

# Getting the Nitrogen out

LEARNING FROM NITROGEN  
REMOVING SEPTIC SYSTEM  
DATA TO FIND A PATH FORWARD

SARA WIGGINTON, PHD

# Barnstable County Dept of Health and Environment - Wastewater Division:

- MASSTC
- Aquifund
- Advanced Septic Systems Tracking Database
- Septic Utility Program

## The Massachusetts Alternative Septic System Test Center

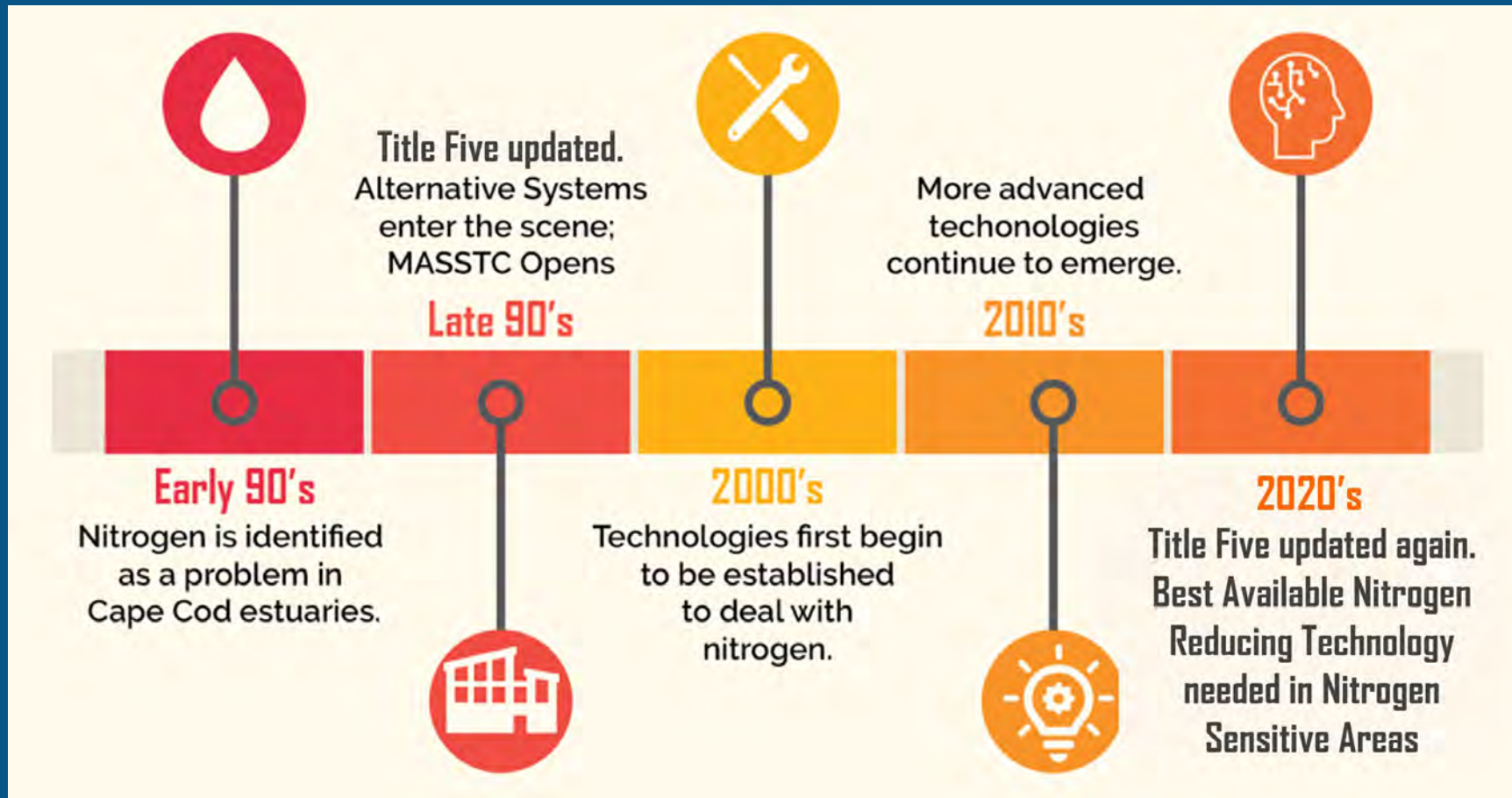




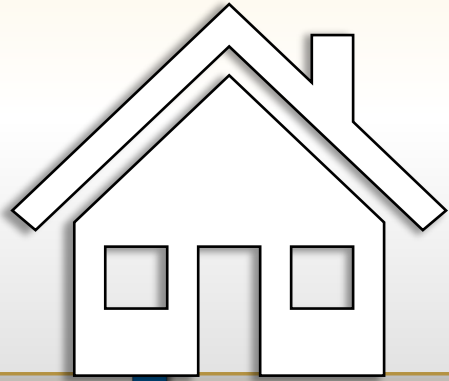
- Established 1999
- Premier 3rd party testing for septic technology
- Test bed for advanced septic systems
- Global reach
- Public tours and outreach



# Wastewater Treatment in Cape Cod



# “Standard” System



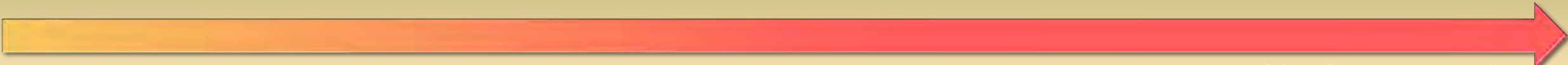
Septic Tank Effluent  
~80 mg/L N  
~8-10 mg/L P



~35% Nitrogen Gas

~65% Nitrogen  
~75% Phosphorus

Groundwater



## Water quality 'unacceptable' for 90% of Cape Cod's coast

January 17, 2024 By [Barbara Moran](#)



### As temperatures rise, a 'nightmare' of toxic algae plagues the hidden gems of Cape Cod

By [David Abel](#) Globe Staff. Updated July 31, 2020, 10:43 a.m.



### Pollution is threatening Cape Cod's famous waters. Its towns are spending hundreds of millions to head off an environmental disaster.

By [Beth Treffeisen](#) Globe Correspondent. Updated August 18, 2023, 6:23 p.m.

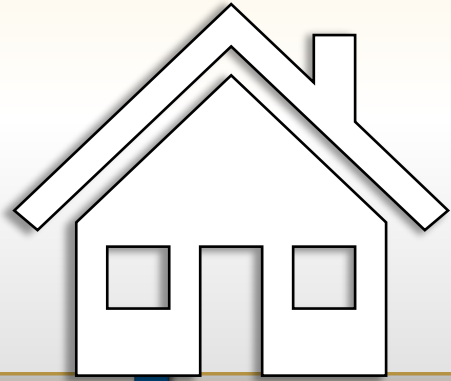


Algae bloom in West Reservoir, Harwich, Massachusetts, on Aug. 21, 2023. (Courtesy Association to Preserve Cape Cod)

### *A Toxic Stew on Cape Cod: Human Waste and Warming Water*

Climate change is contributing to electric-green algae blooms. Massachusetts wants a cleanup of the antiquated septic systems feeding the mess, but it could cost billions.

# Innovative/Alternative Nitrogen Removing System



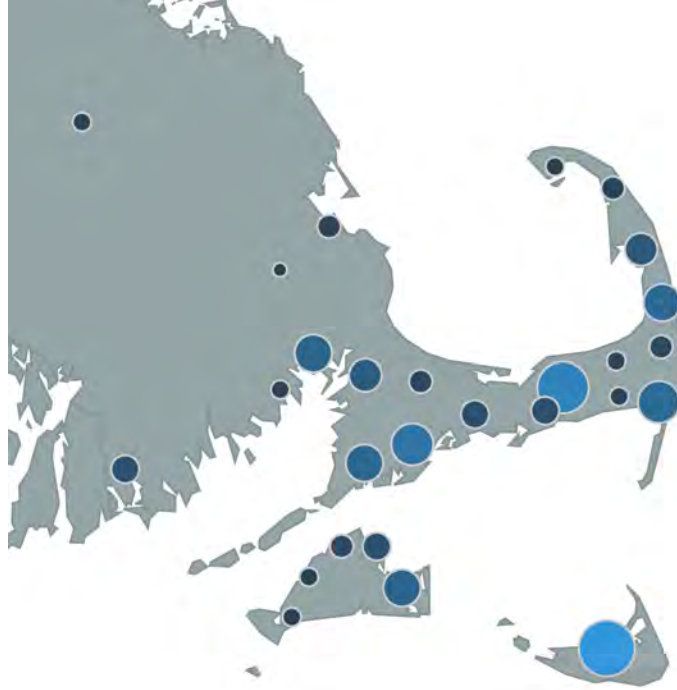
~85-90% Nitrogen Gas

~5% Nitrogen Gas

< 10% Nitrogen  
~75% Phosphorus

Groundwater

# Barnstable County I/A Database



## Sampling Statistics

4,621 Permits

55,886 Samples

374,041 Datapoints

## Barnstable County Septic Management Program

Sara Wigginton - Barnstable County DHE

5:20 pm

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[Home](#) > [Samples](#) > [Submit Sample](#)

### Search Permits

#### Permit Numbers

Permit Number

Municipality Permit Number

#### Location

Address 1

Municipality

#### Owner

Last Name

#### System Components

Serial Number



# Data in the database:

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$$TN = TKN + NO_3 + NO_2$$

Total Nitrogen = Total Kjeldahl Nitrogen + Nitrate + Nitrite

Please note that this list of technologies is non-exhaustive, and inclusion of a technology or manufacturer on this list in no way constitutes an endorsement or recommendation by MASSTC or Barnstable County.

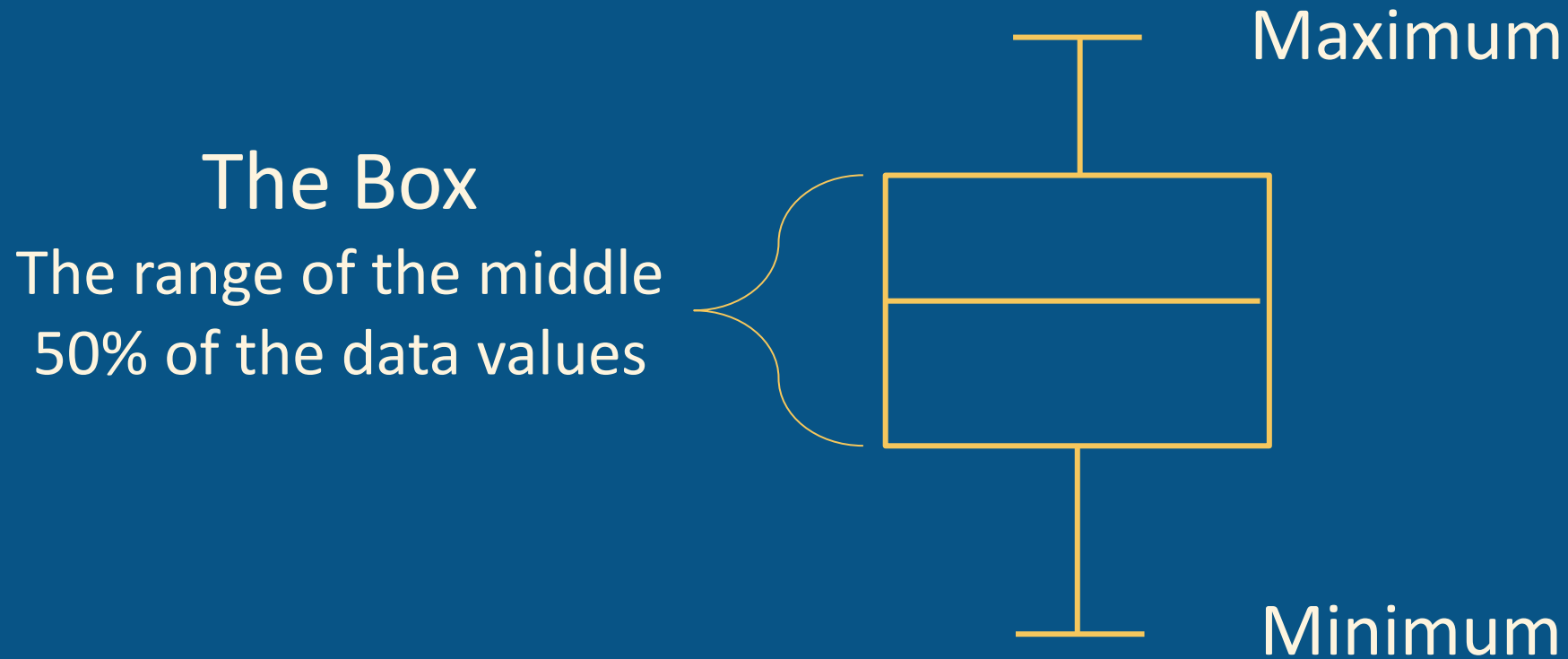
SORT:

|   |   |   |  |  |  |  |
|---|---|---|--|--|--|--|
| <b>AdvanTex</b><br>Orengo Systems, Inc.                                 | <b>Aerobic Recovery System</b><br>On-Site Treatment Systems™  | <b>Amphidrome</b><br>F.R. Mahony & Associates, Inc.       | <b>BioBarrier MBR</b><br>Bio-Microbics               | <b>Bioclere</b><br>Aquapoint.3, LLC                    | <b>Busse-MF</b><br>Busse Green Technologies Inc. | <b>CERES III</b><br>None   |
| <b>Clean Solution Treatment System</b><br>Wastewater Alternatives, Inc. | <b>Clear Rex Bubblers</b><br>PekaSys Inc.                     | <b>Clivus</b><br>Clivus Multrum                           | <b>Cultec Chambers</b><br>CULTEC, Inc.               | <b>ECOPOD-N</b><br>Delta Environmental – Pentair Water | <b>Eliminite</b><br>Eliminite                    | <b>Enviro-Septic Wastewater Treatment System</b><br>Presby Environmental, Inc. |
| <b>FAST</b><br>Bio-Microbics  | <b>Fuji Clean</b><br>Fuji Clean USA, LLC                      | <b>Geoflow Subsurface Drip</b><br>Geoflow, Inc.           | <b>GPC Filter</b><br>Ground Penetrating Carbon, Inc. | <b>HOOT</b><br>Hoot Systems, LLC                       | <b>Jet</b><br>Jet, Inc.                          | <b>Layer Cake</b><br>Non-Proprietary   |
| <b>Nitrex</b><br>Lombardo Associates                                    | <b>NITROE</b><br>KleanTu LLC                                  | <b>PERC-RITE Drip Dispersal</b><br>American Manufacturing | <b>PhosRID</b><br>Lombardo Associates                | <b>Recirculating Sand Filter</b><br>None               | <b>SantOE</b><br>KleanTu LLC                     | <b>SeptiTech</b><br>Bio-Microbics  |
| <b>SoilAir™</b><br>GEOMATRIX  | <b>Waterloo Biofilter</b><br>Waterloo Biofilter Systems, Inc. | <b>Waterloo EC-P</b><br>Waterloo Biofilter Systems, Inc.  | <b>White Knight™</b><br>Knight Treatment Systems     |  |  |  |

# Database Public View

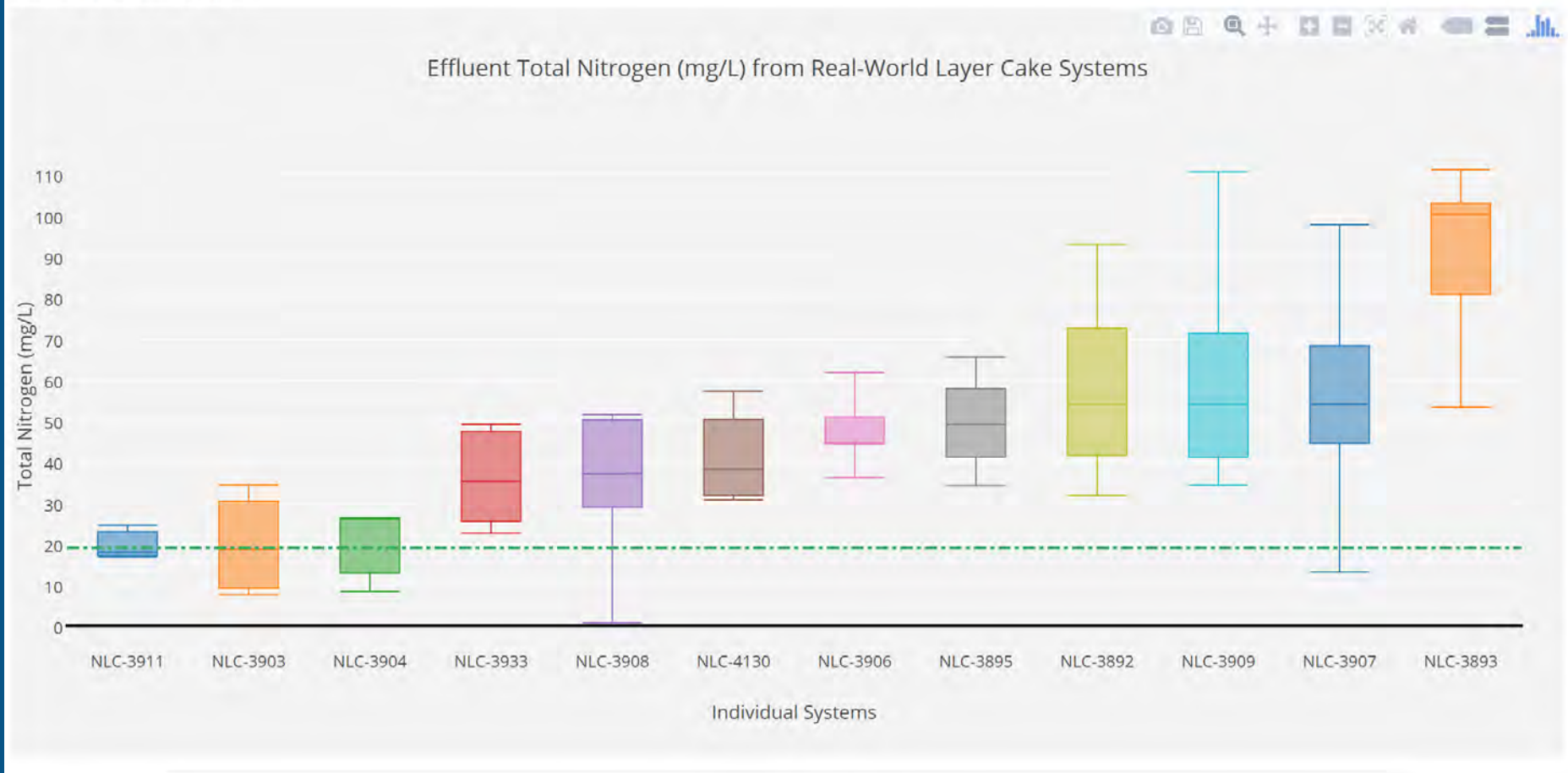
# Box and Whisker Plots

We often use median data to represent performance



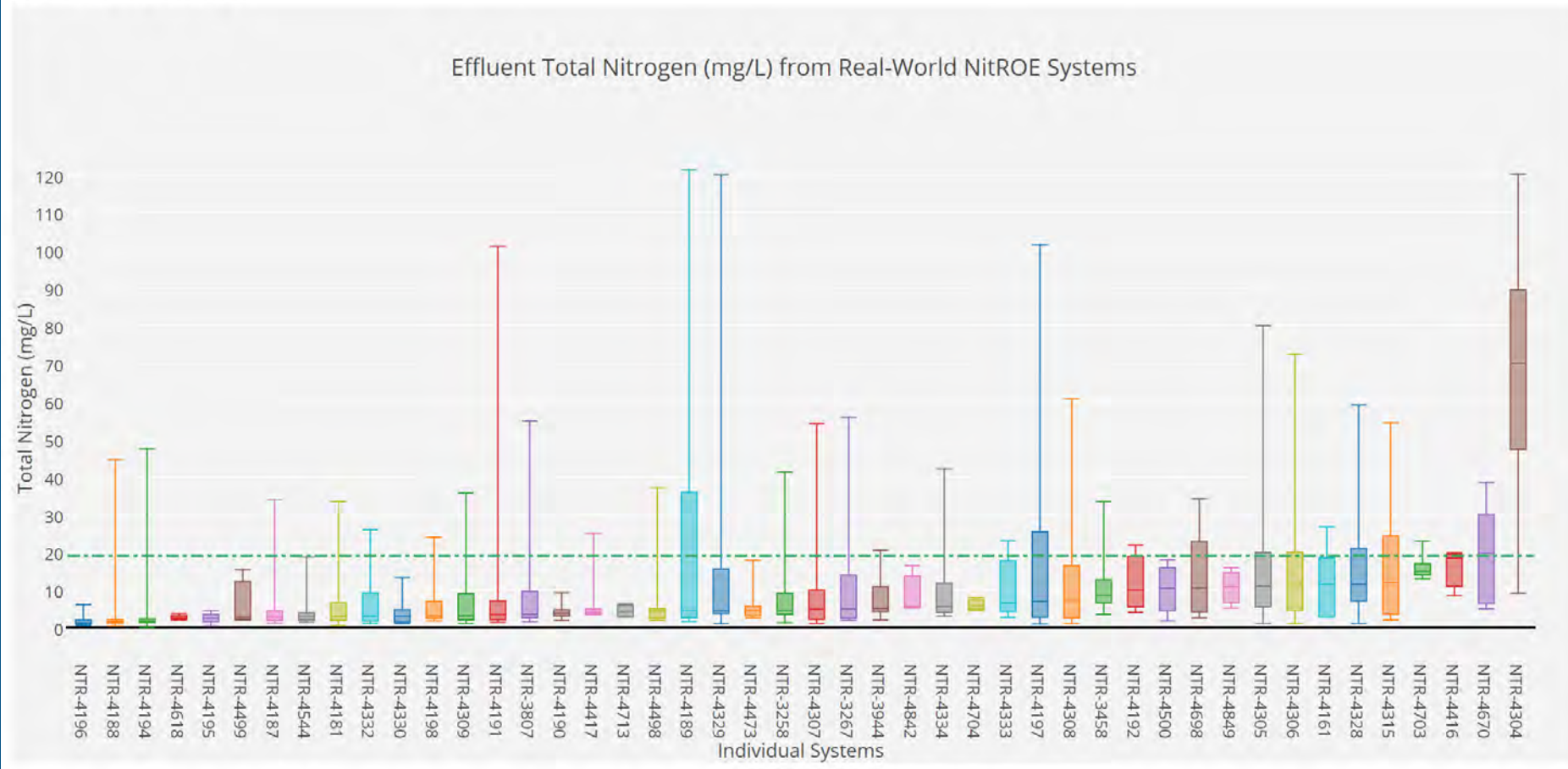
# Real world database examples

REAL-WORLD DATA



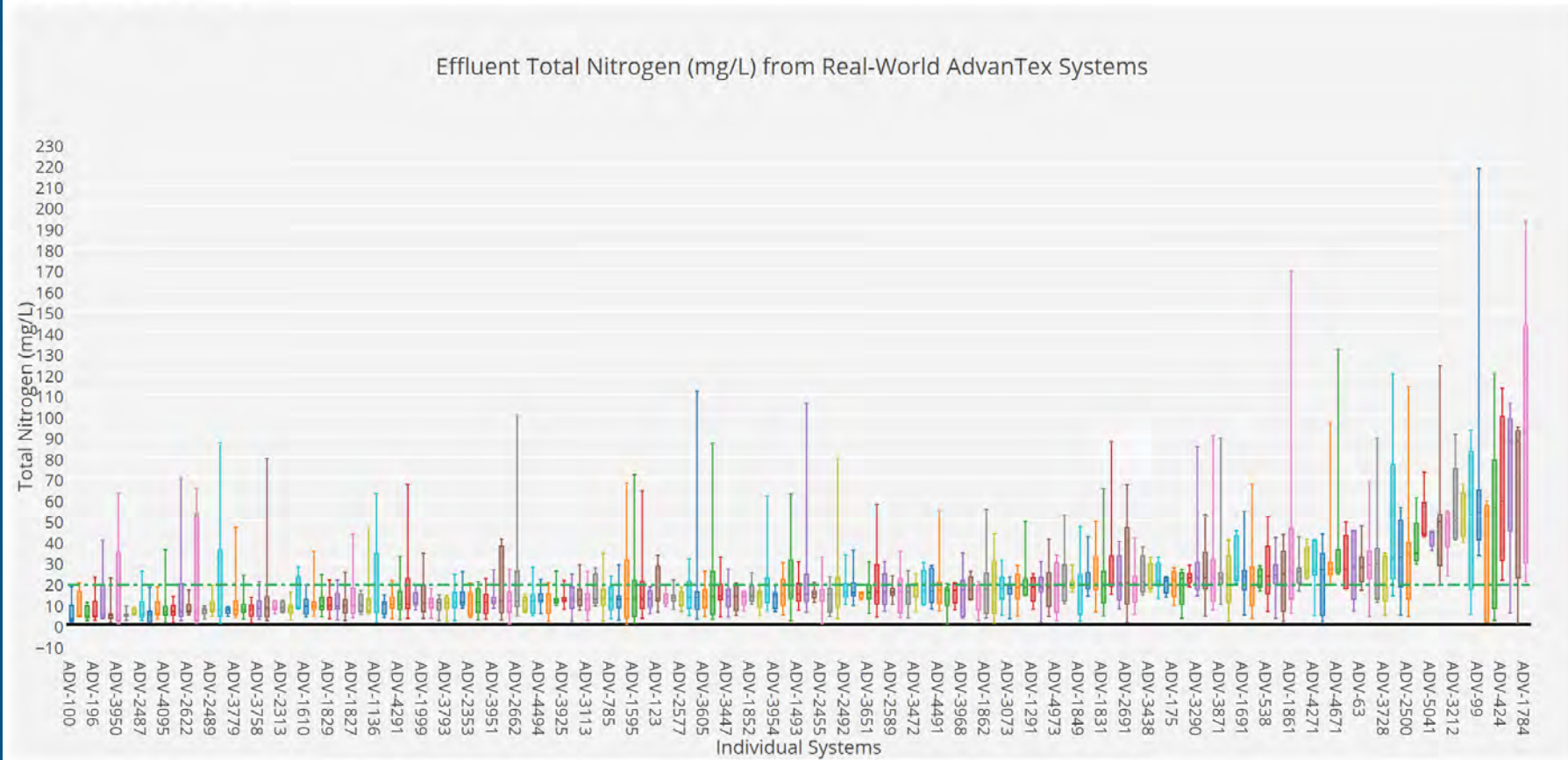
# Real world database examples

## REAL-WORLD DATA



# Real world database examples

## REAL-WORLD DATA



# Database summary

|              | % of systems with median $\leq 19$ mg/L | Number of Systems |
|--------------|---|-------------------|
| Technology 1 | 36%                                     | 792               |
| Technology 2 | 62%                                     | 96                |
| Technology 3 | 60%                                     | 106               |
| Technology 4 | 71%                                     | 142               |
| Technology 5 | 36%                                     | 164               |
| Technology 6 | 87%                                     | 61                |

- Most common six systems
- A look 5-years back (2018-2023)
- Represents ~1/2 the systems in the database
- Only sites with 3+ samples collected
- Removed incomplete data (e.x. TN reported with no TKN)

# Enhanced I/A systems?

|           | % of systems with median $\leq 19$ mg/L | Number of Systems |
|-----------|---|-------------------|
| FAST      | 36%                                     | 792               |
| SeptiTech | 62%                                     | 96                |
| Bioclere  | 60%                                     | 106               |
| Advantex  | 71%                                     | 142               |
| Singular  | 36%                                     | 164               |
| NitROE    | 87%                                     | 61                |

Would need significant modifications across the technology



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A promising candidate!

Special thank you to George Heufelder and Emily Michele Olmsted for cleaning and crunching this data

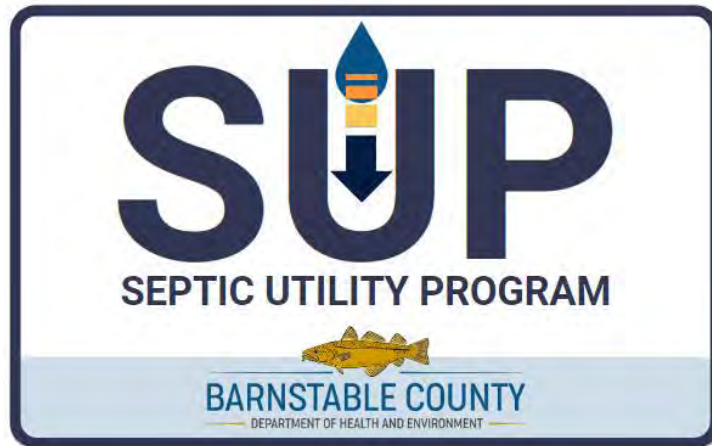
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What would happen if management was centralized?

# Protecting our assets

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# Questions?

THANK YOU!

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