

Decision Maker Workshop

Solutions to Nitrogen Pollution: Installation of Nitrogen Reducing Septic Systems



**West Falmouth Septic
System Upgrade
Demonstration Project**
April 4, 2018





Decision Maker Workshop

First in a Two-Part Series

Solutions to Nitrogen Pollution: Installation of Nitrogen Reducing Septic Systems

114 Front Street
New Bedford, MA 02740

West Falmouth Septic System Upgrade Demonstration Project April 4, 2018

- 12:00 p.m. Check-in and Lunch
- 12:30 p.m. Project Background: Korrin Petersen, Buzzards Bay Coalition
- 12:45 p.m. Technology Selection: George Heufelder, MA Alternative Septic System Test Center (MASSTC)
- 1:15 p.m. Homeowners Perspective: Mike Angelini
- 1:30 p.m. Design and Permitting: George Heufelder, MASSTC & Stephen Rafferty, Falmouth BOH
- 2:00 p.m. Installation: Arthur Hawkes
- 2:30 p.m. Results & Costs: Korrin Petersen & George Heufelder
- 3:15 p.m. Wrap up and Questions
- 4:30 p.m. Optional Field Tour in West Falmouth
Meet in West Falmouth at Burgess Street (Off Swift Street),
Falmouth, MA 02540

Earn Professional Credits: This workshop is eligible for TCH credits for Title 5 Soil Evaluator and System Inspector.

Nitrogen Pollution

Healthy coastal waters for fishing, boating, and recreation are a vital part of southeastern Massachusetts' economy and way of life. Nitrogen is a top concern for coastal waters' ecological health.

Healthy Area:

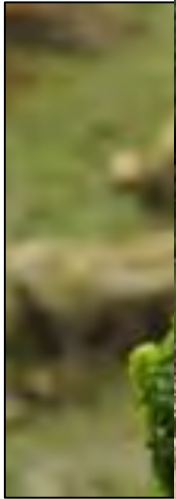
- Clear water
- Dense eelgrass beds
- Abundant fish and shellfish
- Enjoyable place for recreation



Nitrogen polluted:

- Cloudy and murky water
- Eelgrass can't grow
- Low oxygen levels
- Fish and shellfish disappear

Nitrogen Pollution in the Harbor

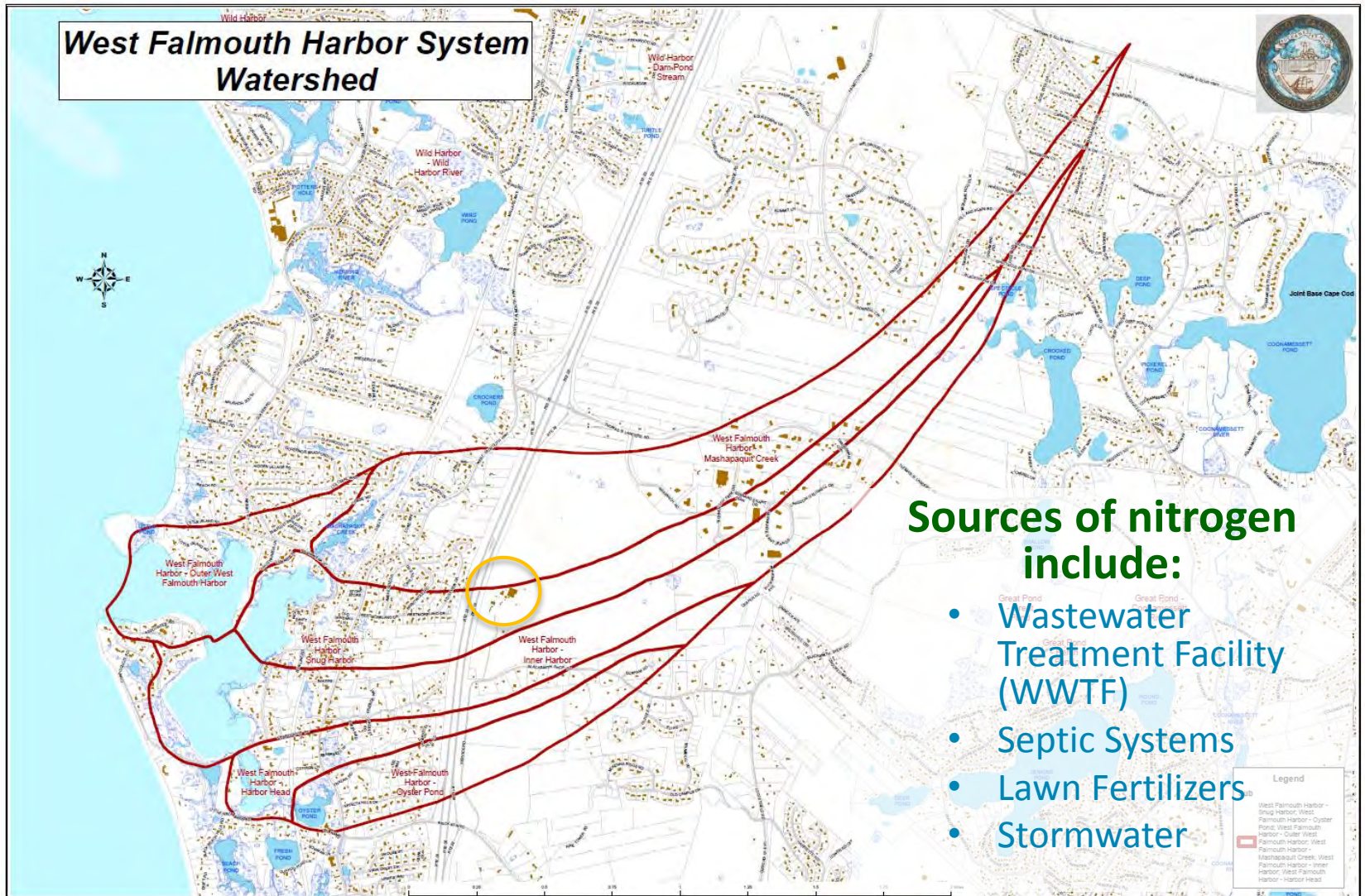


Credit: Cape



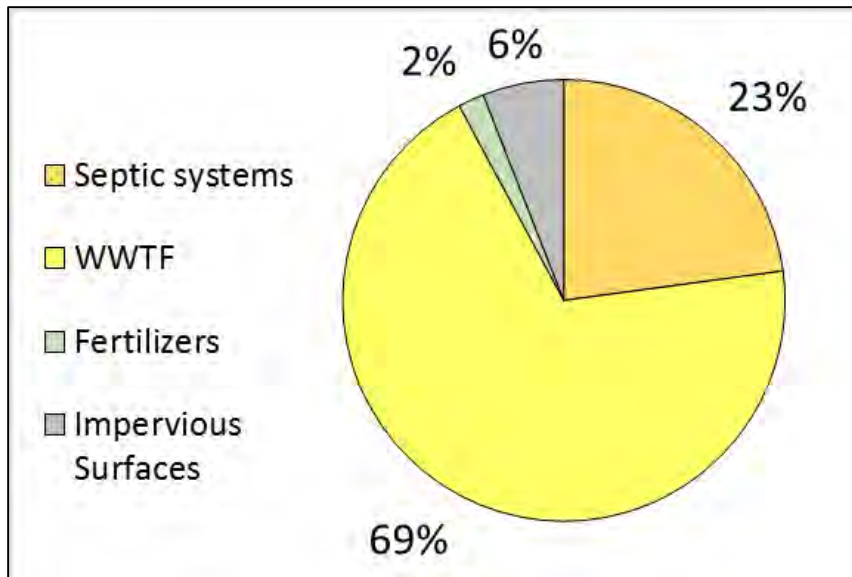
on Globe)

Sources of Nitrogen to West Falmouth Harbor

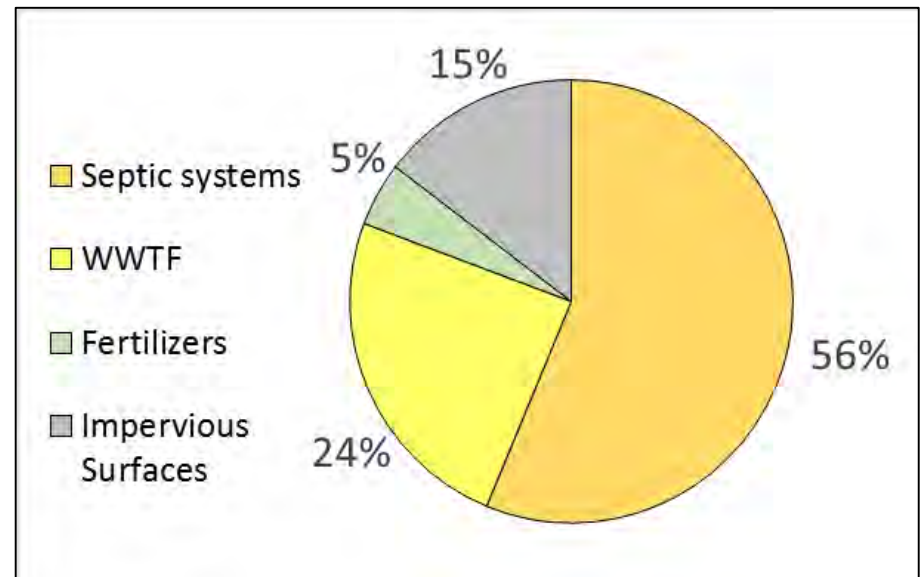


Sources of Nitrogen in West Falmouth Harbor

Prior to WWTF Upgrade



After WWTF Upgrade



Data source: West Falmouth MEP Report
(Howes et al. 2006)

Wastewater is the Largest Source of Nitrogen to West Falmouth Harbor

1. Town of Falmouth Wastewater Treatment Facility (WWTF)

- Discharges effluent (treated wastewater) into the ground where it flows directly to West Falmouth Harbor (WFH)
- Historically, contributed ~70% of nitrogen load into WFH, now 24%
- *Facility upgrades and strict permit limits are addressing this problem, and significantly reducing load coming from WWTF.*

2. Conventional Septic Systems Near the Harbor

- Discharge wastewater into the ground where it flows directly to WFH
- Historically, contributed 23% of nitrogen load into WFH, now account for almost 60%
- *This is now the largest source of nitrogen entering WFH; a problem we need to address*

Reducing Nitrogen from Septic Systems

- How can we reduce nitrogen to West Falmouth Harbor from EXISTING septic systems to improve water quality?
- Use best available technologies. Systems that meet 12mg/L or less. The goal was to do better than the state standard of 19mg/L.
- Evaluate total costs, and implementation logistics associated with installing, operating, maintaining and monitoring these systems.
- Upgrade 20 conventional septic systems and cesspools very near WFH to N-removing septic systems
- Monitor and report results.



The West Falmouth Harbor Shoreline Septic Remediation Project

- Project partners

- Town of Falmouth
- Buzzards Bay Coalition



- Additional support

- West Falmouth Village Association
- Barnstable County Department of Health and the Environment



- Project scope

- Partners received a \$250,000 federal grant
- This grant enabled us to provide \$10,000 subsidies to up to 20 homeowners within 300 feet of WFH who installed a nitrogen-removing septic system, and monitor results
- Estimated N removal: 175lbs/year



Qualifying Technologies

Nitrogen Reducing Septic Systems at 12 mg N/l or better:

- AdvanTex AX20RT
- Amphidrone-SBR
- Biobarrier MBR
- Bioclere
- Blackwater
- BUSSE Green Tech
- Eliminite
- GPC
- Hoot
- Layered Soil Treatment Area
- Nitrex
- NJUN
- RUCK
- Hydro-Kinetics
- Waterloo Biofilter
- SepticNET
- SeptiTech

Candidate Properties

West Falmouth Harbor Shoreline Septic Remediation Project



Created by: Buzzards Bay National Estuary Program, 2870 Cranberry Highway, East Wareham, MA 02538. www.buzzardsbay.org March 10, 2015

Prioritize homes based on:

- Sub-watershed location
- Age and type of septic system
- Distance from mean high water
- Home use

15-2-25 FINAL list updated with BOH research and formulas - Excel														
<div> <div>FILE</div> <div>HOME</div> <div>INSERT</div> <div>PAGE LAYOUT</div> <div>FORMULAS</div> <div>DATA</div> <div>REVIEW</div> <div>VIEW</div> <div>DESIGN</div> </div> <div> <div>Clipboard</div> <div>Font</div> <div>Alignment</div> <div>Number</div> <div>Styles</div> <div>Cells</div> <div>Editing</div> </div>														
<div> <div>N2</div> <div> <div>✕</div> <div>✓</div> <div>fx</div> </div> <div>{=IF(OR(C2="Buzzards Bay",C2="Outside line",C2=""),0,IF(OR(C2="Snug Harbor",C2="Mashapaquit",C2="Harbor</div> </div>														
	A	B	C	D	E	H	I	J	K	L	M	N	O	P
	Location Street	Location Street Address	Subwatershed	Score	Distance to MHW (feet)	Score	YearBuilt	EffYr	Score	5 year average water use (gpy)	Score	Sub Total Score	Owner Occ	LUCD
80	32	CHAPOQUOIT RD	Harbor Head	3	190	2	1930	2004	3	142,270	5	13	X	ONE F
81	40	ASSOCIATES RD	Outer WFH	2	89	4	2008	2009	2	179,071	5	13	P	ONE F
82	68	OLD DOCK RD	Snug Harbor	5	204	2	1972	1980	5	19,897	1	13	P	ONE F
83	27	LITTLE ISLAND RD	Outer WFH	2	254	1	1890	1985	5	60,887	5	13	X	ONE F
84	36	LITTLE ISLAND RD	Outer WFH	2	156	3	1998	2001	3	66,273	5	13	P	ONE F
85	42	OLD DOCK RD	Snug Harbor	5	189	2	1940	1970	5	10,173	1	13	P	ONE F
86	475	WEST FALMOUTH HV	Oyster Pond	1	213	2	1924	1985	5	61,486	5	13	X	MULT
87	454	WEST FALMOUTH HV	Oyster Pond	1	58	5	1890	1989	5	29,471	2	13	X	ONE F
88	67	NASHAWENA ST	Snug Harbor	5	145	3	1900	2004	3	20,495	2	13	P	ONE F
89	7	NASHAWENA ST	Snug Harbor	5	281	1	1900	1984	5	20,645	2	13	P	ONE F
90	76	OLD DOCK RD	Snug +200	4.5	268	1	1940	2007	2	140,325	5	12.5	P	ONE F
91	10	NASHAWENA ST	Snug Harbor	5	142	3	1900	2014	2	29,359	2	12	P	ONE F
92	61	NASHAWENA ST	Snug Harbor	5	138	3	1900	2013	2	22,590	2	12	P	ONE F
93	11	SNUG HARBOR LN	Outer WFH	2	199	2	1962	1997	3	73,154	5	12	P	ONE F
<div> <div>Master Matrix</div> <div>Snug and Mash</div> <div>Ranking</div> <div>+</div> </div>														

Homeowner Technology Selection

Summary of Available Technologies

System Name Contact Website	Estimated Equipment Cost*	Estimated Installation Cost*	Estimated Engineering and Permitting Cost*	Average Estimated Installed System Cost	Annual Cost for Quarterly Inspections	Lab Costs after 1st year	Monthly Energy Use (kWh)*	Annual Energy Cost at \$0.25/kwh	20 year equipment replacement cost	20 year Present Worth for O&M**	TOTAL** 20 year Present Worth	Retrofit to Title 5	Company Warrantee on System	Special Considerations	Number of Pumps
AdvanTex AX20RT (Orencia) Joseph Soulia 800-230-9580 http://www.orencia.com/sales/choose_a_system/advanced_treatment_systems/index.cfm	\$ 27,000	\$ 14,580	\$ 3,550	\$ 45,130	\$ 900	\$ 305	60	\$ 180	\$ 1,035	\$ 28,430	\$ 73,560	Yes	3 years	Part of unit located above ground (alkalinity dosing system)	4 mech
Amphidrome - SBR Mollie Caliri 781-982-9300 x 33 http://www.amphidrome.com/	\$ 8,175	\$ 7,500	\$ 3,550	\$ 19,225	\$ 1,364	\$ 305	85	\$ 255	\$ 1,925	\$ 40,100	\$ 59,325	Yes	2 years	Blower components in shelter located above ground	2 mech
Biobarrier MBR (Biomicrobics) Lauren Usilton 508-823-9566 http://www.biomicrobics.com/products/biobarrier-membrane-bioreactor/	\$ 8,500	\$ 4,800	\$ 3,550	\$ 16,850	\$ 550	\$ 305	150	\$ 450	\$ 2,000	\$ 27,795	\$ 44,645	Yes	2 years	Part of unit located above ground (small box for fan and potential addnl aeration)	1 mech
Bioclere (AquaPoint) Mark Lubbers 774-930-3900 or 508-985-9050 http://www.aquapoint.com/bioclere.html	\$ 7,000	\$ 7,000	\$ 3,550	\$ 17,550	\$ 900	\$ 305	103	\$ 309	\$ 1,864	\$ 31,839	\$ 49,389	Yes	2 years	Part of unit 18" above ground (~13 sf). Unit that is flush with ground available for added cost.	2 mech
BUSSE Green Tech Ingo Schaefer 708-204-3504 http://www.busse-gt.com/	\$ 23,000	Part of equip \$	\$ 3,550	\$ 26,550	\$ 800	\$ 305	120	\$ 360	\$ 4,000	\$ 32,995	\$ 59,545	Yes	2 years	Exterior insulated enclosure (or interior installation)	2 air

NAME:

WEST FALMOUTH PROPERTY ADDRESS:

DATE:

Please tell us how important the following characteristics are to you based on the following scale:

First Cost (equipment and installation)

20 Year Present Worth (including O&M)

Energy Use

Aesthetics

Complexity

1 = very important

2 = important

3 = somewhat important

4 = not very important

5 = not a concern

Is there another criteria not listed here that is important to you?

Summary of top 7 systems to consider based on your weighting of the above criteria:

System Name Contact Website	Decision Tool Total Score	Average Estimated Installed System Cost	Annual Cost for Quarterly Inspections	Lab Costs after 1st year	Monthly Energy Use (kWh)*	20 year Present Worth for O&M**	Company Warrantee on System	Special Considerations	Number of Pumps
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Finding 20 Participants

- Connected to community through West Falmouth Village Association
- Sent personalized letters from WFVA and the Coalition to top 60 candidates
- Consulted with neighborhood leaders
- Held workshop with vendor presentations
- Met multiple times with interested candidates to:
 - discuss technologies
 - assess feasibility of installations



Homeowner Perspective

You want to do WHAT to my home?





Designer Concerns

- Technology Considerations
- Homeowner Considerations
- Installer Considerations



Designer Concerns

Technology Considerations

- Location of above-ground structures such as air blowers, vents and pumps -SAMPLING LOCATIONS
- Adequate notes for installers regarding specific requirements (slopes on lines, limits on depth to grade , observation ports, sampling locations, location of electrical components, maintenance access)
- Discussion with homeowners and developing and managing expectations.



Designer Concerns

Homeowner Considerations

Designers should:

- Become familiar with the technology before incorporating into the design (size, electrical use, maintenance requirements, sampling requirements, noise, legal requirements)
- Have discussion with homeowners regarding above so that there are no surprises.



Designer Concerns

Installer Considerations

Designers should:

- Be available to discuss with installers how the system works and critical aspects of component placement.
- Ensure that electrical components are installed by licensed individuals.

Installer Considerations

- **Final cover**
- **Component placement**



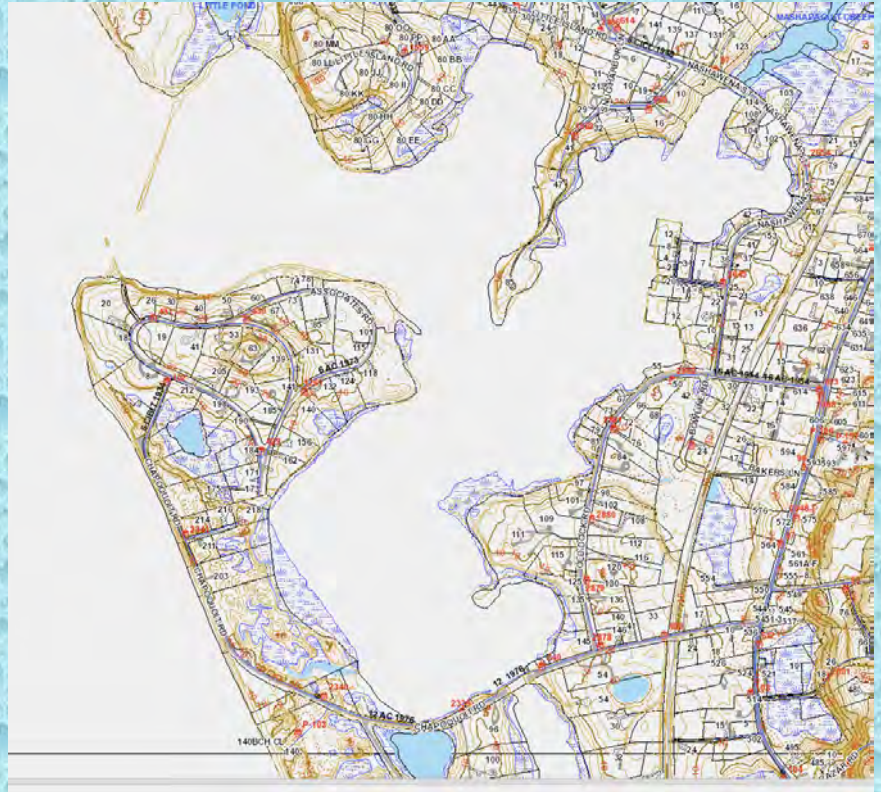
Installers usually have the more direct contact with the owners. If they don't like how something looks, sounds or seems they often ask an installer to modify things such as component placement, final cover, etc. This should all have been done in the planning stage (and be shown on the plan) – consider not modifying any component placement until approved by the designer and/or the local BOH.

Sampling

- There will likely be some !
- How convenient/intrusive this will be to the owner will depend on the design and location of the sampling ports.
- Design them as if you had to use them.

BOH – Approvals and Conditions.

- Public Hearings
- Abutter Notifications
- Engineered Plans
 - Flow estimations
 - Historical usage
- Form of Approvals
 - Register at Barnstable County ROD
 - Incorporation of Demonstration Project's Conditions
 - Maintenance Contracts



BOH – Approvals and Conditions.

- Approval – Description of what is approved.
- Findings
 - Addition is not a requirement
 - Existing system is not in failure
 - Improvement over existing
- Conditions



BOH – Conditions.

- Sampling/Access per the West Falmouth Demonstration.
- Work in accordance with approved plans.
- System approved is subject to DEP approval as well
- System maintenance per DEP technology approval
- Low flow fixtures/No garbage disposal
- No additional flows
- Two years to implement



Questions



Installer Perspective

Harlow-Hawkes

- Local Installer – Neighborhood Focus
 - Priority on the People
 - Finish product is something to be proud of
- Homeowner Considerations:
 - Landscaping
 - Tank cover location
 - Alarm and counter location
 - Compressor location
 - How the home is used -seasonal or year round
 - Long term plans for the home (retirement, additions)

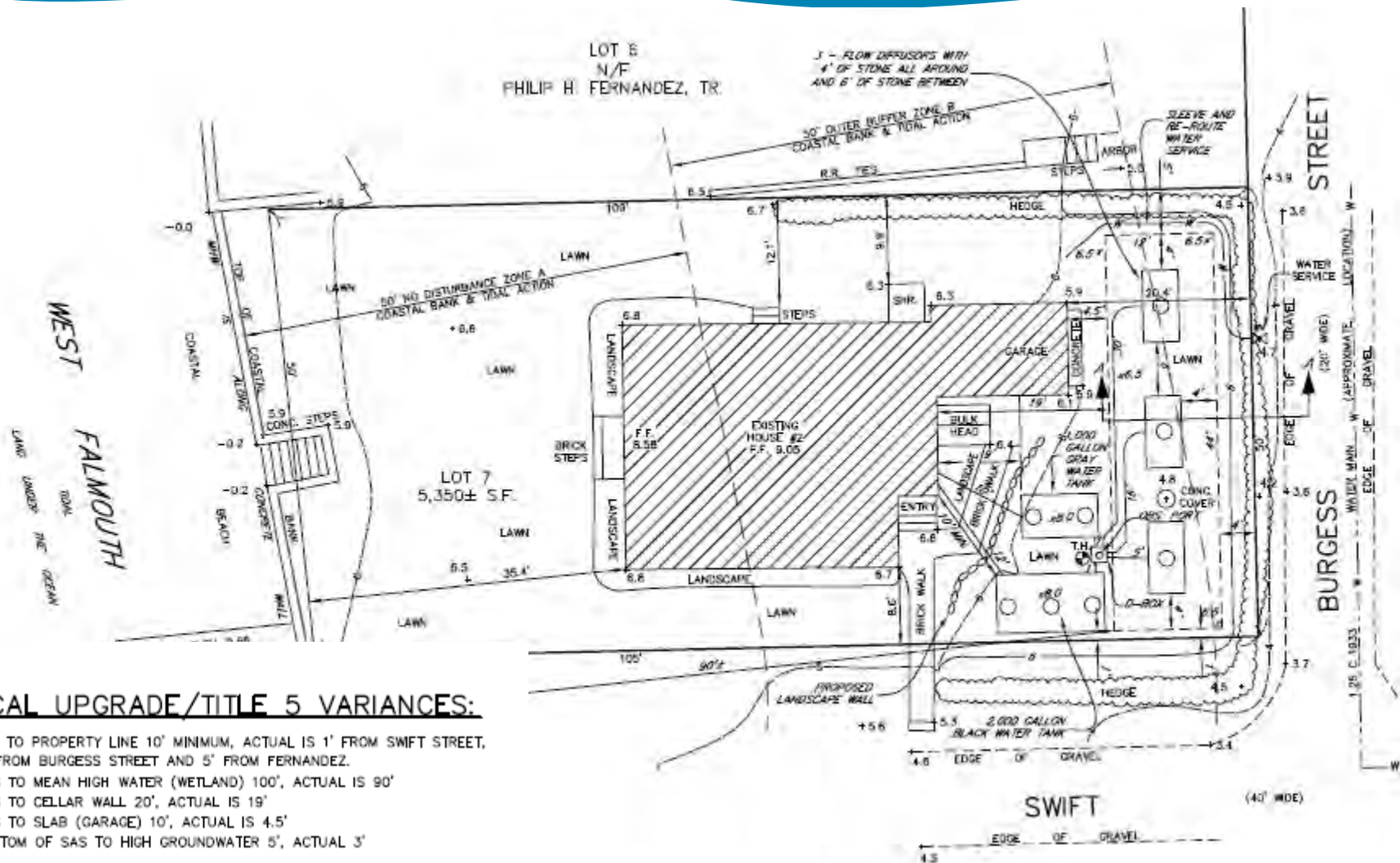
Installer Perspective

- Challenges related to retrofitting existing septic systems.
- Logistics of working on small lots
 - Material management and stockpiling
 - Tank delivery
 - Landscaping
- Overhead and underground utilities (Dig Safe and private markings)
- Equipment Limitations.
- Accuracy of As-Builts
- Electrical
- Dewatering
- Focus on Driveways with H-20 tanks

Blackwater Systems



Blackwater Systems



Blackwater System



Blackwater System



Blackwater System



Blackwater System



Blackwater System



Blackwater System



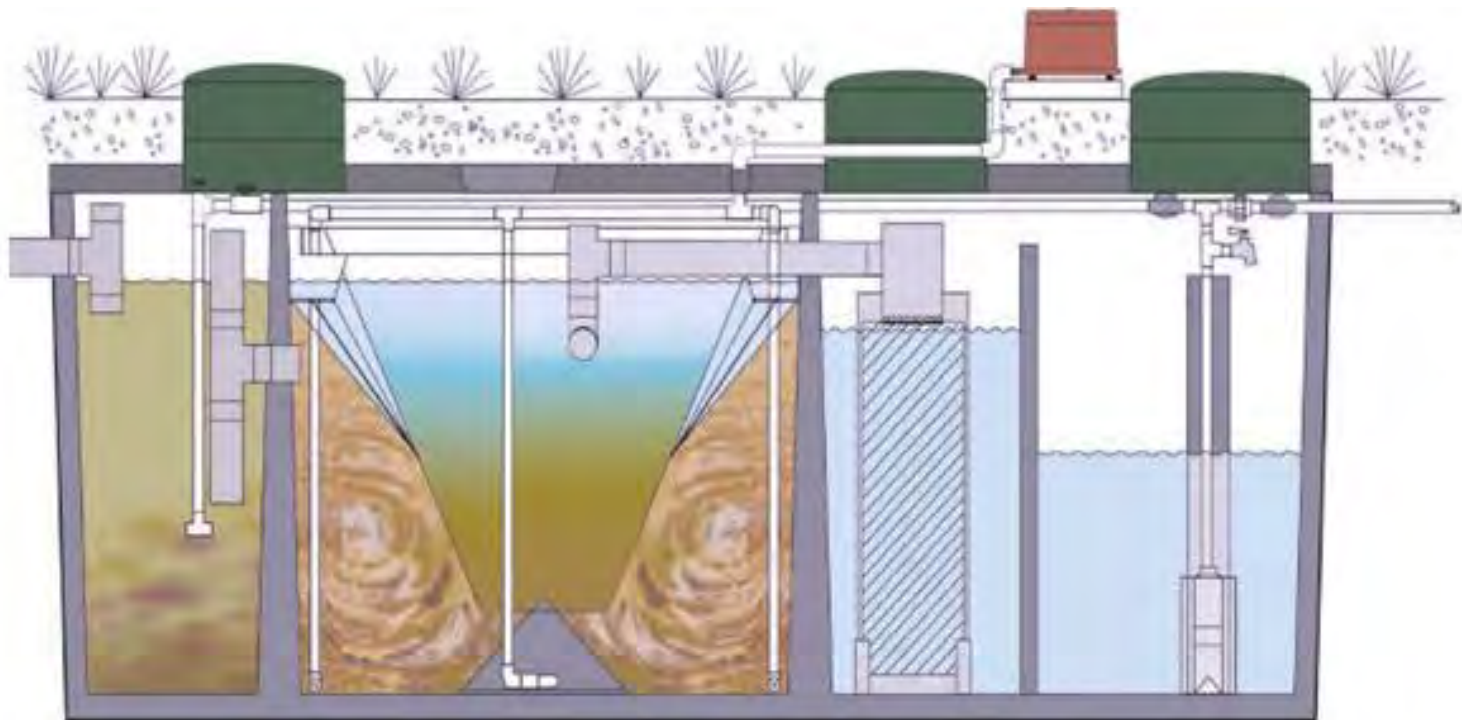
Blackwater System



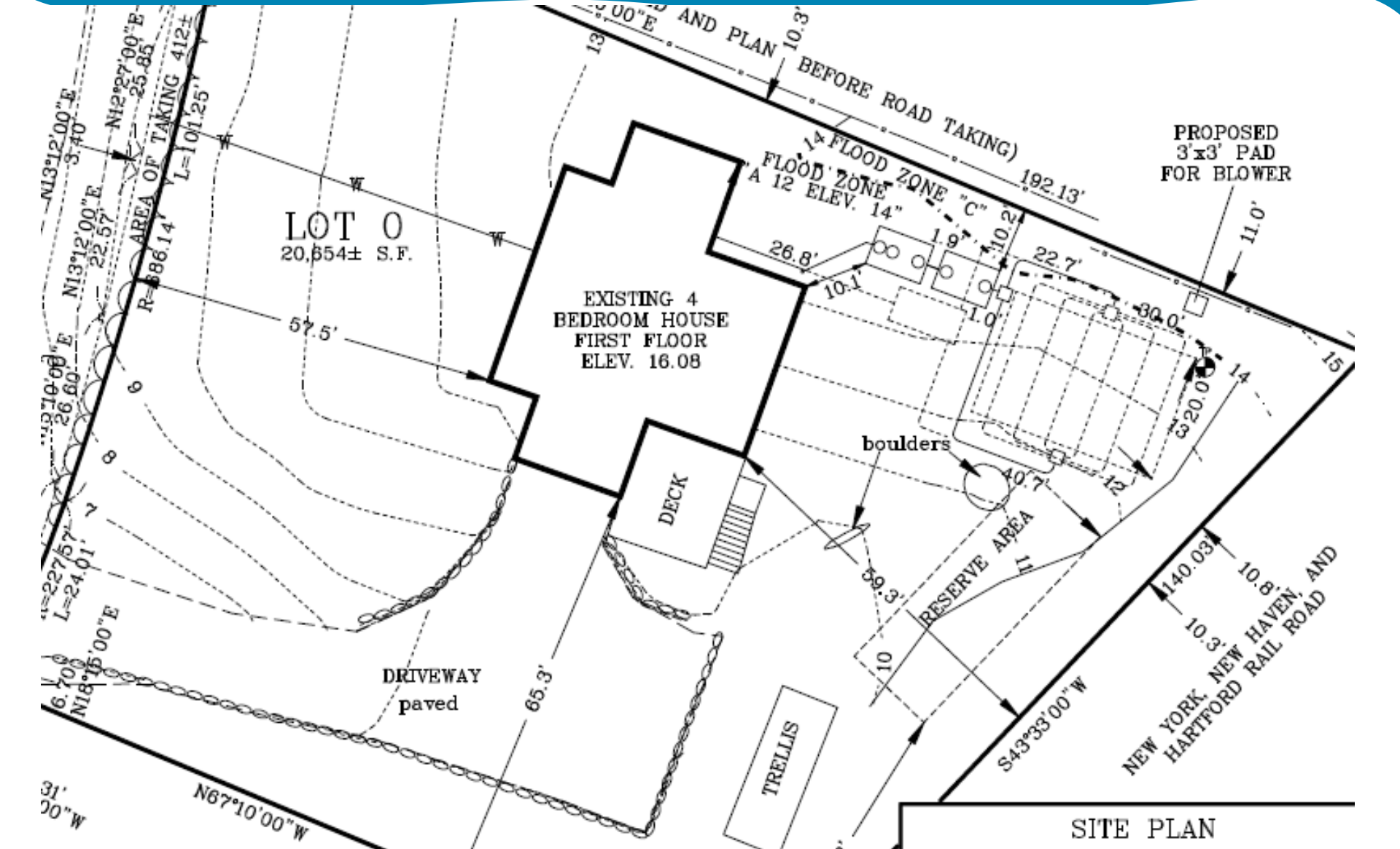
Blackwater System



Hoot Systems, LLC.



Hoot Installation



Hoot Installation



Hoot Installation



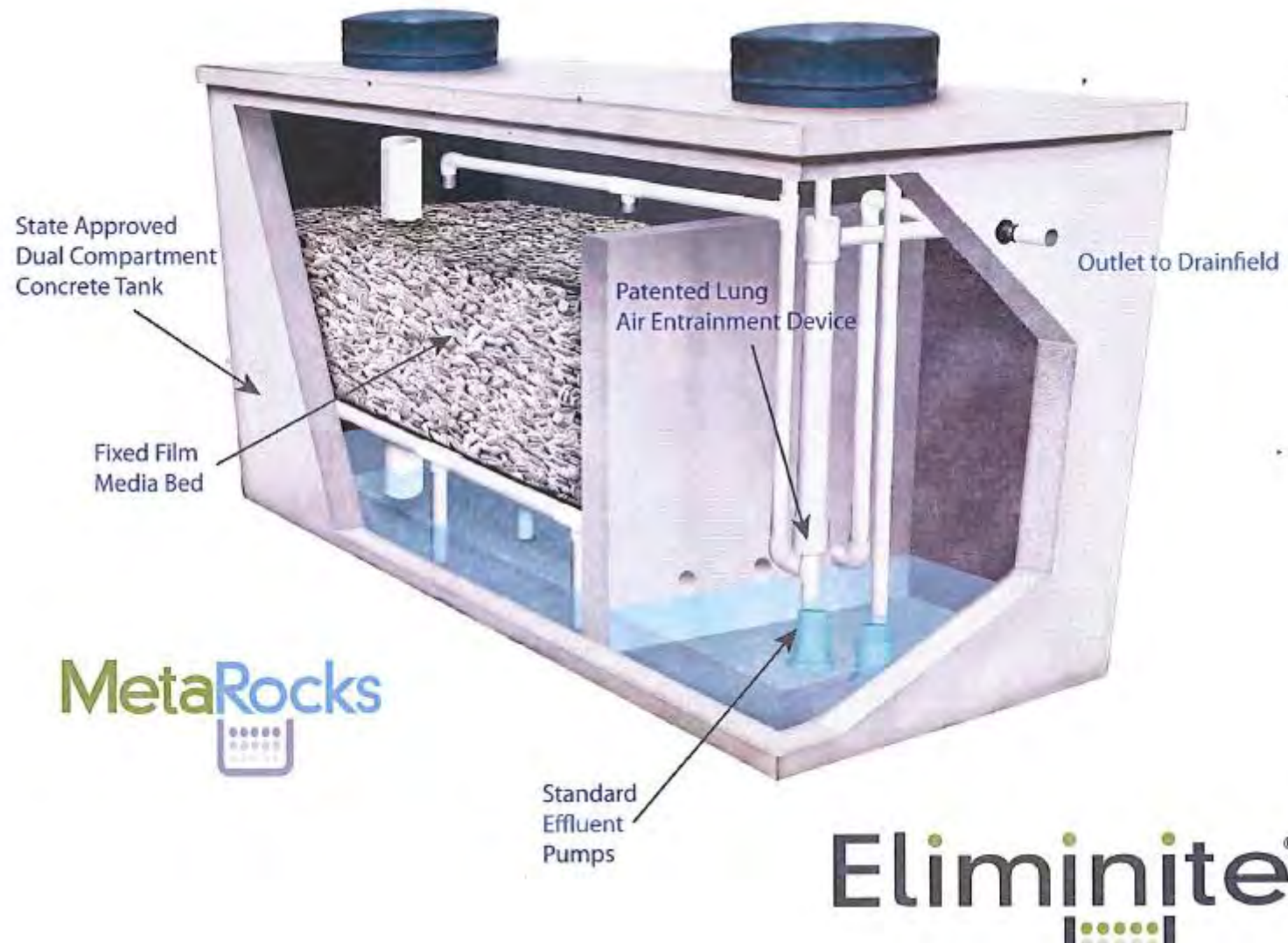
Hoot Installation



Hoot Installation



Eliminite™





Eliminite™



New Eliminite Tank

Existing D-Box

**Existing 1500 gal
Septic Tank**

Eliminite Install



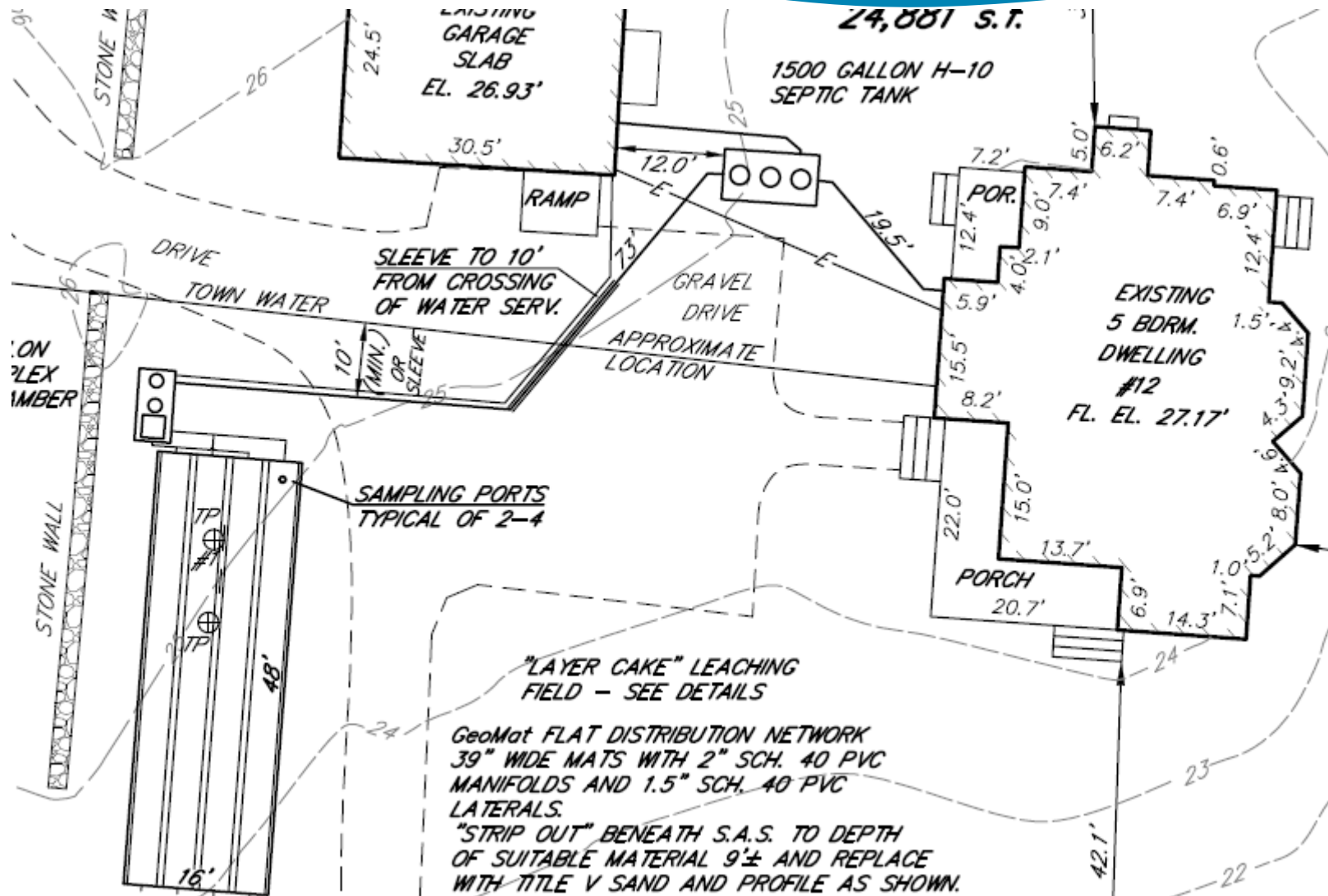
Eliminite Installation



Eliminite Installation



Layer STA



Layer Cake Installation – Upgrade from Cesspool



Layered STA Installation



Sampling and Results

20 Installations Complete

4 Technologies Installed

- 9 Blackwater Tanks
- 3 Eliminite Systems
- 7 Hoot Systems
- 1 Layer Cake

11 Cesspools Upgraded



Sampling and Results



Average Post Construction Concentration
14.6 mg/L Total Nitrogen or
5.5lbs/year/home

Average Pre Construction Concentration
121.25 mg/L Total Nitrogen or
45.8lbs/year/home



Costs



ITEM	AVERAGE COST	COST RANGE
Equipment (denitrification tanks)	\$8,437	\$4,146-\$10,625
Engineering	\$2,620	\$606-\$4,200
Installation (adding a nitrogen-reducing system to an existing Title 5 system)	\$11,096	\$10,600-\$15,350
Installation (full upgrade from a cesspool)	\$20,675	\$17,720-\$25,600
Landscaping	\$2,142.97	VARIABLE

	Average Cost Full Upgrade	Average Cost Add-On
Blackwater	\$26,799.44	\$14,520.13
Eliminite		\$20,760.49
Hoot	\$37,725.63	\$28,291.00

Questions?



- 
- A scenic view of a coastal town with houses and a body of water under a cloudy sky. The text is overlaid on the image.
- Field Visit
 - 2 Burgess Street Falmouth, MA
(Park along Swift Street and Burgess)
 - Credits
 - Workshop Evaluations
 - Layer Cake Project APRIL 17