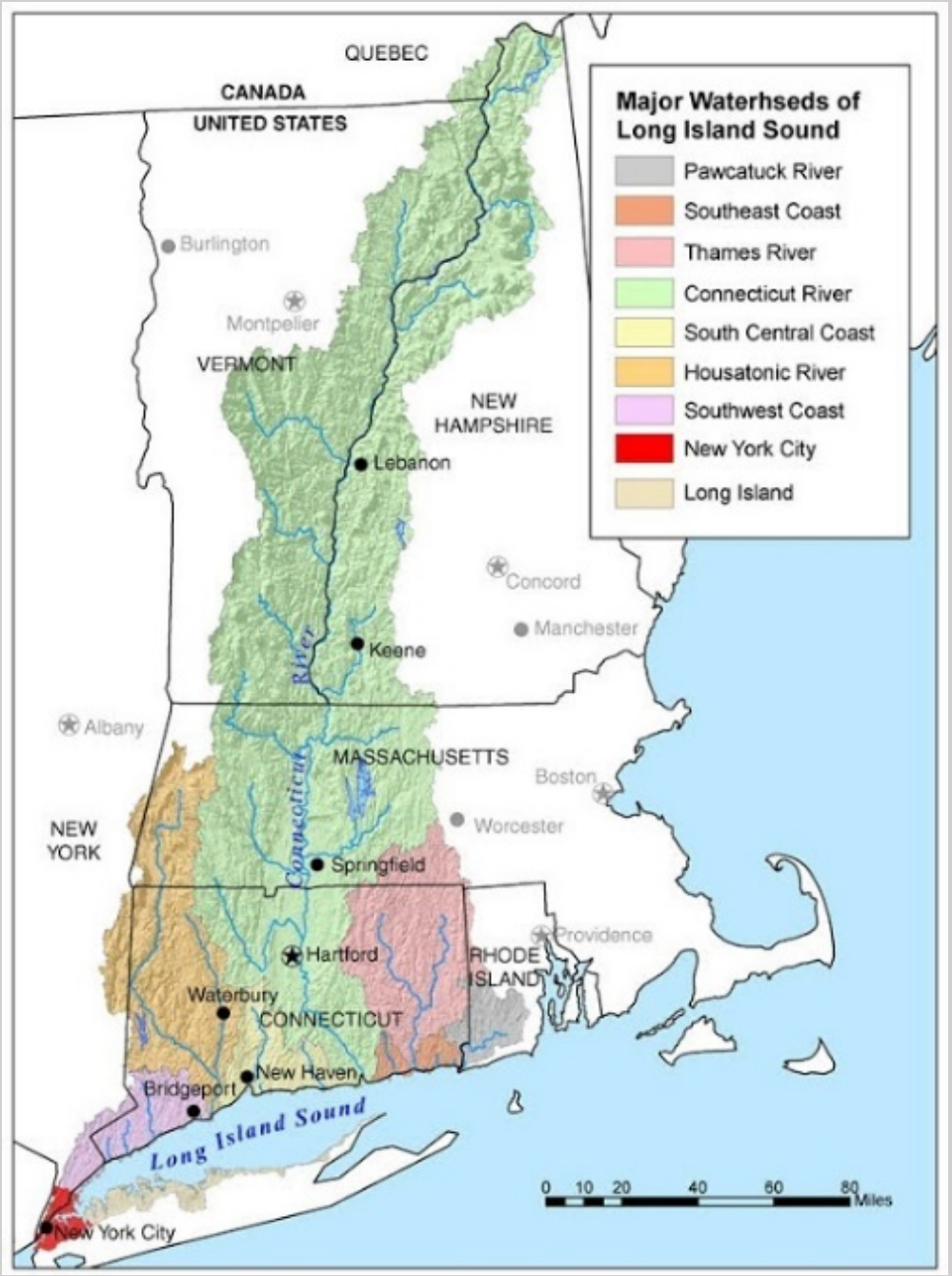
Long Island Sound Nitrogen Reduction Strategy
Public Informational Webinar

November 29, 2018

Photo Credit: CTDEEP/Hammonasset Beach State Park, CT

Long Island Sound



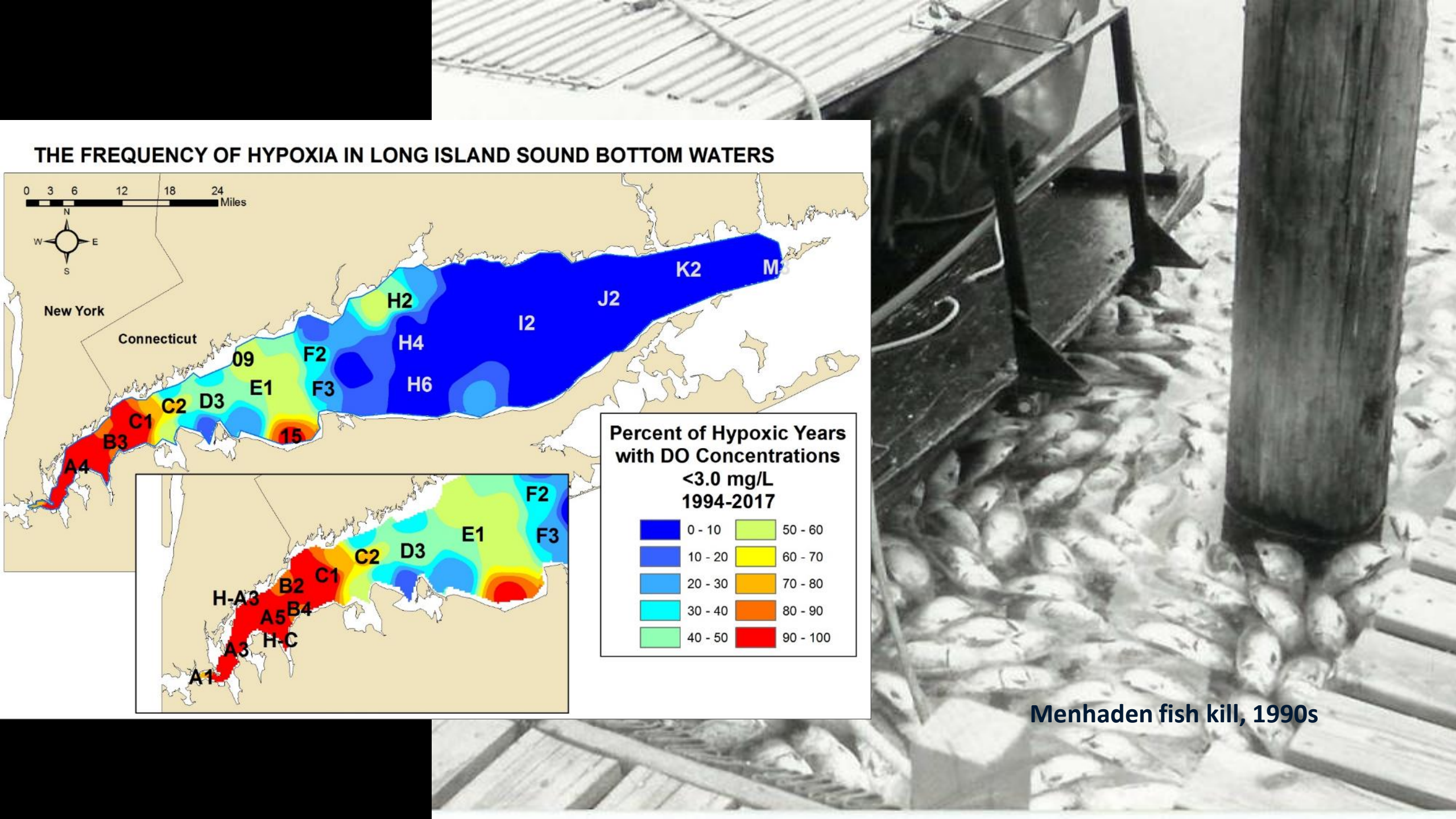
Webinar Agenda

- Brief Background
- Review of Phase 1 contract
- Highlight Task F & G memo out for public comment
- Outline Phase 2 of contract
- Overview of Ongoing Work
- Questions?

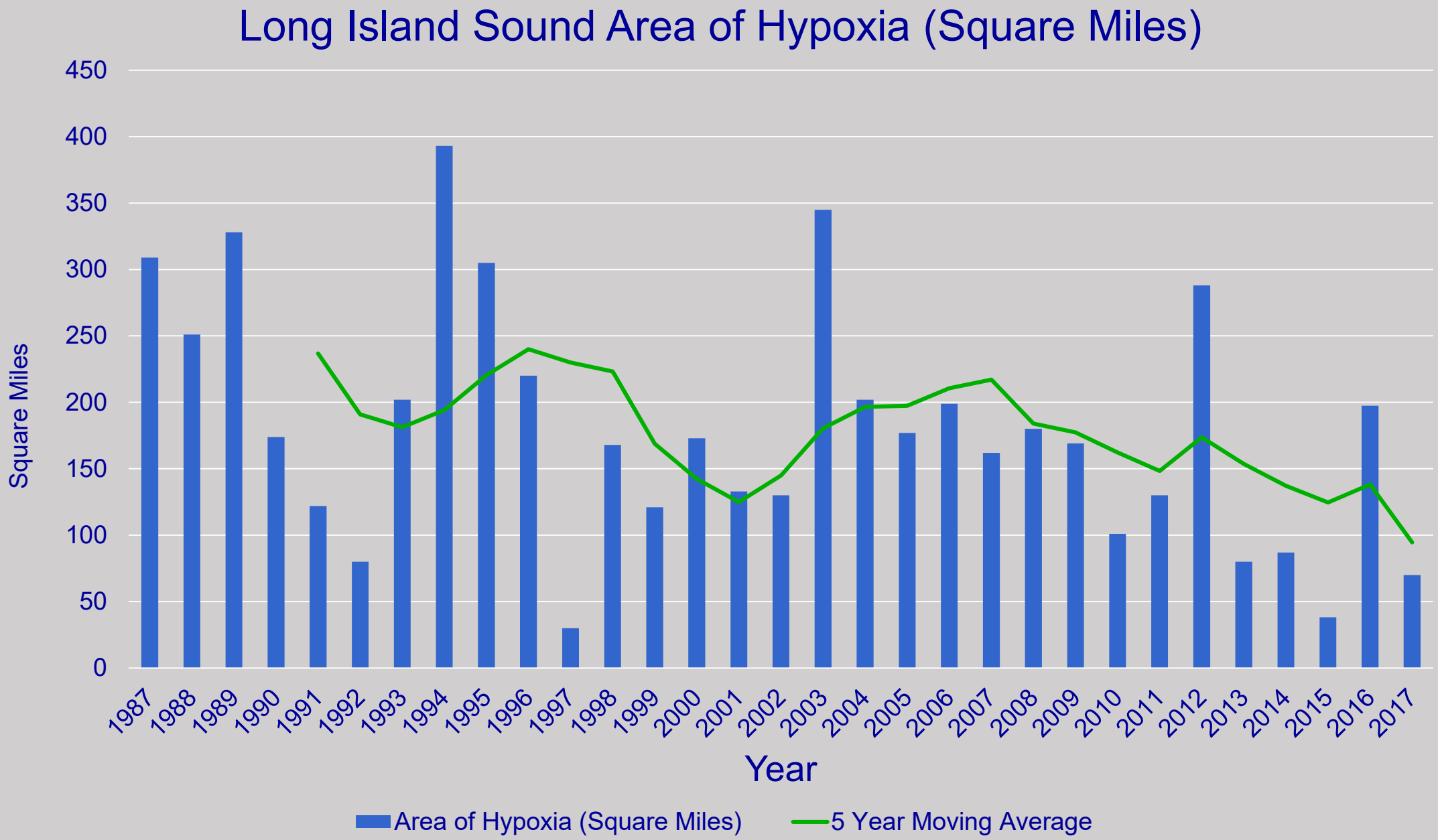
Previous Public Events

- November 8, 2017 Public Webinar
  - Discussion of previously completed tasks and upcoming work
- December 19, 2016 Public Webinar
- February 26, 2016 Public Webinar
- Public In-person Meetings – Spring 2016

Available at: www.longislandsoundstudy.net



Menhaden fish kill, 1990s


Long Island Sound Area of Hypoxia (Square Miles)
Square Miles
450
400
350
300
250
200
150
100
50
0
1987
1988
1989
1990
1991
1992
1993
1994
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1998
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2001
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2004
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2006
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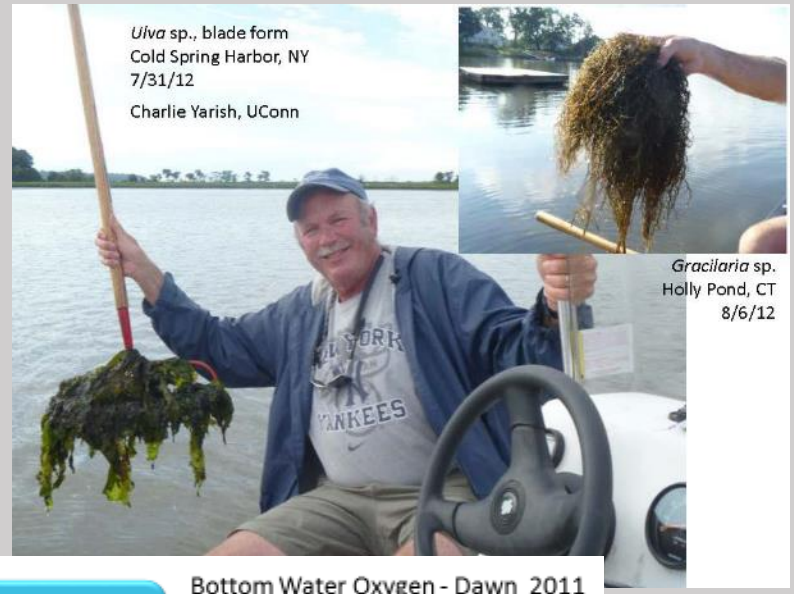
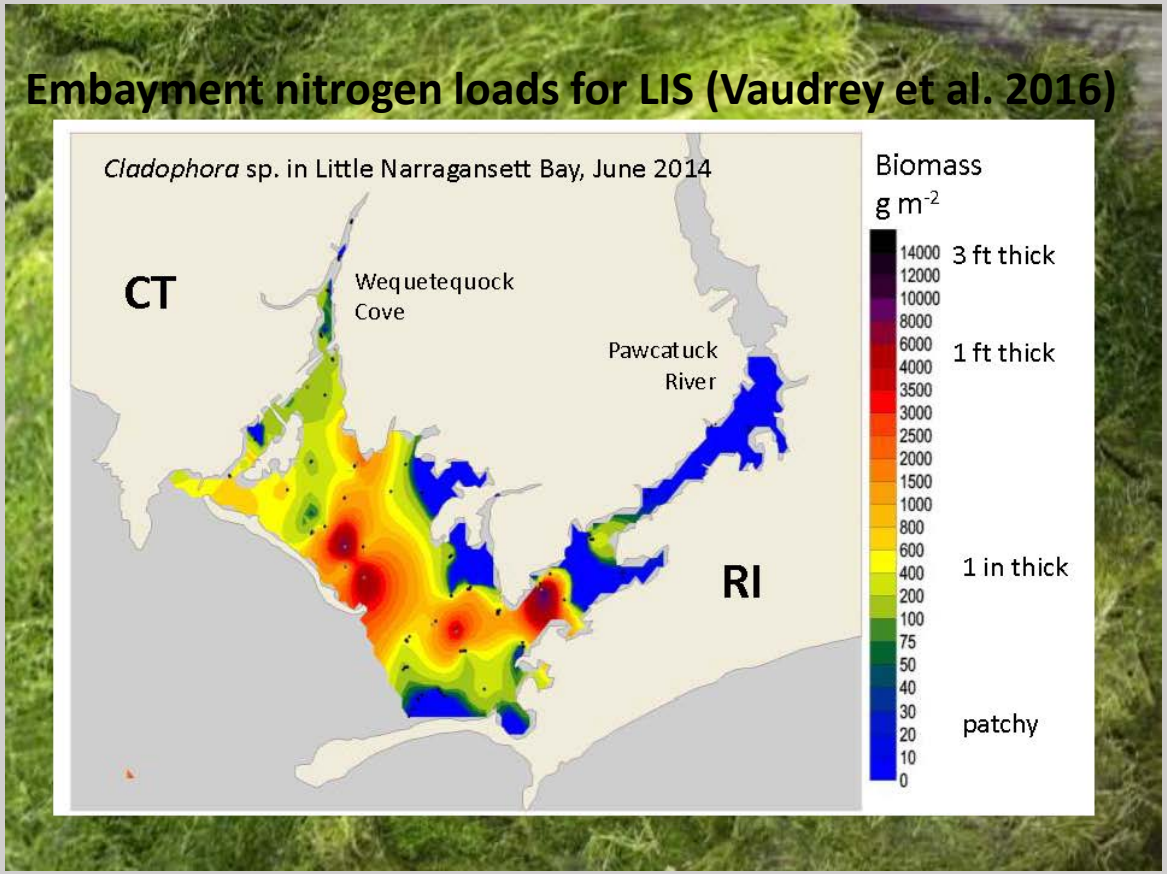
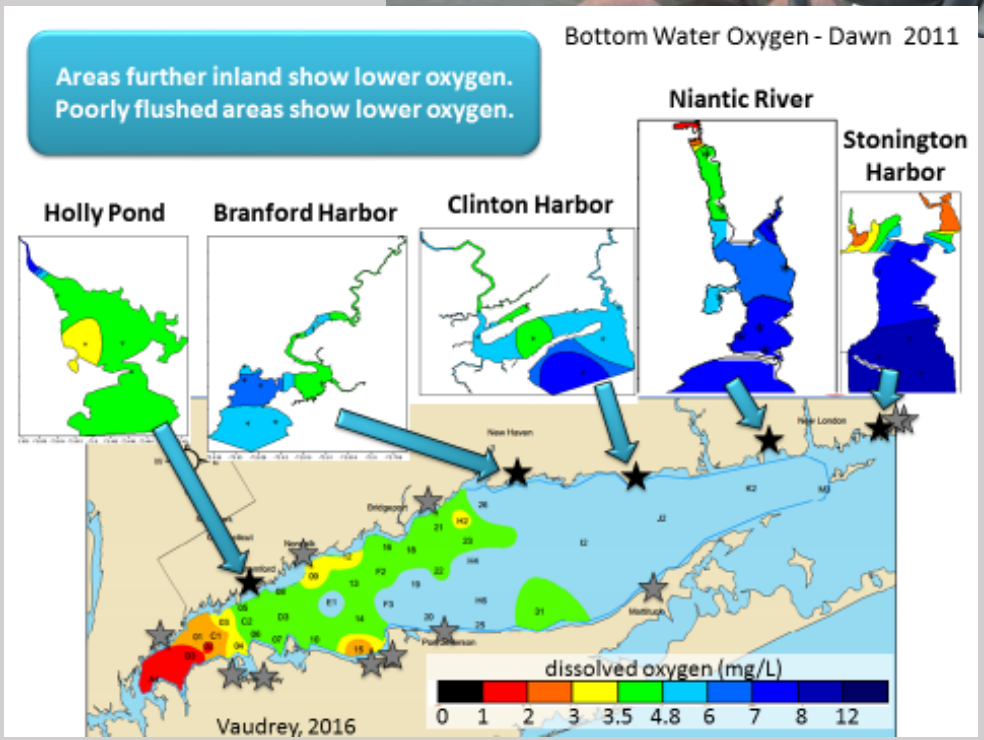
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Year
Area of Hypoxia (Square Miles)
5 Year Moving Average

Despite this good progress & positive trends, all the monitoring & modeling show that there is still more to do.







Review of Technical Methodology Phase 1

USEPA

Tetra Tech Inc.

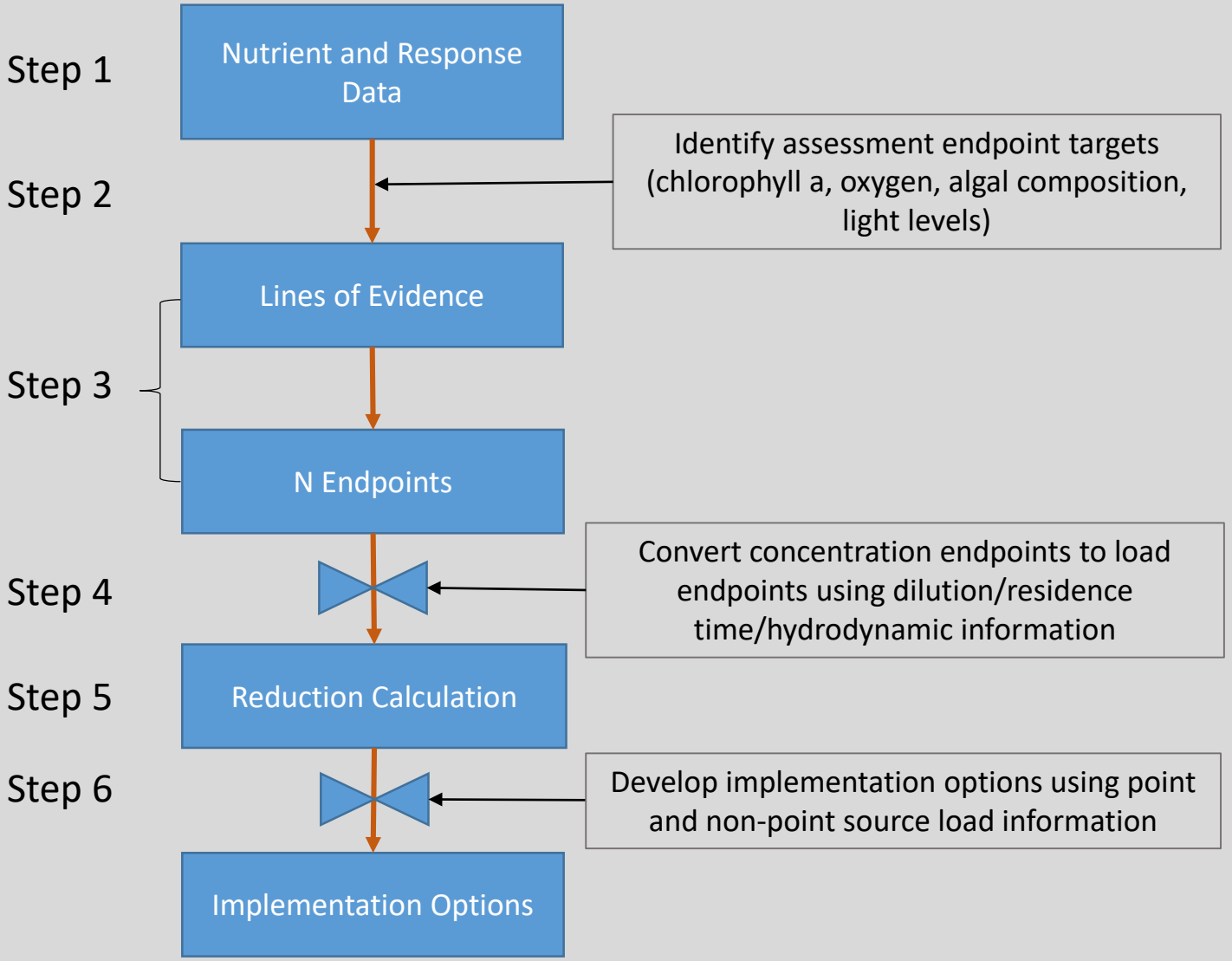
Goal: Develop Nitrogen (N) loads to meet desired water quality conditions in the Long Island Sound (LIS)

Coastal watersheds that directly drain to embayments or nearshore waters

Tributary watersheds that drain inland reaches

WLIS coastal watersheds with large, direct discharging wastewater facilities

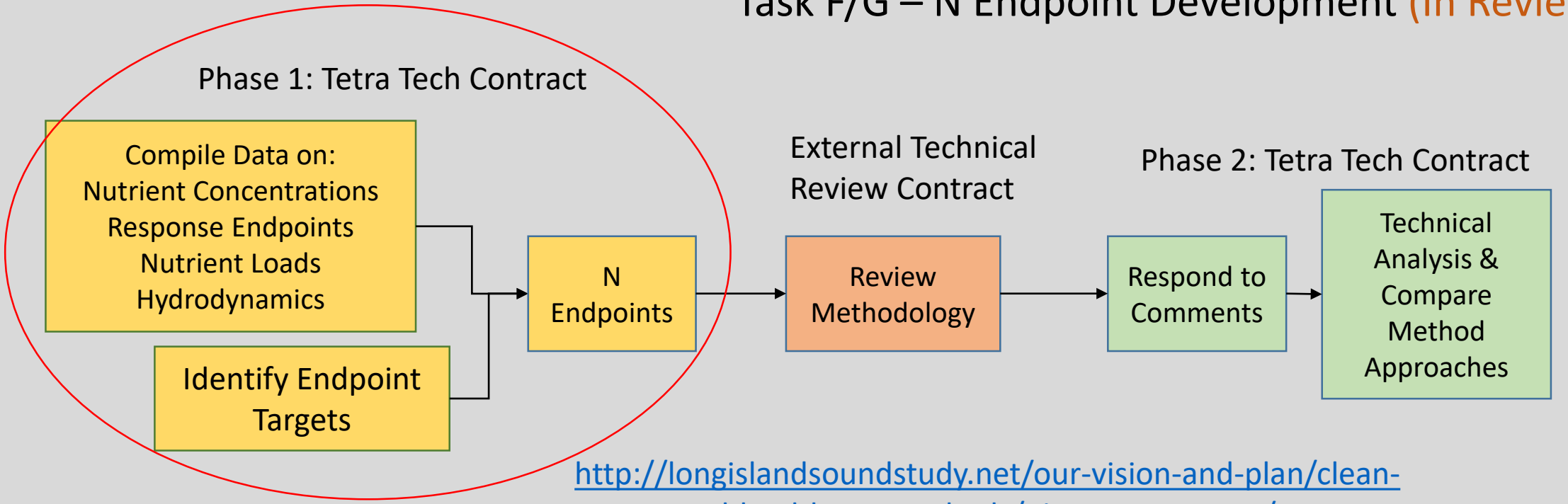
General Approach



Nitrogen Strategy Contract Approach

Phase 1 Deliverables

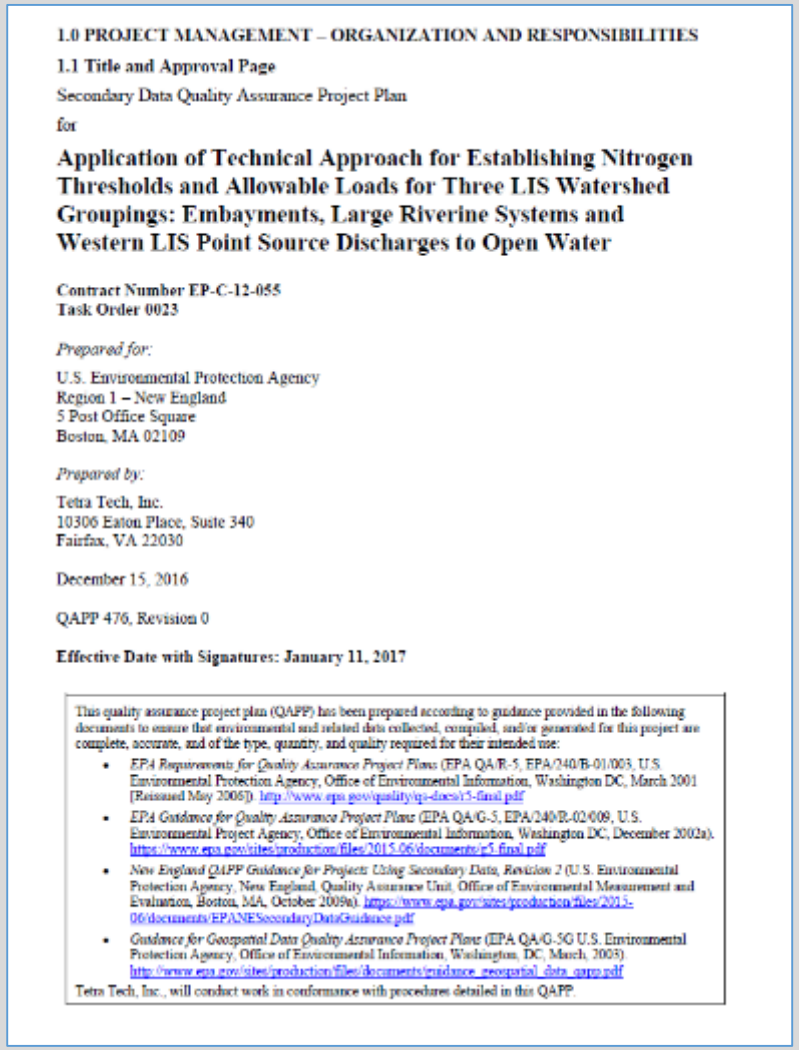
QAPP and Literature Review
Task A – Compile Embayment Loading Data
Task B – Compile Discharger Data
Task C – Compile Tributary Loading Data
Task D – Water Quality Data Summary
Task E – Hydrodynamic Modeling
Task F/G – N Endpoint Development (In Review)



http://longislandsoundstudy.net/our-vision-and-plan/clean-waters-and-healthy-watersheds/nitrogen-strategy/

Quality Assurance Project Plan (QAPP)

- Describes quality system Tetra Tech will implement to support EPA in establishing N endpoints
- Finalized January 11, 2017 (drives deliverables)
- Updated November 14, 2018 (for new Task Order)



1.0 PROJECT MANAGEMENT – ORGANIZATION AND RESPONSIBILITIES

1.1 Title and Approval Page

Secondary Data Quality Assurance Project Plan

for

Application of Technical Approach for Establishing Nitrogen Thresholds and Allowable Loads for Three LIS Watershed Groupings: Embayments, Large Riverine Systems and Western LIS Point Source Discharges to Open Water

Contract Number EP-C-12-055
Task Order 0023

Prepared for:

U.S. Environmental Protection Agency
Region 1 – New England
5 Post Office Square
Boston, MA 02109

Prepared by:

Tetra Tech, Inc.
10306 Eaton Place, Suite 340
Fairfax, VA 22030

December 15, 2016

QAPP 476, Revision 0

Effective Date with Signatures: January 11, 2017

This quality assurance project plan (QAPP) has been prepared according to guidance provided in the following documents to ensure that environmental and related data collected, compiled, and/or generated for this project are complete, accurate, and of the type, quantity, and quality required for their intended use:

- *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5, EPA/240/B-01/003, U.S. Environmental Protection Agency, Office of Environmental Information, Washington DC, March 2001 [Reissued May 2006]). http://www.epa.gov/quality/qs-docs/r5-final.pdf
- *EPA Guidance for Quality Assurance Project Plans* (EPA QA/G-5, EPA/240/R-02/009, U.S. Environmental Project Agency, Office of Environmental Information, Washington DC, December 2002a). https://www.epa.gov/sites/production/files/2015-06/documents/g5-final.pdf
- *New England QAPP Guidance for Projects Using Secondary Data, Revision 2* (U.S. Environmental Protection Agency, New England, Quality Assurance Unit, Office of Environmental Measurement and Evaluation, Boston, MA, October 2009a). https://www.epa.gov/sites/production/files/2013-06/documents/EPANESecondaryDataGuidance.pdf
- *Guidance for Geospatial Data Quality Assurance Project Plans* (EPA QA/G-5G U.S. Environmental Protection Agency, Office of Environmental Information, Washington, DC, March, 2003) http://www.epa.gov/sites/production/files/documents/guidance_geospatial_data_qapp.pdf

Tetra Tech, Inc., will conduct work in conformance with procedures detailed in this QAPP.

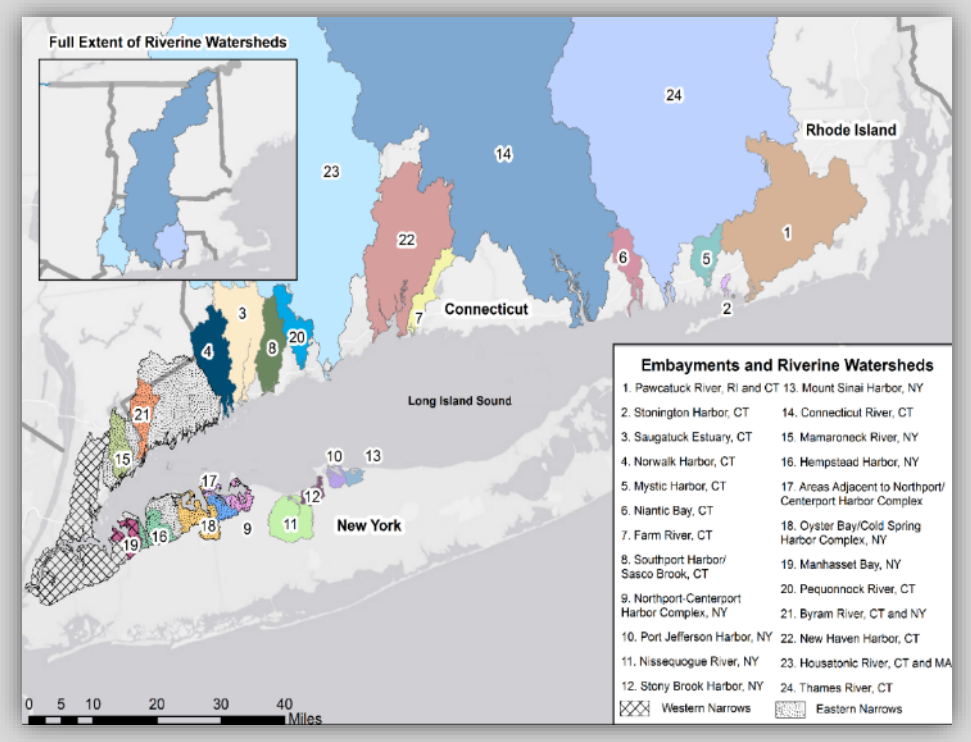
http://longislandsoundstudy.net/wp-content/uploads/2016/02/January-11-2017_TO-23-QAPP_LIS-N-Thresholds-and-Allowable-Loads.pdf

Literature Review Memo

- Clarifies science underlying technical approach and identifies data gaps
- Summary of:
  1. Data sources reviewed for selected watersheds
  2. Approach for deriving N endpoint
  3. Review of assessment endpoint targets (e.g., seagrass, DO)
- Finalized June 1, 2017
- Updated March 27, 2018

Endpoint	Importance	Linkages to, or Effects of, Nutrients	Advantages	Disadvantages
Seagrass	• Valuable marine habitat • Primary food source for many organisms	• Spatial extent, density, and growth rates decline with decreased light transmittance • Light requirement usually 20–25% surface irradiance • Light transmittance decreases with decreased clarity in part due to excess phytoplankton or epiphytic biomass from increased nutrients	• Mechanism of nutrient impact mostly well-understood • Colonization depth (Z_c) useful indicator • Once Z_c goal is established, can use light requirements to infer water clarity requirement and water column chlorophyll a criteria • Historical depth of colonization could be used to infer reference water clarity	• Cofactors exist: salinity stress, food web change, dredging, propeller scarring, sediment loading, disease • Response to nutrients can be slow (especially recovery)

Summary of Tasks A-D



- Purpose: summarize data compilation
  - Task A: Embayment Loadings
  - Task B: Point Source Loadings
  - Task C: Tributary Loadings
  - Task D: Water Quality Data
- Selected watersheds: 23 embayments; Connecticut, Housatonic, and Thames Rivers; and Western LIS (includes Eastern and Western Narrows)
- Finalized first 13 embayments, CT River, and Western LIS: August 4, 2017 and September 15, 2017
- Updated memo with additional waters: March 27, 2018

Task A. Embayment Loadings

- J. Vaudrey Nitrogen Loading Model
- TNC N loading model for Long Island
- Compiled and presented for each waterbody
- Range of N loads (kg N/y)
  - 23 embayments: 7,155 to 1,222,734
  - Eastern Narrows: 1,937,052
  - Western Narrows: 16,541,950

A.2 Stonington Harbor, CT

Figure A-2 shows a map of the Stonington Harbor watershed. Summary statistics are included in Table A-4.

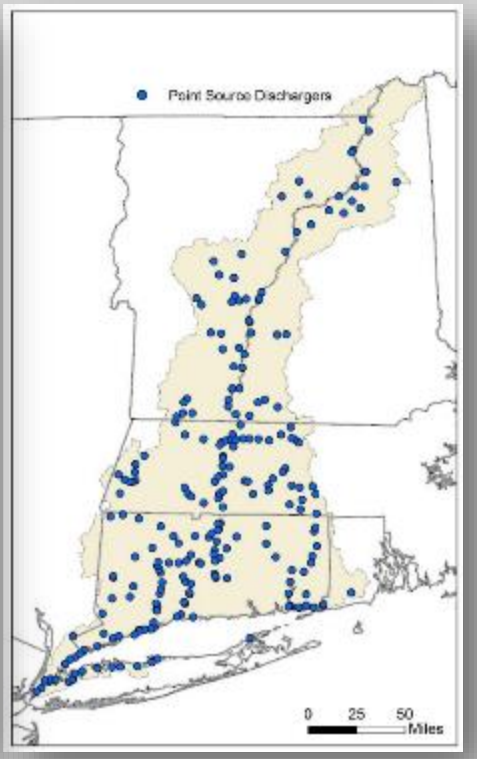
Figure A-2. Stonington Harbor Watershed, CT

Table A-4. Summary Information for Stonington Harbor Watershed, CT

Total Drainage Area of Watershed (Vaudrey et al. 2016)	6.2 km²
Total Area of Priority Embayment (Vaudrey et al. 2016)	1.8 km²
Main Tributaries (ESRI 2017)	• Stony Brook
Residence Time (Abdelrhman 2005 derived)	• 2.5 days
Depth at MLLW (NOAA 2015)	• 2.4 m average • 6 m maximum
Land Use Characteristics (Vaudrey et al. 2016; CLEAR 2010 land use data)	• Developed: 23% (developed) • Forested: 53% (deciduous, coniferous, forested wetland) • Agricultural: 2% (agricultural field)
MS4s • New London • Stonington	Percent of watershed with MS4: 35%
Point Sources	• Stonington Borough WPCF: 663 kg N/year in 2015
Total Nitrogen Loading (Vaudrey et al. 2016)	• For entire embayment: 7,155 kg N/year • From atmospheric deposition: 3,061 kg N/year • From fertilizer: 1,131 kg N/year • From sewer: 2,070 kg N/year • From septic and cesspools: 894 kg N/year

Task B. Point Source Loadings

- Point sources (Data from EPA, ICIS and USGS)
- MS4s (NY and MA – watershed models; CT – in development by state, NH/VT – no MS4s)
- 235 point source dischargers
  - Together discharged 19.2 million kg N/yr
- 340 regulated MS4s
  - 202 in CT, 86 in NY, 47 in MA, and 5 in RI
  - NY/MA loads: over 1.3 million kg N/yr

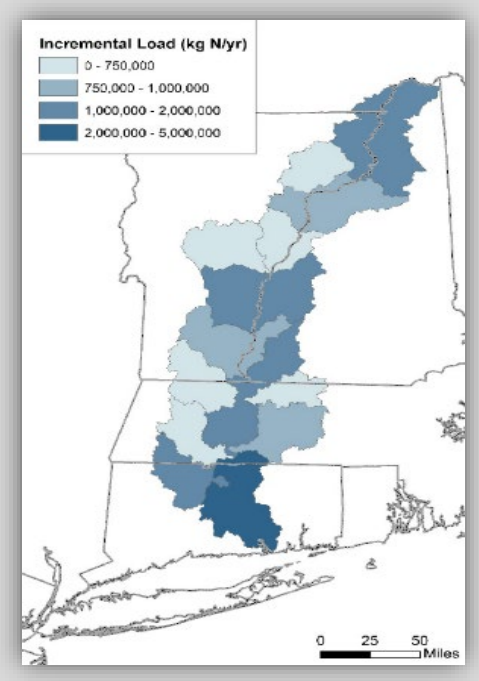


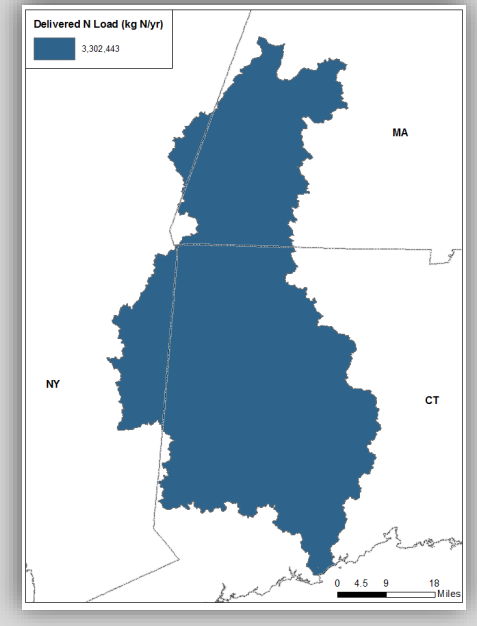
Facility (WN=Western Narrows; EN=Eastern Narrows; CRW=Connecticut River Watershed; PTW=Primary Tier Watershed)	NPDES ID	Embayment Watershed	Receiving Water	Design Flow (MGD)	Actual Flow (MGD)	Load (kg N/yr)	Concentration (mg/L)
Kimberly-Clark Corporation	CT0003212	N/A	Housatonic River	N/A	2.955	7,324	1.79
Ledyard WPCF PTW	CT0101681	Mystic River, CT	Seth Williams Brook	0.26	0.131	663	3.65
Litchfield WPCF	CT0100803	N/A	Bantam River	0.8	0.423	2,651	4.53
Manchester WPCF CRW	CT0100293	N/A	Hockanum River	8.25	5.33	48,543	6.58
Marsam Metal Finishing CRW	CTCIU0001	N/A	Unnamed Stream	N/A	0.005	182	27.23
Mattabasset WPCF CRW	CT0100307	N/A	Connecticut River	20	16.1	136,185	6.11
Meriden WPCF	CT0100315	New Haven Harbor, CT	Quinnipiac River	11.6	8.84	19,218	1.57
Middletown WPCF CRW	CT0100323	N/A	Connecticut River	6.75	3.63	83,003	16.52
Milford Beaver Brook WPCF	CT0100749	Housatonic River, CT	Housatonic River	3.1	1.45	8,449	4.21
Milford Housatonic WPCF	CT0101656	Housatonic River, CT	Housatonic River	8	5.76	43,407	5.44
Montville WPCF	CT0100935	Thames River, CT	Thames River	7.2	1.408	9,112	4.68
Naugatuck WPCF	CT0100641	N/A	Naugatuck River	10.3	5.341	30,153	4.08
New Canaan WPCF EN	CT0101273	Five Mile River,	Five Mile River	1.7	0.881	2,816	2.31

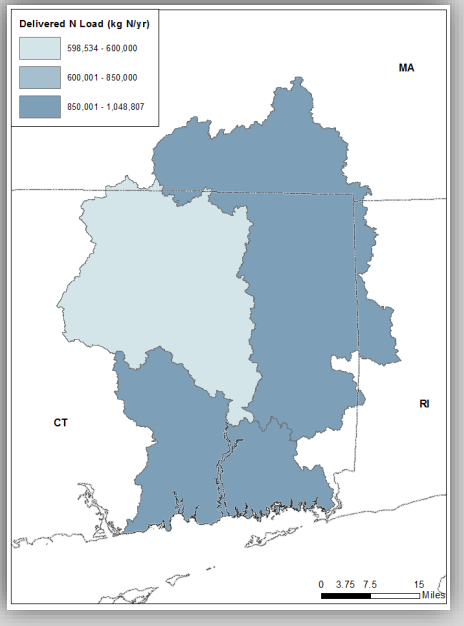
Task C. Tributary Loadings

- Data: USGS, NOAA, SPARROW, LIS TMDL, AVGWLF model, HSPF model
- Load estimates for CT, Housatonic, and Thames at 3 scales:
  - Entire watershed
  - Specific USGS gauges
  - Subwatersheds
- Load Range (kg N/y):

  2,601,608 (Thames) to 15,604,101 (CT)

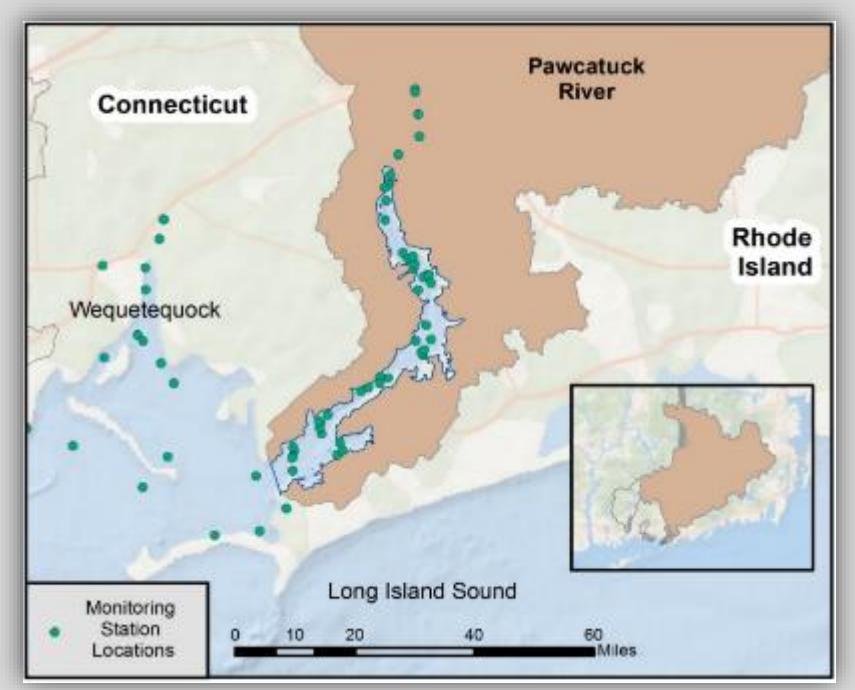






Task D. Water Quality Data

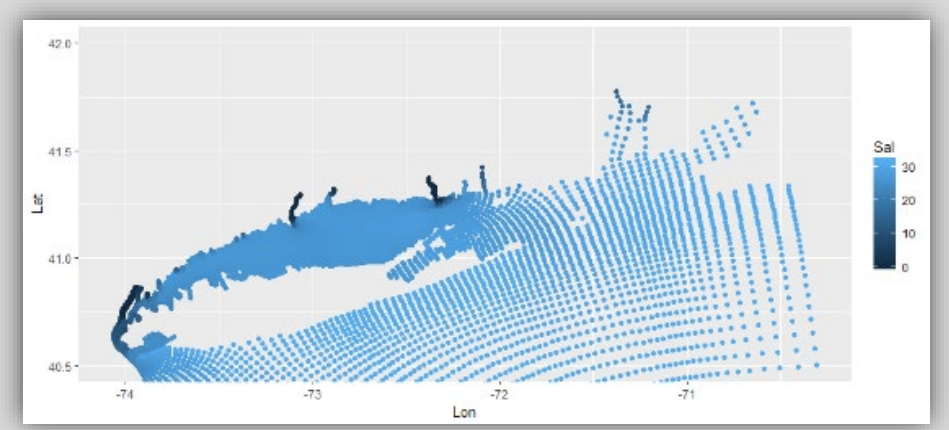
- Solicited data from broad range of sources (N=27)
- Screened for data requirements (applicability, availability, QA)
  - >24,000 nutrient samples
  - >65,000 response measure samples
  - 588 stations
- Memo provided data details by waterbody

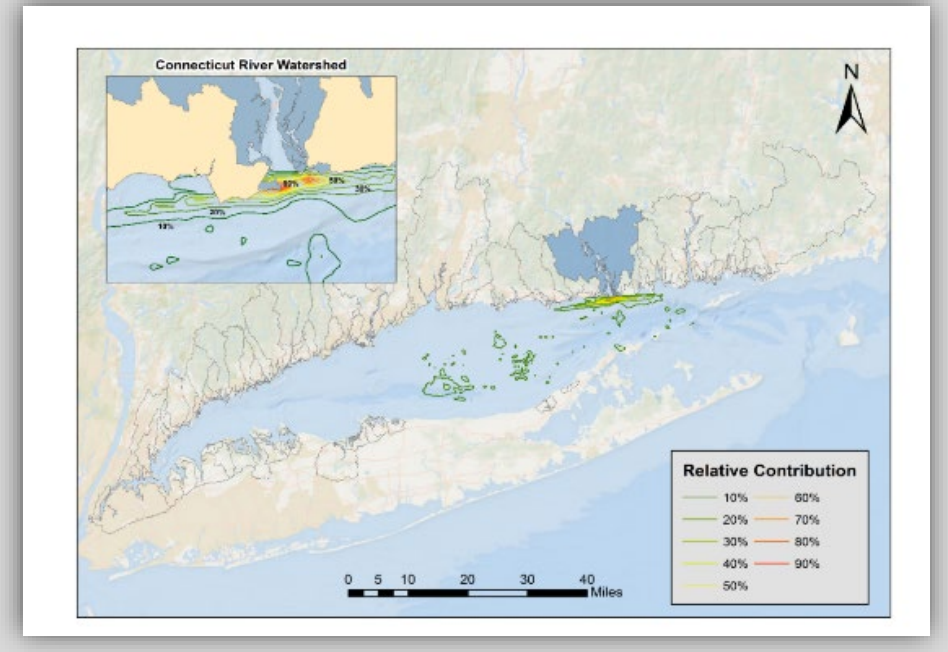


Monitoring Organization	Number of Stations	Data Collection Period	Number of Nutrient Samples		Number of Response Samples		
			TN	TP	Chl *a*	DO	SD
CT DEEP	60	2006–2015	4,068	3,956	3,876	8,204	2,295
EPA NCCA	56	2006–2010	54	53	54	72	23
EPA Region 1	7	2017	23	23	23	23	21
EPA ORD	152	2000–2009	88	0	448	1,320	580
Friends of the Bay	22	2008–2014	612	0	0	0	0
Harbor Watch	36	2006–2015	0	0	0	2,343	639
IEC	22	2006–2015	99	99	641	7,574	2,367
NOAA (Hunts Point)	1	2012	26	0	112	143	0
NYC DEP	45	2006–2015	5,179	5,185	5,191	7,828	7,973
Stony Brook University–Dr. Gobler	6	2014–2016	0	0	216	216	210
Suffolk County	57	2006–2015	1,697	1,697	1,547	3,311	1,639
University of Connecticut (Vaudrey)	96	2013–2014[a]	269	0	140	530	19
University of Connecticut (Yarish)	3	2011–2016	0	0	0	0	33
URIWW	25	2007–2015	725	724	942	1,379	365
Total	**588**		**12,840**	**11,737**	**13,190**	**32,943**	**16,164**

Summary of Task E. Hydrodynamics

- Calculate mixing between LIS and selected embayments
  - Off-the-shelf model (NYHOPS)
- Particle tracking routine used to estimate area of influence and contribution of rivers to LIS waters
- Salinity model used to estimate mixing/dilution
  - Range: 100% to 77% dilution
- Round 1 memo: October 20, 2017
- Updated: March 27, 2018



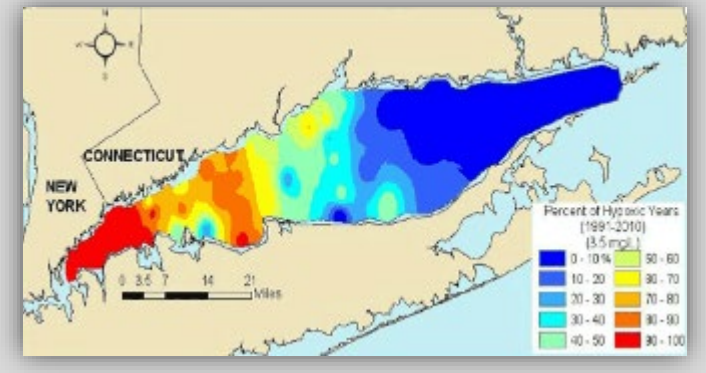


Task F/G. N Endpoint Development

- Develop TN endpoints for each waterbody
- Protect:
  - Seagrasses (light)
  - Aquatic Life (DO)
- Targets for round 1 waters: 13 embayments, CT River, and Western LIS

Seagrasses

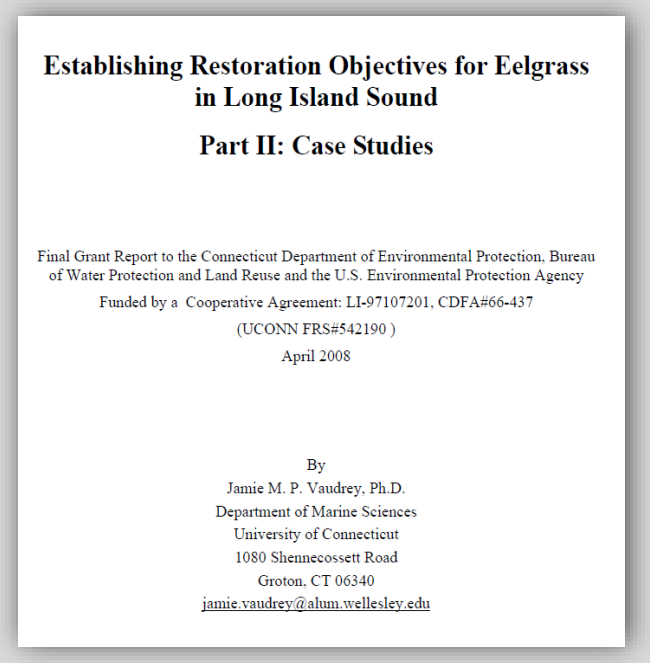
Dissolved Oxygen



N Endpoints Development: Methods

Multiple lines of evidence

- Literature
- Stressor-Response
- Distribution-Based



Establishing Restoration Objectives for Eelgrass in Long Island Sound

Part II: Case Studies

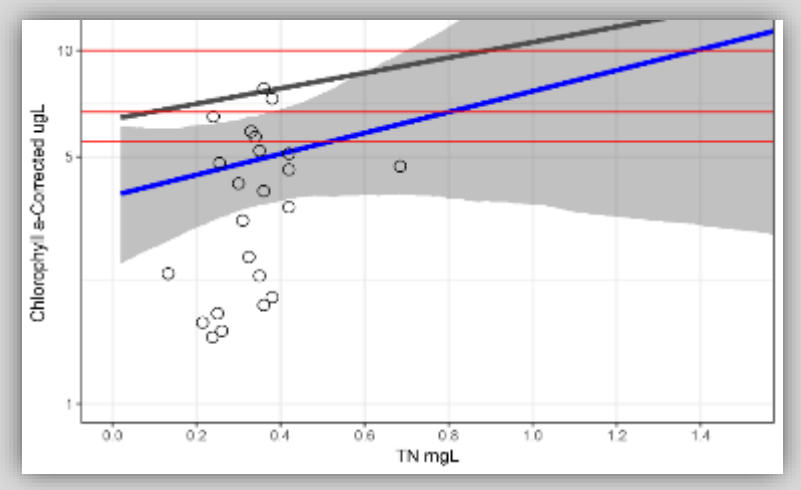
Final Grant Report to the Connecticut Department of Environmental Protection, Bureau of Water Protection and Land Reuse and the U.S. Environmental Protection Agency

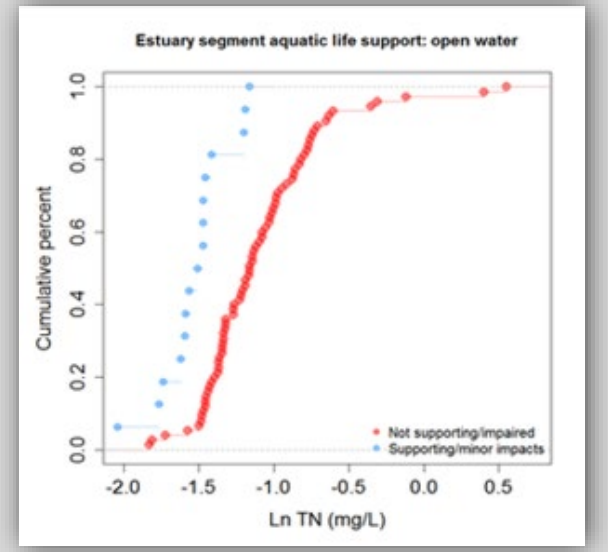
Funded by a Cooperative Agreement: LI-97107201, CDFA#66-437

(UCONN FRS#542190)

April 2008

By
Jamie M. P. Vaudrey, Ph.D.
Department of Marine Sciences
University of Connecticut
1080 Shennecossett Road
Groton, CT 06340
jamie.vaudrey@alum.wellesley.edu





Results: Literature

- TN values to protect valued endpoints
- Relied on heavily researched and studied Massachusetts estuaries

Embayments

Median TN (mg/L)	**0.39**	**Summary for Seagrass Protection**
Min TN (mg/L)	0.30	
Max TN (mg/L)	0.49	

Open Water

Median TN (mg/L)	**0.46**	**Summary for Non-seagrass Endpoints***
Min TN (mg/L)	0.30	
Max TN (mg/L)	0.60	

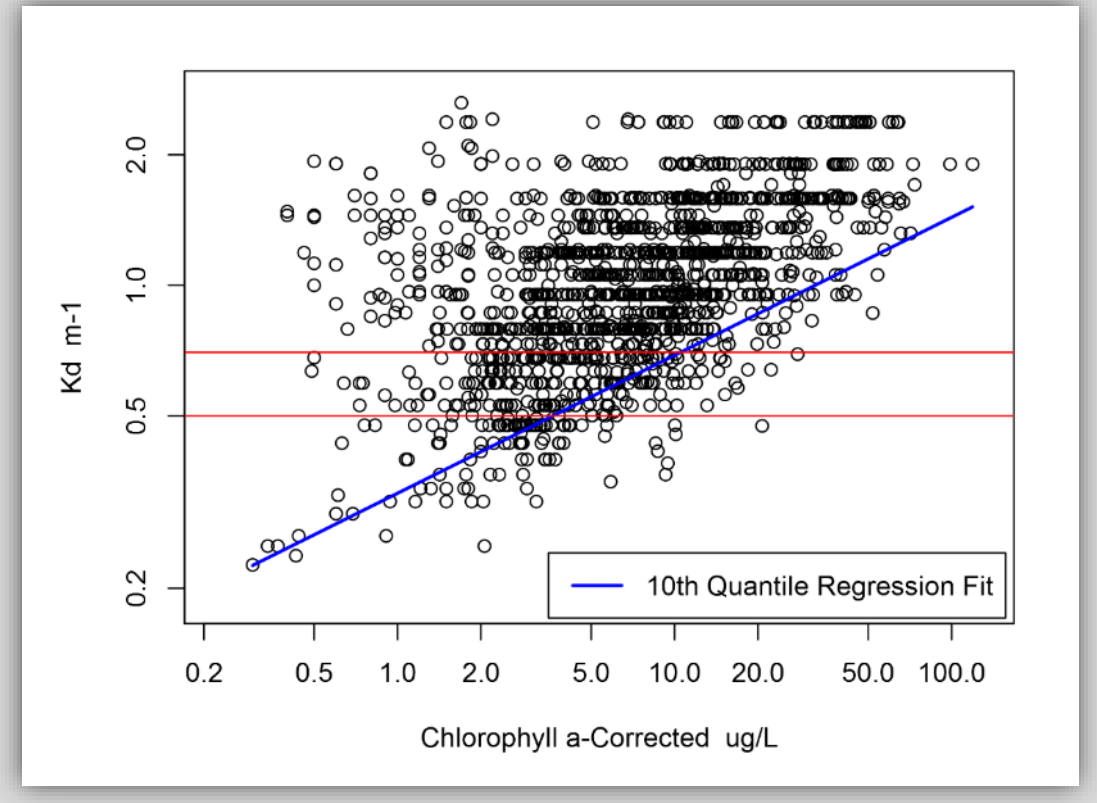
*Excludes values at or above 0.800 severe degradation endpoint

Results: Stressor-Response

- Chlorophyll tied to clarity goals
  - Based on providing 15% to 35% surface light at seagrass colonization depths
  - K_d of 0.5 to 0.7
  - Provides 14% to 78% light at average embayment depths (Average = 52%)

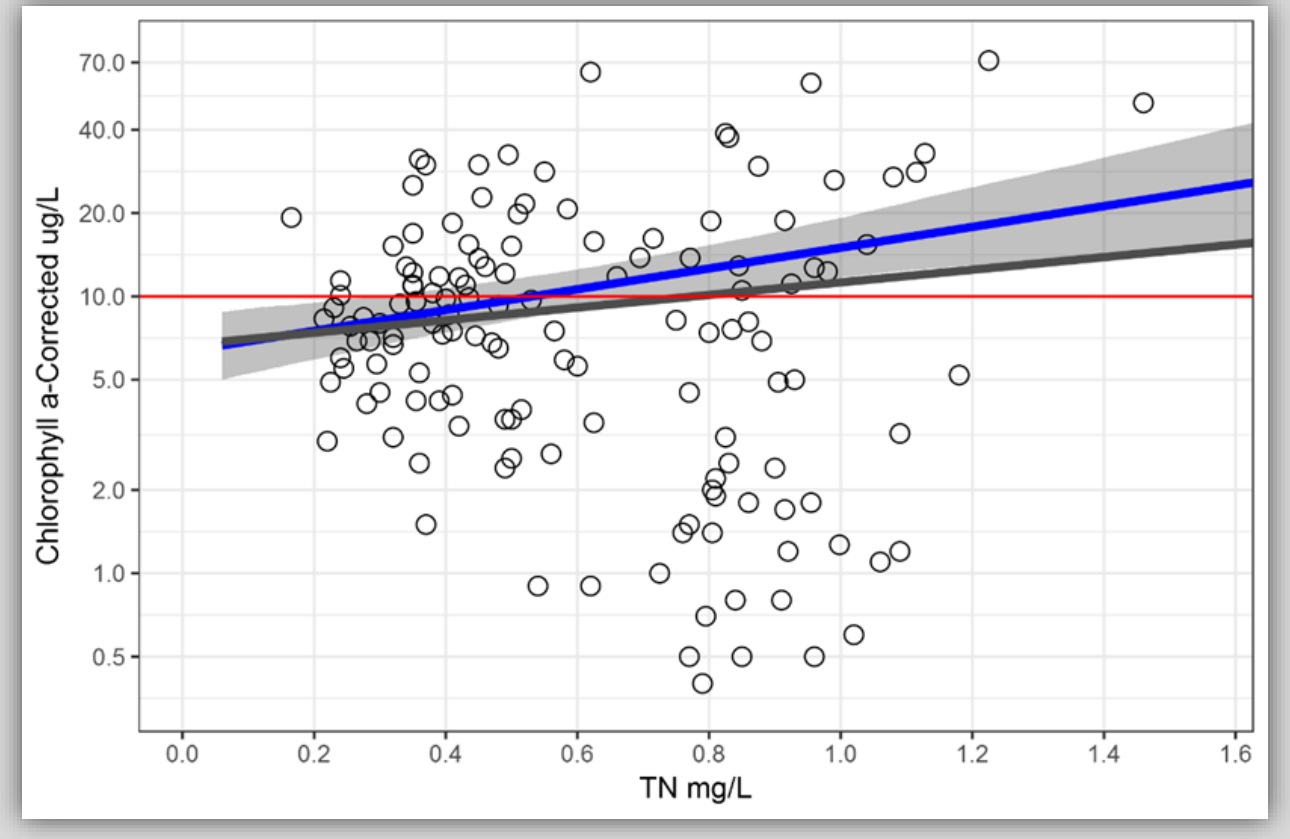
- Dissolved Oxygen models were not significant

K_d Endpoint	Associated Chlorophyll a
0.5	3.71
0.7	9.83



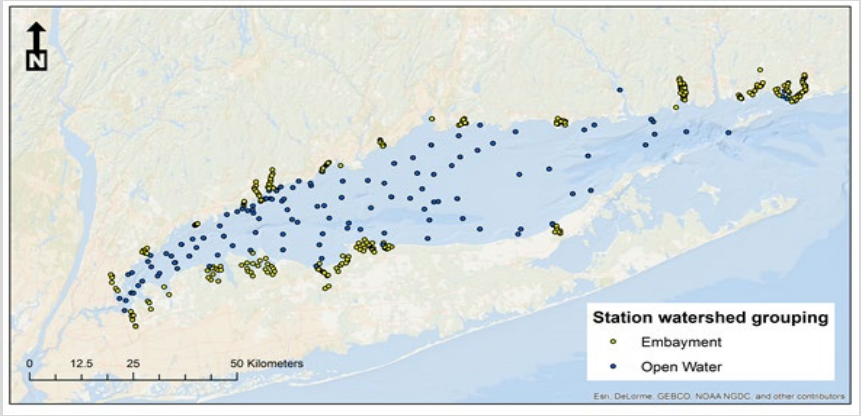
Results: Stressor-Response

- Used chlorophyll (Chl) values of 3.5, 5.5, and 10 µg/L
- Ran embayment specific Chl vs Total Nitrogen models
- Interpolated values from regressions (e.g., here 0.53 mg/L TN at 10 µg/L chlorophyll)



Results: Distribution-Based

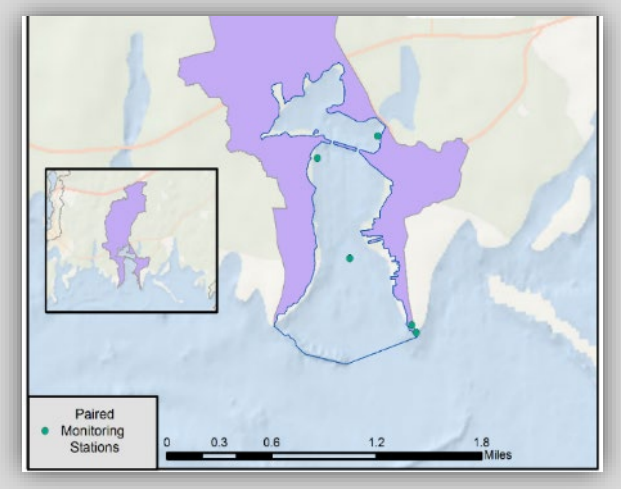
- Percentiles of Total Nitrogen (TN) concentrations at embayments or open water
- Per 2001 EPA guidance



Watershed Grouping								
Percentile	5%	10%	25%	Median	75%	90%	95%	N
All Embayments TN (mg/L)	0.19	0.22	0.27	0.37	0.56	0.95	1.66	587
All Open Water TN (mg/L)	0.20	0.21	0.24	0.30	0.50	0.98	1.34	345

N Endpoint Development: Results

- Compiled tables for each selected tier water
- Report ranges of values from different lines
- Accompanying narrative explains each value



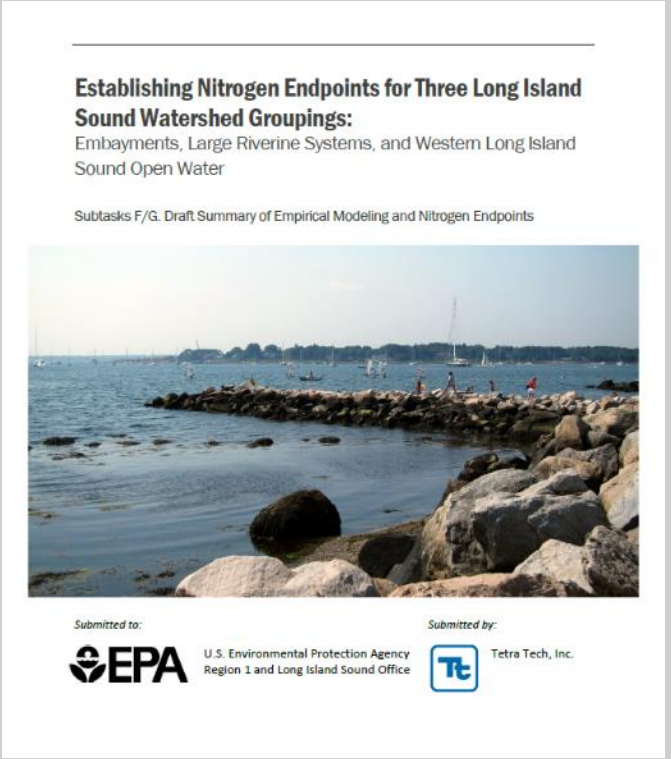
Endpoint Parameter	Endpoint Method	TN Endpoint (mg/L)
Chlorophyll a-corrected	Stressor–Response Model for Individual Embayments Mean (90^{th} Percent Confidence Interval)	0.48 (0.06–2.52)
Aquatic Life Protection	Literature Review Median Protective of Seagrass Endpoints (Range)	0.40 (0.30–0.50)
	Distribution-Based Approach	0.27

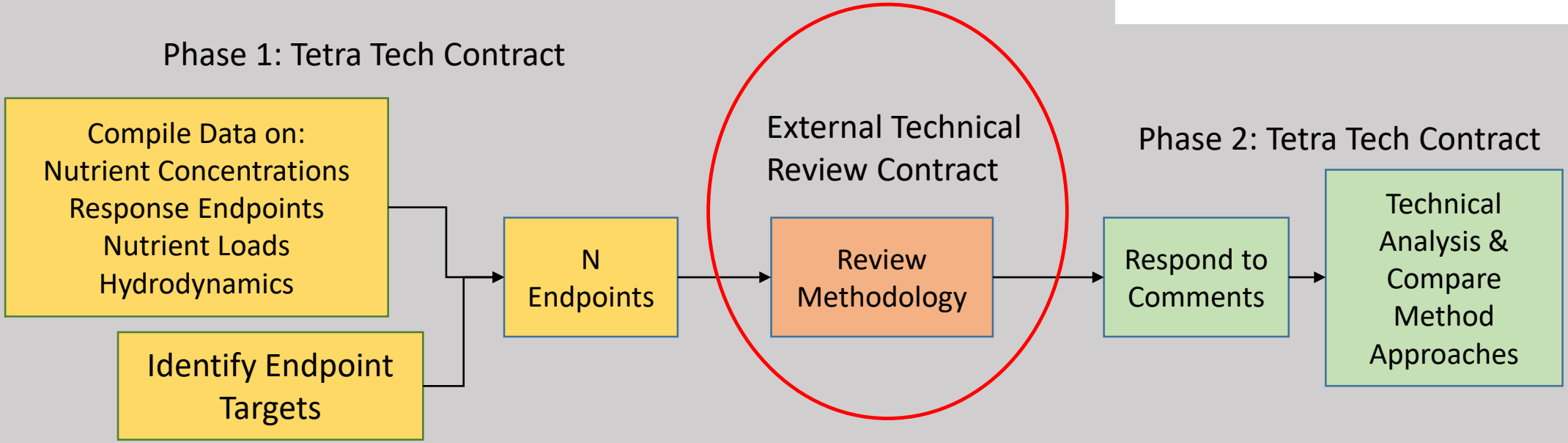
N Endpoint Development: Task F/G

- Draft out for public review
- Task F/G memo can be found at: http://longislandsoundstudy.net under Nitrogen Strategy link
- Will incorporate feedback
- Please provide your technical comments to LISNitrogen@EPA.gov by Dec 14, 2018

External Technical Review

- Four external specialists are reviewing the Phase 1 deliverables
- This review will be used to further refine the deliverables and inform Phase 2
- Results are expected in early 2019





Overview: Phase 2 of the Nitrogen Strategy

Phase 1: Tetra Tech Contract

Compile Data on:
Nutrient Concentrations
Response Endpoints
Nutrient Loads
Hydrodynamics

Identify Endpoint Targets

N Endpoints

External Technical Review Contract

Review Methodology

Phase 2: Tetra Tech Contract

Respond to Comments

Technical Analysis & Compare Method Approaches

Phase 2: Response to Comments

- Respond to External Technical Review
- Respond to Public Comments
- Refine and complete the technical approach

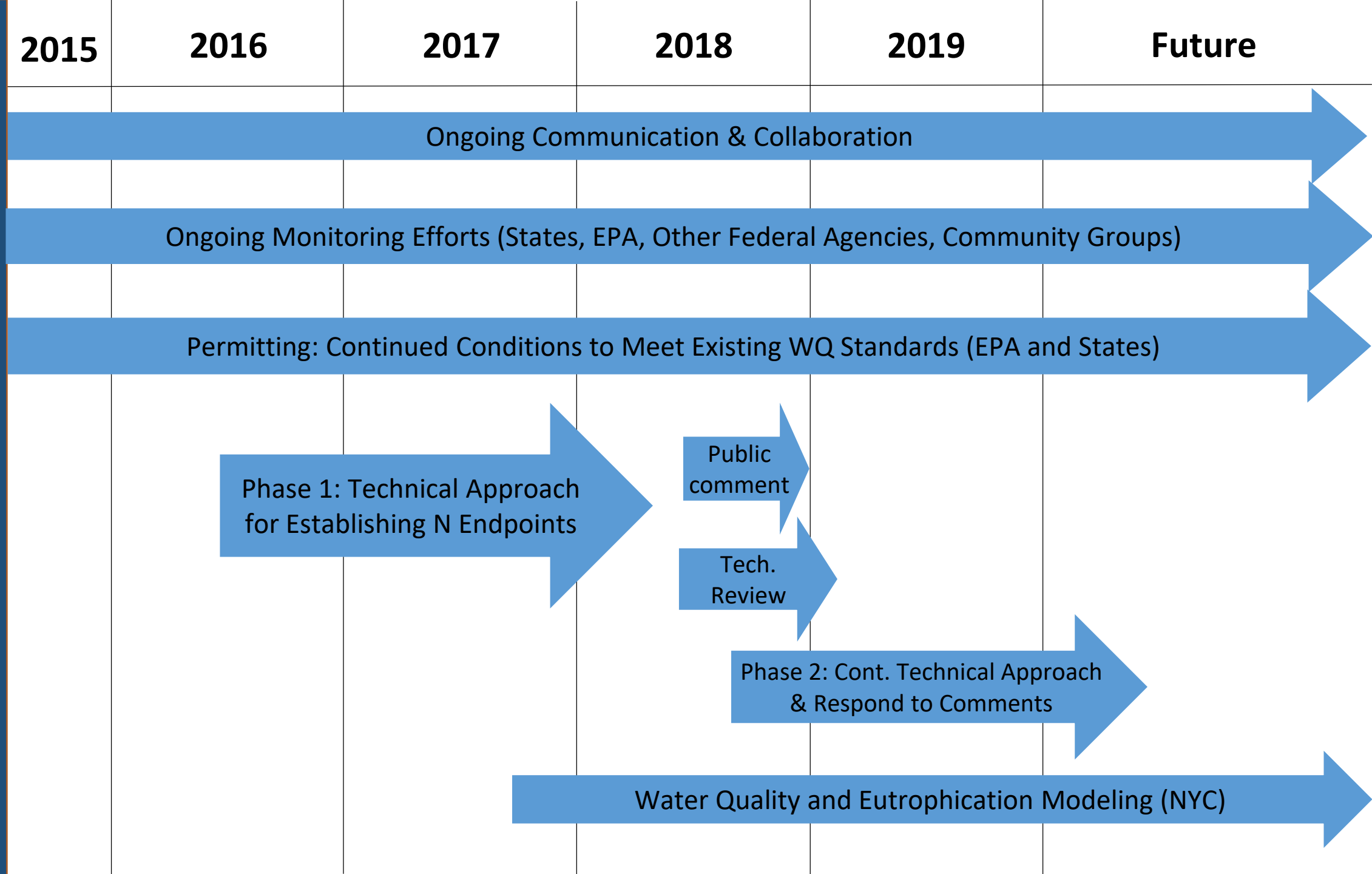
Phase 2: Increased Collaboration

- Coordinate Nitrogen Endpoint Work
  - Long Island Sound Nitrogen Action Plan
  - Suffolk County
  - Niantic River Estuary Workgroup
- Technical Stakeholder Group Coordination
- Increase collaboration, knowledge sharing, and data sharing among all partners

Phase 2: Addressing Evaluation and Monitoring Gaps

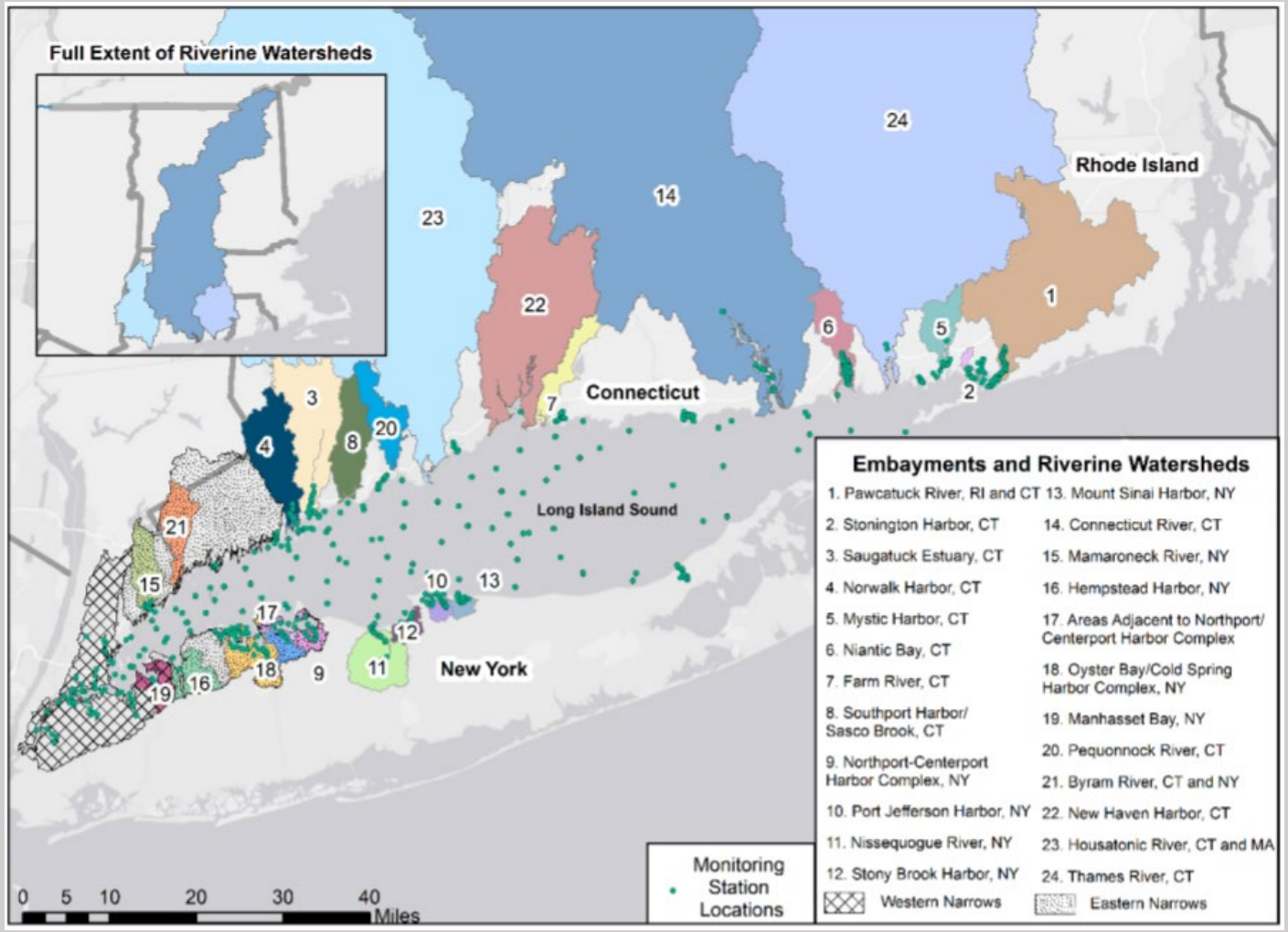
- Revise deliverables based on new monitoring data
- Identify where water quality monitoring data gaps exist
- Expand geographic focus of methodology
- Draft technical gap analysis and method comparison

EPA Long Island Sound Nitrogen Reduction Strategy

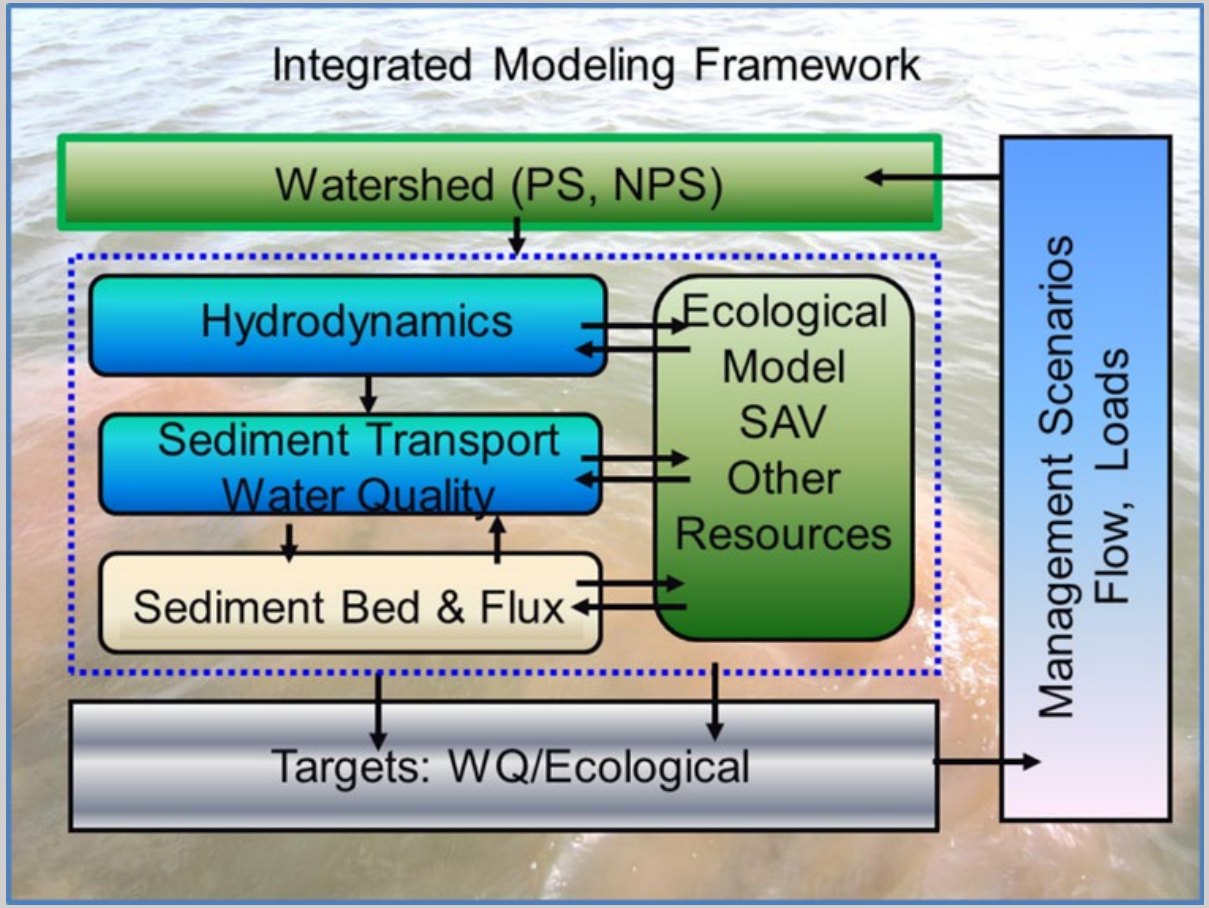


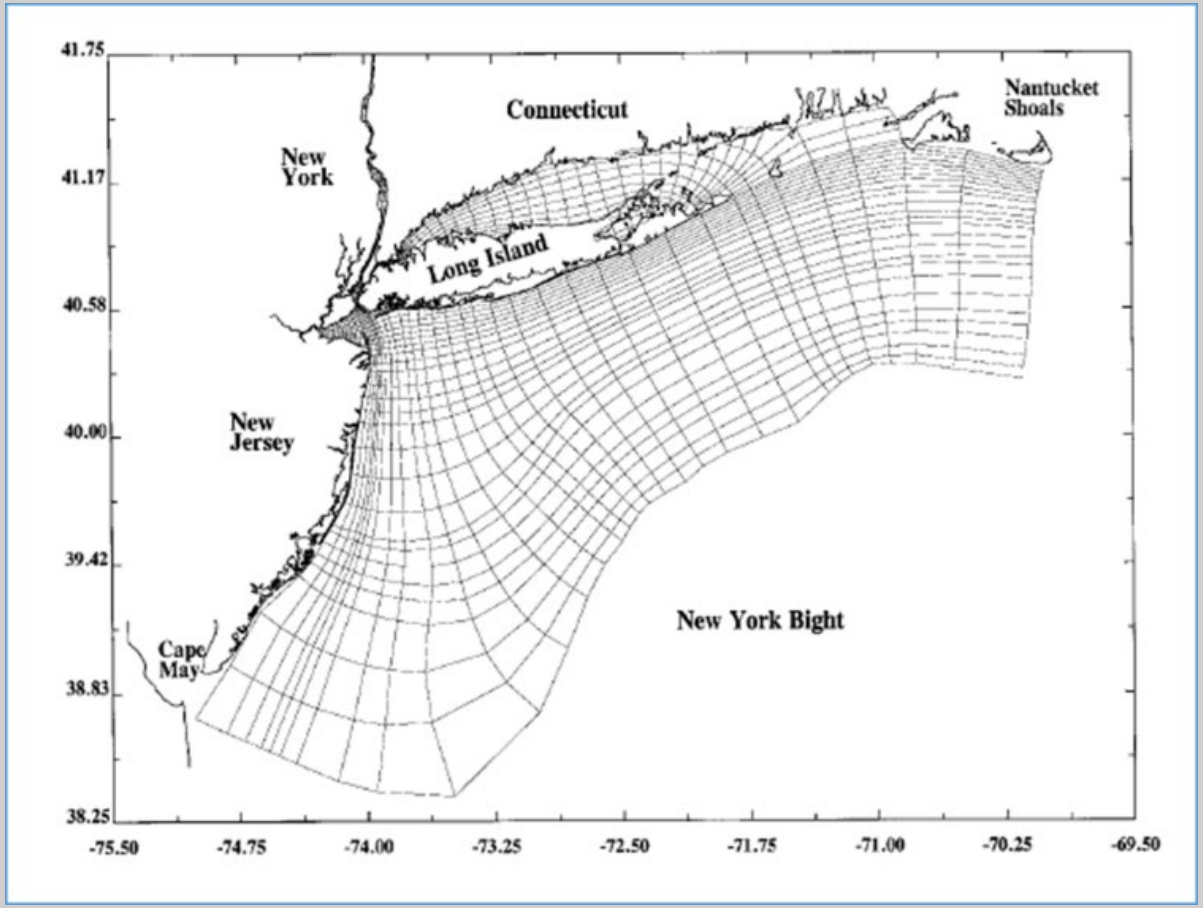
Ongoing: Water Quality Monitoring

- Continuation of ongoing LIS monitoring efforts
- Expansion of LIS open water and embayment monitoring around the Sound
- Mouth of Connecticut River
  - 2017 EPA CT River Data Report posted on LIS website
  - Sampled CT River again in 2018, report anticipated early 2019



Ongoing: Integrated Modeling (NYC)





Thank you for participating

- Please go to http://longislandsoundstudy.net under Nitrogen Strategy link to:
  - Register for email updates
  - Access technical documents and presentation slides

- Provide your technical comments on Task F & G Memo to LISNitrogen@EPA.gov by Dec 14, 2018

Direct link for access http://longislandsoundstudy.net/issues-actions/water-quality/nitrogen-strategy/