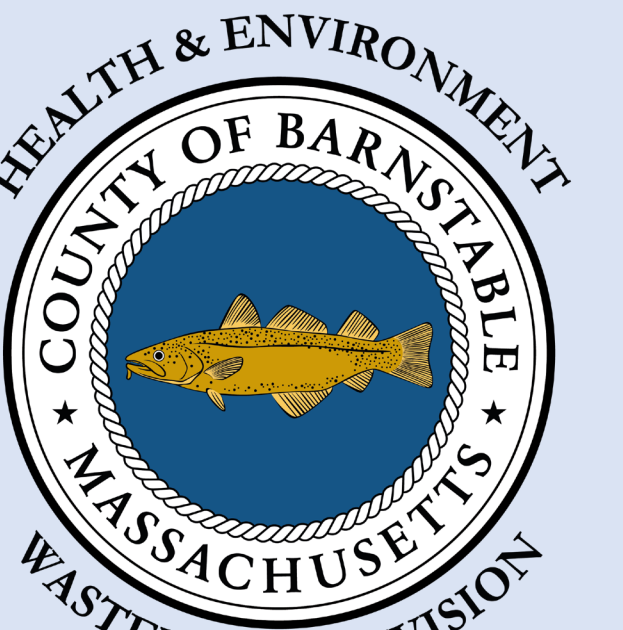


Shubael Pond Project Update:

An Innovative/Alternative Septic System Research Pilot and Demonstration

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Background:

Problem:

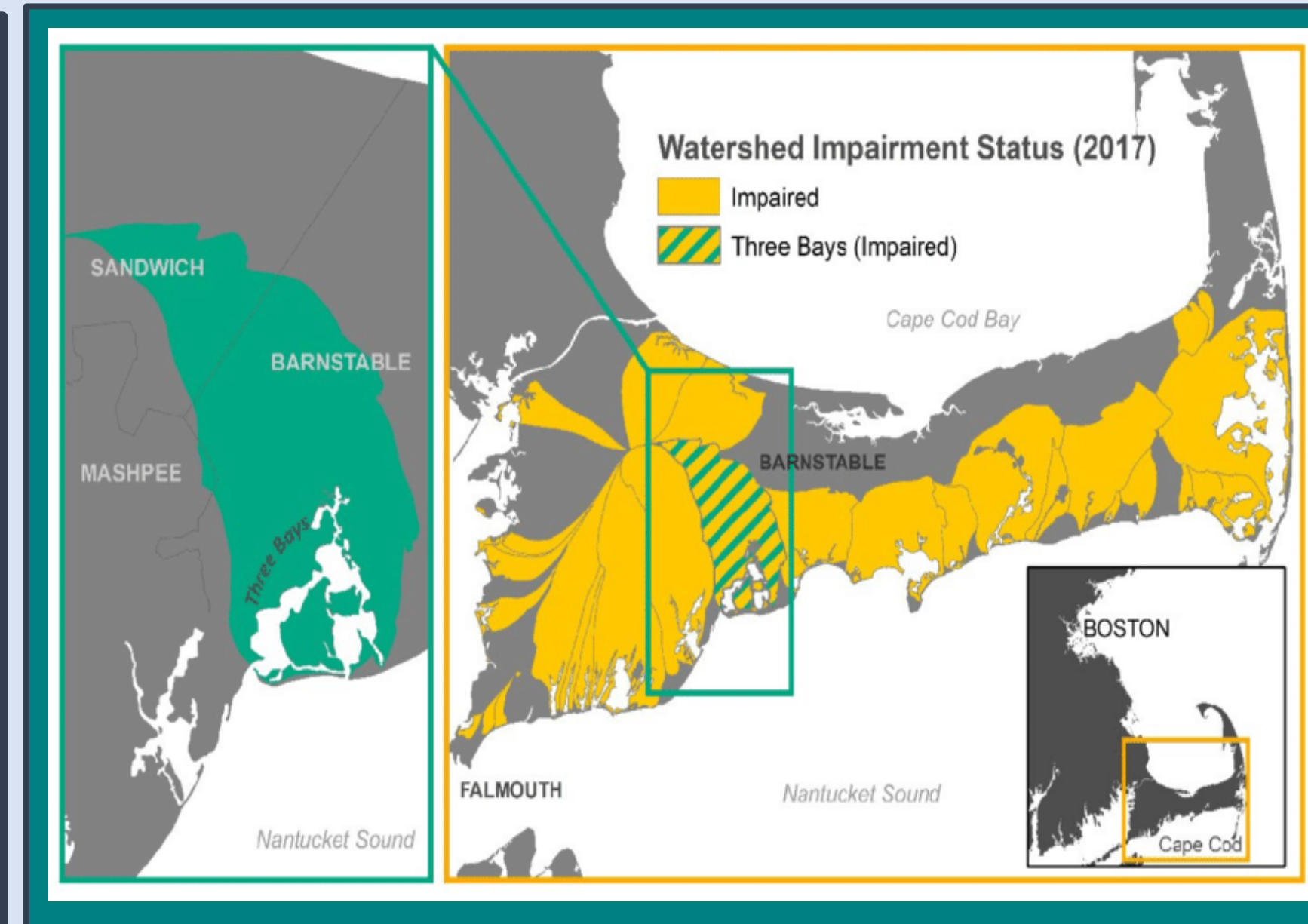
Impaired estuaries due to excess nutrients on Cape Cod, MA, largely from non-point sources (i.e., old and aging septic systems). Adverse impacts to water quality, ecosystems, recreation, coastal economy.

Project goals:

Inform watershed-based solutions for nutrient loading using non-traditional interventions in a manner that best meets stakeholder needs. Support stakeholders in meeting nutrient reduction goals. Identify Innovative/Alternative (I/A) nitrogen-removing septic system designs capable of reducing Total Nitrogen in effluent to **10 mg/L**.

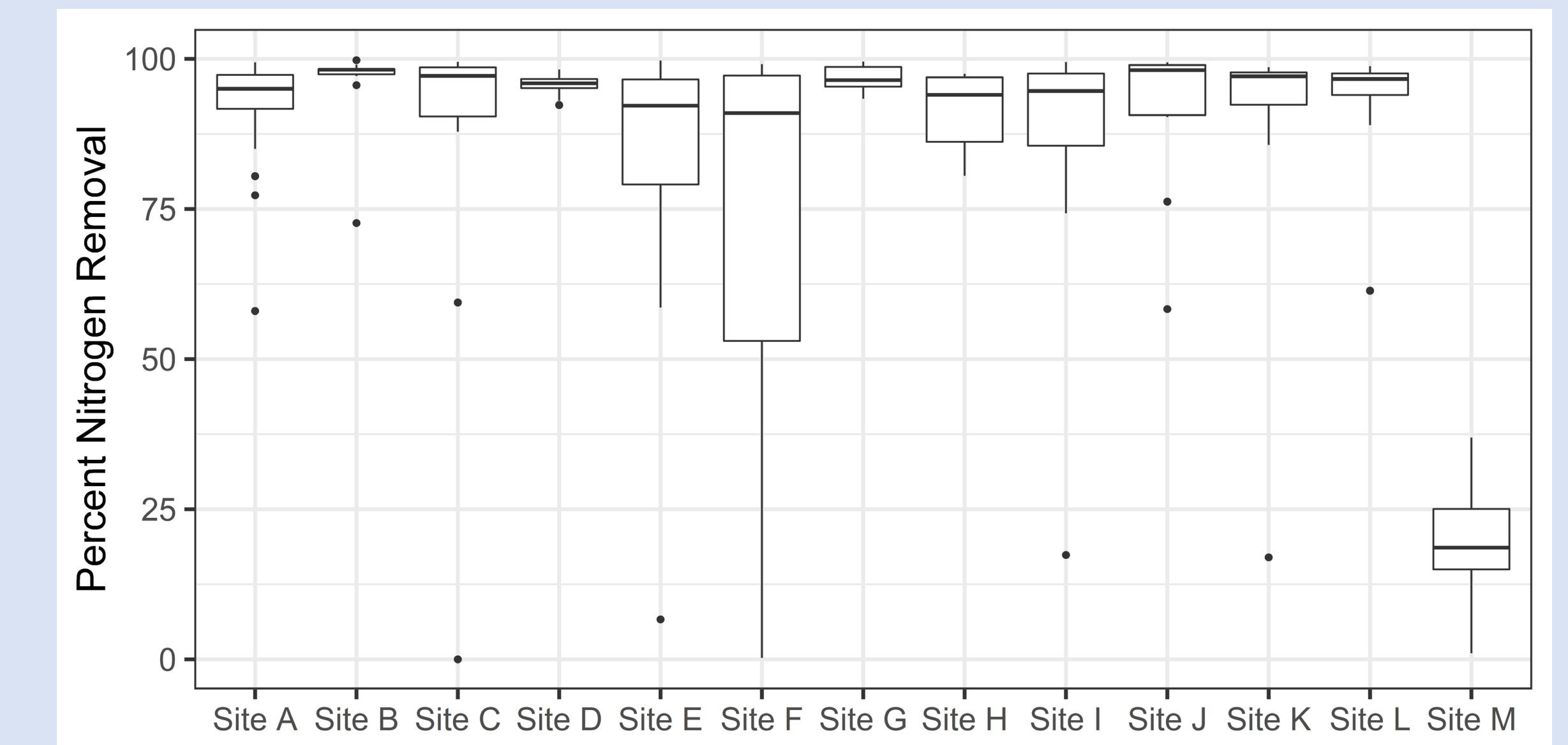
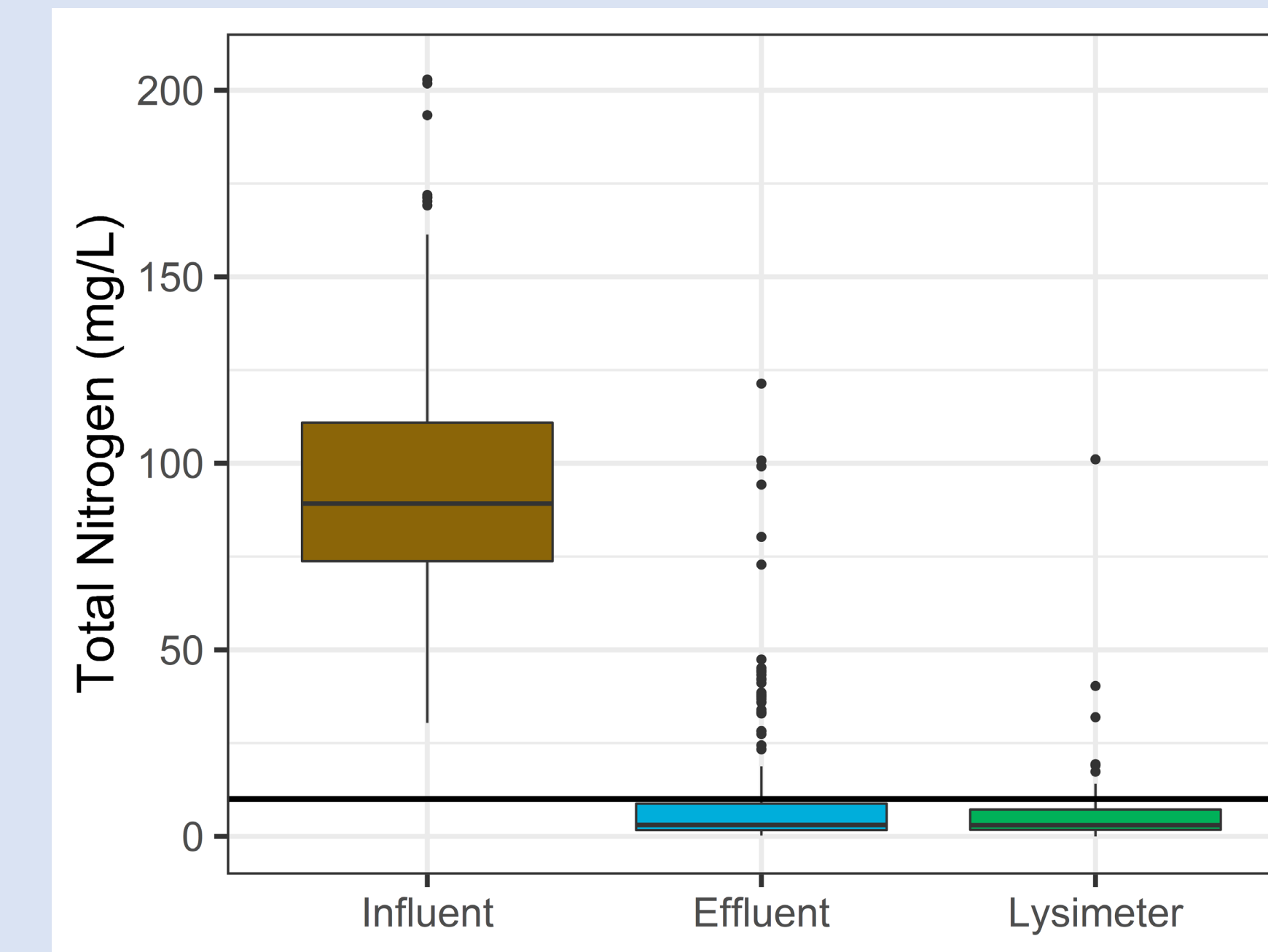
Project description: Pilot neighborhood-scale Innovative/Alternative (I/A) nitrogen-removing septic system deployment. Work with partners to support installation of two I/A designs (at 14 total households), monitor system performance, and look for signal in groundwater.

Site: Shubael Pond Neighborhood, in Three Bays Watershed, Barnstable MA (Cape Cod).



Map of Three Bays, Cape Cod: impaired watersheds are shown in yellow, and Three Bays is highlighted in green [Twichell et al. 2019]

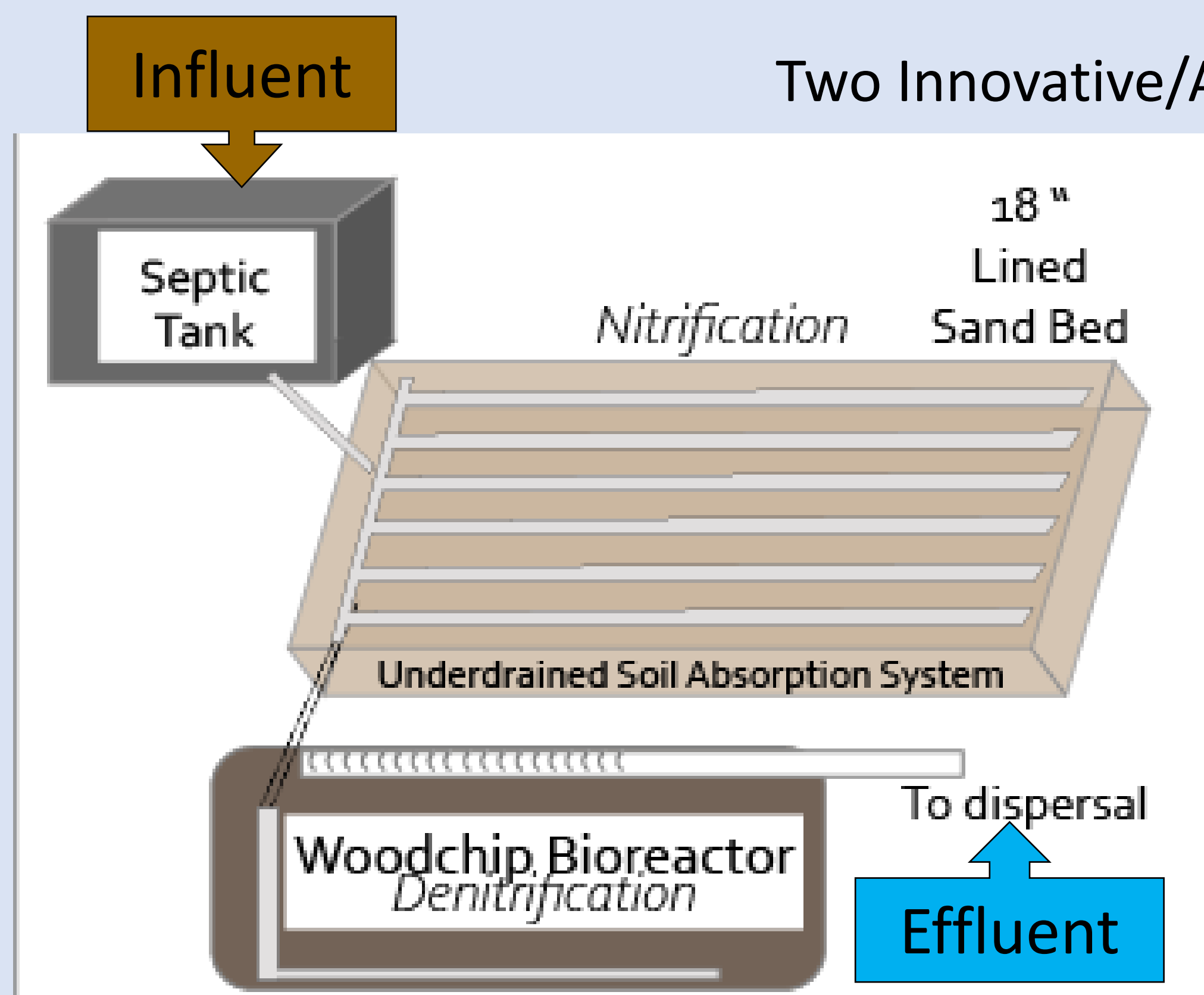
Nitrogen Removing Performance:



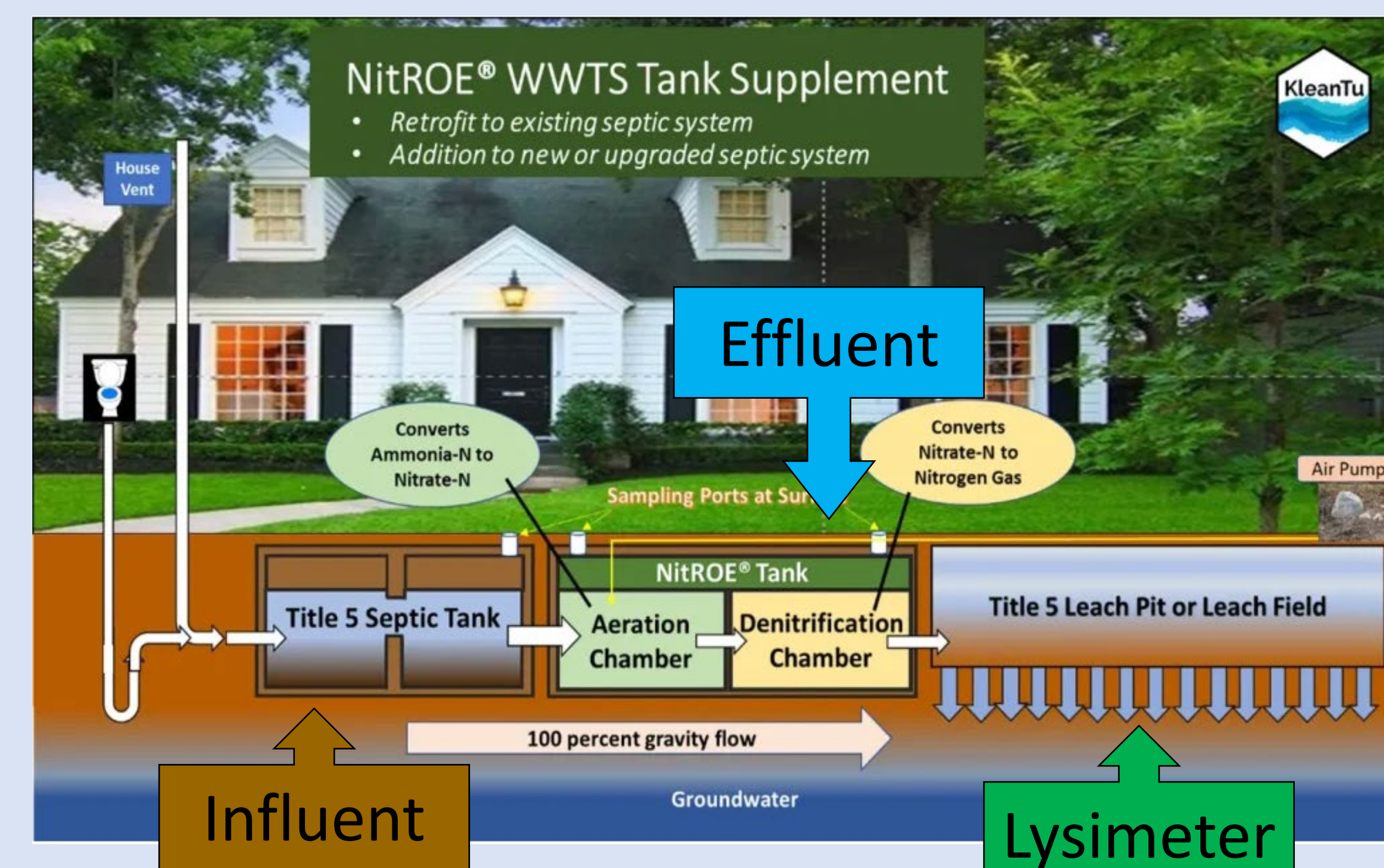
Nitrogen removing performance of thirteen nitrogen-removing I/A septic systems in Shubael Pond, MA. Top left graph: Box-and-whiskers plot of all systems influent, effluent and lysimeter sampling location data. Black line at 10 mg/L to represent project goal. Top right graph: Percent total nitrogen removal in each of the systems. Bottom left graph: Each system data across all sampling dates.

Methods:

Two Innovative/Alternative Septic System Technologies:

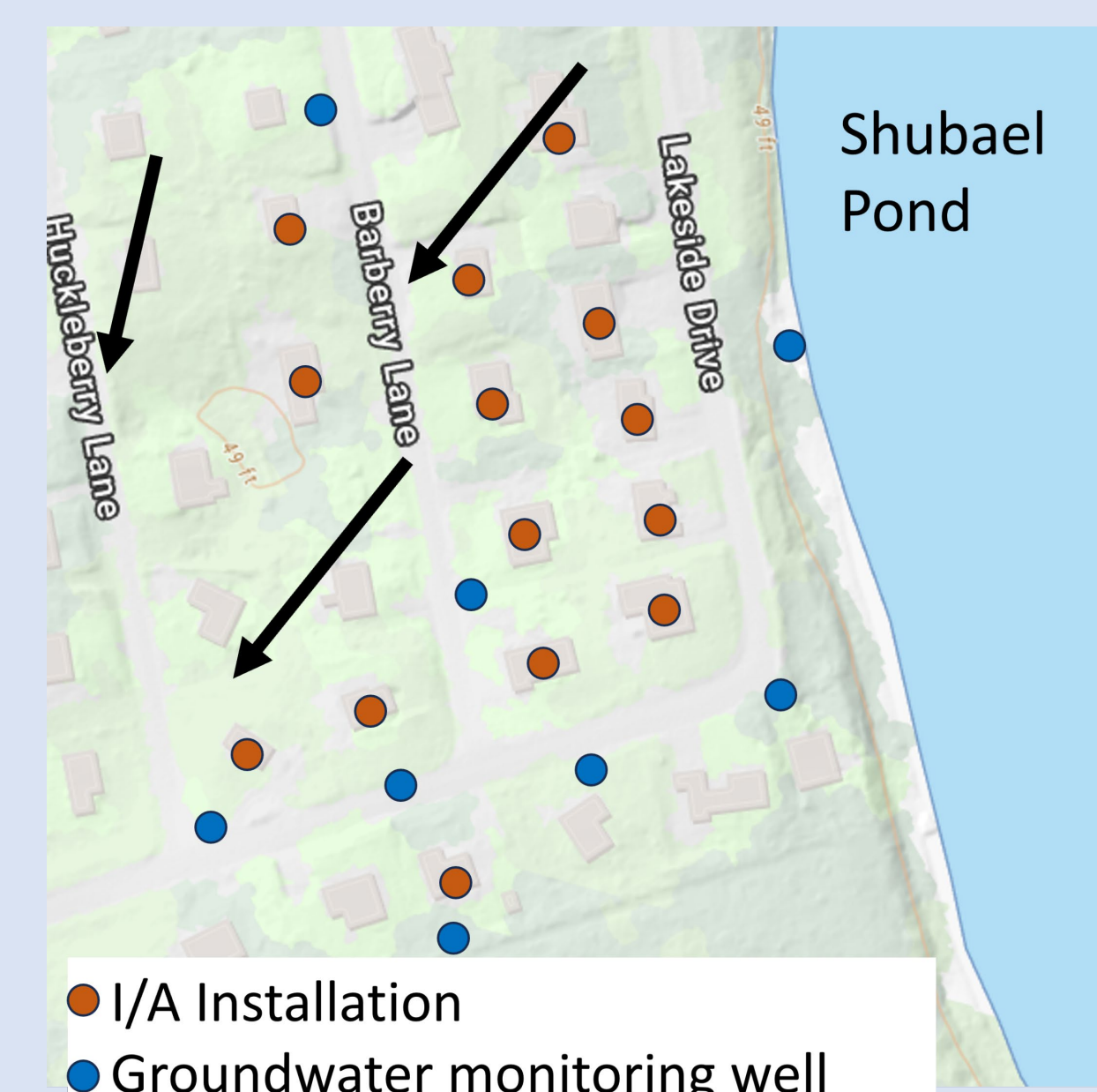


Woodchip Bioreactor (WBR). Nonproprietary Technology developed in collaboration with Stony Brook University. One system installed in Shubael Pond neighborhood. Installation funded by the Barnstable Clean Water Coalition and the EPA.



NitROE by KleanTU. Proprietary Technology developed in Massachusetts, USA. Twelve systems installed in Shubael Pond neighborhood. Installation funded by the Barnstable Clean Water Coalition

Sampling Scheme:



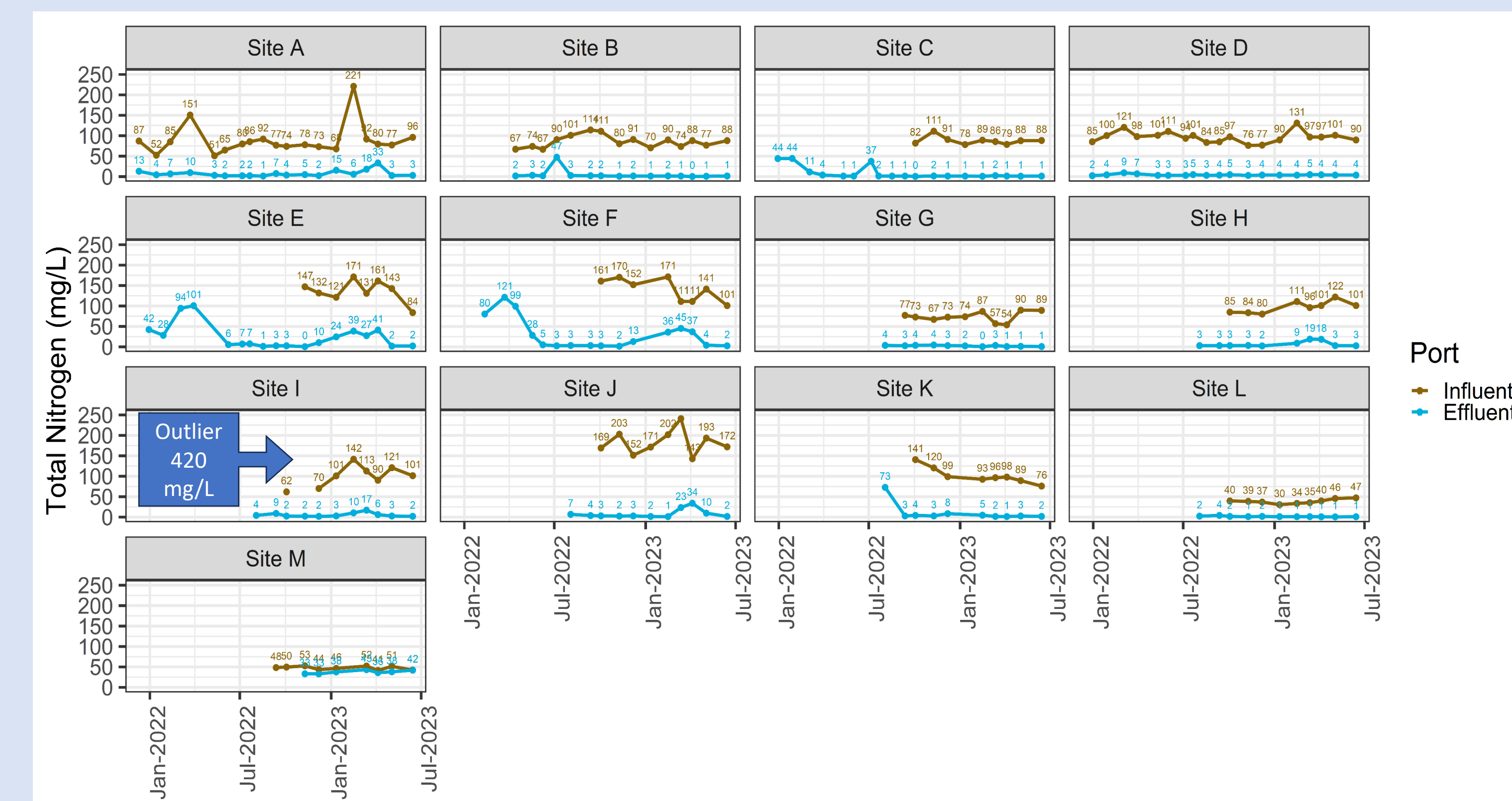
- Monthly septic system sampling
- influent and effluent
 - Performed by MASSTC
 - Continuous water flow data to calculate load

- Quarterly groundwater sampling
- Extensive well network
 - Wells in groundwater flow path
 - Wells near new pilot installations
 - Wells away from pilot installations (control)

Average influent TN: 98 mg/L

Average TN removal: 86%

Average effluent TN: 10 mg/L



Conclusions and What's Next?

- System performance meeting goal of 10 mg/L
- Calculate load using water use data
- The WBR system is underperforming; a chance to identify and address issues that might affect expansion of I/A as septic infrastructure
- Continue sampling Shubael Pond systems. Goal of five years of data
- Troubleshoot the WBR system. Address high water use.
- Look for patterns in groundwater results from USGS
- Continue to engage stakeholders



Project Partner



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