



Connecticut Department of Energy and Environmental Protection



Using Narrative Nutrient Criteria in 303(d) Program Implementation in Connecticut

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Connecticut Department of Energy and Environmental Protection

Presentation Goals

- Provide an understanding of the narrative provisions in the CT WQS related to nutrients
- Provide examples develop of plans and planning approaches under 303(d) for:
 - Long Island Sound (Estuary)
 - Freshwater Wadable Rivers
 - Lakes
 - Coast Embayments





CT Water Quality Standards



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Applicable CT Narrative Criteria & Standards

Narrative Nutrient Criteria (22a-426-9 Table 1)

- The loading of nutrients, principally phosphorus and nitrogen, to any surface water body shall not exceed that which supports maintenance or attainment of designated uses

Requirement to Control Nutrients (22a-426-4(a)(11))

- Requires controls such as BMPs or permit limits for point and nonpoint sources of nutrients to support maintenance of designated uses, restore impaired waters and prevent excessive anthropogenic inputs of nutrients or impairment of downstream waters



WQS Provisions for Natural Conditions

Natural Conditions (22a-426-4(A)(4))

- WQ Criteria do not apply to environmental conditions brought about by natural causes or conditions

Natural (22a-426-1(47))

- Means the biological, chemical and physical conditions and communities that occur within the environment which are unaffected or minimally affected by human influences.





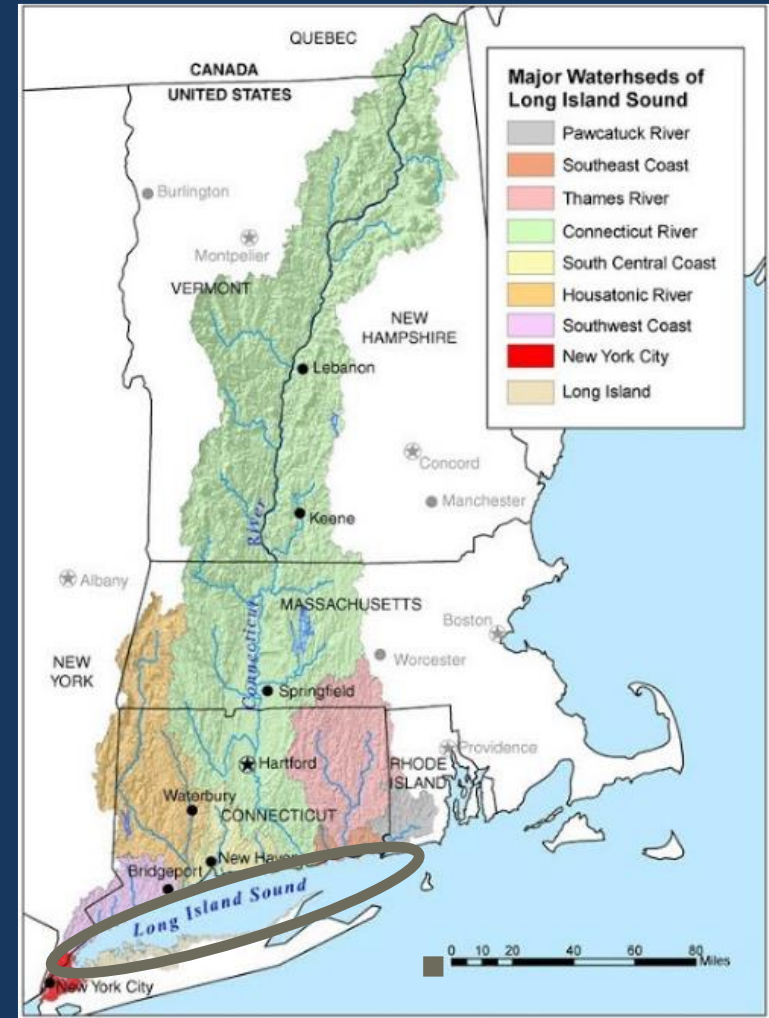
Long Island Sound TMDL



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2000 Long Island Sound TMDL

- Issue: Hypoxia due to excess nitrogen loading
 - WQ Target = DO 3.0 mg/l
 - Established TN WLA & LA based on modeling to achieve DO levels
 - Required overall 58.5% reduction in TN from WWTPs & 10% reduction from NPS and Stormwater



Successful Implementation

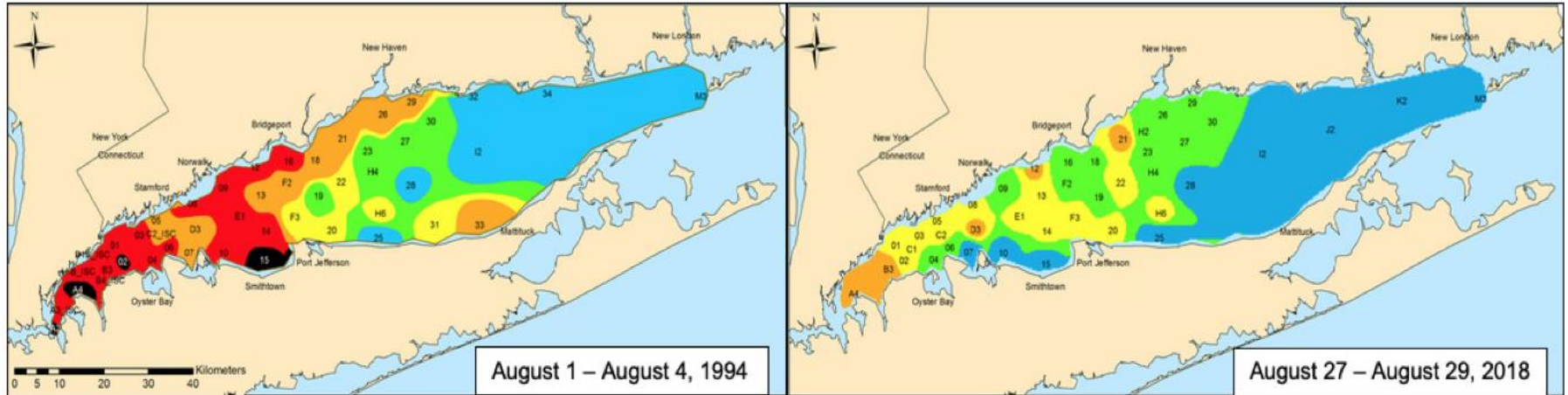
- CT & NY met WLA
 - CT Reduction of 63.5% TN
 - 16,381 pounds TN removed at cost of \$720M
 - Facilitated by a Nitrogen Trading Program
- Decrease in NPS contributions & Atm Deposition
- Decrease in Agricultural contributions
- Improved fertilizer management

Significant level of effort and investment based on implementation of narrative standards

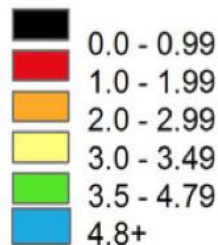


More effort still needed

Dissolved Oxygen in Long Island Sound Bottom Waters



Dissolved Oxygen (mg/L)



Severity of impact

- Severe
- Moderately severe
- Moderate
- Marginal
- Interim management goal
- Excellent - Supportive of marine life



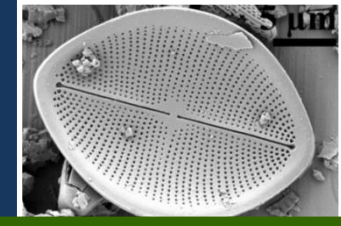


Rivers



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CT Approach to Phosphorus Management



Human Sources

NPDES Discharges, Urban and Agricultural Runoff

Habitat Conditions

Canopy Cover, Flow, Temperature, Natural Nutrient Loading

Algal Response

Increases and Changes in Algal Communities

Changes in Fish and Other Aquatic Life Communities or Fish Kills

Aquatic Life Response



Changes in Habitat Structure and Water Chemistry

Physical / Chemical Changes



CT Approach to Phosphorus Management

Anthropogenic Input of Nutrients:

- NPDES Facilities
- Non-Point Sources (Urban and Agricultural Runoff)

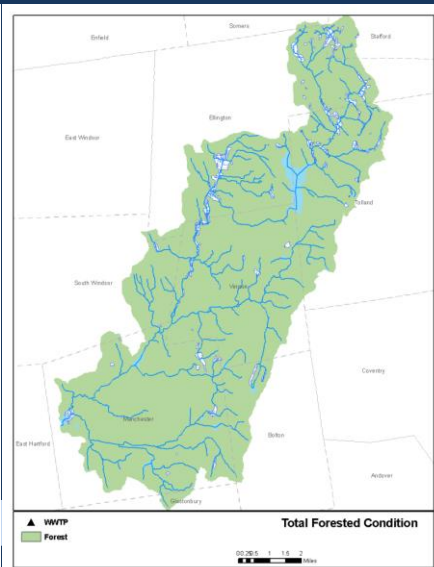
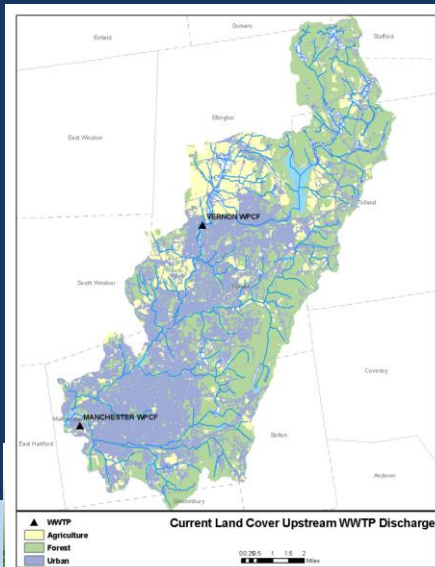
- Non-Tidal
- Canopy Cover
- Temperature
- Flow
- Natural Nutrient Loading

Changes in Algal Community and Biomass

Total NPDES Load (lbs/day) + Land Cover Load (lbs/day)

Enrichment Factor (EF) =

Forested Condition Load (lbs/day)



Enrichment Factor (EF)

Example:

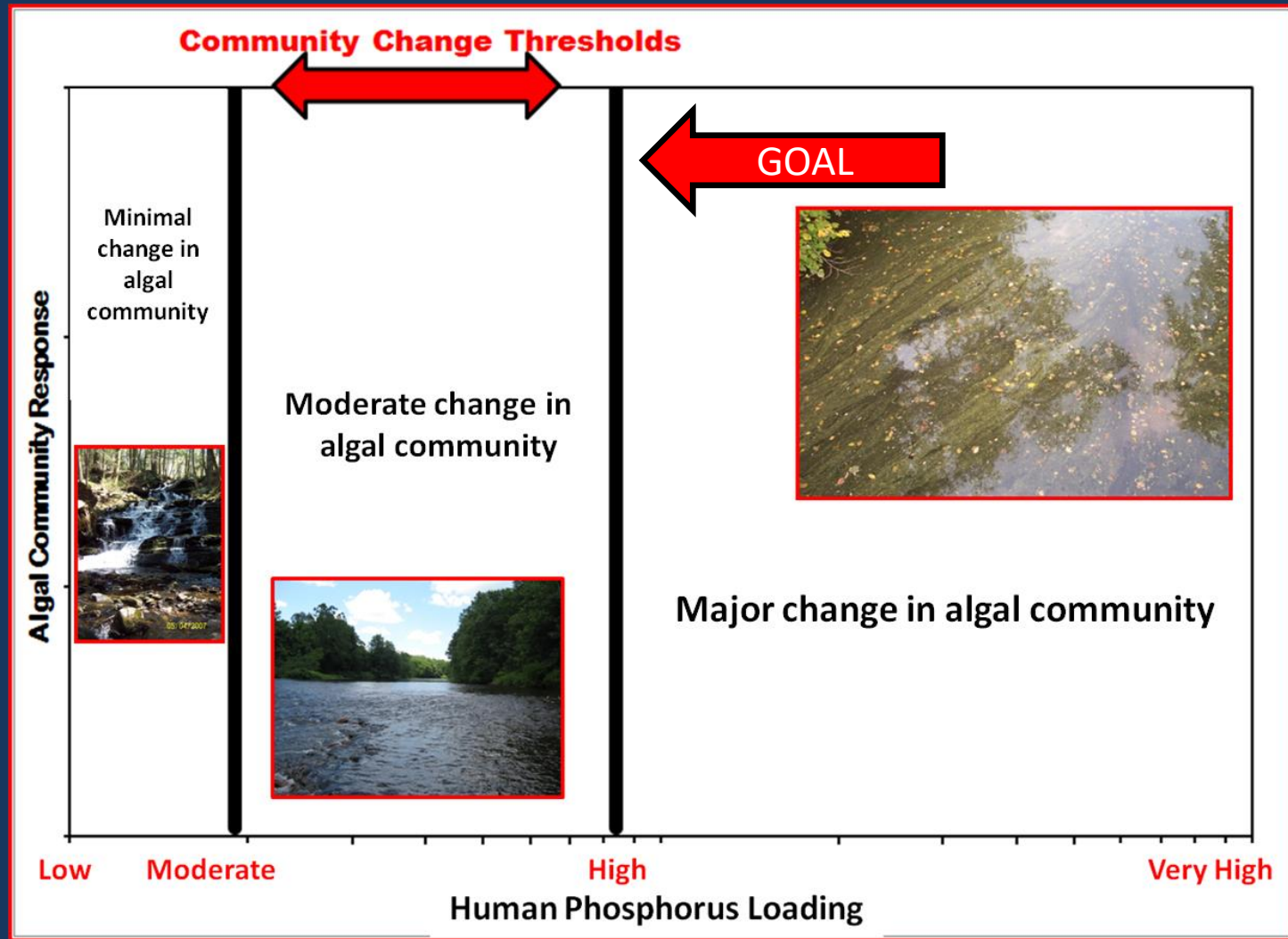
Current Load (lbs/day)	205.3
Forested Load (lbs/day)	4.80
Enrichment Factor	42.79

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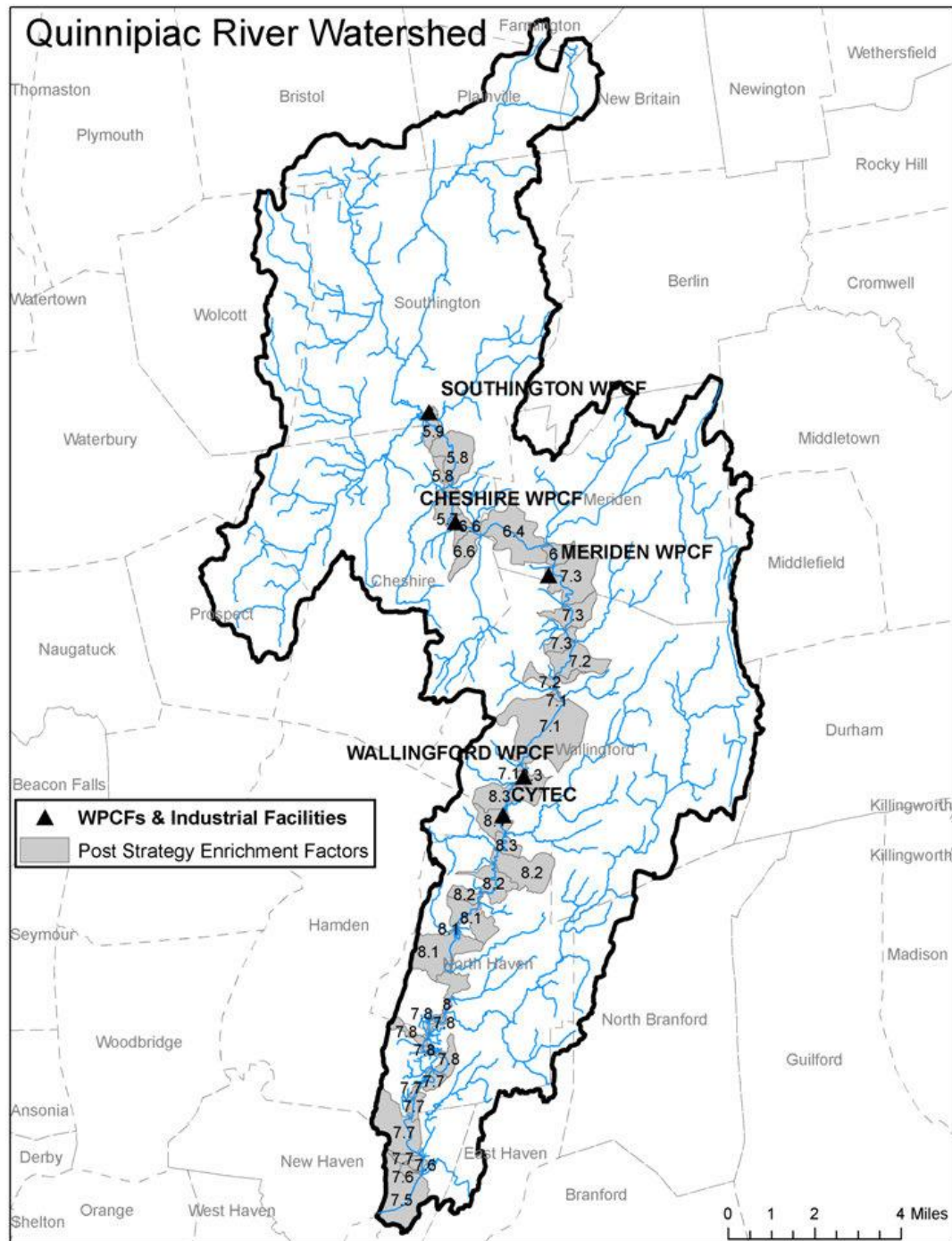
Linking Enrichment to Algal Community Changes

A water body is considered impaired for aquatic life when major ecological changes occur

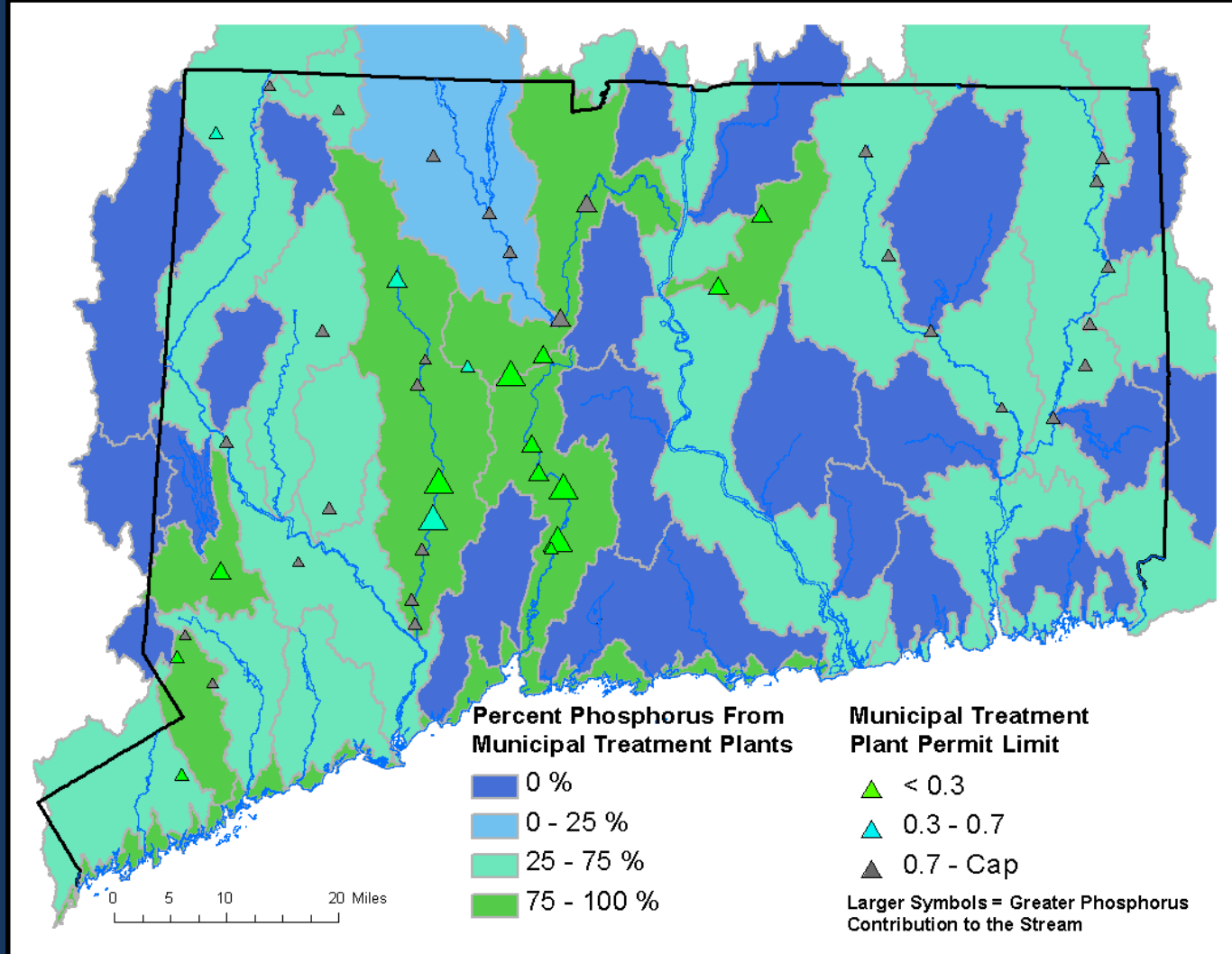
Conducted a statistical analysis to identify algae response to excess phosphorus



- Watershed approach
- WQ attainment based on WLA reductions only
- WQ based limits for TP incorporated into all fresh water POTW and industries discharging TP
- 303(d) program commitment (Advanced Restoration Plan)



Current Management Efforts Target Local Water Conditions





Lakes



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Additional Lake Specific WQS

Lakes (22a-426-6)

- Identifies nutrient levels associated with various trophic states
- Provides consideration to adjust trophic state evaluation based on macrophyte coverage
- BMPs and other controls for NPS nutrient sources are preferred over use of biocides to address altered trophic state in lakes. (22a-426-4(a)(12))

Identifies the **Natural Trophic State** of the lake as the WQ Goal

Trophic State	Parameter	Range
Oligotrophic	Total Phosphorus	0-10 µg/l
	Total Nitrogen	0-200 µg/l
	Chlorophyll- <i>a</i>	0-2 µg/l
	Secchi Disk	6 + meters
Mesotrophic	Total Phosphorus	10-30 µg/l
	Total Nitrogen	200-600 µg/l
	Chlorophyll- <i>a</i>	2-15 µg/l
	Secchi Disk	2-6 meters
Eutrophic	Total Phosphorus	30-50 µg/l
	Total Nitrogen	600-1000 µg/l
	Chlorophyll- <i>a</i>	15-30- µg/l
	Secchi Disk	1-2 meters
Highly Eutrophic	Total Phosphorus	50 + µg/l
	Total Nitrogen	1000 + µg/l
	Chlorophyll- <i>a</i>	30 + µg/l
	Secchi Disk	0-1 meters



Developed Narrative Translator for Lakes

Lake specific TN
and TP water
quality targets set
through the TMDL
process

Identify natural
trophic state (Chl A)



Identify TN and TP
concentrations
related to achieving
Chl A target



Natural Trophic State WOE Analysis

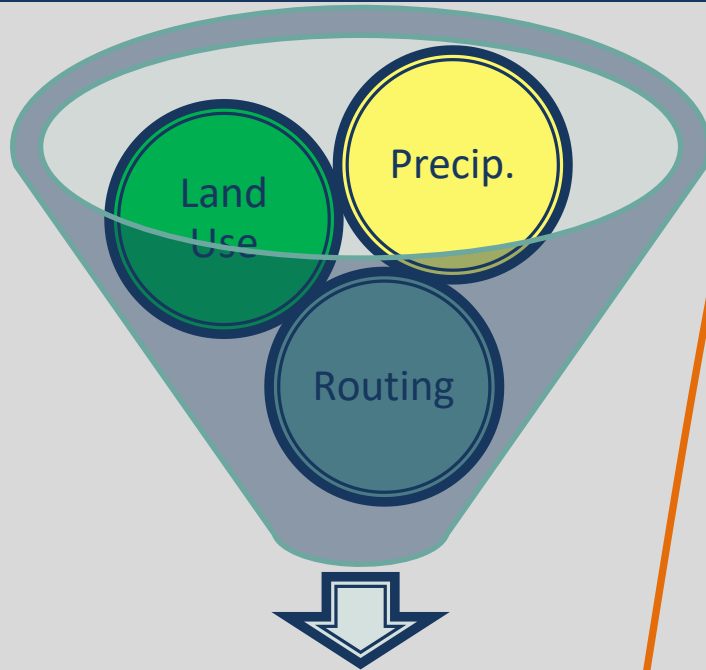
Weight of Evidence Evaluation	EPA Chl A Targets (ppb)	0-2	2-7	7-30	>30
Bantam Lake	CT Chl A Targets (ppb)	0-2	2-15	15-30	>30
	CT Total Phosphorus (ppb)	0-10	10-30	30-50	>50
	CT Total Nitrogen (ppb)	0-200	200-600	600-1000	>1000
	CT Secchi Disk (m)	6+	2-6	1-2	0-1
Line of Evidence	Confidence	Oligotrophic	Mesotrophic	Eutrophic	Highly Eutrophic
Current Trophic Level	High			★	
Taylor Landscape Analysis	Medium		★		
EPA Hollister Model	Medium		★		
New England Lake & Pond Model	Medium	0.457	★ 0.286	0.21	0.047
Fully Forested Model			★		
Lake Specific Studies			★		

- Expected Range of Trophic Conditions
- Predictive Models for Trophic State
- Additional Lake-specific Studies
- Outcome = Chlorophyll A level associated with Natural Trophic State



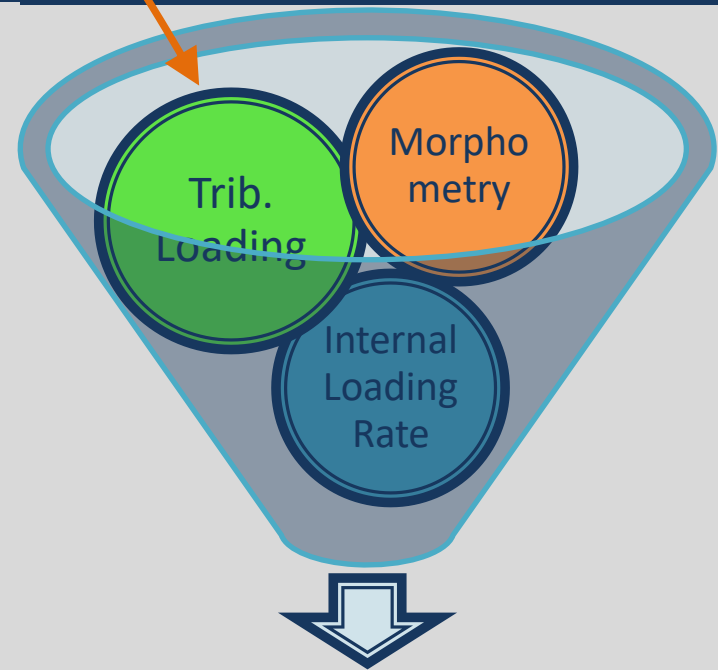
Modeling for TP & TN

Lake Loading Response Model



Tributary Loading

BathTub



In-Lake WQ

Models used to Identify nutrient loads associated with Chl A
Provides basis for setting WLA and LA

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Embayments



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Similar to Approach Used for Lakes

- WQ Targets in Embayment
 - Dissolved Oxygen
 - Clarity for Eel Grass
- Identify Embayment specific TN & TP targets to achieve WQ targets
- Translation of narrative WQS will be implemented through TMDL development

Watershed
Model (HSPF)



Embayment WQ
Model (WASP)



Narrative Nutrient Criteria

- Critical tool for nutrient management
- Identifies waterbody specific nutrient targets based on water quality attainment
- Allows for adaptive changes to narrative translation and implementation targets as needed



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