

# Region-Wide Response to Pollution Uses Blend of Emerging Technologies

By DAVID STILL II

**S**eptember 12, 2011, found Paul Niedzwiecki, executive director of the Cape Cod Commission, on the floor of Yarmouth Town Meeting to lend support for Phase 1 of the town's Comprehensive Wastewater Management Plan. Working within state regulations and built on proven wastewater technologies, the plan provided a comprehensive, long-term approach to halt the flow of nitrogen from the town's many Title 5 septic systems, the leading source of nitrogen pollution on Cape Cod. It was also expensive. Town meeting voters were asked to support \$55 million for the first of five phases, which in total were estimated to cost \$275 million over twenty-five years. Yarmouth voters spoke loudly, and the plan went down on a voice vote. There was no need to count.

A month later in Orleans, the same fate awaited another well-engineered, central wastewater collection system that relied on traditional technologies.

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As Niedzwiecki watched these debates, it became clear that if a town could do everything by the book, develop a good plan, satisfy regulators, provide open and transparent outreach, and yet fail so badly, something needed to change. "That's when it became clear to me that the old process was not going to work," he recalled, "because it was producing results that weren't affordable."

Two days after the Yarmouth vote, Niedzwiecki and Andrew Gottlieb, executive director of the Cape Cod Water Protection Collaborative, appeared before the Barnstable County Commission to present their assessment. "We've done a great job at describing the problem," Niedzwiecki said. "We now have to have a more comprehensive and cohesive discussion of what the solution is, and we have to do it from the priority of what's affordable and effective." Gottlieb said he heard people suggest that a regional approach was necessary and sensed more receptivity to that notion than in previous forums.

The Cape Cod Commission was already building the tools to define and explain the problem on a watershed basis. Gottlieb and Niedzwiecki were tasked by the County Commission to develop a new way forward for the region on wastewater. They spent the better part of the next year going town to town listening to stakeholders in order to prepare their recommendations.

At the same time, the Cape Cod Commission was drafting the Regional Wastewater Management Plan, which was released on December 31, 2012, and provided the blueprint for an update of the Area-Wide Water Quality Management Plan for Cape Cod, known as the Section 208 Plan. Within a month, the Commonwealth designated the commission to update the thirty-five-year-old Section 208 Plan and provided \$3.35 million from the Water Pollution Abatement Trust to do it.

## A Problem Without Boundaries

The difficulty in addressing environmental problems for the Cape's year-round population is matched by the seasonal economic reality of the region. Infrastructure must be designed to meet the doubling and sometimes tripling of the population during a peak demand period

of just eight weeks each summer. It's an expensive problem for year-round residents and property owners. While land values are high, incomes are not, falling below the state median.

As a fragile coastal peninsula, Cape Cod has a finite capacity to accommodate development and maintain healthy human and natural environments, upon which the region's economy depends. Early development on Cape Cod was centered in dense villages surrounded by less-developed outlying areas. During the last century, however, Cape Cod's natural beauty, recreational opportunities and proximity to major urban areas attracted a rapid increase in population to outlying areas as well as village centers. This put increasing stress on the marine environment, which is susceptible to an excessive richness of nutrients, particularly nitrogen.

Cape Cod lacks the kind of wastewater infrastructure found in other parts of the

The Department of Environmental Protection estimates that 90 percent of the Cape's estuaries do not meet water quality standards. Determining responsibility is a tricky question. Groundwater does not flow based on municipal boundaries, but on conditions below the surface. Water that enters the system in one town can emerge in another. Most of the Cape's fifty-seven nitrogen-impacted watershed embayments are shared by two or more towns. The Cape needed a watershed-based plan that better reflected the jurisdiction of the problem.

The 1978 Section 208 Plan—which addressed "nonpoint sources" of contamination, such as septic systems that discharge into the groundwater—recognized future impacts of nitrogen on saltwater bodies, but it also acknowledged that the science of the day could not adequately identify the source. The Massachusetts Estuaries Project changed that. The project, conducted by the School for



*Cape Cod Commission Executive Director Paul Niedzwiecki speaks during a stakeholder conference held in February and attended by 300 people.*

state. Less than 3 percent of its septic discharge is collected and treated at central facilities. The rest is handled through traditional septic systems licensed under the state's Title 5 regulations. (The Cape has just 4 percent of the state's population, but 20 percent of its Title 5 systems.) These systems were designed to remove pathogens as a way to protect drinking water sources, and they served that function well. When the issue for coastal communities became excessive nitrogen reaching estuaries, however, Title 5 systems were not up to the task.

Marine Science and Technology at UMass Dartmouth, started in 2001 to develop nutrient budgets for coastal embayments, primarily nitrogen. Healthy embayments need nitrogen to sustain the ecosystems they support, but there's a tipping point where healthy systems go out of balance. Total Maximum Daily Loads, or TMDLs, represent the scientifically determined upper limit of nutrients a system can handle.

The work of the Massachusetts Estuaries Project has been validated numerous times by outside groups, including a 2011 county-sponsored panel of scientists.

## REGION-WIDE RESPONSE TO POLLUTION USES BLEND OF EMERGING TECHNOLOGIES

Once adopted by the U.S. Environmental Protection Agency, the maximum daily load data created regulatory water quality obligations on the contributing communities.

The Cape Cod Commission is working with staff at MassDEP and the U.S. EPA to broaden this approach beyond the restrictive confines of town boundaries. A foundation of the Section 208 update is that solutions for shared embayments must be developed and permitted on a watershed basis, regardless of political borders.

### Nontraditional Strategies

If central collection is the solution of last resort for Cape Cod, what's left? The biggest savings will be found in not building what isn't needed. The Section 208 update points the way to avoid extraneous infrastructure while meeting water quality

standards. The solution for the Cape's water quality problems won't be found in a single technology, but in a blend of non-traditional and traditional approaches. As the commission entered the Section 208 update process, a first order of business was to come up with a list of all technologies and how they worked. "I had rather naively thought at the beginning of this process that this was in the back of some textbook somewhere," Niedzwiecki said. "But that was not the case."

Commission staff and consultants looked at every conceivable technology with a potential to remove nitrogen and meet water quality standards. Screening criteria included the ability to remove nutrients, the land characteristics necessary for optimal performance, and the scale at which the method could be deployed.

Some technologies are remedial, such as permeable reactive barriers, which convert dissolved nitrogen already in groundwater to gas. Others are treatment reduction techniques used to keep nitrogen from getting into the system. And others are preventative based on controllable activities, such as fertilizer and stormwater management.

The result is a first-of-its-kind comprehensive matrix of technologies and techniques capable of solving the problem, and the only one known to exist. (Other areas of the country have begun reaching out to the Cape Cod Commission in the interest of solving their own wastewater issues.) The matrix is built as an advanced spreadsheet, but it's more than that. It's a living document that is updated as better information becomes available. And it

feeds the other tools developed to address specific challenges associated with the plan, such as financing, and economic and social impact models.

To apply the matrix to individual watersheds, work was divided between two teams. One concentrated on traditional technologies to determine a maximum possible infrastructure footprint. The other used the nontraditional approaches identified in the technology matrix to determine the smallest possible footprint. That set the boundaries of the discussion and a range of potential solutions that could meet water quality standards within that watershed. This was done for all fifty-seven embayment watersheds. If monitoring shows that these nontraditional approaches don't work as expected, another technology can be chosen.

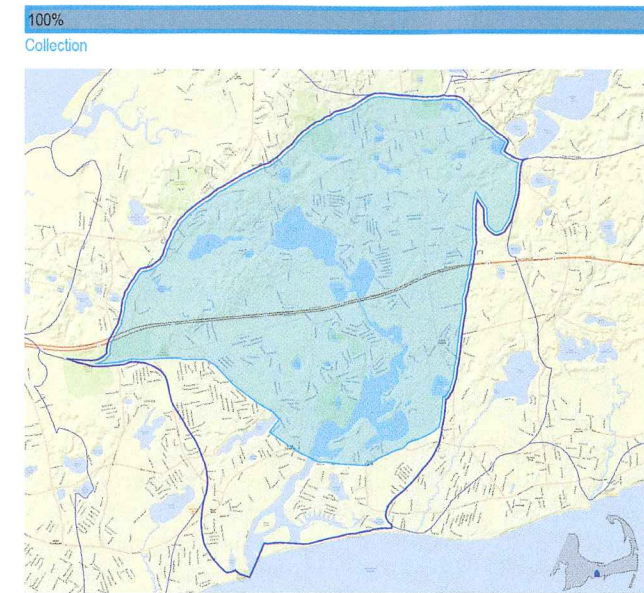
There's an important end result for taxpayers, of course. At the 208 Stakeholder Summit in February, Niedzwiecki announced that the total cost to the region for this new approach would be less than \$4 billion—still a lot of money, but roughly half of earlier estimates.

### Public Involvement

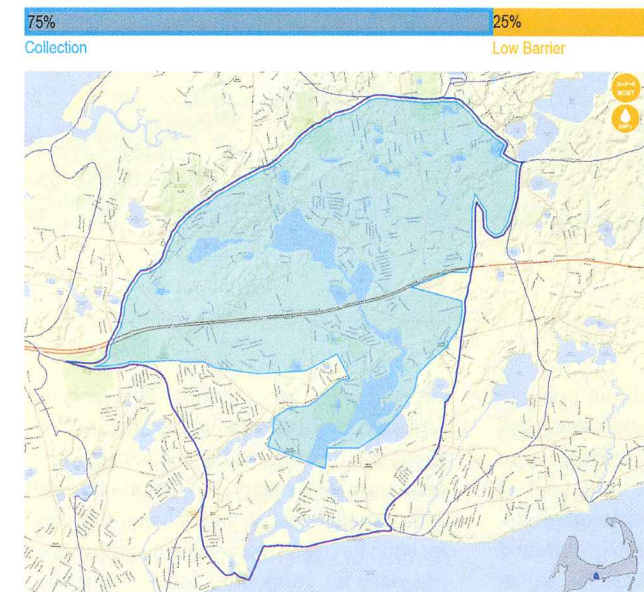
On Cape Cod, the environment is the economy. It's why visitors come in droves during the summer months and why coastal properties command the prices they do. The economic models developed for the Section 208 update confirm this. It is to the benefit of all taxpayers to ensure that coastal water quality maintains the high values of those properties and continues to invite tourism.

Research unveiled at the 208 Stakeholder Summit shows that roughly 60 percent of the Cape's total property value is located within a kilometer of the coast. Multiple studies across the country link water quality measures to the value of coastal properties. A decline in coastal property values would shift tax burdens inland, where many property owners are much less able to afford it. "If we do nothing," Niedzwiecki said at the summit, "there is the potential for an economic dislocation that this community will never recover from."

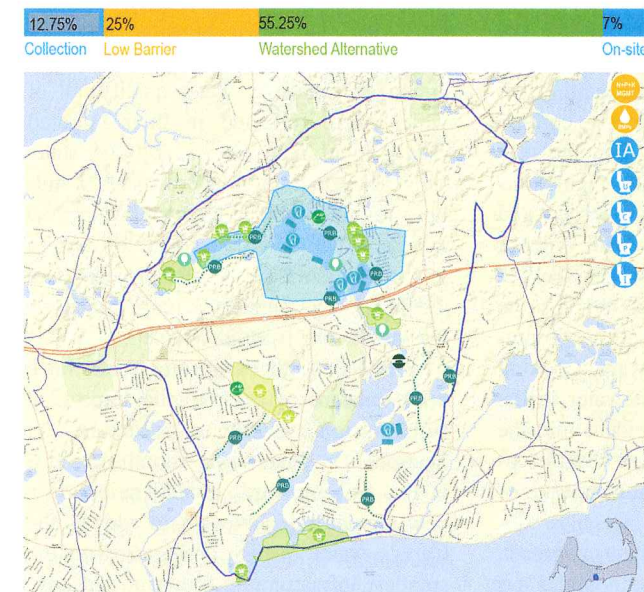
Along with tools that define the environmental issues, the Cape Cod Commission spent time developing a set of tools to link the financial, environmental and social consequences of water quality



The shaded area represents the conventional wastewater collection footprint needed to meet water quality standards for this watershed. It sets the upper limit for construction and cost to solve the problem.



Management techniques to reduce nitrogen through fertilizer and stormwater management, as represented by the gold-colored icons in the corner, shrink the conventional collection footprint.



The addition of non-traditional technologies, such as permeable reactive barriers, oyster reefs, fertigation (wastewater as irrigation), floating wetlands and nitrogen-removing septic systems, shrink the traditional collection footprint considerably, while greatly reducing the cost to achieve water quality targets.

### Technology Flow Chart for Water Quality Management Plan



Source: Cape Cod Commission

investments and policies. The “Triple Bottom Line” model was built to evaluate the ancillary, or downstream, consequences. TBL analysis is often used to identify the best alternative and to report to stakeholders on the public outcomes of a given investment. This analysis will be run for each of the fifty-seven impacted watersheds on Cape Cod.

There is a required public outreach and participation piece to the development of Section 208 plans. Stakeholders were sought across all watershed areas, and to maintain the integrity of the stakeholder process the commission contracted with the Consensus Building Institute of Cambridge to assemble these groups and then facilitate stakeholder meetings.

the potential to take billions of dollars off the table. To fund what remains, a finance subcommittee developed complex financial models to provide options to towns in paying for local mitigation measures. The financial models, some carrying out over the course of this generation and the next, start to make the plan affordable, but there’s more work to be done.

## Financing, Permitting and Regulation

The final months of the Section 208 update process were spent on the thorniest issues for towns: financing, permitting and regulation. MassDEP data provide the nitrogen-reduction targets for many of the watersheds and help to identify

“We think that that is a bellwether for a new approach,” Niedzwiecki said.

In May, the town of Orleans approved five water quality projects based, in part, around the concepts discussed in the year-long Section 208 update process. It’s the first money to implement portions of the town’s approved water quality plan to gain Town Meeting support.

In a recent conversation with then-DEP Commissioner Ken Kimmell, Niedzwiecki was asked if the 208 update was a plan or a menu. “It’s both,” he said. If each of the options achieves water quality standards, does the method really matter? The commission maintains that there’s a greater likelihood that towns will move on their own when the options are theirs. The intended outcome of the Section 208 update is a set of options and decision-support tools for towns. “We’re trying our best to create the tools to make this an easier, more productive discussion to have,” Niedzwiecki said.

Four days after the state’s unprecedented Certificate of Adequacy for the Falmouth approach, Niedzwiecki found himself back in Yarmouth before the Board of Selectmen. He and Gottlieb presented the work to date and the traction being gained on alternative approaches. More than two years had passed since the Yarmouth plan was defeated.

“Frankly, what Yarmouth did was the right thing to do, which was to pause and to wait for the system to evolve and catch up to the problem here,” Niedzwiecki told the board. It was a thought not lost on Board of Selectmen. At the end of the presentation, Board Chair Erik Tolley said, “Yarmouth’s sewer system debate started with watersheds, and it’s interesting how we’ve come full circle after how many years and how many millions of dollars. It was because we were convinced that it was the best solution available to us at the time. This town was this close to spending half a billion dollars, and we said no. And now we have a matrix with forty technologies that range in effectiveness and price. ... So it’s exciting. I don’t know if it’s the answer to everything, but it’s exciting.”

The Section 208 update draft was submitted to the MassDEP and the U.S. EPA for review in early June and will be released for public comment on August 1. 🌟

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— YARMOUTH BOARD OF SELECTMEN CHAIR ERIK TOLLEY

With meetings that averaged four hours in length, the commission spent more than 130 hours directly with stakeholders to guide the plan. Through the initial set of three meetings for each working group, 170 stakeholders met in eleven groups and provided feedback on the baseline information, technology and approaches.

In the months leading to submission of the draft update, the commission met with four reconfigured regional groups of stakeholders to focus on the hard parts. How do communities that share an embayment share in its recovery and the cost associated with it? Existing regulations confine solutions within town borders and have long-range price tags that, without subsidy, can choke communities seeking to do the right thing. Cost remains the greatest source of friction within communities that have moved forward. Looking at the management of wastewater in the last forty years, it’s no accident that the greatest steps forward came from top-down enforcement, financial incentives or a lack of options.

The adaptive management approach and use of nontraditional technologies has

targeted areas for solutions. This targeted approach requires a new way of thinking about the implementation and permitting of such plans. In January, the Commonwealth demonstrated that it understands the need for such flexibility by issuing a certificate of adequacy for Falmouth’s innovative plan.

The town of Falmouth is pioneering many of these nontraditional methods. Last year, its Town Meeting approved \$5.7 million for a host of pilot programs aimed at improving water quality, all of which were reflected in their targeted management plan blessed by the state. This year, Falmouth approved \$50 million to construct a targeted watershed approach that includes a collection system and implementation of pilot projects over the next five years. Reaching this point was neither easy nor an accident.

The Falmouth certificate would have been unheard of prior to the Cape Cod Commission’s work on updating the Section 208 Plan eight months ago. It is the first outward demonstration of a new regulatory framework to address the Cape’s water quality problems with the smallest infrastructure footprint and cost.