

Estimating Nitrogen Loading from Onsite Wastewater Treatment Systems in Coastal Connecticut

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**CDM
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NEWEA – 2021 Annual Conference & Exhibit



AGENDA

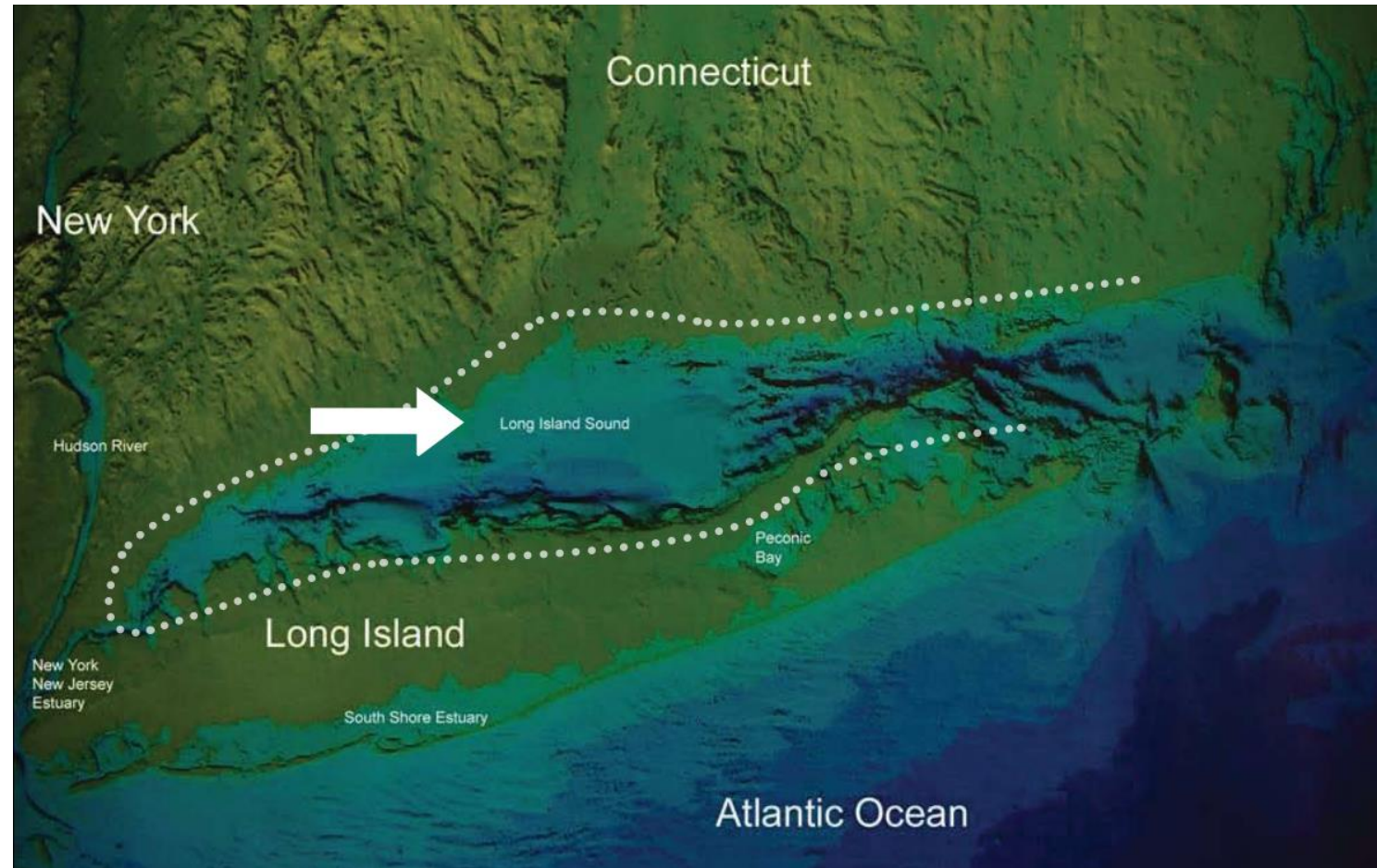
- Background
- Project Goals, Methods, and Results
 - Septic System Inventory
 - Develop Nitrogen Load Estimates
 - Develop Nitrogen Attenuation Estimates
- A Database Approach to Modeling
- Data Driven Dashboards



Background

Long Island Sound

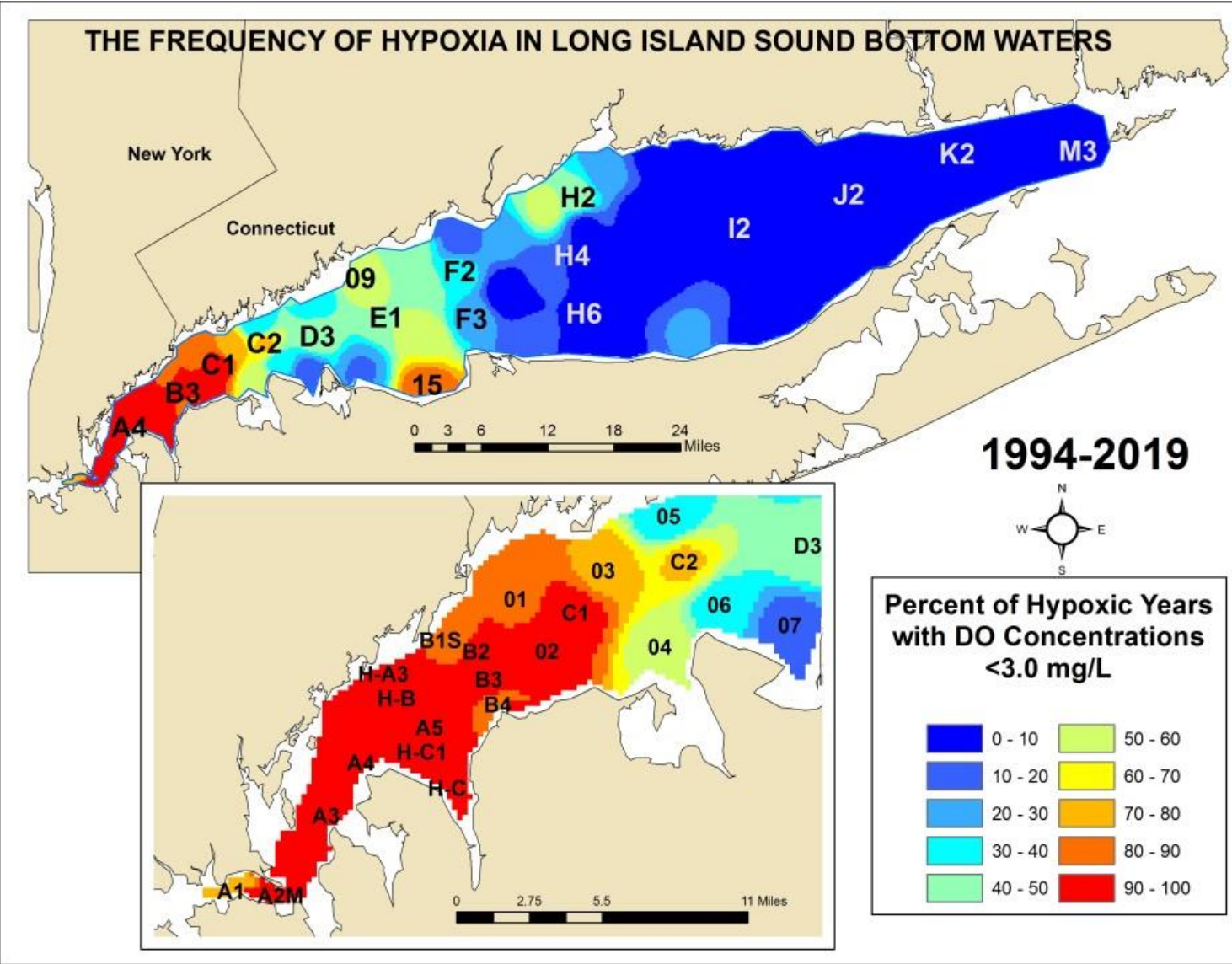
- 600 miles of coastline
- 115 harbors, bays, and coves
- 16,820 square miles of tributary area



Hypoxic Long Island Sound



Menhaden kill, along the Mianus River



CT Second Generation Nitrogen Strategy

- Load reduction goals set by 2001 TMDL were met in 2012 largely through wastewater treatment plant upgrades
 - Water quality issues associated with nitrogen persist
- Connecticut is committed to additional focusing on three areas:



WWTPs



Nonpoint Sources &
Stormwater



Embayments

Connecticut Embayments on LIS

Jamie Vaudrey |
[Marine Sciences \(uconn.edu\)](https://marine.sci.uconn.edu/)

- UCONN study of all 82 embayments in Connecticut
- Assess eutrophication potential and evaluate sources of nitrogen to embayments

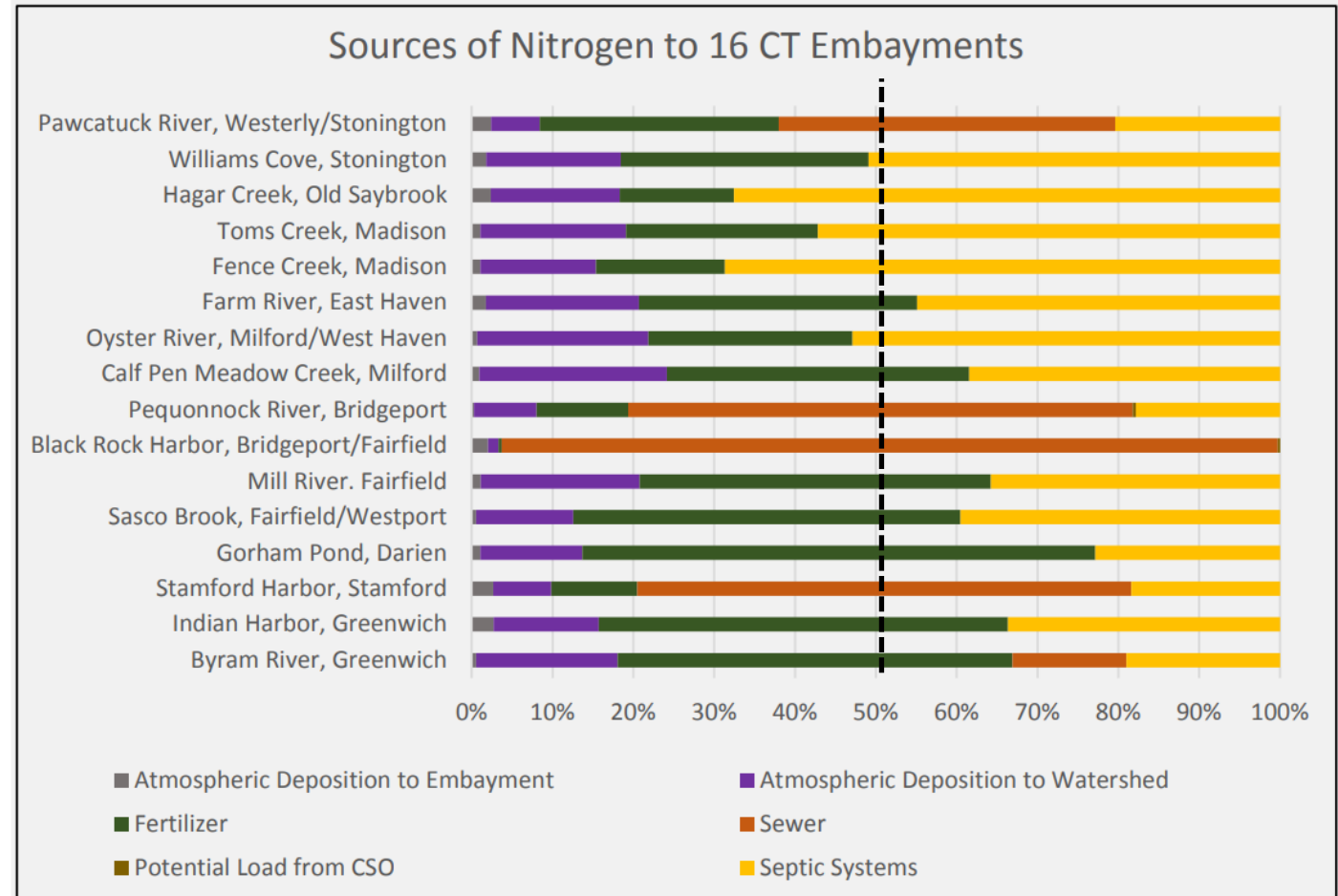


Figure 6. Proportion of sources to Connecticut's 16 Embayments with highest Nitrogen loads (scaled to embayment area).



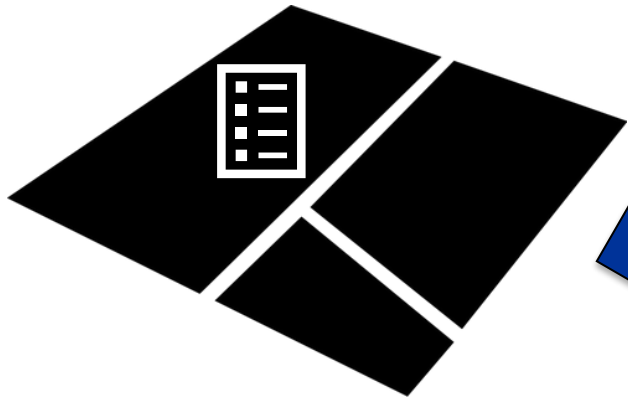
Project Goal: Improve Septic Inventory and Nitrogen Load Estimates for 10 Watersheds

10 Watersheds Evaluated

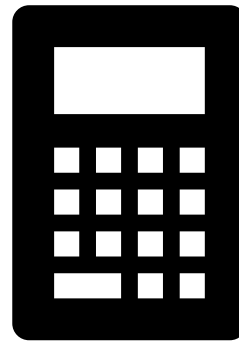


Strategy to Improve Septic Inventory and Nitrogen Load Estimates

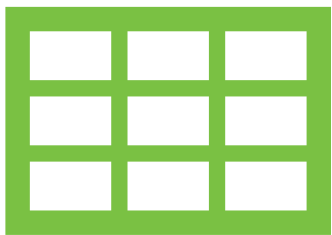
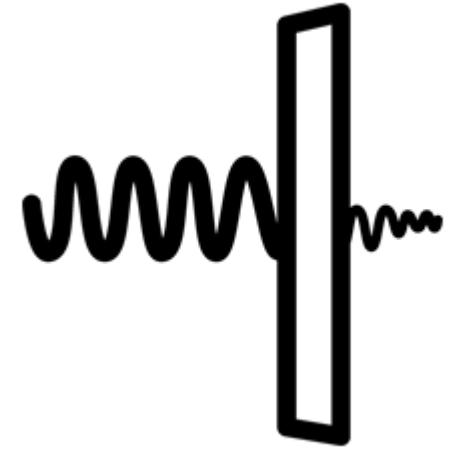
Parcel Specific Inventory
and U.S. Census Data



Site Specific
Loading Factors



Attenuation Estimates



Summary Tables



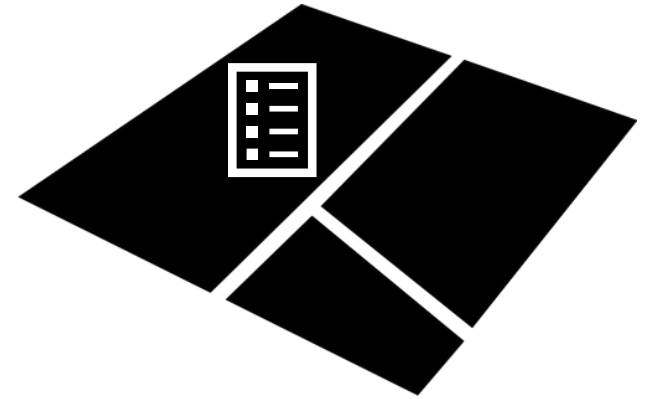
Spatial Database



Mapping



Inventory Development



Data Driven Septic System Inventory Logic

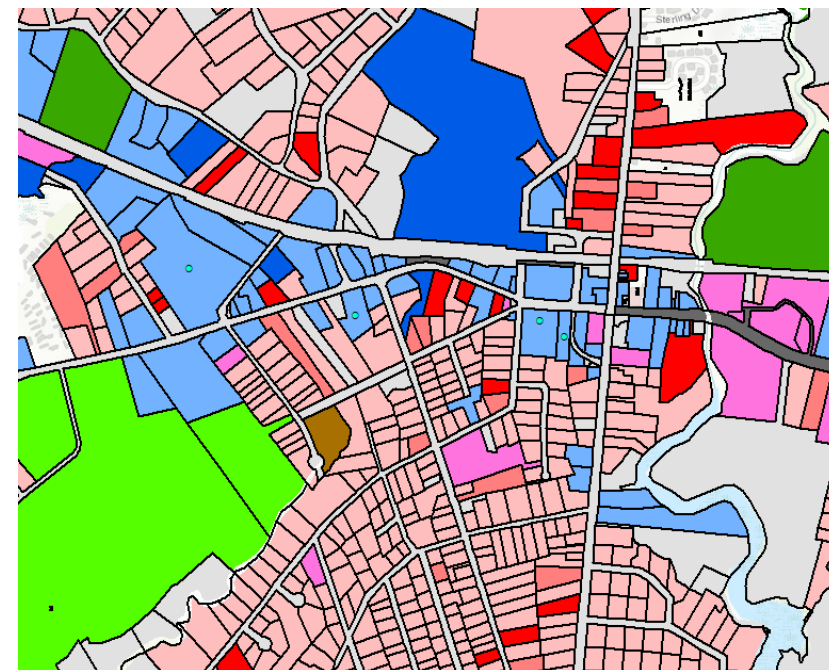
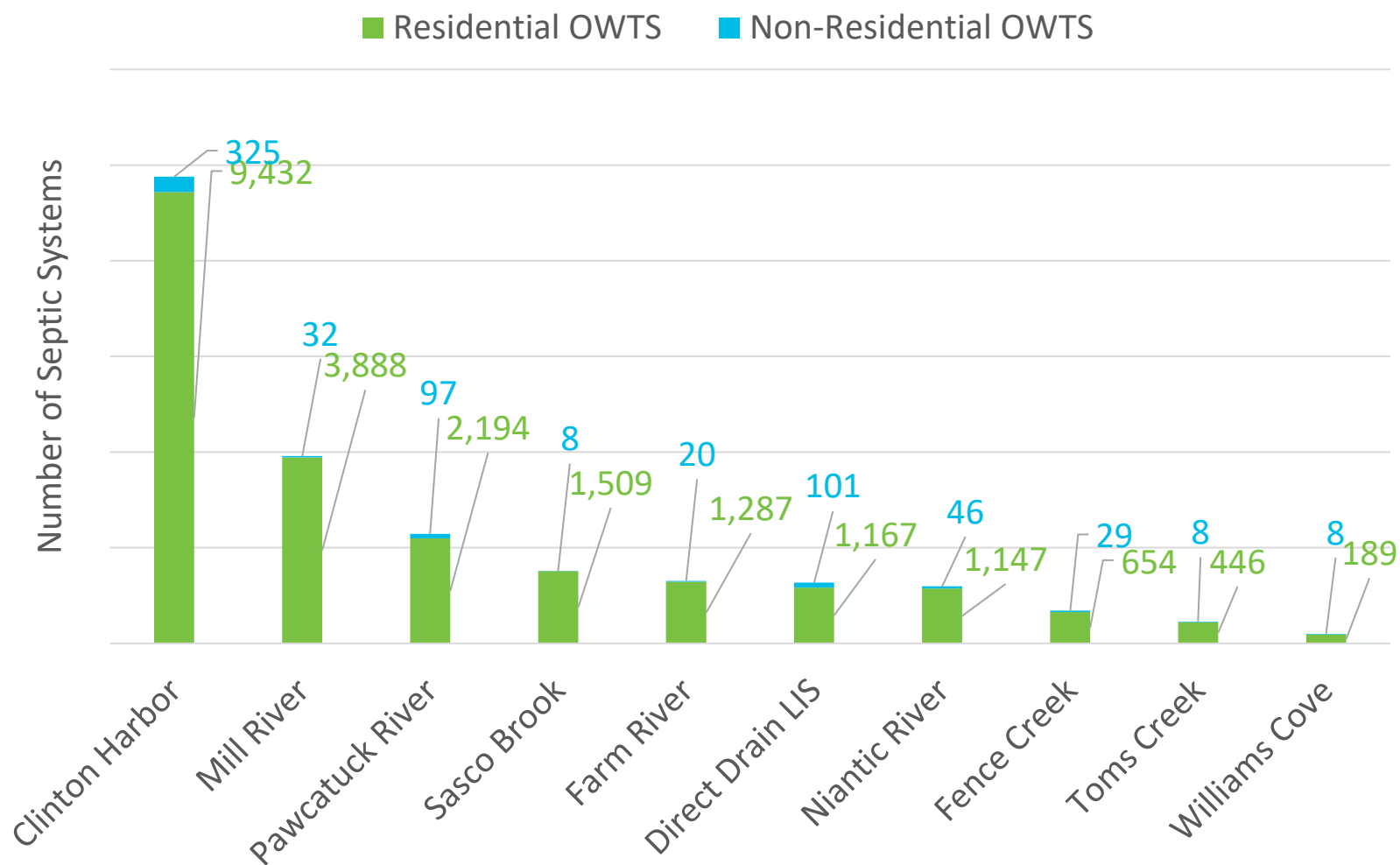
1. Parcel land use description implies wastewater generation
2. One or more structures are within the parcel's boundary
3. The parcel is outside known sewer service areas

Aggregated Data Sources

- Tax parcels from 22 communities
 - Land use descriptions
- Microsoft building footprint dataset
 - Number and size of structures
- Connecticut statewide sewer service area



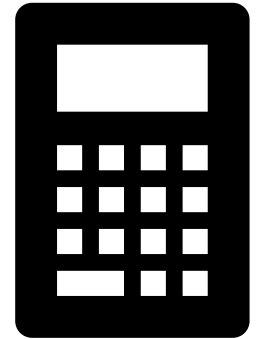
Final Inventory Results



Example Land Use Map



Site Specific Loading Factors



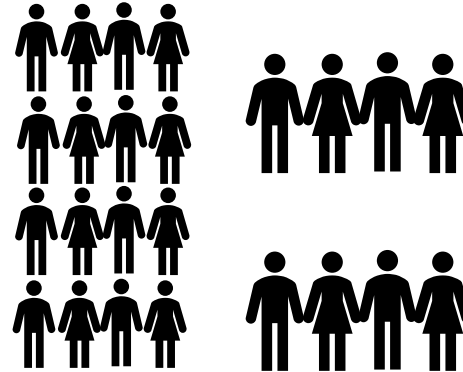
Three Parts of Nitrogen Loading

1. Year-round residential load
2. Seasonal residential load
3. Non-residential load

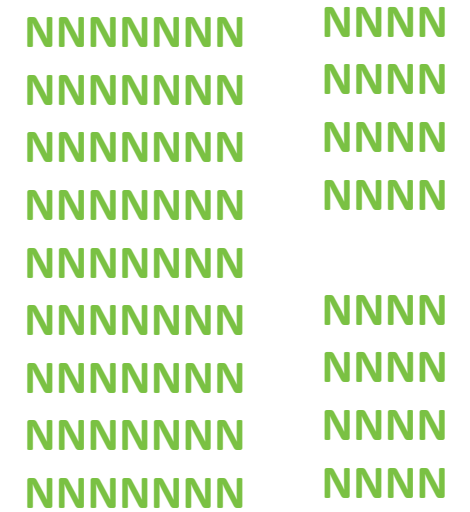
1. Year-Round Residential Load Estimation



Housing units



People per housing unit



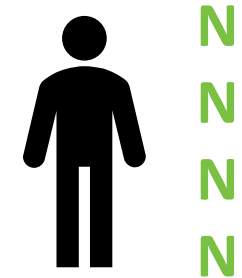
Nitrogen per housing unit



Land use

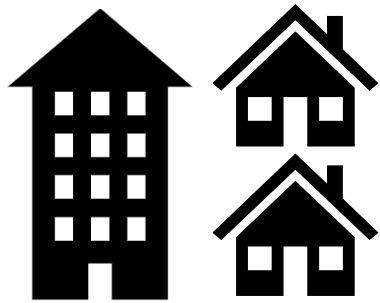


Population

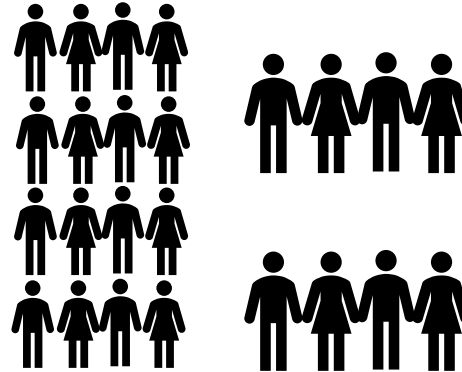
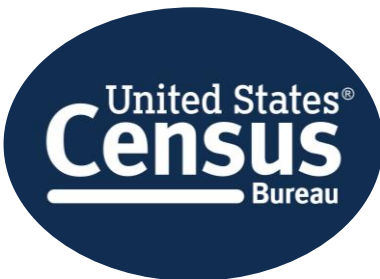


Nitrogen per person

2. Seasonal Residential Load Estimation



Seasonally vacant
Housing units



Seasonal residents



Average people per housing unit
from residential analysis

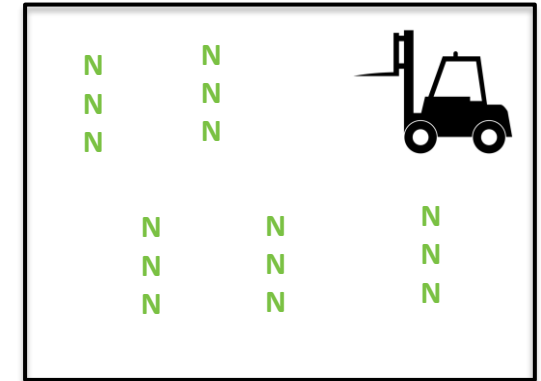
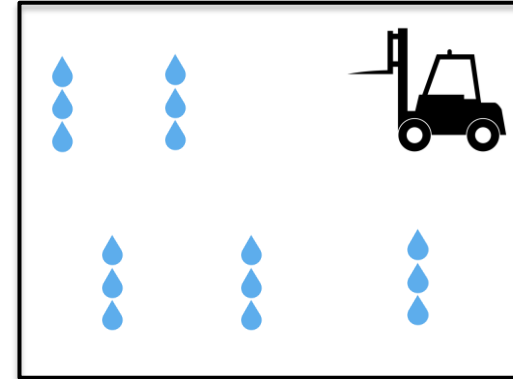
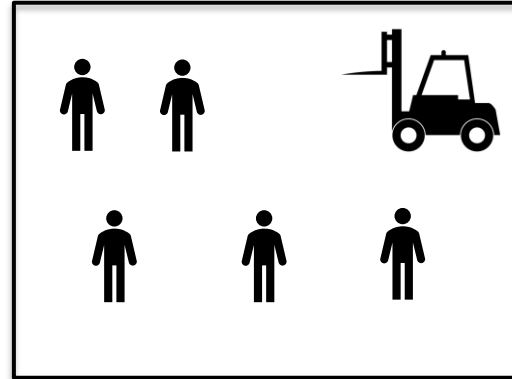
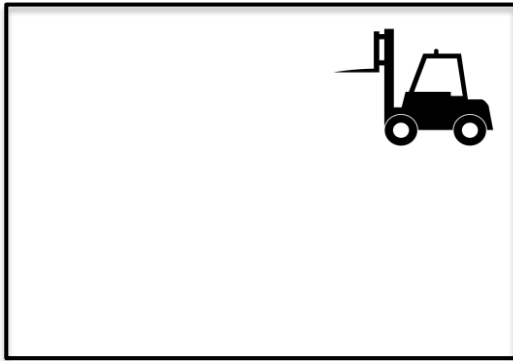
NNNNNNN NNNN
 NNNNNNN NNN
 NNNNNNN NNNN
 NN

Seasonal nitrogen
per housing unit



Nitrogen per person

3. Non-Residential Load Estimation



Maximum occupancy



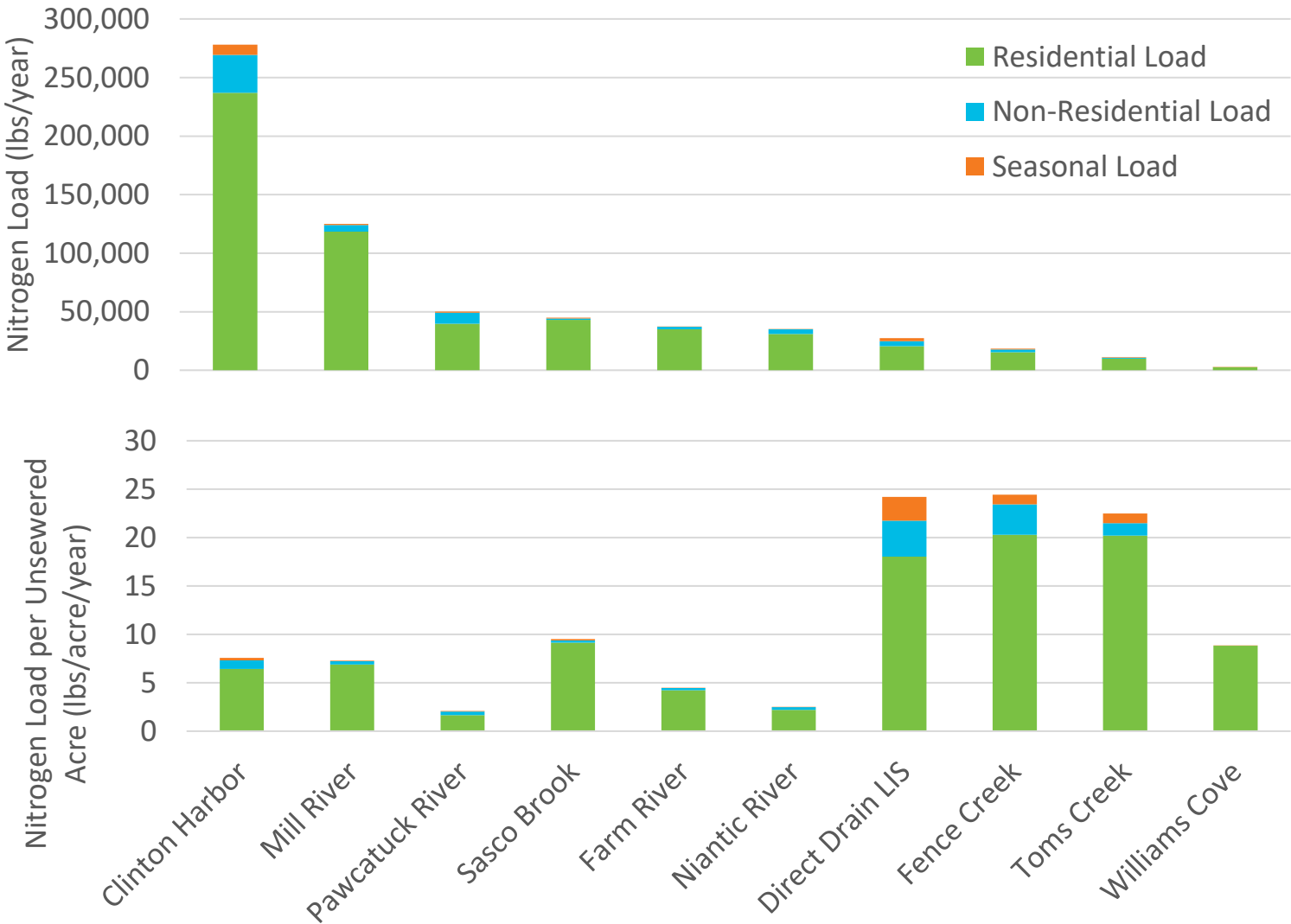
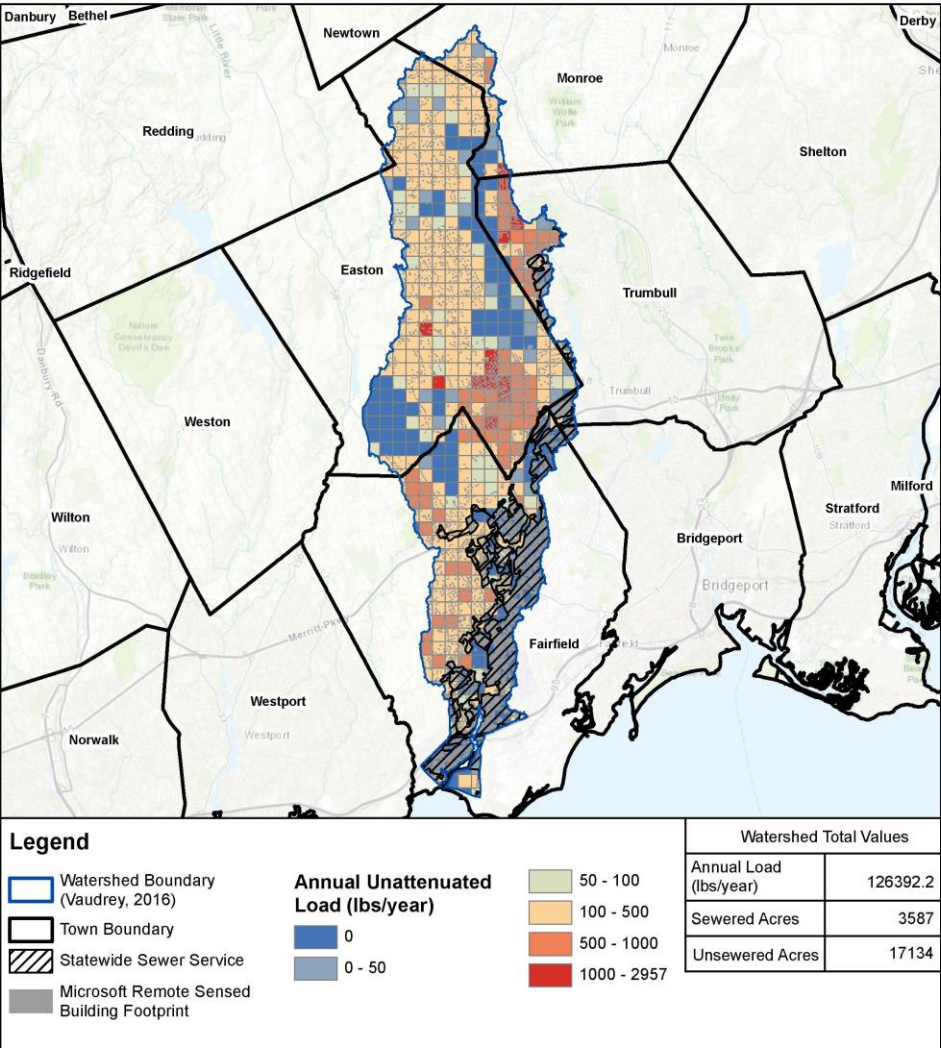
Flow per occupant



Concentration

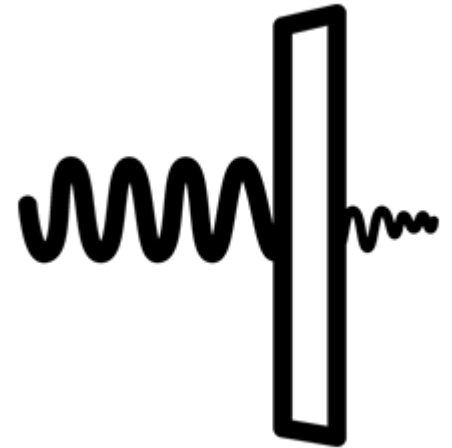
Final Unattenuated Loading Results

Figure 3-7: Example Map for Mill River Showing Annual Unattenuated Loads Including Seasonal Loads (lbs/year)

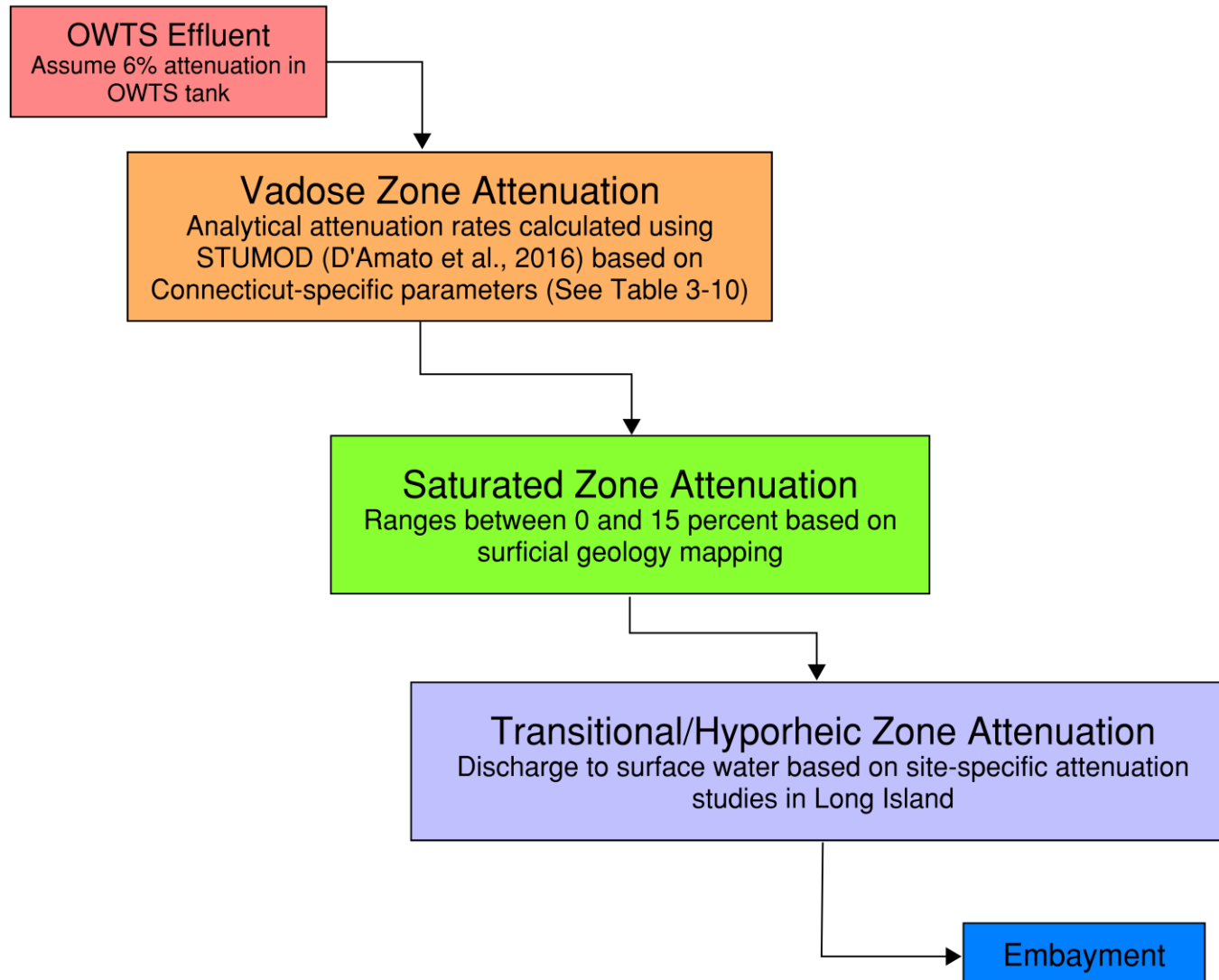




Attenuation Estimates



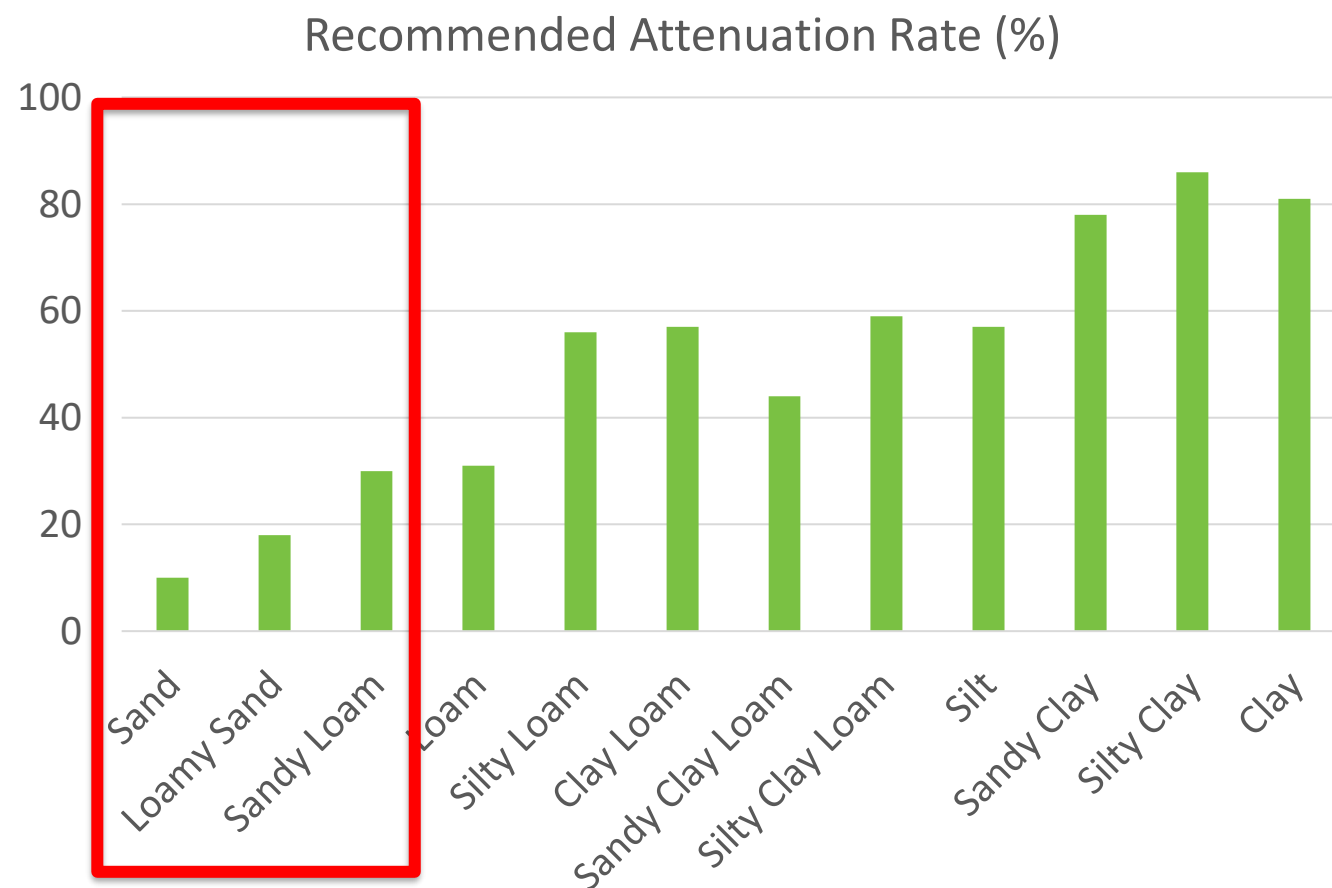
Four Compounding Attenuations



Estimating Vadose Zone Attenuation

■ Soil Treatment Unit Model (STUMOD)

- Soil texture
- Depth to groundwater
- Hydraulic loading rate
- Soil temperature

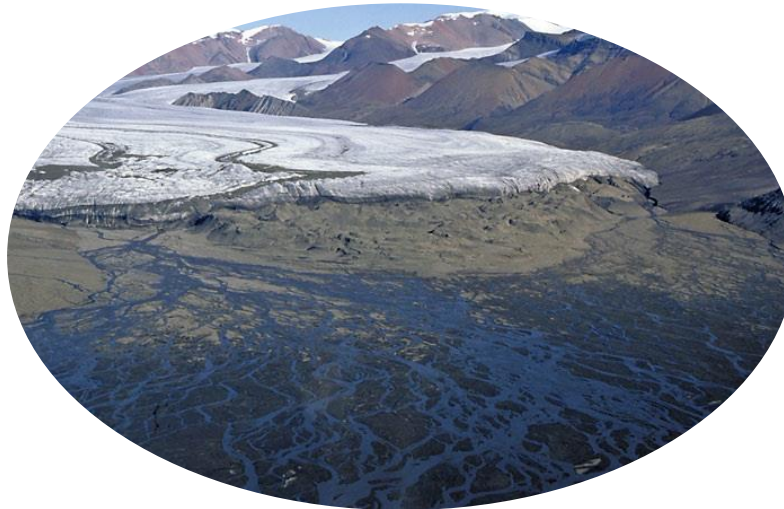


Estimating Saturated Zone Attenuation

Glacial Ice-laid Deposits



Glacial Meltwater Deposits



Postglacial Deposits

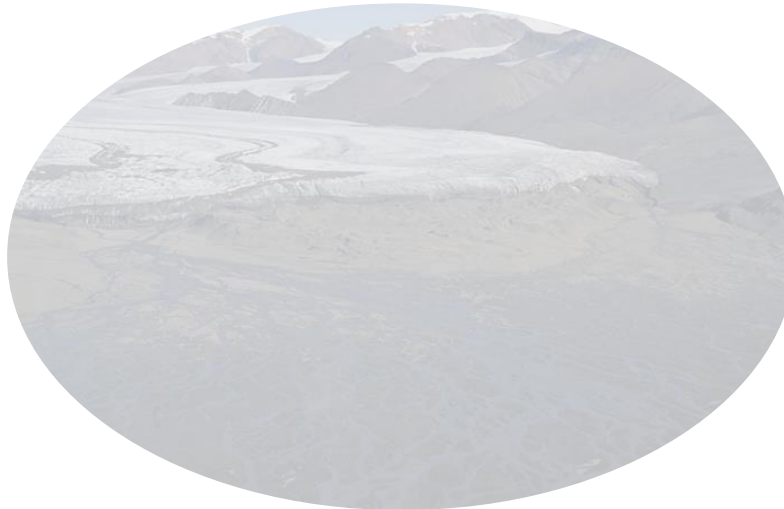


Estimating Saturated Zone Attenuation

Glacial Ice-laid Deposits



Glacial Meltwater Deposits



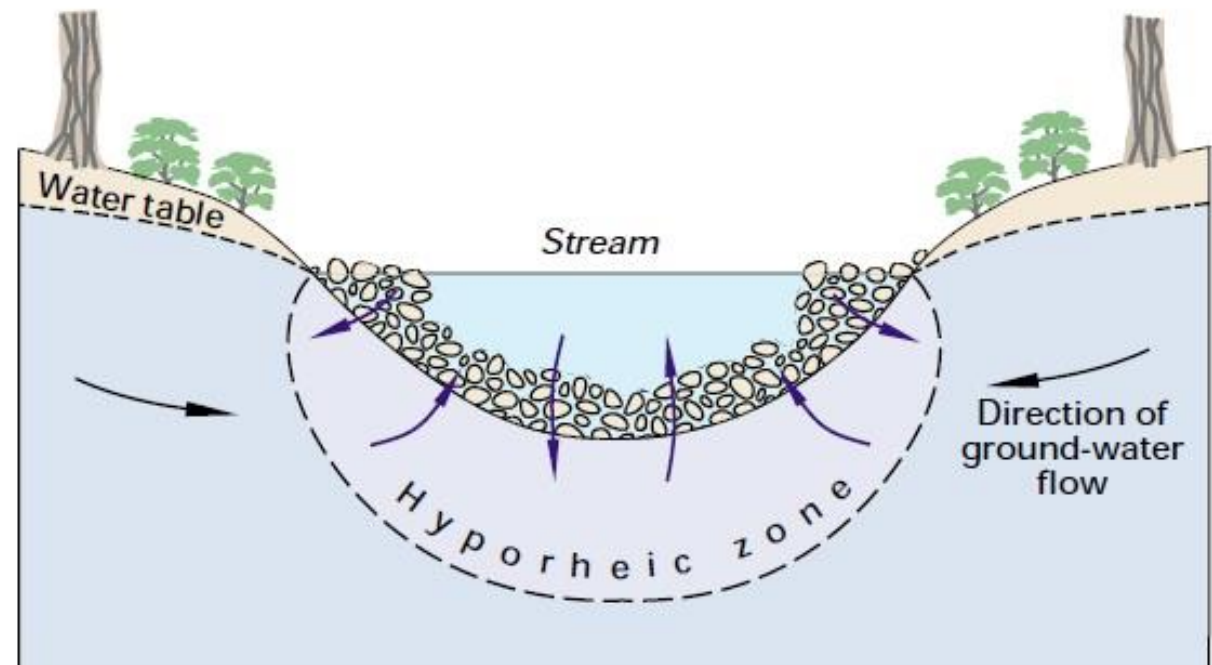
Postglacial Deposits



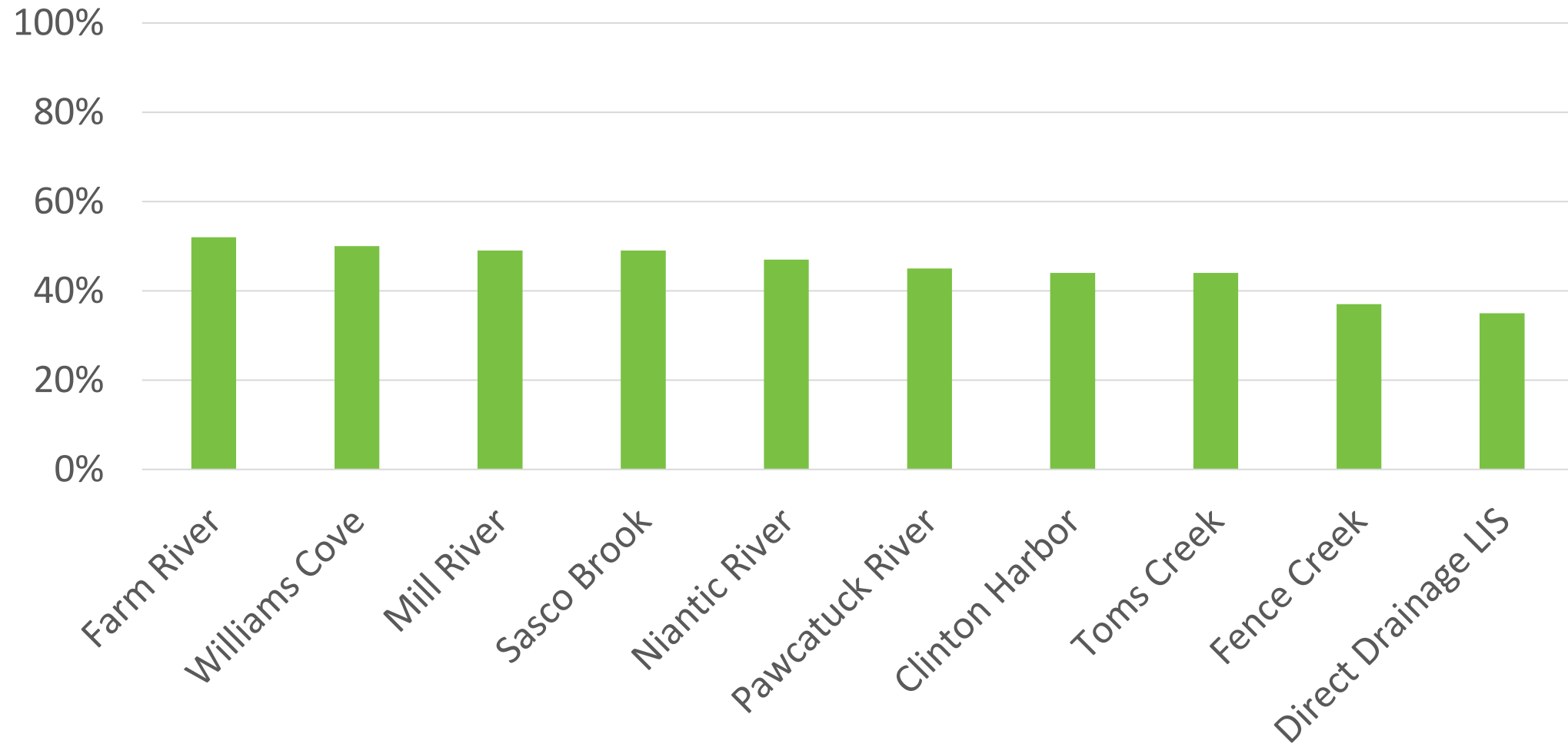
15% Attenuation

Estimating Transitional/Hyporheic Zone Attenuation

- Anoxic sediments at groundwater-surface water interface
- 10% for rivers, ponds, lakes, embayments, ocean
- 15% for marshes, shoals, bars, and mudflats



Combined Total Attenuation Rates



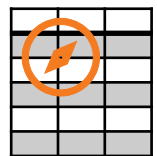
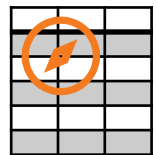
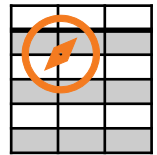
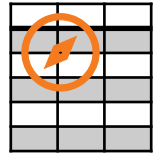
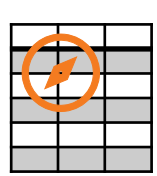


Database and Dashboard

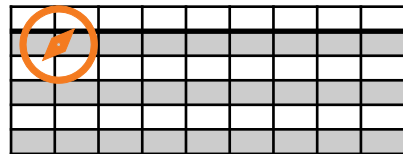


A Database Approach to Modeling

Base Data

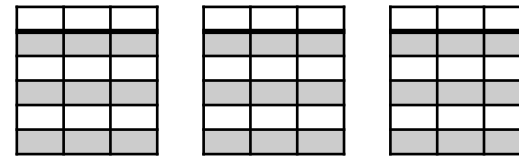


Intermediate,
Spatially Joined Data

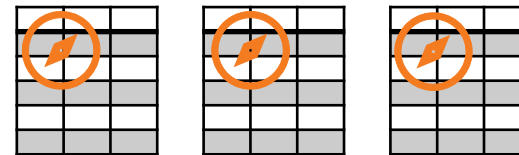


SQL Calculations
and Aggregations

Aggregated Summary Tables

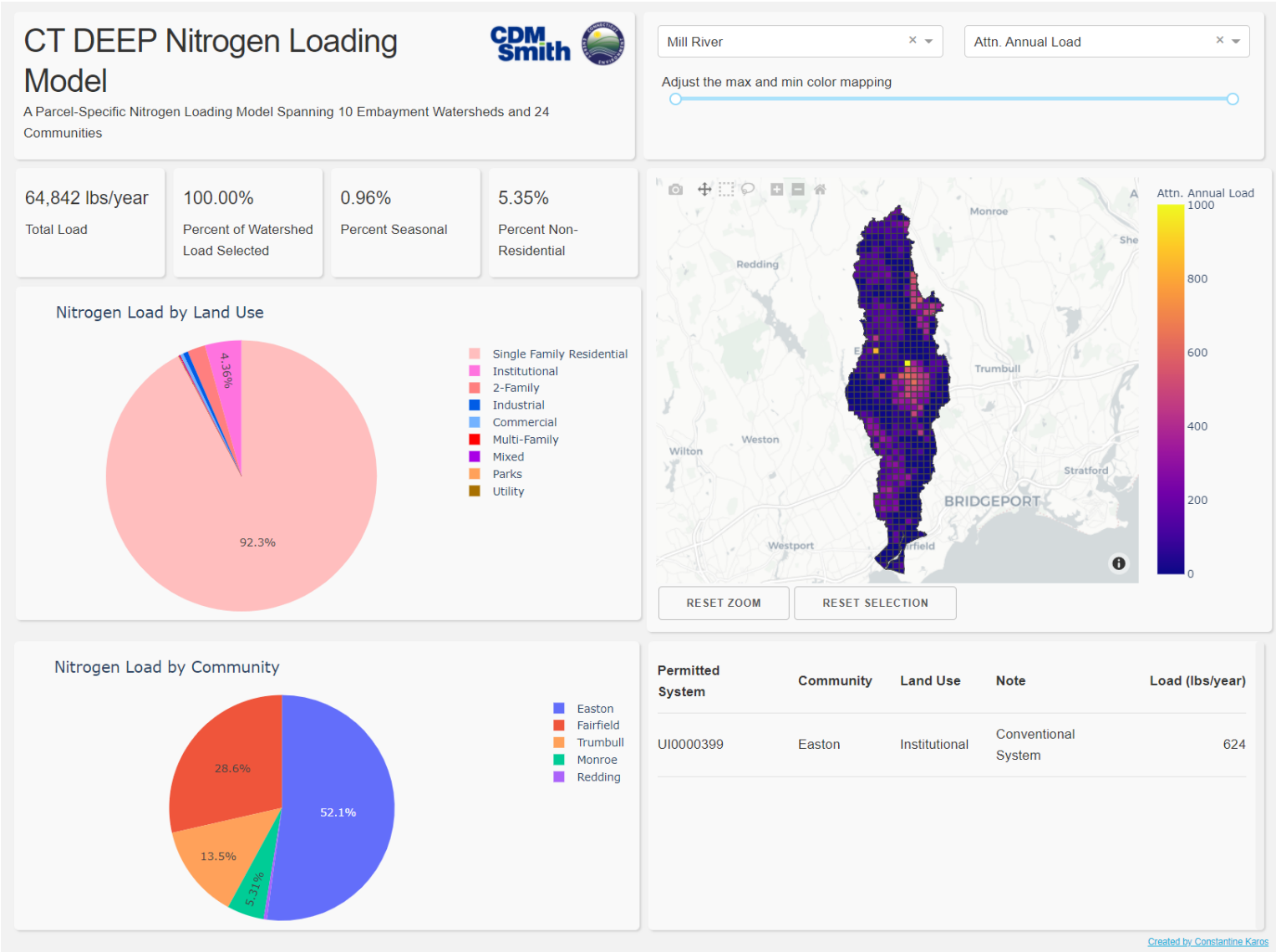


Aggregated GIS Feature Classes



Updates to base tables can be rapidly propagated through the model

Database Driven Dashboard



Contact us!



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