www.jetcc.org/; tel (207) 253-8020, eml jetcc@jetcc.org.

Citizen action, private groups:

- There are numerous lake associations throughout the state, further information NA.
- Maine Association of Site Evaluators (MASE); http://www.mainese.com, eml info@mainese.com (contact David Marceau, President, Gartley & Dorsky, P.O. Box 1031, Camden, ME 04843, tel 207-236-436, eml dmarceau@gartleydorsky.com).
- Albert Frick Associates, Inc., Soil scientists, site engineers, 95A County Rd Gorham, ME 04038; (contact: William O'Connor, tel 207-839-5563, fax 207-839-5563, eml wmhoc@yahoo.com).
- Individuals from Maine are active in the Yankee Onsite Wastewater Association (YOWA); see http://www.yankeeonsite.org/

Newsletters, forums, other sources of information:

- DHE web site: http://www.maine.gov/dhhs/eng/plumb/newsletters/e-newsletter.htm.
- There is a MASE newsletter (see above); the organization also hosts an annual meeting.

2.19.9 Enforcement (Q7)

Enforcement is reported to be variable, with some communities doing an excellent job; others are lax with respect to violations, if not permitting. The state is undertaking a program to follow up on municipal performance with respect to regulations.

2.19.10 Role of Cluster Systems and Package Plants (Q8)

Cluster systems and package plants play only a small role; though that role was expected to increase in the initial Market Study, there is only one well-documented instance of a managed decentralized system in the state, serving the villages of Brownville and Brownville Junction (Stone Environmental, Inc. 2004; Town of Brownville n.d.).

2.19.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

No interest or involvement noted as of January 20, 2009.

2.19.12 What's Changed

Patterns

Concern continues to grow that Maine is losing the regional landscapes that are essential to its future economy. "Maine's sprawling land use patterns threaten to transform many of the state's rural areas into suburbs. Between 1960 and 1990, the percentage of Maine's population living in service centers declined from 59 percent to 44 percent. Between 1970 and 1990 land development in Maine occurred at four times the rate that population increased. Between 1964 and 1997, Maine lands in agricultural production declined by more than 50 percent, and over 20 million acres of Maine's northern forest have changed ownership since 1980" (Maine State Planning Office, 2008).

Drivers

While events like red tide and flooding can close large areas swaths of coastline to shellfishing activities for relatively short durations, sewage pollution from wastewater treatment plants and

malfunctioning onsite systems is the cause for most local and long-term shellfish growing area closures (Schmitt, 2008).
The Maine Legislature sponsored L.D. 2160 in the 123rd Session, which would require that septic systems in shoreland areas are inspected and certified as working properly within three years prior to, or one year after, a property is sold (Schmitt, 2008). The bill was apparently signed into law (State of Maine, 2008), but its implementation is not clear at this time.
Funding needs for Wastewater infrastructure in Maine, both for upkeep of existing centralized infrastructure and for replacement of malfunctioning onsite systems, far outpace the available state and federal funding (Littell, 2006).

2.19.13 References

Dix, S. P., and D. C. Hoxie. 2001. Analysis of septic system longevity in Maine. In On-Site Wastewater Treatment: Proceedings of the Ninth National Symposium on Individual and Small Community Sewage Systems, edited by K. Mancl. Fort Worth, TX: ASAE. Accessed online at http://asae.frymulti.com/abstract.asp?aid=6043&t=1 on December 19, 2006.

Littell, David (Commissioner). 2006. Trends in Maine's Environmental Infrastructure. Report dated September 2006. Accessed at http://www.maine.gov/dep/pubs/infrastructure.pdf on January 20, 2009. *Short report about progress made—and still needed—regarding programs and infrastructure supported in part by Maine's CWSRF funding.*

Maine Department of Environmental Protection. 2003. DEP Issue Profile: Overboard Discharges, updated September 2003. Accessed at http://www.maine.gov/dep/blwq/docstand/OBD/ip-obd.pdf on January 20, 2009. *Information about systems with surface water discharges in Maine, and efforts and programs to eliminate these systems where possible.*

Maine Division of Health Engineering. 2003. Enforcement Manual for the Maine Subsurface Wastewater Disposal Rules. Accessed at http://www.maine.gov/dhhs/eng/plumb/Adobe/enforcement_manual.pdf on January 20, 2009. *Informational manual for local plumbing inspectors to help them understand how to enforce the onsite code correctly and consistently.*

Maine Division of Health Engineering. 2005. Maine Subsurface Wastewater Disposal Rules, 144A CMR 241. Effective August 1, 2005. Accessed at http://www.maine.gov/sos/cec/rules/10/144/144c241.doc on January 20, 2009. *Current onsite system regulation for the state of Maine.*

Maine Division of Health Engineering. 2006. Rules for Site Evaluators of Subsurface Wastewater Disposal Systems, 144 CMR 245. Effective June 1, 2006. Accessed at http://www.maine.gov/sos/cec/rules/10/144/144c245.doc on January 20, 2009. *Current regulation governing the licensing, testing, etc. of site evaluators in Maine.*

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including a new appendix on system use and maintenance guidelines but no requirement for performing maintenance/management activities.
Maine Division of Health Engineering, Subsurface Wastewater Program. 2008a. Justification for Increase in Internal Plumbing and Subsurface Wastewater Disposal System Permit Fees. Memo to Nancy Beardsley, Director, Division of Environmental Health, from Russell G. Martin, PE, Director Subsurface Wastewater Program, dated August 18, 2008. *Financial analysis of revenues and expenses, leading to request to increase permitting and certification fees charged by the Program to support its statutory required activities.*

Maine Division of Health Engineering. 2009. Maine Subsurface Wastewater Program website. Last updated January 5, 2009. Accessed at http://www.maine.gov/dhhs/eng/plumb/index.htm on January 20, 2009. *Website for the state of Maine's onsite systems regulatory program; includes information about training activities, re-certification of site evaluators, and recently proposed changes to state regulations.*

Maine State Planning Office. 2008. Regional Landscape Conservation in Maine: Best Practices for Enhancing Quality of Place. Report prepared by the Maine State Planning Office and Brett Richardson, Muskie School of Public Service, USM, dated September 2008. Accessed at http://www.maine.gov/spo/specialprojects/qualityofplace/documents/Regional_Landscape_Conservation_SPO_2008.pdf on January 20, 2009. *Provides a succinct summary of current land use issues in Maine, though the main focus of the report is on regional conservation rather than onsite wastewater systems.*

Martin, Russell G. 2004. The Maine Experience—Subsurface Wastewater Treatment and Dispersal Trends – 1984 to 2003. In *NOWRA 2004 Conference Proceedings, 13th Annual Conference and Exposition*, Albuquerque, New Mexico, November 7-11, 2004. *Summary of trends in permits issued, types of systems installed, limiting conditions, soil types, and other key indicators for onsite systems in Maine.*

National Small Flows Clearinghouse. 2005. Maine Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/Maine.pdf on January 20, 2009. *This short document summarizes onsite wastewater system regulations and activities in Maine.*

Schmitt, Catherine. 2008. Coastal pollution costs $29 million in lost revenue. *The Working Waterfront*. March 2008. Accessed at http://www.workingwaterfront.com/articles/Coastal-pollution-costs-29-million-in-lost-revenue/12076/ on January 20, 2009. *A news article providing detailed information about the impacts of bacterial pollution on Maine's shellfish growing areas, and about efforts to reverse a trend of long-term closures due to urbanization and sewage pollution from malfunctioning onsite systems and "overboard discharges".*

State of Maine. 2008. Maine House of Representatives, Weekly Legislative Report, Volume XXXIV, No. 19, Monday, April 14, 2008: 123rd Legislature, First Special Session, Bills Enacted. Accessed at http://www.maine.gov/legis/house/history/123rd/123wlr/wlr0819.htm on January 20, 2009. *This document shows that the Act To Protect Shellfish Waters and Shellfish Resources from Coastal Pollution (H.P. 1535, L.D. 2160), which contained requirements for inspecting systems in shoreland areas, was enacted.*

Stone Environmental, Inc. 2004. Management, Policy Options, and Guidance for Decentralized Waste Water. Report and documents prepared for the Maine State Planning Office. Accessed at http://www.stone-env.com/docs/reports/StoneWW-Me07TAB10ManagePolicyDecent.pdf on January 20, 2009. *Technical bulletins and guidance for allowing towns to focus growth in planned areas using decentralized systems. Includes a case study for the decentralized wastewater infrastructure serving two villages in Maine.*

Town of Brownville, Maine. n.d. Brownville Wastewater Treatment Facility. Accessed at http://www.katahdingateway.com/brownville-maine/ on January 20, 2009. *Information on the Town of Brownville's website about the 65,000 gpd system which comprises the largest portion of the wastewater treatment infrastructure for the Village of Brownville.*

2.20 Maryland

2.20.1 Summary

Maryland has about 420,000 onsite systems in the ground, installs some 7500 annually, and repairs or replaces about 5000 systems annually, of which up to 50% are alternative. However, alternative technologies are permitted only on a case-by-case basis, and must have management plans. The resource most in jeopardy in Maryland is the Chesapeake Bay and its shellfish beds. Here special management measures, such as targeted remediation and subsidized upgrades, have been introduced. State policies attempt to control sprawl and steer new development where infrastructure, including sewers, is in place or planned. Management entities or utilities are required of cluster systems. There is limited funding available to help owners with upgrades, though a new program is targeted at upgrades within critical areas of the Chesapeake Bay watershed. There is little testing of alternative technologies and no university research. Anne Arundel County participated in a National Demonstration Project. Installers of mound systems, and other alternatives, are state-certified, and the state runs training programs for soil and site evaluation, design and construction. There is an active state onsite wastewater professionals' association.

2.20.2 Numerical Information

Total number of onsite systems: About 420,000 (Maryland DHE, 2008); the state does not record the number of permits issued for new construction, repair of existing systems or upgrade or modification (NSFC, 2006).

Number of new systems installed each year: About 7000-8000.

Failure definition: Effluent surfacing, or contaminating drinking water supplies or surface water.

Number or proportion of systems presently failing: About 3000-4000.

Number or proportion *repaired* annually: About 2000-3000.

Number or proportion *replaced* annually: About 2000-3000.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Approximately 50%; (20% sand filters, or recirculating sand filters; 20% sand mounds, fewer than 10% drip irrigation systems).

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): None required; however, systems with nutrient removal capability are being encouraged in critical areas of the Chesapeake Bay watershed (MDEQ, 2004).

Cost of a conventional *septic system* installation: $3000-5000 for a conventional drainfield system, up to $10,000 for a mound system.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): About $10,000.

2.20.3 Present Onsite Status (Answers 2a-2f Summarized)

There are isolated areas in the state where nitrate levels in private wells are high because of older systems in densely developed areas. There are other areas, particularly around Chesapeake Bay, where shellfish beds are in jeopardy, or where nitrogen loading is a problem. The Bay, and particularly shellfish harvesting areas within it, is being targeted for a higher level of inspection and enforcement. In general, state policy is attempting to control sprawl by concentrating development in areas with existing infrastructure. In areas designated for growth, the creation or extension of central facilities is supported. It isn't anticipated that future growth will cause problems with onsite systems because they wouldn't be permitted; however, this is not always the case. Washington County, on the northern fringe of the Washington DC metro area, is experiencing increasing pressure to use alternative systems (particularly sand mounds) to support growth in unsewered, severely limited portions of the county as other areas of the county reach build-out development density (von Gunten, 2007).

2.20.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Code is made at state level; county health departments enforce state onsite regulations; and may make tighter regulations, as, e.g., has Anne Arundel County, on Chesapeake Bay. The City of Baltimore has its own Health Department. Permits for larger systems (>5,000gpd) are issued at the state level (NSFC, 2006).

Code was last revised in: June 1991 and October, 1992.

New revisions in progress? To be adopted when? Revisions occur every few years on no set time schedule. Proposed revisions include establishing standards for septic tank construction; elimination of the use of seepage pits; and elimination of different soil loading rates for residential versus commercial wastewater systems; it is unknown at this time if these proposed revisions will be implemented (NSFC, 2006).

Role of legislature, regulatory agency, and politics: See above**.**

2.20.5 Management Programs (Answers 3e-3g Summarized)

There are resource areas where systematic remediation is required, and where special management or planning requirements are in place. In particular, shellfish harvesting areas are being targeted for a higher level of inspection and enforcement. Management entities or utilities are required of cluster systems, the Mayo Water Reclamation Subdistrict (on Mayo Peninsula in Anne Arundel County) being one that has received national attention. For individual advanced systems, the manufacturer or supplier of that treatment unit provides the "management", with oversight at the local level (NSFC, 2006).

Through the Bay Restoration Fund (described below), the state pays for the first five years of operations and maintenance in the cost of installing advanced systems. Maryland is requiring manufacturers to provide training to the private contractors who service the advanced treatment systems. The fund covers the first five years of operations and maintenance as part of the installation cost, and the objective is that property owners will pick up the maintenance contract after the five years of grace the state provides; however, the ‘flush tax’ is controversial (Grenoble, 2008).

Strict rule enforcement, a reliance on hard engineering, and continuous inspections of septic systems are emphasized by Prince Georges County (Duffy, 2008). Provisions exist for installation of alternative and advanced systems, and the county performs routine monitoring of their performance, as well as direct inspections and evaluations of individual systems (Duffy, 2008).

2.20.6 New Technology (Answers 4a-4h Summarized)

Alternative technologies may be permitted on an individual basis, chiefly for repairs or replacements to failing systems, but occasionally for sites unsuitable for conventional systems. In all such cases, more involved site evaluation, design review and construction inspections are required. These systems are also monitored. Alternative systems include mounds, aerobic systems, bermed infiltration ponds, drip irrigation, constructed wetlands, low pressure distribution, and Infiltrator. The state is now encouraging and subsidizing Best Available Technology for system remediation in the critical resource areas around Chesapeake Bay (MDEQ, 2004 and 2008).

The State of Maryland follows performance based codes for systems greater than 5,000 gpd for onsite sewage dispersal. For circumstances where a technology is not listed in code to be used, “any non-conventional treatment and/or disposal system” can be considered (NSFC, 2006). The use of advanced (nitrogen reducing) treatment systems in Maryland is increasing due to two factors: a shared facilities law that allows for lots to share a sewage disposal system and a disposal area based on two or more lots, and Chesapeake Bay restoration efforts where system upgrades within a critical area (1,000 feet from the shoreline of any tributary to the bay) are being prioritized (Brzozowski, 2007).

2.20.7 Onsite Funding (Answers 5a-5c Summarized)

Through the Bay Restoration Fund, since 2006 the state has awarded approximately $19 million for upgrading septic systems to Best Available Technology for the removal of nitrogen (MDE, 2008). The Bay Restoration Fund is funded through a $30 fee paid by every property owner in the state (MDE, 2004). The fees paid by owners on centralized systems go towards upgrading sewage treatment plants, while the fees paid by owners on individual systems go partly to the cost of upgrading septic systems to denitrification units, and partly to cover crop programs (MDE 2004, Grenoble 2008, Summers 2008).

Efforts by the Chesapeake Bay Foundation and the agriculture lobby in Maryland to eliminate funding support for the Septic Replacement Program portion of the Bay Restoration Fund in the 2008 state budget were rolled back after members of MOWPA and others organized against the funding cuts (Dayton, 2007)

2.20.8 Leadership and Information

State-level agencies, task forces:

- Maryland Dept of Environment, Water Management Administration, 2500 Broening Hwy, Baltimore, MD 21224 (Contact: Mr. Jay Praeger, Environmental Program Manager, Wastewater Permits Program; tel 410-631-3780, fax 410-631-3163, eml jprager@mde.state.md.us)
- State Water Quality Action Committee's Onsite Wastewater Disposal Subcommittee.
- Maryland Citizens *Pfiesteria* Action Commission.

Local governmental agencies, task forces:

- Anne Arundel County contains the Mayo Water Reclamation Subdistrict on Mayo Peninsula, a much-cited management entity; the county also participates in the National Onsite Demonstration Project (contacts: Richard Piluk, Anne Arundel County Health Dept; Robert Kraft, Mayo Peninsula Project).

Research within governmental agencies:

- The state monitors performance of alternative systems, further information NA, except that Jay Praeger (see above) had done a study of existing LPP system performance.

Research within universities: None.

Onsite demonstration programs:

- Anne Arundel County was part of the National Onsite Demonstration Project, see contact above and http://www.nesc.wvu.edu/nodp/nodp_phaseI.htm.

Training or certification programs:

- There is a state-run program to certify installers of mound systems, and there are training programs for soil evaluation, site evaluation, design and construction.

Citizen action, private groups:

- Maryland Onsite Wastewater Professionals Association provides training courses and holds an annual conference, see http://www.mowpa.org/.

Newsletters, forums, other sources of information:

- The Maryland Dept of Environment conducts an annual groundwater symposium.
- MOWPA publishes a newsletter, see http://www.mowpa.org/newsletters.html

2.20.9 Enforcement (Q7)

See above.

2.20.10 Role of Cluster Systems and Package Plants (Q8)

See above.

2.20.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

See above.

2.20.12 What's Changed

Patterns / Drivers
Water quality concerns related to nutrient levels in Chesapeake Bay are the major driver behind Maryland's so-called 'flush tax', see above.

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Dayton, Scottie. 2007. Maryland Association Raises its Voice. *Onsite Installer*, September 2007, p. 16. Accessed at http://www.onsiteinstaller.com/editorial/2007/09 on January 21, 2009. *Short article about recent MOWPA efforts to keep funding allocations steady for onsite system upgrades in critical areas of the Chesapeake Bay watershed in Maryland.*

Duffy, Daniel. 2008. Small Towns, Big Maintenance. *Onsite Water Treatment*, March/April 2008. Accessed at http://www.onsitewater.com/ow_0803_small.html on January 21, 2009. *As part of a larger article, includes information about a long-running management program in Prince Georges County, Maryland.*

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Grenoble, Penny. 2007. Rethinking the future. *Onsite Water Treatment*, July/August 2007. Accessed at http://www.onsitewater.com/ow_0707_rethinking.html on January 21, 2009. *This article includes a conversation with John Boris, project manager for the Maryland Department of the Environment's Bay Restoration Fund, about the funding program and its challenges.*

Maryland Dept. of the Environment. 1992. Sewage Disposal and Certain Water Systems for Homes and Other Establishments in the Counties of Maryland Where a Public Sewage System Is Not Available, Title 26, Subtitle 04, Chapter 02. Effective October 26, 1992. Accessed at http://www.dsd.state.md.us/comar/subtitle_chapters/26_Chapters.htm#Subtitle04 on January 21, 2009.

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Von Gunten, G. 2007. The Politics of Sewage Disposal – Montgomery County (MD) On-Site Systems: Should they be used to Regulate Growth? In Individual and Small Community Sewage Systems Conference Proceedings, 20-24 October 2007, (Warwick, Rhode Island, USA). Accessed at http://asae.frymulti.com/azdez.asp?JID=1&AID=23987&CID=icss2007&T=2 on January 21, 2009. *An article about the current land use situation in Montgomery County, where development pressure is increasing in areas currently zoned for large lots and limited development.*

2.21 Massachusetts

2.21.1 Summary

Massachusetts has about 660,000 systems in the ground. Information is not readily available on the annual number of new systems, or repairs and replacements. Dense development and antiquated systems pose problems in urban areas outside the sewer lines. Of particular concern are the coast, Cape Cod, and the islands of Martha's Vineyard and Nantucket, where shellfish beds have been closed, and where nitrogen loading is increasingly problematic both in terms of nutrient enrichment of coastal waters and in terms of increasing nitrate concentrations in sole-source drinking water aquifers. Code accommodates alternative systems under a 3-tiered process of increasing generality, and in some circumstances requires denitrifying systems in coastal areas. The use of alternatives has increased over the last decade, and each type of system has management and maintenance provisions attached to the permit. There are several institutional possibilities for establishing onsite management districts, and several such entities are operating successfully. There are several types of betterment and loan programs available to the towns, some research at the University of Massachusetts, and several demonstration projects in the state, including a well-known alternative technology testing center. The state certifies system inspectors and soil evaluators through a program at the Northeast Interstate Water Pollution Control Commission. Several citizens groups, or NGOs, are also involved in onsite issues.

2.21.2 Numerical Information

Total number of onsite systems: About a third of dwellings; 1990 U.S. census reports about 660,000. Permits are not tracked within the state for: new construction, repair of existing system, or an upgrade or modification to an existing system (NSFC, 2006).

Number of new systems installed each year: NA

Failure definition: Failure to protect the public health and safety, or the environment.

Number or proportion of systems presently failing: About 25%, many "by definition" because they do not meet current code requirements.

Number or proportion *repaired* annually: NA

Number or proportion *replaced* annually: NA

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): This information is not systematically collected, but it is thought that relatively few alternative systems are employed.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Relatively few.

Cost of a conventional *septic system* installation: $20,000-$30,000 (Cole, 2006); broadest range, $1500-$80,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): NA

2.21.3 Present Onsite Status (Answers 2a-2f Summarized)

There are isolated areas in the state where dense development and older systems pose public health problems such as shellfish bed closures, particularly in coastal, or other, vacation areas where summer homes are being converted to year-round use. There are also large bounded areas, particularly Cape Anne, Cape Cod, and the islands of Martha's Vineyard and Nantucket, nitrogen loading problems are threatening estuaries with eutrophication. The Massachusetts Estuaries Project is conducting an ongoing assessment of the estuaries, which is intended to provide a consistent source of information for nitrogen management planning studies, TMDL development, and wastewater management planning (See "Onsite Demonstration Programs", below). Highly land consumptive development patterns (primarily large-lot residential development) have contributed to a housing affordability dilemma in the state and are perceived in some quarters as being in competition with land and water resource protection (UMass Extension, 2008). Meanwhile, the configuration of sewer and water systems in the Metropolitan Boston area results in substantial transfers of water within and between the various basins of the region; the mechanisms of these transfers include drinking water imports, groundwater withdrawal to regional sewers, and infiltration/inflow to the collection system (Pinkham et al., 2004).

Current regulations for onsite systems (known as Title 5) and enforcement actions are generally thought to have greatly improved the state of onsite wastewater management in Massachusetts (see below). Permits have been denied because of poor soils, high ground water, inadequate setbacks, coastal proximity, wetlands, shallow ledges, poor drainage, and poor design. Failures have been attributed to poor design, age, cesspools, straight pipes, shallow groundwater, improper installation, damage, and saturated absorption fields. Several communities formerly under enforcement actions, including the coastal city of Gloucester on the North Shore and the towns of Tisbury and Oak Bluffs on Martha's Vineyard, have implemented wastewater management plans which rely at least in part upon the continued use of onsite systems (see below). Sewer extensions and community-scale package plants are regarded as viable options for communities, though the creation of wholly new, large-scale centralized systems is problematic.

2.21.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Code is made at state level, with enforcement left to city, town or district health departments or boards of health. Local communities may adopt stricter regulations. Enforcement is reported to be adequate for the most part.

Code was last revised in: 2006 (Massachusetts DEP, 2006).

New revisions in progress? To be adopted when? There is no set time frame for code updates; no major revisions are currently in process.

Role of legislature, regulatory agency, and politics: Legislative influence on rule-making has tended in the direction of making code somewhat more lenient. Legislative influence has also slowed the process of code revision. However, it is legislative action that has made loan money, and tax relief, available for upgrades.

2.21.5 Management Programs (Answers 3e-3g Summarized)

Massachusetts was a national leader in promoting onsite wastewater management, and continues to run the most comprehensive program in New England (Adler and Ottenheimer 2005). All systems require plan review and construction inspections; preexisting systems are inspected at time of title transfer, and, if failing, require demonstrated repairs or replacements. Communal systems require annual inspections. All alternative systems must have maintenance contracts in place (NSFC, 2006). Comprehensive wastewater management planning at the local level, including the development of onsite wastewater management plans, can be funded through CWSRF funds (Massachusetts DEP, 2008). Several communities have implemented management programs, often in lieu of centralization. The Town of Tisbury used a risk-based approach to develop management districts as part of an EPA-funded Capacity Development project (Heigis et al., 2001; Eddy, 2004), and the Town of Concord has developed and is implementing a comprehensive program (Stone Environmental, Inc. 2002; Town of Concord 2004 and 2007, Talend 2008). The Town of Acton has implemented a comprehensive program, which it continues to refine (Adler and Ottenheimer 2005, Reagor and Rafferty 2007). Barnstable County, on Cape Cod, has a program which includes the use of a web-based database to track maintenance of I/A systems (Rask et al. 2002, Adler and Ottenheimer 2005). The City of Gloucester developed one of the first comprehensive decentralized wastewater plans in New England which includes city-run STEP systems, city-run inspection of ISDSs, and the stipulation in some areas for advanced technology, though it has not been without controversy (Adler and Ottenheimer 2005; City of Gloucester Sewer Task Force, 2005). There are no reports of interest on the part of utilities to run O/M programs for onsite systems.

2.21.6 New Technology (Answers 4a-4h Summarized)

Present code accommodates alternative technologies, and nitrogen-reducing technologies may be required in areas such as wellhead protection areas and nitrogen-sensitive coastal embayments (Massachusetts DEP, 2008a). In fact, nitrogen-sensitive areas may be more extensively developed if nitrogen-reducing systems (recirculating sand filters or equivalent alternative technology) are employed. I/A technologies are covered under a three-tiered process of increasing generality: piloting (experimental), provisional, and general use (Massachusetts DEP, 2008b). In addition, certain technologies are allowed for remediation (see Corr 2005 for an analysis of results from periodic monitoring of such remedial systems). Each system, and tier, has operation, management and maintenance provisions attached to it. Several general use technologies are covered under individual sections of the code; these include aerobic units, recirculating sand filters, drip irrigation, mounds and chamber systems. Other permitted systems include package plants, Eljen in-drain, Bioclere, Advantex, peat filter, and Eko-Fin. Through the tiered process described above, new technologies may be added to the code. Best Available Technology may be required of some upgrades. Cluster systems are being increasingly implemented for development in nitrogen-sensitive areas (e.g., Lombardo, 2007), though their overall role in the state is small to moderate.

2.21.7 Onsite Funding (Answers 5a-5c Summarized)

There are several types of betterment loan programs for upgrading septic systems available to towns; some SRF funds are indirectly available to seed these programs. An income tax credit is also available to property owners for repair or replacement of a failing system (Commonwealth of Massachusetts, 2001). SRF monies can be used to assist homeowners for the repair of a failing or malfunctioning system, the replacement of a failing or malfunctioning system, or the new construction of an onsite wastewater treatment system (NSFC, 2006).

2.21.8 Leadership and Information

State-level agencies, task forces:

- Division of Water Pollution Control, Massachusetts Dept of Environmental Protection, One Winter St, Boston, MA 02108 (contact: Mr. David Ferris, Program Director, Watershed Permitting, tel (617) 654-6514, fax (617) 292-5696, eml david.ferris@state.ma.us)
- Massachusetts participates in the New England Interstate Water Pollution Control Commission's Onsite Task Force.

Local governmental agencies, task forces:

- Several boards of health or city health departments are active in onsite discussions (see above for towns considering or implanting inspection or management programs).
- The Cape Cod Commission and the Martha's Vineyard Commission both participate in regional wastewater planning discussions involving the individual towns of the Cape and Islands.

Research within governmental agencies:

- See below, under demonstration sites.

Research within universities:

- There is a program at University of Massachusetts, Amherst (Dept of Soil and Plant Science); further details NA.
- University of Massachusetts, Amherst has also completed, under contract with the Mass DEP, a technology guide: *Innovative and Alternative On-Site Wastewater Treatment Technologies Handbook*, by Eric Winkler.
- The Massachusetts Estuaries Project (http://www.oceanscience.net/estuaries/about.htm) "is a collaborative effort by two state agencies, the Executive Office of Environmental Affairs (through the Department of Environmental Protection) and the University of Massachusetts's School of Marine Science and Technology. This project will provide water quality, nutrient loading, and hydrodynamic information for 89 estuaries in Southeastern Massachusetts that will be combined through the use of a linked watershed/estuary model that will predict the water quality changes that will result from land use management decisions. Reports for each estuary will evaluate several water quality conditions and how they relate to the health of the estuary and the land use changes necessary to bring about improvement."

Onsite demonstration programs:

- Barnstable County Health Dept (in conjunction with the Massachusetts DEP) runs an onsite test and demonstration program at the Massachusetts Military Reservation on Cape Cod (contact: George Huefelder, Superior Courthouse, Rte 6A, Barnstable, MA 02630; tel 508-362-2511; see http://www.barnstablecountyhealth.org/AlternativeWebpage/index.htm and, for example, Higgins et al. 2002).
- The City of Gloucester has an onsite demonstration program (contact: Gloucester Engineering Dept, 9 Dale Ave, Gloucester, MA 01930; tel 978-281-9773, fax 978-281-9725).
- Waquoit Bay National Estuarine Research Reserve participates in an onsite demonstration program (contact: Christine Gault, Director, WBNERR, Rte 28, Waquoit, MA 02536; tel 508-457-0495, fax 617-727-5537; http://www.waquoitbayreserve.org/projects.aspx); current projects include investigation of efficient onsite denitrification systems and reactive barriers for nitrogen removal.

Training or certification programs:

- The state administers onsite certification for system inspectors and soil evaluators. As of January 2007, soil evaluators and system inspectors are required to renew licenses every three (3) years, and to obtain at least 10 contact hours of relevant training prior to recertification beginning in January 2010 (Massachusetts DEP, 2006).
- The Northeast Interstate Water Pollution Control Commission (NEIWPCC) provides training for system inspections and soil evaluators (see http://www.neiwpcc.org/onsitesystems.asp and Groves, 2007).
- Installers are often licensed at the local level, but there is no state program.

Citizen action, private groups:

- Cape Cod Water Protection Collaborative (http://www.capekeepers.org/) was "created by Barnstable County to offer a coordinated approach to enhance the water and wastewater management efforts of towns and the County and to provide cost effective and environmentally sound wastewater infrastructure, thereby protecting Cape Cod's shared water resources".
- Coalition for Alternative Wastewater Treatment (originally formed to address the problems in Gloucester, but now focused on state and national issues as well). Contact: Valerie Nelson, Ph.D., POB 7041, Gloucester, MA 01930; tel 978-283-7569, fax 978-283-3567.
- The Massachusetts Health Officers Association (MHOA), see http://www.mhoa.com/
- Yankee Onsite Wastewater Association (YOWA), see http://www.yankeeonsite.org

Newsletters, forums, other sources of information:

- Barnstable County publishes a wastewater newsletter and hosts an alternate technologies information website.
- The Mass DEP publishes a newsletter and hosts a web site.
- MHOA holds an annual conference with a session on onsite systems (see above)
- NEIWPCC organizes a Short Course and Exhibition approximately once every three years (see above).

2.21.9 Enforcement (Q7)

Enforcement is left to city, town or district health departments or boards of health. Local communities may adopt stricter regulations. Enforcement is reported to be generally adequate.

2.21.10 Role of Cluster Systems and Package Plants (Q8)

Cluster systems are being increasingly implemented for development in nitrogen-sensitive areas (e.g., Lombardo, 2007), though their overall role in the state is small to moderate.

2.21.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

Management programs in Massachusetts are generally administered by towns and municipalities (Health and/or Public Works Departments). There are no reports of interest on the part of utilities or electrical cooperatives to run O/M programs for onsite systems.

2.21.12 What's Changed

Patterns / Drivers

"The transient population and sandy soils combined with heavy economic ties to tourism and reliance on a healthy shellfish industry make proper management of onsite systems imperative in Tisbury. The fact that the entire town relies on a single groundwater aquifer for its drinking water also raises the stakes for proper onsite wastewater management. "We recognized a need to get inventory of the onsite systems that we have and manage them for people. We talked about how professionals are needed to run a large wastewater treatment facility, and the town recognized that the same thing needs to be done in these little systems, just on a smaller scale," said Luttrell" (Eddy, 2004).

Water quality issues—primarily nutrient limitations—have resulted in some towns and inter-municipal districts (such as the Tri-Town Groundwater Protection District on Cape Cod) which were examining the onsite wastewater management district concept in the 1990s, to instead plan centralized treatment plants to meet stringent water quality standards (e.g., Town of Orleans, 2008).

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2.22 Michigan

2.22.1 Summary

Michigan reports an estimated 1,400,000 systems in the ground. Local health departments reported about 14,000 systems were installed or repaired/replaced in 2007. There are scattered areas with problems either because of dense development, antiquated systems (including straight pipes, cesspools, and discharges to agricultural tile drains), or because of unsuitable soils or hydrology. Code for systems serving single and two-family homes is developed at the local health department level, and most accommodate alternatives, albeit with varying management provisions. Several local health departments have initiated mandatory time-of-sale inspection programs. The state Strategic Water Quality Initiatives Fund (SWQIF) allows for low-interest loans to local units of government for the upgrade or replacement of failing septic systems; however, this fund has not been utilized. Presently, there is no research within government agencies. However, Michigan State University has a research program, and there are two demonstration projects related to onsite systems. The Michigan On-site Wastewater Training and Education Center provides a variety of training courses related to on-site wastewater treatment. There are several kinds of training programs, including a new short course on engineering cluster systems, but no state-level certification for onsite professionals.

2.22.2 Numerical Information

Total number of onsite systems: 1,400,000 estimated; 1990 U.S. census reports 1,100,000

Number of new systems installed each year: 13,970 in FY 2007-08 (October 2007-September 2008), including repairs (MDEQ, 2008a). Number of permits issued has declined from 37,000 in FY99-00; decline has become more dramatic in last 3 years (MDEQ, 2008a).

Failure definition: Varies as per county regulations.

Number or proportion of systems presently failing: About 20% in counties where time-of-sale programs have been implemented (Falvey, 2002); in FY06-07, the average proportion of O&M inspections (evaluations of failed systems as part of replacement permitting process) to permits issued for all counties was 36% (MDEQ, 2008a).

Number or proportion *repaired* annually: If one assumes that all O&M inspections result in repair or replacement, about 5,500 were repaired/replaced in FY07-08 (MDEQ, 2008a).

Number or proportion *replaced* annually: See above.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): About 800 alternate/engineered plans were reviewed in FY07-08, this includes new construction, repairs, and replacements (MDEQ, 2008a).

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): NA

Cost of a conventional *septic system* installation: \$2000-\$5000; range, \$1000-\$15,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): NA

2.22.3 Present Onsite Status (Answers 2a-2f Summarized)

It is reported that there are some, and sometimes large or well bounded, areas that pose problems because of dense, antiquated systems or unsuitable soils; and that some of these situations jeopardize resources. Other areas will become problematic with future development, with much of the growth moving from urban centers to rural and unsewered areas (Michigan Land Use Leadership Council. 2004). The main concerns are a significant percentage of failing systems; nutrient loading of surface waters; and elevated nitrogen levels in several aquifers. Fast-developing areas include southeast, southwest, and northwest Michigan, where there exist areas with already high ISDS densities (Falardeau 2009). This is also true of older cities including Detroit, Ann Arbor, and Pontiac. Statewide, historically developed lakeshore areas have experienced problems due to dense development on small lots. Several areas, particularly in the east-central and southeastern portions of the state, have generally unsuitable or severely limited soils for on-site wastewater disposal.

Permits have been denied because of high water tables, clay soils, shallow bedrock and floodplain situations. Failures have been attributed to high water table; poor soils; and inadequate design, construction, or maintenance. The creation or extension of sewers is generally supported in fast-developing areas, but financial resources to fund such projects are inadequate.

2.22.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? The State of Michigan does not have a state-wide regulatory statute for onsite wastewater systems (NSFC, 2005). There have been some recent efforts to develop a state-wide code (MDEQ, 2004). Code for single and two-family homes is developed and administered by local county and district health departments, with support/advice from the Michigan Department of Environmental Quality (MDEQ) On-site Wastewater Section (MDEQ, 2008) . For larger soil absorption systems, state rules apply, with enforcement left to local health departments as authorized by the Michigan Department of Environmental Quality.

Code was last revised in: Depends on the district or county.

New revisions in progress? To be adopted when? Ongoing, but jurisdiction by jurisdiction.

Role of legislature, regulatory agency, and politics: Legislative adoption is always required, but at the local level.

2.22.5 Management Programs (Answers 3e-3g Summarized)

The State does not require regular performance and operation inspections of onsite systems after initial construction, but a number of local health departments have required maintenance contracts for certain types of alternative systems (NSFC, 2005). If a homeowner requests an inspection, where programs are in place, inspections are typically provided by the local health department staff or by inspectors certified by the local health department (NSFC, 2005).

As part of the Rouge River Watershed Project, Washtenaw County passed an ordinance in 2000 requiring onsite wastewater systems to be inspected at the time of sale of a home or property (Falvey 2002) Eight other counties in lower Michigan have also implemented their own mandatory time-of-sale inspection programs (Falvey 2002, MDEQ 2004, Duffy 2008, Falardeau 2009). The staff of the Washtenaw County program are using data collected during the inspections to characterize malfunction causes and identify regions where the probability of sewage system malfunction is unusually high (Gregory, 2004).

Per State administrative rules, all public and/or industrial/commercial systems are required to be operated by a properly certified operator and reported to MDEQ (NSFC, 2005; MDEQ, 2008). MDEQ, however, does not currently provide adequate regulatory oversight, especially for small systems (NSFC, 2005).

2.22.6 New Technology (Answers 4a-4h Summarized)

Most county codes accommodate, and may in some circumstances require, alternative technologies, as well as allowing the development of otherwise undevelopable lots with their use. The level and manner of their oversight varies from county to county. Sand filter technology is increasingly in use in areas with slowly permeable soils. Mounds, package plants, aerobic, gravelless, pressure, chamber, drip irrigation, and lagoon systems have all been permitted. Some counties may require the use of Best Available Technology for remediation or repair, but further information is NA. Most counties have some kind of mechanism to test and authorize new technologies. Their use is generally supported when properly applied, so that if costs diminished, more widespread use could be expected. Cluster systems, typically serving 30 homes or less, are gaining popularity in some new developments, and are increasingly used to address existing problems such as historically developed lakefronts. Any system serving more than a one- or two-family residence, for example public and/or industrial/commercial systems discharging <10,000 gpd to a subsurface dispersal system, may be considered for a local variance or pursue the option of a formal groundwater discharge permit from the Department (NSFC, 2005).

2.22.7 Onsite Funding (Answers 5a-5c Summarized)

The state Strategic Water Quality Initiatives Fund (SWQIF) allows for low-interest loans to local units of government for the upgrade or replacement of failing septic systems; however, this fund has not been utilized (Falardeau 2009). No other funding program or mechanism exists in the state to assist homeowners replacing failing systems or installing new systems (NSFC, 2005).

2.22.8 Leadership and Information

State-level agencies, task forces:

- Michigan Dept of Environmental Quality, On-site Wastewater Unit, 525 W. Allegan, Lansing, MI 48909-7773 (contact Ric Falardeau, tel (517) 241-1345, fax (517) 241-1328, eml falarder@michigan.gov)
- Michigan Department of Environmental Quality, Environmental Health Section, 525 West Allegan, Lansing, Michigan 48909 (contact Mr. Sean Nalepka, tel (517) 241-4687, fax (517) 241-1328, eml nalepkas@michigan.gov)

- ♦ Technical Advisory Council for Onsite Wastewater Treatment; see http://www.mowra.org/TAC Table of Contents.htm)

Local governmental agencies, task forces:

- ♦ Local jurisdictions control onsite regulation, and thus are really the centers of activity.

Research within governmental agencies: None.

Research within universities:

- ♦ Michigan State University; (contact Dr. Ted Loudon, tel (517) 353-3741 eml loudon@egr.msu.edu). With Dr. Loudon's retirement, only limited research relevant to onsite systems continues.

Onsite demonstration programs:

- ♦ The Benzie/Leelanau District Health Department was a participant in NODP Phase 1, which focused on technology demonstration (particularly phosphorus and pathogen removal). Systems installed included iron oxide phosphorus removal horizontal barrier, recirculating sand filter followed by an upflow oxide-rich phosphorus removal filter, packed-bed filter, intermittent sand filter, open-cell foam biofilter, low-pressure shallow trenches, and low-pressure contour trenches. Systems have performed according to expectations with the upflow P-removal filter showing much promise. Regular system monitoring ceased in 1998 but local performance evaluation continues (see http://www.nesc.wvu.edu/nsfc/pdf/sf/SFf99.pdf for details).
- ♦ In conjunction with Benzonia and Lake Township and Benzie-Leelanau District Health Department, Onsite Wastewater, (formerly NWMOWTF), attempted to facilitate a community-wide project, under the Strategic Water Quality Initiative Fund of MDEQ, designed to provide individual and community options for wastewater systems within Benzonia and Lake Townships Crystal Lake and Platte Lake Watersheds. In 2008, the project was suspended because MDEQ declined to support use of Strategic Water Quality Initiative Fund monies or any low interest assistance to privately owned community/cluster systems (Onsite Wastewater, 2008).

Training or certification programs:

- ♦ The State does not require onsite professionals to be certified.
- ♦ MDEQ provides soils training for local health departments.
- ♦ There are training programs at the local level for contractors.
- ♦ There is a Michigan Onsite Wastewater Training and Education Center, associated with the Tollgate Education Center in Novi, that provides education for inspectors involved with SE Michigan time-of-sale inspection programs (Rouge River Project, 2001); see http://www.egr.msu.edu/age/outreach.html#onsite
- ♦ Decentralized system engineers in the state are offering a unique course about the 'need-to-know' information for designing cluster systems (Loudon and Stephens, 2008).

Citizen action, private groups:

- Michigan Onsite Wastewater Recycling Association (MOWRA) (contact: Mike Stephens, tel 517-339-8692, fax 517-339-6330, eml scscons@yahoo.com; http://www.mowra.org/)
- Several watershed groups are in existence, further details NA.
- Rouge Remedial Action Plan Advisory Council, On-site Sewage Disposal Committee
- Onsite Wastewater of Northwest Michigan (formerly Northwest Michigan On-Site Wastewater Task Force): http://www.michigan-onsitewastewater.org/

Newsletters, forums, other sources of information:

- MOWRA occasionally publishes a newsletter.

2.22.9 Enforcement (Q7)

Enforcement is left to local health departments as authorized by the Michigan Department of Environmental Quality. MDEQ acknowledges that the state's enforcement for small commercial or multiple user systems is not adequate (NSFC, 2005).

2.22.10 Role of Cluster Systems and Package Plants (Q8)

Cluster systems, typically serving 30 homes or less, are gaining popularity in some new developments, and are increasingly used to address existing problems such as historically developed lakefronts. Any system serving more than a one- or two-family residence, for example public and/or industrial/commercial systems discharging <10,000 gpd to a subsurface dispersal system, may be considered for a local variance or pursue the option of a formal groundwater discharge permit from the Department (NSFC, 2005).

2.22.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

No role or interest noted.

2.22.12 What's Changed

Patterns / Drivers

Several watersheds in Michigan are designated as "areas of concern" in the Great Lakes Water Quality Agreement between the U.S. and Canada, including the Detroit River, the Rouge River, and the Clinton River (Falvey, 2002). The agreement states that each area of concern must implement a remedial action plan to restore water quality locally (Falvey, 2002). The Rouge River National Wet Weather Demonstration Project was formed in 1992 to use a community-based watershed approach to resolving pollution problems. After identifying SSOs and CSOs, they turned attention to illicit discharges and malfunctioning onsite systems—at about the same time as counties were beginning to identify illicit discharges as part of voluntary stormwater programs and Washtenaw county health officials were encouraging their departments to identify gaps in services (Falvey, 2002).

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Gorman, Hugh, and Kathleen Halvorsen. 2006. The Regulation of Alternative Onsite Wastewater Treatment Systems in the Great Lakes Region. *Small flows* Quarterly 7(1): 23-37. Accessed at http://www.nesc.wvu.edu/smart/pdf/sourcewater/SFQ_W06_great_lakes.pdf on January 21, 2009. *Juried article about changing regulatory practices regarding alternative systems in the Great Lakes states, including Michigan.*

Gregory, Randall. 2004. Assimilation and practical application of field data in Washtenaw County, Michigan. In On-Site Wastewater Treatment X, Conference Proceedings, 21-24 March 2004 (Sacramento, California USA), K.R. Mankin, ed., pp. 37-43. Accessed at http://asae.frymulti.com/abstract.asp?aid=15758&t=1 on January 21, 2009. *Information about how Washtenaw County is using data gathered during their time-of-transfer inspection program to evaluate installation and maintenance practices, identify education needs, and analyze inspection results for clusters of failures where further local collaboration is needed.*

Loudon, Ted and Larry Stephens. 2008. Educating professionals in the “needs-to-know” of decentralized wastewater treatment design. Presented at the NOWRA 17th Annual Technical Education Conference & Exposition (Memphis, Tennessee), April 2008. *This paper describes one attempt to provide an intensive week of training in decentralized concepts for practicing design professionals. Specific areas of knowledge required are shown as subheadings in the paper.*

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Michigan Department of Environmental Quality. 2008. On Site Wastewater Program. Accessed at http://www.michigan.gov/deq/0,1607,7-135-3313_51002---,00.html on January 21, 2009. *State of Michigan’s website on onsite system regulatory support programs and staff.*

Michigan Department of Environmental Quality. 2008a. 2007-2008 Onsite Sewage Quarterly Report and Comparison with Previous Fiscal Years. Unpublished data received from Michigan DEQ, January 22, 2009.

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National Small Flows Clearinghouse. 2005. Michigan Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/Michigan.pdf on January 21, 2009. *This short document summarizes onsite wastewater system regulations and activities in Michigan.*

Onsite Wastewater of Northwest Michigan. 2008. Community Options for Wastewater Systems in Benzonia and Lake Townships, Benzie County, Michigan. Last updated February, 2008. Accessed at http://www.michiganonsite.org/0208.html on January 21, 2009*. Information about the Benzie County demonstration project, including information about suspension of the project timeline due to state funding mechanism problems.*

Rouge River Project. 2001. On-site Sewage Disposal Management Activities. Last updated August 2001. Accessed at http://www.rougeriver.com/techtop/nonpoint/septic/activities.html on January 21, 2009. *Website with information about time-of-transfer and other management activities associated with the demo program in southeast Michigan.*

Rouge River Project. 2002 Septic System Maintenance. Last updated April 2002. Accessed at http://www.rougeriver.com/techtop/nonpoint/septic/index.html on January 21, 2009. *Web site for the Rouge River Demonstration Project dealing specifically with onsite systems.*

2.23 Minnesota

2.23.1 Summary

Minnesota has about 500,000 onsite systems in the ground, by broad criteria more than half of them failing. It adds about 20,000 new systems per year, and another 6000 are repaired or replaced annually. There are many areas throughout the state that have problems with shallow groundwater, karst geology, and poor soils. The northern lakes area suffers from potentially degrading surface water quality. In response to the need for upgraded and managed systems, some communities have responded by creating "Environmental Subordinate Service Districts"; there are presently several such districts, with services often provided by rural electric cooperatives. Cluster systems are increasingly being used in response to both environmental issues and development pressure. Minnesota code accommodates, and can require, alternative and advanced technology, including remediation by BAT. Permits for new technologies require flow meters, monitoring, and remediation plans. There is a loan program for system upgrades. There are mechanisms to test new technology at state and county levels. University of Minnesota is also involved in research, demonstration programs, and training, which it provides on contract with the state. Several private organizations are also active in the state.

2.23.2 Numerical Information

The State Agency does not keep track of the number of permits issued state wide for: new construction, repair of existing system, or upgrade or modification. This information is kept with the local regulators. They file annual reports with MPCA, which are available upon request.

Total number of onsite systems: About 500,000; 1990 U.S. Census reports about 468,000—about 27% of housing units; this includes residential systems of all kinds, including cesspools.

Number of new systems installed each year: Approximately 16,000.

Failure definition: Any cesspool or seepage pit; any surfacing sewage or recurring backup; any system with less than 2 feet separation (3 feet in some circumstances) from saturated soil or bedrock; any tank leaking to groundwater; also systems not meeting applicable performance standards or being operated/managed in accordance with operating permits (MPCA, 2008a).

Number or proportion of systems presently failing: Approximately 50%. MPCA estimates that 12 percent of the 535,000 homes with on-site septic systems are public health threats because untreated effluent ends up on the surface or in waterways (Shaffer, 2006).

Number or proportion *repaired* annually: About 3000.

Number or proportion *replaced* annually: About 3000.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): 40-50% as the question is worded; however, mounds, pressure dosing and aerobic systems are classified as standard systems; mounds may account for 30-35% of new systems.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Only systems that discharge to surface waters; not many.

Cost of a conventional *septic system* installation: $5000, mid-range; $3000-$7000, wide-range $1800-$15,000. Cost of a mound system, $12,000-$14,000 (Wallace and Hallahan, 2005). Individual systems cost $8,000 to $15,000 (Shaffer, 2006).

Cost of a centralized sewer tie-in (including fees and cost of the sewer lateral): $7650-$12,000. In the Twin Cities region, sewer availability charges are $1,500-$15,000 per home (median $7,500), plus about $3,500 for collection system within development and $500 for individual home hookup (Wallace and Hallahan, 2005).

2.23.3 Present Onsite Status (Answers 2a-2f Summarized)

There are areas in the state (some large) that pose problems because of dense development, antiquated systems, or resource or physiographic limitations. Most older lakefront developments are problematic. There are scattered areas with shallow groundwater, and others with poor soils. Phosphorous loading of surface waters and pathogens are concerns. Areas in the northwest and the northeast are marked by heavy soils, shallow saturation levels, or high bedrock. The north-central lakes area is in need of surface water protection; rapid lakeshore development in this area has resulted in the formation of several management districts (e.g., Gilbertson and Otis 2007). Karst topography marks the southeast corner of the state, where an effort is underway to assist unsewered communities with information and upgrades (Malchow, 2007). Minneapolis/St. Paul and surrounding areas are marked by high population and system densities.

It is estimated that nonpoint sources of water pollution contribute approximately 86 percent of the problem in Minnesota (MPCA, 2008f). While over 100 small communities have made progress on addressing wastewater treatment needs from 1996-2007, over 1,000 communities with wastewater needs remain—many in lakeside neighborhoods and other unincorporated areas (MPCA, 2008f).

Recent changes to funding options have increased the likelihood that decentralized systems will be considered favorably in comparison with centralized systems (Etnier et al., 2007); sewering has public support in some but not all areas, except for the cost, and varies with locality.

2.23.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? The Minnesota Pollution Control Agency creates minimum code, and manages and enforces licensing requirements. City-, county-, or multi-county health departments adopt and enforce that code or a local one. Local codes may be more or less strict than the state's model code (Shaffer 2006, MPCA 2008a, 2008c, and 2008e). MPCA, the state agency, has neither the staff nor the authority to regulate septic systems; however, state audits of county enforcement programs that were promised in 2003 were never completed (Shaffer, 2006). Both state officials and outsiders who deal with septic regulation have complained of inconsistent enforcement and poor oversight of local programs (Schaffer, 2006).

Code was last revised in: 2008 (MPCA, 2008a).

New revisions in progress? To be adopted when? None currently in progress.

Role of legislature, regulatory agency, and politics: Code changes have been driven by statutory changes; more power has been shifted to the counties in the last decade.

2.23.5 Management Programs (Answers 3e-3g Summarized)

The state has enabled and increasingly promotes wastewater management districts or utilities (NSFC 2006; McDilda 2007). Several counties, faced with nonconforming systems, have created “Environmental Subordinate Service Districts” for construction and management of collector/communal systems. The first was in Cass County, where a contract with Crow Wing Power and Light (a Rural Electric Cooperative) assures inspection, maintenance, billing and record keeping. There are several well-known management programs in Minnesota, including the Otter Tail Water Management District (Christopherson and Anderson 2004, Hildebrant 2006) and Crow Wing County Sanitary Management District (Gilbertson and Otis, 2007)

The State requires operating permits for performance systems (NSFC, 2006), and as of 2008, all new onsite systems must have a management plan (Dayton, 2008).

Cluster systems are playing an increasingly prominent role in wastewater management in Minnesota, and successful O/M efforts are being carried out by both private utilities and rural electrical cooperatives (see below).

2.23.6 New Technology (Answers 4a-4h Summarized)

Present code accommodates alternative, experimental and advanced systems, and may require it in individual cases. Remediation can require Best Available Technology. Alternative systems may be used on lots unsuited to conventional systems depending on the county. In such cases, the experimental section of the code requires a flow meter, and a monitoring and mitigation plan.

Cluster systems are being used increasingly in areas where individual systems are not appropriate--for example, “hot spot” areas in existing lake shore developments (Gilbertson and Otis, 2007). MPCA issues permits for subsurface treatment systems with flows greater than 10,000 gpd, and all have some type of management (contact Gretchen Sabel at MPCA for a current list; contact information below) (NSFC, 2006). A performance-based code has been developed for ten counties in northeastern Minnesota (Otis 2003; Otis et al. 2004). There are both state and county mechanisms to test new technologies; recently, a state-wide registration process was created for proprietary treatment systems and distribution media (MPCA, 2008g). Systems permitted include sand filters, mound-, at-grade, and aerobic systems; package plants, peat filters, and constructed wetlands.

2.23.7 Onsite Funding (Answers 5a-5c Summarized)

In the State of Minnesota, monies from State Revolving Funds (SRF) can be used to assist individual homeowners to repair or replace failing or malfunctioning systems and to install new onsite wastewater treatment systems; for further information regarding please contact Mr. Bill Dunn at (651) 282-2663 (NSFC, 2006).

2.23.8 Leadership and Information

State-level agencies, task forces:

- Minnesota Pollution Control Agency, Policy and Planning Div, Community and Area-wide Programs Section; 520 Lafayette Street North, St. Paul, MN 55455; tel 651-296-9322, fax 651-297-8674; (contacts: Mark Wespetal, email mark.wespetal@pca.state.mn.us; Gretchen Sabel, eml Gretchen.sabel@pca.state.mn.us; Bill Priebe eml bill.priebe@pca.state.mn.us).
- Minnesota Dept of Natural Resources—Shoreland Region.
- Subsurface Sewage Treatment Systems (SSTS) Advisory Committee: a group of professionals and others interested in the SSTS industry who advise MPCA on matters relating to MN Rule Chapters 7080-7083 and administration of the SSTS program, see http://septic.umn.edu/events/sstsac/index.html.
- SSTS Licensing Stake-holder Task Force
- Northern Minnesota Wastewater Technical Committee (NMWTC) (active from 1994-2002, see Otis et al. 2004)

Local governmental agencies, task forces:

- Information on the Cass County utility may be obtained from: Bridget I. Chard, Resource Consultant, Red River Ox Cart Trail, Rte 1, Box 1187, Pillager, MN 56734; tel 218-825-0528.
- There are many smaller subordinate service districts in the state; most require operating permits (NSFC, 2006). For example: Cass County (contact Mr. Brent Rud – (218) 547-7256), Scott County (contact Mr. Al Frechette – (952) 496-8475), St. Louis (Mr. Dale Schroeder – (218) 725-5200), Rice County (Ms. Marilee DeGroot – (507) 332-6170), and Aitkin County (Mr. Terry Neff – (218) 927-7342).

Research within governmental agencies: NA, but see below.

Research within universities:

- University of Minnesota is involved in a number of projects, see http://septic.umn.edu/Research/index.html for a current summary of research activities and demonstration site locations.

Onsite demonstration programs:

- Yes, at the University of Minnesota, including a cold regions project in the northeast and several technology demonstration sites, (see website above and, for example, Otis et al. 2001).

Training or certification programs:

- Licensing is required for all onsite professionals in Minnesota. At least one employee of each MPCA-licensed Subsurface Sewage Treatment Systems (SSTS) business must be certified in each specialty area offered by the business. As of February 2008, certification may be obtained in several specialty areas, including designer, advanced designer, inspector, advanced inspector, installer, maintainer, and service provider. See http://www.pca.state.mn.us/programs/ists/registration.html for more information.
- Training is provided for the state on contract with the University of Minnesota and its extension services: the Minnesota Onsite Sewage Treatment Program (see Gustafsen, above, or http://septic.umn.edu/events/).

Citizen action, private groups:

- There are several lake associations, such as the Association of Cass County Lakes; there is also a "Statewide Lake Association," further information NA.
- Minnesota On-site Wastewater Association (MOWA, formerly Minnesota Onsite Sewage Treatment Contractors' Association): http://www.mowa-mn.com/.

Newsletters, forums, other sources of information:

- Minnesota PCA publishes a quarterly ISTS report, and hosts a website: www.pca.state.mn.us.
- MOWA publishes a bi-monthly newsletter, see web site above.
- The University of Minnesota Extension has extensive an outreach/public education network and library of publications, including regional onsite wastewater extension specialists and educators: http://www.extension.umn.edu/OnsiteSewage/

2.23.9 Enforcement (Q7)

MPCA, the state agency, has neither the staff nor the authority to regulate septic systems; however, state audits of county enforcement programs that were promised in 2003 were never completed (Shaffer, 2006). Both state officials and outsiders who deal with septic regulation have complained of inconsistent enforcement and poor oversight of local programs (Schaffer, 2006).

2.23.10 Role of Cluster Systems and Package Plants (Q8)

Cluster systems are being increasingly utilized to serve neighborhoods or small communities, with the majority of such systems with flows over 10,000 gpd being installed since 2001 (Christopherson et al., 2006). Such systems are also being used to serve existing development in lakeshore areas with difficult conditions for onsite replacements (Hildebrant 2006, Gilbertson and Otis 2007).

In Rice County, strict ordinances tie properly functioning septic tanks to any home improvement or real estate transaction through compliance inspections; as a result, the county has approximately 20 cluster systems (McDilda, 2007).

Lake Elmo, near Minneapolis, has long used zoning and land use planning activities to restrict its growth (Pinkham et al, 2004). Though the town was forced to accept centralized sewers in limited areas after a protracted legal battle, open-space subdivisions served by managed cluster systems have become the preferred model for development in the town (Wallace and Hallahan, 2005).

2.23.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

Rural electrical cooperatives, both on their own and through partnership with privately owned O/M companies, play an important role in O/M programs for onsite sewage disposal in Minnesota. In southern Minnesota, for example, Connexus Waterways, a subsidiary of the electrical cooperative Connexus Energy, collaborates with EcoCheck, Inc. to provide management services for cluster systems (Yeager et al. 2006, Etnier et al. 2007). As mentioned above, Crow Wing Power and Light provides management services for some programs in Cass County.

2.23.12 What's Changed

Patterns

"Over the last decade, the growth of cluster developments has led to the use of wastewater treatment systems that serve entire neighborhoods or small communities. The use of cluster developments is an increasing trend in Minnesota and across the country. The Minnesota Pollution Control Agency (MPCA) reports that the majority of onsite wastewater systems over 10,000 gallons per day (gpd) in the state have been permitted in the last five years" Christopherson et al. 2006).

Drivers

Declining water quality in the lakes of Otter Tail County in the mid-1980s, caused primarily by malfunctioning systems, was the driver for formation of the Otter Tail Water Management District, which now operates several hundred individual systems and 13 cluster systems (Hildebrant, 2006).

"Double-digit population growth and skyrocketing development has resulted in a dramatic increase in unsewered development in Minnesota's popular lakes county. To help assure protection of human health and the quality of the waters, a county wide decentralized sanitary management district with pilot subordinate districts has been established in Crow Wing County" (Gilbertson and Otis, 2007).

Increasing growth pressure around Minneapolis has created conflicts with suburbs wishing to retain their rural character such as Lake Elmo (Pinkham et al., 2004; Wallace and Hallahan, 2005).

2.23.13 References

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Christopherson, Sara, Dave Gustafson, and Jim Anderson. 2006. Preliminary Evaluation Of Cluster System Septic Tank Performance. In *NOWRA 15th Annual Technical Education Conference and Exposition*, Denver, Colorado, August 28-31, 2006. *Performance evaluation of septic tanks serving larger-flow and cluster wastewater systems that were installed prior to the release of updated state regulations that incorporate guidance for designing cluster systems with flows of less than 10,000 gpd.*

Christopherson, Sara, Dan Wheeler, Jessica Wittwer, and Tim Haeg. 2007. Field Comparison of Rock-Filled and Chambered Trench Systems, University of Minnesota Onsite Sewage Treatment Program. In *NOWRA 16th Annual Technical Education Conference & Exposition* (Baltimore, Maryland; March 2007). *Preliminary results of a comparison of the performance of two types of subsurface dispersal systems in Minnesota.*

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Etnier, Carl, Richard Pinkham, Ron Crites, D. Scott Johnstone, Mary Clark, and Amy Macrellis. 2007. Overcoming barriers to evaluation and use of decentralized wastewater technologies and management. . Project No. 04-DEC-2. Prepared for the National Decentralized Water Resources Capacity Development Project, Water Environment Research Foundation, Alexandria, Virginia, by Stone Environmental, Inc., Montpelier, Vermont. Accessed at http://www.ndwrcdp.org/userfiles/04-DEC-2full.pdf on January 30, 2009. *Includes information about recent changes to Minnesota's priority project ranking system; the prior system encouraged regionalization of centralized systems, in contrast to the state's desired policy direction.*

Gilbertson, Craig, and Richard J. Otis. 2007. Integrating Rural Wastewater Management: Crow Wing County Sanitary Management District. In *Eleventh Individual and Small Community Sewage Systems Conference Proceedings*, 20-24 October 2007, (Warwick, Rhode Island, USA). *Description of the process that stakeholders in Crow Wing County went through in order to get to their management program for onsite and cluster systems, and of the actual management program as it is being implemented.*

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McDilda, Diane. 2007. Clean enough for 10,000 lakes. *Onsite Water Treatment*, November/December 2007. Accessed at http://www.onsitewater.com/ow_0711_clean.html on January 29, 2009. *Information about the increasing number of cluster systems in Minnesota; includes two case studies, one of which is for a cluster system funded by the users instead of using state or federal funds.*
Minnesota Pollution Control Agency. 2008a. CHAPTER 7080, Design Standards For Individual Subsurface Sewage Treatment Systems. Effective February 18, 2008. Accessed at https://www.revisor.leg.state.mn.us/data/revisor/rule/current/7080/7080.pdf on January 28, 2009. *Current regulation governing individual onsite systems in Minnesota.*

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Minnesota Pollution Control Agency. 2008e. Minnesota's Subsurface Sewage Treatment Systems Program (SSTS). Last updated December 2, 2008. Accessed at http://www.pca.state.mn.us/programs/ists/index.html on January 28, 2009. *The state governmental website for information and regulatory programs related to onsite systems.*

Minnesota Pollution Control Agency. 2008f. Small Community Wastewater Needs in Minnesota. Final report dated June, 2008. Accessed at http://www.pca.state.mn.us/publications/wq-wwtp1-06.pdf on January 28, 2009. *Results of a small community wastewater needs survey administered by MPCA; the survey was distributed to counties in 2006-2007; the results show that while many small communities have made progress in addressing wastewater needs, significant issues remain.*

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2.24 Mississippi

2.24.1 Summary

Mississippi has about 425,000 systems in the ground, and annually installs another 5000. Figures for repairs and replacements were not available, but failure rates in some areas are reportedly very high. Many areas of the state, particularly the coast and the Mississippi River flood plain and delta, are marked by wet conditions and shallow groundwater. Restricted, poorly-drained soils mark the south-central portion of the state. Receptivity to alternative systems is strong, and in some areas alternative systems dominate, although cost is an issue. The use of alternatives is not well-controlled, though recent code improvements are likely to improve this situation. No management programs are envisioned, though at least one utilities authority has expressed interest in constructing and managing cluster systems. There is little in the way of research, demonstrations, or training. No loan programs are available for onsite upgrades. Installers, manufacturers, and consultants must be licensed by the state.

2.24.2 Numerical Information

The number of permits issued annually for new construction or system repair or replacement is tracked in the State of Mississippi (NSFC, 2006).

Total number of onsite systems: Approximately 425,000; about 40% of housing is not connected to sewers; 1990 U.S. census reports about 390,000 systems.

Number of new systems installed each year: 5000 estimated.

Failure definition: Surfacing of effluent, or effluent leaving the property of the generator.

Number or proportion of systems presently failing: NA, but aerobic pretreatment is employed at a rate of greater than 60% in areas with restrictive soils, suggesting that failure rates for conventional systems can be high.

Number or proportion *repaired* annually: NA

Number or proportion *replaced* annually: NA

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Alternative systems are used in a majority of installations in some locales.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Local knowledge has resulted in scattered application of advanced systems, but hard data are NA.

Cost of a conventional *septic system* installation: typically \$1500-\$5000; range, \$1000-\$10,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): NA

2.24.3 Present Onsite Status (Answers 2a-2f Summarized)

Restrictive, poorly drained soils extend from Alabama to Texas, and dominate south-central Mississippi. The southern Mississippi River Delta region is marked by high population densities, silty soils and poor drainage. The southern coastal area is faced with onsite failures that contribute to degradation of water quality and fishery resources in coastal estuaries. Rural, unincorporated parts of coastal counties not currently served by centralized wastewater systems are experiencing rapid growth of subdivisions, largely due to resident relocation from the coast toward inland areas as a result of Hurricane Katrina (State of Mississippi, 2008). A similar situation exists along the Mississippi River floodplain, where shallow groundwater limits the effectiveness of conventional onsite systems, and where the gaming industry has resulted in population surges in unsewered areas. A majority of counties report population growth. Onsite system permits have been denied because of undersized lots, topography, and high water tables. Failures have been attributed to poor soils, change in flow, undersizing, unapproved installations, poor installation or maintenance, and excessive rainfall.

2.24.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Minimum state code is administered by county or multicounty health departments. Enforcement is reported to be problematic in some areas (see below).

Code was last revised in: 2008, to become effective July 1, 2009 (Mississippi Dept. of Health, 2008).

New revisions in progress? To be adopted when? Changes are episodic, no information was available on the next update.

Role of legislature, regulatory agency, and politics: NA

2.24.5 Management Programs (Answers 3e-3g Summarized)

Recent changes to the Mississippi code will require maintenance contracts for new alternative systems (Mississippi Dept. of Health, 2008), but there is no requirement for ongoing management of conventional systems. Local agencies do not currently have the authority to adopt or require maintenance/management programs (NSFC, 2006).

Though not funded, a proposal was made in Mississippi's Coastal Impact Assistance Program/Plan for startup funding to assist in the development of capacity for an existing utility authority, Jackson County Utilities Authority, to begin constructing and managing cluster water and wastewater systems in rural, unincorporated areas of the County (State of Mississippi, 2008).

2.24.6 New Technology (Answers 4a-4h Summarized)

I/A technologies are listed under subsections of the regulations, and are added as supplements. Home aeration systems are very common, and reportedly account for up to 60% of installations in some regions. Gravel trench systems are also common. Other permitted systems include mounds, drip irrigation, rock/plant filters, lagoons, spray irrigation, and constructed wetlands. There is a formal process for testing new technologies, where upon approval of information submitted to the Dept. of Health, up to 100 systems may be installed on an experimental/research basis (NSFC, 2006). Cluster intermittent sand filter systems are in limited use, but fall under control of the DEQ rather than the Health Department. A number of code revisions will become effective in 2009, including mandatory pre-cover inspections of all systems, the allowance of performance-based systems, and mandatory maintenance contracts in perpetuity for alternative systems (Mississippi Dept. of Health, 2008). Systems existing on July 1, 2008 are grandfathered until the system is reapproved, there is a change in ownership, or a complaint is received (Mississippi Dept. of Health, 2008).

2.24.7 Onsite Funding (Answers 5a-5c Summarized)

No funding program exists to assist homeowners replacing failing systems or installing new systems, and there are no plans to develop such a mechanism (NSFC, 2006).

2.24.8 Leadership and Information

State-level agencies, task forces:

- ♦ Mississippi State Dept of Health, General Environmental Services, Wastewater Program, PO Box 1700, 0-300, Jackson, MS 39215; (contact: Mr. Jim Weston or Eugene Herring, Wastewater Program Specialists, tel 601-576-7695, fax (601) 576-7632, eml james.weston@msdh.state.ms.us and eherring@msdh.state.ms.us, respectively)

Local governmental agencies, task forces: NA

Research within governmental agencies: None.

Research within universities: None; Mississippi State University Cooperative Extension Service publishes fact sheets; see http://msucares.com/pubs/infosheets/index.html.

Onsite demonstration programs:

- ♦ A 3-year Section 319 grant was used to demonstrate the repair of failing systems; several different types of repairs/replacements were implemented and a summary report/guidance manual was published (Mississippi Dept. of Health, n.d.).

Training or certification programs:

- ♦ Maintenance providers, installers, wastewater environmentalists, professional evaluators, and manufacturers must be certified. Current certifications can be checked by visiting http://www.msdh.state.ms.us/wastewater/Default.asp.
- ♦ Homeowners (of advanced systems) can be trained by factory installers or other factory representatives, allowing them to maintain their own systems (Mississippi Dept. of Health, 2006). Septage haulers are certified by local health departments (Mississippi Dept. of Health, 2009).
- ♦ The U.S. EPA Gulf of Mexico Program held a workshop on decentralized wastewater approaches in 2006-2008; see http://www.epa.gov/gmpo/dwtreatment.html.

Citizen action, private groups: NA
Newsletters, forums, other sources of information: NA

2.24.9 Enforcement (Q7)

Enforcement is problematic in some areas. Property owners sometimes take advantage of a loophole that allows an engineer to approve a septic system, circumventing Health Department regulations (Peterson, 2003). In 2001, George County tightened enforcement after MDEQ discovered fecal coliform bacteria from faulty septic tanks were polluting Red Creek and the Pascagoula River (Peterson, 2003). Along the Gulf coast, there is a perception that local governments are not acting fast enough to address malfunctioning septic systems (Peterson, 2003).

2.24.10 Role of Cluster Systems and Package Plants (Q8)

A limited number of cluster systems are in use; these often use sand filters, but are controlled by MDEQ rather than by the Dept. of Health.

2.24.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

No co-operative interest noted; Jackson County Utilities Authority submitted a proposal for constructing and managing cluster water and wastewater systems in rapidly developing rural/unincorporated areas of the county (see below).

2.24.12 What's Changed

Patterns / Drivers
Rural, unincorporated parts of Jackson County not currently served by centralized wastewater systems are experiencing rapid growth of subdivisions, largely due to resident relocation from the coast toward inland areas as a result of Hurricane Katrina (State of Mississippi, 2008). These area residents are creating a large and immediate demand for water and sewerage services which cannot currently be accommodated.

2.24.13 References

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Peterson, Patrick. 2003. Failing tanks pose threat. *The Sun Herald*, November 16, 2003. Accessed at http://www.etv.state.ms.us/Singing_River_Website_20031204/Singing_River_Website/sh2-failing_tanks.htm on February 2, 2009. *Newspaper article about malfunctioning systems in areas of southern Mississippi, along with enforcement and funding issues.*

State of Mississippi Legislature. 2008. Mississippi Individual On-Site Wastewater Disposal System Law. Effective July 1, 2009. Accessed at http://billstatus.ls.state.ms.us/documents/2008/pdf/HB/0800-0899/HB0892SG.pdf on February 2, 2009. *Law passed in 2008 regular session which will replace current legislation on July 1, 2009. Specifically states Legislature's preference for centralized wastewater treatment systems, but also implements significant improvements in certification, management contracts, and allows performance based systems.*

State of Mississippi. 2008. Executive Summary, Final Mississippi Coastal Impact Assistance Plan 2007 – 2010, Updated August 2008. Accessed at http://www.dmr.state.ms.us/ciap/executive-summary.pdf on February 2, 2009. *Summary of establishment and purpose of the Coastal Impact Assistance Program, of funding to be distributed through the Program and approved Plan, and list of approved projects and proposals—including one, not currently funded, for the start up of a decentralized wastewater utility in Jackson County.*

2.25 Missouri

2.25.1 Summary

Missouri has about 600,000 systems in the ground, adding another 4,500 yearly; an estimated 1,400 are also repaired or replaced annually. Almost a third of the systems are deemed to be failing, because prior to 1996 there was no state code governing their use or installation, and many county codes were weak or nonexistent. There are problem areas throughout the state, especially along lakes and in areas of extensive karst terrain, where surface waters are in jeopardy. The creation or extension of sewers is generally supported as the solution of choice if population density warrants it. For new subdivisions, the state determines if centralized facilities are required. Numerous I/A technologies are permitted, albeit on a case-by-case basis; maintenance contracts may be imposed. In some counties these technologies are in widespread use. Drip irrigation has been popular in areas with heavy clay or thin soils. Several counties or communities have established onsite districts with varying provisions. Loan money is available through USDA Rural Development for upgrades or replacements, but not for new construction; a pass-through loan program using SRF funding is under development. University of Missouri conducts research; there are several well-known demonstration projects. Onsite professionals are registered statewide. There is an active Missouri small flows organization.

2.25.2 Numerical Information

The State does track some numerical data, but defensible numbers of permits issued state-wide for new construction, repairs of existing systems, or upgrade or modification are not available (NSFC, 2006).

Total number of onsite systems: 600,000 estimated; 1990 U.S. census reports about 530,000 systems.

Number of new systems installed each year: 4500 (4,700 new systems were permitted in 2006 (Missouri DHSS, 2009a).

Failure definition: Surface breakout, backup into building, nuisance, or contamination of surface- or groundwater.

Number or proportion of systems presently failing: 180,000 estimated, in some counties, 50% or even higher.

Number or proportion *repaired* annually: 766 systems were repaired in 2006 (Missouri DHSS 2009a).

Number or proportion *replaced* annually: 651 systems were repaired in 2006 (Missouri DHSS 2009a).

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): In 2006, about 25% of permits issued were for aerobic units or advanced pretreatment (Missouri DHSS 2009a). Note that aerobic units are not viewed as "alternative".

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): NA

Cost of a conventional *septic system* installation: $3500-$4000; range, $300-$18,000. In 2001, drainfield replacement cost $2,000 to $8,000 (University of Missouri Extension, 2001).

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $350-$2000.

2.25.3 Present Onsite Status (Answers 2a-2f Summarized)

There are many and large areas of the state, some well bounded, that have problems because of some combination of antiquated systems, dense development, poor conditions, or jeopardy to natural resources. These problems have been aggravated in the last decade by increased development largely occurring in unsewered areas (Casaletto and Borchelt 2007, Guenther 2008). Prior to 1996 (when 1995 code went into effect), there were no statewide requirements for onsite septic systems. In consequence, many poorly designed systems were installed and properties were developed with little consideration for wastewater disposal. Sites in resort areas are particularly problematic because of their small lot sizes, steep slopes, shallow soils and karst geology. Some specifics: Crystal Lake, Lake Viking, and Lake of the Oaks are all characterized by dense development and antiquated systems. At both Table Rock Lake and Lake of the Ozarks resources are currently in jeopardy because of dense development, antiquated systems, and poor soil conditions, though efforts are underway to mitigate these issues through better management and the use of alternative and advanced technologies (see below).. The creation or extension of sewers is generally supported by the state, and by the public in areas of high density and relative affluence. State regulations require a centralized sewage collection and treatment system in new housing developments where the lots are less than 40,000 square feet, and a continuing authority must operate any such system; however, older developments are grandfathered (MDNR, 2007).

2.25.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Minimum code is developed by the Missouri Department of Health, which is also the administrative agency in areas without local ordinances; 103 of 114 counties and a few municipalities issue permits at the local level (NSFC, 2006). The state directly permits systems in the other 11 counties and tracks permits that are issued in 52 of 114 counties (NSFC, 2006). In areas with local ordinances, administration is through city, county, city-county, or multi-county health departments, with authority in some jurisdictions falling to public works or other local agencies.

Enforcement is reported to be adequate, in the sense that all complaints and calls for inspections can be responded to. Regulators are sometimes stymied by Missouri law, which requires regulators to give polluters multiple chances to work into compliance (Arnold, 2003). However, the state's Attorney General has begun aggressively filing lawsuits against property owners who have tainted the state's water quality with improperly treated sewage (Arnold, 2003).

Code was last revised in: August, 2005 (NSFC, 2006).
New revisions in progress? To be adopted when? Yes. The existing rule for inspections of OWTS for real estate purposes is being rescinded and replaced, and the rule that establishes requirements for percolation testers, onsite soils evaluators, and OWTS installers is being amended. It is expected that the effective date of the rules will be May 30, 2009 (State of Missouri, 2008).

Role of legislature, regulatory agency, and politics: Code is state rule and can be amended by the MDHSS. Revision is usually supported politically.

2.25.5 Management Programs (Answers 3e-3g Summarized)

The State of Missouri does not require management programs/contracts or management districts to monitor and maintain onsite systems or individual septic dispersal systems (NSFC, 2006). Although not required by code, maintenance/management contracts are sometimes required at the local level as a condition for variance approval (NSFC, 2006). Routine inspections after construction for conventional systems are performed by licensed private individuals only upon request, usually related to real estate sales (NSFC, 2006).

Despite this, the state, and local health departments, do see the need to systematically target remediation in some areas, and to place special onsite management or planning restrictions on others, including older, densely developed areas, areas where resources are in jeopardy, and new developments. Several counties or communities had already instituted onsite wastewater districts or utilities in 1998, including Taney County Regional Sewer District, Pulaski County Sewer District No. 1, Camden County, and the Four Seasons. The Goose Creek subdivision, mentioned in 1998 as having instituted a management district, has still not implemented a program (Gaughan 2009). Several utilities have since taken on management of decentralized systems—for example, Phelps County's Public Water Supply District #2 provides centralized management program for septic tank effluent pump (STEP) and recirculating sand filter (RSF) systems within its jurisdiction—and was the first entity in Missouri to do so (U.S. EPA 2000, Deitzmann and Gross 2002 and 2003). The Table Rock Lake Onsite Demonstration Project, described below, also resulted in the formation of Ozarks Clean Water Company, a RME that manages onsite and cluster systems both within and beyond the demonstration project.

2.25.6 New Technology (Answers 4a-4h Summarized)

Present code permits numerous I/A technologies such as land application, low pressure pipe, aerobic units, drip irrigation, mounds, chamber systems, gravelless chambers, sand-lined trench, recirculating sand filters, package plants, lagoons, wetlands; and enhanced (advanced) treatment systems—all under a clause which allows their use on a case-by-case basis. Drip irrigation, in particular, has been used for sites with heavy clay or thin soils, and the use of drip irrigation in imported soil for particularly difficult sites has been investigated (Miles et al. 2008). The systems do permit the development of otherwise undevelopable sites. Best Available Technology may be required for remediation, but only for complaint abatement. When systems are permitted under variances, maintenance contracts may be imposed. Otherwise, there are no state requirements for routine inspection or maintenance, although several counties or districts have more stringent requirements. There is no state-level program to test and authorize new technologies. Site conditions, not the cost of alternatives, will determine which technologies are permissible during design and construction review. Recent demonstration projects and increased training/certification initiatives have increased installers', and some citizens', familiarity with alternative technologies (see below). The future role of cluster systems is reported to be moderate.

2.25.7 Onsite Funding (Answers 5a-5c Summarized)

The FHA's Rural Development "504" program provides loans for septic system betterments. A financial assistance program is being piloted by the Missouri Department of Natural Resources (DNR) in conjunction with the State Revolving Fund (SRF) (NSFC, 2006). Missouri DNR is currently piloting the Missouri On-site Loan Program, which will provide county or municipal governments with a source of funding for low or no interest loans to individuals who need to repair, replace, or remove failing or failed on-site wastewater treatment systems (Missouri DNR, 2009).

2.25.8 Leadership and Information

State-level agencies, task forces:

- Missouri Dept of Health and Senior Services, POB 570, Jefferson City, MO 65102-0570; (Contact: Mr. James Gaughan, P.E, Environmental Engineer or Percy Johnson, Environmental Public Health Specialist; tel 573-751-6095, fax 573-526-7377; eml Jim.Gaughan@dhss.mo.gov or Percey.Johnson@dhss.mo.gov, respectively).

Local governmental agencies, task forces:

- Columbia/Boone County Health Dept, 600 E Broadway, POB N, Columbia, MO 65255 (Contact Gerald Worley, Chief, Bureau of Environmental Health; tel 573-874-7345, fax 573-875-5910).
- See management entities mentioned above and below.

Research within governmental agencies:

- On contract (see below).

Research within universities:

- There is a research program, and onsite technology demonstration and training site, at University of Missouri-Columbia; (contact: Dennis Sievers, see below).

Onsite demonstration programs:

- The Rock Bridge National Onsite Demonstration Project (a Phase II NODP project) implemented innovative onsite wastewater treatment technologies to protect ecology and water quality in environmentally sensitive karst terrain (Solomon et al. 2000, Eddy 2000).
- The Table Rock Lake National Community Onsite Wastewater Demonstration Project tested different types of advanced technology for OWTS and utilized the U. S. Environmental Protection Agency's (EPA) management models for proper maintenance of OWTS, resulting in the formation of a successful RME (Midwest Environmental Consultants 2001, Yeager et al. 2006, Casaletto and Helms 2007, Casaletto and Borchelt 2007, Miles et al. 2008).

- ♦ A new 319 grant-funded project is beginning in The James River basin (Stone County, and part of the Table Rock Lake watershed) to focus on creating tools for identifying and remediation of failing or faulty septic tanks (Table Rock Lake Water Quality, Inc. 2008)
- ♦ There is also a Community On-Site Wastewater and Stormwater Project, recently begun in the Springfield region, which will establish a training facility showcasing several alternative onsite septic systems, as well as innovative stormwater techniques (Guenther, 2008).
- ♦ The Springfield-Branson On-site Remediation Project, part of the Watershed Committee of the Ozarks' Water Quality Improvement Project (WQIP), has installed five advanced wastewater treatment systems to replace malfunctioning conventional systems that were posing a threat to water quality in Southwest Missouri. These sites will serve as demonstration sites for advanced wastewater training in the future (Armstrong 2009).

Training or certification programs:

- ♦ Onsite professionals, including installers, soil evaluators, private onsite system inspectors (time of sale), and percolation testers are required to be licensed; certifications are renewable every three years (NSFC, 2006).
- ♦ Training courses are offered jointly by the Missouri Dept. of Health and Senior Services; Missouri Department of Natural Resources staff, and University of Missouri Extension faculty; see http://www.dhss.mo.gov/Onsite/Courses.html.
- ♦ Training courses to fulfill contact hours needed for re-certification are offered by Missouri Smallflows Organization, see below.
- ♦ There is a Missouri Small Wastewater Flows Education and Research Center, 302 Anheuser-Busch Natural Resources Building, University of Missouri-Columbia, Columbia, MO 65211; (contact: Randall Miles, Training Center Director, tel 573-882-6607, MilesR@missouri.edu). The demonstration facility associated with the training center, however, has fallen into disrepair and is not currently used (Gaughan 2009.)

Citizen action, private groups:

- ♦ There is a Missouri Small Flows organization, which publishes a newsletter, offers continuing education courses (see above), and hosts an annual conference; http://www.mosmallflows.org/.
- ♦ Watershed Committee of the Ozarks, http://www.watershedcommittee.org/ is active in watershed protection and non-point source pollution reduction activities; the organization's demonstration site is used for training courses in the Springfield area (contact Mike Kromrey, Education Outreach Coordinator, tel (417) 866-1127 Ext. 140).
- ♦ Table Rock Lake Water Quality, Inc., http://www.trlwq.org/

Newsletters, forums, other sources of information: See above.

2.25.9 Enforcement (Q7)

Enforcement is reported to be adequate, in the sense that all complaints and calls for inspections can be responded to.

2.25.10 Role of Cluster Systems and Package Plants (Q8)

The future role of cluster systems is reported to be moderate. Recently completed demonstration projects may increase this role.

2.25.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

Municipal or regional sewer districts are the most common entity operating onsite wastewater districts or utilities in Missouri; Ozarks Clean Water Company is a not for profit member owned company, like an electric cooperative, that manages onsite and cluster systems both within and beyond the Table Rock Lake demonstration project described above.

2.25.12 What's Changed

Patterns / Drivers

The Springfield region of Missouri has seen high growth rates in the last decade. Much of this growth has occurred south of the city, and in unincorporated areas where residents rely on well water and on-site septic systems (Guenther, 2008).

"Increasing population and development in the Table Rock Lake watershed threatens water resources by increasing sources of nutrient pollution, not the least of which is failing septic systems. The largely rural population uses onsite wastewater treatment systems (OWTS) to treat wastewater, although these systems are often not suitable to the thin existing soils in the region to treat wastewater" (Casaletto and Borchelt, 2007).

"From 1990 to 2005 the population of Stone County increased by over 60% while the average population growth for the entire state during this time was approximately 13%. The vast majority of this new population is moving into rural developments that use on-site septic tank systems to treat wastewater" (TRLWQ Inc. 2008).

2.25.13 References

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Arnold, Jeff. 2003. Open sewage pits spill waste for years before state forces cleanup. News-Leader (Springfield, MO), March 19, 2003. Accessed at http://springfield.news-leader.com/specialreports/stewardshipozarks/sewage031903.html on March 5, 2009. *Newspaper article about enforcement issues pertaining to onsite systems in rural Missouri*.

Casaletto, David, and Rick Helms. 2007. Ozarks Clean Water Company, The Development of a Not-For-Profit Sewer Company as a Successful Responsible Management Entity (RME).In *NOWRA 16th Annual Technical Education Conference & Exposition* (Baltimore, Maryland; March 2007). *This paper covers the formation of OCWC, the acquisition of customers, both* *from inside and outside the demonstration project, and how OCWC has grown to over 1000 customers in 2 years.*

Casaletto, David, and Gopala Borchelt. 2007. Table Rock Lake Water Quality Decentralized Wastewater Demonstration Project, Final Technical Report. Report dated December 31, 2007. Accessed at http://www.trlwq.org/pdfs/DEMO_Project.pdf on February 4, 2009. *Detailed technical report on the formation, execution, and outcomes of the national demonstration project at Table Rock Lake.*

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2.26 Montana

2.26.1 Summary

Montana has somewhere between 150,000 and 300,000 onsite systems in the ground. No data are available on how many new systems are installed each year, or how many are repaired or replaced. The varied hydrology and physiography of the state results in pockets, or strips along floodplains, that have, or could have, problems, although little has been documented. As population density comes to warrant it, sewers are regarded as the solution of choice. Most recent development, however, has occurred outside sewered areas, prompting research and the formation of at least on onsite management district.. While certain alternative technologies are approved for use, namely those acknowledged by the National Sanitation Foundation code, only a handful of new or replacement systems involve their use. Operation, inspection and maintenance requirements are attached to their use, but enforcement is left to local agencies for which this may not always be a priority. There are no loan programs for onsite remediation and little perceived need for systematic remediation or wastewater management entities. However, several individual counties require examinations for site evaluators. Montana State University and the Department of Environmental Quality are doing research on groundwater impacts near Helena, and this research in part has led to the development of an operating permit-based management program.

2.26.2 Numerical Information

Agencies do not keep track of permits issued (NSFC, 2006).

Total number of onsite systems: About 300,000(?); 1990 U.S. census reports about 135,000.

Number of new systems installed each year: NA; approximately 3,600 new lots in subdivisions were approved from January-August 2008 (MDEQ, 2008).

Failure definition: Only by gross hydraulic failure; beyond that, it is not defined.

Number or proportion of systems presently failing: NA

Number or proportion *repaired* annually: NA

Number or proportion *replaced* annually: NA

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): A very small number, probably fewer than 100 per year.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Probably no more than 5 per year.

Cost of a conventional *septic system* installation: $2000-$3500; range, $1500-$12,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): NA

2.26.3 Present Onsite Status (Answers 2a-2f Summarized)

Nearly every possible geologic and physiographic condition is represented in Montana. Recent research has indicated that groundwater contamination from domestic wastewater sources is increasing in areas of unsewered development surrounding urban areas such as Helena, Montana (Zimmer and Drake 2001, Miller and Meeks 2005). System failures have been attributed to restrictive soils; cesspools; improper size, construction, or installation; and steep drainfields. Permits have been denied because of poor soils, shallow groundwater, and floodplain situation. To the extent there is concern, it is with nitrates, pathogens, and PPCPs. When possible, connection of older systems to city sewers has been promoted, but can be resisted by the public. Much new growth remains outside of sewered areas, particularly around Helena, Missoula, Butte, and Bozeman (see, for example, Stauffer 2006).

2.26.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? The state DEQ promulgates the rules; rules can become more stringent on the local level without the state's approval (NSFC, 2006). Onsite wastewater regulations are administered locally through county health departments through septic permits (NSCF, 2006). Enforcement is delegated to city, county, or city/county health departments if they demonstrate the ability and desire to perform it. Eight of 56 counties have this authority; for the others, administration and enforcement is left to the DEQ. In some areas, enforcement is reported to be inadequate.

Wastewater regulations are administered at the state level for subdivisions—parcels less than 20 acres, condominiums, mobile home and recreational vehicle parks—and Montana NPDES permits are required for systems with flows greater than 5,000 gpd (NSFC, 2006).

Code was last revised in: 2004 (MDEQ, 2004).

New revisions in progress? To be adopted when? As of June 1, 2006 revisions were being made to be effective late 2006 (NSFC, 2006), but these were apparently not enacted.

Role of legislature, regulatory agency, and politics: There is political ambivalence about code tightening, but legislative approval is not required.

2.26.5 Management Programs (Answers 3e-3g Summarized)

Montana code requires user agreements and Operation and Management (O&M) plans for shared and multiple user systems (NSFC, 2006). Non-municipal "public" wastewater treatment systems (public is defined by 15 or more connections or 25 or more people) are managed by Water and Wastewater Districts, water users' associations, or homeowners' associations.

Periodic inspections are required by the state for investigating the performance and operation of Level 2 nitrogen removal systems, see below.

The state is not targeting systematic remediation in any area. There is a need for special onsite management or planning in certain small areas. Three local water quality districts have been established (MDEQ, 2007), and Lewis and Clark County's local water quality district (Helena area) is implementing a Septic System Maintenance District (Morrison-Maierle, Inc. 2008).

2.26.6 New Technology (Answers 4a-4h Summarized)

Present code accommodates, and in some circumstances requires, alternative systems, which may be used on otherwise undevelopable sites. For so –called "Level 2 nitrogen removal systems" including recirculating trickling filters, RSFs, and ISFs, the State of Montana uses performance based standards (NSFC, 2006). Use of these systems enables reduction in drainfield size and an increase in allowable nitrogen in groundwater mixing zones, but because of the requirements for monitoring they are not often used (MDEQ, 2004). Monitoring must occur at least quarterly for the first two years, and the systems must have maintenance contracts. State Code allows for drainfield area/size reductions based on loading and treatment. Pressure dosing, chambers, and sand filters are considered for drainfield reduction (see DEQ-4, filters, chambers, etc.).

I/A technologies are added to the code based on National Sanitation Foundation guidelines; technologies not listed may be used through a provision in code covering experimental systems (NSFC, 2006). Site reviews are conducted by the state, while the county inspects construction and does the permitting. Best Available Technology is not generally required in cases of remediation.

2.26.7 Onsite Funding (Answers 5a-5c Summarized)

The only financial assistance programs available of any kind are economic development funds that must be applied for locally (NSFC, 2006).

2.26.8 Leadership and Information

State-level agencies, task forces:

- Montana Dept of Environmental Quality, Water Quality Division, POB 200901, Helena, MT 59620; contact Mr. Steve Kilbreath, Subdivision Section Supervisor, tel 406-444-4440, fax 406-444-1374, eml skilbreath@mt.gov.
- MDEQ's Non-degradation Task Force.
- Septic Pumper Advisory Committee, see http://www.deq.mt.gov/SolidWaste/PumperAdvisory/PumperAdvisorycom.asp

Local governmental agencies, task forces: NA

Research within governmental agencies:

- Montana DEQ recently completed a study of the occurrence of pharmaceuticals, personal care products, endocrine disruptors, and microbial indicators of fecal contamination in groundwater in the Helena, Montana area (Miller and Meek, 2006).

Research within universities:

- Montana State University (MSU) has completed research on groundwater impacts, alternative systems and nitrogen removal; research is ongoing particularly with regard to nitrate, pathogens, and PPCPs. (Contact: Gretchen Rupp, Director, Montana Water Center, Montana State University, 101 Huffman Bldg., Bozeman, MT 59717; tel 406-994-6690, eml grupp@montana.edu.)

Onsite demonstration programs: None.

Training or certification programs:

- ♦ MSU's Extension Service offers fact sheets for homeowners, but information about training programs is N/A. See http://extn.msu.montana.edu.
- ♦ Several individual counties require site evaluators and inspectors to pass a local examination.
- ♦ Septic tank pumpers are licensed by MDEQ; licenses are renewable annually and training is available from MDEQ, (MDEQ, 2008a).
- ♦ The, DEQ Subdivision Program conducts workshops for subdivision review if requested by local health departments, and these workshops may include discussion of wastewater treatment systems (NSFC, 2006).
- ♦ Montana may begin requiting certification for soil evaluators, but further information N/A (NSFC, 2006).
- ♦ There is a Montana Environmental Training Center, though it mostly provides continuing education for WWTP and water system operators: http://www.msun.edu/grants/metc/index.asp

Citizen action, private groups:

- ♦ There are many watershed groups throughout the state, further information is NA.
- ♦ The Montana Water Resources Association holds an annual conference which often contains a session on wastewater-related topics; see http://awra.org/state/montana/events/index.htm

Newsletters, forums, other sources of information: NA

2.26.9 Enforcement (Q7)

Enforcement is delegated to city, county, or city/county health departments if they demonstrate the ability and desire to perform it. Eight of 56 counties have this authority; for the others, administration and enforcement is left to the DEQ. In some areas, enforcement is reported to be inadequate.

2.26.10 Role of Cluster Systems and Package Plants (Q8)

Unclear at this time. Original market study report noted "Cluster systems are thought to "make sense," but the issue is unresolved". Subdivisions with lots less than 20 acres are permitted at the state level, and systems with more than 15 connections or 25 individuals are also permitted at the state level through Montana NPDES—however, it is not clear from the literature how many subdivisions might utilize cluster systems.

2.26.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

No interest noted from rural electrical cooperatives or private utilities in O/M programs for onsite systems as of February 6, 2009.

2.26.12 What's Changed

Patterns / Drivers

“The city of Helena, Montana and its surrounding valley are experiencing marked population growth with attendant proliferation of onsite wastewater disposal (septic tanks and drainfields) systems” (Miller and Meek, 2006).

2.26.13 References

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Montana Dept. of Environmental Quality. 2008a. Septic tank pumper information. Last updated November 2008. Accessed at http://www.deq.mt.gov/SolidWaste/pumpers.asp on February 6, 2009. *Department website with information about septic tank pumper certification, annual relicensing, training programs, and applicable regulations.*

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Zimmer, R.J., and Vivian Drake. 2001. Temporal Change in Groundwater Nitrate Concentrations, Parts 1 and 2 (Abridged). *Professional Surveyor Magazine* (June 2001, Vol. 21, No. 6 and July/August 2001, Vol. 21, No. 7. Accessed at http://waterquality.montana.edu/docs/homeowners/nitrates.shtml on February 6, 2009. *Summary of research documenting increased nitrate concentrations in groundwater underlying unsewered areas outside Helena, Montana.*

2.27 Nebraska

2.27.1 Summary

Nebraska has about 200,000 onsite systems in the ground, and adds 2,000 or more annually. Recent figures were not available on annual numbers of repairs, replacements, or failures. In addition to problems with aging and poorly maintained systems, the heaviest populations occur along the Platte and Missouri river courses which converge to the southeast corner of the state. Nebraska is concerned with both surface and groundwater contamination, though generally the problems aren't regarded as severe. Several communities are considering or implementing actions to deal with aging or inadequate systems, but nothing as systematic as a district or utility. I/A technologies are permitted on a case by case basis with management requirements outlined in the permit; they are not in widespread use. There are limited loan programs for upgrades. Research is conducted by the University of Nebraska, as are continuing education programs. Onsite professionals are required to be certified, onsite systems that are newly constructed, reconstructed, or modified must be registered with the state, and there is an active onsite professionals' association.

2.27.2 Numerical Information

Total number of onsite systems: 150,000-200,000; 1990 U.S. census reports about 120,000.

Number of new systems installed each year: Approximately 8,000 systems were registered between January 1, 2004 and January, 2009; about 1,700 of these were registered in 2008 (NDEQ, 2009). A list of all registered systems is available at NDEQ's website.

Failure definition: "an unauthorized discharge of effluent or wastewater: on the surface of the ground; or to a cesspool, seepage pit, dry well, or leaching pit; or to an absorption system with less than 4 feet to groundwater or other limiting soil characteristics; or which threatens to cause pollution of any air, water, or land of the State; or which threatens public health" (NDEQ, 2007).

Number or proportion of systems presently failing: Current information is NA; previous reports stated up to 40% by current standards.

Number or proportion *repaired* annually: NA; permit/registration tracking system does not distinguish reason for registration or permit (NDEQ, 2009).

Number or proportion *replaced* annually: See above.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Less than 1%.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Very few.

Cost of a conventional *septic system* installation: $4000-$7000, according to NE real estate websites such as http://www.myhavenmakers.com/acreage.asp.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): 3000-$6000, varies.

2.27.3 Present Onsite Status (Answers 2a-2f Summarized)

There are problem areas because of dense development and antiquated systems, some which jeopardize resources; in particular, rivers and groundwater. Nitrogen contamination of groundwater is the main concern. Other areas are expected to become problems with future development. Many systems in older developments are nonconforming. Mainly the regions of concern include the low-lying and densely developed counties surrounding Omaha, in the southeastern corner of the state; as well as the courses of the Missouri, Elkhorn, Loup, and Platte rivers and their tributaries, which also converge in the southeastern corner of the state. Reasons given for onsite failures include groundwater problems, age, size, lack of maintenance, and improper design or construction. Towns generally support central sewering, but are hindered by initial costs of design and construction, as well as those of ongoing maintenance and upkeep (Buttermore 2009).

2.27.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Regulations are made at the state level, and administered and enforced by NDEQ. As of January 1, 2004, all systems must be registered with the state, regardless of whether they are permitted locally, under "authorization by rule", or by NDEQ (NDEQ, 2007). Local governments can make regulations more stringent than those of the state, though the state requirements still apply. The NDEQ works with other governmental agencies on compliance issues as appropriate (Buttermore 2009). Enforcement by NDEQ is based on complaints, and was previously reported to be slow and cumbersome; current enforcement efforts by NDEQ appear to be more adequate and are clearly and regularly reported to the regulated community (NDEQ, 2008).

Permits are required from state and local governments in some instances as a few local governments have their own inspection and permit program, which is separate from the state permit requirement. The local inspection or permit does not act as a substitute or replacement for any state required permit.

Code was last revised in: 2007 (relatively minor changes to system registration fees and allowing fees to be charged for permit and subdivision review by Nebraska DEQ (NDEQ, 2007 and 2007a; also reported in Dayton, 2007).

New revisions in progress? To be adopted when? Amendments to Title 124 are under discussion with the onsite advisory committee; any changes will go to public hearing before the Environmental Quality Council in late 2009 for potential implementation early in 2010 (Buttermore 2009).

Role of legislature, regulatory agency, and politics: Regulatory changes are made in conjunction with the state Environmental Council; development of regulations is provided for in statute.

2.27.5 Management Programs (Answers 3e-3g Summarized)

At the state level, there are no plans, and no perceived need, to target enforcement, or to require special planning or management in any identified regions. The state does require perpetual maintenance on mechanical systems and large lagoons (over 1,000 gpd), and that such systems be operated in accordance with approved operation and maintenance manuals for those systems that are required to have them (NSFC, 2006). There are no requirements to have a maintenance contract with a provider for onsite systems (NSFC, 2006).

In recent years, a large lake front community (Johnson Lake) and a large lake cabin development (on Lake McConaughy) have gone from individual onsite systems to centralized collection and lagoon systems; a few large septic systems for developments have also been permitted, where the system operation is the responsibility of a lake association (Buttermore 2009).

Some local health departments are considering special management requirements in older developments, but nothing as comprehensive as a management district or utility. There are a few education and septic tank repair projects being completed with Section 319 grant funds; see below.

2.27.6 New Technology (Answers 4a-4h Summarized)

Title 124 allows certified professionals to design and install systems meeting prescribed requirements under “authorization by rule” (NSFC, 2006). Mound systems are not currently included in “authorization by rule” (NDEQ, 2007). Any alternative, advanced, or experimental systems require construction and operating permits from NDEQ (NDEQ, 2007).Depending on the site, a construction/operating permit may be required, and the use of alternative, advanced, or experimental systems may be permitted on otherwise undevelopable sites. There are procedures for the approval of new technologies. Sand filters, mounds, aerobic systems, package plants, evapotranspiration beds, wetlands, gravelless chamber, and community-based drip irrigation systems have all been approved. Enhanced treatment systems may also be permitted case by case. Individual management requirements depend on the technology. Best Available Technology is not stipulated for the repair of failing systems. Package plants and cluster systems are reported not to be of much interest.

2.27.7 Onsite Funding (Answers 5a-5c Summarized)

Currently, there is no state-provided funding or financing options for individual homeowners in Nebraska (NSFC, 2006). UNL Extension has teamed up with seven local, state and national groups to help protect water quality in portions of the Sand/Duck Creek and Shell Creek Watersheds; some residents of these watersheds may be eligible for cost-share incentives for septic system upgrades or replacements (UNL Extension, 2007)

2.27.8 Leadership and Information

State-level agencies, task forces:

- Wastewater Section, Nebraska Dept of Environmental Quality, POB 98922, Lincoln, NE 68509-8922 (contact: Mr. Gary Buttermore P.E., Supervisor, Onsite Wastewater Unit, tel 402-471-4285, fax 402-471-2909; eml gary.buttermore@nebraska.gov).
- Private Onsite Wastewater Treatment System Advisory Committee advises the Department on rule changes and administration, see http://www.deq.state.ne.us/wastewat.nsf/pages/POWTSAC

Local governmental agencies, task forces: NA

Research within governmental agencies:

- Yes, in conjunction with University of Nebraska, and the state Dept of Roads, which deploys and monitors alternative technologies at some of the highway rest stops. Current information about this project was NA as of February 9, 2009.
- The USGS completed a study to assess the quality of drinking water from shallow domestic wells potentially affected by seepage from septic systems in the lower Platte River watershed (eastern Nebraska) in 2001-2002; see http://pubs.usgs.gov/fs/fs07203/

Research within universities:

- University of Nebraska-Lincoln has an ongoing research project in the Shell Creek watershed that aims to adopt or install BMPs to improve water quality and decrease flooding; contact David Shelton, Biological Systems Engineering and Extension Agricultural Engineer, at dshelton2@unl.edu or see project website: http://www.esu8.org/~newman/Watershed%20Project/watershed/index.htm
- The UNL Southeast Research and Extension Center also has an ongoing Onsite Wastewater Treatment System Certification Training and Education Project, which included curriculum development for onsite professionals; contact Wayne Woldt, wwoldt1@unl.edu or Jan Hyngstrom, jhygnstrom1@unl.edu.

Onsite demonstration programs:

- The Shell Creek watershed project has an active education component (see above); technology demonstration is not part of this effort.

Training or certification programs:

- Those who perform work on private on-site wastewater treatment systems (septic systems, private lagoons) are required to be certified by the Nebraska Department of Environmental Quality; see http://www.deq.state.ne.us/WasteWat.nsf/Pages/Onsite. Installers, pumpers, inspectors and soil evaluators are all required to be certified. Certification is renewable every two years by obtaining 12 professional development hours and submitting a renewal application.
- Professional Engineers and Registered Environmental Health Specialists are licensed separately, but may also work with onsite systems (NSFC, 2006).
- UNL Extension (see http://water.unl.edu/sewage) and NOWWA both offer continuing education training courses.

Citizen action, private groups:

- Nebraska On-Site Wastewater Association (NOWWA) holds an annual conference and hosts continuing education courses; see http://www.nowwa.org/.

Newsletters, forums, other sources of information:

- Nebraska DEQ publishes an onsite wastewater newsletter: http://www.deq.state.ne.us/Publica.nsf/Publications+Onsite
- NOWWA also periodically publishes a newsletter (see above).

2.27.9 Enforcement (Q7)

Enforcement appears to be adequate at the state level; NDEQ reports information about compliance actions to the regulated community in newsletters (see above).

2.27.10 Role of Cluster Systems and Package Plants (Q8)

Package plants and cluster systems were reported not to be of much interest in 1997-98; this appears to still be the case.

2.27.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

No role or interest noted as of February 2009.

2.27.12 What's Changed

Patterns/Drivers: None additional to those noted above.

2.27.13 References

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2.28 Nevada

2.28.1 Summary

Information on the number of onsite systems, annual installations, repairs, and proportion of alternative technologies was not available. The large cities are sewered, and sewering is the solution of choice for developing areas. There are scattered pockets with onsite problems, chiefly in old mining towns where small lots and antiquated technologies had been the rule. Increasing development outside sewered areas is resulting in more incidences of increased nitrate levels in groundwater and in water supply wells. I/A technologies are permitted case-by-case directly by the state, and may require service contracts. Failures attributed to shallow groundwater are often replaced with mound systems. Lyon County has a requirement to install denitrifying systems in certain areas. There are no loan programs for upgrades, and no academic research underway. Training is through the Nevada boards of RPEs and Contractors; pumpers are also required to be certified.

2.28.2 Numerical Information

Permits are issued for onsite systems for new construction, repairs, upgrades or modifications in the State of Nevada. However, these permits are not tracked by the State Health Division (NSFC, 2006).

Total number of onsite systems: NA (there are no mechanisms in place to acquire this kind of information at state level).

Number of new systems installed each year: NA

Failure definition: Surfaced effluent and/or backed-up plumbing.

Number or proportion of systems presently failing: NA

Number or proportion *repaired* annually: NA

Number or proportion *replaced* annually: NA

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Most failures are replaced with standard gravel trench systems; failures due to shallow groundwater are generally replaced with mound systems; but figures are NA.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Virtually none.

Cost of a conventional *septic system* installation: $3000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $4500.

2.28.3 Present Onsite Status (Answers 2a-2f Summarized)

A few isolated towns in the state have septic system problems because of dense development and antiquated systems, leading to concerns about nitrogen contamination of groundwater. Typically these are old mining towns, such as Silver City, Gold Hill, and Varbidge, that have extremely small lots (1/10 acre or less), but do not presently have large enough populations to sustain a central plant. The incidence of elevated nitrate levels in aquifers underlying suburban and rural subdivisions has increased in the last decade, particularly in valley areas where piecemeal subdivision development is allowed (Nevada DCNR 2003). The construction and use of conventional systems has been discontinued in three areas of the state (Spanish Springs in Washoe County, Grass Valley in Humboldt County, and the Pahrump area of Nye County) primarily due to elevated nitrate concentrations in groundwater (NDEP, 2005). In the Pahrump area, malfunctioning onsite systems have been a source of controversy (Waite, 2004). Carson Valley (in Douglas County, near Lake Tahoe) has experienced rapid growth in areas that are outside those served by public water and sewage systems, leading to the installation of septic systems at a rate of about 1,500 every 10 years (Rosen 2002, Groundwater Protection Council 2007). Where populations are large enough, centralization is supported both by the state and by the population. ISDS permits will not be issued within designated sewer service areas, as established by the state's Public Service Commission.

2.28.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Regulations are made at state level and enforced (for residential systems) directly by the state in rural counties; or otherwise by county health districts or building departments. Commercial systems of any size, and large-capacity systems (more than 5,000 gpd), are regulated by the Nevada Department of Environmental Protection (NDEP, 2008).

Code was last revised in: 2007 (Nevada Health Division, 2007); most recent requirements revised maintenance requirements for nitrate removal systems (NSFC, 2006).

New revisions in progress? To be adopted when? There is no set time frame for updating the code, no revisions are currently underway.

Role of legislature, regulatory agency, and politics: Major revisions require legislative adoption; code revision is supported politically.

2.28.5 Management Programs (Answers 3e-3g Summarized)

With the exception of new development, there is no perceived need for special onsite management or planning requirements linked to particular regions or situations. Presently, pre-cover inspections are required of new systems. No onsite districts or utilities are contemplated. Lyon County has a requirement for denitrifying systems in at least one area (Lyon County, 2009). It, and neighboring counties along the western border, are marked by many old mining towns with dense development and associated problems. Officials from the Clark County Water Reclamation District (near Las Vegas) have expressed interest in using decentralized concepts to provide service in outlying areas; further information NA.

2.28.6 New Technology (Answers 4a-4h Summarized)

Code accommodates, and may sometimes require, alternative systems, which may be used on sites unsuitable to conventional systems. Alternative or advanced systems must meet NSF or equivalent standards (NSFC, 2006). There are systematic means to test and add new technology to the code, through new subsections. Nevada State Health Division directly approves I/A technologies, including enhanced systems, on a case-by-case basis. Such systems must be designed by a Registered Professional Engineer; and may require demonstration of a service contract. Mound systems are used in areas with high water tables. Best Available Technology is not automatically required of upgrades.

2.28.7 Onsite Funding (Answers 5a-5c Summarized)

There are no loan programs for system remediation, and none are contemplated. Washoe County has established an assistance program for the Spanish Springs, Nevada area to pay partial costs of connecting existing homes to a centralized sewer system (NSFC, 2006).

2.28.8 Leadership and Information

State-level agencies, task forces:

- Nevada State Health Division, Bureau of Health Protection Services, 1179 Fairview Dr/Suite 104, Carson City, NV 89701-5405 (contact Mr. Joe Pollock, tel 702-687-4750, fax 775 687-5751, eml jpollock@nvhd.state.nv.us, http://health.nv.gov/BFHS_EHS_FoodInfo_Sewage.htm)
- Nevada State Division of Environmental Protection (NDEP) regulates all commercial and large-capacity systems; http://ndep.nv.gov/.

Local governmental agencies, task forces:

- Lyon County
- Nye County, particularly the Pahrump area (see text).

Research within governmental agencies:

- USGS has conducted research on groundwater impacts of onsite systems (e.g., Rosen 2002).

Research within universities:

- The Desert Research Institute conducts extensive research related to groundwater and climate modeling, and watershed-based monitoring in the Lake Tahoe and Walker Lake watersheds; see http://www.dri.edu/.
- Additionally, a current Desert Research Institute project is constructing a ground water flow and transport model for the Pahrump area, though results are not yet available; see http://www.dri.edu/dhs-research/1940-development-of-a-validated-groundwater-flow-model-of-pahrump-valley.

Onsite demonstration programs: None as of February 10, 2009.

Training or certification programs:

- State of Nevada Board of Registered Professional Engineers.

- State of Nevada Contractors' Board.
- Septic tank pumpers are licensed (NSFC, 2006).

Citizen action, private groups: NA

Newsletters, forums, other sources of information: NA

2.28.9 Enforcement (Q7)

Enforcement at the state (DEP) level seems to be adequate; information about local enforcement NA.

2.28.10 Role of Cluster Systems and Package Plants (Q8)

Difficult to determine from the literature. At least one major utility has expressed interest in using the decentralized concept for systems in outlying areas, see above. Water reuse projects are well-established in Nevada, though mostly in large cities in association with major centralized sewer systems. However, Lyon County, for example, utilizes a variety of treatment systems, including large conventional leachfields, reuse for crop (alfalfa) irrigation, and reuse on golf courses (see http://www.lyon-county.org/index.asp?NID=130).

2.28.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

None observed other than what was noted above.

2.28.12 What's Changed

Patterns/Drivers: None additional to those noted above.

2.28.13 References

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Lyon County, Nevada. 2009. Building Department Information—Septic Systems, Sewage Disposal. Updated January 2009. Accessed at http://nv-lyoncounty.civicplus.com/DocumentView.asp?DID=105 on February 10, 2009. *Information about requirements for new onsite system installations outside the sewered areas of Lyon county, including requirements for denitrifying systems in the Stagecoach development area.*

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Nevada Division of Environmental Protection. 2005. Memorandum, Nevada Division of Environment Protection's Temporary Policy on Small Commercial Septic Systems, dated August 26, 2005. Accessed at http://ndep.nv.gov/bwpc/docs/tem_policy_small_commercial_septic05.pdf on February 10, 2009. *Information about new policy changing approval of commercial systems of all sizes to NDEP.*

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Waite, Mark. 2004. Septic tank failure, State to act on tank inspections. Pahrump Valley Times, February 24, 2004. Accessed at http://www.pahrumpvalleytimes.com/2004/02/25/news/septic.html on February 10, 2009. *Newspaper article about ongoing onsite system malfunction situation in the Pahrump area of Nye County.*

2.29 New Hampshire

2.29.1 Summary

New Hampshire has about 350,000 systems in the ground, installs another 4,000 annually, and repairs about 500 annually. Several areas in the state, chiefly along river and lake fronts developed before subdivision regulations were in place, have problems with dense development and older systems. The Seacoast region (southeast New Hampshire) is experiencing rapid development, with its population expected to increase 30% by 2025. No onsite districts or utilities are contemplated. Code accommodates alternative technologies, but they are not in widespread use, and there is little in the way of their stipulated management. Even so, in much of this mountainous state, with low densities in many areas, onsite systems are perceived to be permanent. There are no betterment loan programs for upgrades. There is limited research in progress at the University of New Hampshire. Designers, installers, and inspectors are state-certified and –licensed, but there is no research and there are no demonstration programs. There is an active, long-established onsite association, Granite State Designers and Installers.

2.29.2 Numerical Information

Permits are issued for the construction of new systems, for upgrading or modifying existing systems, and for repair of existing systems. The state does keep track of all issued permits.

Total number of onsite systems: About 138,000 have been installed since 1986 (since adequate records have been kept); 1990 U.S. census reports about 250,000 systems total.

Number of new systems installed each year: 3300-4000. From 1997-2004, approximately 7,000-10000 systems were installed per year, with increasing totals each year; from 2005-2008 the number of systems installed declined each year, back to about 4,500 installations in 2008 (NHDES, 2009).

Failure definition: "…system does not properly contain or treat sewage or causes or threatens to cause the discharge of sewage on the ground surface or into adjacent surface or ground waters" (NHDES 2008a).

Number or proportion of systems presently failing: Less than 5%.

Number or proportion *repaired* annually: About 500.

Number or proportion *replaced* annually: NA

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Very few.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Almost none, perhaps fewer than 10/year.

Cost of a conventional *septic system* installation: $6000; range $1000-$20,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $1200, not counting tie-in fees, which are set locally and vary.

2.29.3 Present Onsite Status (Answers 2a-2f Summarized)

There are a few areas in the state where dense development and antiquated systems have led to problems. These conditions go back to days before subdivisions were first regulated (in 1965), and have resulted in overdevelopment along lake fronts and rivers. Soils are highly variable on short spatial scales in New Hampshire. The best soils actually exist in areas where sewer service is widespread. Low permeability soils are addressed by using lower loading rates. Permits have been denied because of inadequate soil, depth to water table, and steep slopes. Failures have been attributed to age, overload, abuse, poor design or construction, and high water tables. The Seacoast region (southeastern New Hampshire) has experienced explosive growth over the last decade, sparking a major feasibility study which examined a range of wastewater treatment alternatives—including consideration of cluster systems and decentralized wastewater treatment—for the area (Kelly, 2006). Sewering is generally supported as an environmental improvement, although cost is a cause of resistance. Mandating centralization at state or federal level can also result in resistance because of the very fact of the mandate.

2.29.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Code is made at state level; enforcement is left to state Regional Inspectors, city health departments, or town health officers. Towns may adopt stricter measures than the state, and many towns require local approval in addition to a state permit (NHDES, 2008b). It is reported that improvement in enforcement would be welcomed by all.

Code was last revised in: 2008 (NHDES, 2008)

New revisions in progress? To be adopted when? No revisions currently in progress as of February 11, 2009.

Role of legislature, regulatory agency, and politics: Legislative adoption is always required; political support depends on the issues at hand. Any proposal that costs the state or homeowners money can expect resistance. Individual property rights are very important in New Hampshire.

2.29.5 Management Programs (Answers 3e-3g Summarized)

The need is perceived to undertake special management measures in several older, densely developed areas, although this is likely to take the form of creating or extending sewers. Aside from that, there is no perceived need to undertake special measures or planning outside of the regulatory structure in place. No onsite districts are under consideration, nor are utilities reported to have an interest in onsite management.

2.29.6 New Technology (Answers 4a-4h Summarized)

New technologies must be reviewed and approved by the Subsurface Systems Bureau and/or the Groundwater Discharge Permit Program (NSFC, 2006). Present code accommodates, but never requires, the use of I/A technologies. New technologies are added by addenda to the regulations.

Enhanced systems may be permitted on a case-by-case basis. Separate permits are not required for alternative/experimental/innovative technologies; however, conditional variations in approvals are common and are site and process specific (NSFC, 2006). Permitted technologies include sand filters, mound systems, textile and peat filters, package plants, aerobic systems, and several gravelless dispersal systems; however, none are in widespread use, or have been identified with particular physiographic conditions or areas within the state. There is little in the way of stipulated management of such systems, as there are no mechanisms for enforcement or backup. Best Available Technology is not required of upgrades. The role of cluster systems and package plants is presently small, but expected to grow.

2.29.7 Onsite Funding (Answers 5a-5c Summarized)

There are no betterment loan programs for system upgrades, and none are under consideration.

2.29.8 Leadership and Information

State-level agencies, task forces:

- New Hampshire Dept of Environmental Services, Bureau of Wastewater Treatment, 6 Hazen Dr, Concord, NH 03302-0095 (contact: Mr. Barry Lehneman, Sanitarian; tel 603-271-3711, fax 603-271-6683; eml blehneman@des.state.nh.us, or Mr. Mitch Locker, tel 603-271-2858, eml mlocker@des.state.nh.us)
- The Office of State Planning compiles data and provides advice as well.

Local governmental agencies, task forces: None.

Research within governmental agencies:

- None, although New Hampshire is part of the New England Interstate Water Pollution Control Commission.

Research within universities:

- The University of New Hampshire does have an Environmental Research Group, but the Group focuses on stormwater and LID practices, not decentralized wastewater technologies. See http://www.unh.edu/erg/research/index.html.

Onsite demonstration programs: NA.

Training or certification programs:

- Designers, installers and inspectors are required to pass separate onsite licensing programs administered by the state, and which involve both field and book testing.
- The Granite State Designers and Installers Association offers training courses (http://www.gsdia.org)
- The New England Interstate Water Pollution Control Commission (NEIWPCC) provides state-sponsored training programs (see http://www.newipcc.org)

Citizen action, private groups:

- There are active watershed associations.
- Granite State Designers and Installers (GSDI), see above.

Newsletters, forums, other sources of information:

- GSDI publishes a newsletter and holds an annual conference.

2.29.9 Enforcement (Q7)

Enforcement is left to state Regional Inspectors, city health departments, or town health officers. In 1997-98, it was reported that improvement in enforcement would be welcomed by all; no more recent information is available.

2.29.10 Role of Cluster Systems and Package Plants (Q8)

No significant role noted as of February, 2009.

2.29.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

No role or interest noted as of February, 2009.

2.29.12 What's Changed

Patterns / Drivers

Based on the literature reviewed, there is increased concern about development patterns, and attending wastewater treatment issues, in the southeastern Seacoast part of the state; however, this concern does not appear to be translating to code revision or other changes in onsite wastewater management activity.

2.29.13 References

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New Hampshire Department of Environmental Services. 2008a. Subsurface Systems Bureau website. Accessed at http://des.nh.gov/organization/divisions/water/ssb/index.htm on February 11, 2009. *Current website for the onsite systems regulatory program in New Hampshire;*

includes information about permitting activities, licensing, repairs, and links to permitting statistics.

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New Hampshire Department of Environmental Services. 2009. OneStop Data and Information: Subsurface Applicant Query. Accessed at http://www2.des.state.nh.us/OneStop/Subsurface_Application_Approval_Query.aspx on February 11, 2009. *Database containing information about permitting approvals and reasons for permits.*

2.30 New Jersey

2.30.1 Summary

New Jersey has at least 360,000 systems in the ground, and installs another 2200 annually. No figures were available on repairs or replacements. Isolated areas in the state have problems, particularly along the coast, and in the lake and mountain areas in the northwest. In the south-central New Jersey Pinelands, nitrogen restrictions are in place to protect shallow groundwater and surface water resources. Centralization is supported and funded whenever possible. I/A technologies are permitted case-by-case and with experience come to be recognized as standard, although their use by individual households is generally not encouraged. A pilot program for nitrogen-reducing alternative OWTS for use on smaller lots in recognized growth areas is currently underway in the New Jersey Pinelands Area. In 2008, New Jersey adopted rule changes which mandate wastewater planning and local ordinance-based OWTS pumpout programs for unsewered areas; these changes are still being implemented. There are loan programs for upgrades. The Water Resources Program at Rutgers New Jersey Agricultural Experiment Station provides information and outreach, but there is no active academic research program. The state provides training, but not certification, for onsite professionals.

2.30.2 Numerical Information

Total number of onsite systems: 1990 U.S. census reports about 360,000 systems.

Number of new systems installed each year: About 2,200 (ten-year average).

Failure definition: Hydraulic failure (ponding), backup or seepage into the house, coliform contamination of domestic well water or nearby surface water.

Number or proportion of systems presently failing: NA

Number or proportion *repaired* annually: NA

Number or proportion *replaced* annually: NA

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Very few.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Very few.

Cost of a conventional *septic system* installation: $8000-$17,500; range, $4000-$50,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $5000-$10,000.

2.30.3 Present Onsite Status (Answers 2a-2f Summarized)

Isolated areas of the state are reported to have problems because of dense development and aging systems, or because resources are in jeopardy. Surface water, coastal or inland, is the critical receptor. Areas in northern New Jersey are marked by shallow bedrock, as well as the potential for eutrophication near densely developed lake communities. The coast is marked by the potential for eutrophication of inlets, flooding, and sandy, fast-percolating soils. To the south, the New Jersey Pinelands Area has nitrogen restrictions on ISDS discharges and is administering a pilot program for advanced OWTS that reduce nitrogen levels in effluent. Permits have been denied because of high water table and rock ledges. Failures have been attributed to age, code deficiencies, high water table, clogging, misuse, hydraulic overloading, and poor construction or design. Centralization is supported and funded whenever possible, especially in the densely developed areas of the state.

2.30.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Code is made at state level, and administered by city, county, town or district health departments.

Code was last revised in: 2005.

New revisions in progress? To be adopted when? Updates are made as needed; none are currently in process. The onsite code comes up for revision every five years; there are no plans to review the code again until 2010 (NSCF, 2005).

Role of legislature, regulatory agency, and politics: Only changes in law require legislative adoption. Regulations are proposed, adopted, and amended under administrative provisions.

2.30.5 Management Programs (Answers 3e-3g Summarized)

New Jersey adopted a law in the early 1990s enabling the establishment of onsite wastewater districts, which was later overturned. In 1994, it adopted a universal education and notification system for proper operation and maintenance of systems, which is not enforced and is implemented sporadically (Stone Environmental, Inc., 2008). In the New Jersey Pinelands nitrogen restrictions on septic discharges are in place. A pilot program is currently underway in the Pinelands Area which allows properly managed advanced systems with nitrogen removal technology on lots as small as one acre within unsewered villages and designated growth areas (New Jersey Pinelands Commission, 2002).

Eight townships in northern New Jersey have implemented OWTS management programs which correspond approximately to EPA's Level 3, with renewable operating permits issued upon evidence of inspection/pumpout (Obropta and Berry, 2005).

Significant changes to the Water Quality Management Planning Rules, adopted in July 2008, require wastewater management planning for unsewered areas as well as sewered areas (NJDEP, 2008). The requirements include a buildout analysis with nitrate dilution modeling, adjustment of zoning densities if the buildout scenarios indicate that water quality standards will not be met, and adoption of ordinance-based OWTS management programs that require septic tank pumpouts or inspections every three years (NJDEP, 2008).

2.30.6 New Technology (Answers 4a-4h Summarized)

There is a provision in the regulations for experimental systems. However, I/A technologies are permitted directly by the state DEP strictly on a case-by-case basis. In time they come to be incorporated as "standard." Permitted systems have included sand filters, aerobics systems, mounds, package plants, pressure dosing, RUCK, and pressure distribution. Recirculating sand filters (RUCK systems) and pressure dosing systems were widely permitted in the New Jersey Pinelands where nitrogen discharge restrictions are in place, though monitoring showed that these systems did not remove sufficient nitrogen and are no longer allowed for new construction (New Jersey Pinelands Commission, 2000). There are no requirements for upgrades to use Best Available Technology. With the exceptions noted above, the residential use of systems that require intensive operation and maintenance has generally been discouraged.

2.30.7 Onsite Funding (Answers 5a-5c Summarized)

There are grants and/or loan programs for qualified (generally low-income) homeowners for onsite system repairs. Separate programs are administered by the New Jersey Environmental Infrastructure Financing Program, USDA Rural Development, Small Cities Community Development Block Program, and the New Jersey Housing and Mortgage Financing Agency (Stone Environmental, Inc., 2008). Some funding sources are limited in the dollars awarded per grant/loan, while others are limited to low-income homeowners.

2.30.8 Leadership and Information

State-level agencies, task forces:

- ♦ N.J. Dept of Environmental Protection (DEP), Division of Water Quality, Bureau of Operational Groundwater Permits, Box CN029, Trenton, NJ 08625-0029 (contact: Mr. John Roe, Supervising Geologist; tel 609-292-0407, fax 609-984-2147; eml jroe@state.nj.us).
- ♦ New Jersey Clean Water Council.
- ♦ New Jersey participates in the National Environmental Performance Partnership System; further details, NA.

Local governmental agencies, task forces:

- ♦ Local health departments are varyingly active, depending on their situation.

Research within governmental agencies: None.

Research within universities:

- ♦ The Water Resources Program at Rutgers New Jersey Agricultural Experiment Station provides information related to awareness of the proper care and maintenance of septic systems.(Rutgers, 2008).

Onsite demonstration programs: None.

Training or certification programs:

- ♦ All systems must be designed and certified by a licensed PE. The state DEP provides training, but not certification, for onsite professionals.

Citizen action, private groups:

- The Association of New Jersey Environmental Commissions (http://www.anjec.org/) provides information and resources about onsite systems and their management, including a model ordinance for OWTS management programs.

Newsletters, forums, other sources of information: NA

2.30.9 Enforcement (Q7)

Once OWTS are installed and permitted, inspections are generally conducted only on a complaint basis or by property owner request (Stone Environmental, Inc., 2008). Local administrative authorities (health department) are responsible for enforcement. A notice of violation is issued and, if not corrected, enforcement action is taken through local municipal courts. Enforcement actions are usually conducted under local nuisance ordinances rather than the OWTS code.

2.30.10 Role of Cluster Systems and Package Plants (Q8)

OWTS with design flows larger than 2,000 gpd are permitted at the state level, through the New Jersey Department of Environmental Protection's New Jersey Pollution Discharge Elimination System (NJPDES) (NJDEP, 2008b). These rules contain stricter management, monitoring, and reporting requirements than the small-scale OWTS rules (Stone Environmental, Inc., 2008). Almost all of the large OWTS currently permitted in New Jersey are for individually owned properties (campgrounds, restaurants, institutions, office buildings, etc.) (NJDPES database, 2008).

2.30.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

O/M programs for OWTS in New Jersey, where they exist, are managed by local administrative authorities (health departments). The alternative OWTS pilot program in the New Jersey Pinelands is administered by the Pinelands Commission, a State agency, but upon completion of the program it is expected that municipalities or local administrative authorities will be responsible for overseeing O/M on these systems. One private utility (New Jersey American Water, Applied Water Management Group) and a county utilities authority (Atlantic County Utilities Authority) have expressed some interest in managing OWTS (Stone Environmental, Inc., 2008). Only one electrical cooperative exists in the state, which has no interest in adding OWTS management to the services it offers.

2.30.12 What's Changed

Patterns

Slow, incremental progress is being made towards increased use of alternative/advanced technology and towards improved OWTS management. Fragmented, disjointed regulatory environment makes progress difficult. New management mandate in WQMP Rules (from Watershed Management division of DEP, not the OWTS section) is still playing out—planning entities are supposed to comply by April 2009 but how and whether they can accomplish this is not yet clear.

Drivers
Development pressure is a driver throughout the state. Pinelands pilot program, and local management programs in the northern part of the state, are driven partly by concern about water quality impacts of OWTS in denser development situations. There are a few regulator and quasi-regulatory “sparkplugs”.

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2.31 New Mexico

2.31.1 Summary

New Mexico has 241,000 systems in the ground, and installs another 6,000 and repairs 1,600 annually. About 20% of systems are estimated to be failing. Problems are chiefly historical, relating to dense development mostly along river valleys, but aggravated by continuing development in these same areas. Nitrate contamination of wells is the chief concern. There are well-established mechanisms for bringing new technology into general use; up to 25% of replacements involve its use, chiefly mounds, sand filters, and peat biofilters. Given the physiography and demography of the state, onsite and cluster systems will continue to play a large role in development. Bernalillo County has instituted a special onsite management program. Several villages have instituted decentralized management districts, including well-publicized demonstration projects in Peña Blanca and Willard. There is a state-wide time-of-transfer onsite system inspection program. With the exception of a limited replacement loan program in Bernalillo County, there are no loan programs for system upgrades. New Mexico State University is involved in onsite research and demonstration projects. There is currently no state-level certification for onsite professionals, except that systems must be designed by a PE; however, a state-wide certification program is currently under development and is expected to be implemented in 2009.

2.31.2 Numerical Information

The State keeps track of all permits issued. All such information is kept in a central database, except for information that resides in paper files that have not been entered into the database. Reports of this nature are not currently available, but may be in the future after the database upgrade is complete.

Total number of onsite systems: Estimated at 241,000, about half of which are permitted (NMED, 2006); 1990 U.S. census reports about 160,000 systems.

Number of new systems installed each year: 5,000-7,000 (NMED, 2008a). The number of permits issued and systems registered annually increased from FY 2003 through FY2006, but has decreased in each of the last two fiscal years, likely reflecting wider economic trends (NMED 2008a).

Failure definition: "an on-site liquid waste system that does not operate as permitted, that does not provide a level of treatment at least as effective as that provided by on-site liquid waste systems that meet the requirements of 20.7.3 NMAC or that poses a hazard to public health or degrades a body of water" (NMED 2005).

Number or proportion of systems presently failing: 20%.

Number or proportion *repaired* annually: About 1,600 p.a. are repaired or replaced.

Number or proportion *replaced* annually: See above.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Mounds and sand filters are in common use; in recent years sand filters have accounted for about 10-15% of replacements; the use of peat biofilters is also increasing.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Surface applications require disinfection, and about 500 p.a. are installed; nitrate reduction may account for 50 systems per year. About 1% of the onsite systems in New Mexico are advanced treatment systems (NMED 2007).

Cost of a conventional *septic system* installation: $1600; range, $500-$15,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): NA

2.31.3 Present Onsite Status (Answers 2a-2f Summarized)

There are large areas, often well-bounded, within the state that have problems with dense development and/or antiquated systems, some of which pose threats to surface or groundwater resources. Some other areas are likely to pose problems with future development. The chief concern is with nitrate groundwater contamination in high-density areas and in subdivisions built over bedrock fault zones; several such areas have been the subject of testing by NMED in recent years (NMED 2005a, 2005b, and 2006). Permits have been denied because of shallow groundwater, shallow bedrock, small lots, and poor design or construction. Failures have been attributed to age, poor soils, poor siting, small size, poor construction and damage. Most health districts are experiencing population growth, mostly along river valleys, aggravating the density problem. The physiography of the state does not lend itself to centralized sewering, and thus, aside from in a few big cities, this is not an option.

2.31.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Code is set at state level by the New Mexico Environment Department, and overseen generally by its Field Operations Division, which operates a total of 22 District and Field offices (NMED, 2008a). There is federal control of Indian lands. The regulation program is implemented by the state in all counties in New Mexico except for Bernalillo County, which has adopted their own ordinance (NSFC 2006). All rules apply statewide and can become more stringent on the local level if approved by the state, as was the case for Bernalillo County (NSFC 2006).

Code was last revised in: 2005 (NMED, 2005).

New revisions in progress? To be adopted when? There is no set time frame for revisions; none are in progress as of February 2009.

Role of legislature, regulatory agency, and politics: Legislative adoption is required for any change in departmental powers, but code revision is managed by the Environmental Improvement Board (EIB). Changes that restrict lot size or subdivision options are resisted.

2.31.5 Management Programs (Answers 3e-3g Summarized)

New Mexico Code does recognize and require management contracts or districts to monitor and maintain all advanced treatment systems (NSFC, 2006). In addition, several villages have formed management districts, including EPA-funded demonstration projects in Pena Blanca (Rose 1999) and Willard (Rose 2001 and 2004; NODP 2003; Van Lenten 2005). Several other communities, including Cordova, Elephant Butte, and Corrales, are seeking information or starting construction of managed, decentralized systems (Van Lenten 2005).

Bernalillo County, a high-density area which includes Albuquerque and has limited physiographic potential, has adopted special rules for all onsite systems (see below). State regulations also require the inspection of onsite systems at the time of property ownership transfer (NMED 2005); this has resulted in the discovery of numerous unpermitted systems, which are either registered or replaced with modern systems as appropriate (NMED 2008a).

2.31.6 New Technology (Answers 4a-4h Summarized)

The State of New Mexico follows performance based codes for advanced treatment systems (NSFC 2006). Present code accommodates, and sometimes requires, alternative systems. Development can be permitted on otherwise undevelopable sites when alternative technology is employed.. I/A technologies are initially handled as variances granted directly by the state's Environment Department. As experience is acquired (as stipulated by the state, and executed by the owner), technologies may be systematically included through regulation subsections. Advanced treatment products, including proprietary drainfield products, are reviewed by a technical advisory committee, which makes recommendations for approval, disapproval, or testing (NSFC 2006). All alternative and advanced systems must be designed and installation approved by a licensed engineer.. Permits have been granted for sand filters, aerobic systems, mounds, peat biofilters, package plants, wetlands, irrigation, and evapotranspiration; a list of currently approved technologies is available (NMED 2008d). The state monitors the performance of advanced technologies and is working to increase voluntary compliance with monitoring requirements (NMED 2007). Peat biofilters have been found useful in areas of shallow bedrock or shallow groundwater. There are no requirements for Best Available Technology for remediation or repair. It is thought that given the physiography of the state a greater number of alternatives at lower cost would be readily employed throughout the state.

2.31.7 Onsite Funding (Answers 5a-5c Summarized)

No funding program exists at the state level to assist individual homeowners with either repairing or replacing failing systems or installing new systems (NSFC 2006).
Bernalillo County provides a revolving fund to assist individual homeowners; further information NA (NSFC 2006).

2.31.8 Leadership and Information

State-level agencies, task forces:

- New Mexico Environment Dept, Drinking Water and Community Services Bureau, Liquid Waste Program, 525 El Camino De Los Marquez/ Ste #1, Santa Fe, NM 87505 (contact: Mr. Tom Brandt; tel 505-476-8609, fax 505-476-8564, eml tom.brandt@state.nm.us, or Dennis McQuillan, Liquid Waste Program Manager, eml dennis.mcquillan@state.nm.us).

- There is a Wastewater Technical Advisory Committee, with members appointed by the NMED Secretary, which reviews advanced treatment system technologies and makes recommendations for approval of new technologies; see http://www.nmenv.state.nm.us/fod/LiquidWaste/wtac.html.

Local governmental agencies, task forces:

- Bernalillo County Health Dept. (Albuquerque area), with the cooperation of the N.M. Environment Department has established a management program; see http://www.bernco.gov/live/standalone.asp?dept_id=2330&link_id=3010

Research within governmental agencies: NA

Research within universities:

- New Mexico State University is involved with alternative technology research; for more information, contact Dr. Adrian Hanson, P.E., athanson@nmsu.edu.

Onsite demonstration programs:

- The Peña Blanca Water And Sanitation District was included in the National Onsite Demonstration Project's case studies (Rose 1999).
- An EPA-funded demonstration project, which resulted in the implementation of managed cluster systems, was completed in the village of Willard (Rose 2001 and 2004, NODP 2003).

Training or certification programs:

- The State of New Mexico does not currently require onsite professionals to be certified, but regulations require a certification program to be in place by July 1, 2009 (NMED 2005). Under the proposed implementation plan, qualified homeowners, site evaluators/system designers, installers, installer specialists, third party inspectors, and maintenance service providers for advanced systems will all be certified, and all certifications will be renewable (NMED 2008).
- Until New Mexico's certification program is in place, inspections will be performed by a NAWT Certified Inspector (NSFC 2006).
- The NMED Environmental Health Division Field Offices offer training on topics related to installation of septic systems, liquid waste regulations, groundwater pollution and health risks related to onsite liquid waste systems, see http://www.nmenv.state.nm.us/fod/LiquidWaste/training.schedule.html.

Citizen action, private groups:

- The Professional Onsite Wastewater Reuse Association of New Mexico is active in regulatory and legislative matters, and publishes a regular newsletter, see http://www.powranm.org/

Newsletters, forums, other sources of information: See above.

2.31.9 Enforcement (Q7)

NMED has made several recent efforts to improve enforcement of regulations, including implementing a new database to improve tracking of effluent monitoring requirements for advanced systems (NMED 2007); increasing efforts to improve voluntary compliance of advanced systems with monitoring requirements (NMED 2007); increasing percentages of permitted systems that receive inspections (NMED 2008a); and increasing enforcement actions against contractors installing substandard systems (NMED 2008a). Concern remains in the onsite professionals' community, however, that district offices are not receiving adequate resources to implement programs and enforcement efforts (POWRA-NM 2008).

2.31.10 Role of Cluster Systems and Package Plants (Q8)

Cluster systems as part of managed decentralized solutions, such implemented in Willard, are increasingly seen as viable solutions for small New Mexico villages; the type of solution that took a long time to implement in this village is now being implemented or actively considered in several others (Van Lenten, 2005).

2.31.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

No interest from rural electric cooperatives was noted as of February 2009; existing O/M programs are administered by county government (in the case of Bernalillo County) or municipal governments (in the cases of Pena Blanca and Willard).

2.31.12 What's Changed

Patterns / Drivers

Based on the information above, contamination of groundwater (mostly by pre-existing onsite systems) seems to be the primary driver of improvements to onsite wastewater regulatory programs. Both state regulatory program staff and the onsite professionals' community appear to be actively engaged in improving the state of onsite wastewater management and significant program improvements have been enacted in recent years, though some of these improvements are still being implemented.

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2.32 New York

2.32.1 Summary

New York has about 1.5 million systems in the ground; an estimated 50,000 are repaired or replaced annually; figures for annual new installations were not available. Many areas throughout the state are potentially jeopardized by dense development and old systems, particularly along river and lake shores. Sewer service is generally supported by the state as the alternative of choice. Alternative technologies are added to the code after vetting, with varying management plans stipulated for their use. Their use for remediation is supported, but their use for new systems is not encouraged. New York has several enabling alternatives for jurisdictions wanting to establish management districts, and several counties have implemented management for all systems in their jurisdiction. The Keuka Watershed Improvement Cooperative, Cayuga County, Schuyler County, and several smaller municipalities all have management programs; Skaneateles Lake and Greenwood Lake have national demonstration projects. New York City, in an agreement with the state and surrounding counties, runs a systematic inspection, pumpout, and remediation program for onsite systems within NYC's reservoir watersheds. There are local loan programs for system upgrades; and, in the NYC jurisdiction, upgrades are supported by grants. There is limited research at Cornell University, and a unique, non-profit Onsite Training Network, which conducts workshops, including one that provides hands-on training using systems installed during the Skaneateles Lake national demonstration project.

2.32.2 Numerical Information

Permits are not tracked for: new construction, repair of existing systems, or upgrade or modification to existing systems (NSFC 2006).

Total number of onsite systems: About 1.5 million residential systems (NYSDEC 2008); 1990 U.S. census reports about 1.45 million systems.

Number of new systems installed each year: NA

Failure definition: Wastewater backup, surface flow, contamination of water courses or water supplies. Local health departments, and the New York City Dept of Environmental Protection, may have stricter definitions, as can larger systems which are regulated by the Dept of Conservation rather than the Dept of Health.

Number or proportion of systems presently failing: 50,000 (4%) estimated yearly.

Number or proportion *repaired* annually: 40,000 estimated.

Number or proportion *replaced* annually: 10,000 estimated.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Alternatives are fairly commonly employed for failing systems, perhaps as much as 10-15% for residences, and as high as 25% for commercial establishments.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Replacements only very infrequently involve advanced systems, particularly for residences; there are a few installed for commercial establishments; within the NYC watershed, microfiltration for surface discharge is required.

Cost of a conventional *septic system* installation: $7,000 (NYSDEC 2008).

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $2000-$2500 on average, but costs vary widely.

2.32.3 Present Onsite Status (Answers 2a-2f Summarized)

Some areas are marked by antiquated systems and dense development, and/or by inadequate hydrological conditions; surface water quality is jeopardized in some locations. A few areas could become problems in the future. Reasons cited for problems include poor soils, fast percolation rates, seasonally shallow groundwater, bedrock or hardpan impervious layers. Areas within 100 feet of watercourses are subject to stricter regulation concerning their leaching characteristics.

The extension or creation of sewer service is generally supported by the state, but not necessarily by homeowners, who are concerned about cost as well as effects on growth. New technology has increasing support, particularly if it is targeted to solve an environmental problem (see Management Programs and Demonstration Projects, below); citizens are concerned about its impact on growth rates as well.

The Long Island Sound Total Maximum Daily Load (TMDL) analysis for dissolved oxygen, submitted jointly by Connecticut and New York, was approved by EPA in April 2001 (Stacey 2002). The TMDL sets a 58.5% reduction in baseline nitrogen loads to Long Island Sound (LIS) from portions of Connecticut and New York that drain to LIS by 2014 (Stacey 2002). Communities on Long Island with significant unsewered areas (particularly Suffolk County) are becoming increasingly concerned about the potential impacts of nitrogen from onsite systems on ground water and surface water (Munster 2004, Suffolk County 2009).

2.32.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? New York state's departments of Health, Environmental Conservation, and State all have some role in administering onsite codes. The Department of Health regulates small systems; the Department of Conservation regulates flows over 1000 gpd, as well as those involving surface discharges; and the Department of State makes system reviews at the time of title transfers. Enforcement is left to county or municipal departments of health (if they exist) through code enforcement officers; otherwise the state DOH takes jurisdictional oversight. New York City's Department of Environmental Protection effectively regulates onsite systems for the watershed that serves it, mostly west of the Hudson River.

Code was last revised in: Dept of Health, 1990; NYC Dept of Environmental Protection, 1997.

New revisions in progress? To be adopted when? Significant revisions to Dept. of Health code were proposed in February 2009 (see New Technology, below).
Role of legislature, regulatory agency, and politics: New rules can be promulgated by the state DOH, but often await legislative initiatives to do so.

2.32.5 Management Programs (Answers 3e-3g Summarized)

Management programs/contracts are not currently recognized by state code to monitor and maintain onsite systems or individual septic disposal systems (NSFC 2006). There is definitely a need for onsite planning and management, and onsite planning or management entities are enabled but not required by the state. Their creation is left to local units of government, and this has been happening; several examples are described below. In light of these successes and others, and through the work of onsite professionals in the state, in proposed code revisions, ATUs, peat filters, and other alternative and advanced technologies will be allowed in areas with established RMEs (New York State Register, 2009).

The Keuka Watershed Improvement Cooperative was created in 1994 by intermunicipal agreement among eight municipalities on Lake Keuka's shores. There, a model watershed law provides for revocable permits to operate, zones of special concern (namely within 200 feet of the water), design standards, BAT when appropriate for remediations, periodic inspections and maintenance, and firm enforcement policies. A recent case study described how the cooperative continues to operate and gives an example of a system successfully replaced under particularly difficult conditions (Sorkin Kurland 2007).

Schuyler County, at the southern end of Seneca Lake, is a popular summer vacation area with many seasonal residences. The County's Watershed Protection Agency administers a management program that targets lakeshore properties for periodic inspection (Yeager et al. 2006, Longwell 2008).

In 1997, New York City signed an historic memorandum of agreement with the state, the EPA, and the eight counties and 79 municipalities that fall within the city's watershed, a watershed that contains 19 reservoirs and 3 controlled lakes that provide water for the city. A key element of the agreement is the funding of Watershed Partnership and Protection programs administered by the nonprofit Catskill Watershed Corporation. The corporation delegates administration to various towns, counties, and soil and water conservation districts as appropriate. These programs provide systematic inspection, pumpout, remediation, and financial aid when replacements are required. The first phase of this effort was a Septic Notice of Violation Priority Program for replacing known malfunctioning systems at no cost to the homeowner. This program has continued to evolve; programs to build (or form) up to 22 new municipal wastewater treatment plants, decentralized treatment facilities, or septic maintenance districts and a formal septic inspection and upgrade/replacement program are now underway (Simroe 2000 and Catskill Watershed Corporation website below).

The Skaneateles Lake Demonstration Project was established to demonstrate the use of commercially available alternative onsite wastewater treatment technologies in the Skaneateles Lake watershed, particularly to replace legacy systems on difficult lake-front sites where limitations include steep slopes, shallow groundwater and bedrock, and poor soils for biological treatment (Sorkin Kurland 2006, Dayton 2007, Murdoch and Vanderlyn 2007). An earlier project implemented by the City of Syracuse to replace a historic system of 'pail service' as an alternative to pit privies with composting toilets or other acceptable onsite systems also received national attention (for example, see Abbott 2004).

2.32.6 New Technology (Answers 4a-4h Summarized)

Present code accommodates, and sometimes requires (in order to meet site criteria), alternative or advanced technology, and it can permit development on otherwise undevelopable sites. Onsite systems are not permitted where sewer tie-ins are feasible, and some areas may only be developed with sewers. The level and manner of onsite management depends on the technology. Mound and sand filters are commonly used where vertical separation distances are inadequate, and for slowly percolating soils. Other alternative technologies include aerobic units and fill systems. Management programs, typically meaning service contracts, are required for some of these technologies. There are both state and local mechanisms to test and authorize new technology, but alternative technology is not currently promoted for new systems. The state does permit pilot projects on a case-by-case basis.

The NYC DEP does not allow certain new technologies regardless of state policy, but does have BAT stipulations for remediation within the watershed. The absorption trench length reductions for ETUs and gravelless systems proposed in the February 2009 code revision will not apply within the New York City Watershed (New York State Register 2009).

Code revisions proposed in February 2009, if enacted, will implement significant changes to new technology approvals (New York State Register 2009). The current rule proposal adds a new category of onsite wastewater treatment systems called Enhanced Treatment Units (ETUs) that provide enhanced wastewater treatment prior to discharge to soil absorption systems, recognizes systems using ETUs to use reduced adsorption trench lengths or mound areas. NSF Standard 40 or other third-party standards will be recognized; however, the ETUs will only be allowed in areas served by an RME or where maintenance is monitored and required by local sanitary code, watershed rule, or other regulation (New York State Register 2009). A variety of gravelless dispersal technologies are recognized in rule, and some are allowed a 25% absorption trench length reduction; properly manufactured waste tire chips will be allowed as a replacement for stone (New York State Register 2009).

2.32.7 Onsite Funding (Answers 5a-5c Summarized)

There are local programs for loans or outright grants to upgrade septic systems, and these enjoy citizen support if not that of a fiscally conservative government. New York City's DEP provides funding for upgrades and replacements for failing systems in its watershed provided certain criteria are met (New York City DEP, 2008).

2.32.8 Leadership and Information

State-level agencies, task forces:

- The NY State Dept of Health regulates small systems (those over 1000 gpd are regulated by the Dept of Conservation). Contact: Mr. Ben Pierson, P.E, Senior Sanitary Engineer, Bureau of Community Sanitation and Food Protection, New York State Dept of Health, Flanigan Square, Room 515, 547 River Street, Troy, NY 12180-2216; tel 518-402-7600, fax (518) 402-7609, eml bap11@health.state.ny.us.

- New York State Dept of Environmental Conservation, Bureau of Watershed Programs, 50 Wolf Rd, Albany, NY 12203; http://www.dec.ny.gov; (contact: Tom Boekeloo, eml thboekel@gw.dec.state.ny.us).
- N.Y. Department of State (system review at the time of title transfer).
- N.Y. Soil and Water Conservation Committee, see http://www.agmkt.state.ny.us/SoilWater/about_us/who_we_are.html.
- N.Y. Nonpoint Source Coordinating Committee, further information NA.
- An OWTS Advisory Committee was established by the state DOH in April 2003 to provide technical advice and a broader perspective to its OWTS regulatory program, including revision of the Appendix 75-A regulations. The Committee includes state and local regulators, health department officials, state and NYC DEC representatives, members of the NY Onsite Wastewater Association, and members of other trade, conservation, environmental, and watershed associations (New York State Register 2009).

Local governmental agencies, task forces:

- New York City Dept of Environmental Protection; its watershed protection program (see above) is carried out by: Catskill Watershed Corporation, POB 569, Margaretville, NY 12455; tel 914-586-1400; http://www.cwconline.org/.
- Cayuga County Health Department has an inspection program for all systems, as well as a time-of-transfer inspection requirement, see http://www.co.cayuga.ny.us/hhs/doh/environmental/septicsystem.htm.
- The village of Greenwood Lake has a septic tank inspection and pump-out program, see http://www.villageofgreenwoodlake.org/Village%20Code/Chapter%2085.htm#Chapter85SEWERS
- Keuka Watershed Improvement Cooperative (see above), 110 Court St, Penn Yan, NY 14527; (contact James C. Smith, Watershed Manager, tel 315-536-5110, http://www.keukalakeassoc.org/).

Research within governmental agencies:

- DOH staff review technical reports on treatment systems as part of a Six-State Interstate Technology Pilot Project; further information, NA. This could not be confirmed as of February 2009.
- N.Y. City DEP has an extensive program involving septic systems; however, its focus has shifted from research to implementation of system upgrades and maintenance. Water quality monitoring and other research projects are ongoing; see http://www.nyc.gov/html/dep/html/watershed_protection/pdf/aror.pdf.

Research within universities:

- Cornell Cooperative Extension Program has done research on nitrates, further information NA.
- SUNY College of Environmental Science and Forestry at Syracuse has conducted several studies for the New York City's DEP (for example, see Hassett et al 2007).

Onsite demonstration programs:

- ♦ The Skaneateles National Community Decentralized Wastewater Demonstration Project was initiated to introduce alternative onsite wastewater treatment technologies in the Skaneateles Lake Watershed. By demonstrating design, installation, operation and maintenance, the project has expedited the introduction of alternative systems to the region.
- ♦ Otsego Lake.
- ♦ Another National Community Decentralized Wastewater Demonstration Project started in the Greenwood Lake, NY watershed in 2007 with the objective of demonstrating energy-efficient technologies to remove phosphorus from domestic wastewater; further information NA.

Training or certification programs:

- ♦ New York does require onsite professionals to be certified. Design professionals must be either a Professional Engineer or Registered Architect and must be licensed by the State Education Department (NSFC, 2006).
- ♦ Cayuga County Health Dept runs a training program for inspectors (now part of the NY Onsite Training Network, see below).
- ♦ The SUNY Morrisville Environmental Training Center's demonstration/training site for onsite systems technology was dismantled in 2002; SUNY-Morrisville does continue to house to Environmental Training Center for training and certifying municipal WWTP operators; see http://etc.morrisville.edu/index.aspx.
- ♦ The Onsite Training Network has various classes available for onsite professionals; see http://www.delhi.edu/bcs/otn_wastewater/ or contact Lorraine Keckeisen, OTN Training Coordinator at SUNY-Delhi's Office of Business and Community Services. Now a not-for-profit corporation, the OTN, Inc. has been incorporated in NYS since March 2007 (pers. comm., Tom Boekeloo, NYSDEC, August 2009). New York may be the only state with a training network offering courses where no OWTS-specific certification is required for soils evaluators, installers, inspectors or designers (pers. comm., Tom Boekeloo, NYSDEC, August 2009). Since no demonstration facility is available for training courses, the OTN relies on an annual two-day Manufacturer's Technology Demonstration event at the EPA-funded Skaneateles Lake Alternative System Demonstration Project, where classroom-style instruction is followed by field demonstration of annual maintenance practices for a subset of the 18+ technologies installed during the demo project (pers. comm., Tom Boekeloo, NYSDEC, August 2009).
- ♦ Skaneateles Watershed Program, including further information about the NODP project: http://counties.cce.cornell.edu/onondaga/watersheds/skanhome.htm

Citizen action, private groups:

- ♦ Hudson River Keeper, see http://www.riverkeeper.org/.
- ♦ Keuka Lake Association, see http://www.keukalakeassoc.org/.
- ♦ Lake George Watershed Coalition, see http://www.lakegeorge2000.org/
- ♦ New York Rural Water Association, see http://www.nyruralwater.org
- ♦ The New York Onsite Wastewater Association (NYOWA, formed 1997): NYOWA, POB 97, Bovina Center, NY 13740; (contact Walt Bray, President, tel 607-746-4383). [Further information about this organization NA as of February 2009.]

Newsletters, forums, other sources of information:

- Cornell Cooperative Extension (http://www.cce.cornell.edu/) has a newsletter, videos, education programs and a website.
- N.Y. Water Resources Research Institute (http://wri.eas.cornell.edu/index.html) has had education and research projects related to onsite system issues.

2.32.9 Enforcement (Q7)

See above.

2.32.10 Role of Cluster Systems and Package Plants (Q8)

The Community Wastewater Management Program in the New York City watershed, administered by the Catskill Watershed Corporation, is intended to fund the planning, design and construction of community septic systems and/or the creation of septic maintenance districts in several West-of-Hudson communities (CWC, 2005).

A unique and powerful model for decentralized wastewater treatment and reuse has developed in Battery Park City, a development project launched by New York City in the 1960s but which has only recently come to full implementation (Engle 2006, Talend 2007). Several residential high-rise buildings in this development, such as the Solaire, the Verdesian, and the Visionaire, have integrated wastewater treatment and reuse facilities (Talend 2007). In midtown Manhattan, the newly constructed Bank of America Tower also incorporates significant onsite reuse and is the first office tower to achieve LEED Platinum certification (Engle 2007).

2.32.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

No involvement or interest from rural electric cooperatives noted; most existing management programs in New York are administered and implemented by local or county governments (see above).

2.32.12 What's Changed

Patterns / Drivers: None additional noted as of February 2009.

2.32.13 References

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2.33 North Carolina

2.33.1 Summary

North Carolina has about 2 million systems in the ground and installs another 25-30,000 systems per year; an estimated 3-8% are failing, and large numbers are repaired or replaced annually. The majority of systems serve individual homes. The state has a very large rural population which continues to grow, and siting conditions are often less than ideal. Poorly drained clayey soils, shallow rock ledges, swamps, marshes and coastal inlets mark much of a state which is under strong development pressure. Several communities are considering extending sewer service to overcome obstacles to development with on-site systems, while others are implementing management programs to control development density. Nevertheless, North Carolina has become, with strong support from the legislature, a leader in the development of alternative and advanced onsite technologies. Code accommodates and sometimes requires them, while also requiring their systematic management through a demonstrated contract with a private certified operator, or any of twelve onsite public management entities acceptable to, and enabled by, the state. One of the oldest, Albemarle Regional Health Services, offers management services to nine low-lying counties surrounding Albemarle Sound. There are scattered, mostly local grant and/or loan programs for those upgrading or replacing failing systems. There is extensive research and training at North Carolina State University, and at other universities throughout the state. There are also several demonstration programs in the state, and an active onsite professional association.

2.33.2 Numerical Information

Permits are tracked with the state of North Carolina for: new construction, repair of existing system, and for the upgrade or modification of a system (NSFC 2006); this information is publicly available (NCDENR 2008).

Total number of onsite systems: About 1,900,000 (1990 U.S. census, plus annual average new installations of about 34,000 per year since 1995).

Number of new systems installed each year: 25,000-30,000 new systems per year were installed in 2006 and 2007; from 2000-2004 this number was as high as 40,000 systems installed per year (NCDENR 2008).

Failure definition: "Ground absorption sewage treatment and disposal systems shall be operated and maintained to prevent the following conditions:

> (A) a discharge of sewage or effluent to the surface of the ground, the surface waters, or directly into groundwater at any time; or
> (B) a back-up of sewage or effluent into the facility, building drains, collection system, or freeboard volume of the tanks; or
> (C) a free liquid surface within three inches of finished grade over the nitrification trench for two or more observations made not less than 24 hours apart. Observations shall be made greater than 24 hours after a rainfall event.

The system shall be considered to be malfunctioning when it fails to meet one or more of these requirements, either continuously or intermittently, or if it is necessary to remove the contents of the tank(s) at a frequency greater than once per month in order to satisfy the conditions of Parts (A), (B), or (C) of this Paragraph" (NCDENR 2007).

Number or proportion of systems presently failing: A recent survey of system performance found that 3%-8% of the all trench systems installed in the state are failing to the ground surface (Uebler et al 2006). When a broader definition of failure, including recent pumping of the tank and other factors was used, the reported failure rate increased to 8%.

Number or proportion *repaired* annually: The state developed a data base in 2005 to track installation and repair of systems which is available at www.deh.enr.state.nc.us/osww_new/new1/index.htm. Approximately 4,000 repair permits per year have been issued since the inception of the data base, for a repair rate of about 0.2% (Uebler 2009). This compares to an observed surface failure rate of 3% reported by Uebler et al (2006). State code does not require routine inspection of conventional septic tank systems, which may be the only way to resolve this discrepancy (Uebler 2009).

Number or proportion *replaced* annually: See above.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): This number could be determined from the newly devised state data base, but is not yet available (Uebler 2009).

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): As above, this number could be determined from the newly devised state data base, but is not yet available (Uebler 2009).

Cost of a conventional *septic system* installation: Range is $3,000-$15,000 in the Raleigh area in 2008, according to local real estate websites such as http://activerain.com/blogsview/512209/How-much-does-a-septic-system-cost-Heres-what-a-builder-looks-for.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $10,000-40,000.

2.33.3 Present Onsite Status (Answers 2a-2f Summarized)

The state has one of the largest rural non-farm populations in the country. Siting conditions are often less than ideal, and include poorly-drained clayey soils, shallow rock ledges, and swamps or marshes whose margins have high water tables. In particular, the central area of the state, including Charlotte and Greensboro, is marked by high development pressure and clayey, slowly permeable soils. Several communities within this area are considering the extension of central service. The coast is also marked by high development pressure and sandy barrier islands, extremely small lots, and a high water table. Related resources that are potentially threatened include rivers, shellfish beds, and certain sounds within the state (such as Albemarle Sound, see below) that are restricted from flushing action by the Outer Banks. Onsite failures are attributed to age, soil conditions, high water tables (sometimes seasonal), hydraulic overload, poor design or installation, and improper maintenance. Most recently, the mountain region has begun come under tremendous pressure for development. Many new lots require advanced pretreatment systems in both the coast and mountains, because of development pressure and limited areas of soils suitable for conventional septic tank systems (Uebler 2009).

In consequence, there are both present and future problem areas in the state including water quality threats (fecal and nitrogen) from existing systems and dense development, as well as development pressure in regions that are outside sewer service areas but which contain unsuitable soils. Systematic action on water quality problems awaits clearer definition of the threats and clearer delineation of areas within the watersheds that are especially critical.
To deal with growth, North Carolina has been a leader in developing alternative technologies, which do, however, require regular inspection and maintenance. The state has nearly 30 approved innovative technologies. The increased use of alternative and advanced systems—particularly peat filters, but now also including textile filters—was jump-started as an integral component of systems installed in conjunction with the rebuilding of beachfront homes after the hurricanes of the mid 1990's devastated large portions of North Carolina's coastal resort communities (Berkowitz 2007). The use of these systems is now extending from the coast westward, where increasing numbers of sites require advanced pretreatment to allow for their effective use (Berkowitz 2007).

2.33.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Health departments at county or regional level are responsible for enforcing North Carolina's code; these sanitarians are trained and authorized by NCDENR to enforce the state rules. Enforcement is generally adequate, though past lapses by a limited number of sanitarians have resulted in recent increases in tort claims filed against the state and counties (Young et al 2007). The county-level programs are periodically reviewed by NCDENR through the normal operations of the state-level Program Improvement Team (Arrington 2006).

Code was last revised in: 2007 (NCDENR, 2007).

New revisions in progress? To be adopted when? Minor revisions are made frequently, practically every year. Significant changes are currently proposed; see http://www.deh.enr.state.nc.us/osww_new/new1/images/Rules/Draft_14%5B1%5D-1.pdf; information NA on when changes will become effective.

Role of legislature, regulatory agency, and politics: There is legislative support for facilitating new technologies that widen the potential for development, but not as much support for renewable permits or similar management measures. Still, North Carolina remains one of the few states that has established enabling legislation for onsite management entities.

2.33.5 Management Programs (Answers 3e-3g Summarized)

North Carolina code does recognize maintenance/management contracts for all drip and LPP distribution systems, all systems with pretreatment units, and most systems with flow in excess of 3,000 gpd (NSFC 2006). About 3,000 large systems are presently under management in the state (Uebler 2009). In 1993, the state began a program requiring that homeowners who install several types of alternative technologies, or who install large onsite systems of any type, must establish a contract with a private certified operator or a public management entity. About 5,000 of these smaller systems are presently being managed in the state (Uebler 2009). (Twelve types of management entities or agencies are acceptable to the state, including public utilities or departments, districts, and private certified operators.) One of the oldest management entities in the state, the PPCC District Health Department (now Albemarle Regional Health Services), offers management services for a particular system technology (sand-lined trenches) in nine low-lying northeastern counties surrounding Albemarle Sound. Currently, the district is responsible for the oversight of about 4,500 systems. All new systems in the state require a pre-cover inspection.

A number of coastal communities are choosing to manage onsite systems as part of their overall land use strategy; the Town of Nags Head is one well-known example (Stiles 2003, Macrellis et al. 2006; Grenoble 2007). In the Piedmont region, Orange County (Cary area) was reportedly considering a management program in the late 1990s (Falvey 2000), but further information NA. Wake County (Raleigh area) is currently conducting a stakeholder involvement process to determine whether an inspection-based management program should be implemented for all systems; see below.

2.33.6 New Technology (Answers 4a-4h Summarized)

Performance based codes are followed for systems in excess of 3,000 gpd and for any system which utilizes pretreatment to a level better than what a standard septic tank can provide (NSFC 2006). The code accommodates and sometimes requires alternative or advanced technology, while also requiring its management. Permissible technologies include sand filters, peat, textile, and other media filters; mound systems, aerobic systems, low pressure pipe, drip or spray irrigation, prefabricated panel block, chambers, polystyrene aggregate, and large diameter pipe. Such devices have facilitated development in otherwise undevelopable areas. When failures are extreme (sewage outbreaks), remediation requires the use of Best Available Technology. There are mechanisms in the code to allow innovative and experimental systems on the part of individuals, albeit with many restrictions and controls.

2.33.7 Onsite Funding (Answers 5a-5c Summarized)

There are no state-level, SRF-supported programs to assist individual homeowners in repairing a failing or malfunctioning system, replacing a failing or malfunctioning system, or constructing a new onsite wastewater treatment system (NSFC 2006). The Waste Discharge Elimination (WaDE) program (Stiles 2002) provides a list of potential funding sources for grant or loan funds as part of its mission to eliminate straight pipes; see program website at http://www.deh.enr.state.nc.us/osww_new/new1/WaDE.htm.

2.33.8 Leadership and Information

State-level agencies, task forces:

- North Carolina Dept of Environment and Natural Resources, 943 Washington Square Mall, Greenville, NC 27858, contact Robert L. Uebler, PhD, tel 252-948-3914, fax 252-975-3716, eml bob.uebler@ncmail.net; or Mr. Ted Lyon, North Carolina Department of Environment and Natural Resources, Division of Environmental Health On-Site Water Protection Section, 1642 Mail Service Center Raleigh, North Carolina 27699-1642; tel 919-715-3274, fax 919-715-3227, eml ted.lyon@ncmail.net.

- Experimental and Innovative Advisory Committee (to NC DENR): http://www.deh.enr.state.nc.us/osww_new/new1/images/IandE_Committee10.23.2008.pdf.

Local governmental agencies, task forces:

- PPCC District Health Dept, Box 189, Elizabeth City, NC 27907 (see text).
- Town of Nags Head: http://www.townofnagshead.net
- Wake County has conducted a failure rate study and is considering setting up a risk-based inspection and management program; see http://www.wakegov.com/water/wastewater/default.htm.

Research within governmental agencies:

- On contract, see http://www.deh.enr.state.nc.us/osww_new/new1/research-reports.htm and below.

Research within universities:

- There is extensive research and training at North Carolina State University (NCSU), as well as less comprehensive programs at other universities throughout the state. Contact: Dr. Michael Hoover or Dr. David Lindbo, Soil Science Dept, North Carolina State Univ, Box 7619, Raleigh, NC 27695; tel 919-515-7305; fax 919-515-7494; eml mike_hoover@ncsu.edu or david_lindbo@ncsu.edu; department website at http://www.soil.ncsu.edu/programs/septicsystem/

Onsite demonstration programs:

- Craven County Demonstration Project conducted by the local health department, state DEHNR, and NCSU.
- Chatham County Demonstration Project conducted by NCSU.
- There are also five Onsite Training [and demonstration] Centers in the state, two large ones run by NCSU, and three small ones run jointly by local health departments and NCSU (see below).

Training or certification programs:

- NCSU has operated, on behalf of the state, a National Training Center for Land-based Technology and Watershed Protection; a Subsurface System Operator Training School since rule changes in 1993 that required certified operators for certain systems; and a training program for Environmental Health Interns. Further information about the training centers is available from http://www.soil.ncsu.edu/swetc/.
- North Carolina does require onsite professionals to be certified and to obtain Registered Sanitarian licenses along with Authorization by the State; continuing education is required to maintain certification (NSFC, 2006). All newly hired county personal must complete a centralized training course developed by the NCDENR prior to being authorized to enforce the state Rules.
- Additional details on the evolution of the training centers is available in Hoover 2005; North Carolina's Subsurface Operator Training School underwent substantial revision in 2003-2005, and the update process and its dividends are described in Reid et al. 2007.

Citizen action, private groups:

- North Carolina Septic Tank Association (NCSTA), see http://www.ncsta.net/.

Newsletters, forums, other sources of information:

- NCSTA has a newsletter, and also has run an Annual Exhibition since about 1991.
- The Annual Onsite Wastewater Treatment Conference, conducted by NCSU and the state, is now in its 24th year; further information at http://www.soil.ncsu.edu/swetc/onsiteconf/2008/main08.htm.
- The North Carolina Cooperative Extension has a library of publications for the general public and conducts extensive outreach programs; see, for example, http://chatham.ces.ncsu.edu/index.php?page=community

2.33.9 Enforcement (Q7)

See above.

2.33.10 Role of Cluster Systems and Package Plants (Q8)

Cluster systems can be found in most counties throughout the state but still constitute a relatively small portion of on-site systems in the state (Uebler 2009). The role of cluster systems and package plants appears to be relatively small, but is increasing. For instance, several recent subdivision-scale developments in Chatham County have utilized cluster systems and reuse; see http://www.ncsu.edu/project/calscommblogs/archives/2008/12/moore_county_pu.html.

2.33.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

No interest from electrical cooperatives or municipal utilities was noted in the literature. Management is overseen by the health departments and NCDENR; in a very few cases there are stricter or more involved local municipal programs for management.

2.33.12 What's Changed

Patterns/Drivers

[ANM notes that] new development appears to be a continuing driver; alternative and advanced technologies are becoming more commonly installed—particularly in areas where more suitable land has already been developed, and in coastal/resort communities where such systems allow construction or re-construction with large seasonal/rental houses. Cluster systems and reuse are starting to be used in a few suburban areas, but are not used widely at this time. Sustaining the performance of on-site systems, due to the cost associated with central sewer extension, has spurred interest in on-site pretreatment systems.

2.33.13 References

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2.34 North Dakota

2.34.1 Summary

North Dakota has about 65,000 systems in the ground, adds about 600, and repairs or replaces about 1600 annually. About a third of the systems are failing by current standards. Some of the older subdivisions, chiefly on the banks of rivers, have problems; other areas of the state are marked by clayey soils. In general, subdivisions today are often located on poor soils unsuited to agriculture. Still, water quality is not a large concern. In towns and cities which are growing, extension of sewers is the preferred alternative for handling growth; but many towns and counties are losing population. Code accommodates alternatives, and mounds and communal systems are in fairly widespread use; overall, however, alternatives are seldom used. Maintenance contracts might be required locally for their use, but there is no management requirement in state code. There are betterment loan programs for repairs or replacement, but no research or demonstration projects. Certification is left to local government, although North Dakota State University Extension holds seminars for installers and local sanitarians.

2.34.2 Numerical Information

Permits for new construction, repair of existing system, or upgrade or modification of an existing system are not tracked (NSFC 2006).

Total number of onsite systems: 1990 U.S. census reports about 65,000 systems.

Number of new systems installed each year: About 600.

Failure definition: Backup into house, or surfacing effluent.

Number or proportion of systems presently failing: About 18,000.

Number or proportion *repaired* annually: About 1000.

Number or proportion *replaced* annually: About 600.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Mounds and communal systems (oversizing) are used, but, in general, very few alternatives are accepted by installers as cost-efficient to take on.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Virtually none.

Cost of a conventional *septic system* installation: About $4000; range, $1500-$9000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): About $5000; range, $6000-$7000; housing developments connecting to municipal sewers have lower costs than rural central sewers.

2.34.3 Present Onsite Status (Answers 2a-2f Summarized)

Some areas of the state have problems because of dense development, small lots and aging systems. Old subdivisions with lots of less than 40,000 sq ft have been built along river banks. A few of these may jeopardize resources. Other areas of the state have clayey soils. Some areas are prone to flooding or have high water tables.

Except for isolated household cases, water quality impacts from onsite systems are not regarded as a large problem. Problem areas, such as mobile home parks, have been connected to central facilities. System failures have been attributed to age, high ground water, hydraulic overloading, improper design or installation, surface flooding and drainfield saturation.

North Dakota is a large state with few towns, and small, often shrinking, populations within them. In general, population density in North Dakota diminishes from east to west. The west is marked by a very sparse population with any additional development totally dependent on the prospects for oil discovery and recovery. Still, some areas of the state could have problems with future development, in part because subdivisions tend to be located on poor soils unsuited to agriculture; and, in part, because some towns grow at the expense of others (as people retire, or retire from farming), leaving a pool-pocket configuration. Counties along I-94 (running east-west in the lower half of the state) from Fargo to Dickinson (and particularly between Fargo and Bismarck) are expected to be growth areas for the next 25 years; many new onsite systems can be expected. This is also true of the area around Minot, and it is true in the east along I-29 (running north-south) from Wahpeton to Grand Forks, just west of the Red River. The whole Red River valley has high-clay-content soils that often require mound systems, or similar alternatives, called “NODAK” (North Dakota) systems. Aside from these areas, the rest of the state is expected to lose population. In the cities central sewering is supported; but in rural areas it is not often practicable except on very small scales, and on any scale would most likely face resistance because of costs.

2.34.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Code is developed by the North Dakota State Plumbing Board (as part of the plumbing code) with administration left to “Health Units,” typically at the county or multi-county level. The health units are responsible to the State Health Department. Several counties have no environmental health programs, with administration then passing to township governments or other willing agencies. Some health units contract with other counties or municipalities to provide administration. There are also areas of the state with no regulation of onsite systems. North Dakota is reported to be short on the resources required to fully address onsite problems. At the same time, counties or townships may write more restrictive code than the state.

Code was last revised in: 1996. The Chapter number was changed in 2000 due to adoption of the UPC by the Plumbing Board, but no substantive changes were made (NSFC 2006).

New revisions in progress? To be adopted when? No, not at state level, although district codes are periodically revised.

Role of legislature, regulatory agency, and politics: Adoption of new plumbing code requires public hearings but not legislative approval; however, no adoptions are currently planned. (Adoptions tend to be based on one of the national uniform guides.) Local health unit codes are subject to political scrutiny by county commissioners and local health boards.

2.34.5 Management Programs (Answers 3e-3g Summarized)

North Dakota Code does not recognize or require management programs/contracts or districts to monitor and maintain onsite systems, and there are no plans to develop such a program (NSFC 2006).No areas of the state have been targeted for systematic inspections or upgrades, although virtually all new subdivisions must submit wastewater plans. There is no reported interest from rural cooperatives, or other entities, in establishing O/M programs. Local health units may adopt stricter standards than those in the state code (NSFC 2006).

2.34.6 New Technology (Answers 4a-4h Summarized)

Present code accommodates, but at no time requires, alternative and advanced technologies. I/A technologies are adopted into the regulations by a review process; after approval, they are listed in separate chapters of the regulations. Permitted systems include sand filters, mounds, aerobic, at-grade pressurized trench and bed, Infiltrator, and SB-2. Best available technology is not required of upgrades. Mound and NODAK systems are in fairly widespread use in areas marked by high-clay-content soils or a propensity for flooding. Development may be permitted on otherwise undevelopable sites, with approval coming from the local health unit. If a technology is not listed in the State Code, it falls under "alternative technology" and must be installed per the manufacturer's direction with management and/or operation by a manufacturer-trained entity (NSFC 2006). More widespread deployment of alternative technologies might be expected if costs were to diminish, but initiatives in their use would come from local health units, not from the state. Package plants and cluster systems do not play a large role, and are not expected to except when there no other alternatives.

2.34.7 Onsite Funding (Answers 5a-5c Summarized)

In North Dakota, SRF monies may be used to assist homeowners for the repair of a failing or malfunctioning system, replacement of a failing or malfunctioning system, or for the new construction of an onsite wastewater treatment system (NSFC 2006). Section 319 funds may be used as up to a 60% cost share to repair or replace malfunctioning onsite systems that are causing water quality impacts (North Dakota Dept. of Health, 2008).

2.34.8 Leadership and Information

State-level agencies, task forces:

- North Dakota State Plumbing Board (NDSPB), 204 W. Thayer Ave, Bismarck, ND 58501; tel 701-328-9977; see http://www.governor.state.nd.us/boards/boards-query.asp?Board_ID=83.
- North Dakota State Health Department (NDSHD), Division of Municipal Facilities, 1200 Missouri Avenue, Box 5520, Bismarck, ND 58502; see http://www.ndhealth.gov/MF/.
- North Dakota Environmental Health Association (NDEHA) has an ad hoc committee which advises the plumbing board; further information NA.

Local governmental agencies, task forces:

- Custer District Health Unit, 210 2nd Ave NW, Mandan, ND 58554 (contact: Dick Bechtel, R.S./REHS; tel 701-667-3370, fax 701-667-3371; eml dbechtel@state.nd.us).
- Fargo/Cass Public Health, 410 3rd Avenue North, Fargo, ND 58102 (contact: Mr. Terry Ludlum, R.S., tel 701-241-1396, eml tludlum@ci.fargo.nd.us.

Research within governmental agencies: None.

Research within universities:

- North Dakota State University Extension Office provides information regarding onsite systems, but does not have a research program. (Contact: Thomas F. Scherer, Extension Agricultural Engineer, North Dakota State Univ Extension Service (NDSUES), Box 5626, Fargo, ND 58105-5625; tel 701-231-7239, fax 701-231-1008; eml tscherer@ndsuext.nodak.edu).

Onsite demonstration programs: None.

Training or certification programs:

- Aside from septic tank pumpers and sanitarians, the State of North Dakota does not require onsite professionals to be certified (NSFC 2006).
- Some local health units administer onsite certification programs for plumbers, installers, inspectors, and journeymen (for examples, see First District Health Unit 2009 and Custer District Health Unit (Morton County) at http://www.co.morton.nd.us).
- Seminars conducted jointly by the NDEHA (see below), NDSDH, NDSUES, and NDSPB are held in several different cities every year for installers.

Citizen action, private groups:

- North Dakota Environmental Health Association (NDEHA) is a professional organization for all the local environmental health units; the organization also holds an annual education conference, see http://www.ndeha.org/.
- Garrison (Diversion) Conservancy District (http://www.garrisondiv.org/), and others like it exist within the state.

Newsletters, forums, other sources of information: NA

2.34.9 Enforcement (Q7)

Original report noted "North Dakota is reported to be short on the resources required to fully address onsite problems"; no more current information was found as of March 2009.

2.34.10 Role of Cluster Systems and Package Plants (Q8)

This role was previously reported to be small, and increases were not expected; more current information on whether the role had increased since 1997-98 could not be found as of March 2009.

2.34.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

There is no reported interest from rural cooperatives, or other entities, in establishing O/M programs as of March 2009.

2.34.12 What's Changed

Patterns/Drivers: None noted beyond the information above.

2.34.13 References

Custer District Health Unit (North Dakota). 2008. On-Site Septic System License, Permit & Inspection Program. Page updated April 2008. Accessed at http://www.co.morton.nd.us/index.asp?Type=B_BASIC&SEC={600F694F-EAC1-418C-8B2E-DDE03C1B7FD9}&DE={539F0101-D977-4BFE-AB90-8FF3E2DA6F77} on March 2, 2009. *Health district webpage with information about the District's regulations and contractor licensing requirements.*

First District Health Unit (North Dakota). 2009. Onsite Sewer Treatment Systems (Septic Systems). Page updated January 2009. Accessed at http://www.fdhu.org/cgi-bin/programs.pl?display&pid=96 on March 2, 2009. *Information about the First District's onsite systems program, including installer licensing requirements and educational seminar information*.

National Small Flows Clearinghouse. 2006. North Dakota Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/NorthDakota.pdf on March 2, 2009. *This short document summarizes onsite wastewater system regulations and activities in North Dakota.*

North Dakota Department of Health. 1996. North Dakota State Plumbing Code, Private Sewage Disposal Systems, Chapter 62-03.1-03. Effective February 1996. Accessed at http://www.legis.nd.gov/information/acdata/pdf/62-03.1-03.pdf on March 2, 2009. *Current regulations governing onsite systems in North Dakota.*

North Dakota Department of Health. 2008. North Dakota Nonpoint Source Pollution Management Program, Cost-Share Guidelines For Nonpoint Source Pollution Control Best Management Practices. Department report dated May 2008. Accessed at http://www.ndhealth.gov/WQ/SW/Z1_NPS/PDF_Files/May08_BMPCostGuide.pdf on March 2, 2009. *This report describes the state's current cost-share guidelines and programs for NPS pollution reduction projects funded with Section 319 dollars, including a cost share program for replacement or repair of onsite sewage treatment systems.*

2.35 Ohio

2.35.1 Summary

Ohio has greater than 1 million systems in the ground, serving more than 25% of homes in the state. A quarter or more of older systems are thought to be failing, resulting in an estimated 900,000 gallons of sewage directly discharging into streams, ditches, or the ground surface (Sutherly, 2006). There is statewide concern about the contamination of surface and groundwater, many low-lying areas, and other areas with poor soils. Ambivalence on the issue of sewers, and growing pressure for the approval of alternatives, resulted in 2007 in the first significant revisions to the onsite code in 30 years; however, these rules were rescinded within six months and work is ongoing to implement compromise rules. The current code accommodates experimental technologies, although at present they are not in particularly widespread use. Consistent review and approval policies, as well as expanded options for local management programs, were part of the now-rescinded rule revisions; it is not currently clear which portions of these rules will be eventually implemented. About half the counties in Ohio have some form of inspection-based management program, and some, like Cuyahoga County, have comprehensive programs. There are betterment loan programs in place for upgrades, and several counties have been exploring the onsite district concept. Ohio State University conducts research and has a training and demonstration site. Several private organizations, including an Ohio Onsite Wastewater Association, are active in the state.

2.35.2 Numerical Information

Local health districts and the five OEPA district offices issue permits (NSFC 2006). Permits for new construction and for upgrade or modification are tracked by the OEPA, but currently not by the state DOH (NSFC 2006). Permits are often tracked at the local level, but further information NA.

Total number of onsite systems: Greater than 1 million. (1 million estimated in Hunt 2007)

Number of new systems installed each year: 10,000-12,000 (17,000 in Hunt 2007). Of 6,000 systems studied in 2007, 85% were new installations (ODOH 2008)

Failure definition: Plumbing backup or breakout of effluent.

Number or proportion of systems presently failing: 25-30% (as many as 250,000 in Hunt 2007). Based on a 2007-08 survey of local health departments, 23% of the sewage systems installed today are failing, and 13% are projected to fail within the next 5 years (Ohio DOH 2008a).

Number or proportion *repaired* annually: 2000-3000.

Number or proportion *replaced* annually: 2000+. Of 6,000 systems studied in 2007, 12% were replacements (Ohio DOH 2008)

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): In 2007. 87% of systems installed were septic tank to soil absorption systems; 10% were elevated mound systems; 3% used a pretreatment component to help reduce the vertical separation distance needed, less than 1% used drip distribution systems; 1% were authorized discharging replacement systems, and 4% were reported as unknown (Ohio DOH 2008).

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Very few if any.

Cost of a conventional *septic system* installation: \$6500-\$7500 (Ohio Department of Health 2008) True annual system costs (system installation plus operation and maintenance) amortized over 30 years were calculated as \$336 for a conventional system in 2007 (Ohio DOH 2008).

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): \$6000, range; \$1500-\$20,000.

2.35.3 Present Onsite Status (Answers 2a-2f Summarized)

There are large areas throughout the state, some well-bounded, that are causing problems because of dense development and aging systems; and additional areas are expected to become problems in the future because most health departments report population growth, much of it in unsewered, rural areas. There is statewide concern regarding contamination of surface and groundwater. Onsite system permits have been denied because of poor drainage, floodplains, poor soils, steep slopes, high water table, bedrock, wetlands and quicksand. Almost 40% of the state has a seasonal high water table at 18 inches or less below the surface, while less than 5% of the state has bedrock or ground water within 36 inches of the surface (Ohio Department of Health, 2008). Failures have been attributed to improper design or construction, lack of maintenance, age, damage, small size, and spent leachfields. Poor design criteria in the 1950s and 1960s are also said to account for many current failures. A highly publicized outbreak of gastrointestinal illness that sickened more than 1,400 visitors and residents of South Bass Island in Ottawa County in summer 2004 was ultimately linked to groundwater contaminated by sewage (Ohio DOH 2004). There is ambivalence on the issue of creating or extending sewer lines, and pressure for approval of alternatives is reportedly growing. Some health departments have been more receptive to this approach than others.

2.35.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Code is set at state level through legislative approval, but is administered by city, county or district health departments. Counties may (and some have) set more stringent rules than the state's minimum standards. Enforcement is reported to be inadequate because of the awkward court procedures involved.

Code was last revised in: 2007 (Ohio DOH, 2007).

New revisions in progress? To be adopted when? The Ohio Administrative Code underwent its first major revision in 30 years, becoming effective on January 1, 2007. In June, the state legislature passed a budget bill which included major revisions to the new Administrative Code.

The bill was signed into law on June 30, 2007 and became effective the next day. On July 2, 2007 the Director of Health re-adopted the original 1977 rules. These rules were rescinded on July 25, 2007 by the Public Health Council and rules were adopted that are nearly identical to the 1977 rules, except that the water table separation distances and soil absorption requirements were removed; these are now to be set by local health departments as appropriate to their local conditions. The interim version of the rules will remain in effect until July 1, 2009, while a study group evaluates the issue and makes recommendations, as mandated in the rescinding rule (Dayton 2008).

The Ohio Environmental Protection Agency (OEPA) is working on new rules for Small Flow Onsite Sewage Treatment Systems (OSTS) other than residential systems; however, rulemaking for these systems will not commence until the new HSTS rules are implemented later in 2009 (OEPA 2008a).

Role of legislature, regulatory agency, and politics: Legislative approval of the major changes proposed is required, but the outcome is problematical. Intense lobbying by homebuilders' associations, developers' associations, and manufactured housing associations ultimately resulted in the rule implementation delays described above (see, for example, Sutherly 2006a).

2.35.5 Management Programs (Answers 3e-3g Summarized)

Special regulation and targeted enforcement is reported as being needed in communities throughout the state for new development, older densely developed areas, and critical resource areas. The 1977 rules allowed operation permits, and about 50% of the local health districts have established time of sale or other periodic inspection programs over the past 30 years (NSFC 2006). Cuyahoga County (Cleveland area) has run a time-of-sale inspection program for over 20 years, as well as requirements for septic tank pumpouts every three years (Longwell 2009). In the early 1990s, the time-of-sale inspection program was replaced with a comprehensive management program (Longwell 2009). Mahoning County, in the northeastern corner of the state, has operated a voluntary, reminder-based pumpout program since 1997, with pumpouts tracked in a database, as well as a time of sale inspection program (Duffy 2008). Additionally, existing inspection programs in Ohio were surveyed in 2002 (Caudill 2003).
The rescinded 2007 rules recognized management programs/contracts or management districts to monitor and maintain onsite systems or individual septic disposal systems. Under the rule, operation permit-based programs would still be allowed, and service contracts would be required for many systems with mechanical components (NSFC 2006).

2.35.6 New Technology (Answers 4a-4h Summarized)

Present code accommodates, and sometimes requires, the use of alternative technology, which can allow for development on otherwise undevelopable sites. Regulations allow for experimental I/A technologies, which, as experience is acquired, are then more generally permitted. Experimental systems are permitted directly by the state, and must be monitored by local health departments. Systems more generally permitted now include sand filters, mounds, package plants, and aerobic units, as well as evapotranspiration, pressure dosing, and constructed wetlands. With new regulations there is expected to be a requirement for the use of BAT for upgrades, at least in some circumstances. Expanded mechanisms to test and approve new technology are also expected. It is thought that as alternatives diminish in cost, they would be more widely stipulated, and that there is definitely a place for them in Ohio's wastewater planning. Cluster systems and package plants are not expected to play a large role in the near future because of the state's reluctance to grant operating permits to non-governmental entities. Surface discharging OWTS are permitted when no other alternative is possible; these require an Ohio EPA NPDES General Permit in addition to the HSTS permit issued by a local health department (OEPA 2008).

The rescinded 2007 rules provided prescriptive options, with provisions that allow for flexibility in alternative design options; performance-based rules would be applied more directly to pretreatment and NPDES effluent parameters (NSFC 2006). The rescinded rules established procedures for submitting requests for review of components or systems related to the rule's performance provisions in rule, and a Technical Advisory Committee to review and make decisions about approval of these components (NSFC 2006). It is not clear whether these provisions will be included in the rule that eventually will be approved.

2.35.7 Onsite Funding (Answers 5a-5c Summarized)

State Revolving Funds (SRF) loan funding can be used to assist individual homeowners to repair or replace failing or malfunctioning systems through a linked deposit program (Eddy 2003, NSFC 2006). Ohio's SRF loan program is handled through the OEPA Division of Environmental and Financial Assurance (DEFA) at http://www.epa.state.oh.us/defa.

2.35.8 Leadership and Information

State-level agencies, task forces:

- Ohio Department of Health, Residential Water and Sewage Program, PO Box 118, 5th Floor BLEHS Columbus, OH 43216-0118 (contact Ms. Jean Caudill, RS tel (614) 644-7181, fax (614) 466-4556, eml jean.caudill@odh.ohio.gov, or Tom Grigsby, RS, eml tom.grigsby@odh.ohio.gov).
- Ohio Environmental Protection Agency, Division of Surface Water, Permits & Compliance Section (contact: Mark Stump, tel (614) 644-2028, eml mark.stump@epa.state.oh.us)
- Household Sewage and Small Flow On-Site Sewage Treatment Commission of the Ohio DOH

Local governmental agencies, task forces:

- Cuyahoga County Board of Health; see text above and http://ccbh.net/ccbh/opencms/CCBH/modules/services/HouseholdSewage.html.

Research within governmental agencies: None.

Research within universities:

- The Ohio State University Extension has a strong demonstration, research, and testing program; see the OSU Soil Environment Technology Learning Lab (SETLL) web site at http://setll.osu.edu or contact Karen M. Mancl, Ph.D., Professor, Extension Water Quality Specialist, OSU Department of Food, Agricultural and Biological Engineering, tel (614) 292-6007, eml mancl.1@osu.edu.

Onsite demonstration programs: See above.

- The Lorain County General Health District initiated an experimental project in 1993 using constructed wetlands to treat sewage affluent from single-family homes (see http://www.noaca.org/rapproj.html#cons). In 1998, the systems were still operating; monitoring by the health department showed variable treatment performance, and plants were not established in all wetlands (see http://nesc.wvu.edu/pdf/WW/publications/pipline/PL_SU98.pdf). The results of a performance evaluation of 21 constructed wetland systems conducted between 1994 and 2001 showed that the systems met EPA effluent loading guidelines in about 70% of samples collected (Steer et al. 2002).

Training or certification programs:

- The State of Ohio does not require onsite professionals to be certified. The since-rescinded 2007 rules recognized national and state voluntary certification programs (NEHA, OOWA, NAWT, OWHA, etc.) or 6 CE hours / year; service providers, installers, and septage haulers would be required to register locally with evidence of the certification or CE hours, a bond, and passing a state test related to the rules (NSFC 2006).
- Currently, about half of the counties require installer licensing, and three-quarters require installers to be bonded (Ohio DOH 2008).
- A wide variety of courses and conferences is offered through SETLL and OSU Extension; see http://setll.osu.edu/programs.html.
- The Ohio Dept. of Health holds a workshop each March

Citizen action, private groups:

- Ohio Onsite Wastewater Association (OOWA) holds an annual conference, publishes a regular newsletter, and has been an active participant in the recent rule revision process; see http://www.ohioonsite.org.
- Ohio Environmental Health Association (OEHA) has an annual education conference; see http://oeha.tripod.com.
- Ohio Waste Hauler Association (OWHA), PO. Box 277, Huntsburg, OH 44046-0277, tel (216) 636-5111
- Operator Training Committee of Ohio (OTCO) for water and wastewater system operators, see http://www.ohiowater.org/otco/index.htm.
- Watershed associations, see http://ohiowatersheds.osu.edu/groups/wgp_all.php.

Newsletters, forums, other sources of information:

- The Ohio State University Extension has a strong outreach and public information program; see http://setll.osu.edu/programs.html.

2.35.9 Enforcement (Q7)

See above; more recent information NA.

2.35.10 Role of Cluster Systems and Package Plants (Q8)

Cluster systems and package plants are not expected to play a large role in the near future because of the state's reluctance to grant operating permits to non-governmental entities.

2.35.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

The original report noted interest from utilities in O/M programs for onsite systems, but no current interest was found in the literature as of March 2009.

2.35.12 What's Changed

Patterns/Drivers: None noted in addition to what is recorded above.

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2.36 Oklahoma

2.36.1 Summary

Oklahoma has about 270,000 systems in the ground, installs about 4000, and repairs or replaces about 1000 annually. There are areas throughout the state with problems due to antiquated systems; the chief concerns are with nitrates, phosphates, and complaints. Although the state looks favorably on centralization this often is not possible. Oklahoma's population is growing, and new subdivisions are going into areas with marginal soils. These subdivisions require wastewater plans, and often rely totally on aerobic treatment and land application. There are well-established mechanisms to bring new technology into general use. Many replacements involve aerobic units, but there is also growing interest in rock/reed plant filters. Communal systems, land application of effluent, and many alternative systems require maintenance contracts for the life of the system. There are loan programs for remediation, there have been targeted Section 319 grant programs for repairs and replacements in several watersheds, and there is a hardship grant program funded by environmental penalties.. Several aerobic and evapotranspiration systems have been installed as demonstration projects, and there is at least one Extension professional conducting research relevant to onsite systems. Onsite professionals, including installers, septage haulers, and soil scientists, are required to be licensed and there are state-provided training programs. Several organizations, including one for installers, are active in the state.

Oklahoma's onsite regulatory program was formally recognized by EPA's Office of Wastewater Management in 2007 (Oklahoma DEQ 2007):

2.36.2 Numerical Information

The state tracks the number of permits issued per year for new construction and for system repair and replacement. These records are maintained at both the local and state levels.

Total number of onsite systems: Reportedly about 270,000, although the 1990 U.S. census reports approximately 370,000 systems. Oklahoma is currently attempting to get a firmer grasp of these numbers.

Number of new systems installed each year: Approximately 4000; by another report, 20,000-30,000.

Failure definition: Backup, surfacing, or discharging off the property.

Number or proportion of systems presently failing: 5-10%; up to 20% in wet months; by another report, 5000-10,000.

Number or proportion *repaired* annually: 400-600; by another report, 2000-3000.

Number or proportion *replaced* annually: 300-500; by another report, 1000-2000.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Estimates varied, but a significant percentage of replacements are either aerobic units (90% of alternatives) or evapotranspiration systems using rock/reed plant filters (10% of alternatives).

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): About 700 are on file.

Cost of a conventional *septic system* installation: $3000 (Oklahoma DEQ 2007); range, $900-$6000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral):

2.36.3 Present Onsite Status (Answers 2a-2f Summarized)

Presently there are localized areas throughout the state that pose problems because of dense, aging systems or poor conditions. Problem areas include scenic river and lake developments. In the northeast fractured rock soils allow effluent to contaminate groundwater. Chief concerns are with nitrates, phosphates and complaints. Permits have been denied because of impervious soils and steep slopes. Failures have been attributed to undersizing, age, poor maintenance, improper design or construction, and seasonally high water tables; multiple factors are generally responsible for failures (NSFC 2003). The DEQ (and particularly the Environmental Complaints and Local Services Division) often works collaboratively with small communities and subdivisions to correct problems; in one case helping to replace a subdivision’s centralized collection system with individual onsite systems (Oklahoma DEQ 2006).

Centralization is supported by the DEQ, but often resisted by developers and homeowners because of cost. Most counties have reported population growth. In the future, large areas might be expected to become problems because the land becoming available for residential development is increasingly marginal with respect to site conditions. However, steps are being taken to deal with this.

2.36.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Code is made at state level by the DEQ, and administered by local DEQ offices (the Environmental Complaints and Local Services Division). All rules and regulations apply statewide and cannot be made more stringent on the local level (NSFC 2003). Oklahoma’s onsite systems regulatory program was recognized by EPA at the 2007 State Onsite Regulators Alliance conference for its easy-to-understand rules, efficient certification process for on-site system installers and soil profilers, and effective enforcement processes (Oklahoma DEQ 2007).

Code was last revised in: 2008 (Oklahoma DEQ 2008).

New revisions in progress? To be adopted when? Generally regulations are updated approximately every two years; no revisions are currently under development.

Role of legislature, regulatory agency, and politics: Statutory changes require legislative approval; most (but not all) rule changes do not. Reportedly there is good political support for code revision.

2.36.5 Management Programs (Answers 3e-3g Summarized)

There is a need for special planning and management measures to be taken in several older, densely developed areas, as well as new development. Although the establishment of districts or utilities is not contemplated in a comprehensive way, the residential development planning process requires wastewater plans. In some areas, aerobic treatment or other alternatives are now mandatory. Some developments are wholly aerobic, with land application of effluent. These systems require licensed operators and contractual maintenance and monitoring. Time of sale inspections are often required by lending institutions in Oklahoma for onsite wastewater systems, but the requirement is not in state code (NSFC 2003).

2.36.6 New Technology (Answers 4a-4h Summarized)

Present code accommodates, and sometimes requires, alternative or advanced technology, and in individual cases the possible use of BAT, for remediations. Their use may permit development on sites unsuitable for conventional systems. Lot and setback requirements can be reduced when employing certain alternatives, but the state code does not allow for drainfield area or size reductions (NSFC 2003). I/A technologies are listed in code subchapters subject to ongoing updates. Acceptance and addition to the regulations is done on a technology-by-technology basis, after Department manager review and after sufficient experience has warranted more general application than that provided by individual variances. Permitted alternatives included aerobic systems (though these are considered ‘conventional’ in Oklahoma), rock/reed evapotranspiration systems, lagoons, polystyrene (gravel substitute) systems, and certain chamber systems (NSFC 2003). Aerobic systems, in particular, have been put to use in every county in areas where system failures are abnormally high. Sand filters, mounds and pressure dosing are reportedly not in use. There is no set management protocol for alternative systems. However, individuals are required to have ongoing service contracts with licensed service providers, which prescribe maintenance and monitoring procedures. It is reported that demand for alternatives would definitely increase as their cost diminished; and that there is a clear role for them in opening land to development.

2.36.7 Onsite Funding (Answers 5a-5c Summarized)

There is a statewide loan program for qualifying individuals for repairing or replacing failing systems, which enjoys continued favor in the legislature. Oklahoma’s Section 319 grant program replaced or repaired 97 failing systems between 1988 and 2000. A separate grant program has been established by the DEQ’s Environmental Complaints and Local Services Division (ECLS), which is currently funded with money collected from penalties (Oklahoma DEQ 2004 and 2009) From 1998-2004, ECLS assisted 152 homeowners with installing or correcting on-site sewage treatment systems, and the program continues to operate (Oklahoma DEQ 2009).

2.36.8 Leadership and Information

State-level agencies, task forces:

- ♦ Oklahoma Dept of Environmental Quality (DEQ), Water Quality Division, PO Box 1677, 707 N. Robinson, Oklahoma City, OK 73101 (contact: Mr. Robert Huber, Programs Coordinator, tel 405-702-6222 fax 405-702-6223, eml Robert.Huber@deq.state.ok.us).
- ♦ The ECLS Alternative System Review Committee accepts proposals for new on-site system designs regularly and has approved some new types of treatment systems on an experimental basis (Oklahoma DEQ 2007).
- ♦ There is a "Scenic Rivers" task force: Contact Bob Bates, Oklahoma DEQ/Roland Office, P.O. Box 597, Roland, OK 74954; tel 918-427-6941.

Local governmental agencies, task forces:

- ♦ Oklahoma Municipal League; http://www.oml.org/.
- ♦ Various Lake Conservancy districts
- ♦ CLEAR GRAND (Grand Lake watershed association), http://cleargrand.glaok.com/About%20Us.htm

Research within governmental agencies:

- ♦ The state has created and maintains a database concerning failing systems, and tracks performance data for alternative systems; further information NA.

Research within universities:

- ♦ Dr. Brian Carter with Oklahoma State University has conducted research on soil evaluation for onsite system design (see http://pss.okstate.edu/faculty/carter/carterpi.htm) but there is no comprehensive university research program.

Onsite demonstration programs:

- ♦ Several aerobic units and rock/reed plant filters have been installed as demonstrations; further information, NA.

Training or certification programs:

- ♦ The DEQ runs a Certified Installer Program, which became mandatory in 2002 (Oklahoma DEQ 2002). Almost 700 installers have been certified through the end of 2008 (Oklahoma DEQ 2009a). Certification for installers in Oklahoma means that installers can perform pre-cover inspections on their own installations; the license is renewable annually and has a continuing education requirement (Oklahoma DEQ, 2009a).
- ♦ DEQ also certifies septage haulers, sanitarians, environmental specialists, and soil scientists (NSFC 2003); lists of certified individuals are available at the DEQ website.

Citizen action, private groups:

- ♦ The Oklahoma Certified Installers Association holds an annual education conference, and acts as a link between regulators, legislators, and onsite professionals; see http://www.ocia.s5.com/
- ♦ The Oklahoma Clean Lakes & Watersheds Association: http://www.oclwa.org/about.php
- ♦ Sierra Club

Newsletters, forums, other sources of information: NA

2.36.9 Enforcement (Q7)

The state's Environmental Complaints and Local Services Division has a strong focus on service to residents, with a clear and well-supported complaint reporting and resolution process (Oklahoma DEQ 2006 and 2007). Most complaints are resolved in less than 90 days (Oklahoma DEQ 2005).

2.36.10 Role of Cluster Systems and Package Plants (Q8)

No role was described in the original research, and no increase in interest in cluster systems was noted as of March 2009. It does appear that a common option for small communities in Oklahoma is a lagoon system, which requires an OPDES permit (see http://www.deq.state.ok.us/WQDNew/genpermits.html).

2.36.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

No interest or role was noted from electrical cooperatives or utilities in the literature reviewed to date. It appears that most onsite systems in Oklahoma receive O/M through a maintenance contract model.

2.36.12 What's Changed

Patterns
[ANM notes] Increasing emphasis on professionalism, particularly with regard to installers. The state has clearly communicated and effective complaint reporting/resolution and enforcement procedures that are nationally recognized.

Drivers
None additional noted as of March 2009.

2.36.13 References

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Oklahoma Department of Environmental Quality. 2002. Fiscal Year 2002 Annual Report, Part 5, Local Services. Report dated September, 2002. Accessed at http://www.deq.state.ok.us/mainlinks/reports/2002report/part5ecls.pdf on March 3, 2009. *Annual report on the state's environmental regulatory programs, including onsite systems regulatory programs, the state's transition to using soil characterization for system design and placement, and the transition to mandatory installer licensing.*

Oklahoma Department of Environmental Quality. 2006. Fiscal Year 2006 Annual Report, Part 6, Local Services. Report dated September, 2006. Accessed at http://www.deq.state.ok.us/pubs/ASD/ar2006/section6.pdf on March 3, 2009. *Annual report on* *the state's environmental regulatory programs, including onsite systems regulatory programs, assistance rendered to small communities and subdivisions with wastewater treatment problems, and local enforcement.*

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Oklahoma Department of Environmental Quality. 2009. On-Site Sewage Treatment System Grants. Accessed at http://www.deq.state.ok.us/eclsnew/Complaints/grants.htm on March 3, 2009. *General information about the state's grant program for repair/replacement of systems in the case of financial hardship—the program is funded through payment of other enforcement penalties.*

Oklahoma Department of Environmental Quality. 2009a. Certified Installer Program website. Accessed at http://www.deq.state.ok.us/eclsnew/install.htm on March 3, 2009. *General information about the licensed installer program, including lists of approved classes and currently certified installers.*

Oklahoma Department of Environmental Quality. 2009b. On-site Sewage Treatment System Program. Accessed at http://www.deq.state.ok.us/eclsnew/septic.htm on March 3, 2009. *Department website with general information about onsite systems in Oklahoma; also contains links to technology sheets about commonly installed types of systems in the state.*

2.37 Oregon

2.37.1 Summary

Oregon has at least half a million onsite systems in the ground, installs about 6,000 new systems a year, and repairs or replaces about half that number annually. Septic system problem areas are fairly numerous, particularly in the western portion of the state and along the coast. Some of these areas fall under "geographic rules" pertaining to more careful onsite system management, and alternative or advanced technology may be required for either new construction or remediations in these areas. The DEQ has rather broad autonomy to revise rules, and there are systematic mechanisms to authorize new technologies, many of which carry special stipulations on their operation, inspection and maintenance. The DEQ has come to recognize the sometime necessity or desirability of onsite alternatives, though DEQ continues to struggle to obtain adequate funding for the onsite systems regulatory program. Onsite professionals are required to be certified, and there is an active training program administered by Chemeketa Community College. USGS and the Oregon DEQ have collaborated on several research projects in the La Pine area of Deschutes County, where a National Decentralized Wastewater Demonstration Project has also recently been completed. There has been some academic research at Oregon State University, but there is no formal academic research program. Private entities such as the Oregon Onsite Wastewater Association are fairly active and involved.

2.37.2 Numerical Information

Total number of onsite systems: 560,000 estimated; 1990 U.S. census reports 350,000 systems.

Number of new systems installed each year: 6,000.

Failure definition: "any system that discharges untreated or incompletely treated sewage or septic tank effluent directly or indirectly onto the ground surface or into public waters or that creates a public health hazard (Oregon DEQ 2008). In Oregon, "public waters" includes groundwater (NSFC 2002).

Number or proportion of systems presently failing: NA

Number or proportion *repaired* annually: 2700 repairs, including some replacements.

Number or proportion *replaced* annually: See above.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): The repair or replacement of systems requires the system to meet new construction standards as closely as reasonably possible. Alternative treatment technologies are required at sites not meeting criteria for the standard drainfield system. Numerical data on the technologies involved are not reported by field officers, but many replacements are sand filter systems.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Disinfection is not required of any soil absorption system. Nutrient reductions are obtained with the use of sand filter treatment units or other approved alternative treatment technology (Oregon DEQ 2008). In areas with rapidly drained soils and/or areas where groundwater quality may be impacted, sand filters, pressurized distribution, or other more advanced systems may be required.

Cost of a conventional *septic system* installation: $2,000-$5,000 (Clatsop County 2006); range $2000-$14,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): Charges range from $2000-$4000, but actual costs are $15,000-$30,000 per home.

2.37.3 Present Onsite Status (Answers 2a-2f Summarized)

There are isolated, sometimes well-bounded or large, areas throughout the state that have septic problems related to antiquated systems, small lots, poor soil or hydrological conditions, or jeopardized resources, particularly groundwater. Some details: Clatsop Plains, on the very northwest coast, has a shallow aquifer in dunal sands, and has required by “geographic rule” various alternative technologies to protect groundwater. East of there, East Multnomah County had many cesspools; most of which have now been removed from service as sewers and other systems were constructed (Oregon DEQ 2009a). Also on the coast, the Alsea dunal coastal strip is marked by high-density development and a shallow aquifer and Clear Lake is marked by small lots in dunal sands; in both these areas, as in the North Florence dunal aquifer area of Lane County, “geographic rule” limits the types of systems permitted (Oregon DEQ 2008). The Santa Clara–River Road area is marked by a shallow aquifer, and has a “geographic rule” placing limitations on the mass of nitrate-nitrogen per acre per year that can be contributed to the groundwater (Oregon DEQ 2008). The Upper Basin of Deschutes River is marked by a shallow aquifer, rapidly drained soils, high lot density due to creation of subdivisions prior to statewide land-use laws; an effort there to develop a plan to protect ground- and surface water quality in conjunction with federal funding for a National Decentralized Wastewater Demonstration Project in La Pine is still underway through the demonstration project has concluded; see below.

Permits have been denied, or special systems required, because of poor drainage, thin soils, steep slopes, high water tables and wet conditions. Bacterial contamination has only rarely been reported, but in some areas nitrogen concentrations are predicted to rise to unacceptable levels as buildout continues. The most common reason for system failure in the state is cited as overuse by residents (NSFC 2002). At least half of all new development is outside of sewered areas.

Generally the public resists the extension of central facilities because of anticipated cost as well as annexation to municipalities. Public funding can be difficult to obtain, even for fixing known failures in very small communities; in the mid-1990s, the village of Monument used the ‘do-it-yourself’ approach promoted by Renssalaerville Institute’s Small Towns Environment Program to install a small lagoon system that replaced multiple failing systems (Lawton 2000).

2.37.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? The state DEQ administers and enforces onsite code, although local government entities may administer specific and limited aspects of the program under agreement with the DEQ. Even then, the DEQ provides administrative oversight to the field agents, and field offices are periodically audited for performance. (Twenty-two Oregon counties have such agreements, the remaining 14 being serviced directly by the DEQ.) Major updates in regulations occur approximately every ten years. New technologies are added to the regulations after an experimental time period, followed by technical review. Onsite enforcement is reported to be inadequate. The onsite program is funded entirely by permitting fees, which have not increased since 1998 while costs have climbed; the funding decline has resulted in reduced staffing, fewer local field office audits, and less time devoted to enforcement (Oregon DEQ 2008a).

Code was last revised in: 2008 (Oregon DEQ 2008).

New revisions in progress? To be adopted when? No revisions in process as of March 2009.

Role of legislature, regulatory agency, and politics: The Oregon Legislature has granted the DEQ (through the Environmental Quality Commission) broad authority to adopt administrative rules necessary to protect the environment and public health. The Oregon Onsite Wastewater Association continues to work with both the Legislature and the DEQ to recognize a fuller role for alternatives to central sewering.

2.37.5 Management Programs (Answers 3e-3g Summarized)

In Oregon, the state has sole authority to adopt or require maintenance/management programs (NSFC 2002). All new or repaired systems require pre-cover inspections, and time of transfer inspections are required only for systems with alternative treatment technology as of January 1, 2006 (Oregon DEQ 2006). While management utilities or districts are not yet employed, the DEQ may impose performance, operation and maintenance requirements in geographic areas thought to be in jeopardy. Such systems require operation permits and are regularly monitored, with reports submitted periodically to the DEQ through the Underground Injection Control program. All larger systems, and those with high waste strength, also fall under this regimen; there is an online database where permits and information about such systems is available (Oregon DEQ 2009a). Sand filters have been so successful that only large systems had required monitoring and maintenance, although regulations now require monitoring and maintenance of all such systems (Oregon DEQ 2008). Discussions of onsite management districts and of rural electric cooperatives managing O/M programs apparently occurred in the 1990s, but more current information NA.

2.37.6 New Technology (Answers 4a-4h Summarized)

Present code accommodates and sometimes demands the use of alternative or advanced technologies, which require a renewable operational permit, and are conditioned with operation, maintenance and reporting requirements. In particular, sand filters, recirculating gravel filters, and similar systems, may be required in locations where rapidly draining soils are present. Other permitted systems include mounds, package plants, aerobic systems (called ‘alternative treatment technologies’), capping fill, tile dewatering, pressurized distribution, evapotranspiration, and gravelless systems. As part of the La Pine Demonstration Project, a total of 40 systems representing 12 nitrogen-reducing technologies were installed and monitored for 2-3 years (Keating 2005 and text below)

Drainfield area or size reductions are allowed in code for alternative drainfield products, but these are approved based on demonstrated performance compared to standard trenches (NSFC 2002). A study comparing the failure rates of traditional trenches and gravelless (Infiltrator) chamber systems found no significant difference in failure rates between the two technologies at 3-4 years after installation (King et al. 2002). Best Available Technology may be stipulated for the remediation of older systems if they are clearly failing. There are mechanisms to authorize new technologies, but they must build a sufficient history under experimental permits to clearly demonstrate their performance, which is reviewed by a technical oversight committee (Oregon DEQ 2008).. Systems not specifically listed in the onsite rules (installation permits) can be permitted through the State Water Pollution Control Facilities permit process (operating permits) (NSFC 2002).

Cluster systems using STEP and recirculating sand filters have played a large role for several years, and their importance is expected to increase (see, for example, Eddy 2000). Package plants have not played such a role.

2.37.7 Onsite Funding (Answers 5a-5c Summarized)

There are no funding programs/mechanisms available to assist homeowners replacing failing systems or installing new systems, and there are no plans to develop such a mechanism (NSFC 2003). A financial assistance program was developed during Deschutes County's Groundwater Protection Plan process, but information on its implementation is NA.

2.37.8 Leadership and Information

State-level agencies, task forces:

- Oregon Dept of Environmental Quality, Water Quality Division, 811 SW 6th Ave, Portland, OR 97204-1390 (contact: Mr. Mike Kucinski, Program Manager, tel 541-687-7331, eml kucinski.michael@deq.state.or.us).
- The DEQ's Technical Review Committee.

Local governmental agencies, task forces:

- Local governmental representatives participate in advisory committees formed by the DEQ.

Research within governmental agencies:

- USGS conducted a study of fate and transport of pharmaceuticals and personal care products in groundwater in coordination with the La Pine Demonstration Project (Hinkle et al. 2005). The same researchers also investigated the fate and transport of nitrate and ammonium in the same groundwater system (Hinkle et al. 2007).

Research within universities:

- There is limited research at Oregon State University, though the professor primarily responsible for that research, Dr. James Moore, is now retired; see http://bioe.oregonstate.edu/Faculty/moore/index.htm.

Onsite demonstration programs:

- Deschutes County, Oregon DEQ, and the USGS collaborated on a National Decentralized Wastewater Demonstration Project in the La Pine region of Deschutes County. Beginning in 1999, the demonstration project focused on I/A technologies, nitrate reducing systems, onsite management, and groundwater/contaminant monitoring. Performance data from the systems installed during the demonstration project are available online at http://www.deq.state.or.us/wq/lapine/siterptcriteria.asp. The process and results of the demonstration project are well reported in the literature (for some recent examples, see Rich 2004 and 2004a, Rich et al 2004, 2005, and 2006).
- The demonstration project and additional modeling work by USGS have strengthened realization that changes in onsite systems management are needed in southern Deschutes County, and a Groundwater Protection Project followed on the demonstration project (see http://www.deschutes.org/cdd/gpp/. For further information, contact Barbara Rich, Program Coordinator, tel 541-617-4713, eml barbarar@co.deschutes.or.us.

Training or certification programs:

- Installers and maintenance providers are required to be certified, with renewal every three years upon completion of continuing education requirements; lists of licensed professionals are available on the DEQ website. Pumpers are also required to be licensed. See http://www.deq.state.or.us/wq/onsite/certification.htm
- Installer and maintenance provider certification is handled by Chemeketa Community College under contract; see http://www.chemeketa.edu/aboutus/locations/ted/deq.html
- The Oregon Environmental Services Advisory Council (OESAC) evaluates non-credit educational programs for continuing education and assigns CEUs; see http://www.oesac.org/.
- There is an Oregon Onsite Wastewater Training Center, POB 967, 1140 College Rd, Roseburg, OR 97470; (contact: Joel Smith , tel 928-440-4683, eml smithj@umpqua.cc.or.us).
- The Oregon Onsite Wastewater Association offers workshops to license holders and others at the training center and other locations; see below.

Citizen action, private groups:

- Oregon Onsite Wastewater Association holds an annual conference and provides training opportunities throughout the state, see http://oronsite.org/.
- There are Watershed Councils throughout the state.
- Orenco Systems, 2826 Colonial Road, Roseburg, OR 97470 (contact: Harold Ball, President; tel 541-459-4449, fax 541-459-2884; eml HBall@Orenco.com).

Newsletters, forums, other sources of information:

- The DEQ issues bulletins, maintains a website, and coordinates regional workshops throughout the state.

- The Oregon Onsite Wastewater Association has a newsletter, see http://oronsite.org/pages/news.php

2.37.9 Enforcement (Q7)

Onsite enforcement is reported to be inadequate. The onsite program is funded entirely by permitting fees, which have not increased since 1998 while costs have climbed; the funding decline has resulted in reduced staffing, fewer local field office audits, and less time devoted to enforcement (Oregon DEQ 2008a).

2.37.10 Role of Cluster Systems and Package Plants (Q8)

Cluster systems using STEP and recirculating sand filters have played a large role for several years, and their importance is expected to increase (see, for example, Eddy 2000). Package plants have not played such a role.

2.37.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

Discussions of onsite management districts and of rural electric cooperatives managing O/M programs apparently occurred in the 1990s, but more current information NA.

2.37.12 What's Changed

Patterns/Drivers: [ANM notes that] The big picture is increased professionalism, driven both by involved onsite professionals and organizations, and by the DEQ's need to involve the private sector given their funding difficulties. Overall, the major concern in Oregon related to onsite systems is nitrogen contamination of groundwater, particularly in shallow aquifers which are also used as drinking water sources.

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2.38 Pennsylvania

2.38.1 Summary

Pennsylvania has about 1.3 million systems in the ground; annually, another 12,000 are newly installed. About 4000 are repaired or replaced annually. Problems are widespread throughout the state, due to older developments with antiquated systems, mountainous terrain, thin soils, and karst geology. Several communities are under enforcement actions, and the state favors the development of sewers when feasible. Alternatives are in widespread deployment, particularly for upgrades, and there are established mechanisms for bringing new technology into general use. Many of the alternatives require annual inspection and performance evaluation. Initially the state strongly promoted management districts, and though this was not popular, a number of townships and municipalities have implemented such districts. One township assumed ownership and operation of onsite and cluster systems, and another has a management program in place for recirculating sand filters. Several others have reminder-based pumpout programs. There are established loan programs for qualifying owners to upgrade systems. The DEP itself tests and authorizes new technology, or contracts testing out. There are research and demonstration programs at several colleges. Sewage Enforcement Officers (inspectors) are trained and certified by the state; voluntary training is offered for installers; and there are several active onsite professionals' associations in the state.

2.38.2 Numerical Information

A number of performance measures are tracked for surface discharging systems, including number of permits issued, but similar measures do not appear to be tracked currently for onsite systems; see http://www.depweb.state.pa.us/watersupply/cwp/view.asp?a=1450&q=512592.

Total number of onsite systems: More than 1.3 million estimated (Day et al. 2008); 1990 U.S. Census reports 1.2 million.

Number of new systems installed each year: About 12,000; one source reports 20,000; there are over 2000 permitting entities in the state, which may contribute to the uncertainty in the numbers here and above.

Failure definition: Discharge to surface, backup, or contamination of ground- or surface water.

Number or proportion of systems presently failing: Detailed survey results in recent Act 537 plans have reported malfunction rates in the 25% to 60% range (Borland 2007). The true extent of statewide onsite system failures has not been quantified, as neither the Pennsylvania Department of Environmental Protection (DEP) nor most local governments have maintained effective record keeping systems that allow for the analysis of failure issues (Day et al. 2008).

Number or proportion *repaired* annually: Approximately 20- 25% of permits issued are for system repairs (Day et al. 2008).

Number or proportion *replaced* annually: In 2005, nearly 24 % of all repairs were for old systems that were being brought up to modern standards (Day et al. 2008)

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): From a regulatory perspective, many so-called alternative technologies are now considered conventional. Newer technologies are employed in system upgrades or repairs; permits are generally issued with varying conditions attached to them.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Less than 2%.

Cost of a conventional *septic system* installation: $2500-$20,000, depending on system type and location within the state.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $2500-$10,000, depending on location and other variables.

2.38.3 Present Onsite Status (Answers 2a-2f Summarized)

There are many, and widespread, problem areas in the state because of antiquated systems, small lots, dense development, steep slopes and poor soils. Dense development is concentrated in the southeastern portion of the state (near Philadelphia), and in the southwest (surrounding, and west and southwest of, Pittsburgh), as well as in small towns throughout the state. Both areas have soil and hydrological limitations. In fact, poor soils are widely distributed, while good soils occur only in pockets, chiefly in valleys. Soil problems (shallow soils and shale) are worse north of I-80 (roughly the northern third of the state), and in the Poconos in the east. The southwest including Pittsburgh; and the southeast including Bethlehem, Harrisburg and Philadelphia, are under development pressure with a large percentage of onsite systems, and often with nitrate problems associated with limestone soils. Centre County, along I-80, also faces development pressure.

Nitrate levels limit the installation of onsite systems in many counties with karst geology and intensive agriculture, which is generally the largest source of nitrates (Day et al. 2008).Within its Chesapeake Bay watershed, Pennsylvania recently adopted a nutrient and sediment trading policy (NSFC 2006a). While it appears that stormwater BMPs and other non-point source protection initiatives are eligible through Conservation Districts, no attempts have been made to date to include onsite management programs as eligible activities (Pennsylvania DEP, 2008c).

Several townships are presently under enforcement actions. Generally the extension or creation of central facilities is apparently the solution of choice to the DEP, particularly in the larger townships. Although this perception was previously reported to be changing, recent reports indicate otherwise; for example, a centralized system is currently proposed for portions of Karthaus Township and Pine Glen (Clearfield and Centre Counties) to serve 225 homes currently on wildcat sewers or malfunctioning onsite systems, at a construction cost of almost $10M (Mahon 2009). Meanwhile, the state's Clean Water Needs survey reported $840 Million (40%) of $2.077 Billion in wastewater treatment needs was associated with onsite system repair (Borland 2007). Centralization remains the solution of last resort to the townships themselves (see, for example, Dayton and Day 2008). In any event, much of the population increase is happening in rural areas. Central facilities are required for certain new developments. Resistance from residents is in proportion to anticipated costs.

2.38.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Individual municipal and local agencies in most cases (2000 townships), although five county health departments have the responsibility for an additional 500 townships. The state promulgates regulations, and trains, tests, and certifies Sewage Enforcement Officers (SEOs). Every municipality or local agency must hire or contract with at least one SEO, who evaluates sites and makes stipulations to the builder with respect to design. Sewage enforcement officers issue permits at the local level for conventional soil-based (on-lot) systems designed for treating under 10,000 gpd, while permits for experimental systems, community on-lot systems over 10,000 gpd, and surface discharge systems requiring NPDES permits at any scale are issued by the state (NSFC 2006). Complaint resolution for locally permitted systems is handled entirely at the local level (PA DEP, 2008f). Enforcement was previously reported to be inconsistent from local agency to local agency; current information is NA.

Code was last revised in: November, 2008 (last major revision in 1999) (Pennsylvania DEP, 2008b).

New revisions in progress? To be adopted when? Revisions currently in progress will reorganize regulations for better clarity and update requirements, including those for sewage facilities planning and permitting, reclassification of many alternate systems to conventional, and operation and maintenance needs for described technologies (NSFC 2006). The anticipated effective date for these revisions is uncertain; as of March 2009 these changes are still being considered.

Role of legislature, regulatory agency, and politics: Regulations undergo major revision only in response to new state law. New technologies may be episodically added to the regulations through amendments. Generally the legislature is aware of wastewater treatment problems.

2.38.5 Management Programs (Answers 3e-3g Summarized)

The Pennsylvania Sewage Facilities Act (Act 537) requires that all Commonwealth municipalities develop and implement comprehensive official plans that provide for the resolution of existing sewage disposal problems, provide for the future sewage disposal needs of new land development and provide for the future sewage disposal needs of the municipality (Borland 2007 and Pennsylvania DEP 2008g). All municipalities legally have such a plan, but the level of detail provided and ages of the plans vary widely, and many are not been updated in over 20 years (Day et al. 2008 and Pennsylvania DEP 2008g).

Presently, the SEO evaluates sites, carries out inspections during construction and prior to covering, and issues permits. SEOs also investigate complaints, take enforcement actions, and review development proposals for their consistency with municipal sewage facilities plans. Initially, the DEP took a firm approach to compel management programs under Act 537, including pumpout and inspection every three years for all onsite systems, but backed off in the face of public reaction. Though the management requirements have not been adopted universally, a number of municipalities and multi-local agencies have developed and implemented management programs of varying scope. A few examples: Broad Top Township, Bedford County, used state and federal subsidies to construct and assume ownership and operation/maintenance responsibility for onsite and cluster systems within the township in the mid-1990s; a detailed case study of this initiative is included in Pinkham et al 2004. Conewago Township (near Hershey) has implemented a successful management program that requires pumpouts for all onsite systems every three years (Longwell 2002). The Centre Region Council of Governments (State College area) is phasing in an inspection and pumpout program for the over 3,000 onsite systems in its jurisdiction (Joseph 2008). Carroll Valley Borough has a management program for recirculating sand filters. Several other local programs are listed below. The Pennsylvania Rural Electric Association reportedly considered a possible role in onsite management, but further information NA.

2.38.6 New Technology (Answers 4a-4h Summarized)

Pennsylvania's regulations are primarily prescriptive in nature, but performance requirements and siting methodologies are employed for a limited number of alternate system technologies (NSFC 2006). Present code accommodates, and sometimes requires, both alternate and advanced technologies, and can require the use of Best Available Technology (called Best Technical Guidance) for difficult remediations. Non-conventional systems in use include a variety of recirculating sand filters, peat-based filter systems, mound systems, package plants, aerobic systems, gravelless chambers, pressure distribution in shallow absorption areas, separation of blackwater and graywater flows, evapotranspiration beds in greenhouses, and spray irrigation (Pennsylvania DEP 2005). Small-scale surface discharging systems are allowed in Pennsylvania, but only if soil-based options cannot be feasibly implemented; these systems require a state permit, and additional guidance is available (Pennsylvania DEP 2006). The DEP tests and authorizes new technologies, or contracts to have it done. Private companies can also obtain permits to test and prove proprietary technologies. Experimental proposals must be evaluated in accordance with Chapter 73, Section 73.71 and through the Pennsylvania Experimental On-lot Wastewater Technology Verification Program (Pennsylvania DEP 2004).

Alternative or advanced technologies are permitted on sites that cannot support conventional systems, and these technologies may be tied to particular site conditions. For example, Bio-Microbic's FAST system may be required for denitrification, and Ecoflo's peat-based filter may be required for shallow soils. Certain technologies require annual inspection and performance evaluations. State regulators require an alternatives analysis for developments and municipalities which would include new technologies, but they, and their cost, would need to be justified. As the cost of advanced treatment diminishes, it could be expected that it would be more widely stipulated. Cluster (or community) systems have been allowed since 1973; the potential for more widespread use is there, but it depends on municipal acceptance, and changes in subdivision and zoning regulations; these are not assured.

2.38.7 Onsite Funding (Answers 5a-5c Summarized)

For over a decade, there has been a state low-interest loan program (PENNVEST), partially funded by Clean Water State Revolving Funds, for individual system repairs to low-income households. See http://www.pennvest.state.pa.us/pennvest/cwp/view.asp?A=4&Q=77871 or contact Mr. Lou Buffington, Pennsylvania Infrastructure Investment Authority (tel 717 787-8138, eml lbuffingto@state.pa.us).

2.38.8 Leadership and Information

State-level agencies, task forces:

- Dept of Environmental Protection (DEP), Bureau of Water Quality Protection, Division of Wastewater Management, PO Box 8774, Harrisburg, PA 17105-8774; fax 717-772-5156; contact Mr. Dana Aunkst, P.E., Chief, Division of Planning and Permits, tel 717-787-8184, eml daunkst@state.pa.us or Mr. James Novinger, Sanitarian Program Specialist, tel (717) 772-5157, eml jnovinger@state.pa.us.
- There is a DEP Sewage Advisory Committee (see http://www.depweb.state.pa.us/advcommittees/cwp/view.asp?a=1521&q=524177), and PASEO (see below) also advises the DEP.
- Sustainable Water Infrastructure Task Force (for centralized water and wastewater treatment infrastructure); see http://www.depweb.state.pa.us/watersupply/lib/watersupply/municipalfinance/taskforce/3800-bk-dep4208.pdf

Local governmental agencies, task forces:

- Broad Top Township and Carroll Valley Borough (see above).
- Other existing sewage management programs include (from Borland 2007): Maxatawny Township, Berks County; Athens Township, Bradford County; Doylestown Township, Bucks County; Blooming Valley Borough, Crawford County; Middlesex Township, Cumberland County; Washington Township, Franklin County; Lower Windsor, Springettsbury, and York Townships, York County.

Research within governmental agencies:

- DEP funds onsite research (see below).
- DEP and the Department of Conservation and Natural Resources together locate and monitor experimental technologies in state parks (see, for example, Kaintz and Snyder 2004).

Research within universities:

- Delaware Valley College has a contract with the DEP for an onsite demonstration project and research program; see http://www.dep.state.pa.us/dep/deputate/watermgt/Wqp/WQP_WM/GENERAL/delvalcoll/TOC.htm for an online report of the results of the demonstration project. For current information, please contact: Dr. Larry Hepner, tel 215-489-2334eml Lawrence.Hepner@delval.edu,
- Pennsylvania State University, Wilkes College, and University of Pittsburgh also have research programs.

Onsite demonstration programs: See above, also:

- Centerville, PA has an NODP Phase II project, where a model management district for onsite wastewater systems was established and technology (contour trenches) new to PA was tested (McKenzie 2001).
- Sustaining Greene County and the Canaan Valley Institute are collaborating on a constructed wetland demonstration system at Tally Hollow Farm, located in southwestern Pennsylvania., which will serve as a larger demonstration of sustainable

farming methods for small farmers in Greene County; see http://www.canaanvi.org/canaanvi_web/community.aspx?collection=highlighted_projects&id=705.

Training or certification programs:

- Sewage Enforcement Officers (SEOs) are required to attend pre-certification training; successfully pass a combined written and field examination, and regularly complete continuing education courses after certification (which is renewable every two years).
- Academy and continuing education training for sewage enforcement officers is available through the Pennsylvania State Association of Township Supervisors (http://www.psats.org/) and DEP. Visit the training web site at: http://www.seotraining.org/, or contact Ms. Karen Atkinson, PSATS at (717) 763-0930.
- PA DEP is obligated to provide voluntary training to sewage facility installers and list those installers who have completed training, but installers are not certified in Pennsylvania (NSFC 2006).
- Septage pumpers must be registered (see http://www.depweb.state.pa.us/watersupply/cwp/view.asp?a=1260&q=449326)
- Penn State Cooperative Extension runs educational and outreach programs and provides other resources, see http://www.abe.psu.edu/extension/factsheets/f/onlotsewageindex.htm.
- PASEO and PSMA (see below) also run periodic training courses and field trips to demonstration sites.

Citizen action, private groups:

- The Pennsylvania Association of Sewage Enforcement Officers (PASEO) is a professional association for the SEOs, holds an annual conference, and has an internal task force which advises the DEP's Water Quality/Sewage Advisory Committee: 4902 Carlisle Pike, Mechanicsburg, PA 17050, tel 717-761-8648; eml paseo1@verizon.net (Gil Longwell, Jr., Administrator), http://pa-seo.org/paseo.php?page=welcome.
- Pennsylvania Septage Management Association (PSMA) is a very active trade organization, with regular training courses, an annual conference, and involvement in legislative and legal issues related to septage management; see http://www.psma.net/.
- The Pennsylvania Rural Electric Association was considering a possible role in the management of onsite systems, but current information NA; see http://www.prea.com/Content/default.asp.
- Alliance for Chesapeake Bay.
- Audubon Society.
- Sierra Club.

Newsletters, forums, other sources of information:

- PASEO publishes a newsletter, and holds an annual conference (see above).
- PSMA holds an annual conference (see above).

2.38.9 Enforcement (Q7)

Complaint resolution for locally permitted systems is handled entirely at the local level (PA DEP, 2008f). Enforcement was previously reported to be inconsistent from local agency to local agency; current information is NA.

2.38.10 Role of Cluster Systems and Package Plants (Q8)

Cluster (or community) systems have been allowed since 1973; the potential for more widespread use is there, but it depends on municipal acceptance, and changes in subdivision and zoning regulations; these are not assured. Several recent demonstration-type projects, including the Centerville NODP Phase II project and the work in Broad Top Township, have utilized cluster systems, but it is not clear that these examples have been applied successfully in other areas of the state.

2.38.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

The Pennsylvania Rural Electric Association reportedly considered a possible role in onsite management, but further information NA. [ANM notes that] The management models in most common use in Pennsylvania appear to be contract operation for alternate, experimental, and surface-discharging systems; or municipal administration of USEPA Model 1 to 3 programs where any such program is implemented for conventional systems.

2.38.12 What's Changed

Patterns/Drivers: None additional to those described above.

2.38.13 References

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2.39 Rhode Island

2.39.1 Summary

Rhode Island has about 150,000 systems in the ground (90,000 estimated to be cesspools), installs about 800 new systems, and repairs or replaces 1000 annually. Problems are fairly widespread due to aging developments, the many lakes and ponds, and the sinuous coastline, marked by several closed shellfish beds. Mechanisms exist to authorize alternative systems with management controls on them, the use of such systems is increasing though concerns remain about permitting still denser development in sensitive areas. Nitrogen reducing systems are now required in critical resource areas, including the watersheds of the salt ponds on the southern coast. The state has had enabling legislation for onsite districts since the mid-1980s. Local management programs with additional controls are in place in several communities. Several state and local loan/grant programs for upgrades are in existence. The DEM has undertaken several research initiatives, sometimes in cooperation with the University of Rhode Island, which also runs an onsite training and demonstration center. Block Island and the Green Hill Pond watershed are the sites of a National Decentralized Wastewater Management Demonstration Project. Rhode Island currently licenses installers, inspectors, designers, and soil evaluators.

2.39.2 Numerical Information

Permits are issued for new construction, repair of existing systems, and upgrade or modification of onsite systems. Permits are issued at the State level, by the Department of Environmental Management. The numbers of permits for all conditions are tracked; contact: Ms. Linda Washington, RI DEM – OWR, 235 Promenade Street, Providence, Rhode Island 02908; (401) 222-4700 ext. 7718; (401) 222-3564 (fax); linda.washington@dem.ri.gov.

Total number of onsite systems: 150,000 (Linda Washington, RIDEM, pers. comm. May 2009)

Number of new systems installed each year: 800 (Linda Washington, RIDEM, pers. comm. May 2009)

Failure definition: “any OWTS that does not adequately treat and disperse wastewater so as to create a public or private nuisance or threat to public health or environmental quality” as evidenced by one or more of 10 conditions, including surfacing or breakout of effluent, backup into a structure, leaking tankage, or more than two pumpouts per year required (Rhode Island DEM 2008a).

Number or proportion of systems presently failing: Approximately 25%, with some estimates higher.

Number or proportion *repaired* annually: Approximately 1,000 repaired or replaced annually (Linda Washington, RIDEM, pers. comm. May 2009)

Number or proportion *replaced* annually: See above.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): About 600 per year are either alternative or advanced (Linda Washington, RIDEM, pers. comm. May 2009).

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): See above.

Cost of a conventional *septic system* installation: $5000-$9000, but $20,000 or more on problematic sites with severe constraints.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $2000-$10,000.

2.39.3 Present Onsite Status (Answers 2a-2f Summarized)

There are problem areas within the state related to dense development, failing systems (age, substandard design, inadequate maintenance), or both. Although new development pressure in this small, already heavily developed, state is not the greatest concern (in part because much of the state now has 2-5 acre zoning), the conversion of vacation homes to year-round use is causing problems around inland lakes and ponds. (Loomis et al. 2008) The use of alternative and advanced systems is increasing, particularly for upgrades and replacements on very small and difficult sites—on the one hand helping to facilitate the use of sustainable development and “smart growth” principles sought by community planners (Joubert et al, 2005), and on the other hand raising concerns about redevelopment and conversion of seasonal to year-round homes in coastal areas (see below).

Problems on the coast stem from aging dense developments, seasonal to year-round conversions, and high fecal levels in embayments used for shellfishing, as well as nitrate loading in coastal ponds. Nitrogen loading to the salt ponds along the southern coast remains a major concern, and a significant portion of nutrient loading to the ponds comes from onsite systems (see, for example, Hickey and Joubert 2003, Nixon and Buckley 2007, Loomis et al. 2008). Shellfish bed closures are estimated to cost $4 million in annual losses. Coastal areas in jeopardy include Narrow River, Bristol Harbor, Greenwich Bay, Portsmouth’s Island Park, Green Hill and Ninigret ponds, and Point Judith’s Great Salt Pond; onsite code revisions effective in 2008 require nitrogen reducing technologies and, in some cases, increased separation distances between bottom of stone and seasonal shallow groundwater, for new construction, leachfield repair (including cesspool upgrades), and alterations within the Salt Pond and Narrow River Special Area Management Plan areas (Rhode Island DEM 2008a).

There are also inland areas marked by concern over nitrate levels in private wells. The Scituate Reservoir Watershed, marked by dense tills and a high water table, will not meet code. Added wastewater controls are already in place to protect the reservoir, which supplies drinking water for 90% of the state. The Wood-Pawcatuck River Watershed has generally good water quality, but future pressures and problems are anticipated. Block Island has a sole source aquifer, and has instituted a watershed-based management program (see below).No enforcement actions underway are concerned specifically with onsite problems, but TMDLs are being developed for some of the salt ponds, and studies there do indicate significant nutrient contributions from onsite systems. .

2.39.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Rhode Island does not have local health departments. All septic system permitting and pre-cover inspection is conducted by the Rhode Island Department of Environmental Management (DEM).

Code was last revised in: 2008 (Rhode Island DEM 2008a). Technical changes include higher performance standards for septic systems in salt pond watersheds and on small lots with drinking water wells (see below).

New revisions in progress? To be adopted when? Revisions are often in progress by way of amendments; however, none are currently being actively debated.

Role of legislature, regulatory agency, and politics: Past history has shown a basically supportive legislature.

2.39.5 Management Programs (Answers 3e-3g Summarized)

There are areas in Rhode Island where systems are being systematically remediated, and critical resource areas (such as shellfish beds) where special technological or management requirements are now being emplaced. The issue remains complicated and controversial: debate continues over whether critical resource areas are sufficiently protected by other land use tools that discourage or limit development. Advanced technology may permit denser development than otherwise, bringing with it other nonpoint impacts which could negate or exceed the added benefit of special onsite technology.

Rhode Island passed enabling legislation for municipalities to establish onsite wastewater management districts in 1987, although such districts are not required. Certification letters for approved technologies specify O&M provisions, and applications for systems incorporating a Department-approved innovative or alternative technology requiring special operation and maintenance procedures must include a maintenance contract (Loomis 2004, NSFC 2006, and see New Technology, below).The first community to establish a district was Narragansett in 1994, where a mandatory four-year pumpout program was established (Chateauneuf 2002).

As of 2002, eight communities had adopted onsite management program ordinances, and 21 (78% of unsewered communities) had completed wastewater planning processes under grants issued by RIDEM (Chateauneuf 2002). In Charlestown and Westerly, programs were implemented out of concern for coastal pond quality, in South Kingston out of concern for water quality and overdevelopment, and in Block Island out of concern for nitrate loading of its sole-source aquifer. Block Island's watershed-based plan, carried out with federal funding, calls for treatment standards, and inspection, monitoring, maintenance, and evaluation, with denitrifying systems and/or enhanced pathogen removal in critical resource areas (Adler and Ottenheimer 2005, Grenoble 2006). Charlestown and South Kingstown, in the Green Hill Pond and Ninigret Pond watersheds, both have implemented programs that include cesspool phase-out, inspection of all systems on a prioritized basis, and town-level record keeping (Adler and Ottenheimer 2005; Grenoble 2006). Jamestown's inspection and management program is administered using a web-based database (Grenoble 2006a). Tiverton, has enacted a tight onsite ordinance to protect Stafford Pond, a public drinking water supply. The Town of Glocester developed and implemented a demonstration project that used alternative technologies to upgrade systems serving multi-family and commercial properties on particularly difficult sites in a historic mill village (Joubert and Loomis 2005, Loomis et al. 2005).

Researchers and planners in Rhode Island have made significant efforts to integrate land use and wastewater/nutrient management planning efforts; including the development and application of a GIS-based pollution risk assessment tool called MANAGE (Joubert et al. 2004, Joubert et al. 2005, URI Water Quality Program 2006). In addition, URI Cooperative Extension has compiled a useful resource on existing management programs in Rhode Island, based on the outcomes of the EPA Block Island/Green Hill Pond National Decentralized Wastewater Management Project:
http://www.uri.edu/ce/wq/RESOURCES/wastewater/RI_Towns/index.htm.

2.39.6 New Technology (Answers 4a-4h Summarized)

Mechanisms to test and authorize new technology at the state level have been in place for over a decade (Chateauneuf 2002). Over twenty types of I/A technology have been approved, including Bioclere, Indrain, Infiltrator, Norweco, Orenco, Waterloo Biofilter, RUCK, PuraFlo peat filters, Nitrex, mound, intermittent and recirculating sand filters, shallow narrow drainfields, and pressure dosing (RI DEM, 2008). Shallow narrow drainfields and bottomless sand filters are used only after pre-treatment, and are a solution of choice for very small lots or in critical resource areas (Loomis et al. 2006). Present code accommodates alternative and advanced systems, and provides for periodic oversight, but management of systems after installation falls to local municipalities; Rhode Island DEM does not have a legislative mandate to establish management programs of its own.

Regulations governing onsite systems in Rhode Island are generally prescriptive (NSFC 2006). However, recent changes to RI’s rules require nitrogen-reducing systems in critical resource areas (coastal salt ponds or river system watersheds) (RI DEM 2008a). For a system to be approved as a nitrogen reduction technology in Rhode Island, the technology must be capable of producing “final effluent” (before soil treatment or dispersal) with a concentration of ≤ 19 mg/L total nitrogen, and must achieve s a 50% or greater total nitrogen reduction (RI DEM 2008a, Loomis et al. 2008). Prior to the adoption of the state code, Block Island (New Shoreham) had a performance based local ordinance that established two treatment zones as a function of a property’s proximity to sensitive areas; the T1 zone allows conventional systems, while the T2 zone requires advanced treatment (NSFC 2006). This ordinance is currently being updated to conform with the 2008 revisions to state code.

2.39.7 Onsite Funding (Answers 5a-5c Summarized)

State Revolving Funds (SRF) makes loans available to municipalities which have DEM-approved Wastewater Management Ordinances (NSFC 2006). The municipality in turn makes low interest loans to the homeowner for repair/replacement of failing systems (NSFC 2006). The SRF program does not have income restrictions; several other state programs are also available for limited-income recipients, including Community Development Block Grants and USDA Rural Development 504 grants and loans (Loomis 2004). Tax credits and other innovative means of encouraging onsite system repairs and upgrades have been discussed from time to time, but thus far none have been implemented (Chateauneuf 2002).

The city of Warwick operates a 60/40 loan/grant program for the upgrade or replacement of single family onsite systems.

2.39.8 Leadership and Information

State-level agencies, task forces:

- R.I. DEM has undertaken several initiatives, sometimes jointly with URI (see below). These include targeted enforcement projects in sensitive areas; establishment of a loan program to finance upgrades; funding of seed initiatives to establish onsite districts, development of an inspection manual; and coordination and funding of research and training programs. (Contact Div Groundwater and OWTS, OWTS Section, 235 Promenade St, Providence, RI 02908; Ms. Deb Knauss, Senior Environmental Planner or Mr. Ernie Panciera, Principal Environmental Scientist, tel (401) 222-4700, ext. 7612 or ext. 7603 (respectively), eml dknauss@dem.state.ri.us or epancier@dem.state.ri.us.
- The OWTS Technical Review Committee reviews all I/A applications and makes recommendations to RI DEM based on their findings

Local governmental agencies, task forces:

- Town of Charlestown: http://www.charlestownri.org/index.asp?Type=B_BASIC&SEC={57BE787A-1F23-406A-906B-4FBC5BCACF34}
- Town of Glocester: http://www.glocesterri.org/wastewater.htm
- Town of Jamestown: http://www.jamestownri.net/pw/wwm/
- Town of Shoreham (Block Island): http://www.town.new-shoreham.ri.us/displaydept.cfm?id=18
- Town of South Kingstown: http://www.southkingstownri.com/code/pubsvc_owm.cfm
- See text above for other communities that have started special programs.

Research within governmental agencies:

- On contract, see below.

Research within universities:

- URI Cooperative Extension (contacts below) has done research on a variety of denitrifying systems and on management programs; see http://www.uri.edu/ce/wq/OWT/Research/index.htm for a summary list of related projects.
- The URI Graduate School of Oceanography also conducts research relevant to onsite systems (see, for example, Nixon and Buckley 2007, Masterson et al. 2007).

Onsite demonstration programs:

- R.I. DEM has funded several demonstration projects in the 1990s including recirculating sand filters, waterloo biofilters, shallow drip irrigation systems, and a community STEP system.
- The Block Island and Green Hill Pond watershed management plans both contain well-reported demonstration components (see, for example, Loomis et al. 2002, 2002a, and 2005, Hildebrant 2006). .

Training or certification programs:

- R.I. licenses onsite professionals including septic system installers, inspectors, designers and soil evaluators (RI DEM 2009), There is a continuing education requirement for designers and soil evaluators; all licenses are renewable every three years (NSFC 2006 and RI DEM 2008a).
- URI Onsite Wastewater Training Program: URI Cooperative Extension-Water Quality Program, Natural Resource Science, 135 Woodward Hall, 9 East Alumni Ave, Suite 5, Kingston, RI 02881; http://www.uri.edu/ce/wq/OWT/index.htm. (Contact George Loomis/David Kalen, tel 401-874-5950, fax 401-874-4561).
- There is an Onsite Training Center at URI, as part of their training programs described above, with above-ground installations of several technologies; see http://www.uri.edu/ce/wq/OWT/OWTCenter/index.htm and Hildebrant 2006.

Citizen action, private groups:

- Ocean Ridge Civic Association (Green Hill Pond Watershed).
- Several other communities have groups working on onsite issues, further details, NA.

Newsletters, forums, other sources of information:

- URI Cooperative Extension runs a series of workshops (in addition to those through the training center described above) for a variety of clientele.
- RI DEM has an e-mail notification list, see http://www.dem.ri.gov/programs/benviron/water/permits/isds/index.htm#list
- See the towns mentioned above that have created, or are considering, management districts.

2.39.9 Enforcement (Q7)

See above.

2.39.10 Role of Cluster Systems and Package Plants (Q8)

[ANM notes that] the role of cluster systems in Rhode Island appears to be relatively small at this time. Even in very closely developed village and coastal settings, the focus for unsewered areas has been on on-lot solutions rather than communal ones with municipal or RME ownership. There are cluster systems that serve commercial multi-building developments with lease tenants, but in these cases the land is under single ownership.

2.39.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

[ANM notes that] In Rhode Island, programs for ensuring O&M are administered by municipalities, through their boards of health (or through public works departments). No role for electrical cooperatives is envisioned; the current regulatory structure could allow for municipal utility management of onsite systems, but municipalities currently use a contracted maintenance provider model and there appears to be little incentive for this to change.

2.39.12 What's Changed

Patterns/Drivers: None additional to those described above.

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Rhode Island Department of Environmental Management. 2008a. Rules and Regulations Establishing Minimum Standards Relating to Location, Design, Construction and Maintenance of Individual Sewage Disposal Systems. Effective January 1, 2008. Accessed at http://www.dem.ri.gov/pubs/regs/regs/water/owts08.pdf on March 11, 2009. *Current regulations pertaining to onsite systems in Rhode Island.*

Rhode Island Department of Environmental Management. 2009. Onsite Professionals Licensing webpage. Page updated January 21, 2009. accessed at http://www.dem.ri.gov/programs/benviron/water/licenses/isds/index.htm on March 11, 2009.

Information about licensing, testing, and training opportunities for onsite professionals in Rhode Island.

University of Rhode Island, Water quality Program. 2006. Pollution Risk Assessment Methods: The MANAGE Method. Page updated Accessed at http://www.uri.edu/ce/wq/NEMO/Tools/pollution_assessment.htm#manage on March 11, 2009. *Summary of the MANAGE method, with links to supporting information.*

2.40 South Carolina

2.40.1 Summary

South Carolina has about 1,000,000 systems in the ground. How many are repaired or replaced each year is not known, but about 25,000 per year are installed. Problem areas are generally found in the middle of the state (poor permeability), and along the coast (wetness and shallow water table being particular problems). However, South Carolina's focus is on the totality of nonpoint pollution control, with septic systems believed to contribute only 5% to the total load. For permitted alternative systems periodic maintenance or oversight are not required under the code; however, pre-treatment and advanced treatment are not provided for in the code. Several individual communities are considering or have established voluntary local programs for periodic inspection and maintenance. Generally, when density warrants it, the state prefers the creation or extension of sewer service, and absent maintenance entities does not favor the widespread use of new technology. There no state-wide programs for financial assistance for system repairs or replacements. All professionals who evaluate sites and approve permits undergo state-level certification, as do installers and pumpers. There is little in the way of state or university research, but there is an active onsite professionals' association.

2.40.2 Numerical Information

Total number of onsite systems: 1,000,000; 1990 U.S. census reports about 578,000 systems.

Number of new systems installed each year: 25,000 or more (South Carolina DHEC 2009).

Failure definition: "An onsite wastewater system that is discharging effluent in an improper manner or has ceased to function properly" (South Carolina DHEC 2008).

Number or proportion of systems presently failing: Conventional systems that have been in operation for more than 5-6 years fail at a rate of about 6-7%, while the failure rates for various alternative systems range from 3-22%. Common reasons cited for failure were high water table, poor permeability, shallow soils. Not all failures are due to hydraulics or siting; one survey indicated that physical damage to systems (vehicle overpasses, broken components) accounted for more than half the failures. Lack of proper maintenance was recently cited as the most common reason for system failure in the state (NSFC 2006). It is estimated that during a cold, wet winter and spring 10-20% of all systems will fail, that percentage dropping with warmer, drier weather.

Number or proportion *repaired* annually: NA

Number or proportion *replaced* annually: NA

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): NA

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Less than 1%.

Cost of a conventional *septic system* installation: \$1800-\$3700; range \$650-\$12,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): Rates range from \$500 to \$12,000 per tap, averaging \$750-\$1500. Monthly fees average \$25 or \$30.

2.40.3 Present Onsite Status (Answers 2a-2f Summarized)

There are problem areas with aging septic systems installed prior to current standards; most if not all cesspools have been replaced with modern systems or connections to central sewers. Problem areas are generally found in the middle portion of the state, and on the coastal plain; coastal areas in particular are experiencing continued development pressure, with much growth occurring outside of sewered areas (Hajjar et al. 2006). South Carolina's focus is on understanding and controlling all sources of nonpoint pollution, of which septic systems are believed to contribute only 5% of the total load. As regards septic systems, the contaminant of most interest is fecal coliform, although concerns about nitrogen loading are increasing. South Carolina DHEC conducted a pilot project in 2006 using remote sensing techniques to identify non-point sources of fecal coliform, such as malfunctioning onsite systems, which might be contributing to the closure of shellfish bed areas (NOAA 2006). Resource concerns include drinking water supplies as well as commercial and recreational use of fresh and coastal waters.

Whether alternative technology would be more widely employed as cost diminished would depend on the management and maintenance scenario. Homeowners, on their own, are not expected to be capable of managing advanced technology. Were such technologies promoted or demanded by a management entity that also saw to their regular oversight, that would lower overall cost in itself, as well as create demand.

2.40.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? State regulations (Dept of Health and Environmental Control, DHEC) are implemented by county health departments. The health departments are extensions of the state agency, and enforcement is regarded as both adequate and uniform across the state.

Code was last revised in: 2008 (South Carolina DHEC 2008).

New revisions in progress? To be adopted when? The revisions that became effective in 2008 were the first since 1986, and the entire text of the older regulation was re-written to incorporate numerous changes in design and installation technology and practices (South Carolina Legislature 2008). Review and comment on proposed changes are held in a public forum, and licensed contractors and septage haulers are notified by memo or newsletter as required.

Role of legislature, regulatory agency, and politics: It is the general reaction of the public to resist new legislation that increases public or private costs. There is no predicting how the General Assembly will react to proposed changes.

2.40.5 Management Programs (Answers 3e-3g Summarized)

Throughout the state there is some degree of need to remediate older systems, but not necessarily systematically, and there is a statewide effort to educate the public to the need for regular maintenance. South Carolina code does not require management contracts or districts to monitor or maintain onsite systems or individual septic disposal systems (NSFC 2006). Recent code revisions state that shared systems now must be owned and managed by public entities (see below). A few coastal communities, on their own, are considering local ordinances to require periodic maintenance or establish management entities; their discussions are encouraged by the state. The DHEC Office of Ocean and Coastal Resource Management (OCRM) has been conducting onsite septic system management pilot projects and, ultimately, developing educational tools for coastal areas of the state as a result of the need for an approved Coastal Nonpoint Pollution Control Program (Hajjar et al. 2006). The toolkit is available at http://www.scdhec.gov/environment/ocrm/plan_tech/septic_system_management.htm. In addition, several communities in the Sewee to Santee region (near Charlestown) received help from the NODP staff of the National Environmental Service Center to raise awareness, conduct surveys, and eventually help a pilot community through a needs and feasibility decision-making process for both water supply and wastewater treatment systems (McKenzie 2006).

There are no reports of interest by utilities in operating O/M programs.

2.40.6 New Technology (Answers 4a-4h Summarized)

Alternative systems are required for sites that are unsuitable for conventional systems, although not all sites are suitable even with approved alternatives. For alternative systems that have been permitted, periodic maintenance or oversight is not required under current regulations. ‘Alternative’, in South Carolina, refers entirely to dispersal technology; there are no provisions in the code for pretreatment or advanced treatment (South Carolina DHEC 2008). Current regulations require that failing systems be repaired, even if the measures taken do not conform to current standards. This is not the same thing, however, as expecting every family to purchase “Best Available Technology”; more typically the local board will do “the best that it can,” given the site and the resources of the household. Package plants are discouraged for residential subdivisions.

The state’s subdivision regulations require connection to public water and wastewater systems if such facilities exist, and set out requirements for subdivisions that use onsite systems for wastewater treatment, but make no specific provision for the use of cluster systems to serve such subdivisions (South Carolina DHEC 2004). However, the recent onsite code update clearly defines both privately owned large systems and cluster systems and emphasizes that cluster systems need “some form of common ownership and management [to] be established and approved by the Department” (South Carolina DHEC 2008). The regulation stipulates that a viable public entity must own the system and be responsible for its operation, maintenance and replacement (South Carolina DHEC 2008).

2.40.7 Onsite Funding (Answers 5a-5c Summarized)

No funding or financing options are available to individual homeowners for the repair or replacement of failing or malfunctioning systems or for new construction (NSFC 2006). In limited circumstances, public money has been made available to low-income families in need of repairs or replacement of failing systems.

2.40.8 Leadership and Information

State-level agencies, task forces:

- The Dept of Health and Environmental Control periodically re-examines its requirements relative to onsite systems. (Contact: Mr. Leonard Gordon, Director or Mr. Lawrence (Bob) Roberts, Environmental Health Manager, S.C. Dept of Health and Environmental Control, Onsite Wastewater Management Branch, 2600 Bull St., Columbia, SC 29201; tel 803-896-0641; eml GordonLa@Columb72.dhec.state.sc.us or RobertLw@Columb72.dhec.state.sc.us, respectively).

Local governmental agencies, task forces: NA

Research within governmental agencies: NA.

Research within universities:

- The University of South Carolina has conducted limited research at various times in the past; current information is NA.

Onsite demonstration programs:

- Two constructed wetland systems were installed in the early 1990s, but have not been properly maintained by their owners. For additional information, contact: Mr. Keith Cain, Coordinator, East Piedmont Resource Conservation and Development Council, 414-A South Congress St., Winnsboro, SC 29180, tel (803) 635-2757.

Training or certification programs:

- All persons responsible for evaluating sites, and approving permits undergo department certification. There is also a program in development at state level to ensure continued program competency and consistency in practice (South Carolina DHEC 2009).
- Contractors (installers) and pumpers are required to be licensed (South Carolina DHEC 2002). The license is renewable annually; there is no continuing education requirement in the regulation.
- New licensure regulations were proposed in 2007 to implement a tiered licensing program for onsite wastewater system contractors, but these changes had not been enacted as of March 2009 (South Carolina Legislature 2008a).

Citizen action, private groups:

- The Beaufort County Clean Water Task Force continues to examine the onsite issue, and has advocated in the past for a county ordinance more restrictive than state regulation. Current activities, however, appear more geared toward other non-point sources of pollution such as stormwater runoff; see http://www.townofbluffton.com/link.php?link=epa@home.
- Carolina Onsite Wastewater Recycling Association, see http://www.carolinaonsite.org/
- South Carolina Rural Water Association (primarily for rural water and wastewater utilities), see http://www.scrwa.org/index.htm

Newsletters, forums, other sources of information:

- The Carolina Onsite Wastewater Recycling Association occasionally publishes a newsletter.

2.40.9 Enforcement (Q7)

See above; enforcement is generally considered to be adequate.

2.40.10 Role of Cluster Systems and Package Plants (Q8)

Package plants are not encouraged for residential subdivisions. However, the recent onsite code update clearly defines both privately owned large systems and cluster systems and emphasizes that cluster systems need “some form of common ownership and management [to] be established and approved by the Department” (South Carolina DHEC 2008). The regulation stipulates that a viable public entity must own the system and be responsible for its operation, maintenance and replacement (South Carolina DHEC 2008).

2.40.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

No interest was noted from utilities or electric cooperatives as of March 2009;

2.40.12 What’s Changed

Patterns
[ANM notes] Increased professionalism as evidenced by licensing for installers and pumpers; the drivers behind the clear inclusion of managed cluster systems as separate from large privately owned systems in new rule are not clear, but they indicate significant change in state of knowledge in the state as compared to previous state code.

Drivers
[ANM notes] Continued development pressure in the coastal area of South Carolina is driving concern about the impacts of that development on shellfisheries and water quality in general; however, concern remains focused on all nonpoint sources of pollution, not only on onsite systems.

2.40.13 References

Hajjar, Lisa, Josh Boulware, Dan Burger, Calvin B. Sawyer, and Clifton H. Roberts. 2006. Educational tools to advance onsite management in coastal South Carolina. Presented at the *NOWRA 15th Annual Technical Education Conference and Exposition*, Denver, Colorado, August 28-31, 2006. *Description of the development, sometimes at the grassroots level, of ordinances, inspection training courses, and other management tools for onsite systems in coastal areas of South Carolina.*

NOAA Coastal Services Center. 2006. Identifying Non-Point Sources of Fecal Coliform. Accessed at www.csc.noaa.gov/crs/rs_apps/issues/septic.htm on March 13, 2009. *Results of a pilot study to use remote sensing in the identification of illicit discharges, such as sewer cross-connections and failing onsite systems, in areas where shellfish beds are closed due to fecal coliform contamination.*

McKenzie, Caigan. 2006. Preserving natural character while planning for a community's future. Small Flows Quarterly 7(2): 12-15. Accessed at http://www.nesc.wvu.edu/pdf/ww/publications/smallflows/magazine/SFQ_SP06.pdf on March 12, 2009. *The Sewee to Santee region (near Charlestown) received help from the NODP staff of the National Environmental Service Center to raise awareness, conduct surveys, and eventually help a pilot community through a needs and feasibility decision-making process for both water supply and wastewater treatment systems. The region has economic difficulties, but the people value their rural setting and wish to preserve it.*

National Small Flows Clearinghouse. 2006. South Carolina Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/SouthCarolina.pdf on March 11, 2009. *This short document summarizes onsite wastewater system regulations and activities in South Carolina.*

South Carolina Department of Health and Environmental Control. 2002. Regulation 61-56-1, License to Construct or Clean Onsite Sewage Treatment and Disposal Systems and Self-Contained Toilets. Effective July 1, 2002. Accessed at http://www.scdhec.gov/administration/regs/docs/61-56-1.pdf on March 13, 2009. *Current regulation governing the licensing of installers and pumpers in South Carolina. Does not include revisions proposed in 2007-08.*

South Carolina Department of Health and Environmental Control. 2004. Regulation 61-57, Development of Subdivision Water Supply and Sewage Treatment/Disposal Systems. Effective April 23, 2004. Accessed at http://www.scdhec.gov/administration/regs/docs/61-57.pdf on March 13, 2009. *Current subdivision regulation for South Carolina; requires connection to public water and wastewater service if available and sets out requirements for individual onsite systems on lots in new subdivisions, but makes no provision for cluster systems as a viable option.*

South Carolina Department of Health and Environmental Control. 2008. Regulation 61-56, Onsite Wastewater Systems. Effective May 23, 2008. Accessed at http://www.scdhec.gov/administration/regs/docs/61-56.pdf on March 13, 2009. *Current regulation governing the permitting and construction of onsite systems in South Carolina.*

South Carolina Department of Health and Environmental Control. 2009. Environmental Health – Onsite Wastewater (Septic Tank and Drainfield) webpage. Accessed at http://www.scdhec.gov/health/envhlth/onsite_wastewater/ on March 13, 2009. *Web site with general information about South Carolina's regulatory programs related to onsite systems, including contractor and pumper licensing information.*

South Carolina Legislature. 2008. Regulation and legislative status for Individual Sewage Treatment and Disposal Systems Rules. South Carolina Register 31(9), document no. 3154. Accessed at http://www.scstatehouse.net/regs/3154.doc on March 12, 2009. *State register document with timeline for rule adoption, discussion of changes, and text of new rule as adopted.*

South Carolina Legislature. 2008a. New Regulation to Address Licensure of Onsite Wastewater System Contractors. South Carolina Register 31(9), no document number. *State register document with description of changes and request for comment.*

2.41 South Dakota

2.41.1 Summary

South Dakota has about 80,000 systems in the ground. Figures on new installations, repairs and replacements were not available. The cities are sewered; elsewhere populations are sparse. Alternative systems are permitted case by case by the state. Mound systems are permitted to deal with high water tables or shallow bedrock, but their use is not widespread; and problems with onsite discharges are not thought to be serious. There are no loan programs for upgrades. At least one county is contemplating an operating-permit based management program for onsite systems, but special management measures are not contemplated at the state level. There are no research or demonstration projects. There are certification programs for inspectors and installers, but details on training programs, if any, were not available.

2.41.2 Numerical Information

Total number of onsite systems: 1990 U.S. census reports about 80,000 systems.

Number of new systems installed each year: NA

Failure definition: Backup, surfacing of effluent, pollution of ground- or surface water.

Number or proportion of systems presently failing: NA

Number or proportion *repaired* annually: NA

Number or proportion *replaced* annually: NA

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Very few alternative systems are in use other than mounds, and those are rare as well; DENR (which reviews all alternative systems) only sees about ten applications per year for mound systems.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): None.

Cost of a conventional *septic system* installation: $2500-$3000 for conventional; range $1800-$15,000; higher for mounds and other alternatives (Minnehaha County 2009).

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $500 and up.

2.41.3 Present Onsite Status (Answers 2a-2f Summarized)

Problems with onsite systems are few and isolated. Problems that do arise are related to shallow groundwater (especially in the eastern half of the state), poor soils, and shallow bedrock or steep slopes in the Black Hills. In general, it is the western area of the state, particularly the southwest, that is growing, especially along I-90. For much of the state, water tables are deeper than 100 feet. No communities are reported as being under enforcement actions. Sewering is supported in the cities, but most of the state is sparsely enough populated that sewering is not an option. Onsite wastewater treatment is reported not to be a pressing concern; in a few areas, malfunctioning onsite systems are being replaced either by connection to existing central sewers or by construction of new facilities (South Dakota DENR 2008).

2.41.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Code is made at state level, and in some cases administered by county or city health or planning and zoning departments; otherwise, oversight falls to the DENR. All rules and regulations apply statewide, but can become more stringent at the local level without the state's approval (NSFC 2004). Alternative systems are reviewed by the state DENR. Enforcement is reported to be adequate, but variable.

Code was last revised in: 1997 (minor revisions).

New revisions in progress? To be adopted when? Regulations are updated on an "as needed" basis; no revisions are planned (NSFC 2004).

Role of legislature, regulatory agency, and politics: Legislative adoption is required for major changes, which would be supported if well justified.

2.41.5 Management Programs (Answers 3e-3g Summarized)

South Dakota Code does recognize management programs/contracts or districts to monitor and maintain onsite systems; however, individual homeowners cannot be required to have such monitoring of maintenance, so mechanical treatment systems are not allowed (NSFC 2004). Only commercial or multifamily installations presently require plan review. Systems exceeding 7,500 gpd or serving multiple properties can be required to have maintenance/management contracts (NSFC 2004). Remediations may require Best Available Technology. At state level, no areas or types of development are targeted for special measures, and no onsite management entities are contemplated. Nevertheless, new development and some densely developed older areas might benefit from such measures, and Pennington County is considering the adoption of an operating-permit based inspection program (see below). There is no current interest in managing O/M districts on the part of electric cooperatives or utilities.

2.41.6 New Technology (Answers 4a-4h Summarized)

Code accommodates I/A technologies as experimental systems, which are approved directly on a case-by-case basis by the state. Their use can enable development not otherwise possible. Nevertheless, such systems are not in widespread use. Permitted alternatives include aerobic treatment systems, evapotranspiration systems, mounds, and gravelless systems. It is thought that there is not much need or demand for I/A technologies, although mound systems are coming into some use in areas with high water tables, or shallow bedrock, e.g., in the Black Hills (western South Dakota). Package plants and cluster systems play only a moderate role, but any new dense subdivision (with lots of less than 20,000 square feet each) requires central sewage treatment, so the role of package plants can be expected to grow.

2.41.7 Onsite Funding (Answers 5a-5c Summarized)

There are no state level betterment loan programs for upgrades, and none are contemplated (NSFC 2004). Individual counties sometimes have programs for qualifying homeowners; they are viewed favorably.

2.41.8 Leadership and Information

State-level agencies, task forces:

- South Dakota Dept of Environment and Natural Resources, Div Environmental Services, Joe Foss Bldg, 523 E Capital, Pierre, SD 57501 (contact: Mr. Scott Hipple, Environmental Project Scientist, tel 605-773-3351, eml scott.hipple@state.sd.us).

Local governmental agencies, task forces:

- Meade County has a local ordinance that requires site evaluation and regular maintenance, including pumpout every three years; see http://www.meadecounty.org/
- Pennington County is drafting a local ordinance which, if approved, will require all systems to be inspected and pumped every four years; see http://www.co.pennington.sd.us/planning/docs/SepticOrdinanceJan09.pdf.
- Lawrence County was considering onsite issues in the 1990s, but the county has now ceded onsite permitting authority to South Dakota DENR; see http://www.lawrence.sd.us/environm.htm.

Research within governmental agencies: None.

Research within universities:

- No research, although South Dakota State University has sponsored onsite system workshops and prepared written materials for system owners.

Onsite demonstration programs: None.

Training or certification programs:

- All inspectors are required to be certified (NSFC 2004).
- Installers are required to be certified (South Dakota DENR 2009); though there is no continuing education requirement and little training appears to be available.

Citizen action, private groups:

- Various groups are involved in watershed planning, further details NA.

Newsletters, forums, other sources of information:

- The South Dakota State University Extension Program publishes bulletins and other informational resources; see http://abe.sdstate.edu/page_e.cfm?page=Natural%20Resources.

2.41.9 Enforcement (Q7)

Code is in some cases administered by county or city health or planning and zoning departments; otherwise, oversight falls to the DENR. Enforcement was previously reported to be adequate, but variable; current information is NA.

2.41.10 Role of Cluster Systems and Package Plants (Q8)

Systems exceeding 7,500 gpd or serving multiple properties can be required to have maintenance/management contracts (NSFC 2004). Package plants and cluster systems play only a moderate role, but any new dense subdivision (with lots of less than 20,000 square feet each) requires central sewage treatment, so the role of package plants can be expected to grow.

2.41.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

There is no current interest in managing O/M districts on the part of electric cooperatives or utilities.

2.41.12 What's Changed

Patterns/Drivers: None additional to those noted above.

2.41.13 References

Minnehaha County Planning and Zoning. 2009. Wastewater Information (Septic Systems), Questions and Answers. Accessed at http://www.minnehahacounty.org/dept/pl/septic_system/05faqs.aspx on March 13, 2009. *A list of frequently asked questions, including information about costs for current installations in South Dakota.*

National Small Flows Clearinghouse. 2004. South Dakota Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/SouthDakota.pdf on March 13, 2009. *This short document summarizes onsite wastewater system regulations and activities in South Dakota.*

South Dakota Department of Environment and Natural Resources. 1997. Individual and Small On-Site Wastewater Systems, Chapter 74:53:01. Effective April 30, 1997. Accessed at http://legis.state.sd.us/rules/DisplayRule.aspx?Rule=74%3A53%3A01 on March 13, 2009. *Current regulation governing onsite systems in South Dakota.*

South Dakota Department of Environment and Natural Resources. 2008. South Dakota Clean Water State Revolving Fund, Fiscal Year 2009 Intended Use Plan. Department report dated June 26, 2008. Accessed at http://denr.sd.gov/dfta/wwf/cwsrf/09CWSRFIUP.pdf on March 13, 2009. *Current Intended Use Plan and Project Priority List for CWSRF funding in South Dakota. The Priority List indicates three relatively small projects where onsite systems are being connected to central sewer or where small collection and treatment systems are being constructed.*

South Dakota Department of Environment and Natural Resources. 2009. Septic tank Systems webpage. Page updated February 4, 2009. Accessed at http://denr.sd.gov/des/sw/septic.aspx on

March 13, 2009. *General information about current regulations and regulatory activities, as well as information about installer certification and lists of currently licensed installers.*

2.42 Tennessee

2.42.1 Summary

Tennessee had about 780,000 systems in the ground in 1990. Estimated figures on installations since that time were not available. About 6000 repairs or replacements are made annually. With many nonconforming systems, mountainous terrain, shallow bedrock, and karst topography, problems with contamination of surface and ground waters are widespread, if small in scale. Code accommodates alternative systems, but they are not in widespread use; a current regulatory proposal has the potential to greatly increase the use of advanced treatment for individual onsite systems. There are limited, local cost-share programs for upgrades. No special management measures are contemplated for conventional onsite systems; however, RME-managed cluster systems have become the solution of choice for providing wastewater service to new developments outside sewered areas. Installers, pumpers, and soil scientists require certification by the state. There is a research program and training center at the University of Tennessee, and there is a state onsite professionals' association.

2.42.2 Numerical Information

Total number of onsite systems: From 1990 U.S. census, approximately 780,000.

Number of new systems installed each year: NA

Failure definition: Overt surface discharge, backup into residence, or clear public health hazard; or any system proven to be contaminating groundwater (NSFC 2002).

Number or proportion of systems presently failing: NA

Number or proportion *repaired* annually: About 6000 repaired or replaced.

Number or proportion *replaced* annually: See above.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): A small percentage involve alternatives such as low pressure pipe, mounds, and gravelless trenches, but most will be replaced by conventional ISDSs.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): NA

Cost of a conventional *septic system* installation: About $3,500; range $1000-$10,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): Estimated at $1000-$2000(?).

2.42.3 Present Onsite Status (Answers 2a-2f Summarized)

There are presently many "pockets" of problem areas in the state. For years systems were blasted into solid rock. While the practice is no longer permitted, existing systems have caused groundwater contamination in several areas. There are also extensive areas in Tennessee with steep slopes, poor or shallow soils, and karst topography. The most common reasons for system failure include poor installation/construction, lack of proper maintenance, faulty or inadequate site evaluation, and inadequately sized system based on soil properties (NSFC 2002). Likewise, there are areas under development pressure with similar conditions. Eastern Tennessee is marked by many small systems, often substandard. In the Smoky Mountain area in particular, there is an attempt to balance growth with environmental and resource conservation, but the mountains make sewering costly and onsite systems more attractive in spite of poor onsite conditions. Growth in central Tennessee (around Nashville) and eastern Tennessee (around Knoxville) is occurring mainly outside sewered areas and in many cases is being accommodated by cluster systems (Buchanan 2008). Many rural areas are also shy on expertise and funding.

2.42.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Within the Tennessee Department of Environment and Conservation, the division of Ground Water Protection (GWP) and the division of Water Pollution Control (WPC) are both responsible for promulgating and enforcing wastewater regulations. GWP is the state agency responsible for subsurface sewage disposal, while WPC is responsible for municipal-scale sewage systems, and can issue operating permits (Buchanan 2007). City and county health departments enforce statewide regulations for onsite systems. All enforcement actions undertaken by the state are well-documented and are accessible to the public at http://www.state.tn.us/environment/enforcement/index.shtml.

Code was last revised in: 2006 (Tennessee DEC 2006).

New revisions in progress? To be adopted when? Generally there are revisions approximately every year. Revisions to allow advanced treatment systems with drip dispersal, to be managed on an operating permit basis by licensed maintenance providers, are currently under consideration (Tennessee DEC 2008).

Role of legislature, regulatory agency, and politics: Political support or its absence would depend on the terms of any future code revisions.

2.42.5 Management Programs (Answers 3e-3g Summarized)

There are presently no systematic remediation or management programs for conventional onsite systems in the state. Tennessee State Code requires management contracts or management districts to monitor/maintain onsite systems or individual septic disposal systems only in limited circumstances for systems with advanced treatment (NSFC 2002).

Cluster systems with subsurface drip dispersal have, in the last decade, become an increasingly common means of accommodating new development outside sewered areas in Tennessee. Only three operating permits for such systems were issued in 1999, but 62 were issued in 2006, 84 were issued in 2007--and the numbers are expected to keep increasing for the foreseeable future, particularly around Nashville and Knoxville (O'Dette 2008). Many of these cluster

systems are owned and operated by publicly regulated, privately owned utility companies such as Tennessee Wastewater Systems (Wasson 2006). Though such systems are a successful means of accommodating growth outside of sewered areas, the costs of providing such service can be on par with those of centralized systems (Carey 2009).
Increasing application of decentralized concept technologies and management in Tennessee has resulted in regulatory uncertainty--neither regulatory agency with responsibility for wastewater could permit both the treatment unit processes (contained within secondary treatment operations) and the subsurface discharge (using subsurface drip dispersal) being applied (Buchanan 2007). A committee has been working to develop uniform design criteria for decentralized wastewater systems and establish a reasonable division of labor between the DEC’s Groundwater Protection and Water Pollution Control divisions, and revised guidelines for site evaluation and for design of such systems were recently released (Buchanan 2007, O’Dette 2008).

2.42.6 New Technology (Answers 4a-4h Summarized)

The present code accommodates alternative and innovative systems under a state-level testing and certification program. There is no written provision for advanced or enhanced treatment, but it may be allowed on a case-by-case basis. Alternatives presently employed include conventional gravel, large diameter gravelless pipe, chambers, low-pressure pipe, elevated sand mounds, and oxidation lagoons (NSFC 2002). In 2000, rule changes allowed advanced treatment systems meeting NSF Standard 41 to be used in conjunction with approved disposal fields with up to 40% size reductions, only in those counties with approved wastewater authorities (NSFC 2002).

Significant revisions to the onsite systems rules are currently proposed, which would allow the use of small-scale advanced treatment systems followed by drip dispersal on individual lots, to be managed through the use of certified maintenance providers through an operating-permit model (Tennessee DEC 2008)

2.42.7 Onsite Funding (Answers 5a-5c Summarized)

No state-level funding program exists to assist homeowners either replacing an individual failing system or installing a new one, nor are there plans to develop such a mechanism (NSFC 2002). However, Section 319(h) grant funds will be used to pay for repairs failing systems in the Bullrun Creek Watershed on a cost share basis; the amount of cost share will be based on the homeowner’s Average Gross Income (AGI) with rates ranging from 50% to 90% (Bullrun Creek Watershed Initiative 2007).

2.42.8 Leadership and Information

State-level agencies, task forces:

- Division of Ground Water Protection, Tennessee Dept of Environment and Conservation, Tenth Floor L&C Tower, 401 Church St, Nashville, TN 37243. (Contact: Dan E. Hoover, Environmental Program Manager, tel 615-532-0772. eml Dan.Hoover@state.tn.us)
- Tennessee Valley Authority, 6001 Trotwood Ave, Columbia, TN 38401. (Contact: Ms. Leanne Whitehead, Water/wastewater Specialist, tel 931-380-8032, fax 931-380-8008; eml lawhiteh@tva.gov); see http://www.tva.gov/

Local governmental agencies, task forces: NA

Research within governmental agencies: Not at present.

Research within universities:
- ♦ The University of Tennessee has an active research program, see below.

Onsite demonstration programs:
- ♦ The University of Tennessee has a demonstration and training center, see below.

Training or certification programs:
- ♦ Onsite installers, soil consultants, and pumpers require certification by the state; there is no continuing education requirement (Tennessee DEC 2006).
- ♦ The Center for Decentralized Wastewater Management, at the University of Tennessee's Institute of Agriculture, has a staffed applied research lab and a premier onsite wastewater training center; see http://onsite.tennessee.edu/ or contact John Buchanan, tel (865) 974-7266, eml jbuchan7@utk.edu

Citizen action, private groups:
- ♦ Tennessee Onsite Wastewater Assn (TOWA) holds an annual educational conference and publishes a newsletter; see http://onsite.tennessee.edu/TOWA.htm or contact Tom Petty, Past President, tel 615-299-9725);.

Newsletters, forums, other sources of information:
- ♦ TOWA publishes a periodic newsletter, see above.
- ♦ The Water Quality Forum (Knoxville area) publishes a quarterly newsletter on a variety of nonpoint source issues; http://www.waterqualityforum.org/default.asp

2.42.9 Enforcement (Q7)

See above.

2.42.10 Role of Cluster Systems and Package Plants (Q8)

Cluster systems with subsurface drip dispersal have, in the last decade, become an increasingly common means of accommodating new development outside sewered areas in Tennessee. Only three operating permits for such systems were issued in 1999, but 62 were issued in 2006, 84 were issued in 2007--and the numbers are expected to keep increasing for the foreseeable future, particularly around Nashville and Knoxville (O'Dette 2008). Many of these cluster systems are owned and operated by publicly regulated, privately owned utility companies such as Tennessee Wastewater Systems (Wasson 2006). Though such systems are a successful means of accommodating growth outside of sewered areas, the costs of providing such service can be on par with those of centralized systems (Carey 2009).

2.42.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

No interest from any entity was observed for the implementation of management programs for conventional onsite systems. Both municipal utility authorities (such as the Rutherford County CUD, see http://www.cudrc.com/dept_wastewater.html) and privately owned, publicly regulated utility companies such as Tennessee Wastewater Systems (see above) are actively involved in the ownership, operation, and management of cluster systems in the state.

2.42.12 What's Changed

Patterns
[ANM notes] Increased professionalism, as denoted by certification programs for most onsite professionals and the development of university research programs and training centers devoted to onsite wastewater treatment topics; major changes to the regulatory environment around cluster systems, including the development of publicly regulated, privately owned utilities that own and manage such systems.

Drivers
[ANM notes that] The primary driver in Tennessee appears to be the accommodation of development pressure, particularly in exurban areas where centralized sewer service cannot be provided and, indeed, where such service is not expected to reach in the future.

O'Dette (2008) makes note that while subdivisions served by cluster systems are advantageous to developers, the systems are enabling population growth at a rate faster than other needed infrastructure (roads, schools, etc.) can support. "This has become a dilemma for regulators because as long as the water environment and public health is not likely to be impacted, SOPs for these systems will be issued. While the regulatory community empathizes with those concerned about the problems with too rapid growth, the solution to the problem lies with the local communities and their planning and zoning authorities" (O'Dette 2008).

2.42.13 References

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Bullrun Creek Watershed Initiative. 2007. Bullrun Creek Watershed Newsletter, November 2007. Accessed at http://216.119.90.50/asp/pdf/septic2008Bullrun.pdf on March 16, 2009. *Newsletter about watershed protection activities, including information about septic system maintenance and announcement of a new cost share program for repairing onsite systems in the watershed.*

Carey, Clay. 2009. Sewage company wants to raise rates up to 70%. *The Tennessean*, January 24, 2009. Accessed at http://www.tennessean.com/article/20090124/news01/901240344/1006/news01 on March 16, 2009. *Newspaper article about proposed rate increase for Tennessee Wastewater Systems' managed cluster systems.*

National Small Flows Clearinghouse. 2002. Tennessee Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/Tennessee.pdf on March 16, 2009. *This short document summarizes onsite wastewater system regulations and activities in Tennessee.*
O'Dette, Robert G. 2008. On-Site (Drip Dispersal) Systems In Tennessee. In *NOWRA 17th Annual Technical Education Conference & Exposition* (Memphis, Tennessee, April 2008. *Background on how the increasing use of managed cluster systems with drip dispersal is requiring changes to the regulatory system and design standards in Tennessee, and how the regulatory agencies are responding to that change.*

Tennessee Department of Environment and Conservation. 2006. Regulations to Govern Subsurface Sewage Disposal Systems, Chapter 1200-1-6. Effective January 2006. Accessed at http://www.state.tn.us/sos/rules/1200/1200-01/1200-01-06.pdf on March 16, 2009.

Tennessee Department of Environment and Conservation, Groundwater Protection Division. 2008. Position Paper Supporting 2008 Proposed Rule Change (1200-1-6) For Advanced Treatment Systems, Drip Disposal, And Maintenance Provider Certification. Department paper dated September 2008. Accessed at http://www.state.tn.us/environment/gwp/ppo/policypaper_atsdd.pdf on March 16, 2009. *Policy paper stating the background for proposed changes, and research/deliberation conducted to support changes, including the results of an informal survey conducted of regulatory programs in other states where such systems are currently permitted with varying degrees of management.*

Wasson, Carol. 2006. Cluster Treatment Systems: the Smart-Growth Approach. *Onsite Water Treatment*, September-October 2006. Accessed at http://www.forester.net/ow_0609_cluster.html on March 16, 2009. *Discussion of the use of managed cluster systems as sustainable and responsible wastewater treatment infrastructure, with case examples including Adenus Wastewater Solutions in Tennessee.*

2.43 Texas

2.43.1 Summary

Texas has about 1.8 million systems in the ground, and installs another 42,600 per year. Figures for annual replacements or repairs were not available. Problem areas scattered throughout the state. East Texas is low, wet and marked by clayey soils. Outside of the sewered cities, coastal areas and the Rio Grande Valley are marked by small lots, antiquated systems and marginal soils. There are major concerns about protection of the Edwards Aquifer, which is a karst aquifer, and there is extensive karst geology in the area of Austin-San Antonio-Rocksprings and outlying rural areas. Code accommodates ANSI-NSF certified alternative systems, each permitted with specific limitations and criteria for testing and monitoring, as well as a maintenance contract. Aerobic systems are in widespread use; implementation of new regulations in 1997 resulted in a significant increase in the permitting of aerobic units followed by chlorination and spray irrigation. Enforcement of the operation and maintenance of these systems has been problematic, though efforts are underway to improve oversight of maintenance providers. There are limited loan programs for upgrades. Site evaluators, installers and inspectors are certified by the state. State research is funded through an Onsite Wastewater Treatment Research Council; there are research and demonstration programs at two universities; and there is an active Texas Onsite Wastewater Association.

2.43.2 Numerical Information

Total number of onsite systems: 1990 U.S. census reports 1.27 million. Applications for new construction have been tracked at the state level since 1991; permits issued have been tracked by technology since about 1994 (Texas CEQ 2008a). About 500,000 additional systems installed between commencement of state-level tracking and the end of 2006, the latest year for which a complete report was available.

Number of new systems installed each year: on average, 42,600 (Texas CEQ 2008a).

Failure definition: Hydraulic failure (surfacing effluent) or inadequate treatment resulting in contamination of surface- or groundwater.

Number or proportion of systems presently failing: 13% on average; as high as 19% in the eastern portion of the state (Reed, Stowe, and Yanke 2001).

Number or proportion *repaired* annually: NA

Number or proportion *replaced* annually: NA

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Efforts are underway to collect this sort of information, but at present it is not systematically available. In east Texas, marked by tight clayey soils, 20-30% of new systems are reported to be alternative. Statewide, in recent years, half of new systems involve spray irrigation (Texas CEQ 2008a).

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Systematic information is NA, but aerobic systems and spray irrigation systems with disinfection are reported to be commonly used in some areas.

Cost of a conventional *septic system* installation: $2000-$6000, according to Texas A&M fact sheets and recent newspaper articles such as http://www.scrippsnews.com/node/39398, range $3000-$24,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): NA

2.43.3 Present Onsite Status (Answers 2a-2f Summarized)

The state has significant variability in climatic conditions, ranging from very dry to very wet, and from year-round semitropical to severely "temperate". This has significant implications for the types of systems likely to be most successful. Generally, areas most threatened by physiographic or hydrological conditions are located in the eastern portion of the state where poor soils predominate. These problems are worsening with development pressure outside of sewered areas. Some specifics: the northeast, including Dallas/Fort Worth, is marked by clay soils and heavy rainfall. Aerobic systems are in widespread use. The Gulf coast, including Houston, is marked by increasing development, small lots, marginal soils, and above-average rainfall. The southwest, along and north of the Chihuahua and Rio Grande rivers, is marked by historically small lots, few water and sewer hookups, and a wide variety of soils. A few colonias along the Texas/Mexico border have taken advantage of the Small Towns Environment Program to install sewer lines, and a number of state and federal programs are available to help implement improvements to sanitation in these areas, but problems remain (MacKenzie 2002, Stiles 2003).

Reasons cited for failures include poor soils, neglect/lack of homeowner education, seasonal wetness and heavy rains; the main reason, however, is antiquated systems and cesspools. Under new code, focus in the state is on assuring that soil and hydraulic conditions are adequate to handle the proposed system; however, a lack of effective enforcement, adequate property owner education, and lack of records continue to result in chronically malfunctioning systems (Reed, Stowe, and Yank 2001). Generally the extension or creation of central facilities is supported by regulators and the public, when and if conditions so warrant.

2.43.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Code is made at the state level by the Texas Commission on Environmental Quality (Texas CEQ), and administered by designated local authorities, which may include county, city, or district health departments, public works departments, or river authorities. Generally enforcement is regarded as inadequate; the industry organization, TOWA, continues to press for greater accountability and stiffer enforcement. Information about current enforcement activities is available at http://www.tceq.state.tx.us/compliance/compliance_support/regulatory/ossf/10381.html.

Code was last revised in: 2008. Revisions implemented in 2008 address homeowner maintenance of ATUs; develop a new licensing and registration program for maintenance

providers; and address definitions, ownership requirements, and utility regulations relating to cluster systems (Texas CEQ 2008b).
New revisions in progress? To be adopted when? No revisions are in progress as of March 2009.

Role of legislature, regulatory agency, and politics: While rules are created by the Texas Commission on Environmental Quality, the legislature has an active role in the process.

2.43.5 Management Programs (Answers 3e-3g Summarized)

State code requires management programs for any system that has been permitted to maintain secondary quality effluent; these systems must have an ongoing maintenance contract with a valid maintenance company (Lesikar 2004, NSFC 2006). Alternative systems receive operating permits with specific maintenance conditions. Enforcement is left to demonstrated homeowners' contracts with licensed installers; inspections are required at the time of title transfer. However, enforcement remains inadequate, expectations and contract requirements are not clearly defined, and homeowners do not perceive the value of having a maintenance contract (Lesikar 2004). The Texas Onsite Wastewater Association is offering a Certified Maintenance Provider program, and the state is now implementing a mandatory licensing program for maintenance providers (Lesikar 2004, Texas CEQ 2008).

In 2007, a new state statute allowed rural residents to maintain their own systems instead of relying on service companies to inspect them three times a year; additionally, homeowners no longer have to file periodic county reports to prove that the systems are working properly (Dayton 2008). Local entities have the authority to require more stringent requirements than state rules (NSFC 2006), and some counties, including Dallas, Denton, and Ellis in North Texas, promptly passed local rules to override the state guidelines (Dayton 2008).

Harris County, the most populated county in Texas, has long kept records about the management and performance of ATUs and other onsite systems in the county (NSFC 2000, Jensen 2001). The county recently implemented a web-based tracking program to help insure that the over 12,000 systems with surface application within its jurisdiction are maintained (Blount 2007).

In Williamson County, north of Austin, health officials require the installation of control components that shut off pumps if sufficient chlorine is not present to ensure adequate disinfection of effluent (Jensen 2000).

2.43.6 New Technology (Answers 4a-4h Summarized)

Code accommodates and may require alternative systems in order to meet minimum criteria, or to permit development on otherwise unsuitable sites. All alternatives certified by an ANSI-NSF accredited laboratory are permitted. Each I/A technology is permitted with specific limitations or design criteria, and specific requirements for testing and monitoring of use. Permitted systems include sand filters, mounds, package plants, aerobic systems, evapotranspiration beds, leaching chambers, low pressure dosing, constructed wetlands, subsurface drip distribution, gravelless pipe, chamber and spray distribution; a complete listing is available (Texas CEQ 2009). Remediation does not require BAT, but must, given soil and flow conditions, meet minimum criteria. Alternative systems require a maintenance contract and, depending on type, may require effluent monitoring. Aerobic systems are in widespread use in east Texas. In areas around Austin, with little topsoil, aerobic systems and drip distribution are widely used; success has been reported in replacing existing conventional systems with advanced treatment and drip dispersal for difficult flows such as those from restaurants (Vere 2007). Since the state began to systematically collect data on the types of new systems installed, the number of conventional system installations has declined (from about 20,500 per year in 1996 to about 8,000 in 2006), while the number of surface application systems has increased (from about 5,000 per year in 1996 to 19-20,000 per year in 1999-2006) (Texas CEQ 2008a).

Cluster systems are in limited use, but ownership problems associated with them, and the operational costs associated with package plants, result in these not being popular choices. Such systems in Texas require an EPA model 4 or 5 responsible management entity, but until quite recently, were not allowed to be permitted through Texas' onsite systems regulations (Lesikar 2004). Recent rule changes to clarify terminology and ownership issues related to cluster systems may result in increased use of these systems (Texas CEQ 2008b).

2.43.7 Onsite Funding (Answers 5a-5c Summarized)

There are limited loan programs (Texas Housing Authority and Texas Water Development Board, USDA Rural Development) to help low-income homeowners with repair and upgrade of onsite systems, but SRF funds are not involved (Jensen 2001a, NSFC 2006).

2.43.8 Leadership and Information

State-level agencies, task forces:

- Texas Commission on Environmental Quality (TCEQ), POB 13087, Austin, TX 78711; tel 512-239-2150. (contact: Mr. James McCaine, Engineering Specialist , eml jmccaine@tceq.state.tx.us).

Local governmental agencies, task forces:

- Harris County (see above): http://www.hcphes.org/eph/
- The Houston-Galveston Area Council of Governments has organized an advisory group to educate decision-makers on their options; they also conduct educational site visits; see http://www.h-gac.com/community/water/default.aspx.
- The City of Austin conducted an Alternative Wastewater Management Project in the late 1990s to investigate managing cluster systems or other decentralized infrastructure instead of continuing to expand sewers (see http://www.ci.austin.tx.us/wri/faq.htm), but nothing was implemented (Etnier et al. 2007).

Research within governmental agencies:

- $10.00 of every septic system permit issued goes to the governor-appointed Texas Onsite Wastewater Treatment Research Council; see http://www.towtrc.state.tx.us/. The Council decides what projects to fund; presently the emphasis is on land application systems and intermittent dosing to improve nutrient reduction.

Research within universities:

- Texas A&M has a research program which has evaluated constructed wetlands, subsurface drip distribution, and nutrient and pathogen removal (see, for example, Lesikar 2003); http://ossf.tamu.edu/; (contact: Bruce Lesikar, Texas Agricultural Ext Service, 205 Scoates Hall, College Station, TX 77843; tel 409-845-7451, fax 409-847-8828, eml b-lesikar@tamu.edu.)
- Baylor University has a research program; (contact: Dudley Burton Chair, Dept Environmental Studies, Baylor University, POB 97266, Waco, TX 76798; tel 254-710-3405; eml dudley_burton@baylor.edu.)

Onsite demonstration programs:

- The U.S. EPA 319(h) program has been used to fund demonstration systems located at individual residences throughout the state; further information is NA.
- The Lower Colorado River Authority does have authority to regulate onsite systems along the river northwest of Austin, but is not currently conducting or supporting research or demonstration projects; see http://www.lcra.org/water/quality/oss/index.html.

Training or certification programs:

- The following certifications are administered by the TCEQ: Apprentice, Site Evaluator, Installer I and II, Designated Representative, Maintenance Provider, and Maintenance Company (NSFC 2006, Texas CEQ 2008b). Licensing was first implemented for most of these fields in 1997; an 8-hr per year continuing education requirement was implemented for license renewal in August of 1999. Maintenance provider certification is being phased in during 2009, after an initial attempt at certification was rescinded (Texas CEQ 2008b). Several "hands-on" training/demonstration centers exist, including:
  - South Texas International Onsite Wastewater Treatment Training Center, 2515 E. Hwy 83, Weslaco, TX, 78596; contact: John Drawe, tel 956-968-5585.
  - Intl Wastewater Treatment Training Center, Texas Agricultural Extension Service, 1030 North Azragosa, Ste A, El Paso, TX 79907; contact: Raymond Bader, tel 915-859-7725.
  - Texas Onsite Wastewater Treatment Training Center, Texas Agricultural Extension Service, 205 Scoates Hall, Texas A&M, College Station, TX 77843; contact: Bruce Lesikar, tel 409-845-7453.
- With the exception of Maintenance Provider courses, certification classes are provided by Texas Engineering Extension Service (at Texas A&M): http://www.teex.org/teex-third.cfm?area=EU&templateid=251

Citizen action, private groups:

- Texas Onsite Wastewater Association (TOWA), see http://www.txowa.org/index.html.

Newsletters, forums, other sources of information:

- "Texas Onsite Insight" is published bimonthly by the Texas Onsite Wastewater Treatment Research Council: http://www.towtrc.state.tx.us/newsletter.php; the Council also holds an annual conference.
- TOWA publishes a quarterly newsletter, the "TOWA Insider", available at the website listed above and hosts a separate annual conference.

- Texas Agricultural Extension Service has developed a variety of fact sheets on various onsite technologies, which can be obtained through their website as well.

2.43.9 Enforcement (Q7)

Enforcement remains inadequate, particularly for systems where maintenance contracts are supposedly required (see above). Expectations and contract requirements are not clearly defined, and homeowners do not perceive the value of having a maintenance contract (Lesikar 2004).

2.43.10 Role of Cluster Systems and Package Plants (Q8)

Cluster systems are in limited use, but ownership problems associated with them, and the operational costs associated with package plants, result in these not being popular choices. Such systems in Texas require an EPA model 4 or 5 responsible management entity, but until quite recently, were not allowed to be permitted through Texas' onsite systems regulations (Lesikar 2004). Recent rule changes to clarify terminology and ownership issues related to cluster systems may result in increased use of these systems (Texas CEQ 2008b).

2.43.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

No interest from rural electrical cooperatives noted as of March 2009. The City of Austin did briefly consider utilizing decentralized strategies, including cluster systems or managing existing onsite systems, but that effort was abandoned; see Etnier et al. 2007.

2.43.12 What's Changed

Patterns / Drivers

[ANM notes that] Difficult site conditions coupled with development pressure seemed to drive the regulatory changes in the late 1990s, which resulted in the installation of significant numbers of aerobic treatment units with disinfection and spray irrigation dispersal. However, management—particularly enforcement of the in-rule and permit requirements for management—has lagged, and as a result landowners do not see the benefit of management, as reflected in the 2007 regulatory changes allowing homeowners to maintain their own systems in some areas of the state.

2.43.13 References

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Jensen, Ric. 2000. Texas Environmental Health District Begins Automated Chlorination Program for ATUs. *Small Flows Quarterly*,1(4): 9. Accessed at http://www.nesc.wvu.edu/pdf/ww/publications/smallflows/magazine/SFQ_FA00.pdf on March 17, 2009. *Short article about Williamson County and Cities Health District's requirement that all aerobic units with disinfection be outfitted with a device that measures the level of chlorination tablets and shuts down the system if effluent is not being adequately disinfected.*

Jensen, Ric. 2001. Harris County, Texas, Engineer's Office Evaluates Field Performance of Low-Pressure Dosing Systems. *Small Flows Quarterly* 2(1): 6. Accessed at http://www.nesc.wvu.edu/pdf/ww/publications/smallflows/magazine/SFQ_WI01.pdf on March 17, 2009. *Short article about the results of field inspections for low-pressure systems in the county; the findings of this evaluation were used to update guidelines for designing and installing such systems.*

Jensen, Ric. 2001a. Resources to Replace On-Site Wastewater Treatment Systems in Texas. TWRI Fact Sheet dated June 2001. Accessed at http://towtrc.tamu.edu/reports/2001/2001-001/sr2001-001.pdf on March 17, 2009. *Information about funding programs available to communities and homeowners for onsite system replacement or repair.*

Lesikar, Bruce, and Suresh D. Pillai. 2003. Removal and Fate of Specific Microbial Pathogens within On-Site Wastewater Treatment Systems. Report Prepared for the Texas On-Site Wastewater Treatment Research Council, dated May 2003. *Results of a research effort to compare use of a sand filter, a submerged flow constructed wetland and an aerobic treatment unit to remove bacterial and viral pathogens from wastewater streams.*

Lesikar, Bruce. 2004. O&M Program in Texas. In *NEHA 68th Annual Educational Conference (AEC) & Exhibition*, Anchorage, Alaska, May 9-12, 2004. *PowerPoint presentation about operation and maintenance requirements for onsite systems with secondary treatment and/or surface dispersal in Texas, as well as the continuing challenges that the state faces in making sure that maintenance is performed.*

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17, 2009. *Short article on a performance study completed by staff in Harris County, Texas. The study found that, if properly maintained, most of the units installed in the county would perform consistently within the standard and similar to those tested by NSF.*

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Reed, Stowe, and Yank, LLC. 2001. Study to determine the magnitude of, and reasons for, chronically malfunctioning onsite sewage facility systems in Texas. Report prepared for the Texas On-Site Wastewater Treatment Research Council by Reed, Stowe, and Yank, LLC, September 2001. *Results of research into the causes of chronic malfunction of OSSFs in Texas.*

Stiles, Nikki. 2003. Colonia residents take STEPs to improve their community. *Small Flows Quarterly* 4(1): 20-22. *Case study of the involvement of the Small Towns Environment Program in installing sewer connections in several colonias in southern Texas, where undersized and malfunctioning septic systems are a particular problem.*

Texas Commission on Environmental Quality. 2008. Title 30 Texas Administration Code Chapter 285 Onsite Sewage Facilities. Effective September 11, 2008. Accessed at http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=4&ti=30&pt=1&ch=285 on March 16, 2009.

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Texas Commission on Environmental Quality. 2008b. Commission approval for proposed rule-making, Onsite Sewage Facilities (OSSFs), Chapter 285, and Occupational Licenses and Registrations, Chapter 30, Docket No. 2008-0048-RUL, interoffice memorandum dated February 29, 2008. *Rulemaking memo describing proposed changes to the current onsite rules and including the text of the proposed rule.*

Texas Commission on Environmental Quality. 2009. On-Site Sewage Facilities (Septic Systems). Page updated February 19, 2009. accessed at http://www.tceq.state.tx.us/nav/permits/on-site.html on March 17, 2009. *General information about onsite systems and permitting activities in the state of Texas; also includes links to information about onsite professionals' licensing.*

Vere, Henry. 2007. The best little BBQ OWT in Texas. *Onsite Water Treatment*, March-April 2007. Accessed at http://www.onsitewater.com/ow_0703_best.html on March 17, 2009. *Case study about a new onsite system for a difficult, high-strength flow in the Austin, Texas area.*

2.44 Utah

2.44.1 Summary

Utah has about 120,000 systems in the ground, installs another 3400 per year, and repairs or replaces about 150 annually. Sewer extensions are supported in the cities; however, development is increasingly moving into rural areas and into areas where site conditions are more difficult, and there is continued concern that development in unsewered areas will bring problems. Alternative technologies are allowed on a case-by-case basis, with inspection and maintenance requirements, and only in areas where the local authorities are approved to issue permits for alternate systems; they are not in widespread use. There are loan programs for upgrades, with some potential for grants, at the state level, but only for limited-income households. There is limited government or university research, but there is an active training and demonstration center at Utah State University. Onsite professionals are required to be certified, and there is a Utah Onsite Wastewater Association.

2.44.2 Numerical Information

Permits issued within Utah are not tracked (NSFC 2006).

Total number of onsite systems: 120,000 estimated; 1990 U.S. census reports 65,000; about 15% of the state's population or ~322,500 individuals in 2000 (Bhayani 2003).

Number of new systems installed each year: 3300-3500.

Failure definition: "an onsite wastewater system which is not functioning in compliance with the requirements of this regulation and includes, but is not limited to, the following: Absorption systems which seep or flow to the surface of the ground or into waters of the state; systems which have overflow from any of their components; systems which, due to failure to operate in accordance with their designed operation, cause backflow into any portion of a building plumbing system; systems discharging effluent which does not comply with applicable effluent discharge standards; leaking septic tanks" (Utah DWQ 2009).

Number or proportion of systems presently failing: several hundred estimated (per annum).

Number or proportion *repaired* annually: 70 estimated.

Number or proportion *replaced* annually: 30-150 estimated.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Virtually none.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Virtually none.

Cost of a conventional *septic system* installation: $2000-$3000, range $1200-$6000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $5000.

2.44.3 Present Onsite Status (Answers 2a-2f Summarized)

Presently there are only a few problem areas (albeit some of them large) due to dense development and failing systems. Counties most at risk include Weber, Summit, Wasatch and Washington. Unsuitable or thin soils and shallow groundwater, as they may relate to nitrate or other chemical pollution of surface- or groundwater, are the main concerns. Freshwater supplies in Utah are limited and must be kept free from contamination from untreated or poorly treated wastewater discharges (Sims 2005). Rural populations are expanding in many areas of the state, with new developments being constructed in areas that can only be served by onsite systems (Sims 2005). Appropriate alternate technologies that, if properly sited, designed, installed, and managed, can accommodate growth in these areas, are being cautiously considered in the state (Sims 2005 and text below).

Failures have been attributed to shallow groundwater, age, inadequate maintenance, poor installation, poor soils, and undersizing or overloading. However, there are many more potentially critical resource areas with unsuitable hydrology or soils that with future development (much of it outside of sewer districts) could become problems. System permits have been denied because of high water tables, impermeable soils, steep slopes, and shallow bedrock or rock ledges. Generally the state supports the extension or creation of central sewers when density comes to warrant it. It is also, however, thought that as the drought in the western United States continues, interest in and use of small-scale wastewater treatment technologies that result in groundwater recharge or provide for beneficial reuse will increase if such technologies are allowed (Sims 2005).

2.44.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? The state prescribes minimum code; administration and enforcement is left to local (city, county, or multi-county) health departments for systems smaller than 5000 gpd, as well as alternative systems with a state-approved plan. Larger systems are overseen directly by the state DEQ with concurrence from the local authority (NSFC 2006). All rules and regulations apply statewide and can be more stringent at the local level without state-level approval (NSFC 2006). Utah Soil Conservation Districts were previously reported to feel that enforcement is sometimes inadequate; current information is NA.

Code was last revised in: 2009 (Utah DWQ 2009).

New revisions in progress? To be adopted when? Amendments occur approximately annually; none are currently in progress.

Role of legislature, regulatory agency, and politics: Major changes must be approved by the legislature, but rules can be amended without legislative approval. In general, the legislature is in favor of assuring onsite protection, but not necessarily of paying for it at state level. The basis for the state's onsite professionals' licensing came from the legislature.

2.44.5 Management Programs (Answers 3e-3g Summarized)

Renewable permits are not required or being considered by the state with the exception of case-by-case experimental technologies, which are managed and monitored through their own state-level administrative program. Inspections of new systems are unusually complete, involving one pre-cover inspection of the tank, and two of the leachfield. Tanks may also be tested at the site for leakage.

The state's priorities include promoting voluntary or incorporable organizations (such as property owners associations or watershed protection groups) for management of conventional systems, and promoting body politic organizations and structures (such as town, city, or county municipal programs or management districts) for alternative and experimental systems first and for all systems later (Bhayani 2003). Administrative rule changes effective in 2006 made management mandatory and institutionalized, especially with regard to alternative systems (Sims 2008; Utah DWQ 2009). A local health department cannot permit alternative systems within its jurisdiction without a management plan that has been approved by DEQ (Sims 2008). Aside from the county environmental health programs with approval to permit alternative systems, there are no management programs in the State of Utah (NSFC 2006).

In Bluff, Utah, consideration of both centralized and distributed wastewater management strategies at the facility plan stage resulted in residents and decision makers in the service area determining that further consideration would be limited to the decentralized concept strategies (Venhuizen 2008).

There are no indications of interest in O/M programs by electric cooperatives or other utilities.

2.44.6 New Technology (Answers 4a-4h Summarized)

Particular heed is paid to new development, especially in critical areas. It is in this context that alternative systems are most likely to be deployed, not in remediation programs. The code accommodates and may sometimes require such systems through design standards. Alternate systems cannot be permitted until the local health department has applied and received approval from the State to administer alternative systems (NSFC 2006); as of July 2008, 11 of 29 health departments or districts in the state were authorized to permit one or more types of alternative systems, and only three local departments were authorized to permit packed-bed filters (Utah DWQ 2008). Mounds and packed-bed filters are inspected at 6-month intervals; at-grade and fill systems are inspected at 6-month to one-year intervals (Utah DWQ 2009).

Sand filters and package plants are permitted as experimental systems. The only mechanisms that exist for testing and approving new technology are protocols for the use of experimental systems. Experimental systems may be designated as an alternative system after sufficient, successful, consistent and reliable experience, and after rules governing their installation, operation and maintenance adopted (Bhayani 2003); so far, only packed bed filters have been added to the code in this fashion.

At present cluster systems and package plants play only a slight role; it is thought that this could change as development pressure opens up sites with less suitable soils.

2.44.7 Onsite Funding (Answers 5a-5c Summarized)

In Utah, SRF monies can be used to assist individual homeowners with limited incomes to repair or replace individual malfunctioning system; 0% loans are available and, in some cases, grants may be available (Utah DWQ 2009).

2.44.8 Leadership and Information

State-level agencies, task forces:

- Utah Department of Environmental Quality, Div Water Quality, POB 144870, Salt Lake City, UT 84114; (contacts Michael L. Hanson, tel 801-538-9218, fax 801-538-6016, eml mhanson@utah.gov).
- DEQ/DWQ's Local Health Department Advisory Group (formerly called the Wastewater Disposal Technical Review Committee.
- Onsite Wastewater Program Committee (Bhayani 2003).

Local governmental agencies, task forces:

- Several counties are involved in wastewater and management district issues; further information NA.

Research within governmental agencies: None.

Research within universities:

- Utah State University's (USU) Water Research Laboratory; early research topics included development of a GIS-based database system for on-site systems and investigation of source water protection (under the USGS–104 program), non-point source assessment (TMDL issues), and other watershed management tools (Utah State University 1999). Utah State University used senior environmental engineering design teams to develop demonstration training models for the Utah On-Site Wastewater Treatment Training Center (Utah State University 1999) but there do not appear to be any current research projects related to onsite wastewater issues.

Onsite demonstration programs:

- There is a demonstration and training center associated with Utah State University; see http://uwrl.usu.edu/partnerships/training/huntsman_demosite.html and below.
- Utah had two communities funded through National On-Site Demonstration Project (NODP) to investigate means of implementing management programs (Sims 2008), but further information is NA

Training or certification programs:

- The Utah Division of Water Quality requires designers, inspectors, and maintainers to be certified (NSFC 2006; Utah DWQ 2009). Certifications are renewable: Level 1 and Level 2 every five years, Level 3 every two years, by attending a refresher course provided by Training Center or other training approved by DWQ, and by submitting application to DWQ (Sims 2008).
- As of January 1, 2007, all groups have to attend recertification classes in order to maintain certification (Sims 2008).

- Installers are exempt from DWQ certification requirements, but the state contractor's exam covers onsite wastewater topics and some installers are also certified as site evaluators and/or system designers (Sims 2008).
- Onsite Training Programs are available through Utah State University, see http://uwrl.usu.edu/partnerships/training/index.html or contact Judy Sims, Utah Onsite Wastewater Treatment Training Center, Utah Water Research Laboratory, 8200 Old Main Hill, Logan, UT 84322-8400, tel (435) 797-3230, eml jlsims@cc.usu.edu.
- A fee associated with permits for new onsite systems pays for the training center and certification courses (Sims 2008).

Citizen action, private groups:

- The Utah Onsite Wastewater Association formed in ~2001 (see NSFC 2000, Sims 2008, and http://uwrl.usu.edu/partnerships/training/uowa.html).

Newsletters, forums, other sources of information:

- The USU Training Center published a newsletter in 1999-2000, see http://uwrl.usu.edu/partnerships/training/utahwatch.html; publication of the newsletter does not currently appear to be active.

2.44.9 Enforcement (Q7)

Utah Soil Conservation Districts were previously reported to feel that enforcement is sometimes inadequate; current information is NA.

2.44.10 Role of Cluster Systems and Package Plants (Q8)

Though the legal basis for constructing and managing cluster systems is clearly established in state rules and laws, at present cluster systems and package plants play only a slight role. It was previously thought that this could change as development pressure opens up sites with less suitable soils; however, current information is NA.

2.44.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

There are no indications of interest in O/M programs by electric cooperatives or other utilities.

2.44.12 What's Changed

Patterns
"Certification program has improved professionalism and knowledge of those who work with and regulate on-site wastewater treatment systems" (Sims 2008).

Drivers
"Increasing development of rural areas in Utah is resulting in demands for more options for treatment and disposal of wastewater, especially in areas not suitable for the use of the conventional septic tank – drain field system. Many of these alternative options are more complex treatment and disposal systems that require increased expertise in site evaluation, design, installation, management, operation, and maintenance. Also small communities that are facing growth pressures that impact water supply resources may be interested in decentralized

wastewater treatment technologies that provide for beneficial reuse of the wastewater" (Sims 2004).

2.44.13 References

Bhayani, Kiran. 2003. Regulatory Philosophy and Technology Transfer, Onsite Systems Program. Presented at the State Onsite Wastewater Regulators and Captains of Industry Conferences, North Las Vegas, Nevada, March 24 - 28, 2003. *PowerPoint presentation about the then-current status of onsite systems, regulations and regulatory/management activities, and the onsite professionals' training and certification program.*

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Sims, Judy. 2005. Alternative Decentralized Wastewater Treatment Systems for Utah Conditions. USGS Water Resources Research Institute report number 2004UT44B, February 2005. Accessed at http://water.usgs.gov/wrri/04grants/2004UT44B.html on March 18, 2009. *Short report on conditions that are resulting in increased demand for alternative and small community wastewater treatment systems in Utah; results of a research project to identify technologies applied in other areas of the U.S. that could be applicable to Utah's conditions.*

Sims, Judy. 2008. Partnerships and Training to Advance Decentralized System Management: The Utah Certification Program. Presented at the *6th Biennial Southwest On-Site Wastewater Conference*, Bullhead City, Arizona, January 30-31, 2008. Accessed at http://wastewater2008.com/Documents/4%20%20Utah%20Certification%20Program.pdf on March 18, 2009. *PowerPoint presentation about the history and accomplishments of Utah's certification programs for onsite professionals.*

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Utah Division of Water Quality. 2008. Alternative onsite systems per R317-4 by county or health district. Updated July 2008. Accessed at http://www.waterquality.utah.gov/Onsite/Alternative_System_by_county_chart.pdf on March 18, 2009. *Listing by county or health district of those counties which are authorized to permit alternative onsite systems.*

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Utah State University. 1999. Utah On-Site Wastewater Treatment Training Program: Intermountain States On-Site Wastewater Treatment Forum, July 27-28, 1999. Accessed at http://uwrl.usu.edu/partnerships/training/ForumSum.htm on March 18, 2009. *Summary of a forum held at the Utah State University campus in 1999, where representatives from the intermountain states met to discuss coordination, needs, and current activities related to onsite systems in the respective states.*

Utah State University. 2009. Utah On-Site Wastewater Treatment Training Program. Page updated January 9, 2009. Accessed at http://uwrl.usu.edu/partnerships/training/index.html on March 18, 2009. *Current information about the state's onsite training programs and annual educational conference.*

Venhuizen, David. 2008. Bluff, Utah – Distributed Wastewater Management Concepts Prove Superior, In *NOWRA 17th Annual Technical Education Conference & Exposition Proceedings*, Memphis, Tennessee, April 2008.

2.45 Vermont

2.45.1 Summary

Numbers were not available on the number of systems in the ground. Annually, about 3,000 new systems are installed and 1,500 repaired or replaced. Large areas of the state have problems with aging and nonconforming systems, as well as with the mountainous terrain, and other soil or hydrological conditions. In 2007, regulations were updated to require permits for all new construction, subdivisions, and repairs/replacements; systems installed prior to 2007 are 'grandfathered'. Several communities are under enforcement actions. A process exists for allowing new alternative technologies, and use of such systems is increasing. Interest in and implementation of onsite management districts remains localized. There are no state-wide loan programs for upgrades, and no state or academic research. There is an onsite training center, and designers are licensed through the state.

2.45.2 Numerical Information

Total number of onsite systems: Numbers NA; reportedly about 50% of the state uses onsite systems.

Number of new systems installed each year: 2,500-3,000 estimated for 2003-2006, newer numbers NA (TAC, 2007).

Failure definition: Wastewater exposed to the open air, pooled on the surface of the ground, discharging directly to surface water, or backing up into a building or structure; system operation results contamination of a potable water supply.

Number or proportion of systems presently failing: NA

Number or proportion *repaired* annually: Approximately 1,500 are repaired or replaced p.a.; 2007 rule changes will likely increase proportion of repaired systems, but no data are available yet.

Number or proportion *replaced* annually: See above.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Mounds have been in use since 1982 and sand filters since 1997. About 100 of each are installed each year, as new or replacement systems.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Very few, if any, require advanced technology. In some cases since 2002, advanced treatment is used instead of mounds or to reduce mound height or disposal system area.

Cost of a conventional *septic system* installation: Conventional, $2000-$4000; with curtain drain, $3500-$6500; sand filter, $8000-$15,000; mound, $7000-$20,000; alternative technology, $25,000-$40,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): NA

2.45.3 Present Onsite Status (Answers 2a-2f Summarized)

There are large areas of the state that have problems due to combinations of dense development, antiquated systems, poor septic system hydrology, or jeopardy of water resources. Vermont's major geologic features run north-south. The western sector is marked by poorly percolating clayey soils. The northwest corner, along I-89, skirting Lake Champlain, and which includes Burlington, is under development pressure. A central mountainous spine is marked by shallow soils, ledges, bedrock, and steep slopes. The eastern sector is marked by glacial tills. In sum, about half of the mountainous state is marked by upland soils with shallow ledges and basil tills, and another quarter is marked by poorly percolating, lacustrine clay soils. Most of Vermont's aquifer recharge area is characterized by a shallow spring-perched water table. Recent rule changes brought all future new construction, subdivision, and onsite system repair/replacement under state regulation. The creation or extension of central facilities is generally resisted or discouraged; only two new surface water discharges have been approved in the last decade (Pownal and Cabot), and these were to solve long-standing wastewater treatment issues in existing village centers (DHCA, 2007).

2.45.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Beginning on July 1, 2007, onsite systems and potable water supplies that were previously exempt from state regulation will be required to obtain permits for such activities as construction of new buildings; construction or modification of a wastewater system and/or potable water supply; new connections; subdivision of land; and repair or replacement of a failed wastewater system and/or potable water supply (DEC, 2007b). The rules include a 'clean slate' provision that grandfathers all buildings, campgrounds, lots, wastewater systems and potable water supplies that were in existence before January 1, 2007—since prior to this rule change the state regulated only lots less than 10 acres in size, with regulation of older lots and those larger than 10 acres left to local (town) health departments. Enforcement is mainly confined to initial permitting steps, after which there is little follow-up.

Code was last revised in: 2007

New revisions in progress? To be adopted when? There is no set schedule for code revisions, and no date has been set for revisions.

Role of legislature, regulatory agency, and politics: A bill in the legislature in the late 1990s to require statewide minimum standards for old and new lots of any size was eventually enacted in phases, with 'universal permitting' realized in July 2007.

2.45.5 Management Programs (Answers 3e-3g Summarized)

The town of Warren completed a National Decentralized Community Wastewater Demonstration Project management district in 2005 (Clark and Macrellis, 2007). Two other towns, marked by high population density and high failure rates, are starting to develop onsite management programs. The Town of Jericho conducted training and outreach as part of the NODP Phase II program (Suhrer, 2000). The town of Colchester is the only town to take delegation of the state onsite permitting program, and is about to begin a National Decentralized

Community Wastewater Demonstration Project to inventory and manage onsite wastewater and stormwater infrastructure (Douglas, 2008). There are no reports of rural cooperative or public utility interest in O/M programs.

2.45.6 New Technology (Answers 4a-4h Summarized)

Present code accommodates the use of alternative technologies. A tiered system of minimum site conditions allows onsite systems to be designed for sites with as little as 6 inches of separation between seasonal shallow groundwater and ground surface (DEC, 2007). I/A technologies are either included in the code (e.g., constructed wetlands and subsurface drip distribution) or are issued general approvals (DEC, 2007b). From the 1990s through 2002, the most common alternative systems were mounds and sand filters, with about 100 of each being installed each year. Since 2002, advanced treatment (particularly textile and fixed media filters and chamber leaching systems) has become more common, particularly for development of limited sites and in repair/replacement situations. Mounds have no management requirements attached to them. Sand filters must be inspected annually for the first two years. Annual inspections are required for I/A technologies and performance-based systems, with reporting to DEC (DEC, 2007). There are no requirements for employing Best Available Technology for remediations, though replacements must conform to the rules to the greatest extent possible. There is a regulatory process through which new technologies can be approved for use in the state (DEC, 2007).

2.45.7 Onsite Funding (Answers 5a-5c Summarized)

Municipalities can obtain CWSRF loans to re-loan to homeowners for repair/replacement of their onsite systems (DEC, 2005). The Town of Colchester manages a loan program for onsite system replacement/repair (http://town.colchester.vt.us/).

2.45.8 Leadership and Information

State-level agencies, task forces:

- Vermont Agency of Natural Resources, Department of Environmental Protection (DEC), Wastewater Management Division, 103 S. Main St, Sewing Bldg, Waterbury, VT 05671 (contact: Mr. Roger Thompson, tel 802-241-3027, roger.b.thompson@state.vt.us).
- DEC's Onsite Sewage Technical Advisory Committee (task force) (http://www.anr.state.vt.us/dec/ww/tac.htm).

Local governmental agencies, task forces:

- The Town of Warren established a decentralized wastewater management district for the village center (Clark and Macrellis, 2007). The Town of Jericho opted for increased education as described above. Colchester continues to move towards increased onsite system management as described above.

Research within governmental agencies: None.

Research within universities: None.

Onsite demonstration programs:

- The town of Warren received federal National Decentralized Community Wastewater Demonstration Project funding for a combined community system and onsite district; work was completed in 2005 (see above)
- The Town of Colchester is currently beginning a National Decentralized Community Wastewater Demonstration Project, see above.

Training or certification programs:

- Licensed designers are certified through the Vermont DEC. Professional engineers are required to have coursework in soils characterization or pass a soils identification test in order to design onsite systems. Ongoing training is required to maintain certification (VTDEC 2007).
- VT DEC maintains listings of qualifying training opportunities (http://www.anr.state.vt.us/dec/ww/sitetech.htm). Other courses may be substituted but should be pre-approved by DEC.
- Vermont Technical College's Center for Sustainable Practices (http://csp.vtc.edu/) provides qualifying workshops.
- Northern New England Wastewater Training Center, c/o Vermont Technical College, POB 500, Randolph Center, VT 05061; (contact: Dick Perez, Director, tel 802-234-9279, fax 802-728-1390, eml newtc@sover.net).

Citizen action, private groups:

- Green Mountain Water Environment Association (contact: J. Hill, jhill@vlct.org, 802-229-9111, www.gmwea.org
- American Council of Engineering Companies of Vermont (http://www.acecvt.org/index.cfm)
- Yankee Onsite Wastewater Association (YOWA) (http://www.yankeeonsite.org/; contact Stephen H. Corr, yankeeonsite@gmail.com).

Newsletters, forums, other sources of information: NA

2.45.9 Enforcement (Q7)

Enforcement is mainly confined to initial permitting steps. Annual reports are required to be submitted for I/A systems and performance-based systems (DEC, 2007).

2.45.10 Role of Cluster Systems and Package Plants (Q8)

Systems with design flows greater than 6,500 gpd are regulated through the Indirect Discharge Rules (IDRs) (DEC, 2003). Compared to the Wastewater System and Potable Water Supply Rules, the IDRs are renewable operating permits that generally contain additional site evaluation and pre-discharge testing requirements, along with increased oversight once a system is constructed. The most common applications of these systems in Vermont include ski/resort areas, schools, hotels/restaurants, and municipal collection/treatment systems.

2.45.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

There are no reports of rural cooperative or public utility interest in O/M programs.

2.45.12 What's Changed

Patterns
Since the original Market Study, marked changes have occurred in regulations, allowance of advanced technologies, and licensing/certification of professionals. Emphasis has generally been on technology and on allowing development in difficult site conditions, rather than on management after construction.

Drivers
Allowance of I/A systems was driven ostensibly by the difficulty of allowing infill development in existing village/development centers where sewers are not feasible. However, reports to date (e.g., MacLain, 2005) indicate that performance-based systems are primarily being installed outside of development centers.

2.45.13 References

Clark, M., and A. Macrellis. 2007. The Warren, Vermont Decentralized Wastewater Management Demonstration Project: Where Are They Now? Proceedings of the NOWRA 16th Annual Technical Education Conference & Exposition (Baltimore, Maryland; March 2007). *Summary of work completed, challenges encountered, lessons learned during this demonstration project, as well as documentation of ongoing challenges and information about how solutions are perceived in the community.*

Douglas, B. 2008. Personal communication with Amy Macrellis regarding Town of Colchester's demonstration project status.

Forcier, J., et al. 2007. Fifth Annual Report of the Technical Advisory Committee Regarding Oversight and Implementation of the Wastewater System and Potable Water Supply Rules. January 15, 2007. Accessed at http://www.anr.state.vt.us/dec/ww/protection/TAC/2006AnnualReport.Final.pdf on October 27, 2008. *Report from the Technical Advisory Committee on rule implementation, including numbers of permits applied for/issued since the implementation of rules allowing I/A systems in 2002.*

MacLain, E. 2005. Initial Report to the Legislature on the Use of the Performance Based Approach for the Design of Wastewater Disposal Systems Subject to the Wastewater System and Potable Water Supply Rules. January 15, 2005. Accessed at http://www.anr.state.vt.us/dec/ww/protection/FirstReportOnPerformanceBasedSystems.pdf on October 27, 2008. *This report summarizes permits issued for performance-based systems in the state to date and maps where systems were installed.*

National Small Flows Clearinghouse. 2005. Vermont Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/VERMONT.PDF on October 27, 2008. *This short document summarizes onsite wastewater system regulations and activities in Vermont; however, with the 2007 regulatory changes it is somewhat dated.*

Suhrer, T. 2006. NODP II at Work in the Green Mountain State. Small Flows Quarterly 1(1): 12. Accessed online at http://www.nesc.wvu.edu/pdf/ww/publications/smallflows/magazine/SFQ_wi00.pdf on October 27, 2008. *Article describes NODP Phase II efforts in Jericho and several other Vermont towns.*

Vermont Agency of Natural Resources, Department of Environmental Conservation. 2003. Environmental Protection Rules, Chapter 14: Indirect Discharge Rules, effective April 30, 2003. Accessed at http://www.anr.state.vt.us/dec/ww/Rules/IDR/Adopted-IDR-4-30-03.pdf on October 27, 2008. *Current version of the large-scale subsurface wastewater treatment regulations for systems in Vermont.*

Vermont Agency of Natural Resources, Department of Environmental Conservation. 2005. Grants and Loans Program Summary. Accessed at http://www.anr.state.vt.us/dec/grants.htm on October 27, 2008. *Webpage summarizing grant and loan programs available for water supply and wastewater infrastructure in Vermont, including for onsite systems.*

Vermont Agency of Natural Resources, Department of Environmental Conservation. 2007. Environmental Protection Rules, Chapter 1: Wastewater System and Potable Water Supply Rules, effective September 29, 2007. Accessed at http://www.anr.state.vt.us/dec/ww/Rules/OS/2007/FinalWSPWSRuleEffective20070929.pdf on October 27, 2008. *Current version of the rules governing siting, design, and construction of small-scale onsite systems in Vermont.*

Vermont Agency of Natural Resources, Department of Environmental Conservation, 2007b. Memo to the Public Regarding Amendments To The Wastewater System And Potable Water Supply Rule And A Summary Of Significant Changes Made To The Statute That Authorizes The Rule. Accessed at http://www.anr.state.vt.us/dec/ww/Rules/OS/2007/2007-11-14-SignificantChangesToRulesMemoToThePublic.pdf on October 27, 2008. *Short memo that summarizes significant changes to the Rules instituted in 2007 in layman's terms.*

Vermont Agency of Natural Resources, Department of Environmental Conservation. 2008. Innovative and Alternative Systems and Products. Accessed at http://www.anr.state.vt.us/dec/ww/Innovative.htm on October 27, 2008. C*urrent listing of approvals for innovative/alternative and experimental technologies.*

Vermont Department of Housing and Community Affairs. 2007. Improving Wastewater Treatment Options for Vermont's Unsewered Villages: Background Report. Accessed at http://www.dhca.state.vt.us/Planning/backgroundreport.doc on October 27, 2008. *Report summarizing current conditions around wastewater management in Vermont, with particular emphasis on the need for increased wastewater management resources for unsewered communities/growth centers.*

2.46 Virginia

2.46.1 Summary

Virginia has about 1.1 million systems in the ground; it annually installs another 23,000 and repairs or replaces over 4000. The creation or extension of sewers is supported in the cities. Many areas of the state are reported to be without problems; however, the Washington D.C. suburbs and exurbs, the Norfolk–Virginia Beach metropolitan area, and the Chesapeake Bay shore are rapidly growing outside service areas; the Appalachians are marked by thin soils, bedrock, steep slopes, and extremely small lots in older coal camp communities. Clayey soils, shrink-swell soils, and variable soils mark the Piedmont. Shallow water tables and wetlands mark much of the coast, where many shellfish beds have been closed; in some areas (particularly outside of Virginia Beach) highly permeable soils and sediments provide minimal soil treatment. A large band of karst geology, comprising much of the Shenandoah Valley and the Valley and Ridge counties, lies across the western part of the state. Throughout rural areas of the state, pit privies, cesspools and straight pipes are common. Present code readily accommodates new technologies under an innovative, experimental permit program, and new technology is in fairly widespread use. Recent regulatory changes allow the design of systems to performance requirements established by the Department of Health, rather than to prescriptive standards. Varying operation and maintenance conditions apply, typically handled by the private sector; a rule proposal is on the table to increase accountability for systems with operating permits. A number of counties have inspection and maintenance protocols in place, and critical zones along the Chesapeake are subject to special measures. Several central utilities have taken on management of cluster systems as part of their charge. Hardship grants and loans are available for upgrades. Several universities have research programs, including a new project in the Virginia Water Resources Research Center looking specifically at decentralized water and energy systems. Environmental Health Specialists and Authorized Onsite Soil Evaluators are trained and certified by the state, and in 2009 certification be mandatory for installers and maintenance providers as well. There is an active Virginia Onsite Wastewater Recycling Association.

2.46.2 Numerical Information

Permits are tracked and issued at the local level for new construction, repair of existing systems, and for upgrade or modification; current numbers not available (NSFC 2006).

Total number of onsite systems: 1 million-1.2 million, estimated; 1990 U.S. census reports 700,000.

Number of new systems installed each year: 20,000-25,000.

Failure definition: Sewage backup to house, surface expression of effluent, or contamination of groundwater.

Number or proportion of systems presently failing: NA

Number or proportion *repaired* annually: 2000+.

Number or proportion *replaced* annually: 2000+.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Less than 10% of either repairs or replacements involve either alternative or advanced technology.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): See above.

Cost of a conventional *septic system* installation: $7,000-$12,000 (see http://www.publicintegrity.org/investigations/luap/articles/entry/1172/)

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $800-$10,000, highly variable.

2.46.3 Present Onsite Status (Answers 2a-2f Summarized)

There are large areas of the state without problems, but many smaller areas that sometimes have severe problems, often aggravated by older systems and dense development. A literature review performed for the VA Dept of Health in the late 1990s concluded that "Virginia ground and surface wasters are being polluted from OSWDS. The principal pollutants from OSWDS are N, bacteria, and viruses. The extent to which Virginia groundwaters are being polluted by these contaminants is currently unknown" (Stolt and Reneau 2000). The Norfolk-Virginia Beach metropolitan area and the Chesapeake Bay area are rapidly growing. Indeed any area accessible to I-81 or I-95, and within (ever longer) commuting distance of Washington, D.C., is under development pressure. On the eastern shore there are large numbers of failing systems, privies, and straight pipes; proposed wastewater treatment plants with surface discharges for existing or new developments in this area remain controversial, even if they propose to produce higher quality effluent than traditional septic tank systems (Harper 2006). In the southwest pit privies and straight discharge pipes still exist. Karst topography, thin soils, shallow/fractured bedrock, steep slopes, and ledges mark the Valley and Ridge portion of the Appalachians; clayey soils, shrink/swell clays, and highly variable soils with unpredictable behavior mark the piedmont; and swamps and high water tables mark the lowlands. The Appalachian Plateaus (Allegheny Plateaus) province of the Virginia Appalachians has major problems with old coal camps that have extremely small lots, thin soils, and many straight pipes.

The Chesapeake Bay and other coastal areas are cited with respect to problems or potential problems. Depending on the area, concerns can be related to pathogens, phosphorous, or nitrogen as a drinking water or coastal contaminant. Shellfish areas in Chesapeake Bay have been closed down because of high coliform counts and/or agricultural runoff. In general, regulations developed by impacted states in the Chesapeake Bay basin, including Virginia, focus on the criteria that must be achieved (and largely have been achieved) by large publicly-owned treatment works (POTWs) and existing facilities (Gaines 2006). Little attention has been paid to criteria that must be met by new, small, facilities, such as those that serve residential and commercial developments (Gaines 2006). The Virginia Department of Health has, in at least one instance, has used GIS analyses to identify areas of fecal-coliform impaired stream watersheds where onsite systems are at high risk of failure, as a tool for identifying areas with potential problems and prioritizing further assessment or repairs (Brewer 2007).

The creation or extension of sewers is generally supported by citizens and regulators, but not without ambivalence with respect to their impacts on growth and their incapacity to recharge aquifers. (Saltwater intrusion is of concern to several cities now looking at the possibility for wastewater recycling.) The issue is complex; when they require operation and maintenance there are insufficient mechanisms to assure this is done properly, and the potential costs of O/M remain an area of controversy.

2.46.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Minimum code is made at state level, and administered by municipal, county or district health departments. Local codes can be more stringent than state code, sometimes addressing valid concerns or O/M, but it often translates to the disallowance of various alternatives, forcing de facto zoning through minimum space requirements, or percolation requirements, of conventional systems. Enforcement of code is regarded as adequate in some areas, not so in others, partly because of budget/staff limitations, and partially because of the lack of civil penalties, which often makes agency personnel reluctant to take enforcement action unless the problem is very serious. For alternative systems, operating permits carry varying operation and maintenance conditions which are system- or process specific; however, operating permits are perpetual, thus limiting incentive for proper O/M (NSFC 2006); currently proposed revisions would increase maintenance/oversight of alternative systems (VA Dept. of Health 2009; see below).

Code was last revised in: 2008 (VA Dept. of Health 2008).

New revisions in progress? To be adopted when? Revisions currently under consideration include significant changes to required maintenance of alternative onsite wastewater treatment systems, as well as licensing of onsite system evaluators, installers and operators (VA Dept. of Health 2009).

Role of legislature, regulatory agency, and politics: The General Assembly has a strong role in code language. Major overhauls have had, and can be expected to have, controversy associated with them. For example, developers are pushing for less stringent code, including a reduction in depth to groundwater, and manufacturers may exert pressure to favor the use of their products. Several interest groups are concerned about potential economic impacts; and a strong property rights ethic prevails as well. The environmental lobby, while having admirable goals, sometimes does not understand the scientific and management issues. In short, if enforcement methods are changed, legislative approval is required, and resistance can be expected.

2.46.5 Management Programs (Answers 3e-3g Summarized)

Generally, the private sector handles monitoring and maintenance of individual systems. Revisions to rules regarding the required maintenance of alternative onsite wastewater treatment system are due to be placed into effect on July 1, 2009, under which alternative onsite wastewater systems will be required to have a licensed onsite system operator under contract to maintain the system (VA Dept of Health 2009). There is definitely a need in the state for systematic remediation in some areas and management/planning protocols in others. Most initiatives continue to come from local government. Many communities in the Washington, D.C. metropolitan area suburbs and exurbs have realized a need for inspection and remediation for expansions and at the time of title transfers. In less affluent areas there is more reluctance to adopt such programs, and such areas may be overwhelmed with more pressing needs such as the eradication of straight pipes. In a few of these cases, municipally managed cluster systems have been the solution of choice: Charles City County has chosen to construct and operate cluster systems as the most cost-effective manner of remediating a number of onsite systems in low-income neighborhoods (VA Dept. of Health 2009). In another, the Dawn Wastewater and Housing Rehabilitation Project, in Caroline County (a rural area between Richmond and Fredricksburg), has utilizing cluster systems to replace malfunctioning septic tanks and drainfields at over a hundred residences in the area (Sorkin Kurland 2007).

There are quite a few county initiatives that move in the direction of a management protocol, from simple education and I/M programs to a willingness to experiment with more advanced systems, environmental monitoring, database management, etc. Critical zones along the Chesapeake Bay have been subject to special requirements since the passage of the Chesapeake Bay Preservation Act in 1992, including regular pumpouts (on a five-year schedule), the designation of reserve leachfields, and the use of effluent filters (Noah 2000, Longwell 2009). Other examples: Fairfax County (just west of Washington, DC) has a long-running program for managing onsite systems, which was modified after the passage of the Chesapeake Bay Preservation Act to include a septage manifest system to allow tracking of pumpouts (U.S. EPA 1999, Noah 2000); this system also allows identification of pumping activity that might indicate a system malfunction. The Loudoun County Sanitation Authority (LCSA) provides wastewater services to unincorporated parts of the county (Yeager et al. 2006, Grenoble 2007). The county Board of Supervisors was interested in maintaining the county's rural and historic nature and passed an ordinance that would cluster new development, and that the new communities would not be served by centralized sewer. LCSA owns and operates any community systems (more than 15 connections) (Grenoble 2007, Danielson 2008). In southwest Virginia, the Lenowisco Planning District Commission produced a regional wastewater study for southwest Virginia in 2005, and an update was produced in 2009. Although both documents are heavily geared toward conventional sewer, there are some decentralized technology and management approaches included (Lenowisco Planning District Commission 2009).

2.46.6 New Technology (Answers 4a-4h Summarized)

Present code or guidance policy accommodates many alternative systems, classified at four levels, but which include low pressure pipe, recirculating sand filters, other media filters, aerobic systems, mound systems, drip and spray irrigation, package plants, artificial wetlands, and shallow absorption systems. Use of such systems is permitted on lots otherwise undevelopable. New technologies come to be authorized through review of existing research or performance data and regulatory experiences in other states; or, if these data are partially supporting, through an experimental protocol under which up to 16 permits (up to 500 by variance through an innovative experimental program) may be granted among the state's four physiographic provinces. The results of a successful performance assessment of the Ecoflo peat filter system, performed during the field evaluation period as part of the approval process moving the technology from provisional to general approval status, were recently reported (Lacasse et al. 2008). A total of six technologies have been approved for general use, including peat filters, textile filters, and any NSF International Standard 40 Class 1 aerobic treatment devices (VA Dept. of Health 2007).

After three years of review a decision is made as to whether the system can be authorized for general use through a "Guidance Memoranda and Policy" bulletin. No alternative or advanced systems are mandated except on a case-by-case basis by the local Environmental Health Specialist who, after site review, is required to list for the owner or builder any and all systems deemed sufficient. Provided the proposal meets criteria (PE-designed, appropriate monitoring), experimental system permits can be obtained from local authorities, with review from Richmond.
Code changes implemented in August 1999 increased the required separation distance to groundwater to a minimum of 18 inches; pretreatment is required on properties not meeting that requirement-, and the increased cost of installation and maintenance for such systems was a source of controversy (NSFC 2000). Also starting in 1999, Authorized Onsite Soil Evaluators and Engineers could certify evaluations and designs; more recent changes have further increased design options and flexibility available to these designers (Knapp 2003). After several years of stakeholder involvement (see, for example, Alexander 2002), significant changes to the state's onsite wastewater regulations were implemented. Beginning July 1, 2008, engineers may design onsite systems outside the majority of prescriptive soil, site, and design requirements of the Sewage Handling and Disposal Regulations; the designs must be compliant with standard engineering practice and with performance requirements set by the Department of Health (Virginia Dept. of Health 2008).

It is reported that cluster systems would provide solutions for many small-lot older communities where sewering is unlikely. Another issue is the great number of large new commercial systems springing up outside sewer districts. In some cases, municipalities or wastewater authorities are making a conscious choice to utilize cluster systems to serve new development or to implement upgrades of malfunctioning systems in difficult conditions (see 'Management' above).

2.46.7 Onsite Funding (Answers 5a-5c Summarized)

The State does provide SRF funding or financing options to individual homeowners for repair or replacement of a failing or malfunctioning system via pass-through programs established with local governments (Virginia DEQ 2001). As of 2003, five local governments or regional planning commissions were participating in this program: Loudoun and Smyth counties, the town of Hillsville, and the Northern Neck and Middle Peninsula Planning District Commissions (Mason 2003). Hardship grants, via the Department of Housing and Community Development, are also available (NSFC 2006). Some 319 nonpoint funds and coastal zone funds are being used for onsite wastewater research or implementation projects (see, for example, Brockenbrough and Lawrence 2008).

There have also been numerous onsite repair, inspection, and pumpout programs funded by the VA Water Quality Improvement Fund, a state fund devoted largely to TMDL related issues (see http://www.deq.virginia.gov/bay/wqif.html).

2.46.8 Leadership and Information

State-level agencies, task forces:

- Virginia Dept of Health, Division of Onsite Sewage and Water Services, Main 109 Governor St, Richmond, VA 23219; tel 804-864-7452; (contact Allen Knapp, eml Allen.Knapp@vdh.virginia.gov).
- Virginia Dept of Conservation and Recreation, Soil and Water Conservation Division, 203 Governor St, Ste 206, Richmond 23219; division tel: 804-786-2064.
- Virginia Dept of Environmental Quality, Division of Environmental Enhancement, Virginia Coastal Zone Management Program, 629 East Main St, Richmond, Virginia 23219; fax 804-698-4319 (contact: Laura McKay, tel 804-698-4323, eml Laura.McKay@deq.virginia.gov).
- The TMDL program shared by DEQ and the VA Dept. of Conservation and Recreation (DCR) has had considerable involvement with onsite wastewater issues, including funding for repairs, replacements, and pumpouts; for examples of recent projects, see http://www.dcr.virginia.gov/soil_and_water/documents/wqsrgrntawds.pdf.
- For work on Chesapeake Bay counties: Chesapeake Bay Local Assistance Dept, 101 North 101 North 14th Street, 17th Floor, Richmond, VA 23219-3665, tel (804) 225-3440 or 1-800-CHES-BAY (1-800-243-7229), eml teresa.foggsteed@dcr.virginia.gov.

Local governmental agencies, task forces:

- Fairfax County: http://www.fairfaxcounty.gov/hd/codes/sewagecode68_1.htm
- Charles City County (maintenance of small cluster systems described in text): http://co.charles-city.va.us/index.asp?Type=B_BASIC&SEC={3E7BF3AE-60C5-4441-8EFC-9C0E87A836FC}
- Loudoun County (Loudoun County Sanitation Authority): http://www.loudounwater.org/about/servicearea/community.cfm

Research within governmental agencies:

- None apparent as of March 2009.

Research within universities:

- Virginia Water Resources Research Center, www.vwrrc.vt.edu/, Virginia Tech, 210 Cheatham Hall, Blacksburg, VA 24061, tel 540-231-5624 fax 540-231-6673 eml water@vt.edu. Of particular interest is a new research effort around decentralized water and energy systems; see http://www.vwrrc.vt.edu/watercooler_nov07.html.
- Virginia Tech, via coordination from Chuck Hagedorn, along with the USGS office in Richmond, have done groundbreaking work in bacterial source tracking, which has been an important part of both onsite wastewater research and TMDL work in VA; see http://www.cses.vt.edu/people/profiles/hagedorn_profile.html.
- Virginia Polytechnic Institute and State University (Virginia Tech) has long conducted onsite systems research, particularly relating to system performance and pathogen transport; see http://filebox.vt.edu/cals/cses/reneau/index.html
- Old Dominion University and Ferrum College have also conducted research on onsite pollutants; as have George Mason Univ, Virginia Inst of Marine Sciences at Univ Virginia, and James Madison Univ. Further information NA.

Onsite demonstration programs:

- The Virginia Onsite Wastewater Training Center is in the process of constructing a demonstration facility for hands-on training activities, see below.
- There are sometimes demonstration components associated with system testing completed through the experimental systems protocols (see, for example, Lacasse et al. 2008).
- Lenowisco Health District, in the far western Appalachians coalfields, was part of the original NODP; see http://www.vdh.state.va.us/LHD/lenowisco/environmental.htm.
- In the Guest River watershed (Wise County) a combination of NODP funds, local funds and in-kind contributions were used to complete a cluster system consisting of new septic tanks, small-diameter sewers, and a cluster treatment system consisting of a recirculation textile filter and a community drainfield. The municipal sewer utility (responsible management entity) in the town of Appalachia will provide system management. See http://www.nap.edu/openbook.php?isbn=0309095247&page=191 for details.
- Southwest VA has also received funding from TMDL related sources for demonstration projects; see above.

Training or certification programs:

- Environmental Health Specialists who work for the DOH undergo four weeks of training at DOH; advanced professional courses are also offered by the DOH.
- Under provisions for experimental technologies, manufacturers must offer training sessions to state staff and Authorized Onsite Soil Evaluators (AOSE).
- The State of Virginia does require onsite professionals, including AOSE, to be certified. Private-sector designers (including AOSE) must be licensed; AOSE certification is renewable every two years and requires CEUs (NSFC 2006). Professional engineers are licensed but by a different agency (NSFC 2006).
- Effective July 1, 2009, licensing of onsite soil evaluators, installers, and operators will become mandatory (Dayton and Day, 2008). The Virginia Department of Professional and Occupational Regulation oversee licensing (see http://www.dpor.virginia.gov/dporweb/www_main.cfm).
- There is a Center for Onsite Wastewater Training associated with Southside Virginia Community College; see http://www.vdh.state.va.us/EnvironmentalHealth/Onsite/VCOWT/index.htm.

Citizen action, private groups:

- The Chesapeake Bay Foundation has had a number of wastewater related concerns, http://www.cbf.org/Page.aspx?pid=1000; see http://www.cbf.org/Page.aspx?pid=498 for an example of recent efforts. (contact Emily Francis, Capitol Place, 1108 East Main Street, Suite 1600, Richmond, VA 23219-3539; tel (804) 780-1392, fax (804) 648-4011).
- Virginia Lakes and Watersheds Association, http://www.vlwa.org/about.html
- Virginia Onsite Wastewater Recycling Association (VOWRA), http://www.vowra.org/; (contact Benny Morrell, Executive Director, P.O. Box 155, Star Tannery, VA 22654, tel 540-465-9623, fax 540-465-9627, eml vowra@shentel.net).

- Virginia Assoc of Professional Soil Scientists, Virginia Tech/CSES, 238 Smyth Hall – 0404, Blacksburg, VA 24061, fax (540) 231-7630 http://clic.cses.vt.edu/ VAPSS/ VAPSSHomePage.html (contact Sue Brown, tel 540-231-5741, eml suebrown@vt.edu).
- Virginia Environmental Health Association (VEHA), http://www.veha.org/; eml veha.board@hotmail.com.

Newsletters, forums, other sources of information:

- VOWRA publishes a newsletter; http://www.vowra.org/.
- Virginia Dept of Health has a website; http://www.vdh.state.va.us/EnvironmentalHealth/Onsite/index.htm.
- Virginia Tech's Extension Service has published a series of educational materials, see http://www.ext.vt.edu/cgi-bin/WebObjects/Docs.woa/wa/getcat?cat=ir-nrem-wq.
- Loudon County, the Virginia Water Resources Research Center, and others have produced education materials, workshops, etc.
- A major wastewater summit for southwest VA was held at the University of Virginia-Wise in May 2009; see http://www.wisecountyva.us/notices.html.

2.46.9 Enforcement (Q7)

See above.

2.46.10 Role of Cluster Systems and Package Plants (Q8)

Package plants with surface water discharge have apparently been used at the development scale; though information is sparse, their continued use in coastal areas is controversial (see, for example, Harper 2006). The use of primarily municipally-managed cluster systems, as described in more detail above, is increasing, particularly for new development in unsewered areas and for the replacement of malfunctioning onsite systems in limited-income neighborhoods.

2.46.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

[ANM notes that] No interest was noted from rural electric cooperatives as of March 2009. Several public works departments and/or county utility authorities are actively managing cluster systems; Loudoun County Sanitation Authority's programs are particularly notable in this regard. While in the Chesapeake Bay watershed, most counties are now running some form of pumpout tracking program for individual onsite systems, the actual performance of maintenance activities falls to the private sector, and currently proposed regulatory changes will maintain or increase the reliance of homeowners on private contractors.

2.46.12 What's Changed

Patterns

[ANM notes] Increased professionalism and involvement of private engineers and maintenance providers is resulting in major (though slow) changes in regulations towards both increased design flexibility and increased accountability for contract-based management of non-conventional systems.

Drivers

Increasing costs for potable water have caused a major oil refinery to seek out reclaimed water as a less expensive alternative. The York River Water Reclamation Plant, operated by the Hampton Roads Sanitation District, is the result; the plant has been operating successfully for over five years, and was constructed at a time when Virginia had no standards or regulations governing water reuse (Hildebrant 2005). There have been lengthy battles over a proposed Mattaponi River reservoir, to supply increased water needs for VA Beach- Newport News-Hampton Roads area. The reservoir was recently shot down by the courts but opposition to it was part of the impetus for the York River plant—not an "onsite" issue, but is indicative of current and anticipated water supply pressures.

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2.47 Washington

2.47.1 Summary

Washington has about 700,000 systems in the ground as of the 1990 U.S. Census, of which up to a third may be failing by current standards. About 25,000 new systems are installed, and 3500 are repaired or replaced annually. Large areas of the state are without problems, but the densely populated Puget Sound Basin has had shellfish bed closures, and is presently subject to aggressive management measures. No communities are under enforcement actions. Present development policies concentrate growth in designated areas, which tends to favor the extension of sewer lines. However, onsite systems are common, and conditions are often unfavorable. Well-established mechanisms exist to bring new technologies into general use, and half or more of replacements (as well as many new installations) employ some degree of alternative design. All have stipulated monitoring and maintenance protocols. Legislation described in the original market study mandated that, by 2000, all onsite systems in the state must come under some form of compliance monitoring or management program.. Several such programs already exist, and several loan fund options are available for upgrades. Certification of onsite professionals is done through the counties. There is research at Washington State University and University of Washington. A Northwest Onsite Wastewater Training Center runs a demonstration project. There is also a Washington Onsite Sewage Association.

2.47.2 Numerical Information

Total number of onsite systems: Approximately 700,000.

Number of new systems installed each year: Approximately 25,000.

Failure definition: For a system to be defined as failing, a condition must exist that creates a potential for direct or indirect contact between sewage and the public. Examples of a failure can include:

- Sewage on the ground surface
- Inadequately treated effluent contacting the groundwater
- Noncompliance with permit standards

Number or proportion of systems presently failing: 120,000-375,000; by another account, up to a third of systems are failing; by still another, 3-5%; these estimates clearly involve different interpretations of “failing.”

Number or proportion *repaired* annually: Some 1-4% per annum; 3000-4000 repaired or replaced annually; by another account, about 0.5% annually. Note however, these numbers pertain to systems reported and repaired with permits—many are not reported, and instead are repaired by the homeowner or other non-licensed parties.

Number or proportion *replaced* annually: The above number (for repairs) also includes upgrades.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): About 30-60% involve some sort of advance over standard septic tank/drainfield arrangements. Other reports suggest this figure is lower. East of the Cascades conventional systems are the norm.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): About 1-2% of those replaced will be highly advanced.

Cost of a conventional *septic system* installation: $1800-$4500, typically in the range of $2000-$4000; the alternative systems range $8000-$16,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $10,000-$20,000.

2.47.3 Present Onsite Status (Answers 2a-2f Summarized)

There are present and anticipated problem areas in the state, all west of the Cascade Mountain divide, particularly within the Puget Sound Basin where most of the state's population resides. Causes of failure include overloading, age, poor maintenance; and inappropriate design, placement, construction or soils. Permits have been denied because of inadequate separation, shallow groundwater, steep slopes, wetlands, saturated soils, and poor soils. Almost all sites with suitable soils have already been developed, forcing more widespread use of alternative technology. There is an aggressive water- and shellfish monitoring program, through which systems have been identified that are failing because of very poor site conditions, age and neglect. There have been several shellfish bed closures within the sound. While not all of the closures are attributable to septic systems (agricultural runoff and dairy farms are a big problem), the closure at the south end of Hood Canal is clearly due to failing systems. In general, the concern for the Sound's waters is twofold: fecal coliform and nitrogen loading. East of the Cascade Divide there are elevated nitrogen levels in wells because of agricultural runoff.

In 2006, the state legislature passed a law requiring local health jurisdictions to create local onsite wastewater management plans, with increased emphasis on the operation and maintenance of onsite systems. Responding to the challenges facing Puget Sound, the 12 counties bordering the Sound were required to create local onsite wastewater management plans which identified local Marine Recovery Areas (MRA), and submit the plans to the state Department of Health by July 1, 2007(Washington State Department of Health, 2006). Within the MRA, special strategies are required including identification and inventory of all onsite systems. The intent of the legislation is to reduce the negative impact of failing onsite systems on the sensitive resources of the state and to protect public health. To date, the required management plans in the 12-county area are still being phased in.

A Washington growth management act mandates the establishment of boundaries for each urban area, and does not allow planning authorities to approve parcels smaller than one acre outside such boundaries until urban densities are obtained within them—a situation that favors centralization. Respondents were not aware of any current enforcement actions, referring instead to the chilling effect of several challenging lawsuits, and to current efforts to coordinate agency activity in order to bring about effective enforcement actions.

With respect to the more widespread use of alternatives, the key would be to get the cost lower than that of a centralized hookup, where a centralized hookup was the only other option.

2.47.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Law and code are made at state level, with enforcement left to county or municipal boards of health. Counties can, however, write more stringent code. Enforcement is reported to be generally adequate; two inspections accompany all new and repaired systems; a state designer licensing is in progress. One barrier is that enforcement proceedings require action of local prosecutors, and can receive low priority.

Code was last revised in: 2007.

New revisions in progress? To be adopted when? Revision of the regulations governing Large Onsite Septic Systems (LOSS) stalled in 2005. LOSS, regulated by the state Department of Health are defined as onsite wastewater systems with design flows from 3,500 to 14,500 gallons per day. Some sewage treatment systems over 3,500 gallons per day are regulated by the state Department of Ecology. Legislation passed in April 2007 requires new regulations to be in place for LOSS by July 1, 2009, and will grant regulatory authority to the Department of Health for onsite systems up to 100,000 gallons per day (Washington State Department of Health). The revision process involves stakeholder participation, public hearings, and ongoing evaluation.

Role of legislature, regulatory agency, and politics: Revisions have recently been driven by progressive legislative action.

2.47.5 Management Programs (Answers 3e-3g Summarized)

Pre-cover inspections are still required for all new construction and repairs, as described in the original Market Study. Operation and maintenance is now a requirement for all onsite wastewater systems. O&M inspections are required every three years for all conventional gravity systems, and every year for all other systems. All local health jurisdictions are required to write plans for the development and management of onsite wastewater systems in their area. At a minimum, these plans must include descriptions of the steps the local health jurisdiction will take to educate the public regarding O&M, remind owners of the required O&M inspections, and ensure funding of the local management plan (Washington State Department of Health, 2006; Island County Public Health, 2007).

Thurston County has had a county wide O&M program for over 15 years. This program involves cluster systems and other limited system types. As of January 1, 2007, the Henderson Watershed Protection Area Septic System Operation and Maintenance Program became effective in Thurston County. This program requires regular O&M inspections for all of the onsite wastewater systems within the Watershed Protection Area, approximately 6,400 properties (Thurston County Environmental Health, 2008). Inspections are performed by certified providers, however, homeowners may become certified to inspect their own systems by taking a county sponsored one-day course.

2.47.6 New Technology (Answers 4a-4h Summarized)

A state protocol to evaluate and bring alternative technology online has been in place since 1985. When conventional systems cannot be used, alternatives meeting specific treatment standards defined in the regulations must be used. Their permitting is accompanied by monitoring and maintenance stipulations and other tailor-made guidelines. The main use of alternative technology in Washington is on sites that otherwise could not be developed. Where preexisting failing systems exist, "Best (Demonstrated) Available Technology" may be specified. Alternatives include sand filters, mound and aerobic systems, gravelless drainfields, pressure distribution, and the proprietary Glendon Biofilter. The use of single-family aerobic units, as well as cluster systems and package plants, is on the increase, although the two latter play minor roles. Additives to onsite systems are banned, unless specifically approved by the Department of Health (Washington State Department of Health, 2007).

2.47.7 Onsite Funding (Answers 5a-5c Summarized)

Yes, state revolving funds are available to onsite remediation programs; in addition, other local betterment programs are in existence. Thurston County provides financial assistance in the form of low-interest loans and grants for onsite wastewater system repairs. ShoreBank Enterprise Cascadia, a locally based non-profit community development financing institution, provides underwriting and project oversight services for low-interest repair loans in the Willapa Bay watershed (Pacific County) and in the Hood Canal watershed (Clallam, Jefferson, Kitsap, and Mason Counties) (Hull, 2008).

2.47.8 Leadership and Information

State-level agencies, task forces:

- Wastewater Management Program, Washington State Department of Health, PO Box 47825, Olympia, WA 98504-7825. (360) 236-3062
- Washington State Dept of Health, Community Environmental Health Programs, Bldg 2, Airdustrial Center, Box 47826, Olympia, WA 98504-7826. (Contact: Tom Long or Mark Soltman, Washington State Dept of Health; tel. 360-286-3040.)
- Technical Review Committee (answers to the state Dept of Health). (Contact Wayne Turnberg, tel 206-522-1032).
- Puget Sound Partnership, POB 40900, Olympia, WA, 09504; (contact: Krag Unsoeld, tel 360-407-7325; fax 360-407-7333; eml kunsoeld@psat.wa.gov). http://www.psp.wa.gov/index.html

Local governmental agencies, task forces:

- Thurston County Environmental Health (see text); tel 360-754-4111, http://www.co.thurston.wa.us/health/ehrp/henderson.html.
- Several other local health departments have technical advisory committees.

Research within governmental agencies:

- Systems that have been developed and tested elsewhere are tested in-state, under experimental protocols. Current projects include drip irrigation and constructed wetlands.

Research within universities:

- Washington State Univ (contact Craig Cogger, tel 253-445-4512; eml cogger@wsu.edu)
- Hood Canal Dissolved Oxygen Program. http://www.hoodcanal.washington.edu/

Onsite demonstration programs:

- Washington On-Site Sewage Association (WOSSA, the training center cited below) runs a National Onsite Demonstration, Phase II, site; and also was awarded an EPA Small Flows grant to help solve wastewater problems in the town of Burnett through the installation of alternative technologies in use elsewhere around the U.S.

Training or certification programs:

- An onsite certification program administered by the local health departments is required, but see the Certification Workgroup entry above.
- WOSSA (see below) conducts training at the Northwest Onsite Wastewater Training Center, located on the Washington State University extension campus, in Puyallup; contact Dave Lenning, Director, tel 360-455-8880.
- University of Washington runs a "Northwest Onsite Short Course" about every three years; http://www.engr.washington.edu/epp/wwt/.

Citizen action, private groups:

- Washington On-Site Sewage Association (WOSSA), c/o John Thomas, PO Box 9279, Tacoma, WA 98490-0279, tel 253-297-2837; eml wossa1@hotmail.com; http://www.wossa.org/
- Stonebridge Construction Co., Inc. 3329 S. E. Harbor Rd Langley, WA 98260; contact: Jerry Stonebridge, President, tel 360-321-1454, fax 360-730-4905.

Newsletters, forums, other sources of information:

- WOSSA holds workshops and conferences, and publishes a newsletter as well.
- The state Dept of Health has a website with onsite wastewater information at: http://www.doh.wa.gov/ehp/ts/WW/default.htm.
- Puget Sound Water Quality Authority (now the Puget Sound Partnership) runs periodic workshops, tel 360.725.5444; http://www.psp.wa.gov/.

2.47.9 What's Changed

Patterns

Increased management statewide, paired with requirements for specific plans targeting improvements in MRA, are being implemented. Statewide, local health jurisdictions have been identified as the entities to create, regulate, and oversee the implementation of new management requirements.

Drivers

The public perception of declining water quality in environmentally sensitive areas like Puget Sound and Hood Canal spurred the legislature to create new, tougher onsite wastewater system regulations. Lobbyists from environmental groups, like People for Puget Sound, joined other interested parties, like the Pacific Coast Shellfish Growers Association, to push for the new legislation (McClure, 2005).

2.47.10 References

Thurston County Environmental Health. 2008. Henderson WPA Septic System O&M Program. http://www.co.thurston.wa.us/health/ehrp/henderson.html. *The website for the septic system management program—provides information about the program and its requirements, links to forms and outreach materials, and information about financial assistance for repairs.*

Island County Public Health. 2007. Island County On-Site Sewage System Management Plan. May 21, 2007. *This is the version of Island County's plan that was made available for public comment. It follows the basic outline set out in the DOH's June 2006 On-Site Sewage System Management Plan Guidance for the Twelve Puget Sound Counties. Notable elements of the plan include a clear vision statement and the use of risk-based, data-driven decision making in implementing the vision.*

Hull, Terry. 2008. Innovative loans stimulate septic system renovation. In *Proceedings of the NOWRA 17th Annual Technical Education Conference & Exposition*, Memphis, Tennessee, April 2008. *Summary of an innovative loan program for onsite system repairs—particularly in the use of a triple-bottom-line approach to measuring effectiveness. The paper importantly notes the need for managing this repaired infrastructure, but does not offer a clear path for management nor easy ways to duplicate this loan program approach in other parts of the country.*

McClure, R. 2005. Getting tough on septic tanks. *The Seattle Post-Intelligencer*. February 24, 2005. *A newspaper article about then-impending legislation for a system to ensure that septic tanks are inspected, maintained, and repaired that would apply near Puget Sound-area marine waters closed to shellfishing because of pollution, or where water-quality violations are serious enough to trigger a cleanup.*

Washington State Department of Health, Division of Environmental Health. 2006. On-Site Sewage System Management Plan Guidance For The Twelve Puget Sound Counties. June, 2006.

Washington State Department of Health, Division of Environmental Health. 2007. On-site Sewage Systems Chapter 246-272A Washington Administrative Code. July 1, 2007. *The current regulation governing the location, design, installation, operation, maintenance, and monitoring of on-site sewage systems to achieve effective long-term sewage treatment and effluent dispersal and limit the discharge of contaminants to waters of the state.*

Washington State Department of Health, Regulatory Jurisdictions for On-Site Wastewater. http://www.doh.wa.gov/ehp/ts/WW/default.htm *This is the homepage of the DOH Wastewater Management Program, which contains links to State regulations and activities pertaining to onsite wastewater permitting and management. Included on the homepage is a table summarizing regulatory jurisdiction for different types of onsite systems based on design flow.*

2.48 West Virginia

2.48.1 Summary

West Virginia has about 590,000 systems in the ground, installs another 9000 annually, and annually repairs or replaces large numbers of them. Almost two thirds of systems are failing by current standards; many of these are pit privies, straight pipes, or cesspools. Many stream segments in mountainous terrain are polluted, though mining activities and mining hydromodification accompanying mountaintop removal are the prime concerns. There is a statewide push to replace failing systems with disinfecting home aerobic units that discharge to streams; however, these systems are not well-maintained and enforcement of maintenance contracts is problematic. Code accommodates other alternatives as well, generally requiring maintenance programs. At least three counties have completed or are undertaking comprehensive wastewater assessments, and most have utilized cluster systems to solve wastewater dispersal problems in small development centers. A state-wide program is available for repairs and upgrades of onsite systems, and at least one county has an additional revolving loan program. Several EPA demonstration projects exist, and the National Small Flows Clearinghouse is located at the University of West Virginia. The state administers a certification program for installers.

2.48.2 Numerical Information

Permits are issued, and kept track of, for new construction, repair of existing system and for an upgrade or modification of onsite systems, but this tracking occurs at the local level and current numbers are NA (NSFC 2007).

Total number of onsite systems: Reportedly about 590,000; 1990 U.S. census reports about 320,000.

Number of new systems installed each year: About 9000.

Failure definition: Backup, and discharge of sewage to surface or ground waters.

Number or proportion of systems presently failing: 60%.

Number or proportion *repaired* annually: 10%.

Number or proportion *replaced* annually: 7%.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Aerobic treatment units with surface discharges are supported in the state for remediations. Less commonly used alternatives include low pressure pipe, mounds, and sand filters. Numbers or ratios NA.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Disinfection is required of the HAUs.

Cost of a conventional *septic system* installation: \$4500; range, \$3000-\$6000; (Ohio DOH 2008).

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): Approximately \$6000.

2.48.3 Present Onsite Status (Answers 2a-2f Summarized)

Much of West Virginia is mountainous, marked by thin soils, bedrock and steep slopes. Many older systems in rural areas are unpermitted, self-installed, straight pipes, perhaps the largest wastewater problem in the state. (Mining wastes and hydromodification resulting from mountaintop removal are, however, the leading environmental concern.) Some specifics: Much of the northern border of the state is marked by impervious soils, and older dense developments with many failing systems. The Appalachian (Allegheny) spine runs in a northeasterly direction, dividing the state east and west; much of it is protected; onsite conditions are not good. The area immediately off I-64, running east-west, remains under strong development pressure. The southwest corner of the state is marked by old mining towns with many straight pipes and pit privies. Highly susceptible karst terrain is under extreme development pressure as a D.C. exurb. Efforts to repair onsite systems in this area after valley flooding are contentious, with sanitarians arguing for centralized systems which cannot be funded through federal relief funds (Barker 2001). Some of these communities are now using cluster systems to repair long-standing problems (see below).

Permits have been denied because of shallow bedrock, high water table, poor soils, steep slopes, and floodplain siting. Reasons cited for system failure include undersizing, poor soils, saturated soils, damage, improper maintenance, and poor construction or installation. In the 1990s there was a statewide push to replace failing systems with ATUs, disinfection, and surface discharge to streams. However, lack of maintenance and of enforcement resources has resulted in numerous malfunctions and in water quality problems. A survey of over 400 such units in 1998 found that 92% of the systems appeared to be discharging effluent of unacceptable quality and that disinfection and maintenance problems were common; the authors recommended that lifetime maintenance should be mandatory for West Virginia ATU systems (Sexstone et al. 2000).

While state policy is to centralize whenever possible, much new development is in rural areas, and sewering is often not feasible nor popular.

2.48.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Rules are made at state level and administered by city, county, or district health departments. Permits for subsurface discharge with flows at 1,000 gpd or less are issued by the local health department. The Department of Environmental Protection regulates surface discharges over/under 600 gpd, and subsurface systems over 1,000 gpd. The health department and DEP share responsibility for shared systems with subsurface dispersal (NSFC 2007).

Code was last revised in: Onsite regulations for West Virginia were last amended in May 1998 and July 2003 (NSFC 2007).

New revisions in progress? To be adopted when? No revisions are currently in progress.
Role of legislature, regulatory agency, and politics: Rule changes require legislative approval, but the legislature seems attuned to the need to improve wastewater management.

2.48.5 Management Programs (Answers 3e-3g Summarized)

Presently, all new or repaired systems require a pre-cover inspection. There is clearly a need to take special planning and measurement measures for older, rural communities, new development, and in critical resource areas. West Virginia code does require management programs/contracts or districts to monitor and maintain onsite systems or individual liquid waste systems, mostly for surface discharging systems, or systems where additional treatment is required (NSFC 2007).

In McDowell County, flood damage and continued fecal coliform contamination of streams led community members, faith-based organizations, and representatives of local and state government to form a Wastewater Treatment Coalition to evaluate the county's wastewater challenges (MacKenzie 2006, Grenoble 2007). The coalition used a lot-by-lot GIS analysis, followed by ground-truthing, to identify potential projects, and those were prioritized based on public health benefit, environmental benefit, and community interest (MacKenzie 2006). This effort produced West Virginia's first county-wide wastewater management and prioritization plan for McDowell County (Wastewater Treatment Coalition of McDowell County 2005). So far, a few demonstration systems and one community system for about 20 homes have been installed, and another community system is planned (Grenoble 2007). The County Commission will eventually take over administering the wastewater programs (MacKenzie 2006).

In Monongalia County, unplanned growth outside of sewered areas has created a need for continued reliance on onsite systems. Because of resistance from its own public service district/commission, the County has (through a NODP II project) created a public/private partnership between the Health Department, customers, and maintenance providers to manage onsite systems (MacKenzie 2001). This management effort includes a revolving loan program for repairs and system replacements—at the time, the only one of its type in West Virginia (MacKenzie 2001).

2.48.6 New Technology (Answers 4a-4h Summarized)

Present code accommodates alternative and advanced systems, and in some circumstances requires them, as it may BAT. Residential ATUs with disinfection are often required of upgrades. Development on otherwise undevelopable sites is permitted with the use of suitable alternatives.

I/A technologies are reviewed by both sanitarians and engineers who sit on an Alternative Onsite Review Board. If deemed satisfactory, new technologies are then added by legislative rule changes that include design criteria. Prior to that, they may be permitted by variance. Alternatives in use include sand filters, mound systems, package plants, aerobic systems, wetlands, low pressure dosing, and shallow trenches. Enhancements are allowed for aerobic systems that permit surface discharges. All mechanical individual sewer systems with surface discharge, or that involve additional treatment steps, require an approved, perpetual maintenance program.

2.48.7 Onsite Funding (Answers 5a-5c Summarized)

There is a state-wide loan program for system repairs, replacements, or connection to new publicly owned sewer systems, administered through the West Virginia Housing Development Fund and West Virginia DEP; see https://www.wvhdf.com/homebuyers/onsite.cfm. In West Virginia, both 319 and SRF can go to non-governmental entities/private utilities for decentralized systems, but only to correct nonpoint source pollution problems, i.e. replacing existing failing septic systems or straight pipes (NSFC 2007). Monongalia County also administers its own revolving loan fund; see above.

2.48.8 Leadership and Information

State-level agencies, task forces:

- West Virginia Bureau for Public Health, Office of Environmental Health Services (OEH), Public Health Sanitation Division, One Davis Square, Suite 200, Charleston, West Virginia 25301-1798; fax 304-558-6020. (Contact Mr. Rick Hertges, Director, tel 304-558-8457, eml rickhertges@wvdhhr.org).
- West Virginia Sewage Advisory Board: http://www.wvdhhr.org/phs/sewage/advisory/index.asp

Local governmental agencies, task forces:

- McDowell County: http://www.wvdhhr.org/wvlocalhealth/lhd_profiles/lhdreport/index.asp?CountyName=mcdowell
- Monongalia County: http://www.monchd.org/programs-services/detail.php?id=14
- Raleigh and Wyoming Counties (Upper Guyandotte River watershed) are also working on construction of a community system serving 84 homes; residents in the watershed have access to low interest loans and other support for installing septic systems; see http://www.ugwawv.org/solutions.html.

Research within governmental agencies:

- See below.

Research within universities:

- U.S. EPA's National Environmental Services Center (including the National Small Flows Clearinghouse), Box 6064, West Virginia University, Morgantown, WV 26506-6064, tel (800) 624-8301; http://www.nesc.wvu.edu/wastewater.cfm

Onsite demonstration programs:

- Six systems were installed through NODP Phase I at Chestnut Ridge Park, West Virginia (MacKenzie 2001; see also http://www.nesc.wvu.edu/nodp/nodp_phaseI.htm).
- Monongalia County was also a NODP Phase II community (see above and http://www.nesc.wvu.edu/nodp/nodp_reports.htm).
- A demonstration system employing a peat filter and a recirculating sand filter as secondary treatment technologies was installed and monitored at the Conservation

Fund's Freshwater Institute in Shepherdstown, West Virginia, as part of the NODP Phase III for small communities (Ebeling et al. 2003).

- A demonstration project in Lincoln County/Mud River has had involvement from the WV Water Research Institute and Canaan Valley Institute; a conference on rural wastewater issues was recently held in this area as well; see http://www.canaanvi.org/canaanvi_web/uploadedFiles/Wastewater/Lincoln_Co_FlexE_Conference_Report.pdf.

Training or certification programs:

- The State of West Virginia requires that installers be certified. Class I Certification is required for the installation of conventional gravity systems; a Class II Certification is required for all alternatives. These certifications are required to be renewed every 5 years; there is no continuing education requirement (West Virginia DHHR 1998, NSFC 2007).
- Training courses are available for sanitarians and installers. The Chestnut Ridge Regional Park (the NODP Phase I site described above), in Monongalia County, is a training site (NSFC 2007).

Citizen action, private groups:

- The Freshwater Institute (1098 Turner Road Shepherdstown, WV 25443-4228, tel (304) 876-2815, fax (304) 870-2208, eml info@freshwaterinstitute.org, web http://www.freshwaterinstitute.org/).
- The West Virginia Rivers Coalition has had an interest in onsite issues and related microbial indicator monitoring (see, for example, http://www.wvrivers.org/wvrcpermitassistance/Wastewater%20Manual.pdf). Contact: Evan Hansen, Decker's Creek Watershed Association, eml ehansen@downstreamstrategies.com.
- Ashco-A-Corporation, Rte 9, Box 66-B, Morgantown, WV 26505 (contact: Paul R. Ashburn, President, tel 304-291-0808, fax 304-291-0843.) The company is involved in several research and development efforts throughout the state.
- Canaan Valley Institute has been involved in several successful community wastewater project in the state; http://www.canaanvi.org/canaanvi_web/index.aspx
- West Virginia Association of Sanitarians: http://www.wvdhhr.org/wvas/
- Upper Guyandotte Watershed Association: http://www.ugwawv.org/

Newsletters, forums, other sources of information:

- Canaan Valley Institute has a quarterly newsletter; see http://www.canaanvi.org/canaanvi_web/news.aspx?id=44

2.48.9 Enforcement (Q7)

See above; enforcement of maintenance contracts for surface-discharging systems has been particularly problematic.

2.48.10 Role of Cluster Systems and Package Plants (Q8)

As described above, residential-scale package plants with surface discharge are the solution of choice for remediations where soil-based systems cannot be successfully sited. Cluster systems have been used in a few well-publicized instances to solve long-standing wastewater treatment problems; the use of such systems appears to be increasing particularly in the last 3-4 years.

2.48.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

[ANM notes that] No interest from rural electric cooperatives in managing onsite or cluster systems was noted as of March 2009. County health departments or districts and private contractors appear to be the most common entities responsible for ongoing maintenance of onsite systems in the state.

2.48.12 What's Changed

Patterns / Drivers

[ANM notes that] While uncontrolled growth was cited as the driver for the NODP Phase II project in Monongalia County, the drivers towards solutions in other areas appear to be the local citizens and organizations struggling to overcome long-standing situations where substandard systems result in water quality/public health problems and impede economic development opportunities, and individuals' resources to fix problems are extremely limited.

2.48.13 References

Barker, Allison. 2001. FEMA funding shortsighted? Money to replace septic systems 'ludicrous,' sanitarian says. Charleston Gazette (West Virginia), Sunday, July 29, 2001, page 7A. *Newspaper article about the use of FEMA relief funding to repair onsite systems or fix straight pipes in flooded areas in the southwest part of the state.*

Ebeling, James, Scott Tsukuda, Joseph Hankins, and Clement Solomon. 2003. Performance Evaluation of a Recirculating Sand Filter and Peat Filter in West Virginia. Small Flows Quarterly 4(1): 27-37. Accessed at http://www.nesc.wvu.edu/pdf/ww/publications/smallflows/magazine/SFQ_WI03.pdf on March 24, 2009.

Grenoble, Penelope. 2007. The Fine Art of Wastewater Master Planning. In *Onsite Water Treatment* 3(5), September-October 2007. Accessed at http://www.onsitewater.com/ow_0709_fine.html on March 24, 2009. *Information about McDowell County's straight pipe elimination initiative.*

McKenzie, Caigan. 2001. NODP II Helps West Virginia Overcome Barriers to Onsite Systems. Small Flows Quarterly 2(1): 12-13. Accessed at http://www.nesc.wvu.edu/pdf/ww/publications/smallflows/magazine/SFQ_WI01.pdf on March 24, 2009. *Monongalia County, because of resistance from its own public service district/commission, has (through a NODP II project) created a public/private partnership to manage onsite systems needed to serve unplanned growth outside of sewered areas in the county.*

McKenzie, Caigan. 2006. Treating troubled waters. *Small Flows Quarterly* 7(2): 14-17. Accessed at http://www.nesc.wvu.edu/pdf/ww/publications/smallflows/magazine/SFQ_SP06.pdf on March

24, 2009. *Case study of the then-current status of efforts to improve wastewater treatment in McDowell County, written before construction of the Ashland cluster systems.*

National Small Flows Clearinghouse. 2007. West Virginia Summary Citation. Accessed at http://www.nesc.wvu.edu/pdf/summaries/WestVirginia.PDF on March 23, 2009. *This short document summarizes onsite wastewater system regulations and activities in West Virginia.*

Ohio Department of Health. 2008. Report to the Household Sewage and Small Flow On-Site Sewage Treatment System Study Commission. January 1, 2008. Accessed at http://www.odh.ohio.gov/ASSETS/7797839E4C32408484AE4A3C6EC5D866/Rep1.pdf on March 2, 2009. *Pertains primarily to Ohio but includes information submitted by West Virginia regulators on then-current average costs for conventional system installation.*

Sexstone, Alan, Mike Aiton, Gary Bissonnette, Kelly Fleming, Krista Kinneer, Keith Hench, Todd Bozicevich, Brian Cooley, and Ed Winant. 2000. A Survey of Home Aerobic Treatment Systems Operating in Six West Virginia Counties. *Small Flows Quarterly* 1(4): 38-46. Accessed at http://www.nesc.wvu.edu/pdf/ww/publications/smallflows/magazine/SFQ_FA00.pdf on March 24, 2009. *Results of a 1998 survey of over 400 ATUs with chlorination and surface discharge conducted in West Virginia.*

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2.49 Wisconsin

2.49.1 Summary

Wisconsin has about 780,000 systems in the ground, annually installs another 6,000-13,000, and replaces about 6,000-9,000. Under current code, about a quarter of Wisconsin is deemed "largely unsuitable" for onsite systems. Central and northeastern areas are marked by high water tables and wetlands. Southwestern, north-central, and northeastern areas are marked by shallow bedrock. Real problems are few and isolated, due in part to the fact that the population is densest in the southeast, where onsite conditions are good, and in part due to aggressive efforts to discover and implement effective onsite solutions. Up to 25% of systems are alternative in some sense, though state regulators made a conscious decision not to define systems as "conventional" or "alternative" in code. When public health impacts resulting from improperly maintained holding tanks in central Wisconsin were discovered in the late 1990s, changes were made to county ordinance and compliance improved dramatically. Code revisions in 2000 expanded the options for putting new technologies into general use, and specified performance standards; site-specific design; and management plans with demonstrated compliance for every system. 2008 code revisions mandated inventory of all onsite systems in the state within the next three years, and implementation of maintenance reporting programs at the county level within five years. Several small management entities exist in the state, including Westboro's Sanitary District No. 1 and the Washington Island Sanitary District, which have received national attention. The state has several grant and loan options available for upgrades, though SRF funds are not used. University of Wisconsin's nationally known Small Scale Waste Management Project developed several new technologies, and ran experimental and demonstration projects; though the project has concluded, some research continues. The state also runs training and experimental programs in collaboration with UW. Installers, inspectors, soil testers, and maintenance providers are certified at state level. There is an active onsite professionals' association.

2.49.2 Numerical Information

Permits issued state-wide for new construction and upgrades or modifications to existing systems are tracked; however, permits are not tracked for the repair of existing systems (NSFC 2006). The state does not track reason for permit issuance, but applies a ratio of 60% new construction, 40% replacement, which was developed in the late 1990s during the preparation of an Environmental Impact Statement for the 2000 code revision (Kaminski 2009). Within the last 2-3 years, housing starts have declined and counties have increasingly implemented onsite system inventory and maintenance reporting programs, such that the ratio is now likely to be closer to 50% new construction, 50% replacement (Kaminski 2009).

Total number of onsite systems: Approximately 780,000 (30% of households); 1990 U.S. census reports approximately 580,000 systems.

Number of new systems installed each year: Approximately 6,000-13,000. Highest number of permits issued in 2003, declined slightly each year in 2004-2006, with marked declines to 6000-7500 permits issued per year in 2007-2008 (Kaminski 2009).

Failure definition: Discharge of "sewage" into the building, surface- or groundwater, drain tile or zones of bedrock, or onto the ground.

Number or proportion of systems presently failing: NA

Number or proportion *repaired* annually: NA

Number or proportion *replaced* annually: Approximately 6000-9000 (Kaminski 2009; proportion of replacements has increased in recent years as described above).

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Approximately 2500 per year: 1800 mounds, 400 Wisconsin-at-grades, 300 in-ground pressure systems.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Less than 100; about 75 aerobic units and 25 sand filters.

Cost of a conventional *septic system* installation: $1,800 to $4,000 (Town of Kinnickinnic 2007); range $1500-$15,000. Based on recent Wisconsin Fund grant application documentation the average cost of a "conventional" system was $4,569 in FY2008 and $5,225 in FY2009 (Kaminski 2009).

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): $12,000-$30,000.

2.49.3 Present Onsite Status (Answers 2a-2f Summarized)

Southwestern, and some of north-central and northeastern, Wisconsin is marked by a prevalence of shallow bedrock. Portions of central and northeastern Wisconsin have high water tables and an abundance of wetlands. Approximately 45% of Wisconsin's land has been categorized as "largely" physically unsuitable for ISDSs, meaning that adequate siting and design could pose problems for a given development using conventional technology. Code revisions implemented in 2000 allowed more technologies and greater flexibility, decreasing this percentage to approximately 20%. The severely limiting conditions in Wisconsin were one of the driving forces behind the extensive research and development program (now concluded) at the University of Wisconsin/Madison. It is also reported that there is out-migration from the cities to rural areas not reachable by sewer lines, which could pose problems in the future; though technology is generally keeping up, there are concerns about the land use implications of out-migration and the conversion of agricultural land to recreational and residential use (Wisconsin Center for Land Use 2008). The most densely populated area of the state is the southeast quadrant where soil conditions are good. In consequence, problems with onsite systems are described as few, isolated, and not extensive, with no particular concentrations in any geographic area. However, in the late 1990s, researchers investigated whether septic system density was associated with endemic diarrheal illness in children in central Wisconsin; the research found that septic system densities (particularly holding tank densities) were associated with endemic diarrheal illness in central Wisconsin (Borchardt et al. 2003). This study was the first to assess residential proximity to septic systems as a risk factor for intestinal pathogens, and resulted in the swift implementation of an improved management program for holding tanks (see below).

Permits have been denied because of poor soils, shallow groundwater, shallow bedrock, steep slopes and seasonal saturation. Reasons cited for system failures include surfacing of effluent, and discharge to bedrock and/or groundwater. System failures generally relate to inappropriate design or abuse, and to only indirectly relate to soils or technology through misapplication. Sewers have been supported in the past, but this is changing as the costs associated with them rise above owners' ability to pay.

2.49.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Wisconsin Department of Commerce, Division of Safety and Buildings creates uniform standards at state level, with local city and county health departments acting as agents. Wisconsin Department of Natural Resources is indirectly involved insofar as ISDS rules have environmental impacts, and in the review of systems with flows of over 12,000 gpd (Wisconsin Department of Natural Resources 2009). For the most part, enforcement is deemed adequate. Counties are able to make civil citations, and follow up with state help if criminal citations are necessary.

Code was last revised in: 2008 (Wisconsin Department of Commerce 2008).

New revisions in progress? To be adopted when? No changes to the onsite codes are proposed as of March 2009. 2008 changes increased county responsibility for onsite management activities (see below) and prevented government employees whose duties include administering the onsite program from competing against the regulated community (Dayton 2008).

Role of legislature, regulatory agency, and politics: Any proposed new or revised code must be approved by the legislature. Support can depend on whether the package is deemed environmentally friendly or not. The pre-2000 code was a de facto land use (zoning) tool for many years, and the change to more performance-based rules was a source of controversy.

2.49.5 Management Programs (Answers 3e-3g Summarized)

Wisconsin state code does require management programs/contracts or districts to monitor and maintain onsite systems (NSFC 2006). All onsite systems approved after July 1, 2000, must include a management plan that lists maintenance requirements, maintenance contracts are required if service, inspection, or maintenance is required more than once a year by the system designer or component manufacturer stipulation(s), and proof of contract must be recorded in land records (NSFC 2006). Property owners must demonstrate compliance with maintenance and monitoring responsibilities, generally by hiring properly credentialed individuals to perform required activities. All new or repaired systems are subject to a pre-cover inspection. Most counties had, by the late 1990s, fixed pumping and reporting schedules, and had a notification system for property owners in place. Recent changes to Wisconsin's onsite systems code require all counties to inventory all systems in their jurisdictions within 3 years, and implement and enforce a comprehensive maintenance reporting program for all of these systems within 5 years

(Wisconsin Department of Commerce 2008). Aside from this, the state is not directly involved in planning issues, leaving that to the counties.
There are several small management entities that exist in the state. Westboro was an early participant in the University of Wisconsin's Small Scale Waste Management Project, and has a sanitary district that owns and operates a number of onsite systems and a STEP system with two communal leaching fields.

After an epidemiological study in the late 1990s found that illegal wastewater disposal was the major cause for an unusually high number of viral diarrhea cases in Wood County (Borchardt et al. 2003), the Board of Supervisors approved an ordinance amendment that permitted the Planning and Zoning Department to regulate all holding tanks in the county under a unified reporting system (McKenzie 2004). Since the implementation of the program, which relies on a web-based data management and reporting system, proper maintenance of holding tanks has reached a compliance level of over 95%, and the county's three-year septic tank maintenance and inspection program is close to 99 percent compliance (McKenzie 2004). As of March 2009, compliance for holding tanks was 84%, and compliance for septic tank systems remained at 94% or greater (Kaminski 2009).

The Town of Washington, after rejecting plans for centralized infrastructure, came to implement the Washington Island Utility District, which oversees operation of the Town's management plan for a septage treatment plant, land application, and about 1,000 onsite systems and holding tanks (Pinkham et al. 2004). Although onsite sand filter systems were expected to be used extensively, state-level legal wrangling unrelated to the Town resulted in liberalizing of the then-expected nitrate performance standards, and in most cases conventional or mound systems were installed instead (Pinkham et al. 2004). In addition to Washington Island's activities, Door County maintains a three-year inspection program for onsite systems, and has operated a time-of-transfer inspection program since the mid-1980s (Door County 2004).

2.49.6 New Technology (Answers 4a-4h Summarized)

The State's code includes performance requirements for influent, effluent, particle size, and freezing issues (NSFC 2006). The code accommodates and sometimes requires the use of alternative technology, effectively allowing the development of parcels not otherwise developable. Permitted systems include sand filters, aerobic systems, sand in-fill, in-ground pressure dosing, Wisconsin mounds and at-grade systems. Recirculating sand filters were approved in 1995, and a variety of ATUs and other aerobic treatment systems (including textile filters, peat filters, and fixed-film reactors) are now allowed; a current listing of approved technologies is available (Wisconsin Department of Commerce 2008a). A product review process exists that allows voluntary submittal of products and technologies not listed within code for review and approval (see committee listings below and Wisconsin Department of Commerce 2009). All applications are site-specific, with the expanded number of technologies available lending themselves to the specifics of a given site. Effective July 1, 2000, all new systems require a management plan, and counties will be expected to follow up if problems develop. The 2000 code revisions eased and expanded options for testing and bringing new technology into more general use, provided they meet discharge standards. Converse (2004 and 2005) reported the results of a long-term performance evaluation of a variety of aerobic treatment systems under field conditions in Wisconsin. The results indicated that there is significant variability both within and between treatment technologies included in the study, as to whether NSF performance standards are being met consistently under field conditions. The author noted that it was likely many of the systems involved in the study were not maintained on a regular basis, and that improved management would likely also improve field performance.

Outside of the management districts described above, there is little comprehensive information available about the use of cluster systems in the state. However, there are some anecdotal indications that the use of such systems is increasing, particularly for wastewater service in new developments (Door County Environmental Council 2003, Washington County 2008).

2.49.7 Onsite Funding (Answers 5a-5c Summarized)

Wisconsin runs a statewide grant program, the Wisconsin Fund, for failed system upgrades. Since 1978, the state's private sewage system replacement or rehabilitation grant program has awarded $83.2 million to assist more than 36,100 owner-occupied homes and owners of small commercial businesses in replacing or repairing their onsite systems (Dayton 2007). Depending on a homeowner's income eligibility and other qualifications, it will pay for up to 60% of the price of upgrading or replacement. The state has regularly re-budgeted the program at $3-3.5 million per annum, funds coming out of general purpose revenues. Despite initial concern that this program would be de-funded, the state's FY 2008 budget included continued funding (Dayton 2008). The proposed FY10 budget submitted by the Governor includes funding for this program in the amount of $2,819,000 (Kaminski 2009).Additional information is available at http://commerce.wi.gov/SB/SB-WisconsinFundProgram.html.

State revolving loan funds are not available to individual homeowners, but are available to counties if public management is provided (NSFC 2006).

2.49.8 Leadership and Information

State-level agencies, task forces:

- Wisconsin Department of Commerce (WDC), Bureau of Program Development, 2715 Post Road, Stevens Point, WI 54481-6456 (contact: Roman A. Kaminski, Program Manager; tel 715-345-5334, fax 715-345-5269; eml roman.kaminski@wi.gov).
- Wisconsin Department of Natural Resources jointly reviews large system applications with the Dept. of Commerce: http://dnr.wi.gov/org/water/wm/glwsp/facilities/.
- Wisconsin County Code Administrators' Association advises the state on wastewater issues: c/o Marathon County Zoning Dept, 210 River Dr, Wausau, WI 54403.
- POWTS Advisory Code Council, appointed by the Division Administrator, assists with review and updating of rules for soil and site evaluation, and the design, installation, inspection and maintenance of Private Onsite Wastewater Treatment Systems (POWTS): http://commerce.wi.gov/SB/SB-CodeCouncils.html#PowtsA
- POWTS Technical Advisory Committee, appointed by the Division Administrator, assists with review of specific methods or technologies that are submitted to be utilized as POWTS holding, treatment, or dispersal components: http://commerce.wi.gov/SB/SB-CodeCouncils.html#POWTS

Local governmental agencies, task forces:

- Westboro "Sanitary District No. 1" (further information NA as of March 2009).
- Some counties have Groundwater Management Advisory Boards.

- Wood County Planning and Zoning Department: http://www.co.wood.wi.us/zoning/
- Door County: http://www.co.door.wi.gov/localgov_departments_details.asp?deptid=50&locid=137

Research within governmental agencies:

- The department administers an experimental program to gather data on POWTS performance (contact Mark Finger, mark.finger@wi.gov, for more information) (Wisconsin Department of Commerce 2009).

Research within universities:

- University of Wisconsin's Small Scale Waste Management Project (SSWMP) was a nationally recognized research effort which was active for over 30 years, and developed both management programs and technologies including Wisconsin Mound, and Wisconsin-at-Grade systems; see http://www.soils.wisc.edu/sswmp/. However, with the retirement both Tyler and Converse, the Project's activities are considered complete (Etnier et al. 2007). (contacts: E. Jerry Tyler, Professor Emeritus, tel 608-262-0853; James Converse, Professor Emeritus, tel 608-262-1106).
- Current research at UW-Madison focuses on the removal of organic wastewater compounds by onsite and advanced treatment systems; contact Jean Bahr at (608) 262-5513.
- There is some limited research at University of Wisconsin/Stevens Point; http://www.uwsp.edu/cnr/gndwater/.

Onsite demonstration programs:

- The SSWMP ran many experimental systems on university agricultural property; current information about the status of these systems is NA.

Training or certification programs:

- The State does require onsite professionals to be credentialed. Credentials include Certified Soil Testers, Licensed Plumbers (Installers), Certified Inspectors, and Registered Maintainers; these credentials are renewable and subject to Continuing Education requirements (NSFC 2006).
- A variety of Onsite Training Programs are available throughout the State for all credentialed individuals. Programs range from Code Update courses to Specialized Training in soils, designs, and inspection; see http://commerce.wi.gov/SB/SB-DivContinuingEducation.html for a current listing.
- The Wisconsin Onsite Water Recycling Association (WOWRA) also offers a POWTS Evaluator Course; see http://www.wowra.com/POWTS/index.html

Citizen action, private groups:

- Wisconsin Onsite Water Recycling Association (WOWRA), 16 N. Carroll St. Suite 900, Madison, WI 53703; tel 800-377-6672, web http://www.wowra.com/
- Many groups have taken an interest in the proposed code, pro or con.
- There are watershed groups throughout the state.

Newsletters, forums, other sources of information:

- The WDC maintains an e-mail announcement list: http://commerce.wi.gov/SB/SB-DivEmailSignup.html.
- WOWRA publishes a monthly newsletter; see http://www.wowra.com/newsletter.html. The organization also holds an annual conference.

2.49.9 Enforcement (Q7)

Enforcement was previously reported to be generally adequate. In some cases, compliance with existing regulations has been dramatically improved through the implementation of management programs (e.g., Wood County). While not specifically stated, it may be expected that the 2008 code update mandating inventory and periodic inspection of all onsite systems at the county level will similarly increase the compliance of existing onsite systems with modern regulations.

2.49.10 Role of Cluster Systems and Package Plants (Q8)

Outside of the management districts described above, there is little comprehensive information available about the use of cluster systems in the state. However, there are some anecdotal indications that the use of such systems is increasing, particularly for wastewater service in new developments (Door County Environmental Council 2003, Washington County 2008).

2.49.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

No role or interest from rural electric cooperatives was noted as of March 2009. Most existing management programs are administered either by County agencies (planning/zoning departments, health departments, county sanitarians)--or by sanitary districts in the cases of the cluster systems and onsite/community systems described under Management Programs above.

2.49.12 What's Changed

Patterns / Drivers: None additional to those noted above.

2.49.13 References

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Converse, James C. 2004. Effluent Quality From ATUs and Packed Bed Filters Receiving Domestic Wastewater Under Field conditions. In *On-Site Wastewater Treatment X, Conference Proceedings*, 21-24 March 2004 (Sacramento, California, USA), ed. Richard Cooke. Accessed at http://asae.frymulti.com/abstract.asp?aid=15815&t=1 on March 25, 2009. *Results of a study in which a "number of aeration units, including both ATUs and packed bed units, were field evaluated for performance ranging from approximately 1 year to about 12 yrs. Units evaluated* *were Multi-flo, Norweco, BioMicrobics, Delta Whitewater, Nibbler Jr, Orenco SPSF, Orenco RSF for homes, RSF for commercial units and RSF for homes with filter in a concrete box."*

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2.50 Wyoming

2.50.1 Summary

Wyoming has about 60,000 systems in the ground, annually installs about 1000, and repairs or replaces about 200. Problems are few and isolated. Though development outside sewered areas accounts for more than half of the state's growth in the last decade, concerns about water quality impacts are mainly associated with older onsite systems near watercourses. New developments must show the feasibility of onsite treatment. New technology is accommodated in the code first for piloting, and later for more general use, but is not widely deployed. The state cannot mandate maintenance of alternative/advanced systems and thus does not encourage their use; nevertheless, installation of such systems is increasing in a few high-growth areas of the state. There are several cost-share programs for upgrades administered at the county level. There is limited academic research at the University of Wyoming, and at least one county has conducted a demonstration project. Two counties require licensure for installers and haulers.

2.50.2 Numerical Information

Permits are issued for new construction, and for upgrade or modification of existing onsite systems. All permits issued are kept track of at the state Water Quality Department or delegated county; however, these numbers are not reported to the state on any regular basis (NSFC 2003).

Total number of onsite systems: Estimated 60,000; 1990 U.S. census reports about 50,000 systems.

Number of new systems installed each year: Over 1000.

Failure definition: Backup, surfacing effluent, or impacts on groundwater. Repair or replacement is not necessarily defined as failure (NSFC 2003).

Number or proportion of systems presently failing: About 200 per year.

Number or proportion *repaired* annually: About 200 per year repaired or replaced.

Number or proportion *replaced* annually: See above.

Number or proportion of repairs or replacements that require *alternative* technology (e.g., sand filters, pressure dosing): Very few.

Number or proportion of repairs or replacements that require *advanced* technology (e.g., disinfection, nutrient removal): Only in the most exceptional circumstance.

Cost of a conventional *septic system* installation: $2000-$2500; range, $1000-$10,000.

Cost of a centralized *sewer tie-in* (including fees and cost of the sewer lateral): NA

2.50.3 Present Onsite Status (Answers 2a-2f Summarized)

Problems are described as few and isolated in this sparsely populated state. System permits have been denied because of shallow groundwater and thin soils. Fractured rock aquifers common in the Wyoming mountains make subsurface disposal inherently risky; in such environments subsurface disposal may not be permitted (Harmon 2007). Failures have been attributed to poor soils, age, shallow groundwater, and poor design or construction that may have predated regulations. A few watersheds are impaired for fecal coliform, in part stemming from such systems often being located near streams (Crook County NRCD 2006, Sheridan County CD 2006). New subdivision proposals must include a feasibility study of the potential for using onsite wastewater systems and water supplies (Wyoming DEP 2002); however, final approval authority rests with county officials, not the State (Harmon 2007).

Significant residential development is occurring in many areas. Growth from South Dakota's Black Hills is moving into the state's northeast corner, as well as from Colorado in the southeast. Portions of Wyoming, especially the western part of the state and areas of the Powder River Basin, have seen population growth as rapid as any area in the Mountain West (Lieske and Taylor 2007). Areas around Casper, Cody, Lander, Dubois and Pinedale are seeing major growth (Wyoming Open Spaces Initiative 2006). From 2000 through 2005, almost half of Wyoming's population growth occurred in rural areas.

2.50.4 Anticipated Changes in Regulations

Who administers, enforces onsite code? Code is made at state level, but administered by 16 of the 23 counties. Wyoming DEQ issues permits directly for the remaining seven counties. Enforcement is reported to be adequate, "failure to meet code and obtain permit is almost always resolved through conference and negotiation."

Code was last revised in: 1984.

New revisions in progress? To be adopted when? Onsite regulations for Wyoming were last amended in May 1984. There are currently no plans to update or revise the existing Code (NSFC 2003).

Role of legislature, regulatory agency, and politics: NA

2.50.5 Management Programs (Answers 3e-3g Summarized)

State Code does not require management programs/contracts or districts to monitor and maintain onsite systems or individual liquid waste systems, and there are no plans to develop such programs (NSFC 2003). Construction permits are required to be transferred to new owners in accordance with Chapter 3, Wyoming Water Quality Rules and Regulations; however, this requirement is overlooked in most instances (NSFC 2003).

Enhanced systems utilizing both anaerobic and aerobic treatment methods are heavily promoted for use in new subdivisions (Harmon 2007). The state recognizes the need for continued maintenance of such systems, but has no mechanism to enforce maintenance and proper operation of homeowner systems. Thus, for subdivisions, the State will only issue a non-adverse recommendation for enhanced home owned systems if a local organization is willing and legally capable to guarantee proper operation of the enhanced systems (Harmon 2007). In at least one area, the Star Valley portion of Lincoln County, such agreements are in place (Lincoln County 2008).

2.50.6 New Technology (Answers 4a-4h Summarized)

New technologies are in use, but not widely so, although that could change because they do allow for development on otherwise undevelopable sites. I/A technologies are added after a review of their performance during pilot projects. Enhanced treatment may be permitted through exceptions. Permitted systems include sand filters, mounds, package plants, aerobic systems, evapotranspiration, lagoon, and leaching chambers. STEP systems are permitted with a maintenance contract. State code does allow for drainfield area/size reductions for chamber systems (NSFC 2003). Enhanced systems are heavily promoted for use in new subdivisions, but the state will only approve these in cases where a local organization is willing to guarantee proper operation (Harmon 2007). Package plants and cluster systems reportedly have only a small role.

2.50.7 Onsite Funding (Answers 5a-5c Summarized)

There are no state-wide loan programs for system upgrades, and none are contemplated. There is at least one cost-share program for onsite system upgrades or replacements, funded by Section 319 grants as part of BMP implementation through the Belle Fourche River Watershed Plan, a voluntary plan developed by local stakeholders in lieu of a TMDL (Crook County Natural Resource District 2006). A similar cost-share program is being implemented in Sheridan County (Sheridan County CD 2006).

2.50.8 Leadership and Information

State-level agencies, task forces:

- Wyoming Dept of Environmental Quality (DEQ). Water Quality Division, Herschler Bldg., 122 West 25th St. Cheyenne, WY 82002 (contact: Mr. Larry Robinson, tel 307-777-7075, eml lrobin@state.wy.us).

Local governmental agencies, task forces:

- Crook County Natural Resources Conservation District: http://www.ccnrd.org/
- Sheridan County Conservation District: http://www.sccdofwyo.org
- Lincoln County: http://www.lcwy.org/

Research within governmental agencies:

- None.

Research within universities:

- Limited research on mound systems, cost comparisons, leach field failures/causes, and wellhead/source water protection occurred in the 1990s at the University of Wyoming (Utah State University 1999), and limited research continues in the Civil and Environmental Engineering Department (see, for example, http://wwweng.uwyo.edu/civil/research/environmental/projects/SepticSystemsWastewater.html).

Onsite demonstration programs:

- Sheridan County CD provided funding assistance for a landowner to construct a mounded leachfield system located along the Tongue River as part of a demonstration project (Sheridan County CD 2006).

Training or certification programs:

- Two counties require licensure for installers and haulers.

Citizen action, private groups:

- Wyoming Association of Rural Water Systems also assists with wastewater systems; http://www.warws.com/aboutus.htm.

Newsletters, forums, other sources of information:

- NA

2.50.9 Enforcement (Q7)

See above.

2.50.10 Role of Cluster Systems and Package Plants (Q8)

[ANM notes that] Cluster systems and package plants reportedly only had a very small role in the 1990s, and there is no new information that contradicts this report. The recent developments of residential subdivisions in rural areas generally are served by individual onsite systems, sometimes with community wells.

2.50.11 Role of Rural Electric Cooperatives (and/or Others) in O/M Programs for Onsite Sewage Disposal (Q9)

[ANM notes that] No role or interest was noted from rural electric cooperatives in administering O/M programs. While the state will not give a positive review to subdivisions utilizing enhanced treatment systems if no management authority exists, ultimate decision-making authority resides with the counties, and information about their management programs was NA.

2.50.12 What's Changed

Patterns / Drivers

"The impact of recent climate changes—particularly drought conditions that occurred in 2002—precipitated the move toward water recycling, notes Tim Wilson, director for the [City of Cheyenne] BOPU. "Cheyenne has a very good water supply system, but it is heavily dependent upon snowpack," he says" (Brozowski 2007). In 2002, the region received record low runoff from snowpack and experienced record high water usage. The BOPU adopted three strategies: adopting conservation measures, purchasing a nearby ranch to explore development of groundwater sources, and treating the city's wastewater to a higher standard for reuse in irrigation (Brozowski 2007).

2.50.13 References

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