

Presentation to NEWEA Innovation Pavilion

NEWEA Annual Conference

I/A OWTS Update

1/24/2023

To avoid confusion, since these slides come from multiple sources and may be viewed by a general audience:

IA = I/A = I&A = Innovative/Alternative

OWTS = Onsite Wastewater Treatment Systems = Septic Systems

EIA = Enhanced I/A System (the newest generation) operating at effluent nitrogen levels < 12 mg/L

MADEP = MassDEP = MA Department of Environmental Protection

NEWEA – New England Water Environment Association

WEF – Water Environment Federation (NEWEA's parent organization)

Presenters

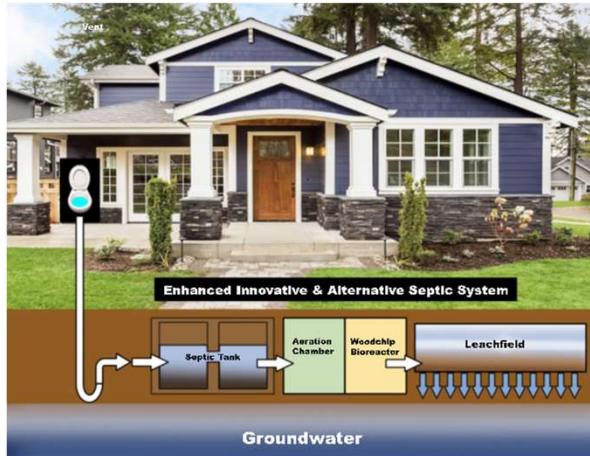
- ▶ **Brian Baumgaertel** Director, MA Alternative Septic System Test Center (MASSTC)
- ▶ **Scott Horsley** Water Resources Consultant
- ▶ **Bruce Walton** NEWEA I/A OWTS Task Force Chair

Brian is an experienced environmental specialist who has served as Chair of the Mashpee Board of Health. He leads one of only two research centers in the country focused on septic systems and is engaged nationally in advancing the state of the art in septic system nutrient removal.

Scott has over thirty years of professional experience in the field of water resources management. He helped develop the Cape's 208 Plan and serves as a consultant to multiple towns on the Cape as they develop their wastewater plans. He also teaches at both Harvard and Tufts.

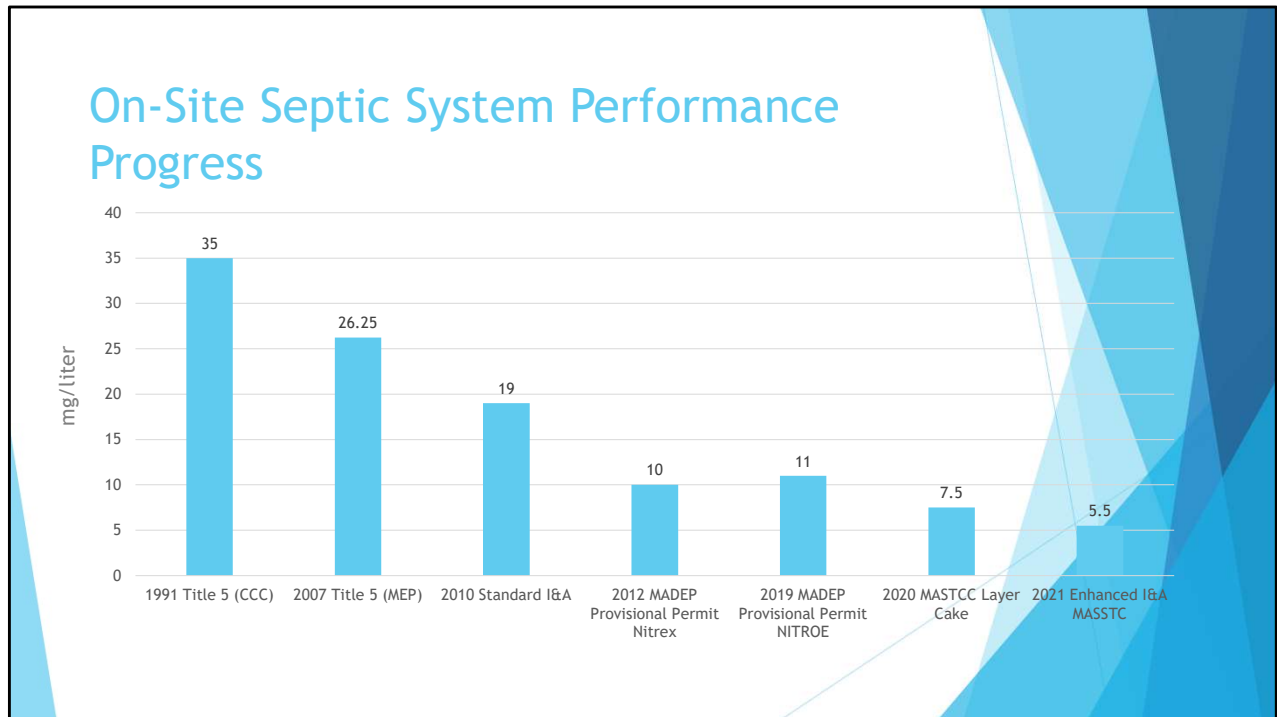
Bruce is a third-generation homeowner on the Cape and is a retired executive recruiter. The I/A OWTS Task Force consists of over two dozen water professionals and individuals from engineering/consulting firms, vendors, towns/counties, NGOs, and academia. From our charge: *We aim to convene productive collaboration between innovators, water utilities and regulators to enable viable solutions to be brought to market faster and more economically.*

Enhanced Innovative and Alternative (I&A) Septic Systems



Enhanced I/A is the new generation with performance at or better than 12mg/L effluent nitrogen.

Installation essentially involves putting an extra tank in the ground between the septic tank and the leach field. Many homes can utilize the existing septic tank and leach field. The system generally uses a small amount of electricity (usually for a blower and associated controls) and has access ports at ground level.



CCC – Cape Cod Commission
MEP – MA Estuaries Project
MADEP – MA Department of Environmental Protection

We are finding generally 50-70 mg/L influent nitrogen levels, with some over 100 mg/L.

Effluent nitrogen levels continue to improve, with some systems now yielding 3-4 mg/L. 5-7 mg/L might be a fair average for Best Available Nitrogen Removing Technology.

Permitting levels generally trail testing performance levels, especially in MA where it takes 5+ years to get from a Provisional to a General Permit. This slide combines permitting (1991-2019) and testing (2020-21). **Nitrex tested in the 2.2-4.1 mg/l range in 2006, while the 10 mg/l level in 2012 reflects their Provisional Permit.** Preliminary NITROE testing similarly beats their current permit, as we shall see in the next slide.

Centralized wastewater plants have averaged 5-7 mg/L, with a target of 3 mg/L based on state-of-the-art technology investments.

Shubael Pond Performance

- ▶ Preliminary Data
 - ▶ Through November 2022
 - ▶ Twelve homes on small (generally 10k sq. ft.) lots
- ▶ Influent - Average 71.4 mg/L nitrogen (range 23-98 mg/L)
- ▶ Effluent - Average 3.7 mg/L nitrogen (range 2-7 mg/L)
- ▶ Percent Removed - 94%
- ▶ Nitrogen Removal - Average 9.3 kg/Year (range 3-24 kg/Year)

This information is preliminary or provisional and is subject to revision. It is being provided to meet the need for timely best science. The information has not received final approval by the Massachusetts Alternative Septic System Test Center (MASSTC) and is provided on the condition that neither MASSTC nor Barnstable County shall be held liable for any damages resulting from the authorized or unauthorized use of the information.

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Project is driven by Barnstable Clean Water Coalition (BCWC) , US Environmental Protection Agency (US EPA), US Geological Survey (USGS), and The Nature Conservancy (TNC) with the objective of really understanding I/A's impact on groundwater.

To demonstrate the principles

- **12 systems installed 8/2021-10/2022**
- **37 EPA monitoring wells installed to chart nutrient movement in groundwater**

Preliminary data shown. Official EPA reports should be published in late spring, 2023.

Managing I/A Infrastructure: Responsible Management Entity (RME)

- ▶ Manage/Coordinate the Full Lifecycle of Decentralized (onsite and cluster I/A) Infrastructure
 - ▶ Planning -> Design -> Permitting -> Finance-> Installation -> O&M -> Monitoring -> Reporting
- ▶ MASSTC RME Pilot Underway
- ▶ \$1.25M Initial Funding from TNC and EPA SNEP
- ▶ Develop and Implement a Financially Sustainable RME Program
- ▶ Flexible Architecture - every town has different needs

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A key to long term performance is managing decentralized systems as Infrastructure. This is the purpose of an RME.

To stand-up a pilot RME will cost about \$3m over 5 years.

Once operating at volume, user fees would cover operating costs and would be similar to sewer fees.

Title 5 & NSA Watershed Regulations

- ▶ Why - 50 years since Clean Water Act. CLF lawsuit.
- ▶ Amend Title 5 to add a new type of Nitrogen Sensitive Area (NSA).
- ▶ Amendment applies to 30 estuaries along Cape Cod south coast plus Wellfleet, immediately. Mainland South Coast and Islands to follow through a separate public process.
- ▶ All homeowners in impacted watersheds must upgrade standard Title 5 systems to Best Available Nitrogen Reducing Technology within 5 years, if town does not have a watershed permit.
- ▶ Watershed Permits
 - ▶ 20 years to reduce nitrogen load by 75% of 208 Plan target for that watershed
 - ▶ May use any combination of solutions (sewer, I/A, PRBs, N credits, etc.)

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The Conservation Law Foundation (CLF) lawsuit is set aside while real actions are taken to clean-up watersheds. The lawsuit is a forcing action.

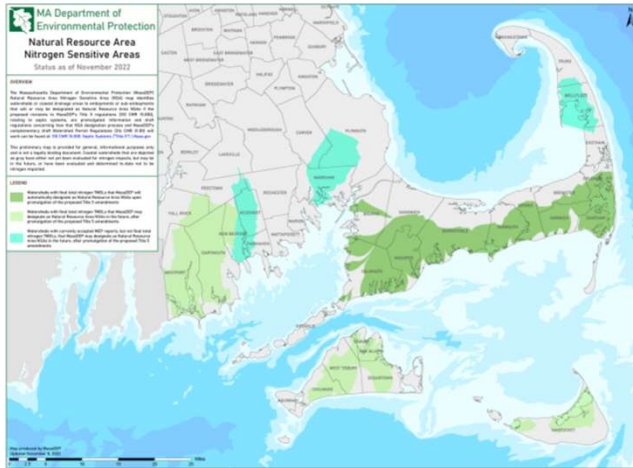
Per MassDEP, a Nitrogen Sensitive Area (NSA) is “any watershed to an embayment or sub-embayment that is the subject of a Nitrogen Total Maximum Daily Load (TMDL) approved by the EPA pursuant to the federal Clean Water Act and an Area-Wide Water Quality Management Plan pursuant to Section 208 of the Clean Water Act addressing nitrogen pollution.”

The 208 Plan (2015) provides many options beyond traditional sewerage to satisfy the Clean Water Act target of reducing the total nitrogen load on Cape Cod by about 50%.

Public Comment period on the proposed regulations ended 1/30/23. Expectation is that regulations will go into effect soon.

This plan really pushes the towns to develop and implement watershed plans.

Nitrogen Sensitive Areas



NSAs cover 30 estuaries along the south side of Cape Cod.

Regs would apply immediately to dark green areas, plus Wellfleet. Later to other shaded areas.

Towns not in a shaded area could contract to develop TMDLs and watershed plans.

NEWEA Comments

- ▶ NEWEA Comment Letter to MassDEP - 1/17/23
 - ▶ See Task Force Resources Website for a Copy
- ▶ We Are Supportive, and We Must Do It Right - Three Headlines:
 - ▶ Need State Legislation to Help Fund
 - ▶ Must Develop Best Available (Nitrogen-Reducing) Technology (BAT) Process
 - ▶ RME Required
- ▶ Additional Comments
 - ▶ I/A = Cost-effective “Tool in the Toolbox” for lower density areas
 - ▶ With TMDL credit, equalize homeowner cost to match sewerage
 - ▶ Permitting installations need state support
 - ▶ OM&M will need Workforce Development support

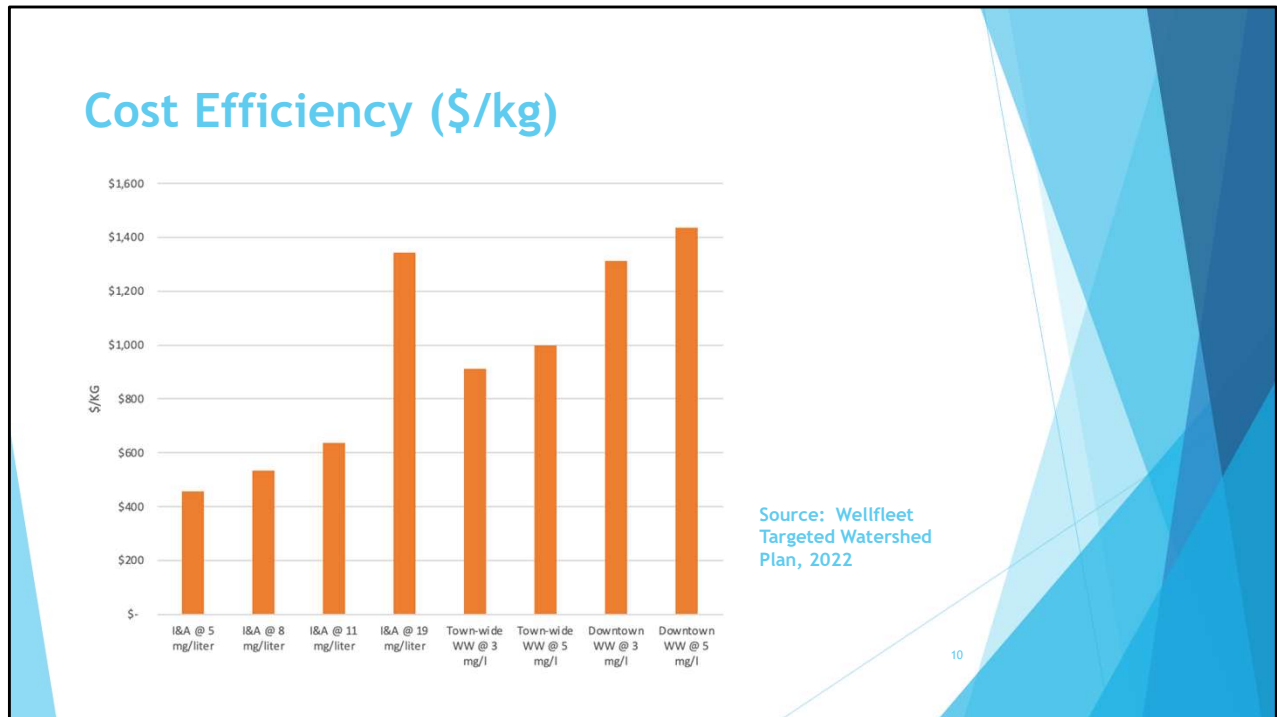
URL for Resources Website is shown on Contact Information slide at end of presentation.

I/A is a cost-effective “tool in the toolbox”, based on preliminary data.

We need to focus on total Cost to the Town. Best I/A use is for lower density areas where sewerage is less cost-effective.

If I/A will get TMDL credit, town should equalize homeowner cost to match sewerage. i.e. subsidize it as towns now do with sewerage.

Permitting is a state or town function, not a homeowner function. The state’s permitting process is so expensive (\$1.5m and 5-6 years, once Provisional Permit is granted) that vendors cannot afford it. So the state should fund it.



This is a sensitivity analysis on relative cost of I/A and Sewering in Wellfleet.

I/A generally costs about one half of sewerage. For example, compare Townwide Sewering at 5 mg/l (\$1000/KG) to I&A at 8 mg/l (a bit over \$500/KG).

Sewering is best for downtown where density is high.

Outside downtown, Wellfleet plots are ½ acre and density is low.

Enhanced I&A Septic Systems - Actual Costs

		Construction	Engineering Design	Total Cost Per System	Total Construction	Total Cost
Retrofit of Existing Title 5 System:						
	Buzzards Bay Coalition	4	\$24,891	\$3,000	\$27,891	\$99,564
	Barnstable Clean Water Coalition	4	\$19,852	\$6,351	\$26,203	\$79,408
	Average		\$22,372	\$4,676	\$27,047	
Partial Upgrade (replace septic tank or leachfield)						
	Barnstable Clean Water Coalition	2	\$27,981	\$6,351	\$34,332	\$55,962
	Average		\$27,981	\$6,351	\$34,332	\$68,664
Full Upgrades (including both septic tank and leachfield)						
	Buzzards Bay Coalition	4	\$35,535	\$3,000	\$38,535	\$142,140
	Barnstable Clean Water Coalition	2	\$32,808	\$6,351	\$39,159	\$65,616
	Average		\$34,172	\$4,676	\$38,847	
	Total	16				
	Average		\$27,668		\$32,344	\$442,690
						\$517,498
References: Buzzards Bay Coalition, Designing a Municipal Model for Mandating, Funding, and Managing Innovative/Alternative Septic Systems, June 2020						
Barnstable Clean Water Coalition, Schubael's Pond Study, 2022						

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There is a lot of mis-information and dis-information out there.

These numbers reflect actual numbers for actual installations.

The 16 systems shown (installed 2015-2021) have an average cost of \$32,344.

Inflation will affect both these numbers and sewerage numbers. Volume purchasing through an RME would help reduce costs.

Wellfleet Targeted Watershed Plan (\$M)

	Scenario A Hybrid	Scenario B Traditional
Collection System	\$9.4	\$80.4
Wastewater Treatment	\$10.9	\$32.7
Sewer Laterals	\$3.2	\$27.5
Design	\$2.0	\$11.3
Construction Services	\$5.0	\$30.7
Total Municipal Centralized Infrastructure	\$30.5	\$182.6
Collection System	\$0.8	\$0.8
Wastewater Treatment	\$0.9	\$0.9
Leaching System	\$0.2	\$0.2
Design & Contingencies	\$0.6	\$0.6
Total 95 Lawrence Capital Costs	\$2.5	\$2.5
I&A Septics	\$63.0	\$44.9
Design	\$10.6	\$7.5
Total I&A Septics	\$73.6	\$52.4
TOTAL COSTS (millions)	\$106.6	\$237.5

This is the Wellfleet summary of two finalist strategies.

Scenario A (Hybrid) includes limited downtown sewerage and the new generation of wood chip-based, Enhanced I&A systems (Provisional Permit) at 8 mg/l.

Scenario B (Traditional) achieves 208 Plan goal primarily through sewerage/centralized. I&A systems, where needed, operate at General Permit effluent levels of 19 mg/l.

Scenario A was chosen, and town has successfully applied for \$3m SRF funding in 2024.

I/A Performance at <5 mg/l could knock perhaps \$20m off the Hybrid approach.

Funding

▶ Uses

- ▶ Permitting - \$5-10m over 5 years
- ▶ RME - \$3m over 5 years. EPA SNEP & TNC have awarded \$1.25m so far.
- ▶ Adoption - \$100-150m/year, just based on existing Title 5 volumes. New regs will increase this substantially. Pay for Performance structure.
- ▶ Vendor Growth - \$ and human capital
- ▶ Workforce Development

▶ Sources

- ▶ SRF and Aquifund
- ▶ Legislative
- ▶ Private - Philanthropy & impact investors. Banks.

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Permitting requires each vendor who has already achieved Provisional permit status to test 50 systems for three years to achieve General Permit. This can cost \$1.5m per vendor. Vendors today take their business to other states where National Sanitary Foundation (NSF) qualifications are sufficient.

Pay for Performance – MassDEP wants multiple vendors serving this market and working to improve system performance. They are interested in systems that produces effluent nitrogen <12 mg/L. We need ways to incent using the right solution, not just the cheapest. Possibly, financial credit differences for systems producing 12, 8 or 5 mg/L?

Vendors will be looking at order of magnitude growth, as will installers/servicers for OM&M. This will require a focus on Workforce Development.

We are working to help decentralized systems compete with centralized for SRF funds. Wellfleet is showing it can be done.

Aquifund - fka: Community Septic Management Loan Program (CSMLP) – provides loans to homeowners.

A sustainable financing architecture will include private sources.

WEF Distributed Water Infrastructure Task Force (DWITF)

- ▶ Formed in late 2022 “...to advance the understanding, planning, implementation, and use of distributed water infrastructure in communities.”
- ▶ Includes: Supply (potable & non-potable), Reuse, Wastewater and Stormwater.
- ▶ WEFTEC Presentation - Oct. 2023
- ▶ White Paper - Q4 2023

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Distributed (decentralized systems, managed centrally) is now getting national attention.

Wastewater (I/A) is only one of four components, here. Three NEWEA Task Force members are on the DWITF.

In the first full task force meeting in January, the need for a common nomenclature became very apparent. The industry does not yet have a set of common definitions.

An objective is to put distributed on a par with centralized.

Q & A (1) - With Thanks to Alexie Rudman, MASSTC

- ▶ **Do the 20-year watershed permits take away the incentive for doing anything in 5 years? Will anything happen in 5 years?**
 - ▶ Watershed plans once permitted have to be reviewed every 5 years by DEP; the threat of defaulting to a 5-year installation window for homeowner upgrades never goes away
- ▶ **What happens to towns that are not included in the new NSAs?**
 - ▶ A town can apply for a study to establish watershed TMDLs. We need to develop estimates on cost data, here.
- ▶ **What is the incentive for a town to launch a study of their watersheds?**
 - ▶ A town could eventually be pursued for violating the Clean Water Act
- ▶ **What are the Best Available Nitrogen Reducing Technologies?**
 - ▶ General Permit for I/A now is 19 mg/L effluent nitrogen, but that won't solve the problem.
 - ▶ Enhance I/A technologies perform at 12 mg/L or better but are not widely available nor have General permit yet.
 - ▶ Title 5 Amendment and NSA regulations will allow Provisional Permit systems to be used.
 - ▶ We don't pick the winners. See the task force Resources website for introductions to eight promising technology vendors.
- ▶ **In the Wellfleet sewerage comparison, did you take into consideration the cost of low-pressure sewer systems?**
 - ▶ The audience member who answered this only noted that the cost analysis was really specific to Wellfleet's unique characteristics.

Q & A (2)

- ▶ **As part of I/A systems installations, are you considering climate change, sea level rise, and increases in groundwater levels?**
 - ▶ This is definitely something we are beginning to consider, We need to build in a climate resilience study.
 - ▶ Pathogen removal, drought, water table change , etc. need to be included.
- ▶ **In Maryland, they calculated that it would take 500 years to get homeowners to adopt I/A systems at the necessary rate. What's your adoption rate?**
 - ▶ Currently low because adoption is voluntary in the absence of the new regulations. That will change. Towns will mandate action, as they do now with sewerage.
 - ▶ In the meantime, other things that can be done to increase voluntary adoption:
 - ▶ Leveraging peer effects and creating opportunities for early adopters to speak to prospective adopters, as was done with solar and Evs
 - ▶ Subsidies, as were used in solar and Evs
 - ▶ Social marketing - target people who care about the environment and have disposable income to do this
- ▶ **Comment from audience member:** Suffolk County, Long Island, has a combined (centralized and decentralized) approach to wastewater management. The systems they are installing require a good amount of maintenance (RME needed), communication is lackluster, and NY stipends of \$20k have been available (IRS just ruled they are not taxable, a reversal of IRS' prior position). MA will need \$30-40k grants.

Q & A (3)

▶ What is Adaptive Management?

- ▶ Towns have to poke their heads up every 5 years and see if there are better ways of achieving nutrient reduction goals. As new technologies are approved, they should be folded into the strategy. I/A fits well into this model.

▶ Final comment from Brian Baumgaertel

- ▶ We need more than one solution. Vendors, bring us your best. MassDEP is interested in systems < 12 mg/L. If you work on it, your best now will get better over time. We need multiple vendors working to achieve effluent nitrogen in the 3-5 mg/L range.

▶ Final comment from Bruce Walton

- ▶ For the past two years our task force focus has been, "What works and how will we manage it?"
- ▶ Now the focus will be, "How do we fund it and build the political capital to get it done?"

▶ Final comment from Scott Horsley

- ▶ My bottom line is that this new generation of advanced septic systems works; in fact, they work well. They are cost-effective, and they offer a viable alternative for towns to meet their water quality restoration goals. They are designed to work passively with minimal maintenance and utilize locally-available woodchips as a sustainable technology.

Contact Information

- ▶ Brian Baumgaertel, Director, MASSTC
 - ▶ bbaumgaertel@capecod.gov
 - ▶ W (508) 375-6888
- ▶ Scott Horsley, Water Resources Consultant
 - ▶ scotthorsley208@gmail.com
 - ▶ C 508-364-7818
- ▶ Bruce Walton, NEWEA I/A OWTS Task Force Chair
 - ▶ bwalton@battaliawinston.com
 - ▶ C 617-633-5065
- ▶ I/A OWTS Task Force Resources Website -
<https://www.newea.org/resources/innovation/resources/>

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The Resources Website was created for self-education. There are over 30 links to Task Force activities/deliverables and another 15 links to websites that may be useful.

Thank you!