



New York State
Water Resources Institute



Cornell University
Cooperative Extension

On-site Wastewater Management Programs

Case Studies

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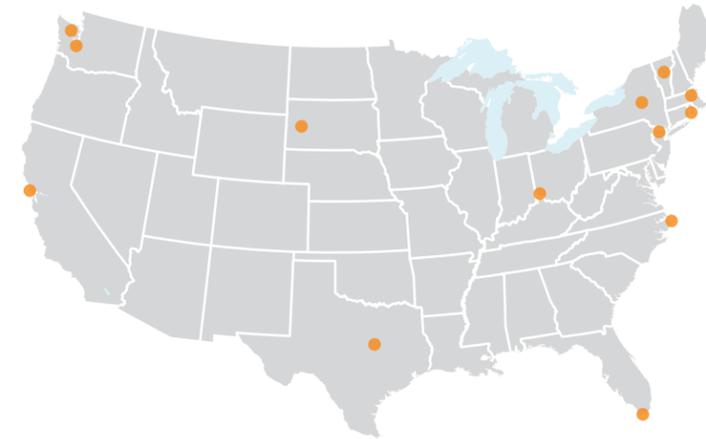
Introduction

Used in 20-25% of homes in the United States, on-site wastewater treatment systems (OWTS) are widespread and can be an efficient and cost-effective alternative to conventional centralized systems if cared for properly. However, poor design and inconsistent maintenance can lead to system failure and negative impacts on nearby water resources. Unfortunately, no federal regulations or uniform standards for the operation and maintenance of these systems currently exist. As such, regional and local governments looking to ensure public health and water quality through system functionality are left to develop and implement management programs.

Over the past decades, many municipalities and regional governments, along with the US Environmental Protection Agency (EPA), have worked to develop information and guidance on best management and administrative practices with respect to OWTS. Management programs differ according to local regulations and legal structures, stakeholder needs and values, as well as other environmental, economic, and social factors. Regardless, learning from past management attempts can be a valuable step for municipalities looking to create their own management system. To help with this process, the Water Resources Institute created the following document containing a collection of case studies from around the US.

Overview

General



13 case studies of on-site wastewater management programs from 12 different U.S. states are reviewed here.

Two of the cases, Hamilton County and Monroe County, were previously documented by the EPA.

Management Levels

Municipality (town or city)	County	Consolidated Group
West Milford Nags Head Tiverton Stinson Beach Waco Warren Acton Rapid City	Thurston County Jefferson County Monroe County Hamilton County	Otsego Lake

The case studies were sorted by three government management levels. The last level, "Consolidated Group" may refer to any association or combined efforts of various groups to manage on-site wastewater treatment systems in the designated area.

There are certain points to note regarding the management levels.

- Even within each management level, we see great variety in the way programs are run.
- Although some programs cover a large geographical area, all tend to focus on a specific area of concern.

Overview

EPA Schema

The EPA has created a management model schema as a guide for communities to develop decentralized wastewater management programs. This schema contains five models that build upon each other, growing more complex in terms of environmental sensitivity, system type, and managing entity. The models are briefly summarized below. More information is available on the EPA website.

homeowner responsibility
less environmentally sensitive
simpler systems

1

“**Homeowner Awareness**” is the simplest, involving minimal government oversight. Homeowners are made aware of their responsibilities and are expected to carry them out with some government monitoring.

2

“**Maintenance Contracts**” is meant to be used in slightly more sensitive environments. In this model, homeowners contract with a qualified service provider for the management of their system and report to a regulatory authority.

3

“**Operating Permits**” are meant for sensitive environments, with homeowners required to obtain operating permits from the managing authority based on performance standards. The authority also keeps track of the permits and ensures standards are met.

4

“**RME O&M**” a “Responsible Management Entity” (RME) assumes responsibility for the operation and management of systems in order to ensure the reliability of their operation.

managing authority
more environmentally sensitive
more complex systems

5

“**RME Ownership**” is for extremely environmentally sensitive areas and differs in that the RME owns the systems and takes care of the operation and management.

THE CASES IN CONTEXT

Many of the programs have been categorized as model 3, with permitting systems that allow OWTS owners to operate their systems so long as they meet established standards. Very few programs involved the creation of a third-party Responsible Management Entity (RME). Rather, most are administered by local governments with homeowners involved in the operation and maintenance of the systems.

Overall, It should be noted that the EPA models are only loose guidelines. In reality, most of the programs reviewed here contain elements of several model types, and are influenced by state legislation, as well as local regulations and conditions.

Case Location	1	2	3	4	5	other
Acton, MA			X			
Rapid City, SD			X			
Nags Head, NC			X			X
West Milford, NJ			X	X		X
Hamilton County, OH			X			
Tiverton, RI		X				
Thurston County, WA	X	X	X			
Jefferson County, WA			X	X		
Warren, VT					X	
Otsego Lake, NY	X					
Stinson Beach, CA			X	X		
Monroe County, FL			X			
Waco, TX		X	X			

Overview

Bodies of Water

Water resources such as lakes or bays act as visible reminders of the importance of water quality and the need for functioning on-site wastewater treatment systems. OWTS management programs reviewed here tend to coalesce around prominent water resources, and these bodies of water appear to fall into three main categories:

● **One large, unifying body of water**, where the water quality usually affects a smaller community within a larger geographical area

● **Surrounding waters**. Here, the water quality of a broad region is of concern

● **Water resources/recreational waters**. Here, the water quality is of concern because of potential impacts to drinking water or recreation

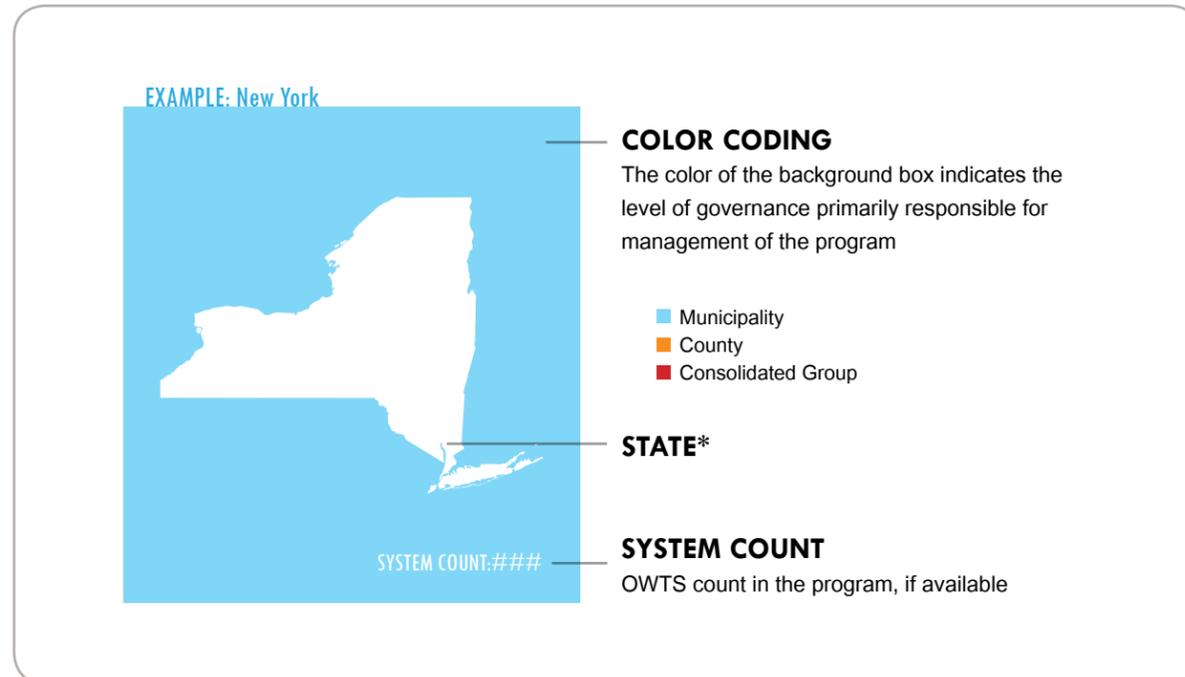
Each case does not necessarily fit into just one category, but may be a combination of categories. The following figure notes the water bodies of significance for each case study in this document, as well as the water body categories that the cases fall into.

CASE	Water Bodies
West Milford, NJ	Greenwood Lake
Thurston County, WA	Puget Sound
Jefferson County, WA	Puget Sound
Otsego Lake Watershed, NY	Otsego Lake
Acton, MA	Assabet River
Monroe County, FL	Surrounding waters of the Florida Keys region
Tiverton, RI	Surrounding waters
Nags Head, NC	Surrounding waters
Stinson Beach, CA	Bolinas Lagoon and surrounding waters
Rapid City, SD	water resources EX. Madison Aquifer
Warren, VT	Freeman Brook, Mad River
Waco, TX	Lake Waco, groundwater
Hamilton County, OH	Unspecified; water resources

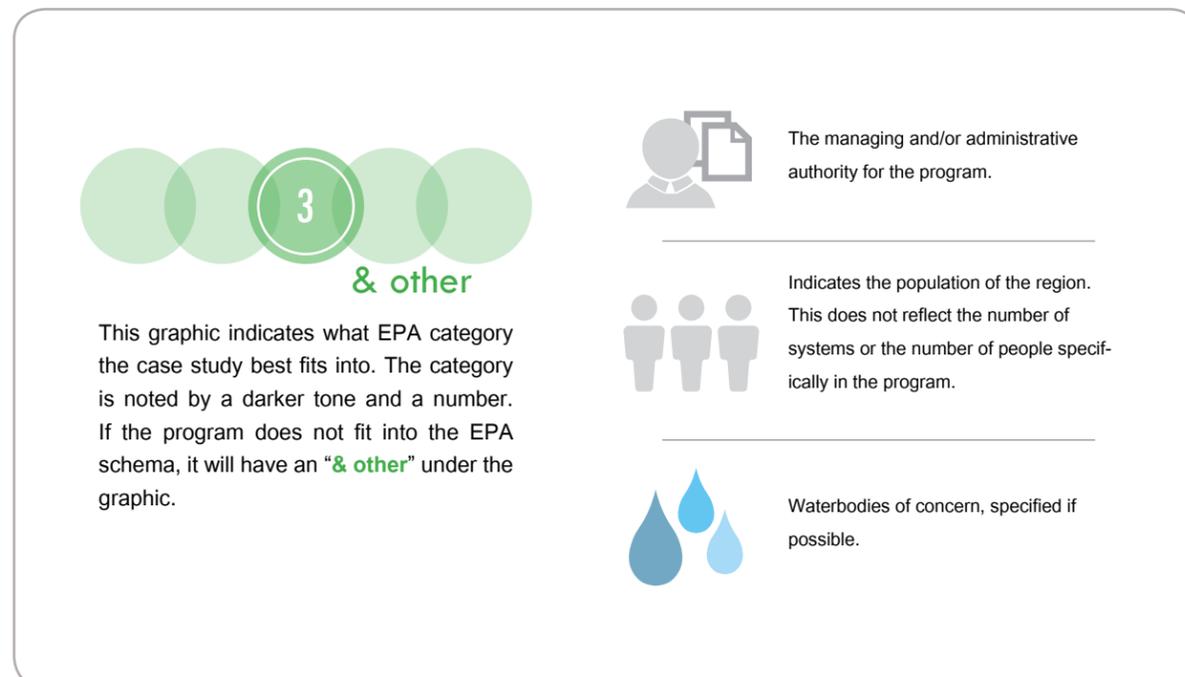
● Acton is marked because the Assabet River is specifically noted in its management plan, though it is unclear whether or not the river serves to unify the community in a water protection effort.

Reading the Case Studies

GRAPHICS



* The vector shape maps for all the states were obtained from FreeVectorMaps.com



Reading the Case Studies

COMPONENTS

PROGRAM DEVELOPMENT

MOTIVES

A brief list of generalized motives that drove this program.

TIMELINE

A timeline depicting events that are relevant to the management program. This includes, but is not limited to, older programs, related events or occurrences such as floods or disease outbreaks, legislation and other legal acts, etc. The timeline is not all-inclusive, and may not contain some related events.

THE PROGRAM

This section describes the program, briefly starting off with a short goal quote from relevant documents.

KEY POINTS

A list of key components of the program(s) in place at the case study location.

IMPLEMENTATION + FUNDING

Describes in short the implementation of the program in terms of who manages the program and (if possible) how many staff members are involved in the administration and management of the program. This section also describes some of the funding options and methods of the programs.

PUBLIC ENGAGEMENT

Looks at public engagement efforts undertaken. This includes, but is not limited to, homeowner-specific programs and outreach efforts.

CHALLENGES

Notes any challenges that the case faced while developing and implementing the program, as mentioned in any documents or in interviews.

RESULTS

Describes any information that may indicate the results of the program, whether it be changes in water quality or level of homeowner participation. Results vary widely from case to case.

OTSEGO LAKE WATERSHED, NY



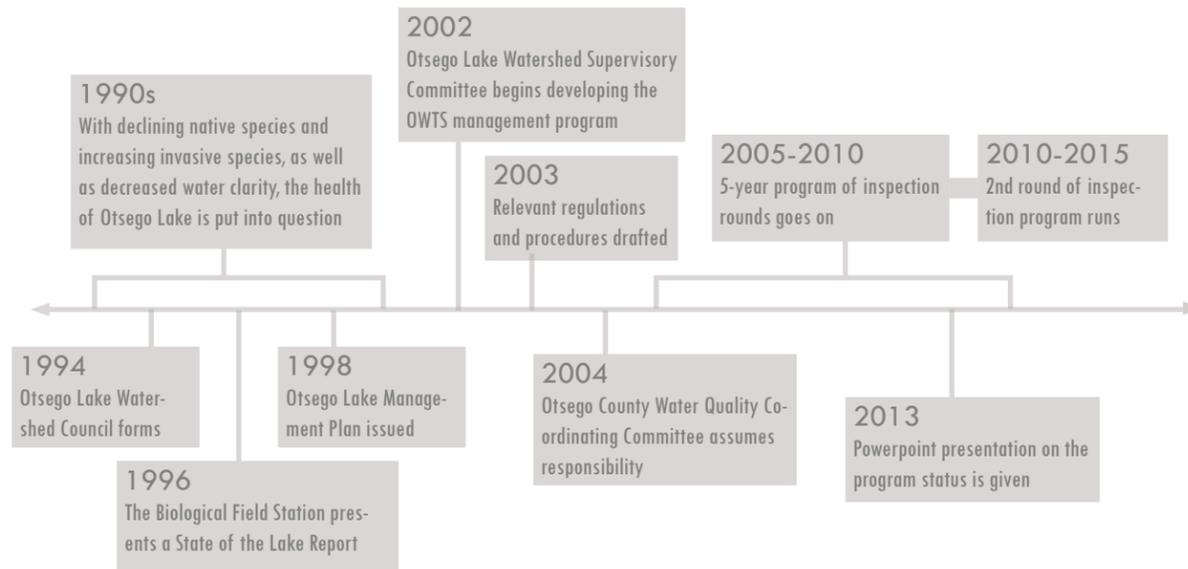
3

FACTS

-  Otsego Lake Water Quality Coordinating Committee
Watershed Supervisory Committee
-  60,000 (Otsego County)
-  Otsego Lake

PROGRAM DEVELOPMENT

MOTIVES: environmental concerns, public health, economic impact



SOURCES Holly Waterfield, e-mail interview by Sohyeon Hwang, 2 July 2015.
Holly Waterfield "Otsego Lake Watershed Management Plan", presentation, *SUNY Oneonta BFS*. 2013.
Map of New York - Single Color by FreeVectorMaps.com
"The State of Otsego Lake, 1936-1996", *SUNY Oneonta*. accessed July 2015, <http://www.oneonta.edu/academics/biofld/sol.asp#POPULATION>
"Watershed Council Hires Lake Manager", *Biological Field Station Reporter*, Summer 2000.

OTSEGO LAKE WATERSHED, NY

THE PROGRAM

"...Protect the quality of drinking water from the lake... preserve the lake's natural beauty... Ensure the safety of recreational users of the lake."

- Otsego Management Plan 1998

KEY POINTS

- + Creating a comprehensive inventory of all OWTS in the Lake Shore Protection District
- + GIS program tracking and database creation
- + Inspection program codified, inspections required every five years
- + Advanced technology systems as replacement systems
- + Public education and outreach
- + Monitoring program with the Biological Field Station (BFS) at the State University College at Oneonta

IMPLEMENTATION + FUNDING

OWTS management at the Otsego Lake Watershed is administered by the Otsego Lake Water Quality Coordinating Committee and the Watershed Supervisory Committee (WSC).

The program was initially financed by a variety of sources, such as a New York State Department of Environmental Conservation (NYSDEC) grant, the Clark Foundation, Otsego County Conservation Association, and the Village of Cooperstown.

PUBLIC ENGAGEMENT

The 2007 update of the 1998 plan indicated various public education and outreach efforts in the community on lake-related issues in general by several relevant groups in the area, with mail newsletters and the Otsego Lake festivals in 2005 and 2006. Homeowners are responsible for the operation and

maintenance of their systems, but the WSC follows up on systems that receive a failing certificate to make sure they are repaired in a timely manner.

CHALLENGES

In a 2013 presentation, it was noted that communication, especially with homeowners, had been an issue. It was important to have very clear criteria for inspections and maximize public education as much as possible. It also became clear that a solid legal standing was important given that the program functions across multiple townships and involves several organizations.

RESULTS

The monitoring program indicated that system performance was variable, and sensitive to seasonal use. It was also found that phosphorous removal in alternative systems was not as efficient as hoped.

The program has seen several accomplishments. In 2004, all systems in the zone of protection (within 500 ft of the lake shore and 100ft of tributary streams) were inventoried. In 2006, the NYSDEC awarded \$76,000 to the WSC to implement demonstration projects of alternative system designs, monitored by the BFS.

Inspection cycles have indicated improvements in system performance and active repairs. 2014 was the end of the second 5-year cycle of inspections. Cycle 2 showed notable improvement. In both cycles, 373 systems were inspected, but Cycle 2 had a failure rate of only 4% as opposed to the 51% in Cycle 1. According to the same status report, Cycle 3 for 2015-2019 has been entered into the system schedule.

SOURCES "Otsego Lake Management Plan 2007 Update", *Otsego County Water Quality Coordinating Committee*. 2007.
Holly Waterfield, "Otsego Lake Watershed Management Plan", presentation, *SUNY Oneonta BFS*. 2013.
Win McIntyre, "Annual Status Report 2014", accessed 7 July 2015.

HAMILTON COUNTY, OH



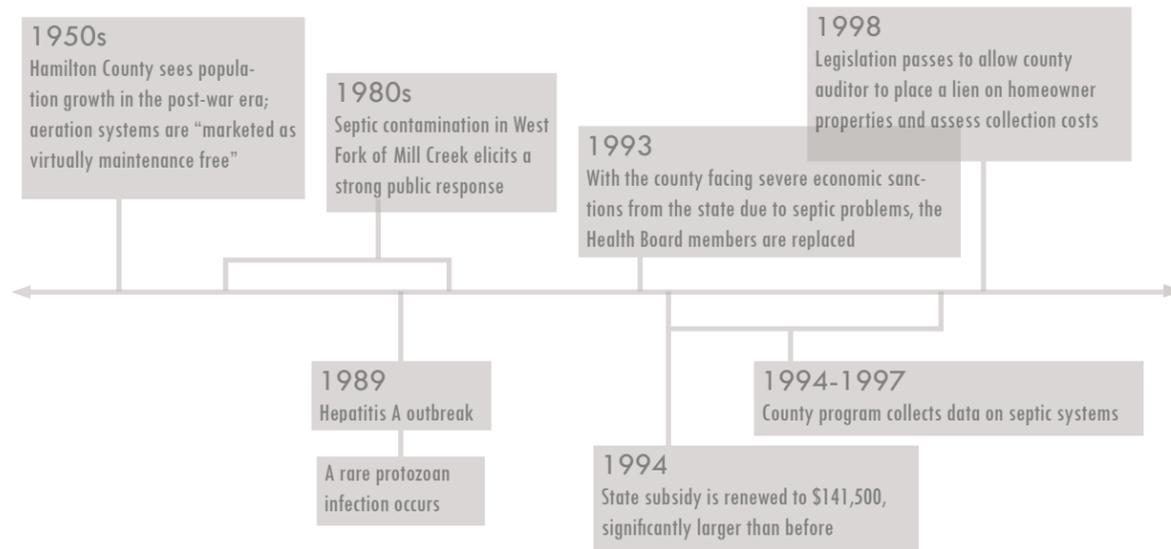
2 3

FACTS

- Hamilton County Public Health
- 802,374
- groundwater resources, unspecified

PROGRAM DEVELOPMENT

MOTIVES: environmental concerns, public health, economic impact + legislative compliance (sanctions)



SOURCES STS Management Program, *Hamilton County Public Health - Department Environmental Health Services*, last modified 25 July 2012.
Tim Ingram, “Onsite Wastewater Management: An Integrated Approach to Improving Water Quality and Preventing Disease”, *Journal of Environmental Health*, 1999.
M.C. McKenzie, “Hamilton County Ohio: An Onsite Wastewater Management Success Story”, *Small Flows*, Vol. 12, No. 4, Fall 1998.
“Hamilton County”, USEPA Decentralized Management Case Studies, accessed June 2015.
Census Bureau, State and County QuickFacts, Hamilton County, 2011. <http://quickfacts.census.gov/qfd/states/39/39061.html>
Map of Ohio - Single Color by FreeVectorMaps.com

HAMILTON COUNTY, OH

THE PROGRAM

“...to ensure all of the critical elements, when dealing with on-site sewage treatment systems, are properly addressed.”
- STS Management Plan, rev. 2012

KEY POINTS

- + Routine inspections of OWTSS
- + Renewable operation permit systems, with associated fees
- + Maintenance contracts with a service provider
- + Access database for scheduling, tracking, permitting and billing
- + Registering of service providers

IMPLEMENTATION + FUNDING

The program is administered by the Department of Environmental Health Services at Hamilton County Public Health.

Currently, the program is primarily supported by fees. According to the EPA case study document of Hamilton County, the budget for 2008 was \$1.24 million, with \$850,000 coming from user fees and the remaining \$390,000 coming from the Hamilton County Stormwater District.

PUBLIC ENGAGEMENT

Community involvement played a huge role at Hamilton County. When the program initially came to action, lack of homeowner compliance and engagement prevented the program from running smoothly. The health commissioner at the time, Tim Ingram, made efforts to connect with the community through multiple public neighborhood meetings to explain to homeowners why maintenance and routine inspections of systems were so important. The meetings also discussed the necessity and use of the fees, and the importance of referring to health district

SOURCES STS Management Program, *Hamilton County Public Health - Department Environmental Health Services*, last modified 25 July 2012.
Tim Ingram, “Onsite Wastewater Management: An Integrated Approach to Improving Water Quality and Preventing Disease”, *Journal of Environmental Health*, 1999.
M.C. McKenzie, “Hamilton County Ohio: An Onsite Wastewater Management Success Story”, *Small Flows*, Vol. 12, No. 4, Fall 1998.
“Hamilton County”, USEPA Decentralized Management Case Studies, accessed June 2015.
Sewage Code Regulation 529, Hamilton County Public Health, 2013.

standards as opposed to manufacturers’ standards. Ingram further reached out to local radios and newspapers to publicize the importance of proper maintenance. The health department also mailed out pamphlets and fact sheets to the county to explain why the aeration systems in place had to be inspected and actively maintained.

CHALLENGES

When the program went into place, Hamilton County faced opposition. While the health board approved of the new measures, many homeowners were initially opposed to participating in inspections, with a new \$40 inspection fee in place. Some homeowners saw the inspections as an invasion of privacy. The county passed legislation to be able to enforce compliance in certain cases. In addition, the county lacked data regarding systems despite multiple years of effort.

RESULTS

The program has yielded results indicative of success. Data collected in 1997 indicated a four-fold reduction in BOD and other contamination indicators, and a 1998 survey noted public approval. Record-keeping was successfully updated to include detailed information, and the county was able to renew and increase its state subsidy in 1994.

The EPA case study file notes that more than 32,000 system repairs have taken place. 2000 and 2001 studies found significant improvements in suspended solids (54%), BOD (36%) and fecal coliform (60%). Furthermore, system malfunctions have dropped dramatically, with non-mechanical system malfunctions dropping from 23% in 2003 to 2.6% in 2012.

THURSTON COUNTY, WA



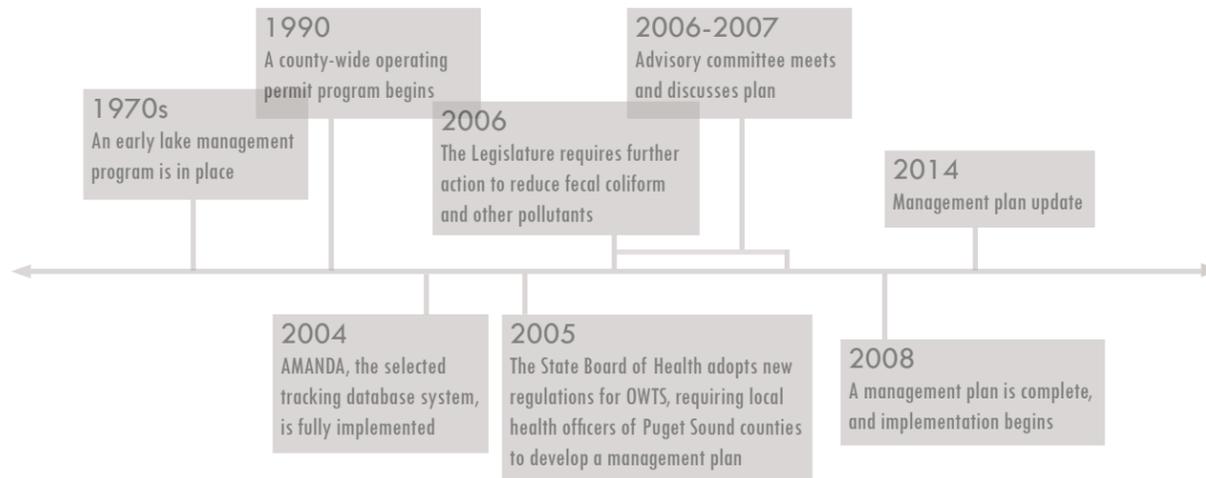
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FACTS

- Environmental Health Division in the County Public Health and Services Department
- 252,264
- Puget Sound

PROGRAM DEVELOPMENT

MOTIVES: environmental concerns, public health, legislative compliance, economic impact



SOURCES Environmental Health Program Manager at Thurston County, e-mail interview by Sohyeon Hwang, 8 July 2015.
Onsite Sewage System Management Plan, Thurston County Public Health and Social Services Department, 7 January 2008.
Onsite Sewage System Management Plan 2014 Update, Thurston County Public Health and Social Services Department, July 2014.
Map of Washington - Single Color by FreeVectorMaps.com
Census Bureau, State and County QuickFacts, Thurston County, 2011.

THURSTON COUNTY, WA

THE PROGRAM

“...to protect the public health in Thurston County by assuring that on-site sewage systems are properly built, operated, and maintained.”

- Thurston OSS Management Plan, 2008

KEY POINTS

- + Electronic database of operation, management and permit data
- + Identification and protection of environmentally sensitive areas
- + Permits for new or developing systems
- + Licensed service providers/installers
- + Submission of records for each tank pumped/serviced
- + Routine inspections and inspections during site evaluation and construction of systems, and a notification system
- + Homeowner certification of inspection (certain cases)
- + Required service contract (only in certain cases)

IMPLEMENTATION + FUNDING

Thurston County's management plan is run by the Environmental Health Division in the county Public Health and Social Services Department. Several groups were a part of the advisory group that was essential to creating and promoting the 2008 plan. Thurston County has multiple programs with varying levels of required management. The Water Quality and On-site Sewage Program is staffed by approximately 11 full-time positions and 3 part-time positions.

The plan is funded by a combination of fees and grants. In December 2013, a progress report estimated a 2014 budget of \$714,715. The Washington State Department of Health provided some funding for the program and recently started a project which will help create a funding source for local health authorities.

PUBLIC ENGAGEMENT

Thurston County has stressed the important of public en-

gagement and community awareness. Training sessions have been held for real estate and on-site industry professionals to be aware of Marine Recovery Areas (MRAs), as well as for advanced system owners in the Nisqually Reach MRA. Many workshops for homeowners have also been held.

CHALLENGES

Thurston county initially encountered some trouble because of the large-scale nature of a county-wide program. There were over 70,000 systems and they were not all on record. Of these, a majority were determined to not require management. Approximately 13,648 are now in the management program.

A major challenge was funding. The Board of Health determined that the plan be generally funded through fees. The Board of Health also provided some County General Funds, but due to the high demand of these funds in other areas, the amount was not sufficient. As the development plans required more funds, the program turned to grants.

RESULTS

Thurston County has made significant progress. According to the 2014 Update, about 3,700 tanks are pumped annually and 7,500 notices are sent out annually. Required repair rates have been on a downward trend since 2007. The county has created a systematic approach to identifying and inventorying new systems, developed an electronic report system for service professionals, and enhanced the database to be more efficient. There is also now a required inspection of a system when property is sold.

The program has had many education and training opportunities for pumpers, homeowners, and other stakeholders. From 2007 to 2014, 161 workshops were held and 2,295 homeowners became certified to inspect simpler types of systems on their own; this program was for MRAs only.

SOURCES Environmental Health Program Manager at Thurston County, e-mail interview by Sohyeon Hwang, 8 July 2015.
Onsite Sewage System Management Plan, Thurston County Public Health and Social Services Department, 7 January 2008.
Onsite Sewage System Management Plan 2014 Update, Thurston County Public Health and Social Services Department, July 2014.
Map of Washington - Single Color by FreeVectorMaps.com
Census Bureau, State and County QuickFacts, Thurston County, 2011.

JEFFERSON COUNTY, WA



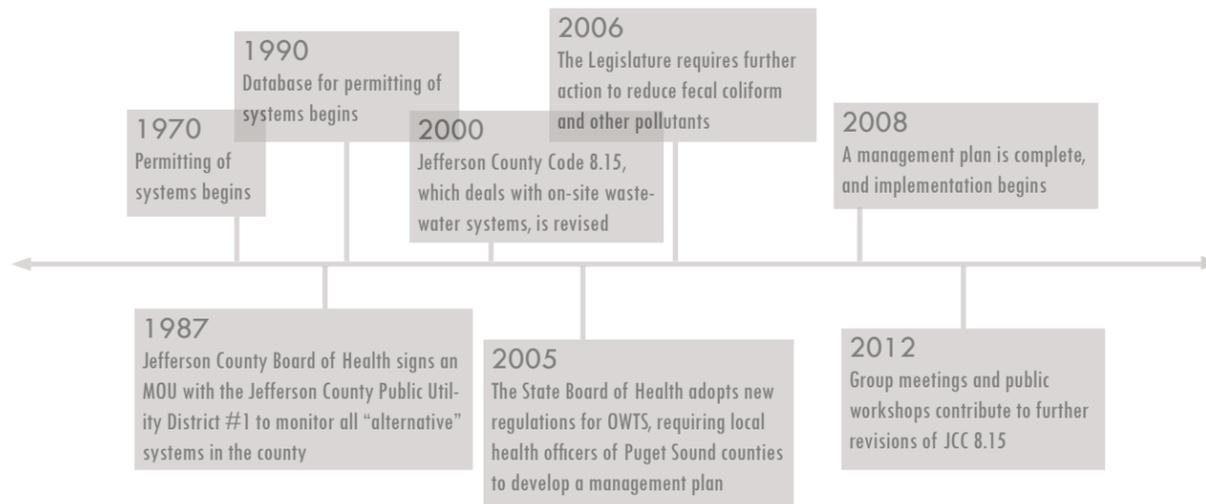
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FACTS

-  Jefferson County Public Health
-  29,872
-  Puget Sound

PROGRAM DEVELOPMENT

MOTIVES: environmental concerns, public health, legislative compliance



SOURCES Jefferson County OSS Management Plan, Jefferson County Public Health, 20 August 2007.
Planned Performance Measures 2013: OSS and Septic O&M Programs, Jefferson County Public Health 2013.
Census Bureau, State and County QuickFacts, Jefferson County, 2011.
Map of Washington - Single Color by FreeVectorMaps.com

JEFFERSON COUNTY, WA

THE PROGRAM

"...minimiz[e] the public health effects of On-Site Sewage Systems on surface and ground waters... protection of environmentally sensitive areas."

- Jefferson County OSS Plan

KEY POINTS

- + Database to record and track systems
- + Review and issuance of installation permits for systems
- + Inspections with a submitted monitoring report, with a reminder/notification system
- + Service certification program for installers, repairers, other service providers, etc.
- + Education program for stakeholders
- + Low-interest loan program to repair failing or substandard systems

IMPLEMENTATION + FUNDING

Jefferson County Public Health is the managing authority for the On-site Sewage System Program (OSS Program) which works to prevent contamination of waters due to OWTS failure.

The program is funded by fees generated from permits and inspections and the local Clean Water District. In addition, the program has applied to state and federal grants to cover costs.

PUBLIC ENGAGEMENT

Jefferson County has widespread community engagement. There was public participation in the planning process, as seen in the 8.15 revisions in 2012. The 2008 plan sought to enhance the educational program with educational materials, reminders/notifications, public meetings and classes, and events independently and jointly with Washington State University Cooperative Extension. From 2008 through 2011, 33 workshops were

held, with over 800 participants overall. Press releases were planned for 2012 and 2013, according to the 2013 Planned Performance Measures Report.

One of the programs is a Homeowner Authorization Program, which allows homeowners to inspect their own systems. Relevant and necessary classes were to be provided by the county.

CHALLENGES

Eeducational programs, as well as staff, are limited by the yearly revenue stream. In 2012, permitting workload increased by approximately 25% but due to the recession of more recent years, more staff could not be employed. While staff became more efficient, "permit turnaround time" became longer.

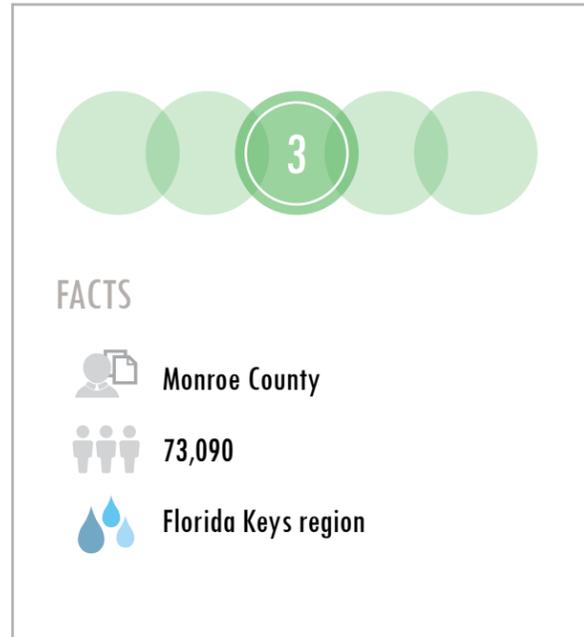
The program staff also strove to improve and maintain effective communication with clients and partners to meet regulations.

RESULTS

The 2012 Year End Report for the management plan noted a constant stream of system repairs, upgrades, and complaints (both received and closed) from 2008 to 2012. The percent of monitoring inspections resulting in some necessary maintenance was just under 30% in 2008 and 2009, and then went up to 56% and 68% in 2010 and 2011 (respectively) due to the fact that tank pumping was included as a maintenance item in the latter two years. The percent of inspections indicating a need for "significant maintenance or repair" remained under 20% and failures stayed under 2% for all years.

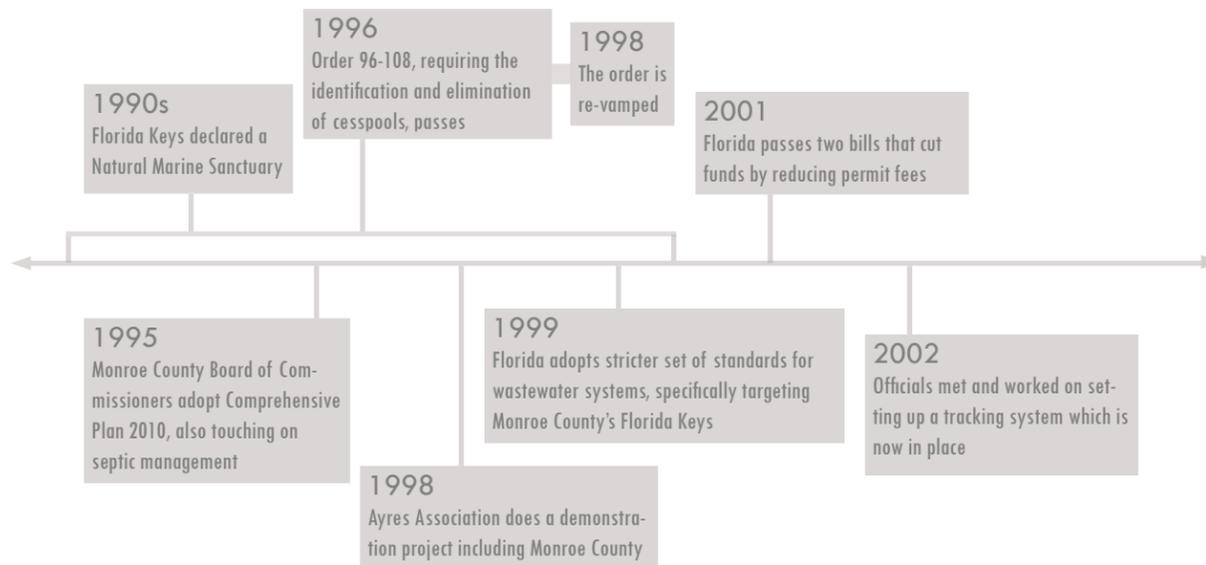
SOURCES Jefferson County Board of Health Ordinance Number 06-0517-12/8.15 On-Site Sewage Code, adopted 17 May 2012.
On-Site Sewage (OSS) and Septic Operations & Monitoring (O&M) Programs 2012 Year End Report, Jefferson County Public Health, 2013.
Jefferson County OSS Management Plan, Jefferson County Public Health, 20 August 2007.
Planned Performance Measures 2013: OSS and Septic O&M Programs, Jefferson County Public Health 2013.

MONROE COUNTY, FL



PROGRAM DEVELOPMENT

MOTIVES: environmental concerns, public health, legislative compliance



SOURCES "Monroe County", USEPA Decentralized Management Case Studies, accessed June 2015.
 Kevin Sherman et al., "Implementation of Model Programs 3 and 4 of the U.S.E.P.A. Voluntary Management Guidelines in the State of Florida" (paper, 25 June 2003).
 Census Bureau, State and County QuickFacts, Monroe County, 2011.
 Map of Florida - Single Color by FreeVectorMaps.com

MONROE COUNTY, FL

THE PROGRAM

"Protecting the health of coastal waters and marine habitats.."
 - EPA Decentralized Case Studies, 2012

KEY POINTS

- + Renewable operating permits
- + Routine inspections
- + Maintenance contracts required of homeowners
- + System inventory
- + Service reminders assisted by a tracking system
- + Licensing for contractors and service providers

IMPLEMENTATION + FUNDING

The program in place at Monroe County is part of a state-wide program. Due to the high number of on-site treatment systems in Florida and the environmental sensitivity of the area, Florida adopted a stringent set of standards, which partly addresses the Florida Keys and Monroe County specifically. Monroe County had adopted these standards in their Monroe County 2010 plan. Permits for construction, repair, and other services are officially distributed by the state. The Monroe County program is staffed by 8 full-time employees. The program is financed by federal funds and extensive statewide trust funds, the latter of which gather revenue from fees generated from permits and licenses. According to the EPA, the annual budget is \$330,000.

PUBLIC ENGAGEMENT

The Florida Department of Health provides resources for homeowners to familiarize themselves with the permits and requirements, available online. Technical training for service providers is given by the Florida On-site Wastewater Association. The Monroe County Sanitary Wastewater Master Plan published in 2003 indicated several meetings, workshops, and outreach events and activities to raise awareness and create a dialogue with the public

SOURCES "Monroe County", USEPA Decentralized Management Case Studies, accessed June 2015.
 Kevin Sherman et al., "Implementation of Model Programs 3 and 4 of the U.S.E.P.A. Voluntary Management Guidelines in the State of Florida", 25 June 2003.
 Florida Administrative Code 64E-6 "Standards for Onsite Sewage Treatment and Disposal Systems", Florida Department of State, last modified 2013.
 Monroe County Sanitary Wastewater Master Plan, submitted to Monroe County and CH2MHILL, June 2000.

on wastewater systems, though this was not necessarily limited to septic systems. Homeowners receive service reminders/notifications and are responsible for maintenance contracts with a lawful septic contractor in order to ensure the proper operation and maintenance of their system.

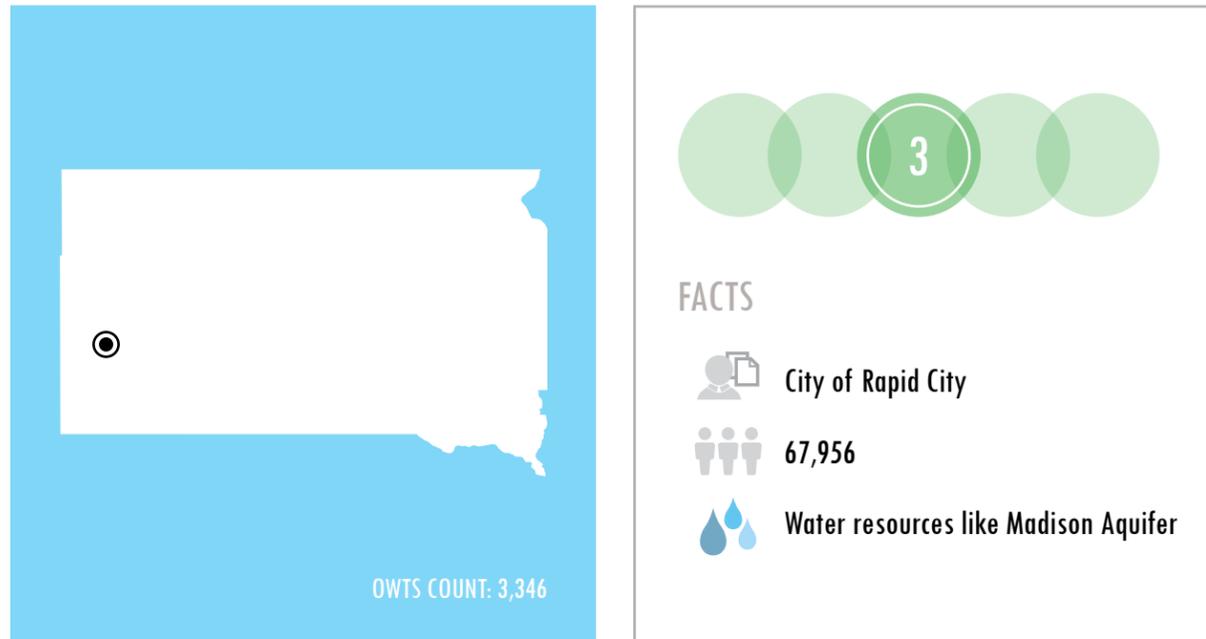
CHALLENGES

The highly sensitive nature of the Florida Keys posed a serious problem as it was difficult to devise a program such that the safety of the Keys would be ensured. The program experienced some trouble in tracking operating permits and maintenance of the growing number of systems in the region. This issue was addressed largely by the 2002 initiative to set up a tracking program. Communication issues with service providers were also present, but a series of workshops and outreach efforts such as meetings improved the situation.

RESULTS

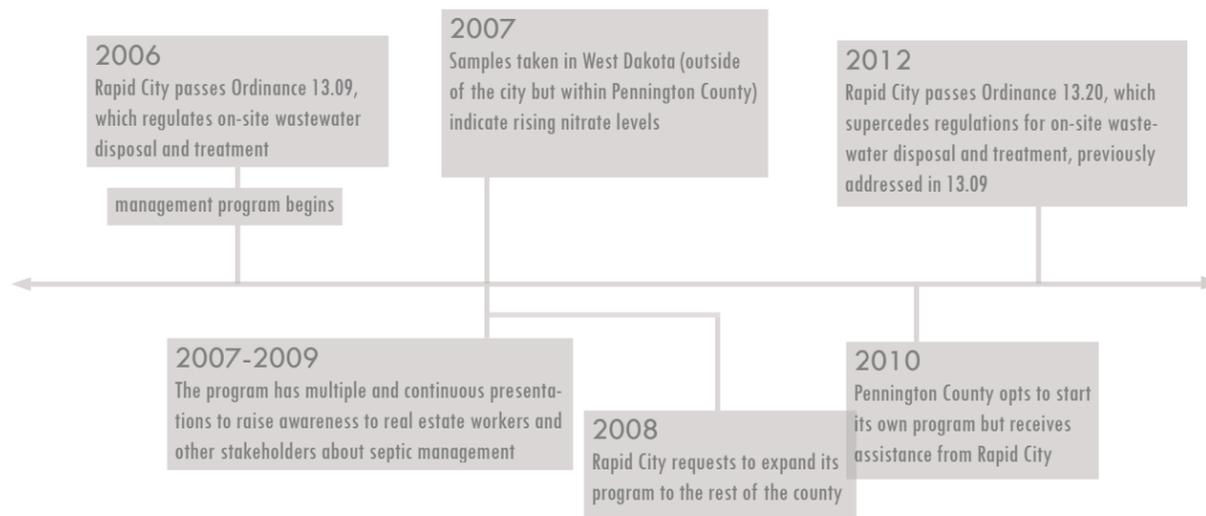
A case study of Monroe County in 2003 described the program as an "unequivocal success". In the span of one year (since 2002, when the tracking system was put in place), over 1,000 service events and 2,196 operating permits were added to the tracking system. Revenue from permits also increased. The tracking program specifically was considered successful enough that Monroe County's unused funds for the project were set up to assist nearby Franklin County. In a 2012 EPA case study of the county, Monroe had 3,065 permitted systems and relatively strict standards for effluents, which are sampled before being discharged into the soil.

RAPID CITY, SD



PROGRAM DEVELOPMENT

MOTIVES: environmental concerns, public health



SOURCES Rieb Jesse, e-mail interview by Sohyeon Hwang, 2 July 2015.
Louie Arguello, "On-site Wastewater Treatment Management: Assuring Sage Drinking Water Now and for Future Generations," (presentation notes, 19 February 2008).
Census Bureau, State and County QuickFacts, Rapid City, 2010.
Map of South Dakota - Single Color by FreeVectorMaps.com

RAPID CITY, SD

THE PROGRAM

"...[for] the protection of public health and the environment, by minimizing public health effects of on-site domestic wastewater disposal systems on waters..."
- Rapid City On-site Wastewater Program Intent, 2014

KEY POINTS

- + An Access database to track permitting information for systems
- + Permitting system generating 6-year permits, which come after a routine inspection (every six years) and pumping (recommended every 3 years)
- + Inspection reminders
- + Use of state-licensed service providers

IMPLEMENTATION + FUNDING

Rapid City's program is staffed by one full-time employee and two part-time employees. The part-time employees are utilized in the case that the full-time employee is not available.

The program was initially supported by permit fees of \$120 for a 3-year permit. It is now funded by fees, including a permit fee of \$20 for 6-year permits and water and sewer fees.

PUBLIC ENGAGEMENT

When the program began, an informational program brochure was distributed to system owners. The program administrator at the time also gave several presentations to real estate agents and businesses to raise awareness about the program and explain on-site wastewater treatment systems. The program gives out inspection reminders, as system owners may be unaware of the program or of when their permit expires. Homeowners are responsible for the proper operation and management of their

systems and for notifying the city of any violations that [may] occur.

CHALLENGES

A challenge Rapid City sometimes faces is dealing with permitting that occurs within the one-mile buffer zone around the city limits. Homeowners in this region do not always want to comply with the city ordinances as they felt they are not obliged to do so, although this zone is set by state law and agreed upon by Pennington County. However, communication with these system owners usually leads to program compliance.

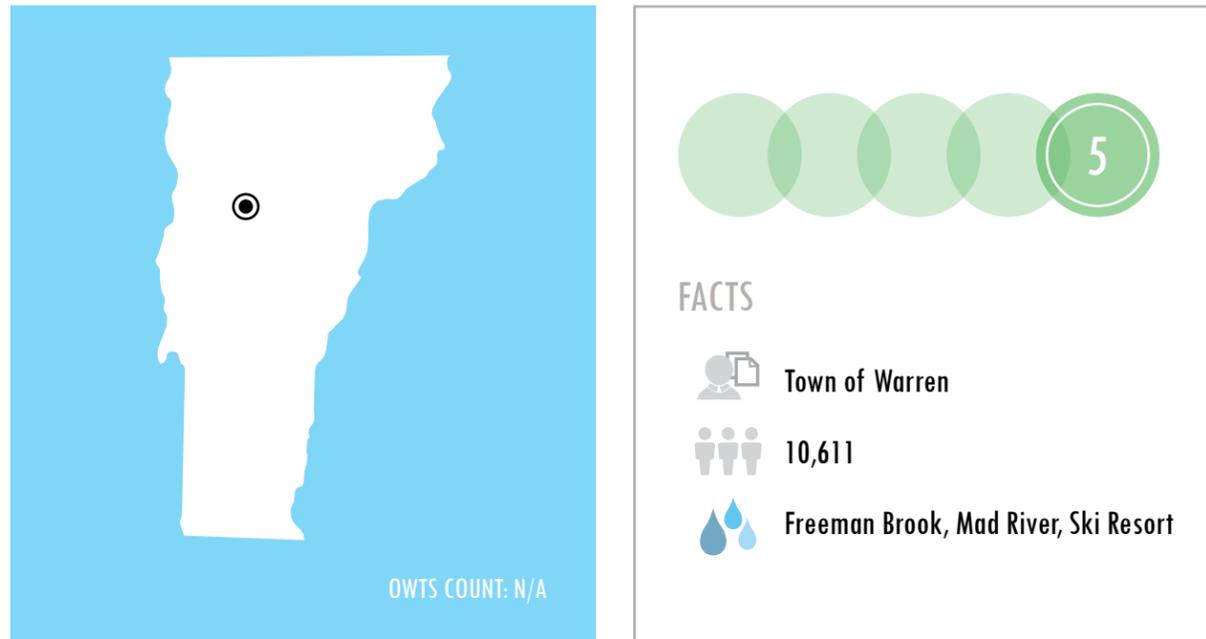
RESULTS

The program at Rapid City has been described as "very effective", with every found failure or spillage being dealt with accordingly in a relatively prompt manner. In the months of May and June of 2015, the On-site Wastewater Administrator inspected 160 of the 3,346 systems on record, with only 5% of those inspected (8) failing in some way. Expanding on its success, the city helped Pennington County develop and start a program to tackle OWTS problems outside the city's jurisdiction.

The U.S. Geological Survey (USGS) has monitoring wells throughout the area, though this data is not necessarily in the Rapid City database. The administrator noted an interest in looking at data by the USGS and the Department of Environment and Natural Resources (DENR) at a later time.

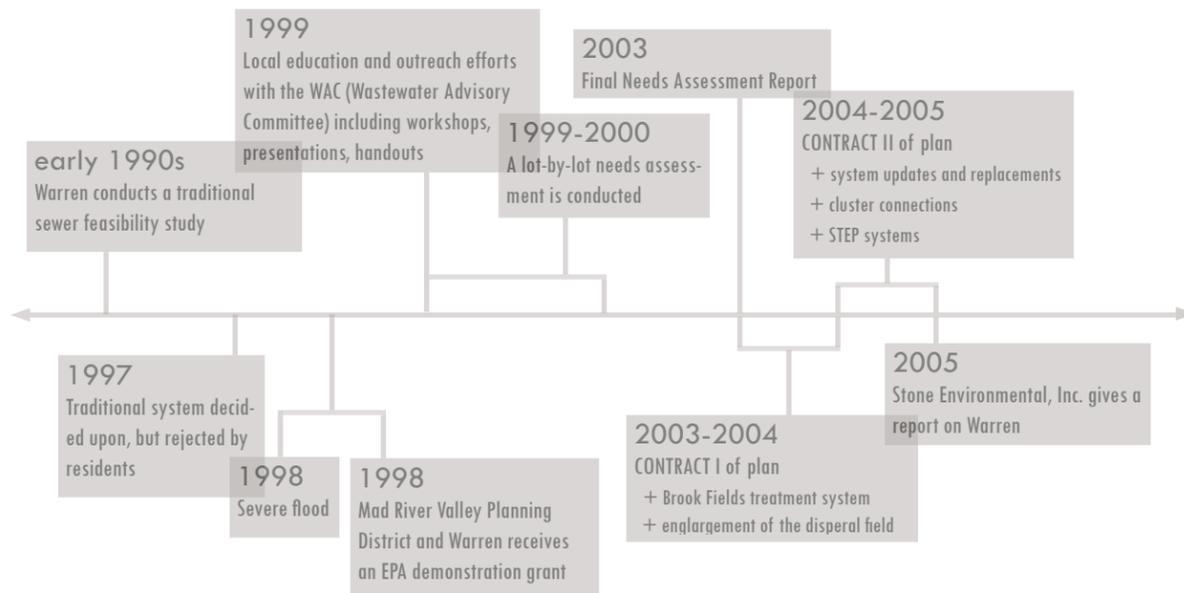
SOURCES "Source Water Protection: On-site Wastewater Program Intent", City of Rapid City, last modified October 2014.
Chapter 13.20: Onsite Wastewater Disposal and Treatment, City of Rapid City Code of Ordinances, accessed July 2015.
Rieb Jesse, e-mail interview by Sohyeon Hwang, 2 July 2015.

WARREN, VT



PROGRAM DEVELOPMENT

MOTIVES: environmental concerns (surface water quality and needs assessment results), economic (resort)



SOURCES "Case Study: Town of Warren, Vermont" (case study, WERF, accessed June 2015).
 "Warren, Vermont: A Different Approach For Managing Wastewater in Rural Villages" Stone Environmental Inc., 11 March 2005.
 Amy Macrellis of Stone Environmental Inc., e-mail correspondence by Sohyeon Hwang, June 2015.
 Census Bureau, State and County QuickFacts, Warren, 2010.
 Map of Vermont - Single Color by FreeVectorMaps.com

WARREN, VT

THE PROGRAM

"...[to maintain] superior water quality..."
 - Stone Environmental Report, 2005

KEY POINTS

- + Town ownership of systems
- + Contract with engineering firm for inspections and O&M
- + Permits from the state for operation of the system
- + Annual inspection reports go to the state
- + Public education and outreach
- + Licensing of service providers

IMPLEMENTATION + FUNDING

The Town of Warren runs the OWTS management program, as it now owns the systems in the program and ensures proper operation and maintenance of those systems through contracts with engineering companies. The program was supported by a variety of grants including the EPA demonstration grant, USEPA STAG, and the Vermont State Pollution Abatement Grant. A loan program (SRF Loan) was also in place, and the town allocated money to support the program. The program is now funded further by user fees, interest and penalties, and sewer permits. Future costs of construction and connection to the system are covered by (private) owners.

PUBLIC ENGAGEMENT

Homeowners and the public were widely involved with the project at Warren. It was their vote that rejected the initial traditional sewer system in 1997, and they continued to be heavily involved, approving an essential bond vote. It has been noted that there is a high participation rate in the project (approximately 95%). At the beginning of the program's conception, the WAC was pivotal in public engagement. Furthermore, there were multiple outreach events and educational efforts such as workshops and meetings.

SOURCES "Warren, Vermont: A Different Approach For Managing Wastewater in Rural Villages" Stone Environmental Inc., 11 March 2005.
 Annual Report of the Town of Warren and Warren Town School District For the Year Ending December 31, 2014, Town of Warren, accessed July 2015.
 Mary K. Clark et al., "WARREN, VERMONT CASE STUDY: A DIFFERENT APPROACH FOR SMALL RURAL VILLAGES (Case Study Paper)", accessed June 2015.
 Amy Macrellis of Stone Environmental Inc., e-mail correspondence by Sohyeon Hwang, June 2015.
 Sewer Ordinance, Town of Warren, accessed June 2015.

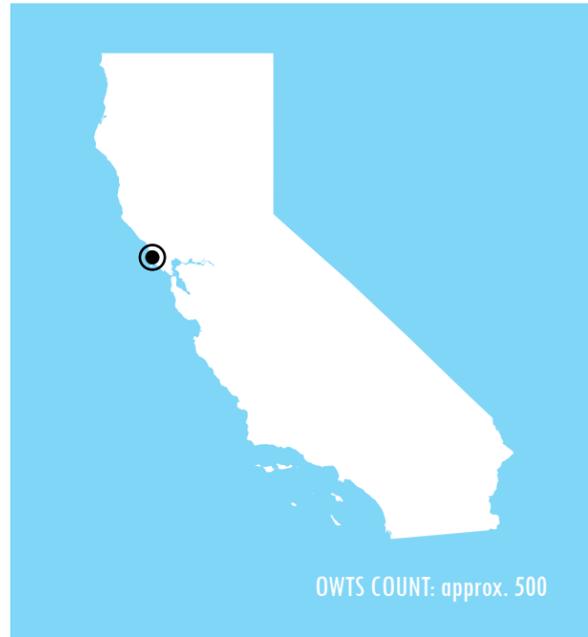
CHALLENGES

The Town faced several difficulties in implementing their program. One was that the town strove to own the systems in this program and had to obtain the rights. Until the decision to move forward, the community did not show much support for the program. There was additionally a lack of data, making it hard to determine which properties needed to be upgraded. Finally, Warren's use of innovative technology put it at odds with the state, which "did not initially promote innovative treatment and dispersal technologies or distributed management." This made it difficult for Warren to obtain the required state permit to update the system at the elementary school.

RESULTS

Warren has been deemed a success, and continues to expand. For the school system and clustered systems in its program, it was awarded the Vermont Grand Awards for Engineering Excellence from the American Consulting Council. Furthermore, sampling reports indicated that contaminants remained well within standards, according to a case study document by the Water Environment Research Foundation (WERF).

STINSON BEACH, CA

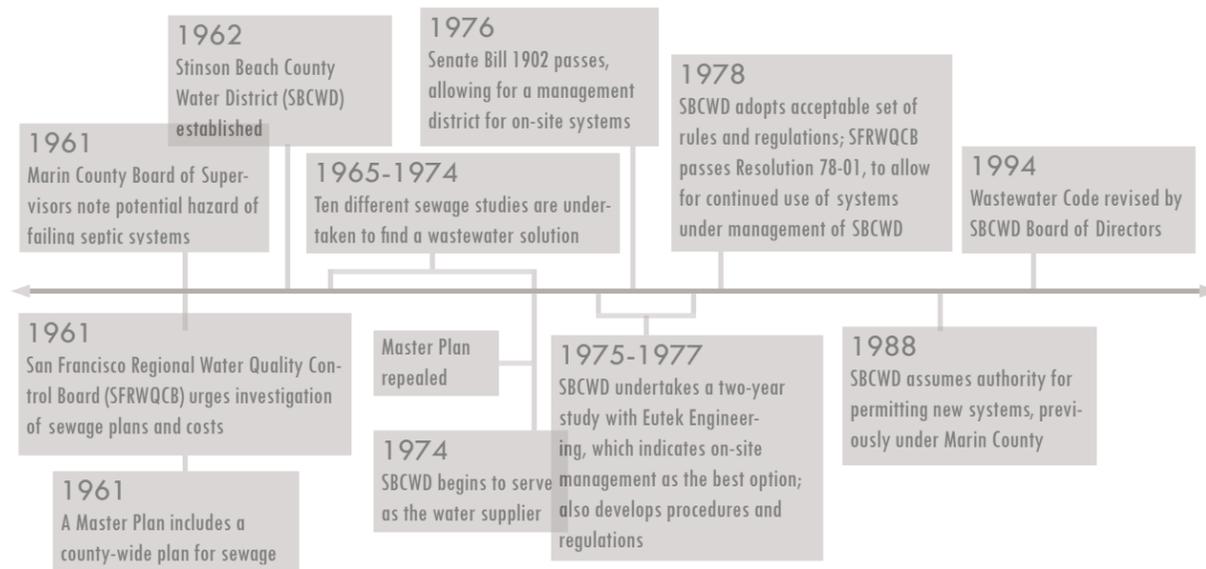


FACTS

- Stinson Beach County Water District
- 632
- Bolinas Bay, Bolinas Lagoon

PROGRAM DEVELOPMENT

MOTIVES: environmental concerns, public health



SOURCES "HOMEOWNER'S GUIDE: BRIEF HISTORY OF MANAGEMENT PROGRAM", *Stinson Beach County Water District*, <http://stinson-beach-cwd.dst.ca.us/guide/hog1.html>, accessed June 2015.
 William Whipple, Jr., *New Perspectives in Water Supply* (CRC Press, 11 January 1994).
 Title IV Onsite Wastewater Management Code, Stinson Beach County Water District, adopted 15 November 2014, accessed June 2015.
 Census Bureau, State and County QuickFacts, Warren, 2010.
 Map of South Dakota - Single Color by FreeVectorMaps.com

STINSON BEACH, CA

THE PROGRAM

"...[to] control and enhance the quality of ground and surface waters of the District."
 - Stinson Beach Title IV

KEY POINTS

- + Renewable 2-year permits
- + Routine inspections by the Stinson Beach County Water District (SBCWD), with files for each system and inspection notifications sent accordingly
- + Inspection right of entry with an inspection warrant
- + Licensing of contractors and service providers
- + Monitoring wells to track water quality
- + Public education and outreach

IMPLEMENTATION + FUNDING

Stinson Beach's program is run by the Stinson Beach County Water District which oversees both water and wastewater management in the area.

The program is now supported by the revenue generated by annual service charges and permitting fees. In order to aid owners, state funding was made available for loans.

PUBLIC ENGAGEMENT

When the program at Stinson Beach was being developed, water contamination was a huge problem, leading the county to take on large and forceful measures when enforcing the new rules and regulations. As such, homeowner cooperation was essential. Homeowners were made aware and involved in the decision-making process during the development of the program, voting down several proposals before collectively deciding on decentralized management.

The district sends out inspection notifications and requires that homeowners file contractor information. Homeowners are responsible for applying for necessary permits regarding their systems during the construction and maintenance process. Notably, the district maintains

the right of entry to property if owners do not cooperate.

CHALLENGES

A challenge faced by the program at Stinson Beach was the number of different authorities related to the program. Multiple levels of approval and authority were required to truly get the program started, as the program needed legitimate legal backing in order to enforce the strict regulations that were being adopted.

RESULTS

The program at Stinson Beach is generally considered a success, having been included as a model in "Model for Success in On-Site Wastewater Management" published in the May 2002 run of the *Journal of Environmental Health*. In *New Perspectives in Water Supply*, William Whipple, Jr., an expert on managing water programs, described the program as "successful in demonstrating the technical and financial viability of on-site systems serving the wastewater needs of an existing community."

SOURCES William Whipple, Jr., *New Perspectives in Water Supply* (CRC Press, 11 January 1994).
 Title IV Onsite Wastewater Management Code, Stinson Beach County Water District, adopted 15 November 2014, accessed June 2015.
 Stinson Beach County Water District Budget for Fiscal year 2014-2015, accessed July 2015.

ACTON, MA



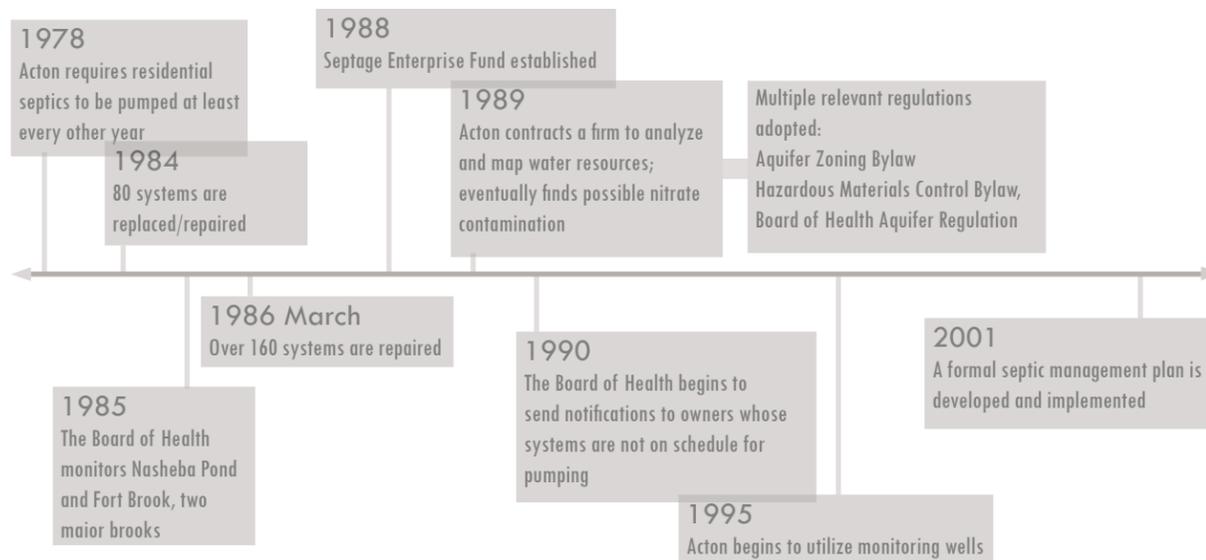
2 3

FACTS

- Acton Board of Health
- 21,924
- Assabet River

PROGRAM DEVELOPMENT

MOTIVES: environmental, public health



SOURCES William Whipple, Jr., *New Perspectives in Water Supply* (CRC Press, 11 January 1994).
 Doug Halley, "Town of Acton Wastewater Management Plan Grant Proposal", Town of Acton, 2001, accessed 16 June 2015.
 Doug Halley (Health Director), e-mail interview by Sohyeon Hwang, June 2015.
 Census Bureau, State and County QuickFacts, Acton, 2010.
 Map of Massachusetts - Single Color by FreeVectorMaps.com

ACTON, MA

THE PROGRAM

"...to manage all wastewater discharges comprehensively, with the goal of prolonging the lifespan of all systems and ensuring that environmental impacts are minimized, if not eliminated."

- Town of Acton Wastewater Management Plan, 2001

KEY POINTS

- + Licensing of system installers
- + Routine inspections and pumping to prolong the life of septic systems
- + Computer database system for notifications and tracking
- + Monitoring of surface and sub-surface environmental impacts
- + Educational program and outreach for homeowners

IMPLEMENTATION + FUNDING

The program at the town of Acton is run by the local Board of Health.

The program is currently funded by a combination of fees. There is a \$20 permit fee for every system and a combination of other fees associated with the Septage Enterprise Fund, which had about \$150,000 in revenue during the fiscal year of 2013.

PUBLIC ENGAGEMENT

The program in Acton emphasizes the need for public awareness and education for homeowners on septic systems. The plan delineates that educational mailings be periodically sent through the Town's quarterly newsletter. Acton has a Wastewater Advisory Neighborhood Taskforce that meets and discusses options, concerns, and other wastewater-related issues.

Homeowners are responsible for the operation and

maintenance of their systems by hiring professionals. The town sends out notifications and reminders.

CHALLENGES

One of the greatest challenges Acton faced was septage haulers who were being charged an additional fee for every septic tank pumped. Haulers had to pay a discharge fee and receive a permit from the Acton management office to be able to discharge waste at the wastewater facility due to facility policy.

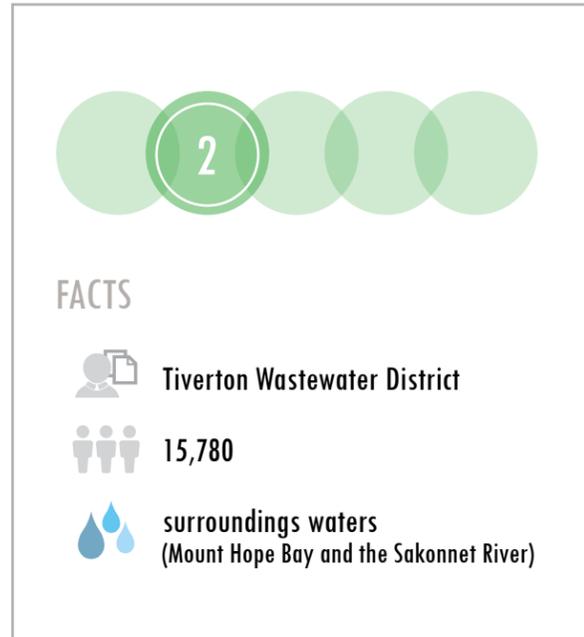
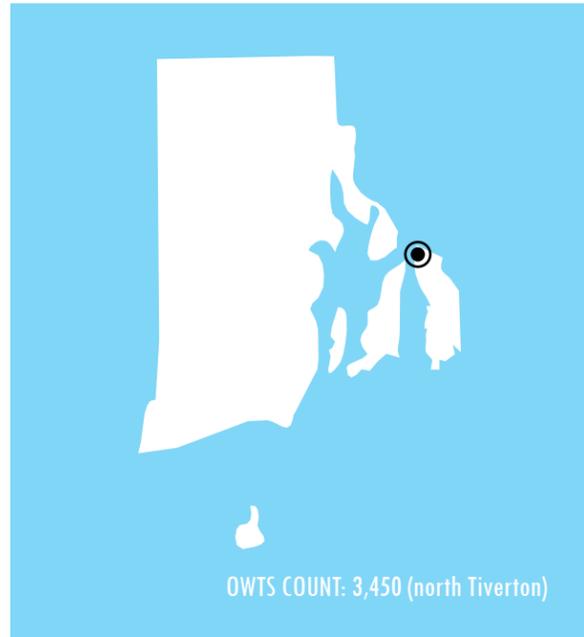
Acton needed significant outreach efforts to get residences and homeowners on-board with the program through targeted mailings and by working closely with real estate agents to make bi-annual pumping the norm.

RESULTS

Most of the goals outlined in the management plan have been implemented. An official at the program has noted a trend of decreasing numbers of replacements over time, but it is unclear as to whether this is an indication of success or of a stagnating economy. A 2010 internal assessment reviewing the program indicated "high compliance with regular pumping, a decrease in variances required for systems, an increase in nitrogen removal systems, and a decrease in system replacements." Environmental monitoring, started in 1990, notes a slow but steady increase in fecal coliform levels, though that has been attributed to various factors, of which septic systems are only one.

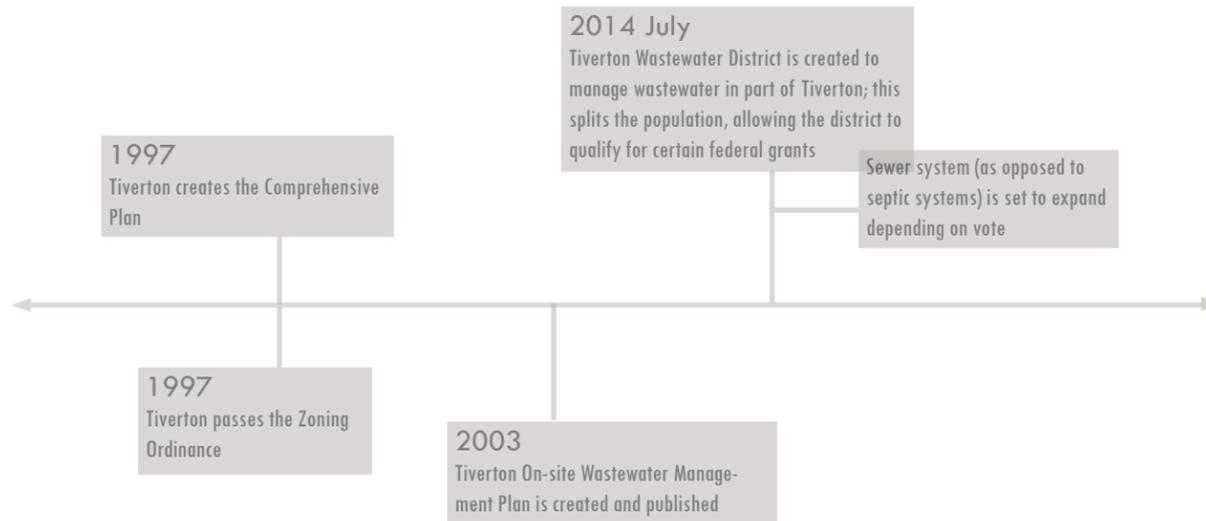
SOURCES William Whipple, Jr., *New Perspectives in Water Supply* (CRC Press, 11 January 1994).
 Doug Halley, "Town of Acton Wastewater Management Plan Grant Proposal", Town of Acton, 2001, accessed 16 June 2015.
 Doug Halley (Health Director), e-mail interview by Sohyeon Hwang, June 2015.
 Municipal Budget Supplement for Fiscal Year 2015, Town of Acton, accessed July 2015.

TIVERTON, RI



PROGRAM DEVELOPMENT

MOTIVES: environmental concerns, water pollution concerns, public health, legislative compliance



SOURCES Brenda A. Dillman and Galen H. MvGovern, Tiverton Onsite Wastewater Management Plan for Tiverton, February 2003.
 Article IX ONSITE WASTEWATER MANAGEMENT, Appendix C in Sewers and Sewage Disposal, Tiverton Code, accessed June 2015.
 Kevin P. O'Connor, "Bill Signed by RI Governor Establishes Tiverton Wastewater District", *The Herald News*, last modified 8 July 2014, <http://www.heraldnews.com/article/20140708/News/140707427>.
 Census Bureau, State and County QuickFacts, Tiverton, 2010.
 Map of Rhode Island - Single Color by FreeVectorMaps.com

TIVERTON, RI

THE PROGRAM

"...Safeguard public health and protect and improve ground and surface water resources."

- Tiverton On-site Wastewater Management Plan, 2003

KEY POINTS

- + An OWTS inspection and maintenance program, with a baseline inspection determining the frequency of routine inspections
- + Notifications to remind homeowners of inspection schedules
- + Town-approved inspectors with standardized inspection reports
- + Financial assistance in the form of loan programs
- + Educational program to facilitate implementation of the plan

IMPLEMENTATION + FUNDING

Tiverton's program is administered by the Tiverton Wastewater District (formerly the Tiverton Wastewater Management Commission). The District Board is made up of five members and is staffed by three employees, according to their website.

The program is financed by a fee structured around associated services and bonds. The plan indicated that the administration intended to apply for grants at one point. Loan programs have been put in place to assist homeowners maintain their systems properly.

PUBLIC ENGAGEMENT

Public engagement and education is a significant part of the management program at Tiverton. The ordinance indicates that the Wastewater Collection Superintendent develop and implement an annual educational program, meant to build upon the existing Stafford Pond Educa-

tional Outreach Program. According to the 2003 plan, such educational materials were planned to be distributed through letters, press releases, and newspapers ads. Annual targeted mailing to owners were also planned, though it is not clear how much these goals were implemented.

Homeowners in the Tiverton program are responsible for the operation and maintenance of their systems. Tiverton has a notification system and loan program in place to remind, aid, and engage the community.

CHALLENGES

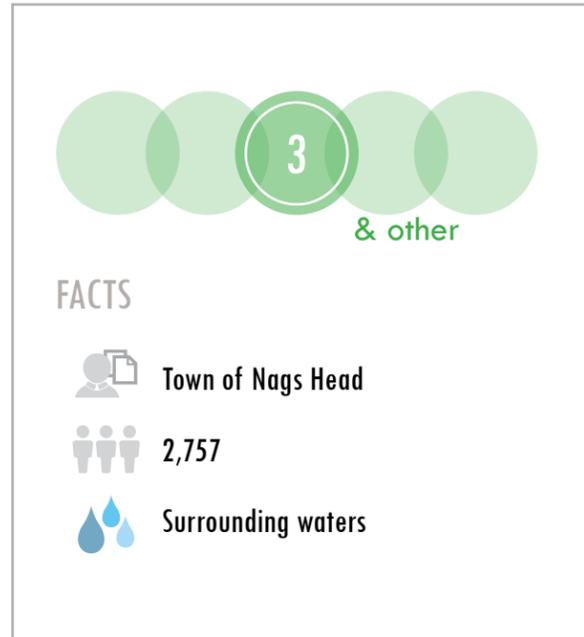
A challenge faced by Tiverton was funding. Some grants provided by the U.S. Department of Agriculture are targeted to communities wanting to update sewer systems with populations under 10,000. Tiverton, at 15,000, did not make the cut. In order to qualify for funds for wastewater and sewer issues in general, the town created the Tiverton Wastewater District last year. The District oversees on-site wastewater treatment system management and sewer connections.

RESULTS

With the formation of the Wastewater District in the past year, Tiverton has been able to apply for more grants to fund their program. As of July 2014, north Tiverton residents were looking at two options: to connect to traditional sewers or to install "more efficient and... much more expensive septic systems". In June 2015, the sewer expansion project was voted on and approved by residents.

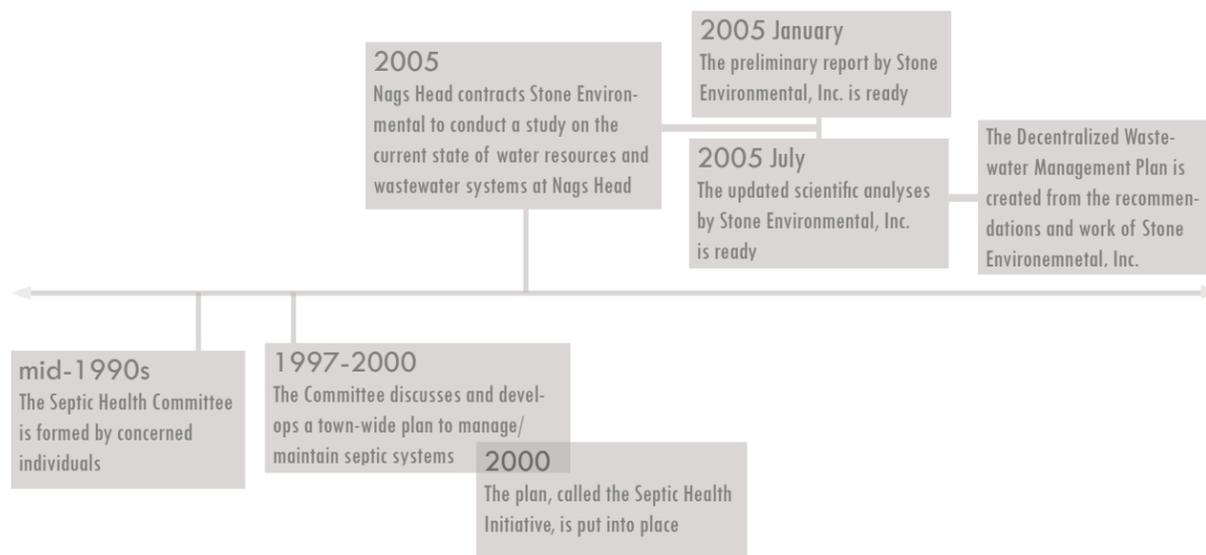
SOURCES Brenda A. Dillman and Galen H. MvGovern, Tiverton Onsite Wastewater Management Plan for Tiverton, February 2003.
 Article IX ONSITE WASTEWATER MANAGEMENT, Appendix C in Sewers and Sewage Disposal, Tiverton Code, accessed June 2015.
 Kevin P. O'Connor, "Bill Signed by RI Governor Establishes Tiverton Wastewater District", *The Herald News*, last modified 8 July 2014, <http://www.heraldnews.com/article/20140708/News/140707427>.
 "Our View: Tiverton's Sewer Question" *The Herald News*, 9 July 2014, <http://www.heraldnews.com/article/20140709/OPINION/140706944>.

NAGS HEAD, NC



PROGRAM DEVELOPMENT

MOTIVES: environmental concerns, public health



SOURCES "Town of Nags Head Decentralized Wastewater Management Plan" (report, Stone Environmental Inc., 12 July 2005).
"Final Technical Report" (report, Stone Environmental Inc., 11 July 2005).
"Septic Health Initiative/Water Quality", Town of Nags Head website, accessed June 2015.
Census Bureau, State and County QuickFacts, Nags Head, 2010.
Map of North Carolina - Single Color by FreeVectorMaps.com

NAGS HEAD, NC

THE PROGRAM

"...committed to protecting the environment and public health. Effective care of on-site systems is essential to keeping this commitment..."

- Decentralized Wastewater Management Plan, 2005

KEY POINTS

- + Septic Tank Pumping and Inspection Program
 - Loan fund and money incentives
- + Water Quality Monitoring Program
- + Education Program
- + Decentralized Wastewater Management Plan
 - Expansion of previous key points
 - Permit tracking and reporting
 - Water use tracking and reporting
 - Zoning regulations

IMPLEMENTATION + FUNDING

The Septic Health Initiative is implemented by Nag's Head. Cooperation between multiple groups within Nags Head made the program possible.

In 2005, the program was financed by the revenue generated from the town's Water Department and administered by Planning Department staff. The 2014-15 Fiscal Report indicated that the 2014 year budget total was approximately \$280,000

PUBLIC ENGAGEMENT

Nags Head has an extensive public outreach program. The initial Septic Health Initiative in 2000 included a survey questionnaire, workshops, and multiple kinds of handouts (door-hangers, stickers, web pages). Currently these are all available, as indicated online, and the town gives informational links on the operation and maintenance of septic systems for homeowners and other inter-

ested stakeholders.

CHALLENGES

Nags Head worked on education and outreach efforts with the development of a Decentralized Wastewater Management Plan, as they found many system owners did not know the components, functions, and possible consequences of on-site systems. The Management Plan also took into consideration the need to have community support and input and the legal authority necessary to implement pieces such as routine inspections.

RESULTS

In 2005, Stone Environmental, Inc. prepared a technical report examining the practices put into place from the 2000 initiative. It found that approximately 29% of the on-site systems in Nags Head had been inspected as part of the voluntary inspection program — that data also suggested that approximately 16% of systems overall had failed in the last four years. The firm concluded that while systems appear to be largely performing well, a significant portion required "more active management".

The report indicated that surface water quality did not appear to be affected by the on-site systems. Groundwater quality was variable, but there were some suggested trends in northern regions of the town. The report found three main groups of several individual systems that appeared to be causing high levels of contaminants such as phosphate and ammonia.

Nags Head has consistently published annual water quality reports indicating no violations, available on the website.

SOURCES "Town of Nags Head Decentralized Wastewater Management Plan" (report, Stone Environmental Inc., 12 July 2005).
"Final Technical Report" (report, Stone Environmental Inc., 11 July 2005).
"Septic Health Initiative/Water Quality", Town of Nags Head website, accessed June 2015.
"Adopted 2014-15 Budget: Septic Health", Town of Nags Head, accessed July 2015.
2014 Annual Water Quality Report, Town of Nags Head, accessed July 2015.

WEST MILFORD, NJ



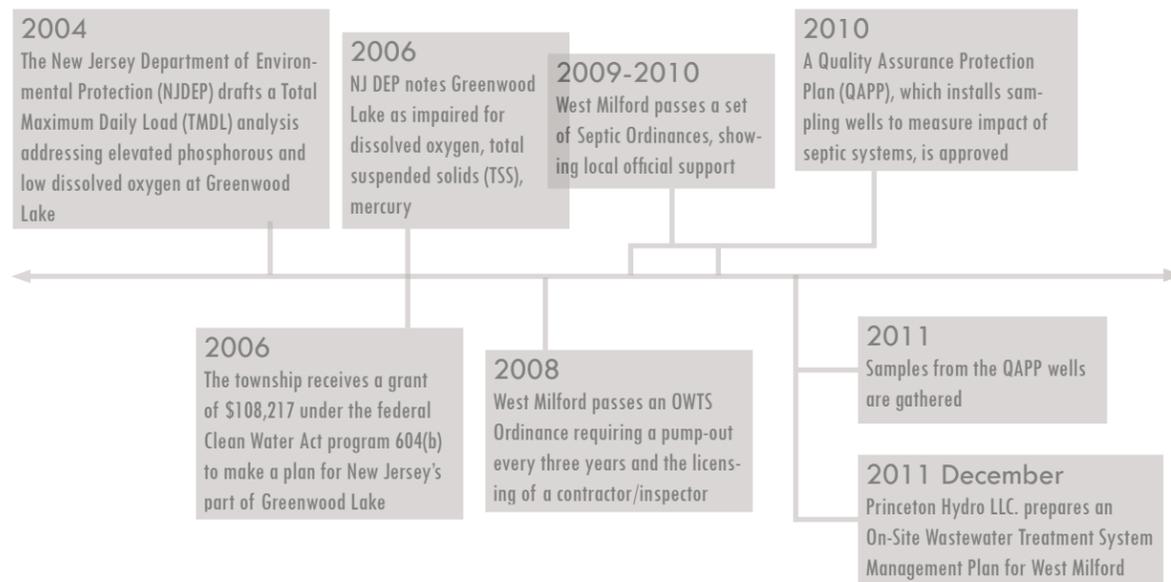
OWTS COUNT: 2,210

FACTS

- Town of West Milford (Dept. of Health)
- 25,850
- Greenwood Lake

PROGRAM DEVELOPMENT

MOTIVES: environmental concerns, public health



SOURCES "On-Site Wastewater Treatment System Management Plan for the Township of West Milford", (prepared by) Princeton Hydro, LLC, last modified March 2012, accessed June 2015.
Census Bureau, State and County QuickFacts, West Milford, 2010.
Map of New Jersey - Single Color by FreeVectorMaps.com

WEST MILFORD, NJ

THE PROGRAM

"...[to] ensure proper operation and maintenance... protect public health and the environment..."

Ch. 300 in West Milford Town Code

KEY POINTS

- + Public involvement and education in order to educate residents on voluntary recommended changes
- + License to own/operate a system, which lasts three years and is renewable with a fee
- + Notification system with educational materials
- + Licensing of service providers, which last one year
- + Pump-outs every three years, with a required pumping permit

IMPLEMENTATION + FUNDING

The program at West Milford is administered by the Department of Health and generates revenue from license and permit fees.

PUBLIC ENGAGEMENT

West Milford's 2011 management plan seems to put a great emphasis on homeowner engagement.

CHALLENGES

Some challenges West Milford faced during the development and implementation of the program were getting the public sufficiently involved to make voluntary changes, obtaining clear support from elected officials, obtaining sufficient financial support, and addressing state, county, and local approvals/permits.

RESULTS

Information pertaining to the impact/success of this program was not found.

SOURCES Article VI. in Chapter 300. SEWERS of Township of West Milford Code, adopted 3 December 2008, accessed June 2015.
"On-Site Wastewater Treatment System Management Plan for the Township of West Milford", (prepared by) Princeton Hydro, LLC, last modified March 2012, accessed June 2015.

WACO, TX

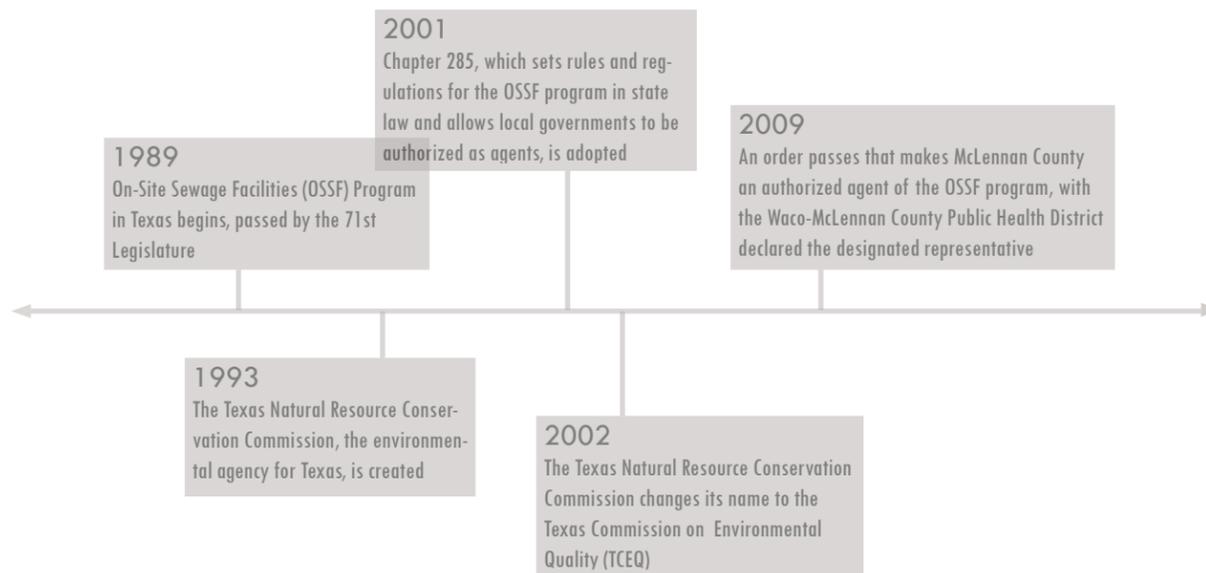


FACTS

- Waco-McLennan County Public Health district
- 124,805
- Lake Waco, groundwater

PROGRAM DEVELOPMENT

MOTIVES:



SOURCES History of the TCEQ and Its Predecessor Agencies", Texas Commission on Environmental Quality, last modified 1 May 20015, accessed July 2015. <http://www.tceq.state.tx.us/about/tceqhistory.html>.
 "On-Site Sewage Facilities Program", Waco Public Health District, accessed June 2015. <http://www.waco-texas.com/cms-healthdepartment/page.aspx?id=89>.
 Census Bureau, State and County QuickFacts, Waco, 2010.
 Map of Texas - Single Color by FreeVectorMaps.com

WACO, TX

THE PROGRAM

"...[to] eliminate and prevent health hazards by regulating and properly planning... on-site sewage disposal systems."
 - Texas Health and Safety Code, Ch. 366

program was not found.

KEY POINTS

- + Local government authority as authorized agent
- + Mandatory permits for all systems regardless of size, with an accompanying fee.
- + Maintenance by service providers licensed by the Texas Commission on Environmental Quality (TCEQ), or by approved homeowners
- + Maintenance inspections and reports

IMPLEMENTATION + FUNDING

The program is implemented by the Waco-McLennan Public Health district, which is authorized to administer the program for Waco and all of McLennan County. Waco is the county seat. The program has approximately 7 staff members, according to the site directory.

PUBLIC ENGAGEMENT

The TCEQ provides information on their website for homeowners, licensors, and regulators. The commission also provides classes that allow homeowners to become authorized to inspect their own systems. Homeowners are responsible for the operation of and obtaining any necessary maintenance of their systems. TCEQ provides a list of approved service providers, searchable by local region.

CHALLENGES

Information pertaining to specific challenges faced by this program was not found.

RESULTS

Information pertaining to the impact/success of this

SOURCES On-Site Sewage Facility Rules Compilation (RG-472), Texas Commission on Environmental Quality, revised March 2013, accessed July 2015.
 Texas Health and Safety § 366.031, Waco-McLennan Order (legal document, City of Waco, 2009, accessed June 2015).
 "On-Site Sewage Facilities Program", Waco Public Health District, accessed June 2015. <http://www.waco-texas.com/cms-healthdepartment/page.aspx?id=89>.