

A Blueprint for Community Wastewater Management

Block Island and Green Hill Pond Watershed, Rhode Island EPA National Community Decentralized Wastewater Treatment Demonstration Project - Final Summary Report

Summary

The Block Island Green Hill Pond Watershed Project brought together the Rhode Island towns of Charlestown, New Shoreham (Block Island), and South Kingstown, with the University of Rhode Island Cooperative Extension, and other government, academic, municipal, resource, and community partners, with the common goal of improving wastewater management in areas especially vulnerable to environmental and health risks.

With support and oversight from the U.S. EPA, they formed a unique partnership and succeeded in developing comprehensive wastewater management programs in each community, with management procedures and resources, as a model for other communities struggling to improve local management of decentralized wastewater treatment systems.

This report highlights the major accomplishments of these partners under the Block Island and Green Hill Pond Watershed, Rhode Island, EPA National Community Decentralized Wastewater Treatment Demonstration Project. This summarizes our findings on the role of a community demonstration project in overcoming barriers to local wastewater management. It describes the value of community, municipal, state and EPA partnerships in achieving success. We review methods these partners used to achieve goals, resources created, and lessons learned for other communities starting or expanding a local wastewater management program. All final products designed to help other communities start or expand a wastewater management program are readily accessible at the Onsite Wastewater Management Resource Center website:

<http://www.uri.edu/ce/wq/RESOURCES/wastewater/index.htm>

Acknowledgements

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The primary project partners included the towns of South Kingstown, Charlestown, and New Shoreham (located on Block Island) and the University of Rhode Island Cooperative Extension. The town of South Kingstown served as the EPA grantee and accepted responsibility for managing the grant, handling subcontracts, and programmatic reporting to EPA. Raymond Nickerson, Environmental Planner, assumed these project management responsibilities with assistance from project manager Brenda Dillmann in the early years, followed by Galen H. McGovern. Frank Xavier, Controller, served as the financial officer for the project, handling grant budgets and reporting duties, including frequent and patient assistance to project partners in preparing monthly budget reports.

This project was truly a shared effort of the many dedicated citizens and community leaders of New Shoreham, South Kingstown and Charlestown who collectively devoted countless hours serving on local boards, councils, commissions, and watershed groups, as well as town staff who made room in their already full schedules for new responsibilities. We also acknowledge the contribution of state agency staff, other professionals, and volunteers of the project advisory committee who shared their time and expertise and brought their group's resources to bear to support decentralized wastewater management.

Finally, we would like to give special recognition to Valerie Nelson who first envisioned this project as a national demonstration and helped craft the scope and the project; and to Dorothy McCluskey, New Shoreham resident and Norris Pike, New Shoreham Planning Board Chair, who both spearheaded early efforts to protect Block Island's water resources through better land use planning and wastewater management.

Authors

This summary report was prepared by the University of Rhode Island Cooperative Extension with information contributed by project partners including Bill Healy, Block Island Steering Committee; Ray Nickerson, South Kingstown; and current and former Charlestown Wastewater Managers, Matthew Dowling and Diane Johnson, respectively. Rob Adler, EPA Region 1 provided assistance in review and offered constructive comments on the draft document.

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1. INTRODUCTION

Community wastewater management was simpler when the choices were constructing and operating a municipal sewer system or leaving property owners to manage their own septic systems. With onsite systems typically designed using the least costly solution, and with maintenance of septic systems left entirely up to the homeowner, inevitable failures over time reinforced the notion of onsite systems as either a second-rate country disposal system or temporary fix until sewer lines could be installed. Meanwhile, with few repair options, communities often paid the price of this simple, hands-off approach to management with declining water quality, inability to attract new investment, and land use patterns driven by onsite system design codes.

Today, managed onsite systems are recognized as a permanent treatment solution, and often the most sustainable from both an economic and environmental perspective. And in recent years an explosion of alternative technologies have become widely available. These can be sized to serve one home or an entire village far from sewer lines with great flexibility, providing useful tools for communities to address site constraints, manage watersheds, and accommodate limited future growth at the density and scale envisioned by town plans.

As a result, the concept of wastewater management has expanded to include management of all wastewater at some level, ranging from conventional, alternative, and shared “cluster” systems, collectively known as decentralized systems. To help make this happen, new EPA guidelines standards now put system management on par with design and installation standards. And while advanced technologies, with their fancy features and small footprints get most of the attention, it’s actually the concept of community management of onsite systems that represents the real progress in our approach to managing wastewater.

Yet small unsewered communities face daunting challenges when managing decentralized systems. Limited staff and budgets, other urgent priorities, homeowner resistance, reluctance to expand bureaucracy, and according to EPA, lack of organizational structures to effectively manage these systems. Since onsite wastewater management is an entirely new area of government for most communities, the community’s motivation for managing onsite systems must be strong enough to overcome these challenges. In other words, the benefits of being able to use and rely on decentralized systems must outweigh the tendency to take a simple, hands-off management approach.

PROJECT PARTNERS SET MANAGEMENT DIRECTION

The Rhode Island towns of Charlestown, New Shoreham (Block Island), and South Kingstown recognized that community wastewater management could help them achieve multiple goals,

ranging from keeping drinking water safe, improving and protecting coastal waters, and guiding growth and development over the long-term.

Local officials here saw that their local economy and quality of life was directly tied to the quality of groundwater supplies and recreational waters. Onsite wastewater treatment systems had been identified as either a source of contamination or future threat to valued water resources. And they were concerned that increasing pressure to develop substandard lots with use of advanced treatment systems would impair both the scenic and environmental character of shoreline areas unless cumulative impacts were addressed. Although these communities were reluctant to impose new and potentially costly regulations, they saw that the benefits of managed systems - especially eliminating failed systems and assuring performance of advanced treatment systems, more than outweighed the costs of creating and running a management program.

After working independently for several years and laying the groundwork for local wastewater management, these towns and the University of Rhode Island Cooperative Extension formed a unique partnership. In April 2000 this group sought assistance from the U.S. Environmental Protection Agency to fast-track implementation of their wastewater management programs as a demonstration for other small communities facing similar challenges. With funding and oversight from EPA, ***these communities were able to construct a national model of how wastewater can be effectively treated and managed onsite by small communities with limited staff and budgets.***

THE NATIONAL DEMONSTRATION PROJECT

The Block Island and Green Hill Pond Watershed, Rhode Island EPA National Community Decentralized Wastewater Treatment Demonstration Project, began in July 2000 and continued through December 2007. It was funded by a U.S. Environmental Protection Agency (EPA) State and Tribal Assistance Grant of \$3,000,000 and a local match of over \$1,000,000.

The project was one of six national wastewater demonstration projects - the first designed to help overcome EPA-identified barriers to use of decentralized systems. The Rhode Island project was unique in several ways: it was locally-led by community partners; with URI involvement it integrated training, research, demonstration and outreach; and it centered on community management of onsite systems using a watershed approach to reduce pollution risks to local water resources.

PROJECT GOALS

The Block Island Green Hill Pond Watershed Project brought together the Rhode Island towns of Charlestown, New Shoreham (Block Island), and South Kingstown, the University of Rhode Island, EPA, and other federal and state government, municipal, resource and community partners, with the common goal of improving onsite wastewater management in areas especially vulnerable to environmental and health risks.

The purpose of the demonstration project was to establish sustainable wastewater management programs in Block Island and in the Green Hill Pond area using performance standards and a

range of alternative technologies to reduce pollution risk to local water resources while accommodating environmentally sound development.

The primary project goals were twofold:

- To accelerate implementation of New Shoreham's wastewater management ordinances that regulate system inspection, maintenance, repair and replacement, and treatment performance, based on risk of impact to local water resources.
- To institute similar standards for wastewater management in Charlestown and South Kingstown RI, using methods suited to the particular needs, administrative capabilities and local concerns in each community.

Although the project began in July 2000 these groups had been working for years to deal with problems of failed and substandard systems. They had already succeeded in establishing the foundation for local management, each working independently but in a loosely coordinated fashion through state agency task force and regional meetings of local planners. For example, project towns had completed local wastewater management plans, new low-interest loans for septic system repair and replacement were available to homeowners beginning in Charlestown, training for system inspectors and service providers was available through the URI Onsite Wastewater Training Center, and New Shoreham had adopted a comprehensive inspection and maintenance ordinance with treatment standards to protect Island water resources that are still considered innovative today.

With this base, these communities were poised to begin managing onsite systems, with New Shoreham leading the way. However, the concept of local oversight of private onsite systems was still highly innovative and very controversial. Actually applying the ordinances and making them work efficiently for both town staff and residents alike was another matter entirely. Hiring staff, working out administrative procedures, setting up the inspection database, training service providers, communicating with residents, creating financial incentives, and enforcing the rules, would be a long, incremental process. In fact, public controversy about the newly adopted treatment standards prompted the New Shoreham town council to put a temporary moratorium on implementing the ordinance until resources were available for a town inspector and specific administrative procedures could be adopted.

The EPA grant enabled New Shoreham to overcome these hurdles to rapidly bring their ordinances into full operation. And it provided the resources for Charlestown and South Kingstown to adopt and apply similar wastewater management programs. URI Cooperative Extension provided technical assistance, training and educational materials to the communities. The partners met regularly through the Project Team and Steering Committee to share ideas and learn from each other, and to collaborate on joint initiatives where possible. In developing their own municipal wastewater management programs these groups created a practical organizational structure that other small communities with can use to manage onsite systems, and through national outreach, made results widely available, thereby directly addressing key barriers identified by EPA as inhibiting use of decentralized systems.

Project Objectives

The project towns focused on the building components of a wastewater management program while the URI effort centered on technical support, training, research and outreach. Together, the project objectives included the following:

- Adopt and enforce local inspection, maintenance and upgrade ordinances.
- Track inspection results using a database.

- Establish treatment standards for sensitive areas and problem sites.
- Provide loans and other incentives for system repair and upgrade
- Keep residents, local officials and others informed about project activities.
- Provide training and build capacity of town staff, designers, and service providers
- Construct 24 demonstration systems and monitor their performance
- Research accuracy of soil evaluations in predicting water table depths
- Assess pollution risks and management options using GIS
- Monitor water quality trends.
- Evaluate wastewater needs and update the management program as needed.
- Make project results available through local, regional and national outreach.

2. SUMMARY OF MAJOR ACCOMPLISHMENTS

By any measure, the accomplishments of the project partners were remarkable. Within the first three years of the project all three communities had fully operational wastewater management programs featuring mandatory septic system inspections, tank pumpouts and maintenance based on need, replacement of failed systems, and scheduled removal of cesspools.

These communities were able to create a model for local wastewater management that other towns can easily adapt to suit their own circumstances. The model - actually three completely independent municipal programs each customized to suit unique characteristics and needs of each town. By using similar management principles and technical standards, they created an organizational structure that any community can use to start, run and expand a local wastewater management program. This provides a template for other communities, with resources and materials that can be used directly or adapted.

Today communities with comprehensive wastewater management programs are still the exception rather than the rule. But the methods and materials for starting and running a management program that these partners developed provides a practical blueprint, tested and revised over several years. And it has proven to be low-cost and sustainable for small communities with very limited staff and tight budgets, for example:

1. In each project town, elected officials voted to adopt a townwide wastewater management ordinance, understanding that this represented a major new regulatory initiative that would only be supported by project funding for a few years.
2. Each town successfully transitioned to 100% municipal funding at the end of the project and each continues to make improvements, including extending inspections into new districts, enforcing compliance with cesspool phase-out, and updating ordinances. The cost of keeping the programs running averages approximately \$50,000 / year. When one town council proposed eliminating the wastewater manager's position in a budget-cutting move in the first year of town funding, public support for the program was so strong that the proposal was quickly dropped.
3. New municipal wastewater programs are affordable and developed "in house" with part time staff. *Example: \$35/yr fee assessed on unsewered properties supports ½ staff in Jamestown.*

IMPACTS IN PROJECT COMMUNITIES

Comprehensive wastewater management programs were adopted in all 3 towns, each moving from completely unmanaged onsite systems, to 100% of all systems under some level of town management. These programs featured:

- Mandatory inspections scheduled based on system type and use, with tank pumpouts, maintenance and repairs as needed, and detailed reporting to towns.
- Immediate replacement of failed systems.
- Complete phase out of cesspools; sunset dates vary by town.
- In New Shoreham, this included retrofitting of existing tanks with access risers and effluent screens.
- Compliance with inspections range from 84% - 99%
- 92% of all known cesspools were removed or in process of being removed on Block Island (129 total). More than 154 cesspools were removed in Charlestown and South Kingstown.
- 97% of tanks were retrofitted with access risers and filters in Block Island - all but 33 of the 1,278 systems on Block Island.

Block Island fully implemented treatment standards for new systems and repairs in areas sensitive to public health and environmental impacts based on watershed location and site conditions. South Kingstown adopted treatment standards for onsite systems within 150 feet of wetlands.

Each town carried out public education programs reaching system owners, realtors, design professionals and maintenance providers.

\$1.6 million in homeowner loans for septic system repair and replacement were secured through the State revolving loan program in the three project towns through 2006. In addition, RIDEM awarded \$100,000 in 319 grants for tank retrofits and inspections Charlestown and South Kingstown.

Each town established a database to track inspection results and organize communication with system owners.

Following Jamestown's lead, Charlestown and New Shoreham switched to this database halfway through the project, with Charlestown transitioning to entirely paperless reporting by operation and maintenance service providers.

Watershed monitoring data was used to document trends and identify illicit discharges, with results made widely available to the public. Watershed groups obtained funding to continue monitoring after project end.

Communities continue to evaluate results and assess needs, allowing programs to evolve and grow. Charlestown and New Shoreham have continued to update ordinances to strengthen enforcement procedures. Staff continue to respond to requests for information from other communities in Rhode Island and nationally. South Kingstown completed a Draft Wastewater Facilities plan to evaluate cost effectiveness of nitrogen control options for Green Hill Pond.

The project has enhanced local capacity for resource-based land use decisions. GIS databases developed for wastewater management are being used to support stormwater management programs, comprehensive plan updates, and other town resource management needs. The town of Charlestown has expanded from part time staff to a full time environmental scientist with other duties, including review of development applications.

BENEFITS EXPORTED TO OTHER RI COMMUNITIES

The demonstration project has resulted in impacts far beyond boundaries of the project. Communities are using project materials with other resources, such as EPA Nonpoint Source funds (319 grants) and State's Community Septic System Loan Program, to expand wastewater management programs.

Other RI communities are following suit. At least 11 other RI communities have some type of management program incorporating demonstration project materials and methods.

Pro-active communities are leading trends to integrate wastewater treatment with stormwater management in vulnerable areas. Examples: Jamestown's High Water Table ordinance combines treatment standards, strict impervious limits, stormwater treatment and volume controls.

\$4.15 million in homeowner loans for septic system repair and replacement secured through State revolving loan program in Rhode Island through 2007.

Alternative systems being used to support more compact "Smart Growth" development through conservation development design and repairs in village centers that don't detract from historical and scenic character.

In cooperation with Carmody Data Systems, Inc., a statewide database for wastewater management known as RIWIS was established in 2006, and is now available to all Rhode Island communities free of charge. Until then, the lack of an affordable but efficient statewide program for managing onsite system data, was considered a major impediment to community wastewater management. This is a web-accessed system maintained by Carmody Inc, not stand-alone software.

Throughout 2007, URI and the town of Jamestown provided training in use of RIWIS, resulting in 10 RI communities adopting the system. Nine of these are managing onsite systems to protect drinking water supplies. For example:

- Scituate and Foster plan to educate homeowners about basic septic system care and track renewal of maintenance contracts for alternative systems. Their actions will help protect the Scituate Reservoir, the source of drinking water for 60% of Rhode Islanders.

- North Kingstown has established districts for mandatory inspections and enforcement that target areas with private wells and sole source aquifers. Previously, only evidence of pumpouts was required for the town's 10,000 onsite systems.
- Tiverton is using the system to begin enforcing cesspool removal in the Stafford Pond drinking water supply watershed and to manage mandatory inspections and repair of the town's 3,000 systems.

URI TRAINING, RESEARCH, CAPACITY DEVELOPMENT AND OUTREACH - LOCAL, STATE AND NATIONAL BENEFITS

URI Provided training, technical support and capacity development for town wastewater managers, including guidance for inspections and retrofits, selection of advanced treatment systems, and ordinance development.

Constructed 25 demonstration systems as repairs using a variety of advanced treatment technologies in partnership with the RIICA. These were used extensively for training and education, performance monitoring, and research.

URI research on advanced wastewater treatment performance, maintenance requirements, and soils suitability for onsite wastewater treatment has been made widely available nationally through peer-reviewed journals and conference proceedings.

URI provided many hours of technical support to homeowners, designers, and local officials in Rhode Island and regionally.

- Master gardener volunteers were trained to answer basic septic system care questions through its toll-free hotline for home landscape care advice
- Addressed designer's technical questions via telephone, email and office visits,
- Conducted informational workshops on septic system maintenance and repair options for residents and local officials to support adoption of management ordinances, and
- Reviewed and commented on proposed ordinances,
- Participated in public hearings on proposed ordinances to address technical questions from residents and local officials.
- Provided design review for replacement of failed systems using advanced treatment at the South Kingstown Town Beach and at the Tri-Town Park, Wakefield RI.
- Provided plan review for 12-14 replacements of failed systems or cesspools in the Wickford Harbor watershed using advanced treatment system under grants provided by the Town of North Kingstown to offset costs. URI also assisted in developing guidelines for the grant program, and mapped priorities for review and selection of grant applications based on property location and pollution risk to the Harbor. This effort was supported only by the Demonstration Project.

Training opportunities for onsite wastewater practitioners and designers and State licensing and certification requirements were significantly expanded to meet demand for trained and reliable service providers generated by the project. Examples:

- In 2001, the URI Onsite Wastewater Training Center offered 4 courses, attended by 66 registrants. In 2006 this had increased to **29** courses, and **417** registrants. From 2001 to 2006, a total of 85 classes were offered, with 1879 registrants trained.
- According to EPA (2002) Rhode Island is the only state with licensing and/or certification for all wastewater professionals and service providers directly responsible for system function and maintenance, including: designers, installers, inspectors and maintenance providers.

Private sector benefits - Wastewater design professionals and practitioners have embraced use of alternative systems and influenced system selection by favoring use of modular, energy efficient technologies. They are also supporting RIWIS, using it to manage system performance and communicate with clients.

Project results and educational materials were made widely through national publications, including Small Flow Clearinghouse, and URI's 3-volume set on Wastewater Treatment Systems www.uri.edu/ce/wq/mtp/html/publications.html

Applications of Demonstration System Research

- Results of demonstration system research led to development of the URI Bottomless Sand Filter Guidance manual, adopted by RIDEM as State design standards.
- URI findings supported development and periodic updates to State design and installation standards for alternative standards, including selection of textile filters, drainfield loading rates, specifications to prevent winter freezing, and others.
- National training curricula incorporate demonstration research results, including the National O&M Service Provider and the National Onsite Installer's training programs developed by the Consortium of Institutes for Decentralized Wastewater Management.

Watershed Needs Assessment

Geographic Information System was used to analyze and display watershed pollution risks, screen wastewater management options, select treatment standards, and support development of ordinances and system upgrades.

- Wickford, North Kingstown grants for replacement of failed systems and cesspools
- URI assessment methods supported development of the Green Hill Pond Watershed Management Plan developed by Horsely and Witten in 2007.

Research on soil site suitability has documented water table monitoring and modeling procedures to accurately evaluate water table depths and duration of cumulative saturation. URI

and DEM are considering application of these methods to verify water table fluctuations with OWT applications on shallow water tables.

URI researchers documented performance of two ground nitrogen barriers installed in the Green Hill Pond area in support of the South Kingstown Wastewater Facilities Plan.

The project has led to increased use of GIS for more efficient wastewater management, land use planning, and other resource-based decisions.

- South Kingstown and New Shoreham expanded their GIS mapping capability and Charlestown established a new GIS program with project support. All three now have professional staff to manage the database.
- The towns acquired high resolution aerial photos and topography suitable for wastewater management planning, analysis, and display for public education. By working together, the towns contracted with the same company for considerable cost savings.

ACTIONS BY STATE PARTNERS

The demonstration project ushered in accelerated progress in decentralized wastewater management not only in the project communities but statewide. The project helped stimulate these changes by heightening awareness of onsite wastewater impacts; by improved coordination among project partners; through local leadership in setting more stringent standards for coastal areas; and by municipal requests for better coordination of the local and State permitting processes.

2006 Cesspool Phase Out Act

After several unsuccessful attempts, and through the persistent efforts of environmental organizations, the RI legislature adopted the 2006 Cesspool phase act. This requires replacement of failed cesspools, those serving commercial or multifamily uses, and those located within 200 feet of coastal shorelines, public wells, or drinking water supplies. Where town cesspool phase out rules are comparable or more stringent, local rules apply. The program takes effect June 1, 2008 and will first target replacement of cesspools in drinking water supply watersheds and coastal areas.

Updated Rules for Onsite Wastewater Treatment Systems

This major revision of the DEM rules, effective January 1, 2008, updates technical standards for siting and design of septic systems, improves treatment for environmental protection and public health, increases protection of water resources and streamlines the permitting process. Among the technical changes are higher performance standards for septic systems in salt pond watersheds and on small lots with drinking water wells, and increased setbacks between large systems and drinking water wells.

Significance: It seems fitting that these major changes coincide with the end of the demonstration project. Many of the resource protection measures first adopted by the project towns in local ordinances are now elevated to state standards. These include for example; use of advanced treatment in coastal areas and wellheads, prohibition on use of deep “galley” leaching chambers, stricter standards for large flow systems, and upgraded tank standards. These amendments expand protection of sensitive coastal embayments and drinking water

supplies throughout the state. And they provide for improved coordination between state and local permit reviews - a longstanding concern that was mostly addressed in project communities, but never fully resolved. Under the new rules municipalities may petition the DEM to require municipal review for compliance with local ordinances prior to DEM initiating its review.

NATIONAL BENEFITS EXPORTED

As a result of project outreach efforts, communities throughout New England are using project materials in wastewater management planning, public education, and to initiate a dialogue among state regulators, local boards of health and other local officials on improved management of decentralized systems to achieve local land use and public health and water quality goals. Although the actual project impacts nationally are difficult to measure project materials have been widely distributed and communities in New England Connecticut, Massachusetts, Vermont, Maine, New Jersey and beyond are using project materials to develop or expand management programs.

And in many cases, benefits / this cross-fertilization worked both ways / providing useful information that benefited the Rhode Island project. URI staff gaining valuable information from national partners that were information gained For example:

Coordination between the Block Island/ Green Hill Pond and the Warren, Vermont demonstration projects fostered progress and innovation in both areas early in the project.

- Vermont project staff met with URI and RIDEM staff to share information about DNA typing methods, analytical lab capabilities and initial results in Vermont trials. This information led DEM to investigate and select technologies for their study of bacteria sources to Green Hill Pond.
- Vermont project staff, local officials and state legislators traveled to Rhode Island for a field tour of advanced treatment systems at the URI Onsite Wastewater Training center and demonstration sites in the Green Hill Pond area, with discussion of local management programs. This helped raised awareness of the benefits of properly managed decentralized systems. Shortly afterward Vermont legislators approved amendments enabling broader use of managed advanced treatment systems in Vermont.

URI responded to numerous requests for information about wastewater management methods, ordinances, educational outreach and advanced treatment technologies from communities seeking to improve wastewater management. URI staff assistance included telephone discussions, meetings with local and state agency staff, videoconferences, and review of proposed ordinances. Many of these local officials attended URI training programs.

- The towns of Westbrook, Old Saybrook, and East Lyme, Connecticut established wastewater management programs and formed a regional wastewater management district as an alternative to sewerage areas with failed systems.
- The Connecticut Department of Environmental revised policies and regulations enabling broader use of management alternative systems. DEP is continuing dialogue with communities and watershed groups to implement changes.

- Several Massachusetts communities are using project materials to educate residents and establish management programs. The Martha's Vineyard Commission created a video about New Shoreham's wastewater management program based on an interview with Don Thimble, the town's wastewater inspector to spread awareness of Block Island's successful approach.
- Following adaptation of the Carmody database in Rhode Island, the Barnstable County Board of Health selected this web-accessed system to track maintenance and analyzing performance of alternative systems in Cape Cod communities. County staff have presented their results at the URI Wastewater Management Conference in March 2006.
- URI provided training and technical support to University of Puerto Rico Cooperative Extension researchers in partnership with EPA Region 5, which including field workshops at the URI Onsite Wastewater Training Center. Seeing the value of a training center to promote use of management alternative treatment systems, these researchers have created the start of a training center at the University of Puerto Rico.

3. PROJECT SETTING AND PARTNERS

The Block Island Green Hill Pond Watershed Project brought together three self-sufficient towns, each with their own administrative capabilities, government structures, resource protection needs and wastewater management priorities – all steeped in long tradition of Yankee independence. Although each community was completely independent and self-governing they shared similar wastewater problems, water quality concerns and goals, which made for a natural partnership.

The three coastal communities receive heavy seasonal use from rental properties and vacation homes, which overtaxes onsite systems and their growth rates are among the highest in the state due to residential construction and redevelopment pressures centered in coastal areas. The three communities share similar resource protection goals, with priorities being to protect groundwater supplies for public and private wells, and to protect saltwater ponds, which are sensitive to nitrogen and bacteria. Onsite systems have been identified as the major source of nitrogen to Green Hill Pond, which is impaired for shellfishing due to excessive pathogens, and also nutrient-enriched. Wastewater treatment systems have been identified as a threat to the quality of Block Island 's groundwater supplies but existing water quality is generally very good.

Block Island (the Town of New Shoreham) lies 10 miles off Rhode Island's mainland. Only 9.7 square miles, the island has a year-round population of about 1,000 which swells to over 10,000 during the summer. The Island's economic and environmental health are dependent on maintaining the existing high level of surface and ground water quality as well as ground water quantity. Public water and sewers serve the town center at main harbor and provide septage treatment for the island's 1,268 onsite wastewater treatment systems (2007 count). About 80% of permanent residents and more than half of summer residents use on-site systems making the potable ground water supply vulnerable to contamination. The groundwater supplies are finite and subject to saltwater intrusion. In 1996 the U. S. Geological Survey concluded that the

availability of fresh drinking water is directly related to the volume and quality of treated wastewater discharged into the Island's sole source aquifer.

The driving force for wastewater management on Block Island is to protect the current high quality of the Island drinking water supplies and other surface waters and wetlands. (BI 2003 report) , These resources include federally designated sole source aquifers, 300 fresh water ponds, over 17 miles of coastal beach, and a large salt pond with a recreational boating harbor which also supports shellfishing, fishing, swimming. The town has a history of pro-active effort to preserve the Island's environmental resources as these are inextricably linked to quality of life and Island economy. The town has preserved more than 40 percent of the island as permanent open space in an effort to preserve unique habitat and maintain the high quality of water resources.

The Town formed the (Block)**Island Steering Committee (ISC)**, composed of town staff, including the town manager, elected officials, members of existing boards and commissions, and other appointed volunteer citizen members. The ISC's charge was to oversee the project and coordinate with the other partners.

The Green Hill Pond Watershed, a salt pond watershed along RI's coastal shoreline, spans 3,400 acres, with three-quarters in South Kingstown and the remainder in Charlestown. **Green Hill Pond** is **390** acre coastal pond – one of several brackish, shallow ponds flanking barrier beaches along the southern Rhode Island coast. Green Hill and other coastal ponds, are considered unique and sensitive ecosystems. These serve as nurseries for fish and shellfish and important recreational resources for residents and seasonal visitors.

The entire watershed is unsewered and at the start of the project in 2000, there were approximately 2,200 homes in the watershed with either septic systems or cesspools. In both communities, development is densely clustered along the pond shorelines and surrounding neighborhoods, at densities of up to eight homes per acres. Many of these are converted from summer cottages to much larger, permanent homes, often heavily occupied seasonally as vacation homes or rentals. These communities continue to face intense development pressure, particularly along the vulnerable coastline where many remaining lots have serious limitations for development and onsite wastewater treatment.

Shellfishing closures at Green Hill Pond, first seasonally in 1987, permanently in 1994 and then the eastern portion of adjoining Ninigret Pond in 1997 prompted local concern about wastewater impacts to both the ponds and local groundwater. Charlestown residents rely entirely on shallow, private wells for drinking water waters while most South Kingstown residents depend on municipal water supplied by a town well located within the watershed. In both towns protection of the EPA-designated sole source ground water aquifers is a top priority, particularly in Charlestown where private well testing organized by local volunteers in 1998 confirmed cases of bacteria contamination in private wells. These shellfish closures, concerns about groundwater drinking water supplies, and the threat of further water quality decline with continued development fueled the motivation to act in both communities. The management goal for the Green Hill Pond Watershed was to restore shellfishing use and eelgrass beds in the pond, to protect groundwater supplies for both public and private wells.

The Town of South Kingstown is Rhode Island's largest and fastest-growing town. This coastal community, located along the state's shore, encompasses 12 square miles and is home

to 28,000 residents. Municipal sewers are reserved for the town's small urban center, villages, and the University of Rhode Island, with outlying areas dependant on onsite wastewater treatment systems. Municipal water serves village centers and a portion of the densely settled coastal areas. However, both public and private water supply wells depend on sole source aquifers. There are approximately 6,600 onsite wastewater treatment systems townwide.

As the project town with most well developed administrative capacity, South Kingstown served as the lead agency, with the Finance Department managing the contract and fiscal reporting. The **Town Planning Department and Conservation Commission** were responsible for project management and oversight, with assistance from a part time project manager.

The Town of Charlestown, also located along the south shore adjacent to South Kingstown, is a rural but rapidly growing community with a population of almost 8,000 residents and approximately 4,970 onsite wastewater treatment systems townwide. It is the only project town that is completely dependent on onsite systems and the only one that relies entirely on a combination of small public and private wells without a municipal water system. The Town's volunteer **Wastewater Management Commission**, guided development of the project in cooperation with the town manager.

University of Rhode Island Cooperative Extension, within the College of the Environment and Life Sciences, brought research-based training and technical support in on-site wastewater management technology, management and public outreach to the project. Staff of the Cooperative Extension Water Quality Program, provided specialized expertise through it's four distinct groups under the direction of Dr. Art Gold.

New England Onsite Wastewater Training Program (NE OWTP) is a regional center for research and training on small scale decentralized wastewater treatment systems. The program maintains an outdoor training center at the URI Kingston campus, featuring conventional and alternative technologies. It offers a curriculum, classroom and field training using the training center and demonstration systems for wastewater professionals, regulators, municipal and state officials, watershed groups and homeowners. Created in 1993, the OWTC is one of only eight regional centers in the nation.

The NE OWTP led research, training, and technical support for management of onsite wastewater treatment systems, including design, construction oversight and performance monitoring and evaluation of demonstration systems. The group had primary responsibility for training and capacity development of town staff, wastewater professionals and service providers. NE OWTP coordinated with the Rhode Island Department of Environmental Management, the Rhode Island Independent Contractors and Associates (RIICA) and other groups on design standards, construction and permitting issues. NE OWTP assisted in development of educational materials and led national outreach efforts on project methods and accomplishments through a network of academic, government and private sector partners.

RI Nonpoint Education for Municipal Officials (NEMO) provides training and watershed assessment tools to support local decision makers in managing impacts of land use on local water resources. RI NEMO is part of a national network of extension programs and other organizations educating local officials in the relationship between land use and water quality using Geographic Information systems for analysis and display.

NEMO staff provided technical support in development of municipal wastewater programs through watershed assessments and mapping using local GIS data. Results were used to identify pollution risks, screen wastewater management options, and display results for educational purposes. NEMO staff assisted in development and review of ordinances and led educational outreach efforts, to include development of educational materials and outreach methods to build support for and compliance with local ordinances. NEMO managed the URI component of the project, coordinated the project in the early stages, and worked with the NE OWT to make project results and accomplishments available nationally.

URI Watershed Watch is a scientist-led water quality monitoring program that helps local governments, watershed organizations and others to recruit and train volunteers to become citizen scientists gathering detailed, quality assured monitoring data. The program focuses on long-term monitoring of RI's lakes, ponds, streams and coastal waters. URI provides training, equipment, supplies and analytical services tailored to organizational needs, while meeting strict quality assurance and quality control guidelines in the field and in a state-certified laboratory.

Watershed Watch staff worked with the Salt Pond Coalition to monitor Green Hill Pond, eastern Ninigret Pond and tributary waters. On Block Island, staff provided assistance to the Island Advisory Committee (ISC) and the Committee for the Great Salt Pond (CGSP) to monitor groundwater wells and Great Salt Pond, including tributaries. Watershed Watch also provided lab services to support demonstration system research through analysis of wastewater effluent samples.

URI Home*A*Syst Program is a voluntary residential pollution prevention program, offering workshops, publications, and other educational resources to individuals, community groups, watershed organizations, and others promote informed decision-making. Home*A*Syst works with these partners to train residents to take actions to protect their health and the environment.

Home*A*Syst provided assistance to town staff and volunteers in commission project communities to educate seasonal visitors renting vacation homes, homeowners, and realtors about basic care and maintenance of onsite wastewater treatment systems and protection of private wells. Staff worked closely with the NE OWTP to organize workshops and make educational materials available to these groups.

CELS Department of Natural Resources Science researchers, graduate students, and undergraduate students, including Coastal Fellows Program interns, provided valuable support throughout the project. Most notably, Dr. Marc Stolt, Professor of Soil Science, directed research on the relationship between soil indicators used in the DEM soil evaluation method (newly adopted in 2000) and water table characteristics. Dr. Stolt also conducted training for town staff and wastewater practitioners in State soil evaluation procedures. Dr. Art Gold, Professor of Hydrology and director of the URI Cooperative Extension Water Quality Program summarized research on the water quality function of wetland buffers focusing on their capacity to attenuate nitrogen. In addition, Dr. Gold directed research on experimental groundwater barriers for nitrogen removal.

RI Department of Environmental Management (RIDEM) played an integral role by participating as technical advisors, working with communities to coordinate state and local permit review, and issuing needed permits for the project's demonstration sites. DEM has taken a leadership role in promoting use of decentralized wastewater treatment systems to protect water resources and achieve sustainable development. Department staff have generated

technical documents, helped create the Community Septic System Loan Program, and provided grants to communities to plan and carry out wastewater management programs. Similarly, the **RI Coastal Resources Management Council** provided technical support and coordination on state permitting in the coastal zone.

EPA Region 1, EPA played an important supervisory role as a project partner. The demonstration project funding is sponsored under an EPA 'cooperative agreement,' which is similar to a grant, but allows EPA to be involved in its oversight and as a valuable partner in assisting project efforts. EPA plays an important supervisory role to assure (1) funding is used as intended and the project proceeds under its objectives to establish community-led wastewater management programs to protect critical coastal resources and ground water quality, (2) that the project develops products, educational materials and "lessons learned" to serve as valuable demonstrations for RI communities and the nation, and (3) how innovative septic systems and other creative techniques can be applied to effectively treat wastewater that threaten water quality on difficult and marginal residential properties. EPA, the three communities and the University of RI established administrative procedures to carry out the demonstration project. EPA's participation included reviewing annual work plans for the communities and URI, concurring with cost reimbursements, standards and specifications, approving quality assurance plans for obtaining reliable water quality monitoring data, selecting sites for installing innovative or enhanced septic systems, and working with RIDEM on the TMDL for Green Hill Pond.

Taking a hands on role, EPA also worked with the project manager to help coordinate the project and resolve staffing or management issues and participated in project team meetings to provide information and technical support. EPA worked directly with Charlestown to update and strengthening their inspection ordinance, and helped make project lessons and accomplishments widely available to regional and national audiences via EPA networks.

Watershed groups were integral to the project in addition to the volunteer commissions noted above. The **Committee for the Great Salt Pond** is a Block Island non-profit organization that promotes stewardship and protection of the Island's major salt pond. The **Salt Pond Coalition** is a designated watershed council dedication to preservation and restoration of the south shore coastal ponds. Both organizations were focused on educating the public about the value and management of coastal ponds, and both had been active in monitoring water quality. These groups worked with the University of Rhode Island Watershed Watch citizen monitoring program to monitor water quality conditions and trends in the salt water ponds and tributary waters over the life of the project. On Block Island, the ISC also oversaw tap water sampling to evaluate groundwater quality trends, and in Green Hill, the Salt Pond Coalition and the Town Wastewater Management program continued a private well sampling program. Other **citizen volunteers** donated their time through local boards and commissions, watershed groups, participation on ad-hoc committees, and independent involvement in the project.

PROJECT MANAGEMENT

A project management structure was created to coordinate efforts of project partners while enabling the towns to maintain their autonomy. This featured a Steering Committee to guide technical, monitoring, assessment and report components of the project. This coordinating structure was designed to: 1) support local leadership through technical support and advice

from town staff, URI, and other state partners; 2) create a forum where project partners could debate different management approaches and share resources, materials and methods for greater efficiency; 3) minimize additional time and effort involved with intertown coordination for town staff and volunteers serving on the Steering Committee.

The **project team** consisted of the project manager, town and URI staff devoted to the project, EPA, and designated local representatives such as chairs of the Block Island Steering Committee and Charlestown Wastewater Management Commission. This group managed the project on a routine basis and coordinated with key town officials, DEM staff and others as needed. The project team met monthly in the first two years of the project and as needed afterwards, mostly bimonthly or quarterly afterwards. Because it wasn't always convenient for Block Island project team members to take the 1 hour ferry ride from Block Island to the mainland for meetings, arrangements were made on several occasions, for mainland staff to meet at the Westerly High School, which offered video conference facilities, while New Shoreham staff met connected in at the Block Island school.

The **Project Manager**, a part time consultant hired by the Town of South Kingstown served as a member of the project team and was responsible for overall project management and programmatic reporting to EPA.

A **Project Steering Committee** was organized to guide the Project Team in achieving project goals and objectives. This was composed of local representatives appointed by each town, representing diverse community interests, and at least one town council member. To ensure full representation of community interests, representatives of local environmental organizations, economic development interests and other group were included. Also participating were URI staff, private sector wastewater professionals and service providers, and representatives of the RI DEM, RI CRMC, and EPA.

The steering committee generally met annually to review the past year's progress and set goals for the coming year. These meetings were typically organized and hosted by URI.

Subcommittees were formed and met as needed to provide technical assistance in specialized topics:

- *A Technical Subcommittee* consisting of academics, regulators, wastewater professionals, and others was established to provide expertise on technical wastewater issues such as site suitability evaluations, system selection, and wastewater treatment standards.
- *An Education Subcommittee*, composed of local representatives, organizations, agencies, and University staff with interest and expertise in this area. This group was active in the early years of the project, helping to coordinate education activities on wastewater management among state partners, and to gain input in developing the education strategy for project communities. Later, the communities assumed oversight for public education and outreach through town staff and volunteer commissions, including the New Shoreham Conservation Commission. URI continued to assist in developing educational materials and outreach methods.
- *A Monitoring Subcommittee* was organized to oversee design of a watershed monitoring program for surface and groundwaters. This was composed of government agency and academic staff, and representatives of volunteer monitoring groups. The full group met initially to design the monitoring strategies for the two project sites and to review preliminary

results, but later annual monitoring strategies were updated with input from the local watershed groups, key DEM staff, and Watershed Watch staff.

4. THE TOWNS ADOPT DECENTRALIZED MANAGEMENT

ESTABLISHING ORDINANCES

New Shoreham established a wastewater management ordinance in 1996 that required inspection and maintenance of all onsite systems. In 1998 they amended their zoning ordinance to establish treatment standards and phase-out all cesspools. With the advent of the Project in 2000, the Town Council appointed the Block Island Steering Committee (ISC) to manage the project and accelerate implementation of these ordinances.

Charlestown also had an existing wastewater ordinance, but as the Project began, they revised the ordinance to enhance the ability of the Town to manage the systems and to reach out to the community. Three wastewater districts were created through that ordinance revision in 2001 to complete first inspections of the town's 4,970 systems within three years. The ordinance was revised again in 2004 to mandate inspection-based maintenance and a cesspool phase-out.

The Charlestown program is managed under the direction of the Wastewater Management Commission with a wastewater management specialist. In the early years Charlestown and South Kingstown shared a wastewater management specialist who split her time between Charlestown and South Kingston. Charlestown eventually transitioned to part time staff with more specialized expertise, first a professional engineer, who's position was made full time in 2005, then later an environmental scientist. In 2005 a part-time GIS Manager was also hired to improve mapping and parcel accuracy, both positions truly enhancing the administrative capabilities of the program. As the program has transitioned to full time professional staff the role of the Wastewater Management Commission has evolved considerably, shifting from hands-on, direct involvement in project activities, to setting policy and guiding work of the wastewater management specialist.

South Kingstown completed their initial Wastewater Management Plan prior to the start of the Project, and they implemented their wastewater ordinance in 2001 under the project. Like Charlestown, the ordinance requires that homeowners hire qualified, town-certified inspectors to conduct inspections. Inspections are regularly scheduled based on system size and water use, with pumpouts and repairs required as needed. Failed systems and cesspools that present an immediate public health threat must be replaced immediately. Otherwise, cesspools are to be replaced within five years of the first pumpout or within one year of property transfer, whatever occurs first. Meanwhile, cesspools must be pumped annually.

Day to day operation of the Onsite Wastewater Management Program in South Kingstown is the responsibility of the Public Services Department and the Wastewater Specialist. The Conservation Commission and the Wastewater Specialist oversee the program, with assistance from the town Planning Department, and town GIS specialist to analyze and map results. In South Kingstown the Wastewater Specialist has been generally filled as a part time clerical position focused on sending inspection notices and routine data entry of inspection results, rather than data analysis to improve system management.

All three towns continued to update their ordinances to address identified needs. For example, New Shoreham and South Kingstown modified their ordinances to specifically require owners of advanced treatment systems and other systems with pumps and mechanical components to require that a maintenance contract be maintained in effect at all times. In addition, these towns strengthened enforcement provisions.

PROMOTING INSPECTION AND TRACKING PROGRAMS

New Shoreham hired a Wastewater Management Inspector in July, 2000 (the first in the state) and in 2002 a Wastewater Management Administrator. New Shoreham is unique in that the Town Inspector performs all inspections on behalf of the town. This arrangement was selected to ensure reliable, consistent and impartial inspection results. At times, the town hired a contractor to conduct inspections to speed the process and meet the town's goals for completion of all first inspections. In 2000 a Geographic Information System (GIS) Specialist worked to coordinate and input inspection data into a tracking database (SIMS). Onsite system locations were located by GPS and tracking data linked to the GIS system for analyzing and displaying results. In 2004 that tracking system was replaced with the Carmody System, a web-accessed database that better suited town needs.

Since the beginning of the Project, 99% of the Town's 1,278 onsite systems have been inspected. These inspections revealed approximately 140 cesspools, of which all but 23 have been upgraded, and of those 23, 12 were in the process of being upgraded by November 30, 2007, the end of the project. One hundred twenty nine cesspools were replaced or in the process of removal at project close. At the end of the project all systems except 33 had tank upgrades, adding effluent filters and access risers. Also, approximately 95 enhanced treatment systems were installed by project end. All this activity was positively supported by the community, whose interest was bolstered by an aggressive Town public relations and outreach effort including: local newspaper editorials, articles, and paid advertising; and Town reports, brochures, and letters sent to property owners.

Charlestown's inspection program featured three districts and was phased in over a three year period, one district per year. The first district, the Green Hill and eastern Ninigret area, was the first priority because of its high density land use clustered near these ponds, and vulnerability of wells to contamination with shallow, unconfined sand and gravel aquifer.

Private inspectors hired by the property owner were responsible for conducting inspections and entering data. Inspectors must be pre-qualified by the town and were required to have taken and successfully passed the onsite inspection training course for conventional onsite septic systems, or the advanced training for the innovative or alternative onsite treatment systems. The course was developed and administered by the Onsite Wastewater Training Center (OWTC) at the University of Rhode Island (URI). Charlestown had an inspection form used by the inspector for field observations and input into the tracking program database which is an online service of Carmody Data Systems contracted by Charlestown. Although Charlestown initially tried to populate their database with information on septic system types and owners these records were found to be incomplete or outdated, and with digital record only available from the 1980's they found that simply using the parcel records to send inspection notices and building the database from inspections received, was by far the most efficient and accurate method to build the database.

During the seven-year life of the Project, Charlestown achieved inspections of approximately 84 percent of its 4970 systems and replacement of approximately 80 cesspools and 53 failed conventional systems. The Town's ordinance requires that all cesspools must be phased-out by 2009. The Town now has about 200 advanced treatment systems. In 2005, the Town contracted with Carmody Data Systems, Inc. to track inspections online in a transition to paperless reporting by service providers.

South Kingstown divided the town into seven districts, allowing seven years to phase-in first maintenance inspections program townwide for more than 7,500 onsite systems. The inspection districts were prioritized based upon environmentally-sensitive areas, beginning with the Green Hill area, followed by other coastal ponds and the Narrow River estuary, aquifer protection districts, other areas served by private wells, and other areas. South Kingstown developed its own database for tracking inspection results with in-house expertise. Like the other towns, the database is link to the town's Geographic Information Systems (GIS) data for analyzing and displaying results.

Similar to Charlestown, private inspectors certified by the URI Onsite Wastewater Training Center are hired by property owners to perform the inspections. Inspectors use the town's data forms and submit them to the town. The town wastewater specialist enters the data into the town's inspection tracking program, with is linked to the town's Geographic Information Systems (GIS) data.

As of September 2006, South Kingstown had completed inspections of 89 percent of the approximately 4800 systems that the Town contacted about inspections. Due to those inspections, 74 cesspools were replaced, and 67 failed conventional systems were repaired or replaced. The Town now has about 90 advanced treatment systems.

OFFERING FINANCIAL ASSISTANCE

Charlestown was the first town in Rhode Island to make low-interest loans available to homeowners for septic system repair, upgrades, and replacement, through the State's Community Septic System Loan Program (CSSLP). This program is administered by the RI clean water finance agency, using State Revolving Loan Funds. At program start in 1999, the loans were available at 4% interest rate. Later, these loans were offered at 2 percent interest. As of April 2006, Charlestown had closed 33 CSSLP loans, totaling \$430,505 and had secured an additional \$300,000 for future loans.

South Kingstown's CSSLP low-interest loan program was approved in 2002, and by September 2006, they had closed 42 CSSLP loans, totaling \$503,820. In addition, South Kingstown offered rebates for locating hard-to-find systems, totaling \$6792 over the course of the Project.

In **New Shoreham** financial assistance to property owners was in the form of rebates and loans. Rebates were a total of \$448,000 for the installation of access risers and effluent filters and 12 "demonstration" enhanced treatment systems. The first increment of \$250,000 at 4% state CSSLP loans has been allocated and an additional \$250,000 is now being processed.

New Shoreham closed 13 CSSLP loans as of April 2006, totaling \$245,074, and has applied for an additional \$250,000 through CSSLP at 2 percent interest. In addition to their loan program, New Shoreham also offered a \$350 reimbursement for homeowners who complied with new standards for tank upgrades with access riser and filter, and another supplemental rebate program. In total, 842 rebates were provided, totaling almost \$362,000. As a result, all but 33 of the Island's onsite wastewater treatment systems have tank risers at grade to facilitate tank access for inspections, and effluent filters to protect the drainfield from system solids.

In addition, **South Kingstown and Charlestown** each applied for and received \$24,000 grants from RIDEM through the EPA 315 Nonpoint Source Program, for rebates for tank retrofits (at-grade risers and filters) and to offset the cost of locating hard-to-find systems for first inspections.

MONITORING WATER QUALITY

Volunteer water quality monitoring was an important component of the Project. It helped towns establish a baseline of information to better understand how factors such as short term weather fluctuations and seasonal variations can affect surface waterbodies and groundwater.

In the **Town of New Shoreham**, the Project has supported a comprehensive study of Great Salt Pond. This six-year monitoring program has provided data that helped locate and eliminate discharge of on-site wastewater effluent to the Pond tributaries. And it has established trends of nutrient and pathogen levels to enable corrective action should they begin to exceed appropriate levels." Data is now shared regularly between the Committee for the Great Salt Pond and Town commissioners, and sampling has helped the town keep the pond swimmable and fishable. Sampling results have been used in public education, to enhance awareness of pond conditions, and in testimony to the CRMC on development applications.

In the **Green Hill Pond** area, the project supported volunteer monitoring by the Salt Pond Coalition, with extensive sampling of Green Hill and Eastern Ninigret Ponds, their tributaries. The group also monitored tap water in the Charlestown area to document the condition of private wells early in the project. The Salt Pond Coalition (SPC) worked with Watershed Watch, DEM, and other members of the Technical Committee to design the sampling program annually and to interpret results. SPC interpreted results and made findings widely available to the general public through their newsletters and public workshops.

Both watershed groups worked with the University of Rhode Island Watershed Watch citizen monitoring program. Over the life of the project, URI Watershed Watch helped recruit and train volunteers, providing field equipment, and data analysis using their certified analytical laboratory at URI, Kingston, RI. URI also provided guidance in developing monitoring strategies and in interpreting results. The project resulted in development of Quality Assurance Plans (QUAP) for field sampling and laboratory data analysis, including analysis of effluent samples collected from demonstration systems.

5. URI BUILDS CAPACITY

DEMONSTRATION RESEARCH SYSTEMS

A key project component of the Block Island Green Hill Pond project was to install, maintain, sample and evaluate 25 onsite nitrogen reducing systems at individual residences. These were constructed as repairs of failing “septic systems” or cesspools in high-density neighborhoods and shallow groundwater in the Green Hill Pond Watershed. Installing new systems diminished the threat of bacteria contamination however, most of the demonstration systems used treatment technologies generally capable of reducing nitrogen by 50% and in many cases, to the 19 mg/l concentration standard set by RIDEM for denitrifying systems. However, further reducing nitrogen to very low levels that might be necessary to restore Green Hill Pond water quality has been a great challenge due to the area’s high residential density, small lots, shallow groundwater table, and limited space for package systems using treatment technologies with higher nitrogen removal efficiencies.

Under this demonstration project, URI, working closely with the Rhode Island Independent Contractors, constructed 25 alternative demonstration systems as repairs at the homes of residents of Block Island and Green Hill Pond watershed. These homeowners had responded to newspaper advertisements targeting residents with failing septic systems in critical environmental areas. URI received and mapped all applications to show location based on soil limitations, lot size, and proximity to surface waters and wetlands. Preliminary sites were selected based on the need to remediate failures to protect public health, groundwater quality and surface waters, and also for the opportunity to demonstrate application of alternative technologies on problem sites. URI then organized a technical review group to conduct field inspections at the preliminary sites and make final selections. This field review team consisted of DEM and CRMC staff, RIICA members, soil scientists, and others.

The participants agreed to allow URI access to construct, monitor, and maintain their system for the life of the Project, and to make the system available for training tours. In return, they received up to \$7,500 rebate for each system, approximately half of the cost of the replacement system at that time. The systems were tailor-designed to fit the specific needs of the various sites, made challenging either because of proximity to water resources or the level of the water table. Most systems aided single-family homes, with some shared systems serving two homes.. Many systems employed nitrogen reduction to reduce the effects on coastal waters and bacteria removal near private drinking water wells, groundwater aquifers or ponds. The

Block Island & Green Hill Demonstration Systems

A total of 25 demonstration systems were installed under the Block Island & Green Hill Pond Community Demonstration Project, exceeding the total number of 24 originally proposed in order to include an additional nitrex upflow filter, a new technology only available for testing in 2004.

Twelve systems were installed on **Block Island** between March 2002 and November 2003. URI staff monitoring all of these systems for at least one year, with six systems sampled routinely for three years. URI also maintained these systems during the monitoring period.

The 13 **Green Hill** systems were installed in June 2004, eight in South Kingstown and five in Charlestown. URI performed all routine operation checks and maintenance for these systems.

Ten of the Green Hill systems were monitored for treatment performance, from June 2004 to August, 2005. Results of effluent treatment performance and operation and maintenance findings were summarized in several publications throughout the project, and results also presented nationally. Findings from this research have also been incorporated into RIDEM design standards, including the Bottomless Sand Filter Guidance Manual, which has been adopted as DEM design guidelines. Findings have also been incorporated into national training curricula.

National Onsite Demonstration Project

Seven systems installed under the National Onsite Demonstration Project (NODP) were monitored and maintained by URI through the Block Island & Green Hill Demonstration project to evaluate long term treatment performance of alternative systems. These systems were installed in the summer of 1999 and monitored through July 2000, at the close of the NODP. The Community Demonstration Project enabled URI to continue routine monitoring and maintenance, through January, 2005 for most systems, resulting in six years of long term performance data, with up to 35 effluent samples for most systems and all routine maintenance conducted by URI, including visits made in response to complaints, telemetry reports and repairs.

Because these systems were already in place at the start of the project before additional demonstrations were installed, the NODP systems were frequently used for educational tours and training for local officials, homeowners, realtors and wastewater professionals, beginning with a tour immediately following the project kickoff, for government staff, municipal officials. A list of technologies installed, monitored and maintained under this Demonstration Project follows, along with a list of additional NODP technologies monitored and maintained. A more complete description of the demonstration systems is provided in the appendix. The project website also provides a virtual tour with photo “draw-overs” showing system components. Demonstration system virtual tour:

http://www.uri.edu/ce/wq/RESOURCES/wastewater/Research_Assessment/Demo_Systems/index.htm

Block Island Green Hill Pond Demonstration Systems

Technologies installed, monitored and maintained under the BIGHP
21 systems monitored

Primary Treatment Units

- Textile filter (AX 20)
- Waterloo foam filter
- Trickling filter (Septitech)
- Peat filter (BordNaMona Puraflo)

Secondary Treatment Unit

- Nitrex
- Peat Drainfield

Distribution

- Tipping D-box and gravity fed poly chambers
- Bottomless sand filter
- Shallow narrow drainfield
- Bottomless peat drainfield

National Onsite Demonstration Project

- Additional technologies monitored and maintained

Primary Treatment Unit

- Textile filter (coupon)
- Single pass sand filter
- Peat filter
- Fixed activated sludge treatment (FAST)

Secondary Treatment Unit

- Ultraviolet light disinfection

Distribution

- Bottomless sand filter
- Drip irrigation with sand lined shallow, narrow drainfield as backup

The demonstration system research provided definitive documentation of the need for careful planning to ensure that systems are properly designed, sited, operated, and maintained. Without that level of consideration, development of marginal sites using new technologies will only result in further degradation of water resources. The partnership between URI, RI DEM and the towns enabled local officials to demonstrate that advanced wastewater treatment systems provide a practical, and often least costly, solution to failed systems on small, substandard lots, but only with the oversight of a functioning wastewater management program.

MONITORING POLLUTANT RENOVATION CAPABILITY OF SHALLOW DRAINFIELDS.

A separate investigation of the pollution removal capability of shallow drainfields was conducted by Steve Holden, a graduate student working under the direction of Marc Stolt. This study examined nine shallow-narrow drainfields (SNDs) constructed as demonstration systems, in Block Island, Green Hill Pond, and adjacent areas. Each site is a demonstration system constructed under either the NODP project or this Project. The older sites were chosen to assess the effect of age on treatment. Sites range from newly installed to five years old.

Initial results suggest that 66% of the sites showed a 50 to 80% reduction in TN levels as a result of treatment in the SND. In these sites, TN in pore-waters below the SND in the spring was 33 to 90% lower than the winter suggesting seasonal treatment effects. An effect due to the age of the SND, or associated primary treatment system, was not observed. Two of the sites have fertilizer applied to the lawn. Samples collected from the control area from these sites had considerably higher levels of TN than those below the SND.

This study indicates that shallow drainfields can provide enhanced nitrogen removal beyond that provided by the treatment unit but that fertilizing lawns can offset benefits of advanced wastewater treatment systems. The URI Watershed Watch lab provided assistance in analyzing field samples for this project. The management implications for this work are that compared to bottomless sand filters, shallow pressure dosed drainfields offer opportunities for additional nitrogen treatment and should be considered wherever lot size and water table depth is great enough deep enough to accommodate shallow drainfields.

EVALUATING ACCURACY OF SOIL EVALUATIONS IN PREDICTING WATER TABLE DEPTHS

Soil / Water Table Relationships

Accurately estimating water table depth is essential for determining suitability for onsite wastewater treatment. In 2000 DEM adopted new soil evaluation procedures that allow site evaluators to rely on soil redoximorphic features to estimate water table depth, and reduce requirements for wet season monitoring. Although URI soil scientists supported use of the soil evaluation method, uncertainties exist in the relationship between soil features and water table fluctuations. The purpose of this study, conducted by Charles Morgan, URI NRS Department graduate student, under the direction of Dr. Mark Stolt, Soil Scientist, was to measure the relationships between soil features and water table depth. Charles Morgan began the study on Block Island in the spring of 2000, installing 32 nested-wells at 12 sites on Block Island. Continuous-read data loggers were periodically placed on wells to track the changes in water table levels on a continuous basis. The data loggers measured the water table level every half an hour and record the depth on a computer chip. Soils directly adjacent to each well will be described in detail. Soil color and other features indicative of wetness, known as soil redoximorphic features, will be recorded. These features will be compared with the water table levels to ascertain the best predictors of seasonal high water tables in these soils.

Results of this study included: development of a simple device to measure maximum water table depth as an alternative to data loggers, and development of a model relating long term rainfall data with monitored water table depth to predict increase in water table for different rainstorms following wet weather. The key finding of this study is that redoximorphic features provide a good indicator of the average water table depth but these researchers found that for all soil types, water tables are expected to rise higher than estimated using RIDEM soil based site evaluation procedures. On an average annual basis, water tables can be expected to rise at least 1-1 ½ feet higher and remain elevated for at least 10% of the year, thus compromising septic system treatment function when separation distance is lost between bottom of the leachfield and higher water table. Findings of this study have been presented at national meetings and published in national publications. Results have also been posted at the New England soils website and in numerous research papers.

As a result of this work URI staff worked with Dr. Mark Stolt to develop a guide to accurately monitoring the height of the water table and cumulative duration of saturation. Although we initially created several of the water table monitoring devices to conduct this work, inexpensive data loggers are now available, which we used for guide. Preliminary results have been provided to DEM and they are interested in requiring use of the procedure to verify water table depths for variance applications.

ENHANCING TRAINING OPPORTUNITIES

The demonstration portion of the project also afforded numerous training opportunities for system designers, installers, and operations and maintenance providers to learn current information about onsite wastewater treatment. In fact, the early work culminated in a significant expansion of the State training program for system designers, installers and inspectors. URI partnered with the State to provide the training necessary for expanded State licensing and certification requirements.

At the project start, the lack of trained service providers to ensure reliable and timely service was a serious concern, especially on Block Island. The project helped to generate greater interest in construction of advanced systems, often for repairs, to attract maintenance service providers to conduct business in southern Rhode Island.

In addition to the new, extensive training courses offered, URI conducted field tours throughout the life of the Project, giving wastewater professionals a first-hand look at the various technologies in action. Training programs were conducted for design professionals, installers, service providers and inspectors. In coordination with RI DEM, URI provided certification for inspectors of conventional and advanced treatment technologies.

Demonstration systems and management programs have been an important EPA method to display and evaluate new technologies, and present field opportunities to install systems and to showcase how systems can “fit” properties and conditions. Expanding opportunities to design and install systems, provides greater variety of conditions that decentralized systems can be shown to accommodate.

For this project the URI Onsite Wastewater Training Program prepared the plans for each advanced or innovative system, which were subsequently approved by RIDEM. URI worked closely with the RI Independent Contractors and Associates (RIICA) to provide training opportunities for installation crews who wanted genuine hands on experience with a variety of systems and property conditions.

URI worked closely with RIICA to install the systems, and each system was installed as a hands-on training opportunity for RIICA members. URI staff were on-site throughout the construction process, providing construction oversight, technical support and hands-on help in system installation. In some cases on Block Island, general notices via newspaper ads, were sent out inviting any contractor to stop in and observe installation.

This process also worked well for contractors. They obtained training in installation of innovative technologies while being compensated for their time and use of equipment. Communities wanting to install and demonstrate a variety of system under varying property and environmental conditions can consider such as approach. Property owners can benefit by having a demonstration system at a reduced cost with the agreement that the system can be showcased to workshop tours. During this project tours have been given to local officials, state and federal non-point source staff, realtors, bank officials, property owners, wastewater officials and planners.

WATERSHED MANAGEMENT / WASTEWATER FACILITIES PLAN

A watershed management plan was prepared and presented which described detailed stormwater management improvements. This assessed nitrogen loading and presented scenarios for various wastewater treatment alternatives and land use options to reduce nitrogen loads. Nitrogen is a chief concern in coastal waters like Green Hill Pond due to its fertilizing effects of stimulating growth of green algae. The assessment showed that more than 50-60% of all nitrogen loads was required to improve water quality. more than 85% of nitrogen from onsite system was necessary. All conventional septic systems, both functional and failing systems release nitrogen to groundwater, which travels to coastal waters. Few single residential nitrogen reducing systems can reliably remove nitrogen to that level. To evaluate in detail the nitrogen management and treatment options, South Kingstown and Charlestown undertook preparation

of a wastewater Facilities Plan to further assess nitrogen loading, and to evaluate and propose specific wastewater and other non-wastewater options to reduce nitrogen discharges to groundwater and the pond. The most promising high efficiency, low operating cost technology investigated was the advanced treatment Nitrex component as a secondary treatment unit added to an onsite treatment system. A similar technology – basically woodchips used in groundwater trenches to treat nitrogen contaminated groundwater flowing to Green Hill Pond, was also a promising option initially. Research by Dr. Art Gold and other URI hydrologists documented that the wood chip groundwater barriers were remarkably effective in removing nitrogen that flowed through the trench. However, groundwater monitoring revealed that elevated ground water nitrogen levels extended to a depth of 40 feet. With the installed nitrogen trench only a fraction of this depth, the nitrogen barrier was capable of capturing and treating only a very small proportion of the nitrogen in groundwater.

A draft facilities plan was prepared under RI DEM guidelines and a scope of work was prepared with EPA technical assistance to the communities. These documents have not been released by the Town of South Kingstown and are not yet available. The draft Facilities plan proposed that a combination of increasing tidal flushing of Green Hill Pond by opening an inlet to Rhode Island Sound and long-term conversion of conventional septic systems to high efficiency nitrogen reducing technologies should be undertaken.

DEVELOPING OUTREACH AND FACILITATING TECHNICAL SUPPORT

URI worked closely with the towns to develop outreach that was appropriate for the public at each phase of the Project. The partnership conducted meetings at Town events; sent notices via direct mail; created displays for Town Halls, libraries, and other public places; and ran advertisements in local newspapers, informing residents about the wastewater management changes that were happening. URI created a fact sheet series that leads homeowners through first maintenance-, routine-maintenance inspections, and pump-outs and informs about tank upgrades and simple daily actions that can promote the longevity of a system. Project communities are including appropriate factsheets when sending inspection notices and other reminders to system owners. To facilitate homeowner education and promote compliance with inspection requirements, URI has created a sample series of mailings to homeowners, for communities to use or adapt when beginning to notify homeowners of inspection requirements, with accompanying factsheets.

In addition to supporting public outreach about the changes happening at the Town-level, URI developed outreach based upon the research generated by the Project. This included a set of three manuals about onsite wastewater treatment alternatives for property owners and local officials known as “A Series About Onsite Wastewater Treatment Alternatives”. Part 1: “Choosing a Wastewater Treatment System” introduces onsite treatment and drainfield options, covering conventional and alternative systems. Part 2: “Alternative Wastewater Treatment for Individual Lots” illustrates how advanced treatment systems can be integrated into the home landscape as repairs on difficult sites. The examples used are demonstration systems installed in the Green Hill Pond watershed. *Part 3: “A Creative Combination: Merging Alternative Wastewater Treatment with Smart Growth”* is a longer booklet for local officials, planners, wastewater system designers and others who are interested in using decentralized systems to promote more creative, compact development. It uses examples of individual onsite systems, large flow, and cluster systems serving more than one building to show how decentralized systems can support more compact development to preserve site features and open space. These were widely circulated and featured in *Onsite Water Treatment* magazine, and state

agencies, researchers, and wastewater professionals from around the country have placed numerous orders.

The project also greatly enhanced the technical support that URI offers to communities. And serves as a great example of how universities and communities can benefit where universities provide technical assistance to communities. Research on treatment performance standards enabled URI to refine their analyses of pollution risks related to onsite systems.

6. RESOURCES FOR THE FUTURE

The Block Island Green Hill Pond Watershed Project may have spanned less than seven years, but it has left behind a wealth of information and several useful tools to help not only other Rhode Island towns, but also municipalities across the nation as they embark upon their own wastewater management initiatives.

An Online Toolkit

A comprehensive online resource center is hosted by URI, offering information to a variety of audiences about onsite wastewater systems and their management.. The Onsite Wastewater Resource Center (<http://www.uri.edu/ce/wq/resources/wastewater>) highlights all of the steps that were involved in the Project, in a way that any Town can replicate the process to create their own wastewater management program. The information includes: bullet creating a plan, coordinating finances, writing ordinances, reaching the public, selecting a tracking system, and dealing with alternative systems. Lessons learned, from the perspectives of the various project partners are included at this site are also included here and in proceedings from the March 14, 2006 workshop “Local Wastewater Management: Starting It, Running It, and Clearing the Hurdles” , at <http://www.uri.edu/ce/wq/NEMO/Workshops-Support/index.htm#previous> along with other resources highlighting accomplishments of the project communities.