

IWR

Interstate Water Report

THE NEWSLETTER OF NEIWPC - THE NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMMISSION

SPECIAL REPORT: WELCOME TO NEW ENGLAND

Plant in Massachusetts Signals Desalination's Arrival in Region What Exactly Are We Getting Into?

by Stephen Hochbrunn, NEIWPC

It started simply. In the early 1990s, a mechanical engineer named Jeff Hanson was merely looking for a way to provide his employer, Commonwealth Electric, with a new customer that would demand a steady, heavy dose of electricity. Knowing a water desalination plant would do just that, and being aware that many communities south of Boston were desperate to increase their water supply, Hanson began investigating possibilities. In 1993, he proposed a major desalination plant on the shores of the Taunton River that would utilize the tidal flow to reduce concerns about the discharge. Soon, the idea consumed him. For well over a decade, he relentlessly pursued it. Even in the face of ridicule.

"The first time that I proposed the desalination concept was at a meeting of a task force formed by

Governor Weld to address water supply problems on the South Shore," Hanson said. "It got a great big laugh. Everybody laughed. They thought it was absurd that anybody would think of doing reverse osmosis desalination in Massachusetts."

Thirteen years after Hanson first pitched the idea, his vision is emerging in steel and concrete on the shores of the Taunton in Dighton, Mass. The region has never seen anything like it. The facility will pull brackish water out of the Taunton, remove the salt and other contaminants, and via a 16-mile pipeline, deliver sparkling clean fresh water primarily to Brockton, Mass., a city that for decades has been looking for new ways to quench its thirst. In the Middle East, it would be just one more desalination plant among the hundreds already in oper-

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ation. In New England, it is unique. From the beginning, it's been scrutinized and analyzed and criticized.

"It was a long, long struggle to get people to even warm up to the idea," said Hanson, whose firm, Hanson, Murphy, and Associates, is now overseeing the

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Work in Progress

Construction of the desalination plant in Dighton, Mass., was already well underway during a visit to the site in August. The illustration at far right depicts how the plant should look when complete. Note the intake/discharge channel and its connection to the Taunton River, seen in the lower left.



ILLUSTRATION BY AQUARIA WATER LLC

HIGH HONOR

NEIWPC's Ron Poltak Receives EPA Lifetime Achievement Award

by Stephen Hochbrunn, NEIWPC

Visitors to NEIWPC Executive Director Ronald Poltak's office in our Lowell, Mass., headquarters may notice a relatively new addition—a gleaming blue-glass EPA Lifetime Achievement Merit Award. Given out by EPA since 1970, the merit awards honor individuals and groups who have shown particular ingenuity and commitment in their efforts to preserve the region's environment. The awards aren't easily obtained; the 2006 nomination process drew approximately 50 nominations from across New England, and no doubt all 50 were deserving. The selection of Ron as a recipient was a tremendous tribute to his accomplishments—and those of NEIWPC as a whole.

U.S. Environmental Protection Agency Administrator Stephen L. Johnson and EPA New England Regional Administrator Robert W. Varney presented the

awards to Ron and the other recipients at a ceremony in Boston's ornate Faneuil Hall.

"These awards are among the highest honors EPA can bestow to recognize environmental accomplishments," Varney said. "The work of these individuals, organizations and businesses reflect the best attributes of New Englanders, working to find solutions to environmental issues. I offer my gratitude for their extraordinary contributions in protecting the environment."

During the ceremony, Linda Murphy, Director of EPA New England's Office of Ecosystem Protection, delivered a speech honoring Ron and his achievements.

"What distinguishes Ron Poltak is not only what he has accomplished," Murphy said, "but how he has conducted his work—through respectful relationships,

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Good Company After receiving an EPA Lifetime Achievement Award, NEIWPC Executive Director Ronald Poltak (second from right) is joined by (left to right) Linda Murphy, Director of EPA New England's Office of Ecosystem Protection; Stephen L. Johnson, U.S. EPA Administrator; and Robert W. Varney, EPA New England Regional Administrator.

EPA



Executive Director
Ronald Poltak

Deputy Director
Susan Sullivan

Established by an Act of Congress in 1947, the New England Interstate Water Pollution Control Commission is a not-for-profit interstate agency that utilizes a variety of strategies to meet the water-related needs of its member states—Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. NEIWPCC coordinates activities and forums that encourage cooperation among the states, educates the public about key water issues, supports scientific research projects, trains environmental professionals, and provides overall leadership in water management and protection. While NEIWPCC's initial emphasis was on surface water protection, the Commission now also devotes substantial attention and resources to such matters as wetlands restoration, nonpoint source pollution, water allocation, and underground storage tanks.

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Interstate Water Report

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Article submissions and questions or comments about *IWR* are welcome and appreciated. Please send material to shochbrunn@neiwpc.org.

FROM THE EXECUTIVE DIRECTOR

NEW LEADERS, NEW QUESTIONS

The November elections are over. The votes have been counted. And the Democrats have won majorities in both houses of Congress. What can we expect now regarding the immediate future of federally-supported environmental programs?

Let me try to answer that question. Democratic leaders announced plans on December 11 to extend EPA funding at Fiscal Year 2006 levels rather than move toward enactment of an FY07 spending bill. This would create a mixed funding picture for EPA programs. Some would likely avoid cuts contained in the FY07 proposal, while others would continue with reduced levels as contained in the FY06 budget.

In their December 11 announcement, Democratic leaders acknowledged that their plan would have some negative consequences. In a joint statement, incoming House Appropriations Committee Chairman David Obey (D-WI) and incoming Senate Appropriations Committee Chairman Robert Byrd (D-WV) said, "While the results may be far from ideal, this path provides the best way to dispose of the unfinished business quickly."

I believe state and interstate officials have very mixed feelings about continuing until next October under a continuing resolution. In terms of programs, the situation would create both winners and losers. Obviously, the Clean Water Revolving Fund would benefit. Its FY06 funding level was \$887 million nationally, while in the FY07 budget proposed by President Bush, it would have been slashed by \$200 million. Conversely, while I'm no big fan of set-asides or earmarks, there were \$270 million worth of them in the FY07 budget, some for very legitimate purposes. How the earmarked funding would get reallocated among EPA and other agencies could create problems for vital organizations that have depended on that source of funding for years.

While sorting out the questions surrounding the FY07 budget will be the order of the day initially for the new Congress, it must be recognized that the FY08 budget will be made public shortly, on February 4. By the time you read this letter, you may already know the details. Writing as I am, in early January, I can only go by the indications, which are that the FY08 budget will be less kind to environmental needs than ever before. If so, it will be a true test of the new leadership. It will be incumbent upon them to work with state officials and craft a budget that truly recognizes the many needs of the nation's water and environmental programs. That is something we've long been waiting for.

Sincerely,

Ronald Poltak
NEIWPCC Executive Director



PERSONNEL MATTER

NEIWPCC Developing Updated Version of WWTP Staffing Guide

John Murphy, NEIWPCC

For any business, determining the precise nature of its workforce needs is not easy, and it's certainly no different for a municipal wastewater treatment plant. How many operators are necessary? How many maintenance personnel? The need for accurate answers to such questions is particularly acute now, with many plants having trouble finding qualified job candidates while simultaneously facing budget cuts from their communities.

To help with the proper identification of workforce needs, NEIWPCC has begun the process of updating *Estimating Staffing for Municipal Wastewater Treatment Facilities*, an EPA guide for the operation of publicly owned treatment works published in 1973. The new version will reflect the many changes in the wastewater field since the first edition. For instance, there are now labor-saving computer applications and telemetry, which did not exist in the 1970s, and new treatment processes, such as sequencing batch reactors. Process control techniques and the effective handling of residuals are commonplace now, which they certainly weren't in the 1970s. Even some technologies that did exist 30 years ago—rotating biological contactors, oxidation canals, and aerated lagoons, for example—weren't adequately addressed in the 1973 guide. In the new version, they will be.

Overseeing the preparation of the guide is an advisory committee made up of NEIWPCC staff, regional 104(g) members, contract service providers, and superintendents from wastewater treatment facilities. This group has already reviewed and commented on the first draft of charts developed for the guide. The charts, which graphically display workforce needs, will undergo further refinement during a pilot study now underway with plants throughout New England. The study will help us fine-tune the charts and locate any inadequacies within them, and allow chief operators to weigh in on appropriate staffing levels.

The guide is expected to be completed in the fall of 2007, and made available for use by municipal WWTP managers, municipal officials and town managers, consultants, contract service providers, and federal and state technical assistance providers. Once published, the guide will provide easy access to information that should help reduce inadequate WWTP staffing, which has been identified by EPA as one of the top causes of permit non-compliance.

John Murphy (jmurphy@neiwpc.org) is a NEIWPCC Environmental Engineer and the coordinator of the development of the staffing guide.

NEW WATER QUALITY TOOL

AVGWLF Facilitates Evaluation of Northeast NPS Pollution

by Tom Mulcahy, NEIWPCC

We've long known about the problem of non-point source (NPS) pollution, which few would deny has a significantly negative impact on the quality of watersheds throughout the country. The challenge has been to find a good way to identify and quantify NPS pollutant loads. In recent years, researchers have begun to effectively tackle that challenge by developing models that simulate NPS loadings and allow water quality managers to determine the best ways to reduce the pollution to acceptable levels. In the Northeast, a new such model, crafted especially for the region with the help of NEIWPCC, is about to become available. It goes by the abbreviation AVGWL F or "average wolf" as some have chosen to pronounce it. It's not a simple name, but the software is relatively simple to use—and that should make it a popular new tool in the quest to control NPS pollution.

A PERSISTENT PROBLEM

EPA defines NPS pollution as "pollution caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even our underground sources of drinking water." In the Northeast, the bulk of NPS pollution can be attributed to stormwater and agricultural runoff.

Stormwater is generated when precipitation runs through storm drains, along streets and highways, or flows directly from land into our lakes, rivers, and streams. However it's generated, stormwater and all of the pollutants it carries enter our waterways untreated when it rains.

Agricultural runoff deposits nutrients, pesticides, pathogens, and organic materials directly into our waterways. The most recent EPA National Water Quality Inventory reports that "agricultural NPS is the leading source of water quality impacts to surveyed rivers and lakes, the third largest source of impairments to surveyed estuaries, and also a major contributor to groundwater contamination and wetlands degradation."

A MODEL SOLUTION

The options for determining the impact of NPS pollution problems include long-term surface water monitoring, which can be effective but has an undeniable downside—it takes a lot of people, a lot of time, and a lot of money. As a result, computer-based simulation modeling has increasingly been relied upon to provide the information needed to develop and implement NPS control programs.

Using a watershed model isn't without its shortcomings. It can be a difficult, tedious task because of the broad spatial and temporal scales that must be considered, as well as the large amount of data that must be compiled, formatted, and analyzed. Fortunately, the last two decades of model development have coincided with rapid advancements in the development and use of geographic information systems (GIS) technology. Due to its many inherent benefits, GIS software has been relied upon to support recent watershed modeling efforts.

One such effort is the Generalized Watershed Loading Function with an ArcView GIS interface, or AVGWL F for short. It's based on the original GWL F model, which Cornell University researchers created in



1987. The GWL F model provides the ability to simulate runoff, sediment, and nutrient (nitrogen and phosphorous) loadings from a watershed given variable-size source areas. It has algorithms for calculating septic system loads and allows for the inclusion of point source discharge data. It is a continuous simulation model that uses daily time steps for weather data and water balance calculations.

Monthly calculations are made for sediment and nutrient loads, based on the daily water balance accumulated to monthly values.

The AVGWL F tool takes all that a step further by incorporating ArcView software, which allows users to visualize, analyze, create, and manage data with a geographic component. Dr. Barry Evans of Penn State University developed the first AVGWL F software package, which was used to quantify nutrient and sediment loads and develop EPA-approved TMDLs for 66 NPS-impaired segments of the Neshaminy Creek Watershed. In January 2005, NEIWPCC began collaborating with Dr. Evans to build a version of the model that would reflect the range of landscape characteristics in the New England states and New York State, and help support NPS and Total Maximum Daily Load (TMDL) programs in the region.

CUSTOM VERSION

According to Dr. Evans, the general approach in most applications of AVGWL F is to 1) derive input data for GWL F for use in an impaired watershed, 2) simulate nutrient and sediment loads within the impaired watershed, 3) compare simulated loads within the impaired watershed against loads simulated for a nearby reference watershed that exhibits similar landscape, development and agricultural patterns, but has been deemed to be unimpaired, and 4) identify and evaluate pollution mitigation strategies that could be applied in the impaired watershed to achieve pollutant loads similar to those in the reference watershed. The primary bases of comparison between impaired and reference watersheds are the estimates of their respective average annual nutrient and sediment loads.

That, however, is the general approach. In order for a simulation model to adequately represent the processes of a specific region, the model algorithms must be calibrated to reflect the region's distinctive environmental conditions. The calibrated model algorithms then must be verified by comparing the calibrated model results to actual water quality data collected from watersheds in the region.

NEIWPCC, with assistance from our member states, EPA, and Dr. Evans, selected 22 watersheds in the Northeast for the purpose of calibrating and validating a model tailored for the region. We selected watersheds that represented the assortment of landscape characteristics in the region; each watershed also met a minimum threshold for available historic water quality and flow data. We used half of the 22 watersheds to calibrate the model, and the other half to validate the calibrated model results.



The Ashuelot River Watershed was one of 22 watersheds in New England and New York State used to calibrate and validate the Northeast AVGWL F.

READY FOR ROLLOUT


The customization process resulted in calibrated and verified model algorithms that can now be applied to watersheds throughout the region. With AVGWL F, sound estimates of sediment and nutrient concentrations can efficiently be established using a user-friendly GIS interface that includes a comprehensive data set covering the entire region. The regional GIS data set will also allow for the evaluation of interstate waters by employing GIS data from all six New England states and New York State in one standardized format. AVGWL F offers the northeastern states an effective alternative to costly monitoring programs and complicated model applications.

A companion software tool for evaluating and implementing agricultural and non-agricultural pollution reduction strategies at the watershed level will be included with the AVGWL F software package. This tool, called



Expert Advice Dr. Barry Evans of Penn State University instructs NYS DEC's Shohreh Karimipour in the use of a beta version of the Northeast AVGWL F model. The training occurred during a meeting of the model's Technical Advisory Committee held in August at NEIWPCC's Lowell headquarters.

PRedICT (Pollution Reduction Impact Comparison Tool), allows the user to create scenarios in which current landscape conditions and pollutant loads (both point and nonpoint) can be compared against future conditions that reflect the use of best management practices. It includes pollutant reduction coefficients for nitrogen, phosphorus and sediment, and has built-in cost information for an assortment of pollution mitigation techniques.

The Northeast AVGWL F software package is nearing completion and will be available to water quality managers early this year. It will be distributed by both NEIWPCC and Penn State. For more information, contact NEIWPCC's Becky Weidman (rweidman@neiwpc.org). 

More information about AVGWL F is also available online at www.avgwlf.psu.edu/ or www.neiwpc.org/avgwlf/.

Special Report: Desalination *continued from page 1*

construction of the plant pipeline. "I would not go away."

But even as his vision becomes a reality, as the form of the desalination plant slowly rises in Dighton, the questions haven't stopped. Is the facility, while innovative in many respects, the right answer for Brockton's water woes? What are the environmental costs of desalination? And in an area hardly lacking in lakes and rivers and other sources of fresh water—why do we need to do it at all? Is desalination really here to stay?

"I think that once we get this first one in New England, people will feel a lot more comfortable with [desalination]."

JEFF HANSON, THE ORIGINAL ADVOCATE FOR THE TAUNTON RIVER DESALINATION PROJECT

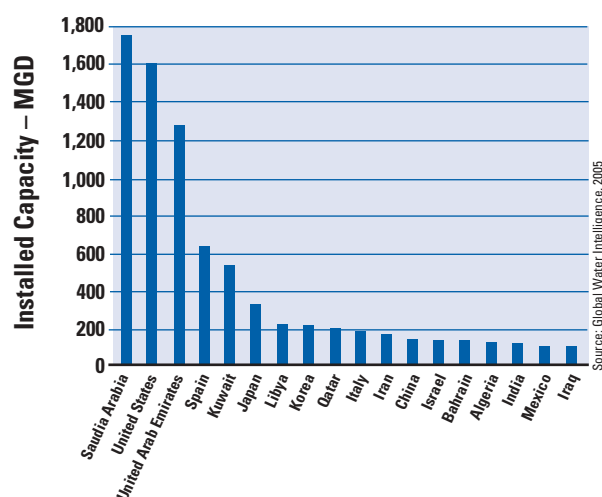
AN ANCIENT PRACTICE GROWS UP

For most of human existence on earth, it was considered an inescapable tragedy of our condition: to live on a planet flush with water and yet virtually all of it—97 percent, to be exact—in a salty, undrinkable state. Making matters worse: Two-thirds of the remaining 3 percent is locked up in polar icecaps and beyond reach. For parched mariners, the salt water tormented and teased. For those of an innovative nature, it was a problem that demanded a solution.

As long ago as 400 B.C., Greek sailors distilled seawater—heated it and captured the vapor—to form fresh water. Centuries later, more sophisticated systems emerged. In 1852, Britain granted a patent to the developer of a seawater distillation system, and by the early twentieth century, development was progressing rapidly. In 1938, the world's first major desalination plant began operating in what is now Saudi Arabia. By the 1960s, large desalination plants could be found throughout the Middle East, a region lacking fresh water but with no lack of the fuel needed to create it by purifying seawater.

The Middle East is no longer alone. Desalination plants now operate in more than 120 countries, and global capacity by some estimates stands at 4 billion gallons per day. While half that output is generated by plants in the Persian Gulf region and North Africa, there is growing interest elsewhere. China, for example, announced in late October that it will increase its desalination capacity almost tenfold by 2010. While Saudi Arabia remains on top in terms of desalinated output, you may be surprised by the nation ranked a close second—the United States.

Countries with More Than 1% of Global Desalination Capacity, January 2005



By January 2005, more than 2,000 desalination plants larger than 0.3 million gallons per day (MGD) had been installed or contracted to be installed in this country, according to an inventory published by the British newsletter *Global Water Intelligence*. Most U.S. facilities are small systems that generate high-quality water for industrial purposes, but interest in desalinating for drinking water continues to grow.

"Ten years ago, it was the crazy aunt in the attic," said Barry Nelson, a senior policy analyst in the Natural Resources Defense Council's San Francisco office. "That's changed. As a water supply strategy, desalination is now entering the mainstream and being taken seriously."

In California alone, more than 20 proposals for major drinking water desalination plants are under consideration. If every one is built, they'll supply enough freshwater to meet 6 percent of that state's massive water needs. Desalination plants now exist in every state in the nation, and a study published by industry analysts Research and Markets predicts that over the next ten years the United States will finally make the breakthrough into large-scale municipal desalination. That wouldn't surprise Hanson.

"I think that once we get this first one in New England," he said, "people will feel a lot more comfortable with it."

A MATTER OF NECESSITY?

One reason for the thawing of the initially chilly reaction to desalination in this region and throughout the country is the belief that some communities now legitimately need more water than their existing water sources can provide. That's an easier case to make for communities in dry western and southwestern states where populations are exploding. But in recent years, nearly every region of the country has suffered water shortages. If water use doesn't change, EPA predicts 36 states will experience shortages by 2013.

Consider what already happened in one community in the generally wet Mid-Atlantic region. As a hotspot for vacationers, New Jersey's Cape May absorbs a crush of tourists every summer. While great for the local economy, the invasion put too much stress on Cape May's groundwater resources; the pace of fresh water being pulled up from the aquifer beneath the city far exceeded the pace of replenishment from water seeping in from above. Water creeping in from the Atlantic Ocean filled the gap. It's a phenomenon called saltwater intrusion, and once it happens, it is virtually impossible to return an aquifer to its original freshwater state. With the water in its wells suffering from high salinity, Cape May officials opted for what they felt was the best solution—get rid of the salt. In 1998, a desalination system with the capacity to deliver 2MGD went online. The plant's been humming along ever since.

"It's been great, very low on maintenance," said Jim Wolfe, an employee in the town's water and sewer department.

The need for such a plant in New England, a region long considered water-rich, may seem hard to believe. On average, New England gets soaked by 44 inches of rain a year, nearly 40 percent above the national average. Our relatively low average air temperature means evaporation from our lakes happens at a lower rate than elsewhere. But don't overlook some natural disadvantages: New England's aquifers are shallower and smaller than those in other parts of the country. They have more gravel in their linings, allowing water to



Need for Desal? The town of Middleton on Boston's North Shore is among the New England communities that regularly limit water use to cope with the demands placed on existing supplies.

leak out faster than the largely sand-lined aquifers in other regions. And all our rivers and streams are incredibly efficient at whisking water out to sea, instead of trapping it inland as happens in areas with fewer rivers and more runoff-slowing mountain ranges.

Then, there are the troubles brought on by human activity. Despite immense progress on water pollution in the region, the water in many of our lakes and rivers remains contaminated. The steady sprawl of development has a powerful impact: when you pave paradise and put in a parking lot, water can't seep through the impermeable pavement to recharge the aquifer. Instead, it runs off to a stream that carries it to a river that brings it to the sea—so long, fresh water. All this is compounded, of course, by the appetite for water in America in general. No nation consumes more per capita than we do.

In its State of the Environment report released in October, the Environmental League of Massachusetts provided data showing that 23 communities in the eastern portion of the state exceeded their permitted water withdrawals in 2000 and that 52 communities are projected to exceed their permits by 2030. On Boston's North Shore, heavy withdrawals from communities along the Ipswich River have led that river to occasionally run dry during summers and earned it a spot among the top ten most endangered rivers in North America.

Such evidence understandably prompts calls for greater water conservation, better control of inflow and infiltration into leaky sewer pipes that drain groundwater out to sea, and a greater emphasis on installing porous surfaces on roads and parking lots. The argument goes that the region's current water supply sources would then be adequate. That may be right. But in Brockton, the argument would be a hard sell.

Since the 1800s, Brockton has struggled with water shortages, which grew acute in recent decades. In 1986, the state banned the city from connecting new businesses or homes to its overloaded water system, effectively killing new development. Brockton responded by placing strict restrictions on outdoor water use, mounting an extensive program to fix and replace old leaky pipes, and reviving the Brockton Reservoir in Avon as a water source. In 1996, the state lifted the ban on new water hook-ups, but Brockton's search for new, reliable ways to supplement the water withdrawn from Silver Lake, its primary water supply, went on. Officials explored digging new wells, building another reservoir, tapping into the Massachusetts Water Resources Authority system. None measured up to the other option on the table—getting water from the proposed desalination plant on the Taunton River.

“We did look at MWRA, and it has a very good water supply, a very good record, and the costs are similar,” said Brian Creedon, Brockton’s water systems manager. “But if we take their water, we’re taking it out of the Connecticut Valley watershed. With the desal plant, we’re taking the water from the Taunton basin, and the water comes back to the Taunton basin as effluent from our wastewater treatment facility. That’s the way it should be done.”

In a research report published in May 2005, the New England Public Policy Center at the Federal Reserve Bank of Boston identified desalination as one of the very few remaining ways for augmenting water supply in the region, noting that some towns hope it will be their “water panacea.”

“There clearly are some concerns that have to be considered and closely watched. Going to desalination is no get-out-of-jail-free card.”

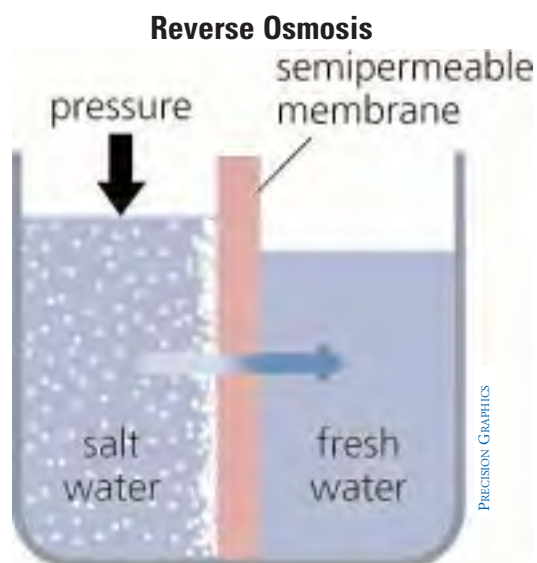
GLENN HAAS, MASSACHUSETTS DEP

“We’re seeing an increase in going to desalination as a way to get safe drinking water without further impacting stream flows,” said Glenn Haas, director of Massachusetts’s Division of Watershed Management and a NEIWPC Commissioner. “But there clearly are some concerns that have to be considered and closely watched. Going to desalination is no get-out-of-jail-free card.”

AN IMPERFECT PROCESS

In the Middle East, many major desalination facilities still remove salt the old-fashioned thermal way, by heating saline water and collecting the condensed vapor. You won’t find them doing that in Dighton. Thermal desalination requires vast amounts of physical space, hence most desalination plants in the United States and around the world now employ the process known as reverse osmosis. In RO, you remove the salt by upending the process we all learned about in biology class.

To jog your memory: Imagine a cellular membrane flanked by water with a low concentration of salt on one side and water with a high salt content on the other. The water will naturally flow from the more diluted side to the more concentrated side until the salt content on both sides of the membrane is equal. That’s osmosis. In reverse osmosis, you apply pressure to send the water in the opposite direction. The more concentrated water is pushed through tightly wrapped membranes with pores so small that tiny water molecules pass through but the relatively larger molecules of salts and other impurities are left behind. The result is fresh water on one side of the membranes, and a salinated residue, known as brine, on the other.



Nobody disputes the effectiveness of RO; the fresh water it creates is very pure. So pure that it’s a threat if sent through an existing water distribution system. The RO process strips water of its calcium and carbonate concentrations, creating an acidic water that can corrode pipes. Plants combat the threat by adding lime or limestone in post-treatment.

Making the choice to desalinate, though, comes with a price. In the *Desalination and Water Purification Technology Roadmap*, published in 2003 by Sandia National Laboratories and the U.S. Department of Interior’s Bureau of Reclamation (USBR), it’s estimated that building a desalination plant costs roughly seven to eight times more than building a conventional treatment plant. The current price tag for the reverse osmosis plant in Dighton: \$40 million (plus another \$22 million for the pipeline).

Construction costs are just the beginning. RO plants incur huge electrical bills due to the extensive energy needed to generate the pressure to push water through the membranes. The Sandia/USBR Roadmap puts the treatment cost of desalinated water at \$1 to \$3 per thousand gallons, or five to six times the average treatment cost for fresh water from a conventional water treatment plant. That’s steep, but it used to be steeper. In 1980, the cost of desalting seawater using membranes was over \$20 per thousand gallons. The drop in cost means that, in some parts of the country, desalination is actually cost-competitive.

“Look what’s happening in California,” said Tom Hinkebein, head of Sandia’s Advanced Concepts Desalination Group and a key contributor to the Roadmap. “The cost of pumping water from the San Francisco Bay/Delta area into greater Los Angeles is virtually equivalent to what it costs right now to desalinate.”

The costs aren’t quite on par yet in our region. Officials in Brockton have estimated that city residents will see their water rates rise 30 percent over time to compensate for the added cost of desalinated water. That cost will average a hefty \$5.80 per thousand gallons in the first three years of the Dighton plant’s operation, based on the terms in the city’s contract with Aquaria Water, the company building the desalination facility.

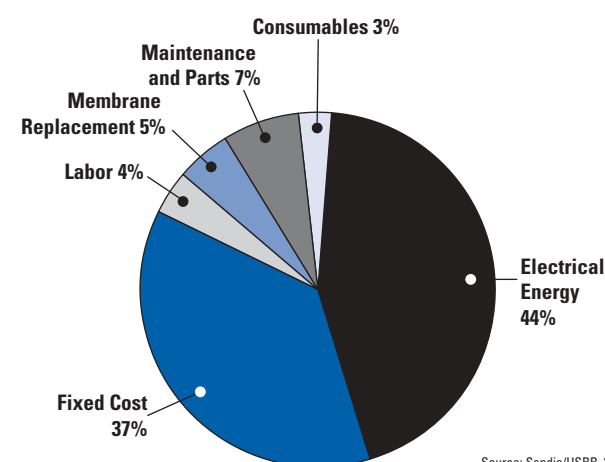
Given the high price tag, you might expect the rise in water rates to be even greater. But Brockton isn’t switching entirely to desalination; the water from the Dighton plant will be blended with the supply from the city’s traditional sources. Brockton residents might even see less of an increase in rates if the cost of desalination drops further. But experts on the technology warn of the risks of assuming a continued decline. Energy still accounts for up to 60 percent of an RO plant’s operating cost, despite extensive gains in efficiency and the widespread use of energy recovery devices such as turbochargers, which capture the energy in a plant’s discharge stream and return it to the front end to increase the pressure in the RO tubes.

“30 years ago, the consumption of electricity was about 30 times more,” said Alfredo Andrés, general manager of Aquaria Water. “We don’t expect it will be



Hot Topic Aquaria Water’s Alfredo Andrés (left) and a colleague discuss the company’s desalination plant in Dighton during a meeting at Aquaria’s offices in Brockton, Mass.

Typical Costs for a Reverse Osmosis Desalination Plant



reduced much more. We can say the process is almost 100 percent optimized.”

THE DIGTON EXPERIENCE

Andrés’s comment came during an interview at Aquaria Water’s small suite of offices in a modest office complex in Brockton. If the name Aquaria Water isn’t familiar, there’s a good reason: it’s a joint venture created specifically for the Taunton River project. And while Aquaria’s just the latest private entity to be associated with the Dighton plant, don’t doubt its ability to finally be the one to complete the task. Eighty-seven percent of Aquaria is controlled by Inima, a division of the giant Spanish construction company OHL, with the remaining 13 percent held by the original developer of the project, Bluestone Energy Services of Braintree, Mass. Bluestone hired Jeff Hanson in 1993 after Commonwealth Electric’s interest in the project waned. At Bluestone, Hanson continued to pursue the project until leaving to form his own firm in 2001, the very year that Inima joined the project.

Inima brings substantial experience to the job; it’s built some 25 desalination plants around the world and operates Europe’s largest seawater desalination plant, the Carboneras facility in Almeria, Spain. Carboneras is designed to treat 31 MGD, well beyond the roughly 2 MGD that the Dighton facility will initially be producing.

The Dighton plant is different from Inima’s other facilities in several other respects. At times of high flow in the river, the plant won’t need to desalinate, as pres-

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sure from the fresh water streaming down the Taunton River will be enough to keep the salt water from Mount Hope Bay from pushing its way upriver to the plant's intake. At these times, the water will be sent only through the plant's ultrafiltration system for treatment, since there'll be no need for reverse osmosis. At times of low flow in the river, when desalination is necessary, it still won't be seawater that's being treated, but rather brackish water, which has far fewer total dissolved solids that need to be removed than seawater and a much lower salinity level. Salinity at the intake will never reach more than about 20 parts per thousand; the average salinity of the world's oceans is 35 parts per thousand. That difference translates into a cost savings. The more salt to remove, the more expensive it is.

There's one other key distinction. When the Dighton plant is desalinating, it will do so by taking water from the Taunton River at low tide, when the salinity of the water at the facility's intake is at its lowest levels. The plant will discharge the unwanted brine when the tide is high and the salt in the river is at its peak. The idea of withdrawing and discharging in Dighton based on the tides originated with Jeff Hanson, who was looking for a way to get around longstanding concerns about the environmental impact of desalination plants emitting brine with much higher salinity than the receiving waters.

"I figured I could use the tide to my advantage to get rid of the brine," said Hanson. "And the big problem for desal plants is getting rid of the brine."

During the talk in Brockton, Aquaria's Andrés brightened when he talked about the tidal idea and its application. "Because of the tidal flow, the level of desalination will vary virtually every day," he said. "That's something I haven't seen in any other desal facility."

HEAVY ON THE SALT

Environmentalists haven't shared such enthusiasm. From the beginning, they've questioned the need for the



PHOTOS BY INIMA MEDIO AMBIENTE, S.A.

International Experience *Two views of the giant Carboneras plant in Spain, one of many desalination facilities built and operated by Inima, majority owner of the company developing the Dighton plant, Aquaria Water.*

plant and expressed concerns about its impact. The Watershed Action Alliance, a coalition of watershed associations, was the most vociferous. At public hearings held by the Massachusetts Water Resources Commission in 2004, the WAA blasted the project as a "clear and present danger" to the Taunton River.

"The potential risks and benefits of the Aquaria proposal have not been carefully weighed, nor have many of the alternatives," said Pine duBois, executive director of the Jones River Watershed Association, a WAA member.

The WAA urged permitting authorities to consider the potential harm to the diverse animal life in the Taunton River Estuary, a vital nursery for the fish and shellfish that live in Narragansett Bay, as well as plant life; the area around the facility boasts a sizable population of Long's Bittercress, an endangered perennial of the mustard family. The WAA argued that the project site was in a relatively pristine area of great ecological significance. State officials don't dispute that point.

"Since desal is cheaper the less salty the water is," said Mass DEP's Glenn Haas, "there's a desire among developers to go up a river, up into the estuaries, so that they can get some fresh water. But there are very

fragile aquatic environments in those areas. We need to be very concerned about that."

For every 100 gallons of water it takes in, the Dighton plant will produce 75 gallons of fresh water and 25 gallons of brine, which will contain four times the salinity of the original water. Although Hanson's idea to time the desalination cycle based on the tides appeared encouraging on the surface, it didn't initially alleviate concerns about the brine's environmental effects.

Brine disposal is an especially serious challenge for inland plants, such as those in Texas, which desalinate brackish groundwater. With no ocean nearby and few lakes and rivers in the neighborhood, the plants can't discharge to surface water, so must resort to expensive strategies such as shooting brine into aquifers via deep injection wells or blending it with fresh water to create a mix for irrigating farmland. But even plants sitting on a riverbank can't throw out their leftovers like a glutton at an all-you-can-eat Chinese buffet.

Brine from desalination plants includes not only high salt levels, but also everything else that can be found in salt water and removed during the treatment process, such as manganese, copper, lead, iodine, and chemicals introduced by runoff from farms and urban areas. Because of the increased salinity, the brine also tends to be heavier than any surface water to which it's discharged. Unless it's adequately dispersed, it sinks. Considering this tendency, and what the brine can contain, it's understandable that there are worries about the impact of the discharge on bottom-dwelling organisms, such as crabs, clams, and shrimp. Fears about the impact on migratory fish have also been voiced; as one theory goes, fish approaching a plant's discharge point may sense a change in salinity or temperature (brine tends to be warmer than the receiving water), and respond by swimming around the area and into parts with less food and more predators.

So, just how much of a threat does brine pose to the environment? Getting a definitive answer on that question isn't easy, even for those working in the desalination industry.

"Every time we do a conference, we always ask for papers on environmental concerns, for people to talk about this, to see what they're doing, but we don't usually get much response," said Patricia Burke, secretary general of the International Desalination Association, a prominent trade group with an extensive global reach that happens to be based in Topsfield, Mass. (Burke lives in Topsfield, and insisted the organization be based there when she was tapped for the top job.) "There doesn't seem to be a whole lot of concern about it. Saudi Arabia did a whole big study on brine disposal, and they didn't publish it. It never saw the light of day. So I asked them, 'What does that mean? What are you trying to tell me?' And they said, 'We just didn't find anything really significant.' The ocean's a big thing out there, and I guess when you throw back a little heavier concentrate, it just dilutes."

Dilution is the solution. Not a new concept, and not entirely without merit. But it would help if more solid science existed to support its relevance to desalination. The report *Desalination, With a Grain of Salt*, published in June 2006 by the Pacific Institute, stated plainly that more research needs to be done. "Only a few studies have performed a comprehensive analysis of the effects of brine discharge on the marine environment," wrote the authors, including Peter Gleick, who also writes the popular "The World's Water" biennial reports. "More comprehensive studies are needed to adequately identify and mitigate the impacts."

Handle with Care *The Taunton River Estuary, which is home to a diverse array of animal and plant life, will be the source of water for New England's first major drinking water desalination plant.*





AQUARIA WATER LLC

Trial Run Aquaria's pilot plant for the Dighton facility included some of the same equipment as will be used in the full-size facility and simulated its operation.

Without broad scientific analysis, plant developers are under pressure to prove their projects won't hurt the environment. In Dighton, Aquaria built and operated a small pilot plant that mimicked the operation of the proposed Taunton River facility. Simulations of the plant's withdrawal and discharge strategy were also conducted, and showed the plant's discharge would increase salinity in the river during times of low-flow by an average of just two parts per thousand, well within the natural variation. It was hard to argue that Hanson's idea to utilize the tidal flow to withdraw at low salinity in the river and discharge at high salinity didn't work as advertised. At the very least, it lessened the impact of the higher salt content in the plant's effluent. But the concerns didn't stop there.

CHEMICAL CONSIDERATIONS

In a typical reverse osmosis plant, chemicals are applied to the water during pretreatment, that is, before going through the RO membranes. These chemicals can include everything from chlorine (for bacterial control) to anti-scalants such as sulfuric acid, which prevent salt deposits on pipes. The most common chemical added is an iron coagulant, such as ferric sulfate or ferric chloride, which helps bind particles like algae together so they can be more easily removed by filters. The key is to get the particles out before they can foul the RO membranes, which are delicate and can clog if you're not careful. Being careful also means cleaning the membranes, usually every three to six months, with caustic and potentially hazardous solutions.

Where do the chemicals go? Plants rinse the cleaning solutions out of the membranes, and while the first rinse usually goes into the sanitary sewer system, any subsequent rinses typically are discharged into the brine. That's where the chemicals added during pretreatment usually end up as well. It sounds alarming. Industry experts say it's not necessarily so.

"As a whole, very few chemicals are added," said Tom Pankratz, editor of the weekly newsletter *Water*

Desalination Report and a consultant who's worked on some of the world's largest desalination projects. "And there are rather simple ways to mitigate any risk, like segregating any cleaning chemicals that are used and sending them to the sanitary sewer or, as some plants do, bleeding them back slowly into the brine over a period of time so they're essentially at a nondetectable level."

By using a sophisticated ultrafiltration system in Dighton, Aquaria will screen out much of the matter that might foul the plant's RO membranes, thereby extending the time between membrane cleanings and minimizing the use of cleaning solutions. Of course, the ultrafilters themselves still require periodic cleaning, and the solid material trapped by them must be disposed of in a landfill. Hardly harmless, but environmentalists who opposed the facility had a bigger issue to press—the potential harm to living things who have the misfortune of being near the plant's intake pipe when water is drawn in for treatment.

IN HARM'S WAY

The terms chosen to describe what happens to the organisms—impingement and entrainment—make it sound almost benign. It isn't. In impingement, larger

organisms such as adult fish and even marine and semi-aquatic mammals are killed as they're sucked against a plant's intake screen. Victims of entrainment suffer a similar fate; they're the smaller organisms such as plankton and larvae who make it through the intake screens but are killed by heat and pressure in the treatment process.

Impingement and entrainment are considered to be the most significant adverse environmental effects of desalination.

Since the development of the very first desalination plants, wildlife advocates have warned of the impact of these twin phenomena on aquatic life. Activists opposed to the Dighton plant decried plans for yet another intake pipe on the Taunton River that would cause additional harm to young fish and invertebrates. While the authors of the Pacific Institute report wrote that in this area too more research needs to be done, the consensus in the scientific community seems to be that impingement and entrainment are the most significant adverse environmental effects of desalination.

Detractors to this view do exist. During a workshop on desalination in September in Monterey, Cal., a marine biologist named John Steinbeck (a distant relative of the literary great) raised an uproar among environmentalists. Steinbeck, who works for the science consulting firm Tenera Environmental, didn't deny that impingement and entrainment were occurring; he just said the talk of their impact was overblown. In an interview for this article conducted after the workshop, Steinbeck summed up his comments.

"In all the years I've been studying and looking at the effects of power plants, I haven't seen any effects on adult fish populations from entrainment attributed to

once-through cooling," Steinbeck said. (Roughly half the power plants in the United States still use once-through cooling, in which water is withdrawn from a waterbody and circulated just once through the plant for cooling purposes; more modern plants use a recirculating cooling system, which reduces water usage by nearly 100 percent.) "A lot of rhetoric gets thrown around, and things get blown out of proportion, probably with good reason. If you multiply the volume of an intake times the larval fish in the water, you can come up with some eye-popping numbers about how many larvae are killed. But in actuality, an adult female may only have to have two of her larvae survive to adulthood to do her part to sustain the population of that species. And over her life, she may produce hundreds of millions of larvae or eggs. Fish have adapted to a high level of mortality."

Environmental groups pounced on Steinbeck, claiming ample proof existed to show once-through cooling caused catastrophic damage. Regardless of who you believe, it is hard to deny the pure unnaturalness of a practice that kills countless organisms, whether the water is being withdrawn for a power plant or a desalination facility. If it must be done, why not combine the two types of facilities and minimize the impact? There's a term for that too—co-location—and when desalination is the topic, you hear it. A lot.

SHARING THE WATER

The concept is simple: Take a power plant that's already circulating, say, 500 million gallons a day of seawater to cool its turbines, and before the water goes back to sea, peel off about 100 million gallons for the desalination plant next door. You get desalted water without any additional impingement and entrainment, along with other benefits. Inflow from a power plant is warmer than a direct withdrawal of water, and warmer water costs less to desalinate. Also, a co-located desalination plant can discharge its brine in a more environmentally friendly way. The brine is pumped back to the power plant, where it blends with the rest of the cooling water headed for the exit door, allowing dilution to occur before discharge to the receiving waters.

During the many years of debate over the Taunton River project, environmental groups repeatedly said that if desalination had to be done, at least do it by co-locating the facility with one of the power plants in the area.

"We believed it would have been better to piggy-back it onto a power plant, and we still believe that's true," Pine duBois said. "But Aquaria convinced us they could not get the cooperation they needed to make that happen."

Even if Aquaria had succeeded in obtaining a co-located site, it's unlikely the company would've gotten a warm hug from environmentalists. In California, plans for large-scale co-located plants are facing intense scrutiny—no more so than two competing proposals to build a 50 MGD oceanfront plant next to the Encina Power Station in the city of Carlsbad. The plant will be the largest seawater desalination facility in the western hemisphere—if it's ever built. Both Poseidon Resources, a private developer based in Stamford, Conn., and the San Diego County Water Authority have put forth proposals, and acrimony has been their constant companion. Lately, environmentalists have been zeroing in on Poseidon's plans for a \$270 million facility at the site. In July, a coalition of groups filed a suit demanding the project be stopped until Carlsbad reassesses the plant's environmental impact, and in September, several groups asked California's water board to throw out Clean Water Act permits granted to Poseidon for the facility. The maneuvers haven't deterred Poseidon; it's moving ahead

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with plans to build the plant, and aims to complete construction by 2009. But the situation in California shows that co-location doesn't immunize a proposal from criticism.

For one thing, environmental groups fear that, by co-locating desalination plants and power plants, it will be that much harder to shut down or retrofit power plants, such as the one in Carlsbad, that still use once-through cooling, a process they consider outdated and harmful. Another concern: Co-location does nothing to reduce the high energy demands of desalination. And engaging in energy-intensive practices, whether driving a gas-guzzler or desalting water, are increasingly difficult to defend as acceptance of climate change grows. Awareness of this issue is driving interest in powering desalination plants with green energy sources. The Renewable Energy Research Laboratory at the University of Massachusetts Amherst, for example, has received a major federal grant to study operating a desalination plant partially powered by wind. In fact, green desalination plants already exist, though on a small scale; the 2005 *Global Water Intelligence* inventory lists about 100 mostly low-output facilities that rely on wind or solar power. Don't expect to find any of the proposed co-located plants in California on GWI's green list in the near future. Their energy source is next door, and they plan to use it.



Thirst Quenched *An intensive effort to augment the water supply of Brockton, Mass., culminated in an agreement that commits the city to buying desalinated water piped in from the plant in Dighton for 20 years.*

WAR AND PEACE

The Aquaria plant in Dighton will also be getting its energy the old-fashioned way, but that issue wasn't a significant factor in the long battle over the facility. About everything else was. Proponents and opponents squared off repeatedly, and not just about the potential for environmental impacts. A former mayor of Brockton threatened to file a lawsuit claiming taxpayers' money was being spent illegally. The threat came after then-Massachusetts Governor Mitt Romney signed a petition from Brockton's City Council allowing the city to commit to a 20-year contract with Aquaria that does not require the Council to appropriate the money every year, as state law typically requires for any purchase of services. The contract assures Aquaria of a steady, thirsty customer. Brockton is initially committed to buying 1.9 MGD, but that will rise to more than 4 MGD by the tenth year of the contract.

While the lawsuit was never filed, the threat to the plant from environmentalists was real. After the Massachusetts Department of Environmental

Protection issued Water Management Act permits to both Aquaria (for withdrawing the water) and Brockton (for buying it) in June 2005, environmental groups filed joint appeals against both permits. With the possibility of the appeals process further stalling the long-delayed project, Aquaria began talking to the groups, looking for ways to settle their differences. In September, the groups withdrew their appeal of the Aquaria permit. Three months later, they pulled their appeal of the Brockton permit. Why, after fighting so hard for so long against the plant, did the groups back off?

"The plant was in review for a very long time," said Pine duBois of the Jones River Watershed Association, which filed the appeals along with Save the Bay (Narragansett Bay) and the Taunton River Watershed Alliance. "We were successful I believe in getting a lot of changes implemented into the design that would at least minimize the impact on the environment. We really required an awful lot of the components in the permits that ensure, to the degree possible, that there will not be a change that is unacceptable in terms of the salinity of the estuary and in the numbers of fish."

That duBois would trumpet her movement's role in applying the pressure that led to a more environmentally friendly project is fair and expected—but state agencies get credit too. The Division of Marine

Fisheries, for example, worked with Aquaria for two years on revisions to its proposal before finally granting approval. And wherever the pressure came from, it worked. Aquaria eased concerns about impingement and entrainment by agreeing to reduce the velocity of the plant's intake. It plans to install either a Gunderboom filter barrier or a filter system made by Filtrex of Attleboro, Mass., at the intake; either system will help prevent fish eggs, larvae, and other small aquatic organisms from being sucked into the plant. As for the endangered Long's Bittercress, the company conducted a survey of the plant's presence in the area, and determined that some will have to be relocated. Once that's done, and desalination is underway, Aquaria will closely monitor the impact of its operations on the Long's Bittercress population. In fact, the extensive monitoring required of Aquaria in the multiple permits it required and received succeeded in assuaging many fears about the facility. It will watch itself very closely—and its findings will be watched closely by others.

Success in achieving a gentler desalination plant wasn't all that motivated the environmentalists' decision to call off the battle.

"We also felt there was an opportunity here to correct a significant environmental damage that was already occurring," duBois said. "We saw the chance to reduce the amount of water that Brockton takes from Silver Lake." If that reduction happens, duBois may achieve something she's long been fighting for—an end to the periodic severing of the connection between Silver Lake and her beloved Jones River. Silver Lake is the river's headwaters, and duBois and other activists have for years blamed Brockton's withdrawals for drawing down the lake to the extent that flow to the Jones dries up during parts of the year.

The idea that desalination can relieve pressure on overly stressed existing water sources isn't new. Proponents have been making that argument for

decades. The tough part is ensuring the new supply of water actually reduces demands on the old, and doesn't simply increase the overall supply. Brockton's Brian Creedon said there's nothing in the city's WMA permit stipulating that, once the desalination plant goes online, Brockton must reduce withdrawals from Silver Lake to help reestablish a constant connection between the lake and the Jones River. But he expects it will happen.

"Do I expect a greater connectivity to the Jones River? Absolutely," Creedon said.

DuBois appeared to agree, saying Brockton's new water management plan sets out a process that should help the Jones. "If it doesn't, we have the right to appeal the permit," she said.

"We felt there was an opportunity here to correct a significant environmental damage that was already occurring. We saw the chance to reduce the amount of water that Brockton takes from Silver Lake."

PINE DUBOIS, JONES RIVER WATERSHED ASSOCIATION

The environmental groups got one other thing—a little money for the cause. In the agreement with Aquaria in which the environmentalists agreed to drop their appeal is the clause that a new group, the Taunton River Stewardship Organization, will be created to protect and enhance the natural resources of the Taunton and its watershed. Funding for the group will come from Aquaria, which will contribute two cents for every 1,000 gallons of desalinated water it sells from the Dighton plant. Even at Brockton's initial commitment to buy 1.9 MGD, that's a contribution of nearly \$14,000 a year. Were the plant to expand eventually to its full capacity of 10 MGD, the annual contribution would rise to \$73,000. Under the agreement, Aquaria must also provide, every year, as many as 10 free laboratory analyses of water samples submitted by the stewardship organization.

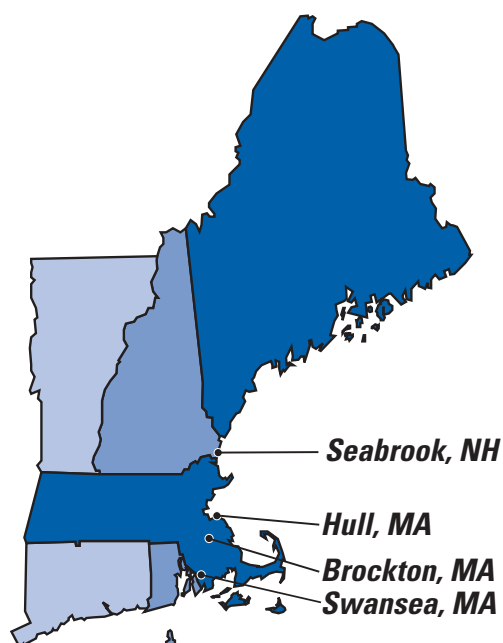
IN BROCKTON'S WAKE

You might think the long, expensive battle over Brockton's quest for a desalination facility would scare off other communities in the region. It hasn't. Several other cities are pursuing the option, none more so than the city of Swansea, Mass. Located 35 miles south of Brockton, Swansea has suffered similar water shortages, and twice in the past 13 years declared water emergencies. Robert Marquis, superintendent of the Swansea Water District, said the city twice proposed in the early 1970s to build a new surface water reservoir at a cost of \$5.7 million, but voters defeated the proposal both times. When officials revisited the reservoir idea years later, they discovered the price tag had ballooned to \$50 million.

"Swansea wasn't going to bear that cost," Marquis said, "and we knew about desalination technology, that it's very effective and that with brackish water, you can reduce the cost of the produced water to something very realistic."

The city proposed an \$18 million project that includes building an intake station on the Palmer River to withdraw brackish water that will be pumped two miles inland to the site of an existing well field. At that site, a treatment plant will be built to perform RO desalination on the river water and microfiltration on the water brought up by the wells.

As with the Dighton proposal, Swansea's plans drew strong criticism. In one of her last acts as secretary



Four New England communities have actively explored desalination as a drinking water supply option, but so far only two—Brockton and Swansea—are moving ahead with their plans.

of Massachusetts's Executive Office of Environmental Affairs, Ellen Roy Herzfelder questioned the project's impact on fish that spawn in the Palmer, and said the city couldn't begin construction until her office saw more evidence that desalination was the best solution. Marquis stood firm.

"We have no potential for additional groundwater supply in Swansea," he said. "And the nearest place to connect to [the Massachusetts Water Resources Authority system] is in Stoughton, 36 miles away. It's somewhat unrealistic to think that you're going to pump that far."

Opposition to Swansea's project diminished after its plans were revised to reduce intake velocity and to reposition the brine discharge to ease the impact on migrating fish. At the water district's annual meeting in May, voters approved appropriations totaling \$19.6 million for the project. Marquis said he's in the final phase of getting all required permits and that a request for construction bids will go out in February 2007.

"Our project is the first municipal desalination project in the Commonwealth of Massachusetts," Marquis said. "I think that's quite a distinction."

About 18 miles southeast of Boston, perched on a narrow peninsula that juts into Massachusetts Bay, is another community considering a desalination facility. The town of Hull doesn't need more water; it's just exploring new and potentially less expensive ways of getting it. (Aquarion Water Company, one of the largest private water utilities in the United States, currently supplies Hull's water.) Hull has hired the engineering firm Wright-Pierce to explore building a facility that would pull in seawater via wells drilled at an angle from the shoreline into water-saturated sands beneath the ocean floor. The advantage of angle wells is there's no threat of impingement or entrainment; the sand acts as a natural filter, screening out aquatic life as well as impurities like red tide. In an interview in October, Hull's town manager Christopher McCabe said the first phase of the feasibility analysis was almost complete.

"I think what Wright-Pierce is going to tell us is that from a technical point of view, a plant doing anything up to 4 million gallons a day is feasible, environmentally permissible," McCabe said. "What we're doing now is some business modeling, because 'at what cost' is the key question."

The question of cost is one that's already been answered in Seabrook, N.H., which suffers from a water shortage that New Hampshire's Department of Environmental Services has called "chronic." It too hired

Wright-Pierce to look into the possibility of desalination, and among the options considered were angle wells. Wright-Pierce's report put the issue to rest.

"There is no plan at this point to proceed," said Fred Welch, Seabrook's town manager. "We don't happen to have 40 to 60 million dollars in our pocket, which is what Wright-Pierce said it would cost. Those costs are enormous for a town of 8,500 people."

Now what?

"Well, we're looking for new supplies," Welch said. "We have a plan on paper for diverting water from rivers, but first we're going to try to rehab our wells to increase the yield."

What happened in Seabrook isn't unique. In Massachusetts, both Stoughton and Provincetown also considered desalination, and decided to forego it in favor of cheaper alternatives. It's not for everybody, especially if the plant is to be built and operated with public dollars. Despite the recent decline in the cost of desalination, the price is still too high for many communities.

"That's why it's difficult to get it to fly in the Northeast," said Gary Smith, senior project manager at Wright-Pierce.

"There is no plan at this point to proceed [with a desalination plant]. We don't happen to have 40 to 60 million dollars in our pocket."

FRED WELCH, SEABROOK, N.H., TOWN MANAGER

A CONTENTIOUS DIVIDE

If the cost of desalination keeps it out of NEIWPCC's member states, you won't find Chris Killian complaining. At the Conservation Law Foundation, Killian and his colleagues use the courts to press an ambitious environmental agenda. While CLF didn't join the fight against the Aquaria plant, and Killian claimed only a superficial knowledge of the situation in Brockton, he condemned the argument that Brockton needed more water for economic development.

"I don't buy it," said Killian, director of CLF's Vermont Advocacy Center. "I think it's a very difficult case for anyone in New England to make that increased efficiency, better transmission of water, and controls on end-use combined with more rational, sustainable development techniques won't provide for our needs. Desalination plants cost a lot of money, use a lot of electricity, and hope away the more difficult questions of water sustainability that the region is facing. They are a big mistake from our perspective."

The strong stance and language is typical of Killian and CLF, but more moderate voices make much the same point. The June 2006 Pacific Institute report, a well reasoned analysis of desalination, concluded by stating "...the recent seawater desalination proposals in California appear to be premature." The May 2005 research report from the New England Public Policy Center at the Federal Reserve Bank of Boston said "demand management is perhaps the most promising tactic" for easing the region's water supply crunch. Barry

Nelson of the Natural Resources Defense Council, who observed that desalination had entered the mainstream, nonetheless added, "The largest reservoir of new water in America to meet our needs is using our existing resources more efficiently."

When water is used more efficiently, the results are impressive: New York announced in October that daily water use in the city had dropped to its lowest level since 1951. Experts attributed most of the drop to requirements for water-saving plumbing fixtures and a dedicated effort to fix leaks in New York's antiquated water pipes. They also credited a tool that economists have argued for years is underutilized—higher water rates. The theory goes that since rates typically fall absurdly short of reflecting the true cost of delivering water, the result is a perception of infinite supply and hence overconsumption. Raise rates, as New York did, and cost-conscious consumers will be more careful about water use.

Until all means of reducing demand are exhaustively explored, critics of desalination argue, there's no need to increase supply; by doing so, you only condone overuse of water, and even promote undesirable sprawl—why not move to a big house in a new development in a formerly rural area if you know water is abundant, cheap, and you can use your lawn's sprinkler system as often as you'd like?

Fair question. Sound points. But so too are the points made by those open to desalination in the region. Consider the case of the Ipswich River: Despite strict limits on water withdrawals imposed on several towns that withdraw from the river—and even a record-breaking flood in the spring—the flow in the Ipswich still dropped this summer to dangerously low levels. The



"I Don't Buy It" The Conservation Law Foundation's Chris Killian, seen speaking at a NEIWPCC Commission meeting in January 2006, disputes the need for desalination in New England.

river's condition alarms nobody more than Kerry Mackin, executive director of the Ipswich River Watershed Association. In an interview in October, she said she agreed with Chris Killian that more conservation can and should be done, and even singled out the city of Lynn, Mass., for not doing enough of it. But she added that she's never been opposed to a desalination plant—though not on the Ipswich, of course. Like Pine duBois, she sees desalination as a problem-solving tool.

"In periods of dry weather, there are significant water shortages on [Boston's] North Shore," Mackin said, "and a desalination plant might alleviate those shortages without putting more pressure on the highly stressed Ipswich River."

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IPSWICH RIVER WATERSHED ASSOCIATION

Stress Reduction *Some river advocates see desalination as a tool for easing withdrawals from their cherished waterways. Portions of Massachusetts's Ipswich River occasionally go dry due in large part to water demand from nearby communities.*

The notion that desalination should not be considered as an option under any circumstances and that more effective conservation can solve water supply problems did not sit well with Mass DEP's Glenn Haas.

"We in Massachusetts have some of the strictest policies that are possible on conservation, yet there are still communities that are growing or feeling the pressure to grow and need additional water that is not readily available to them," Haas said. "This is not an excuse for not doing conservation. But conservation is not the end-all cure-all."

"It's not an 'either-or' situation," said Sandia's Tom Hinkebein. "It's an 'and.' Conservation should always be pursued, but so should water supply. The U.S. population is growing, and our national economy is built upon a plentiful supply of clean water. If we can come up with an efficient way of supplying that clean water that doesn't deplete our national treasure of a really clean environment, then we should be doing it."

IN SEARCH OF SOLUTIONS

Persuasive though they are, it's doubtful Haas and Hinkebein would convince Killian to change his mind on the Brockton plant and desalination in general in the region. Nor likely would potential advances in the process, though they might have a better chance. As part of the National Centers Program, which is run by the National Water Research Institute and the Bureau of Reclamation, six facilities across the country are testing and evaluating desalination technologies. Soon, there will be a seventh. In Alamogordo, New Mexico, construction of the Tularosa Basin National Desalination Research Facility is almost complete. Wells at the site tap into extensive brackish groundwater resources, and scientists will use the center to study new technologies, alternatives for brine management and reuse, and the use of renewable energy. The new facility will allow researchers to build upon the already impressive work being done elsewhere.

At Sandia's labs in Albuquerque, N.M., researchers are exploring numerous ideas, including one based on the science of biomimesis, where designs from nature are incorporated into machines. The researchers are looking into creating reverse osmosis membranes that filter salt and harmful particles from water in the same way as human cells. It's a tantalizing idea, when you consider our cells contain proteins called aquaporins

that filter water 1,000 times more efficiently than current RO membranes.

In May, the Lawrence Livermore National Laboratory in Livermore, Cal., announced that its researchers had created a membrane made of hollow nanotubes that are more than 50,000 times thinner than a human hair. The narrowness means large molecules—salt, for example—can't squeeze through, while the incredibly smooth surface inside the tubes allows liquids and gases to rapidly flow through. The increased permeability would mean far less pressure needed to accomplish reverse osmosis. Since generating pressure requires energy, a need for significantly less pressure could mean the long sought-after major reduction in desalination's energy costs.

But hold on. "It's pretty dangerous to start mentioning these quantum leap technologies as being commercially viable," said consultant Tom Pankratz. "Look, we've been working on RO membranes since the late '60s and there are still issues with them. Nanotubes and the aquaporin research are interesting, they should be pursued, and the government should encourage them. But you can't start building water policy around them."

Researchers understand the skepticism, but say the scientific breakthroughs that might make desalination doable for the Halls and Seabrooks of the world are achievable—if the financial support is there.

WHERE HAVE ALL THE DOLLARS GONE?

About the closest desalination has come to being a hot topic in recent years in the White House is on an episode of *The West Wing*. (In an episode that aired in February 2005, a water lobbyist slams the administration for not investing in desalination technology.) It wasn't always that way.

In 1951, President Eisenhower declared the need for a "farsighted program for meeting urgent water needs by converting salt water to fresh water"; a year later, Congress passed the Saline Water Act, providing federal funding for desalination technologies. In 1962, President Kennedy said if we ever found a way to desalinate cheaply, it would "dwarf any other scientific accomplishments." For decades, federal funds flowed to desalination, with the government spending more than \$1 billion on R&D projects. The support led to major advances, including the development of reverse osmosis.

Then in 1982, Congress killed the Office of Water Research and Technology, and the desalination program moved to the Bureau of Reclamation. Federal funding for desalination virtually vanished. Congress did pass the Water Desalination Act of 1996, which renewed federal R&D in desalination, and it certainly didn't hurt that the U.S. Senate Committee on Energy and Natural Resources was chaired in recent years by Sen. Pete Domenici (R-N.M.), a major supporter of desalination research who secured funding for Sandia's efforts. That funding should continue under the new Democratically controlled Congress, since the new committee chair is New Mexico's junior senator, Jeff Bingaman, another desalination advocate.

But federal funding isn't what is used to be—or should be, according to the 2003 Sandia/USBR Roadmap. It called for a "Renewed National Commitment" to desalination R&D, saying it was the only way to generate much needed next-generation technologies that will reduce the cost of the process. In our interview, Sandia's Hinkebein didn't press that point quite so hard, saying federal funding had been increasing somewhat, and that the growth in funding from states and non-profit groups such as the AWWA Research Foundation was having a real impact. Perhaps he's just being a realist. After all, researchers aren't the only ones in the desalination community chasing federal dollars.

"We feel that a lot of this research money just hasn't produced enough," said Sean Taylor, government affairs advisor for the U.S. Desalination Council, a lobbying group that represents 11 water agencies and utilities looking to encourage desalination projects across the country. "The number one thing that brings the cost down is when folks get out there, start producing the water, and start working on membrane technology and energy recovery. They bring the cost down themselves."

For several years, the Desalination Council has been pushing for the passage of bills in the U.S. Senate and House that would provide funding to spur the development of desalination plants. In the latest House bill, owners of desalination facilities would receive federal incentive payments if they could show they'd significantly reduced the amount of energy used in the process. The amount of the incentive would be based on how much water they produced. The bill stalled in committee, as have other similar measures backed by the council.

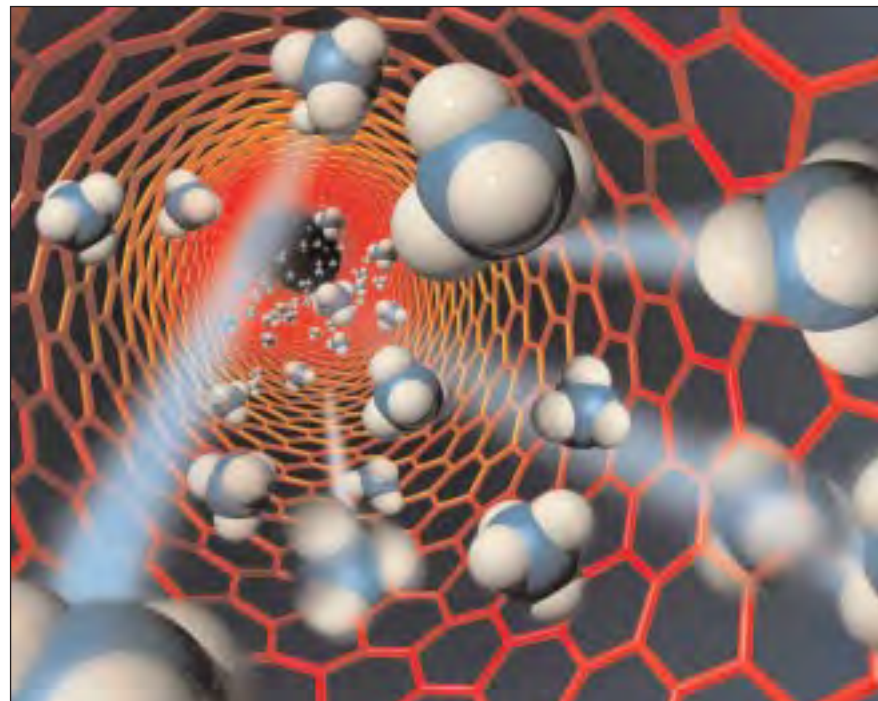
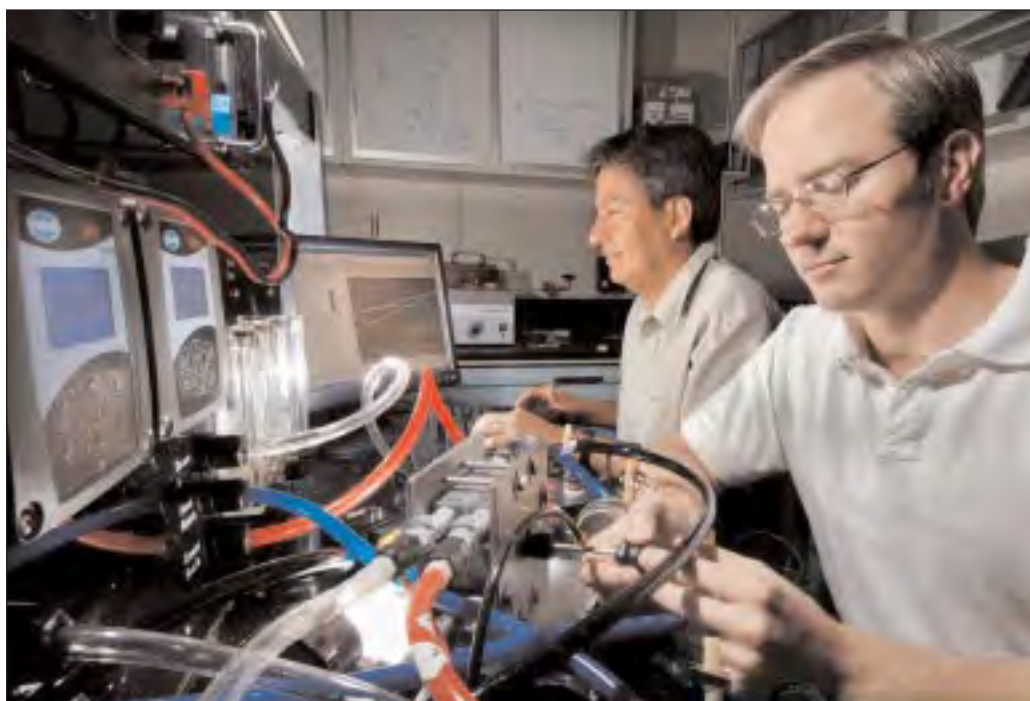
A little push from the White House would help the council's effort, but it hasn't happened. Sean Taylor couldn't explain why.

"I wish I could tell you, but I'm not sure," he said. "Everyone is always interested in drought protection acts, but we just haven't been able to get them into this."

BRUISED BUT NOT BEATEN

The decline in Washington's interest may have slowed desalination's progress, but it hasn't stopped it. The experience in Florida's Tampa Bay region has shown further that the industry can take a punch.

Beset by a water shortage brought on by a binge of development, water officials in the Tampa area approved plans in 1999 to build a reverse osmosis facility co-located with a power plant in Apollo Beach. With a capacity of 25 MGD, it was to be the largest desalination plant in the country. As in Dighton, the plant would be privately owned and operated, with the Southwest Florida Water Management District providing \$85 million to help cover the projected \$110 million cost of building the plant and a 15-mile pipeline. The grand scheme garnered international attention for the project—and its problems. In 2000, one of the contracted developers



Searching for a Better Way Researchers at Sandia National Laboratories (above) are experimenting with promising new ways to improve the desalination process. At Lawrence Livermore National Laboratory, they've created carbon nanotubes (seen on right in an artist's rendering) that may offer a cheaper way to remove salt from water.

declared bankruptcy, and a private consortium led by Poseidon Resources, the Connecticut-based developer, took over. A year later, Poseidon's partner in the consortium failed to post a required construction bond, prompting frustrated officials at Tampa Bay Water, the local utility, to buy out the developers and hire a new contractor.

It was a fresh start for the project, and construction went on. But the curse didn't lift. In 2003, shortly after the plant finally began delivering water, it failed a series of performance tests due to numerous problems, including frequent clogging of its pretreatment filters and RO membranes. The contractor declared bankruptcy, and lawsuits began to fly. Ultimately, Tampa Bay Water settled on a new contractor, American Water-Pridesa, to repair the plant, but it's been no simple fix. Multiple corrections are being done to the plant's pretreatment, RO, and post-treatment systems, and the total cost of construction now stands at \$150 million. While the plant has operated intermittently throughout the debacle—and produced nearly 5 billion gallons of water, according to Tampa Bay Water—it's not expected to be operating consistently at full capacity until later this year.

“Tampa has been a black eye for the industry around the world. But does that mean RO isn't a good process? There were certainly some things that were done wrong [in Tampa], and there's a lot of blame to go around. But the industry has learned from it.”

TOM PANKRATZ, DESALINATION CONSULTANT

With so much attention on the Tampa project, its problems might have sunk desalination in this country like a plume of heavy brine sinking to the sea floor. Instead, it's turned into a case study on how to do it right the next time.

“Tampa has been a black eye for the industry around the world,” said consultant Tom Pankratz. “But does that mean RO isn't a good process? There were certainly some things that were done wrong, and there's a lot of blame to go around. But the industry has learned from it. We learned more about pretreatment. We learned more about the whole project development process. We learned about how to write contracts that

have some teeth in them so that the errors can be borne by the proper parties. [Tampa's] affecting the way business is done all over the world. That's the way it should be. We learn from our mistakes.”

PRIVATE PROJECTS, PUBLIC OVERSIGHT

One characteristic shared by the plants in Tampa and Dighton, and most modern desalination plants and proposals, is that they are so-called BOOT projects. The letters stand for “build, own, operate, transfer,” which essentially means a private entity constructs a plant and runs it for a set length of time in exchange for keeping the revenues from water fees. It's a partnership that allows a public agency or water-service provider to get what it wants—desalinated water—while the private entity nets a profit (or so it hopes). In an interview with Peter Fairbanks, the president of Bluestone Energy Services (one of the partners in the Taunton River project), he didn't hide his motivation when he spoke about his hope that more communities will buy the Dighton plant's water.

“I'm optimistic,” Fairbanks said, “that there'll be many more sales.”

And that would be a good thing, of course?

“Absolutely. More sales, more water, more money.”

This focus on profits, whether it's in southeastern Massachusetts or Tampa, worries public policy specialists who fear that desalination projects represent an increased and dangerous privatization of the nation's water supply. As the June 2006 Pacific Institute report put it, “Some individuals feel that privatized desalination violates the public trust doctrine by turning a public good into a private commodity subject to market rules.”

The legendary economist Adam Smith would have counterattacked by saying that in pursuing their self-interest, desalination developers would be guided by the “invisible hand” of the free market to act in the public interest. Regulators, however, aren't putting their faith in an unseen appendage. Any desalination proposal is now extensively reviewed. Before Aquaria could break ground on its Dighton plant, the company had to obtain well over 30 permits and approvals from everyone from the Dighton Sewer Department to the U.S. Army Corps of Engineers. It took years.

“The problem was that we didn't know the process here, and I think the agencies didn't know it either,” said Aquaria's Andrés. “In Spain, the process [of

getting approval to build a plant] is very similar, but we have hundreds of desal facilities, so everyone knows what the process is, and everybody knows all the issues. I guess we have made the path for the next desal facilities in this area.”

Aquaria's long, circuitous path to approval drove Massachusetts to seek ways to improve its policy on desalination projects. A workgroup of regulators and desalination developers convened in 2005 to refine and define the permitting and monitoring process to clearly delineate what's required of future projects. Kathy Baskins, director of water policy at Massachusetts's Executive Office of Environmental Affairs, said the new policy is in its final stages of development.

“We developed it because we do see desalination as a viable option for water supply,” Baskin said, “and we wanted to make sure that as towns consider it, they'll know what's expected from them in terms of environmental precautions. We wanted to lay out for them, for example, where they might get some relaxation in monitoring requirements if they veer a project in a certain direction.”

Baskin revealed little more about the details of the new policy, but it won't be long before they're known. She said various state agencies are reviewing the proposal, and that it still needs the approval of Ian A. Bowles, secretary of the Executive Office of Environmental Affairs. Once that process plays out, the policy will be released for public comment through the Water Resources Commission.

THE ROAD AHEAD

As desalination grows in prominence in this country, it is emerging not as a magic bullet that will cure all water supply ills, but rather one more tool, albeit an expensive one, in the toolbox for delivering clean, safe drinking water. Opposition remains, but there's a sense of acceptance in much of the environmental community.

“We now have to consider desalination on a case-by-case basis,” said the NRDC's Barry Nelson, “We need to sort out the good ones from the bad ones.”

During a visit over the summer to the site of the Dighton plant, about 30 men could be seen working on various tasks, but it was hot and the pace was languid. Only the base of the giant water tanks had been built, and the path to the river had yet to be cleared. But here it was, the plant that seemed destined never to be built,

continued on page 12

Special Report: Desalination

continued from page 11

undeniably under construction. Aquaria's supervisor at the site, Patrick Williamson, kindly tolerated conducting yet another tour, but in truth, there wasn't much to see—no RO tubes yet, no pipeline from the river, nothing to reveal the significance of what would be happening there. Williamson was subdued, but when asked what it meant to be working on such a unique facility, he answered quickly. "It's pretty exciting," he said.

Aquaria is expected to begin delivering water to Brockton in early 2008, which means not only the plant but also the underground pipeline must be complete by then. For much of its 16-mile trek from Dighton to Brockton, the pipe will follow an old railroad route. But it will also pass through several towns, and getting those towns to agree to the idea has taken some give-and-take. In September, the town of Easton gave Aquaria a right-of-way agreement after the company agreed to build sidewalks and replace water mains in the area where the pipe will be installed. Easton's decision left the city of Taunton as the main remaining holdout, according to Jeff Hanson, whose firm is managing the pipeline construction. But he said an agreement with Taunton had been worked out, and that it lacked only the formal approval of city officials.

Aquaria remains optimistic that more communities will sign on to buy its water, but so far the only confirmed buyer besides Brockton is the town of Norton, and it's committed to just 150,000 gallons a day. Connections to the pipeline will be installed for four other towns, including Taunton and Easton, to use in the event of an emergency; the hope at Aquaria is that once the towns see desalinated water actually flowing through the pipe, they'll want to use the connection on a regular basis. Perhaps that's all it will take—tangible evidence that the water is indeed there for the taking. Considering the history of the project, skepticism about the project ever being finished is understandable. It's been an exhausting process for all involved, so much so that some have had enough. Bluestone's Peter Fairbanks said the Dighton plant marks the end of his affair with desalination.

"It's one and out for me," Fairbanks said. "This took 12 years of development to get it to the point of construction. I'm at the point of my life where that's enough for me. I'll let somebody else do the rest of them."

By "them," Fairbanks meant the other desalination plants that he fully expects will be built in the region. Hanson is counting on future expansion of the process as well, despite being stymied so far in his attempts to generate interest in a plant on Boston's North Shore. Kerry Mackin of the Ipswich River Watershed Association has supported his efforts, even introduced him to key players in the area, but so far no takers. Hanson isn't giving up.

"I can be very persistent," he said.

Don't bet against him. 💧

REPORTER'S JOURNAL

A Place in Maine Where Desalinated Water is Nothing New

by Stephen Hochbrunn, NEIWPC

In researching the desalination article for *IWR*, I occasionally encountered newspaper reports that mentioned a place in Maine, MacMahan Island, as the site of New England's only drinking water desalination plant. But details were lacking. Where was this place? And what were they doing there?

After a dozen phone calls, I got the man with the answers on the other end of the line. Peter Schuerch, MacMahan Island's superintendent, said yes, they were desalinating seawater and happily drinking it, and yes, he'd show me around if I was interested. I imagine he'd made the same offer to other curious callers, who never made the trip. I took him up on it.

Located about 14 miles from the city of Bath, in a cluster of islands just off Maine's southern coast, MacMahan Island was easy to get to—until the final segment of the trip. A half-mile of water separates the island from the nearest road, so I



Small System, Big Success At the top of a hill on Maine's MacMahan Island sits the only (for now) drinking water desalination facility in New England. The building on the left houses the plant's two desalination units; the structure on the right contains the water holding tanks.



Eyeing the Investment MacMahan Island superintendent Peter Schuerch monitors the performance of a desalination unit as it converts seawater into fresh drinking water for the island's residents.

hitched a ride on a boat piloted by an island resident who'd gone for groceries. MacMahan Island is a seasonal community, and there are no stores there. No cars either. Schuerch, a big man with a humble manner, met me at the landing in a golf cart, and we drove up to the desalination plant.

Actually, the word "plant" implies a place considerably bigger and less rustic than what exists on MacMahan Island. Inside a small, cramped wooden building are two Matrix reverse osmosis desalination units, each capable of producing 4,000 gallons of fresh water a day. But on the island, they don't need that much, so Schuerch limits the units' operation to about eight hours a day, generating roughly 1,800 gallons between the two of them. Seawater is pumped up to the plant via a pipeline that begins with an intake in the waters right next to a boat dock. At the plant, the water passes through a filtration system that screens out sediment, seaweed, and anything else pulled up the pipe. The filtered but still salty water is then forced through the RO membranes. There's no disinfection done, no chemical pretreatment. Schuerch said it's not necessary.

"We're required by the state to test the water once a month, and we've never had a problem," he said. "The water in the desal units is under about 900 pounds of pressure per square inch, and any impurities are removed. It's almost like kidney dialysis, but on a bigger scale."

Until it's needed, the water is stored in large tanks next to the desalination building. When water usage creates a demand, the desalinated product is blended with fresh

water pulled up by the island's two wells, and that blend is piped out to the island's approximately 40 homes. The well water alone used to be enough, but Schuerch said that was before the state decided in 1998 to put a stop to the island's practice of flushing toilets with salt water and discharging the wastewater at sea. The state's decision created the need for septic systems on the island—and more fresh water.

"We could have dug more wells, but that would have meant digging about 320 feet through ledge," Schuerch said. He began exploring the option of desalination, and the more he looked, the better it sounded. In 1999, he bought the first of the Matrix units for about \$24,000. He oversaw the building of the plant and pipeline, and the installation of the pumps. It was, he said, a lot of work, but with the dry summer that year, the system proved its worth immediately.

"The wells on these islands ran dry," he said, "and we were the only ones with fresh water. That was a good thing."

You might expect that islands in any ocean, faced with limited means of getting fresh water, would be ideal locations for desalination systems, and in fact many communities in the Caribbean adopted desalination years ago. But along the island-studded Maine coast, Schuerch stands alone in his embrace of the technology. Desalination has made water more expensive on MacMahan Island; the rate rose from 30 cents to 50 cents a cubic foot when the RO system went online. But nobody was complaining on the day I visited. One woman said residents marvel at what Schuerch has done, at how good a teacher he is to the young men who help maintain the desalination plant. Another resident, Lucy Melvin, invited me into her home to test the water for myself. She had told me it tasted "perfectly fine," and she was right.

In September, two months after my visit, Schuerch and his small maintenance crew performed one final cleaning of the desalination system's filters and membranes, treated them with chemicals designed to limit bacterial growth, added antifreeze to the equipment, and then shut the system down for the season. Most residents had already left the island and returned to their mainland homes for school and work and everyday life. In July, they will return for another summer on their cherished island in Maine. Schuerch and his water will be waiting. 💧

LEGAL LINES

Supreme Court Ruling is New, Powerful Factor in Clean Water Act Cases

by Beth Card, NEIWPCC

About a year ago in “Legal Lines,” we provided detailed accounts of two high-profile cases—Rapanos and Carabell—headed to the U. S. Supreme Court. Both concerned Clean Water Act jurisdiction over wetlands and, after months of talk about what the Court would do, the justices finally delivered their decision on June 19. But instead of putting the issues to rest, the conflicting opinions only spawned more talk. The Court has had its say, but this story is ongoing, with no end in sight.

First, the decision. Basically, the Court vacated the decisions of the Sixth Circuit Court of Appeals and remanded both cases back to the appellate court for further consideration of the hydrologic connection between the affected wetlands and a navigable waterway (a connection would make them “waters of the United States” and subject to CWA regulation). But that straightforward ruling was deceptively simple. Wade deeper into the decision, and you see deep divisions.

The justices were divided into three groups—the plurality (meaning their opinion lacked enough votes to constitute a majority, but received more votes than the other opinions), the dissent, and then Justice Kennedy in a stand-alone category. The plurality consisted of Chief Justice Roberts and Justices Scalia, Thomas, and Alito, with Justice Scalia delivering the opinion. The plurality wrote that “...lower courts should determine whether the ditches or drains near each wetland are ‘waters’ in the ordinary sense—containing relatively permanent flow...and if they are, whether the wetlands in question are adjacent to those waters (ditches) in the sense of possessing a continuous surface connection that creates the ‘boundary-drawing’ problem that was faced in *Riverside Bayview*.” (In *United States v. Riverside Bayview Homes* (1985), the U.S. Supreme Court justices grappled with the question of where water ends and land begins. In that opinion, Justice White noted that “...between open waters and dry land may lie shallows, marshes, mudflats, swamps, bogs—in short, a huge array of areas that are not wholly aquatic but nevertheless fall short of being dry land...” The Court found that the Army Corps of Engineers’ conclusion that “adjacent wetlands are inseparably bound up with the ‘waters of the U.S.’” was a reasonable line of thinking.)

The dissenters—Justices Stevens, Breyer, Ginsberg, and Souter—took a more concrete stand; they would have affirmed the Sixth Circuit and upheld lower court rulings that there was a hydrological connection between the wetlands in question and a navigable waterway.

As for Justice Kennedy, his view on the jurisdiction of certain waterbodies or wetlands systems hinged on whether the specific wetlands at issue possess a significant nexus to navigable waters as outlined in the Court’s 2001 SWANCC decision (in which the Corps’ assertion of federal jurisdiction over certain isolated wetlands was overturned) versus the adjacency and boundary-drawing approach outlined by Justice Scalia. Not surprisingly, Justice Kennedy strongly disagreed with Justice Scalia’s analysis and rejected the plurality opinion as being “inconsistent with the Clean Water Act text, structure, and purpose.” Justice Kennedy declined to join the dissenting opinion written by Justice Stevens because he said it went too far in the other direction and did not give enough importance to the word “navigable” in the statutory sense.

The lack of consensus would seem to leave us in a stalemate. Not exactly. In 1977 a prior Court told us

how to handle this situation. In *Marks v. United States*, the Court ruled that “when a fragmented Court decides a case and no single rationale explaining the result enjoys the assent of five justices, the holding of the Court may be viewed as that position taken by those members who concurred the judgments on the narrowest grounds...” Based on a review of the full opinions released in June, it appears that Justice Kennedy’s opinion will be viewed by the legal community as the holding opinion. In a concurring opinion with the plurality, Chief Justice Roberts was probably exactly right when he opined that lower courts that face similar cases will have to feel their way through them on a case-by-case basis. Which brings us to where we are now.

In several cases the Circuit Courts had put Clean Water Act jurisdictional decisions on hold pending the outcome of Rapanos and Carabell. But with the June decision, it was time for the games to begin in earnest. A lot of activity has been happening in the lower courts, and it is important to note that it’s not just wetlands at stake; Clean Water Act programs as a whole are being reviewed in the aftermath of the June ruling. Let’s take a look at recent developments outside the beltway.

U.S. v. Chevron Pipe Line Co. – U.S. District Court, Northern District of Texas

Chevron was found responsible for an oil spill—an action that can result in civil fines if the spill goes into “navigable waters of the U.S.” To avoid fines, Chevron tried to limit the term “navigable waters” to waters that fall within the traditional meaning of “navigable-in-fact,” meaning you can actually navigate a boat down them. The district court cited the Rapanos plurality, which stated that “intermittent and ephemeral streams—streams whose flow is coming and going at intervals” are not jurisdictional. Ultimately the ditch where the oil had been spilled was not considered jurisdictional and no fines were imposed.

Northern CA Riverwatch v. City of Healdsburg – U.S. District Court, Northern District of California


The environmental advocacy group Northern California Riverwatch alleged that the City of Healdsburg had made unauthorized discharges from its wastewater treatment facility into Basalt Pond, which was formed from an old gravel mining pit along the Russian River. The issue was whether Basalt Pond and/or its surrounding wetlands fell within the definition of navigable waters of the United States. The district court said they did, and therefore a permit for the WWTF was required. The City appealed and the appeal was stayed pending

the outcome of Rapanos. In mid-August, the Ninth Circuit Court of Appeals denied the U.S. Supreme Court standard and upheld the district court’s decision. The Ninth Circuit held that the pond is connected to the river and therefore federal water quality standards apply and a permit was required.

United States v. Johnson, 437 F.3d 157 (1st Cir. 2006)

Closer to home for most of our IWR readers is a case that originated on Cape Cod, where a farmer named Charles Johnson used earth-moving equipment to construct, expand and maintain his cranberry bogs. Johnson’s cranberry bogs are located on parcels of land that EPA claims are hydrologically connected to navigable waters. After years of debate, on February 16, 2005, a U.S. District Court judge fined Johnson \$75,000 and ordered him to restore 25 acres of wetlands, which was estimated to cost some \$1.1 million. Johnson appealed to the First Circuit.

The facts of the case were such that there was undisputed evidence that Johnson’s land is indeed hydrologically connected to the Weweantic River, and the land in question contained wetlands adjacent to tributaries of the Weweantic. As a result the First Circuit concluded in a 2-1 panel decision that EPA reasonably interpreted the CWA to extend jurisdiction over Johnson’s land. After this decision, Johnson filed a motion for rehearing and the First Circuit Court of Appeals took it under advisement pending Rapanos. (Fun fact: Johnson and Rapanos are represented by the same attorney.) On October 31, the First Circuit issued an opinion that concluded that the government may establish jurisdiction using either the Kennedy or plurality test from Rapanos and Carabell. The First Circuit remanded the case for further fact-finding on how the standards should be applied.

While we wait, watch, and study how other lower court decisions play out, federal policymaking is in the works. In congressional testimony this summer, EPA and the Army Corps of Engineers made commitments to fully implement the Clean Water Act consistent with the U.S. Supreme Court opinion. The agencies are working with the Department of Justice to interpret the decision and its impacts on the scope of waters of the U.S. protected under the Clean Water Act. Stay tuned for the next IWR, where we’ll examine what regional experts had to say about this topic at NEIWPCC’s Vulnerable Wetlands Conference on November 9. 

Beth Card (bcard@neiwppcc.org) is NEIWPCC’s Director of Water Quality Programs. She is also a licensed attorney in Massachusetts.

Resource for Readers

Looking to expand your knowledge of water and wastewater topics and issues? Visit the online bookstore of the U.S. Government Printing Office (<http://bookstore.gpo.gov>). A search on any subject turns up interesting and occasionally offbeat selections. Type “wastewater” into the search box, and the list of results includes a 2002 Congressional Budget Office study on future investment in drinking water and wastewater infrastructure, and a transcript of a wastewater blending hearing held on April 13, 2005, by the House Transportation and Infrastructure Committee’s Subcommittee on Water Resources and the Environment. The prices are reasonable, and there is no charge for standard shipping. *Check it out!*

Tip

UNDER INVESTIGATION

Assessing New England's Lakes and Ponds

by Becky Weidman, NEIWPC

What portion of lakes and ponds in New England demonstrate impaired conditions? What is the relationship between land use and the biological health of the region's lakes and ponds? What chemical and biological characteristics are related to waterbody health in New England? These are all undeniably important questions. And when a study now underway is complete, we will have an abundance of data to begin answering them.

During the summer of 2006, NEIWPC, the EPA New England Regional Laboratory, and regional collab-

orators including state agencies and universities kicked off the New England Lakes and Ponds Study, otherwise known as NELAP. Utilizing a rigorous statistical process to ensure a representative sample, researchers selected about 300 lakes and ponds reflecting a wide range of characteristics, from pristine environments to ecosystems highly impacted by human activity. With the selections made, the process of assessing each waterbody to

determine water quality and ecological condition began. As the study progresses, researchers will pool together the results to make general conclusions about the state of New England's lakes and ponds.

Technically, it is not the first time such an effort has been made. In the 1990s, EPA began developing sampling methodologies to assess the health of lakes and ponds in the Northeast. Researchers established an ecological picture of the state of lakes and ponds in the region, and identified potential contaminants threatening their health. But the new study incorporates new assessment methodologies alongside traditional evaluation techniques. At each site, scientists are collecting water and sediment samples, which are being analyzed for



Netting the Evidence In the NELAP study, nets towed alongside a boat are used to collect plankton samples. Plankton are good indicators of ecosystem health because they are highly sensitive to environmental change, particularly nutrient enrichment.



Digging Deep Sediment cores are taken at each lake and pond. The cores provide insight into the historic environmental health of the ecosystem.

a suite of nutrients, chemicals, metals, and other constituents. Scientists are also conducting thorough visual observations of each site, noting the presence of invasive species, development, and other relevant biological and man-made features.

With the information collected during the NELAP study, and the results from the previous work, we will be able to identify trends in ecosystem health in this region. We also hope to identify several indicators, both biological and chemical, of lake and pond health that can be utilized in annual monitoring programs to track the ecological status of the region's lakes and ponds. The study is expected to be completed within the next few years. 🌊

Becky Weidman (rweidman@neiwpc.org) is a NEIWPC Environmental Analyst and the coordinator of our work on the New England Lakes and Ponds Study.

LAKE CHAMPLAIN EMERGENCY

Rapid Response to Water Chestnut Infestation Launched

by Nicole Ballinger, Lake Champlain Basin Program

The exotic plant known as the water chestnut (*Trapa natans*) is common in the southern portion of Lake Champlain, but when it was found in July in remote wetlands in the Missisquoi National Wildlife Refuge—on the northern Lake—an alarm sounded. Scientists have long worried that Missisquoi Bay's shallow waters could be inundated by water chestnuts, compounding the area's existing problems with blue-green algae. The refuge is home to endangered species that rely on the wetlands' native plants. If the water chestnut became established, it would displace native plants, causing havoc throughout the food web.

The concerns prompted fast action. Barely a week after the initial sighting of the plants, staff from the New York and Vermont environmental agencies, the Lake Champlain Basin Program, the U.S. Fish and Wildlife Service, the Lake Champlain Committee, and several volunteers launched a "rapid response," as it's called in aquatic nuisance species management parlance. Pontoon boats ferried more than two dozen people and their canoes and kayaks four miles to the infested wetlands, which are sensitive nesting habitat for endangered black terns. These wetlands are normally off-limits to visitors, suggesting that water chestnut seeds were carried there by waterfowl, not humans.



Job Well Done Heather Pembrook of the Vermont Department of Environmental Conservation stands beside a pile of water chestnuts pulled during a "rapid response" in Lake Champlain's Missisquoi National Wildlife Refuge.

Once on site, the rapid responders used the canoes and kayaks to carefully search the wetlands for the water chestnuts, which were often hidden in native pickerel weed and water lily patches. When they found a water chestnut plant, they pulled it out by hand, removing it before the plant had the chance to drop its seeds. In just a half-day, the crew loaded two entire skiffs with piles of the plants.

Had the waters been less sensitive, efficient mechanical harvesters could have done the job. But by carefully hand-pulling water chestnuts, native wetland plants were not destroyed. Although it requires a lot of labor, pulling by hand is effective. In 1998, crews hand-pulled 2,160 pounds of water chestnuts from Roger's Marsh on southern Lake Champlain. According to the Nature Conservancy, just three plants remained in that area by 2004.

The response to the water chestnut invasion in Missisquoi Bay drew plenty of media attention, and it was even a top story on the local television news programs. A good news story too, as the wetlands were declared free of chestnuts—for now. Refuge managers will closely monitor the affected areas to make sure that none of the plants survived this initial response, and to sound the alarm again if a return trip by the responders is needed. 🌊

Nicole Ballinger (nballinger@lcbp.org) is the Communications Coordinator and Webmaster at the Lake Champlain Basin Program, which NEIWPC supports by providing program guidance and financial management.

TECHNOLOGY FOCUS

Oxidation-Reduction Potential and Wastewater Treatment

by Michael H. Gerardi

Editor's Note: This article is far more technical than a typical IWR piece. We have chosen to carry it not only because of its obvious value to the many IWR subscribers who are wastewater operators, but also because it will enlighten all readers about just how technical and sophisticated wastewater operations have become. Michael Gerardi is one of the country's leading authorities on wastewater biology, and is known nationwide for his work in developing wastewater biology courses at Penn State University and for writing numerous technical publications. He contributed this article specifically for use in IWR, and we are grateful for the submission.

A few notes about the topic: Oxidation-reduction potential or ORP has been used for many years in facilities that process wastewater generated by metal finishing plants, but only recently has it become prominent in municipal wastewater treatment plants. When using a typical ORP device, an operator inserts a probe directly into a plant's tank or waste stream (usually two feet below surface level). The probe contains a sensor that measures electrical charges from particles called ions, and these charges are converted to millivolts (mV) that can be either negatively or positively charged. Unlike "wet chemistry" analysis that can be time-consuming and complex, ORP readings are instantaneous and easy to perform. And like all sampling measurements taken by operators, they are snapshots in time that can indicate process efficiency and identify treatment problems before they affect effluent quality.

When used in wastewater treatment systems, oxidation-reduction potential is a measurement of the ability or potential of wastewater to permit the occurrence of specific biological (oxidation-reduction) reactions. Important oxidation-reduction reactions in wastewater treatment systems include nitrification, denitrification, biological phosphorus removal, biological malodor production, and the removal of cBOD (carbon- and hydrogen-containing compounds). These reactions involve carbon (C), phosphorus (P), sulfur (S), and nitrogen (N) and their change from oxidized states (containing oxygen) such as nitrate (NO_3^-) and sulfate (SO_4^{2-}) and reduced states (containing hydrogen) such as ammonia (NH_3) sulfides (H_2S).

Oxidation-reduction potential is measured in millivolts (mV). On the ORP scale, the presence of an oxidizing agent such as oxygen increases the ORP value, while the presence of a reducing agent such as substrate or cBOD decreases the ORP value.

By monitoring the ORP of wastewater, an operator can determine what biological reaction is occurring (see table below) and if operational conditions should be changed to promote or prevent that reaction. For example, an operator doesn't want denitrification or "clumping" to occur in a secondary clarifier; the operator, therefore, must maintain an ORP value of more than +50 mV to prevent clumping. Similarly, an operator doesn't want malodor production to occur in the sewer system. So, the operator must maintain an ORP value of more than -50 mV to prevent sulfide formation and an ORP value of more than -100 mV to prevent volatile acid formation.

Let's take a look at each of these reactions and their relation to ORP values in greater detail.

Nitrification

To satisfy discharge limits for total nitrogen or ammonia, wastewater treatment plants must nitrify. Nitrification is the oxidation of ionized ammonia (NH_4^+) to nitrate (NO_3^-) and is performed by nitrifying bacteria when the ORP of the wastewater is +100 to +350 mV.

Denitrification

Denitrification is performed to satisfy total nitrogen discharge limits or destroy undesired filamentous organism growth. Denitrification is the reduction of nitrate (NO_3^-) to molecular nitrogen (N_2) and is performed by denitrifying bacteria when the ORP of the wastewater is +50 to -50 mV.

Biological Phosphorus Removal

Wastewater plants conduct biological phosphorus removal to meet total phosphorus discharge limits. The process consists of two treatment steps—first, biological phosphorus release and, second, biological phosphorus removal. In biological phosphorus release, fermentative bacteria produce fatty acids in an anaerobic tank having an ORP range of -100 to -225 mV. When the acids are absorbed by phosphorus-accumulating bacteria, the bacteria release phosphorus to the bulk solution.

In the second step—biological phosphorus removal—the phosphorus-accumulating bacteria degrade the absorbed acids in an aerobic tank and store the energy that was obtained from the degraded acids in phosphorus granules. This storage of energy requires the removal of large quantities of phosphorus from the bulk solution. The storage of phosphorus granules or biological phosphorus removal occurs when the ORP of the aerobic tank is +25 to +250.

Sulfide Formation and Fermentation (Biological Malodor Production)

Biological malodor production occurs through two major biochemical reactions, sulfide ($-\text{SH}$) formation and acid formation (fermentation). Hydrogen sulfide is produced in large quantity when sulfate-reducing bacteria degrade substrate using sulfate (SO_4^{2-}). Sulfate is found in groundwater and urine and when reduced through bacterial activity, hydrogen sulfide (H_2S) is formed. Sulfide formation, which occurs when the ORP is between -50 to -250 mV, is a critical event in an anaerobic digester, where the sul-

fide serves as a sulfur nutrient for facultative anaerobic and anaerobic bacteria including the methane-producing bacteria.

During the equally critical event of fermentation, acid-forming or fermentative bacteria produce a large variety of volatile acids, nitrogen-containing compounds, and sulfur-containing compounds. Many of these volatile compounds are malodorous. Acid formation or fermentation occurs when the ORP is between -100 and -225 mV. Fermentation is particularly crucial in biological phosphorus removal systems where the production of fatty acids is required for phosphorus release. Fermentation also is important in anaerobic digesters where many of the acids and alcohols produced through fermentation are used by methane-forming bacteria to produce methane.

However, these reactions must be appropriately confined. Septic conditions that permit sulfide formation and the discharge of sulfide into an activated sludge process should be corrected. The presence of sulfide promotes the growth of undesirable sulfide-loving filamentous organisms such as *Beggiatoa* spp., *Thiothrix* spp., and type 021N.

cBOD Degradation with Free Molecular Oxygen

Removal or degradation of cBOD with free molecular oxygen (O_2) occurs when the ORP in the reaction tank or aeration tank is between +50 and +250 mV. The degradation is performed by cBOD-removing bacteria. The bacteria are aerobes (using only free molecular oxygen) or facultative anaerobes (using free molecular oxygen or another molecule such as nitrate).


Methane Production

Methane (CH_4) production is highly desired in an anaerobic digester and undesired in a sewer system. Methane production is performed by methane-forming bacteria and occurs over a large range of ORP values, -175 to -400 mV.

Knowing the ORP values associated with specific reactions has allowed operators to use ORP probes, and the information gleaned from them, in a variety of helpful ways. Within a sewer system, for example, an ORP value less than -100 mV indicates the production of malodors due to sulfide formation and fatty acid production. By adding sodium nitrate (Na_2NO_3) to a manhole, it's possible to increase the ORP value above -50 mV and prevent biological malodor production.

In another example, the transfer of thickener sludge that is heavily laden with nitrate to an anaerobic digester may be regulated by monitoring the ORP of the digester sludge. As the ORP increases from -400 mV, the transfer of thickener sludge may be terminated at a value less than -300 mV to prevent the loss of significant methane production.

Consider too that the absence of denitrification within a denitrification tank may be detected with the use of ORP and the hydraulic retention time of the tank or cBOD feed (methanol or acetate) to the tank may be adjusted to promote denitrification. Likewise, the occurrence of biological phosphorus release may be monitored in a fermentative tank and if needed, hydraulic retention time may be increased in order to remove residual free molecular oxygen and nitrate that contribute to ORP values of more than -100 mV.

ORP probes are extremely versatile measurement systems for monitoring biological reactions within sewer systems and wastewater treatment plants, and for indicating to operators if acceptable or unacceptable biological activity is occurring. Increasingly, they are a tool that wastewater treatment plants must have and that operators must know how to use. 

BIOCHEMICAL REACTIONS AND OXIDATION-REDUCTION POTENTIAL VALUES

Biochemical Reaction	ORP, mV
Nitrification	+100 to +350
cBOD degradation with free molecular oxygen	+50 to +250
Biological phosphorus removal	+25 to +250
Denitrification	+50 to -50
Sulfide (H_2S) formation	-50 to -250
Biological phosphorus release	-100 to -250
Acid formation (fermentation)	-100 to -225
Methane production	-175 to -400

OTHER VOICES

COLD CAN'T STOP ALASKA SEWAGE COMPOSTING

by Dan Joling, *The Associated Press*

This article appeared over the summer in various U.S. newspapers. It is reprinted with the permission of the Associated Press.

FAIRBANKS, Alaska – Environmental consultant Mike Pollen remembers standing on a pile of sewage sludge composting outside the Fairbanks treatment plant on a November day in 1997. The temperature was 40 degrees below zero but his feet were warm. Then sweaty. Then uncomfortably hot inside his insulated rubber boots.

"They felt like they were going to melt," he said.

He figures there was a 180-degree difference between the compost cooking at his feet and the frosty temperature freezing his head.

Prevailing wisdom said sludge composting wouldn't work north of North Dakota. Pollen, the author of several wastewater system training manuals used in Alaska, remembers turning to a utility official and remarking, "You know what you just did? You just rewrote the textbook."

Over the years, utility officials in the community 120 miles south of the Arctic Circle continued "aerated static pile composting" and now turn waste from 87,000 residents into a product so highly desired they can't make enough to satisfy requests from gardeners and landscapers who want to amend their sub-Arctic soil.

"It's something we think is a big hit," said Dave Dean, support services manager for Utility Services of Alaska.

The compost, cooked in beds bigger than football fields, has the Environmental Protection Agency's highest rating. Cooperative extension officials recommend it for growing vegetables as well as flowers and grass.

The price is right—just \$15 per pickup load or \$5 per yard dropped into dump trucks—and it's free to anyone with a shovel and a trash can.

But merely getting sludge off the premises has been a triumph for the second largest community in Alaska, where winter routinely lasts seven months and the severe cold can make life miserable for microbes.

Sewage sludge is the solid material removed from water that flows into a treatment plant—15 gallons at a time from a dishwasher, 31.5 gallons per 6.3-minute shower, 1.5 gallons per flush.

Treatment plants strive to separate solids from liquids, then deal with each separately.

Rich in nutrients, raw sludge also can be filled with dangerous pathogens or heavy metals that must be addressed before it can be applied to fields, burned, or even buried in a landfill.

There are plenty of ways to neutralize human waste but utility companies are constrained by time, space and money.

If they choose a process that's slow, they end up stockpiling sludge, where it's attacked by anaerobic bacteria that produce offensive odors. For many aerobic processes, abundant space is needed, unless a utility has cash for equipment that can speed or automate decomposition.

The Fairbanks plant itself is designed for the cold. It's one of the few in the country that's fully enclosed, allowing treatment in huge tanks all year round. The plant pumps pure oxygen into its digester, speeding the work of helpful bacteria that turn raw sludge into digested sludge.

In the early 1980s, when the EPA enforced new water quality laws, Fairbanks was banned from hauling digested sludge to its landfill. The utility, then owned by the city, instead merely stored it outside the plant.

When the utility ran out of storage space, it built a lagoon with 20-foot high walls. That filled up too, and utility officials launched a half-dozen attempts to address their sludge trove.

A contractor burning pure sludge produced putrid clouds that hung near the ground during winter temperature inversions. Operators tried mixing sludge with lime, which neutralized the pathogens but made a product that had the consistency of toothpaste and wouldn't mix with soil.

Finally, just before the utility was sold to private investors, operators began experiments with composting.

Digested sludge is run through a press to mash out water. Still, the sludge is 80 percent liquid when it's moved outside by conveyor to a dump truck.

That's where Jeff Karrick, one of three full-time compost operators, comes in. Karrick is a master of mega-mixology with a front-end loader, his measuring cup a 4-yard bucket, his "bin" the flat ground outside the plant.

Like any home composter, he mixes digested sludge, a "green" material rich in nitrogen and phosphates, with a carbon source that feeds bacteria, provides bulk to let in air and absorbs moisture from the sludge. The utility uses fresh wood chips obtained from the only sawmill in the Fairbanks North Star Borough, plus partially decomposed wood chips screened from older compost piles.

Karrick dumps 16 yards of used wood chips onto 16 yards of new chips, then adds 14 yards of sludge. With his heavy equipment, he attacks the pile from all sides, lifting, dropping and mixing until the material is homogenous. Then, on top of perforated pipe that delivers air, he stacks the mix against the main pad, creating a massive 9-foot-high sludge and wood chip cake that when completed will be 120 feet wide and 360 feet long.

Operators frost the top and sides with 2 feet of composted material. The topping keeps odors and nasty clouds of blowflies at bay.

"That's our biofilter," Karrick said.

The extra layer is also the key to the success of cold weather composting, said Nora Goldstein, executive editor of *BioCycle* magazine and a member of the Water Environment Federation, a national nonprofit organization focused on clean water.

In the extreme cold, Goldstein said, bacteria could slow or shut down. That's not bad, unless it forces a utility to stockpile sludge.

"So much of that depends on the composition mix and the insulation of the pile," she said.

Temperature probes detect some cooling in the coldest weather but extra fresh wood chips keep the pile hot enough to let operators add to the pad all winter long—and never stockpile sludge.

EPA requires the compost to cook at 104 degrees for 14 consecutive days. For three consecutive days, the temperature must reach at least 131 degrees so pathogens will be killed.

The highest temperature recorded in a Fairbanks pile was 206 degrees.

"I'm thinking of digging a hole and dropping a pig in there," Karrick joked.



Defying the Odds In Fairbanks, Alaska, the composting operation at a wastewater treatment plant goes on year-round, silencing skeptics who weren't convinced the process would generate enough heat to kill pathogenic bacteria during the extremely cold winter months.

When the piles attain the required temperatures, the stack—now just 8 feet tall because of the shrinkage in the composting process—is run through a screening machine to take out wood chips that didn't process.

EPA allows up to 1,000 fecal coliform bacteria per gram dry weight of compost. Tests of finished compost often don't detect any. Fairbanks has little manufacturing and solids entering the plant contain little heavy metal such as arsenic and lead. The official EPA rating for the compost is "exceptional quality."

The product has been around long enough that most gardeners have overcome their repugnance of using a product made from human waste.

Michele Herbert, land resources agent for the University of Alaska Fairbanks Cooperative Extension Service, recommends the compost to gardeners and has used it herself to grow vegetables, mulch perennial beds and landscape.

"It's crazy, the stuff is so good," she said.

In contrast, the city had to pay more than \$400,000 to neutralize and move the 50,000 cubic yards of sludge that had accumulated over 20 years before a solution was found.

Dean, the utility support services manager, said the company is not making money off compost. It charges enough to defray its cost of loading.

But operators are clearly proud that they've solved their sludge problem by taking something nobody wants and turning it into a desirable commodity. 💧

To read more about Utility Services of Alaska, Inc., and its composting operation, visit the utility's website at www.akwater.com.

In Memoriam

ELAINE KRUEGER

The news of Elaine Krueger's death on October 20 surprised and saddened all of us at NEIWPCC. Since 1996, Elaine had been a familiar and most welcome presence at NEIWPCC Commission meetings as the representative of the Commissioner of the Massachusetts Department of Public Health. She was a loyal friend, a steadfast supporter of our work, and a brilliant environmental scientist for whom we had deep respect. As the director of MA DPH's Environmental Toxicology Program for more than 20 years, she was a compassionate public servant, providing indispensable advice to state officials on environmental health issues and working on hundreds of investigations related to human exposure to environmental contamination. She led DPH's efforts to ban the use of toxic substances such as chlordane, alar, and urea formaldehyde foam insulation. She pioneered efforts to warn pregnant women and nursing mothers of the dangers associated with eating fish contaminated with mercury. She even played a critical role in perhaps the most celebrated public health case in recent memory, when she collaborated with the late Dr. Peter Murphy on the water distribution model used in the final childhood leukemia study in Woburn, Mass.

Elaine's accomplishments were many, and her dedication to excellence in all that she did was evident to all. She is greatly missed.



MA DPH

HELEN COTTRELL

In July, we received the sad news of the passing of Helen Cottrell, the principal environmental scientist at the Narragansett Bay Estuary Program. For many years, NEIWPCC has been a partner and supporter of the NBEP, and we were well aware of the critical role Helen played in many of the organization's most significant accomplishments. She was a driving force behind the first inventory of coastal habitats and coastal features in Narragansett Bay, the first trends analysis of coastal wetlands loss in the Bay area, and the first Atlas of Narragansett Bay Coastal Habitats. As we do at NEIWPCC, Helen believed deeply in the value of building collaborative processes to address environmental issues, and she succeeded in building trusting working relationships across many organizations. It was Helen who in 1995 led the effort to create the Submerged Aquatic Vegetation Workgroup, the forerunner to today's highly praised R.I. Habitat Restoration Team. Our friends and partners at the NBEP miss her tremendously, and we share their sorrow.



NBEP

NOW ACCEPTING LISS ENHANCEMENT GRANTS PROGRAM PROPOSALS

NEIWPCC and the Long Island Sound Study (LISS) are accepting innovative, cost-effective project proposals aimed at protecting and restoring the Sound's living resources, water quality, and vital habitats; promoting sound land use; and engaging the public, educators and communities.

Proposals addressing the following two specific issues are being solicited:

- ◆ Riparian area regulation adoption project
- ◆ Enhancement and application of a decision support tool to facilitate nitrogen load reductions in the Long Island Sound region

Proposals are due February 28, 2007. For more information about the LISS Enhancement Grants Program, visit www.neiwpcc.org.

Ron Poltak Award *continued from page 1*

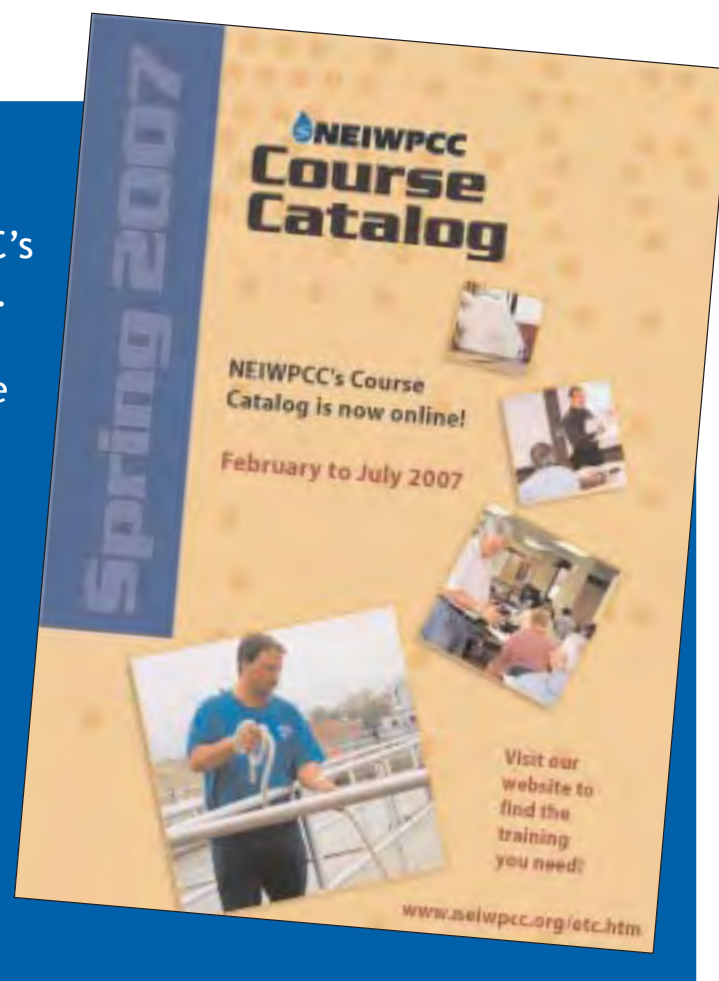
inclusive communications, and a commitment to quality results. The seven Northeast states that comprise NEIWPCC are small in area and population, but diverse in their economic and natural resource base, as well as their cultural and political identities. Ron, while recognizing these differences, has formed state coalitions for increased federal funds for water protection and restoration, and for building and repairing wastewater and drinking water infrastructure.

"He has helped bring about a paradigm shift in resource protection—focusing on watershed approaches, and shifting emphasis from controls on point source dischargers to controlling area-wide sources of pollution. He has acted to control mercury, acid deposition, and leaking underground oil tanks. In all these endeavors, Ron has forged partnerships between different states, different levels of government, and the business and environmental communities."

Ron has served as NEIWPCC's Executive Director since 1983. Under his leadership, we have dramatically increased our activities related to water quality, wastewater treatment, drinking water, and training, and expanded our focus to include issues such as nonpoint source pollution, underground storage tanks, and new threats like mercury. Before joining NEIWPCC, Ron served as the Director of the New Hampshire Division of Parks and Recreation. He also spent 15 years with the New Hampshire Governor's Office in various senior environmental positions. In total, he has spent more than 30 years in environmental policy development and implementation. 💧

The new year means a fresh slate of courses from NEIWPCC's Environmental Training Center. The printed version of our Spring catalog is now available and is being mailed to many IWR subscribers. You can also access a complete electronic version of the catalog and a detailed course schedule at www.neiwpcc.org/etc.htm

Get started now on getting the training you need!



CONFERENCE ALERTS

19th ANNUAL NATIONAL TANKS CONFERENCE AND EXPOSITION

March 5-7, Henry B. Gonzalez Convention Center, San Antonio, Texas

Produced by NEIWPCC in conjunction with EPA's Office of Underground Storage Tanks, the Association of State and Territorial Solid Waste Management Officials, and the Texas Commission on Environmental Quality, this annual event provides the underground storage tanks community with a unique learning and networking experience. The conference focuses on a wide range of tanks-related issues, with the overall intent being to find new and better ways to work together to protect human health and the environment from tank releases. More information, including online registration, is available at www.neiwpcc.org/tanks07.



The Henry B. Gonzalez Convention Center
March 5 - 7, 2007

NEIWPCC EPA ASTSWMO TCEQ

"WATER FOR ALL LIFE— A DECENTRALIZED INFRASTRUCTURE FOR A SUSTAINABLE FUTURE"

March 10-14, Marriott Waterfront Hotel, Baltimore, Maryland

This event, in addition to being the 16th Annual Technical Education Conference and Exposition of the National Onsite Wastewater Recycling Association, is the First U.S. International Program on Decentralized Systems. The conference will bring together U.S. and international experts to share their knowledge, research, expertise, strategies and case studies for achieving sustainability in future water resource use through greater use of decentralized systems (or septic systems, as they're commonly called). Tom Groves, NEIWPCC's Director of Wastewater and Onsite Programs, is the Conference Vice-Chair. More details at www.waterforalllife.org and www.nowra.org.



18th ANNUAL NONPOINT SOURCE POLLUTION CONFERENCE

May 21-23, Hyatt Regency Newport Hotel and Spa, Newport, Rhode Island

Since 1990, NEIWPCC, in partnership with our member states, has been coordinating this annual event, which has become the premier forum in our region for sharing information and improving communication on NPS pollution issues and projects. The three-day conference brings together all those in New England and New York State involved in NPS pollution management, including participants from state, federal, and municipal governments; consulting firms; academia; and watershed organizations. This year's conference is co-hosted by the Rhode Island Department of Environmental Management. More information at www.neiwpcc.org/npsconference.



16th ANNUAL STATE FUND ADMINISTRATORS CONFERENCE

June 3-6, Hilton St. Petersburg Bayfront, St. Petersburg, Florida

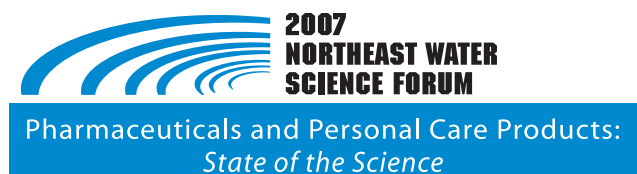
NEIWPCC is once again playing a key role in planning this event, which we have cosponsored since 1992. The conference focuses on issues of interest to state fund administrators, who manage state funds generated by gasoline taxes earmarked for covering the costs of cleaning up leaks and spills at underground storage tank sites. More information at www.neiwpcc.org/statefund.



2007 NORTHEAST WATER SCIENCE FORUM PHARMACEUTICALS AND PERSONAL CARE PRODUCTS: STATE OF THE SCIENCE

August 8 - 9, Holiday Inn by the Bay, Portland, Maine

Pharmaceuticals and personal care products, or PPCPs as they're commonly called, comprise a vast group of compounds manufactured in large quantities that are universally and frequently used by humans (and domesticated animals) worldwide. How big a risk do they pose once they enter the environment? In this conference, which is being organized by NEIWPCC, we will bring together scientists, regulators, water and wastewater professionals, and other technical experts to disseminate and evaluate the latest research findings and technical data on PPCPs in the water environment. For more information on this conference, contact Marianna Vulli at mvulli@neiwpcc.org or visit www.neiwpcc.org/ppcpconference.



August 8 - 9, 2007 / Portland, Maine

THIRD NORTHEAST ONSITE WASTEWATER TREATMENT SHORT COURSE AND EQUIPMENT EXHIBITION

March 11-13, 2008, Mystic Marriott Hotel and Spa, Groton, Connecticut

Preparations are well underway for the third edition of this event, which brings national experts to our region to lead educational sessions on the latest developments in the onsite wastewater treatment industry. Through field trips and the equipment exhibition, attendees also see first-hand the innovative technologies that are changing the way we protect water resources. The event is held every three years and, as NEIWPCC did in 2002 and 2005, we are coordinating all logistics, including developing the conference website. For more information, visit the site at www.neiwpcc.org/onsiteshortcourse.



March 11-13, 2008 - Groton, Connecticut

IN THE SPOTLIGHT

Congratulations to four New England wastewater treatment plants acknowledged for exemplary performance in the 2006 U.S. EPA Clean Water Act Recognition Awards. The **Warner Village, N.H. Water District WWTP** received a National First Place Award in the Most Improved Plant category. In the Combined Sewer Overflow (CSO) Control category, the **Auburn, Maine Sewerage District** took home first place honors. The WWTPs in **Franklin, N.H.**, and **Castleton, Vt.**, placed first respectively in the Large Secondary Plant and Small Advanced Plant Operations and Maintenance Excellence categories. In an interview with NEIWPCC intern Emma Downs, **Ed Tracy**, chief operator at the Castleton plant, said the recognition meant a great deal. "It lets you know people appreciate what you do," Tracy said. "We're only a two man operation. Usually it's kind of an out-of-sight, out-of-mind profession."

NEIWPCC's slate of Commissioners includes a number of new additions. They are **David Littell**, Commissioner, Maine Dept. of Environmental Protection; **Arleen O'Donnell**, Acting Commissioner, Massachusetts Dept. of Environmental Protection; **Thomas Burack**, Commissioner, New Hampshire Dept. of Environmental Services; **Brenda Harvey**, Commissioner, Maine Dept. of Health and Human Services; **Sharon Moffatt**, Interim Commissioner, Vermont Dept. of Health; and **Donald Pryor**, Brown University, Providence, R.I. **William Martinez** resigned as a NEIWPCC Commissioner from Vermont.

In September, NEIWPCC's **Jeremy Campbell**, **Kara Sergeant**, **A.J. Smith**, and **Nicole Wright** received commendations for five years of service to the organization. Honored for 10 years of service were NEIWPCC's **Peter Stangel** and NEIWPCC Commissioners **Albert Curran**, **Nelson Thibault**, and **Elaine Krueger** (see page 17). NEIWPCC Commissioner **William Taylor** was honored for 15 years of service. Thank you to all for your commitment and dedication to our cause.

NEIWPCC is providing key support to the Association of State and Interstate Water Pollution Control Administrators. Executive Director **Ron Poltak** is on ASIWPCA's Board, as are NEIWPCC's current Chair, **Harry Stewart**, and two other NEIWPCC Commissioners, Maine DEP's **Andy Fisk** and NYS DEC's **Sandi Allen**. **Beth Card**, our Director of Water Quality Programs, is Chair of ASIWPCA's Legal Affairs Task Force.

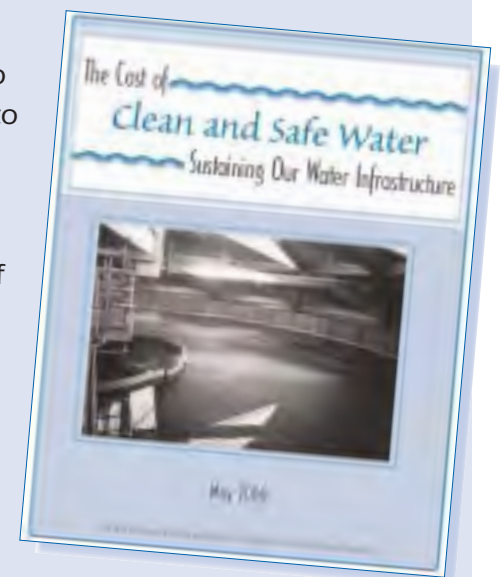
At the American Fisheries Society's 136th annual meeting in Lake Placid, N.Y., in September, nearly 2,000 scientists and fish managers from the U.S. and many foreign countries gathered to network and learn from experts in the field, including several NEIWPCC staff. NEIWPCC's **Dan Miller**, with help from former NEIWPCC staffer Gregg Kenney, organized and moderated a symposium titled "The Hudson River Estuary: The Past, Present and Future of Fishes and Their Habitats." Miller also delivered a presentation at the conference, as did NEIWPCC's **Amanda Higgs**, who spoke about New York's blue crab fishery. Higgs and Miller both work with NYS DEC's Hudson River Estuary Program, with which NEIWPCC has maintained a partnership since 1999, providing funding and staff to help the program protect and conserve the estuary's natural resources and ecosystem health.

NEW FROM NEIWPCC

In September, NEIWPCC published a biosolids sampling guidance document that will help wastewater treatment plant operators develop comprehensive municipal sewage sludge sampling plans. Unlike other sampling guides that provide only general recommendations, our guide offers specific guidance and includes easily adaptable worksheets for developing standardized procedures and documentation for the collection and analysis of biosolids. The guide is designed to enhance regulatory and public confidence in sampling data characterizing biosolids destined for land application or other beneficial reuse. To purchase a printed copy, contact NEIWPCC. It is available online at www.neiwpcc.org/PDF_Docs/samplingguide_web.pdf



Studies point to the need for the United States to invest billions of dollars over the next 20 years to improve drinking water and wastewater infrastructure. How will this investment be felt at the household level? That question provided the impetus for *The Cost of Clean and Safe Water*, a joint project of NEIWPCC, EPA New England, the New England states, and New York State. NEIWPCC staff collected and analyzed cost data from drinking water and wastewater systems serving communities throughout our region, and in May, we published a final report that identifies current and projected annual household costs for maintaining and improving the systems. To obtain a printed copy, contact NEIWPCC. The report is available online at www.neiwpcc.org/PDF_Docs/costofcleanwater.pdf



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116 John Street
Lowell, MA 01852-1124
Phone: 978.323.7929
Fax: 978.323.7919
E-mail: mail@neiwpcc.org

CALENDAR OF EVENTS

Please note that NEIWPCC workgroup meetings are designed to foster focused small-group discussions among workgroup members on specific issues. Workgroup members are drawn from state and federal regulatory agencies and NEIWPCC staff. For general information about our workgroups and their points of focus, please visit our website (www.neiwpcc.org) or call 978-323-7929.

FEBRUARY

February 4-7

NYWEA Annual Meeting & Exhibition
New York, New York

February 6

NEIWPCC Stormwater Workgroup Meeting

February 26-March 1

State Onsite Regulators Alliance Conference
Reno, Nevada

MARCH

March 5-6

Asset Management Excellence Exchange
Newton, Massachusetts

March 8

NEIWPCC Wetlands Workgroup Meeting

March 10-13

Fourth Conference on Watershed Management to Meet Water Quality Standards and TMDLs
San Antonio, Texas

March 10-14

Annual NOWRA Conference and International Symposium
Baltimore, Maryland

March 11-13

ASIWPCA Mid-Year Meeting
Arlington, Virginia

March 13-14

Annual New England Biological Assessment of Wetlands Work Group (NEBAWWG) Meeting
West Dover, Vermont

March 14-16

Annual Conference of the New England Association of Environmental Biologists (NEAEB)
West Dover, Vermont

March 15

NEIWPCC Executive Committee Meeting

March 19-21

Environmental Council of the States Spring Meeting
Alexandria, Virginia

March 20-24

North American Wildlife and Natural Resources Conference
Portland, Oregon

March 21

MWPCA Spring Meeting
Westford, Massachusetts

March 22

Water Reuse Specialty Conference & Exhibition
Worcester, Massachusetts

March 27-29

ASWM State/Tribal/Federal Coordination Workshop
Shepherdstown, West Virginia

APRIL

April 9

New Hampshire Water Conference
Concord, New Hampshire

April 9

MA Water Resources Research Center Annual Conference
Amherst, Massachusetts

April 15-18

WEF/AWWA Joint Residuals and Biosolids Management Conference
Denver, Colorado

April 19

NHWPCA Trade Show
Nashua, New Hampshire

April 25-26

New York State Wetlands Forum Annual Meeting
Lake Placid, New York

Check the NEIWPCC 24-Hour Training and Events Hotline for the latest information on NEIWPCC activities, such as cancellations due to weather, instructor illness, or date and location changes.
Call 1-866-824-9656.

To check for additions or changes to these listings, and to access links to conference websites, see the Calendar at NEIWPCC's website (www.neiwpcc.org/calendar.asp).

Contributions to *IWR* are welcome and appreciated. Please submit articles or story ideas to: Stephen Hochbrunn, *IWR* Editor
E-mail: shochbrunn@neiwpcc.org ♦ Phone: 978/323-7929, ext. 235



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