Nutrient Criteria Development in the Chowan River/Albemarle Sound

September 12, 2019

Brian Wrenn, Division of Water Resources

Talking Points

- Brief history and background of nutrient criteria development in NC
- Roles of the Scientific Advisory Council and Criteria Implementation Committee
- Chowan River/Albemarle Sound status
- Existing Conditions
- Data Gaps

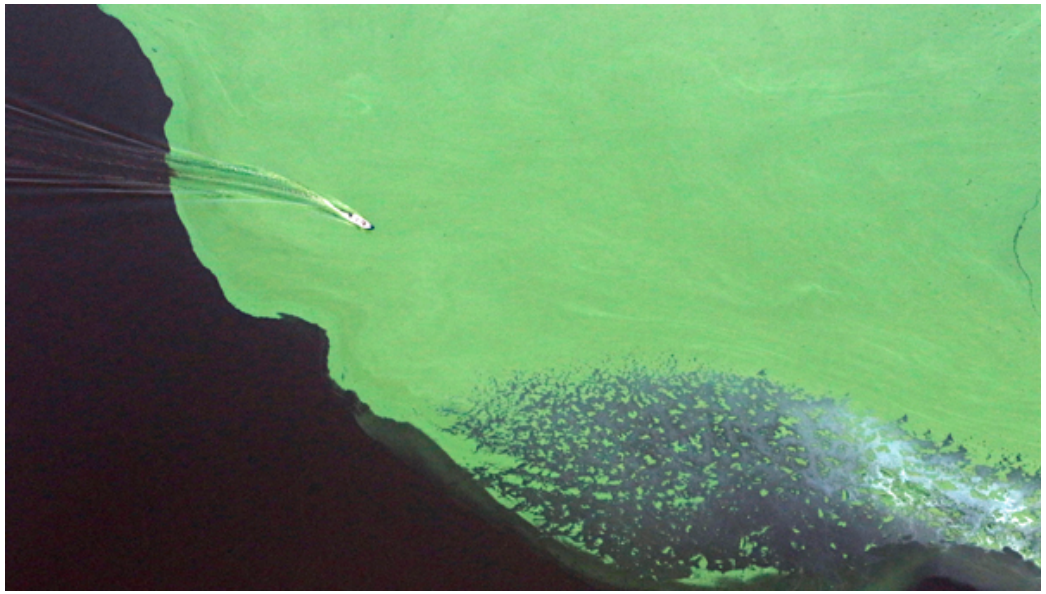


Photo: Sound Rivers

NORTH CAROLINA
Department of Environmental Quality

Nutrient Criteria Development in NC

- 2001 - Federal Register notice, states encouraged to develop nutrient management plans.
- 2004 - NC developed the Nutrient Criteria Implementation Plan (NCIP)
- 2011 - EPA memo to regions placing new emphasis on nutrient reductions
- 2012 - NC Forum on Nutrient Over Enrichment
- 2014 - Nutrient Criteria Development Plan (NCDP)
- 2019 – Revised NCDP

EPA

FEDERAL REGISTER
The Daily Journal of the United States Government

DEQ
NORTH CAROLINA
Department of Environmental Quality

Nutrient Criteria Development Plan

- Links nutrient criteria with protection of designated uses including downstream uses
  - "Fishable, swimmable, boatable"
  - Trout waters, public water supply, primary nursery areas, etc.
- Evaluate causal and response variables (nutrients, chlorophyll *a*, pH, dissolved oxygen, etc.)
- Express numerically or in narrative form with a numerical translator
  - Concentration
  - Mass quantities or loadings

Photo: Carolina Sportsman

Photo: Chuck Beckley, Sun Journal Staff

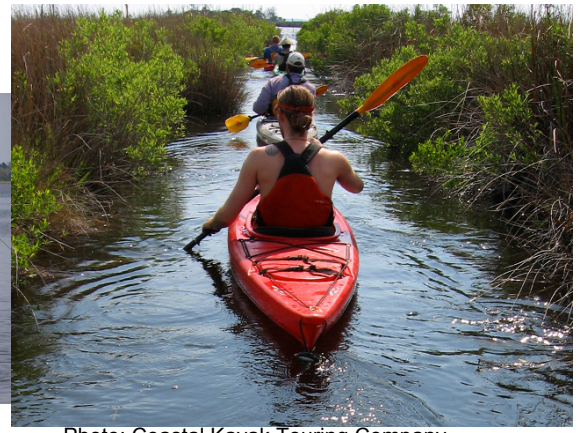


Photo: Coastal Kayak Touring Company

NORTH CAROLINA
Department of Environmental Quality

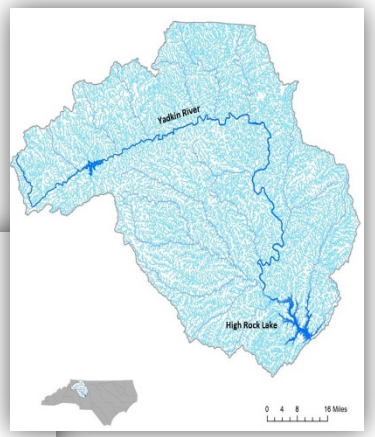
SAC and CIC

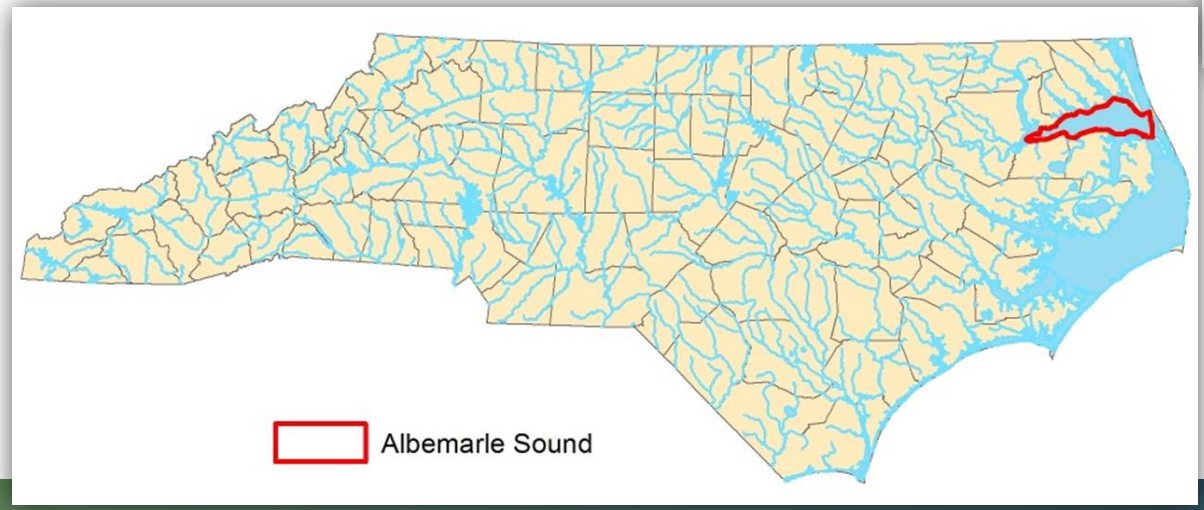
- Scientific Advisory Council (SAC) created
  - Advise on the development of scientifically-defensible nutrient criteria
  - Made up of experts in water quality, nutrient management, nutrient abatement
- Criteria Implementation Committee (CIC) created
  - Comment on the social and fiscal impacts of draft nutrient criteria on stakeholders
  - Made up of economists, stakeholder representatives, and academics

NORTH CAROLINA
Department of Environmental Quality

Nutrient Criteria Development Plan

- Develop criteria for three water body types
  - Landscape position, flow dynamics, sensitive species
  - Lakes/reservoirs, rivers and streams, estuaries
- Specific water bodies
  - High Rock Lake
  - Central Cape Fear River
  - **Chowan River/Albemarle Sound**

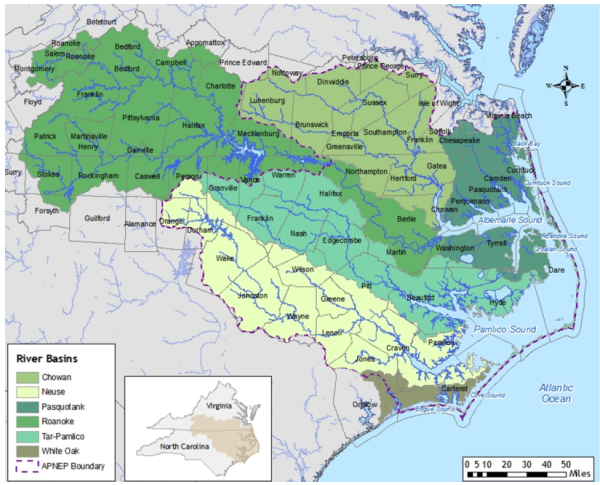




NORTH CAROLINA
Department of Environmental Quality

NCDP and APNEP

- APNEP has done a significant amount of background research in support of the NCDP
- Two phase process:
  - Phase I - identify and prioritize potential criteria parameters, identify data gaps and research needs (bioassays, light attenuation modeling), Phase I report completed February 2018
  - Phase II – DWR and SAC will pick up evaluation efforts and develop final criteria proposal, beginning Fall 2019



NORTH CAROLINA
Department of Environmental Quality

Criteria Development for Estuaries

- EPA's Nutrient Criteria Technical Guidance Manual: Estuarine and Coastal Marine Waters
- Many of the initial steps completed by APNEP in development of the Phase I report
  - Causal and response variables, data gaps, new data needs
- Physical Classification (salinity, hydrography), New Data Collection, Data Analysis, Establishing Reference Conditions

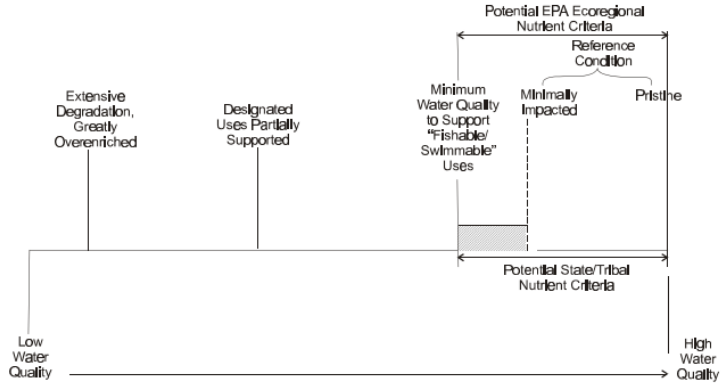


Figure 6-1. Environmental quality scale representing reference conditions and potential nutrient criteria relative to designated uses.

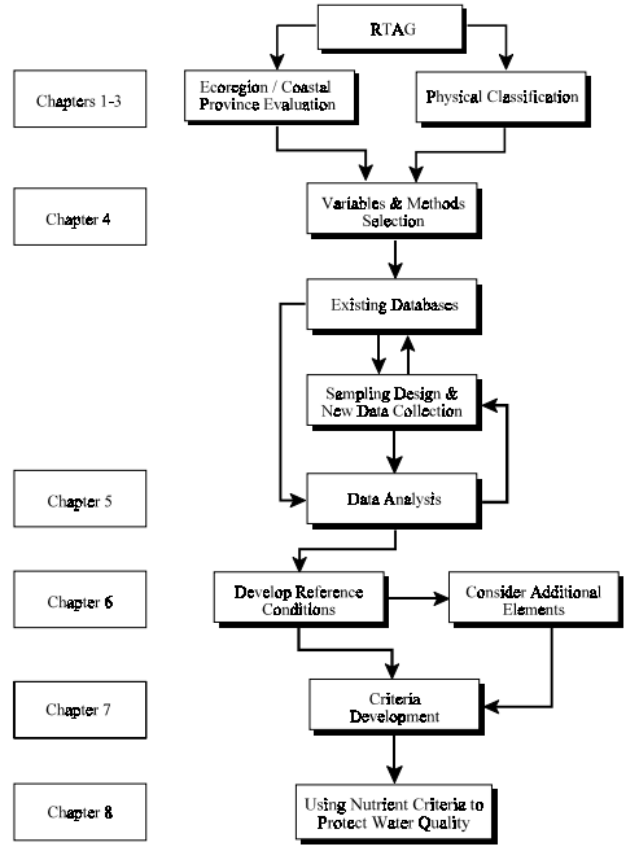
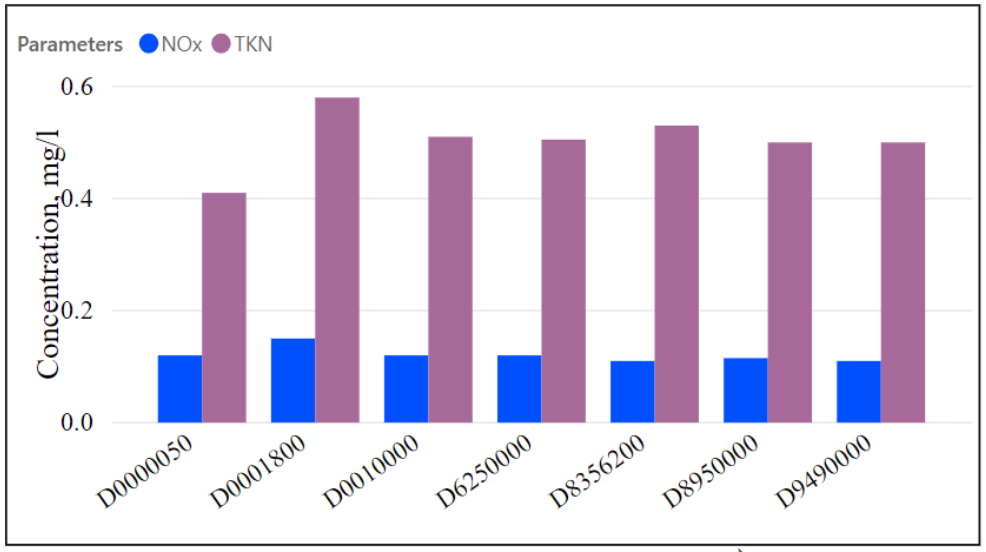


Figure 1-6. Flowchart of the nutrient criteria development process.

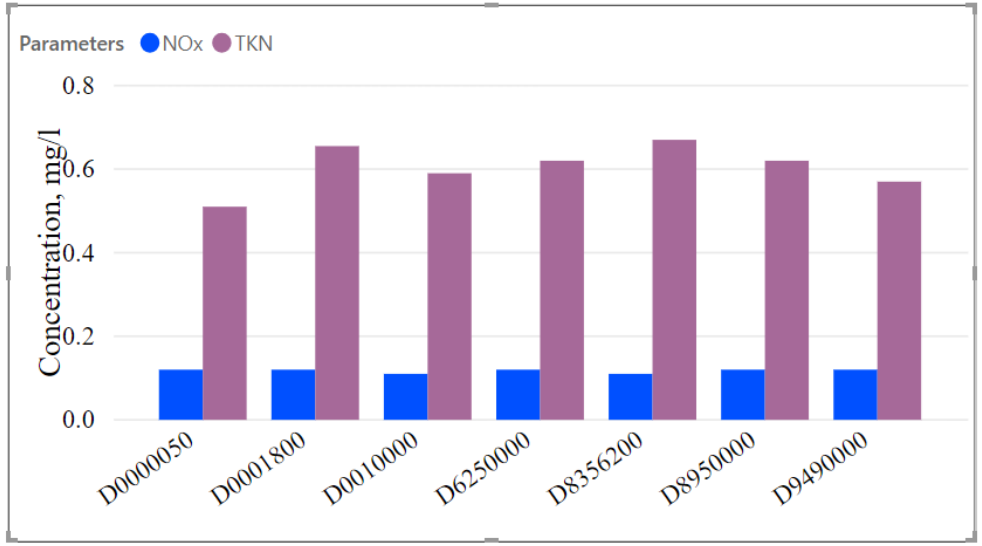
NORTH CAROLINA
Department of Environmental Quality

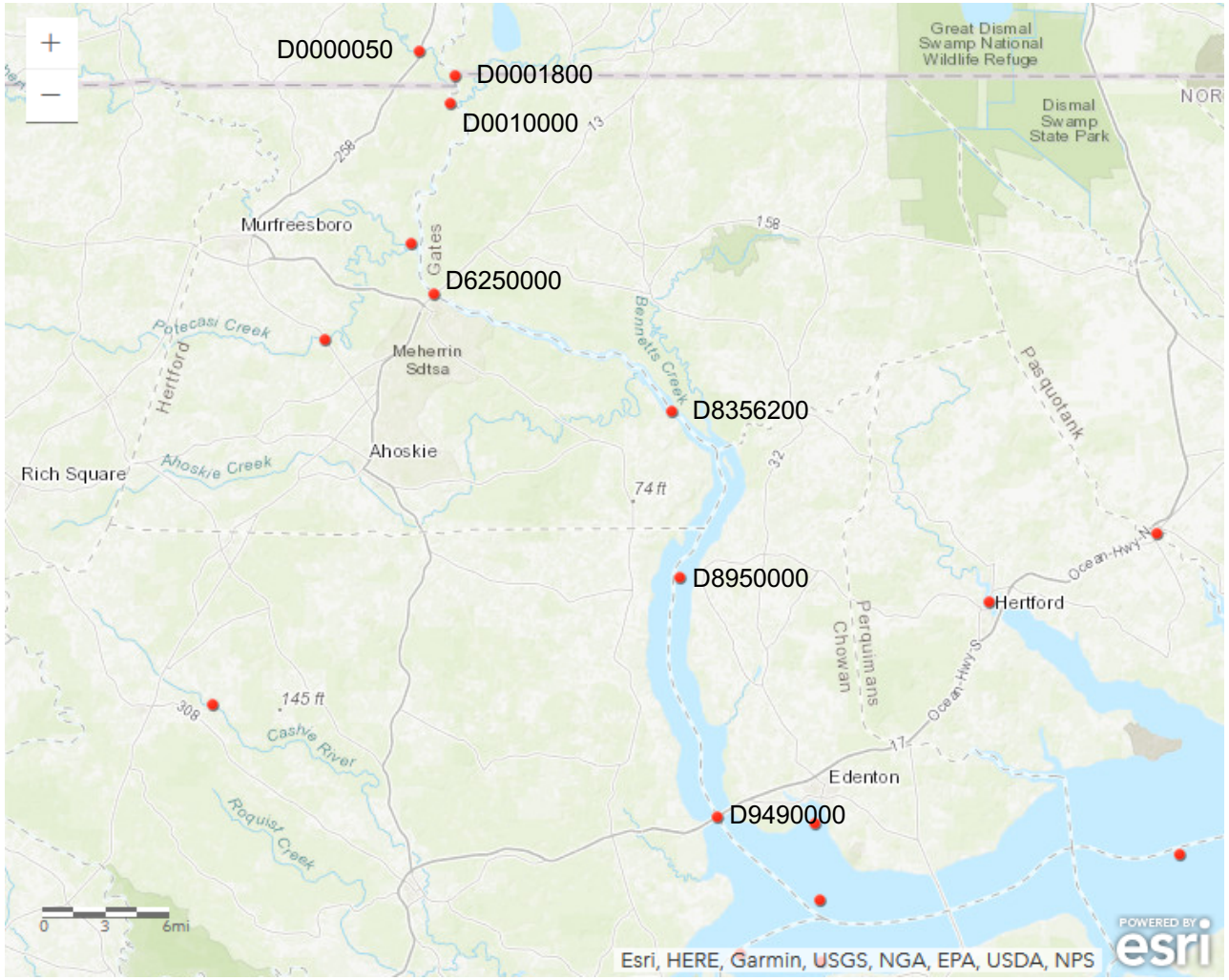
1990-2018



Downstream

2010-2018



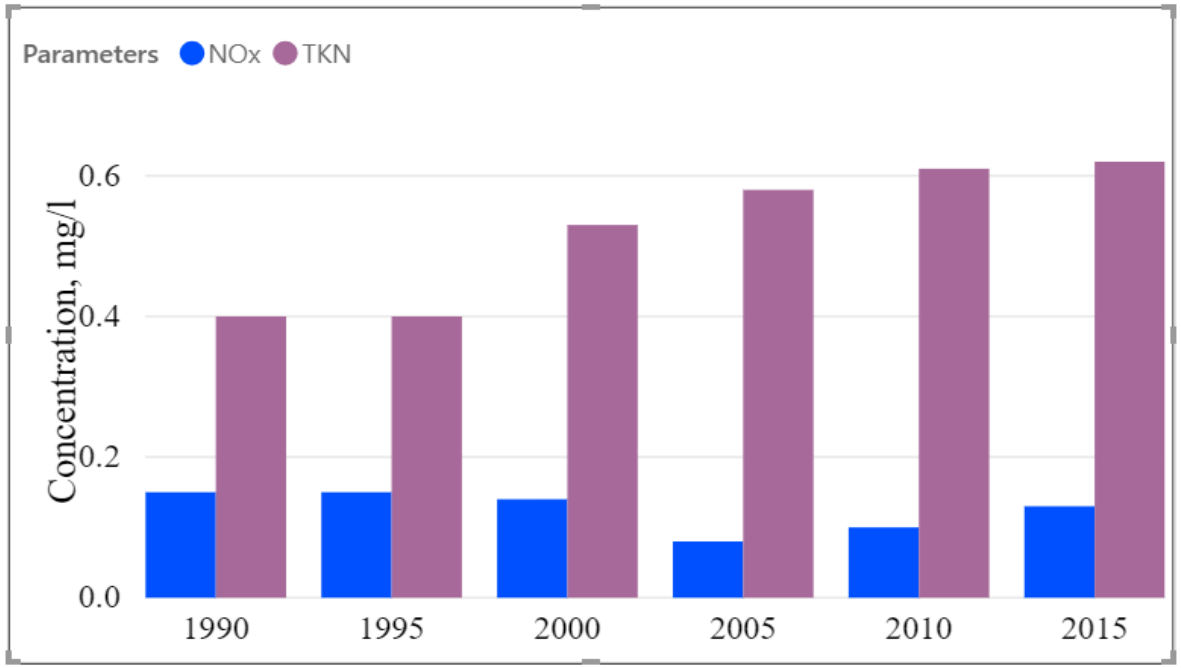


Time period averages for mainstem Chowan River monitoring stations

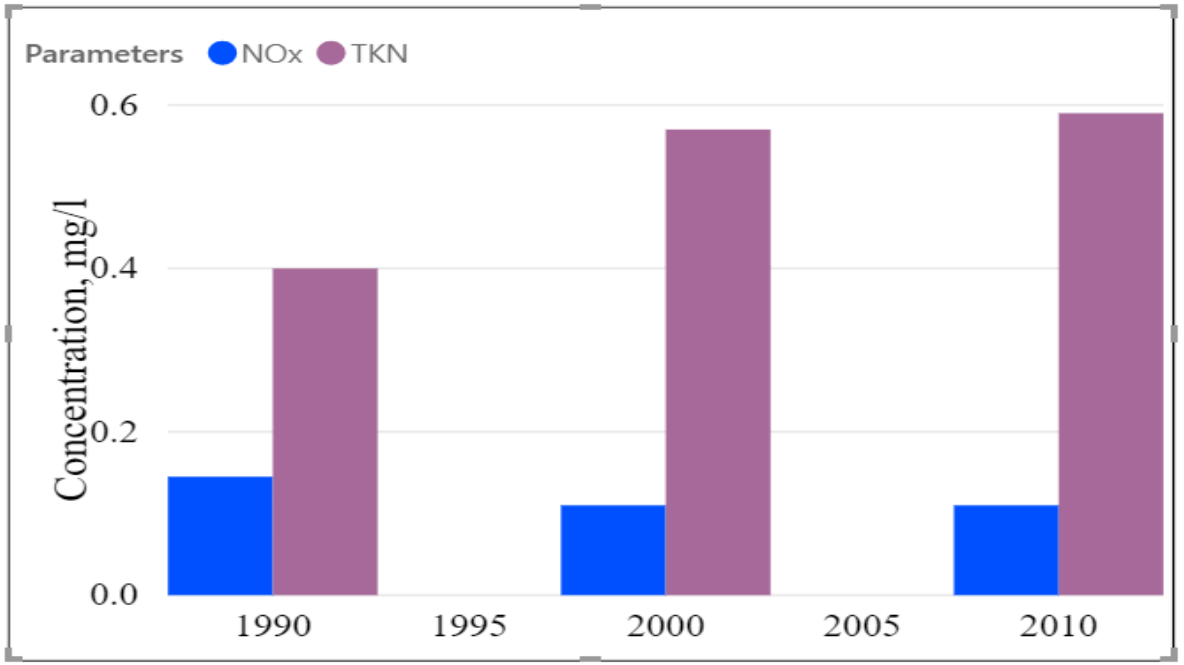
NORTH CAROLINA
Department of Environmental Quality

Average of all mainstem Chowan River stations by 5- and 10-year windows

5 Year Window

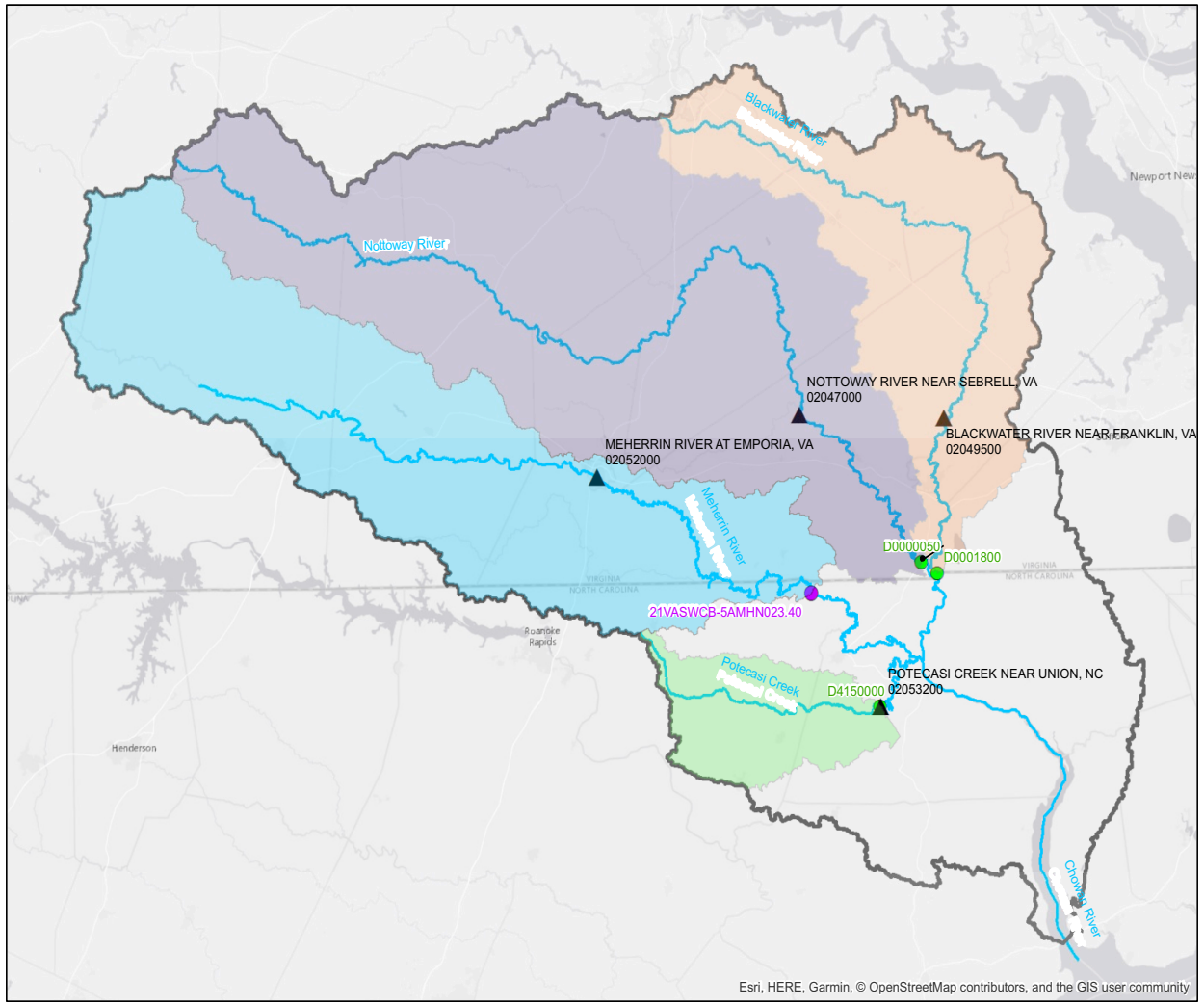


10 Year Window



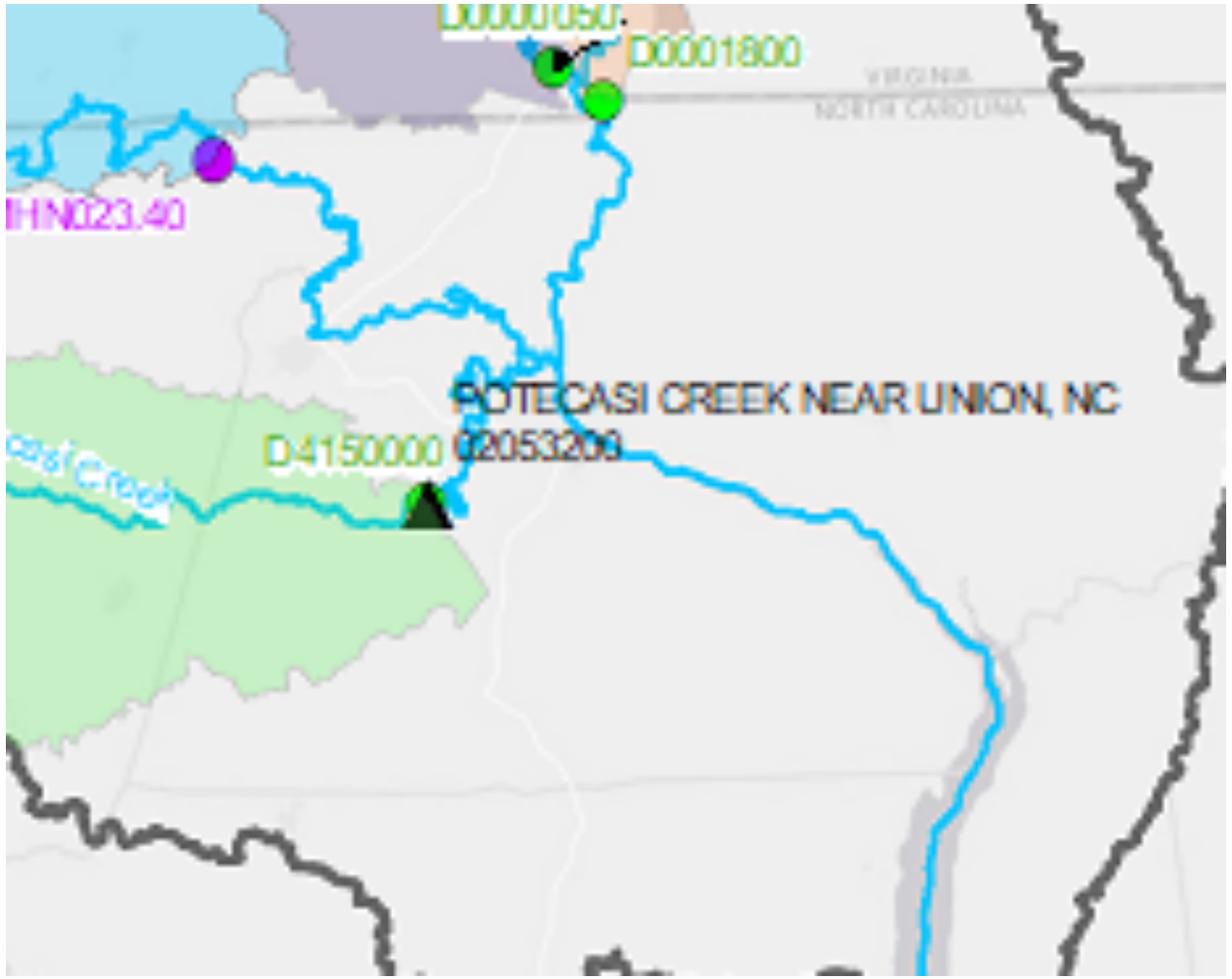
NORTH CAROLINA
Department of Environmental Quality

Chowan River Basin



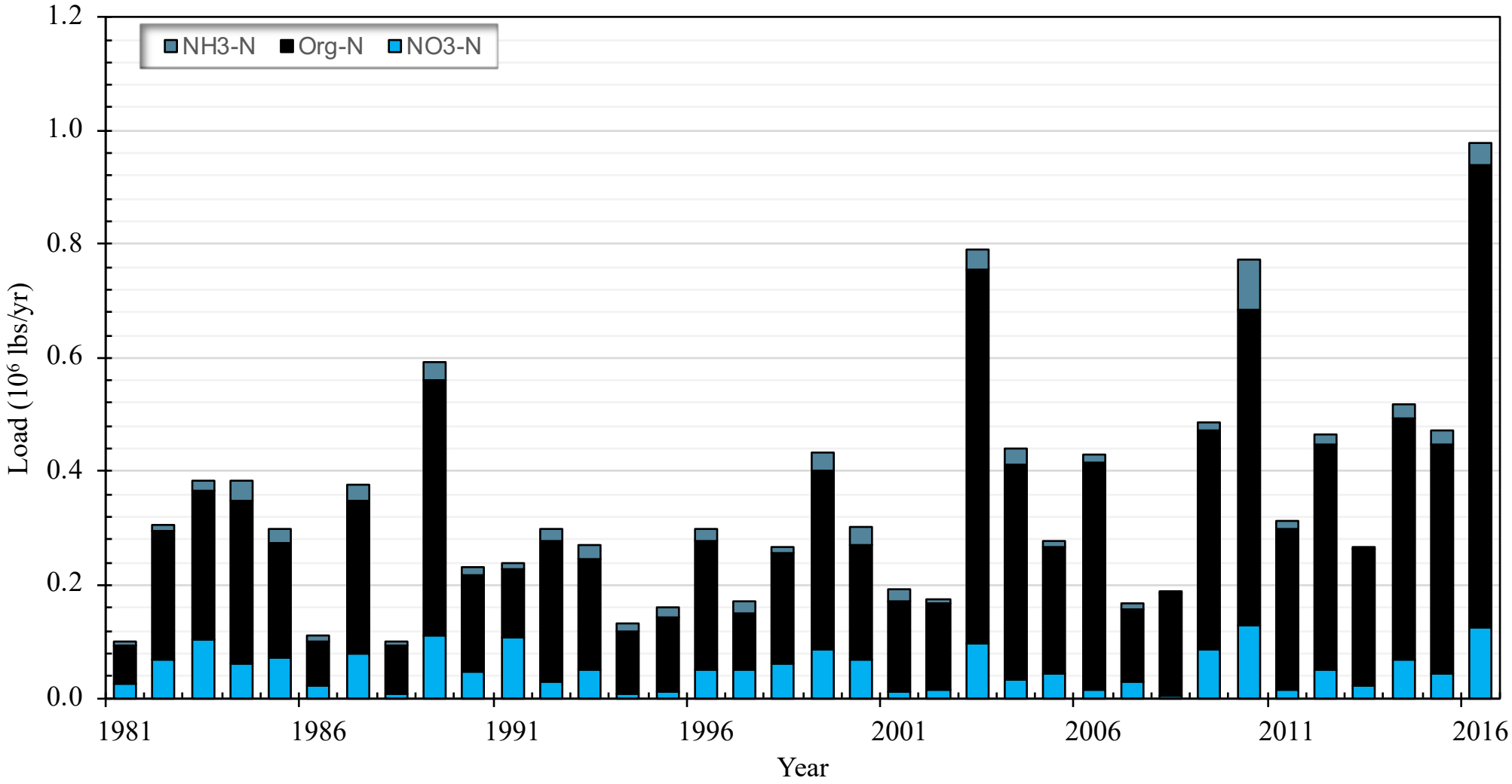
NORTH CAROLINA
Department of Environmental Quality

Potecasi Creek near Union, NC



NORTH CAROLINA
Department of Environmental Quality

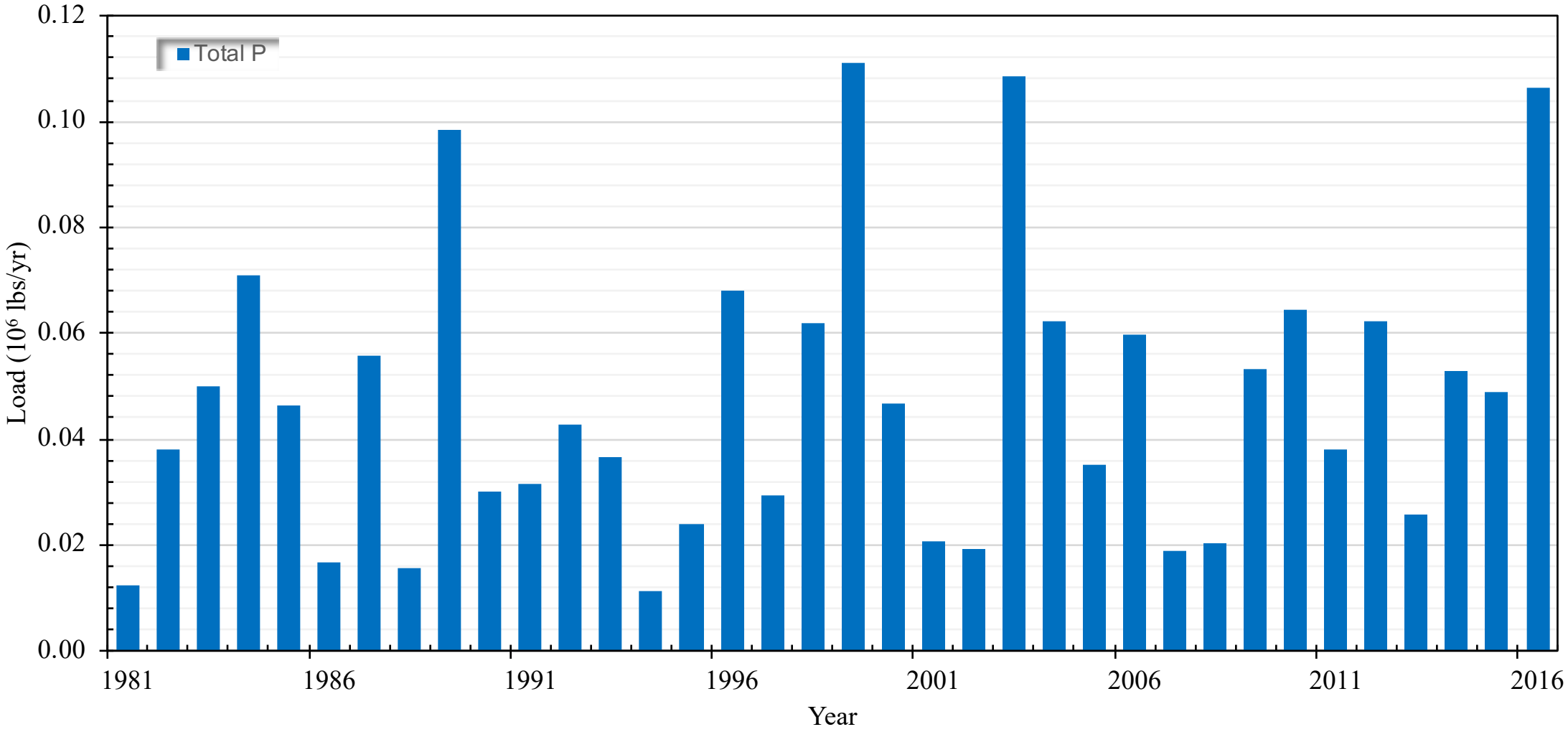
Annual Total Nitrogen Load for Potecasi Creek, NC



NH_3 + Organic N + NO_3+NO_2 = Total Nitrogen

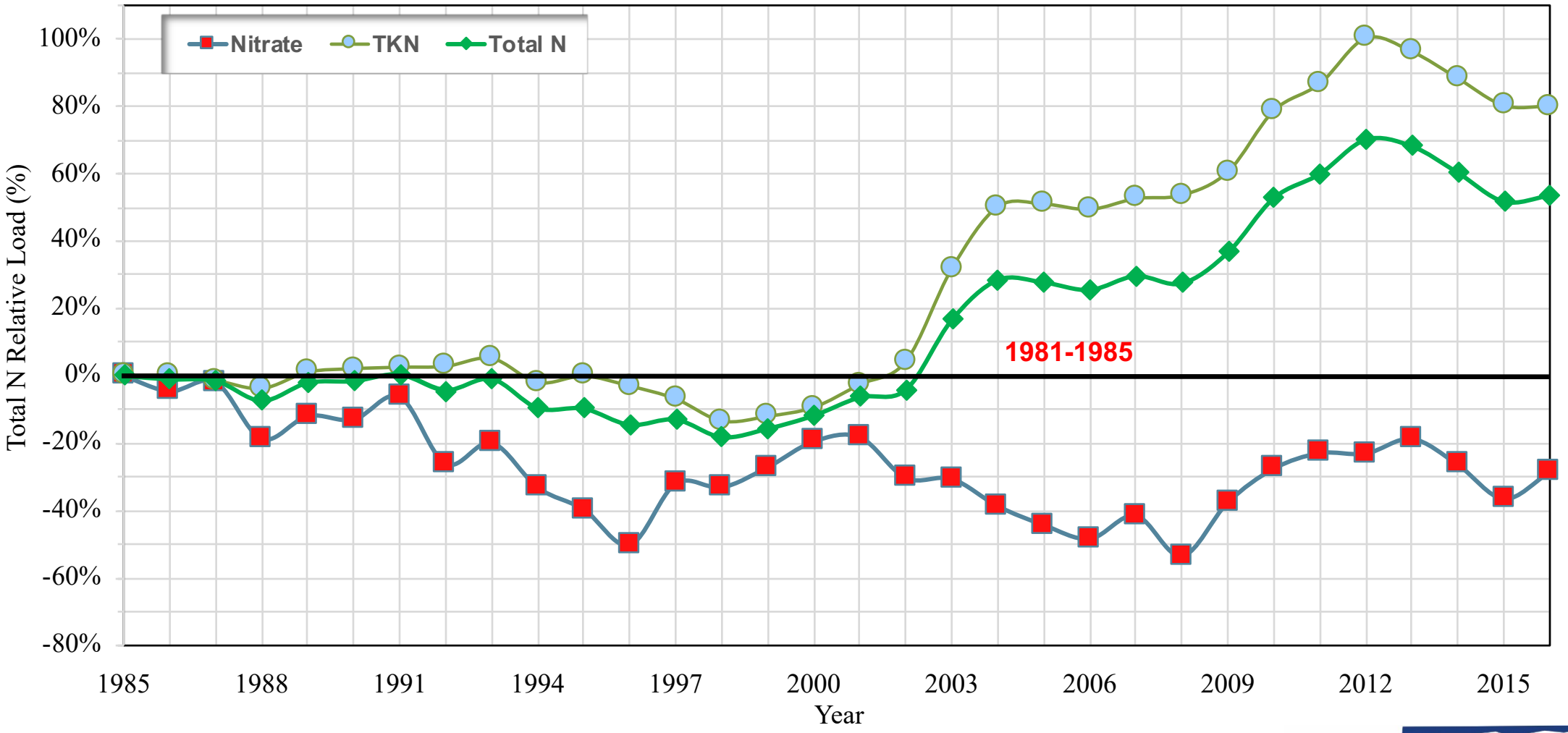
NORTH CAROLINA
Department of Environmental Quality

Annual Total Phosphorus Load for Potecasi Creek, NC



NORTH CAROLINA
Department of Environmental Quality

Nitrogen Reduction for Average Flow Condition for Potecasi Creek Near Union, NC - Relative to 1981-1985

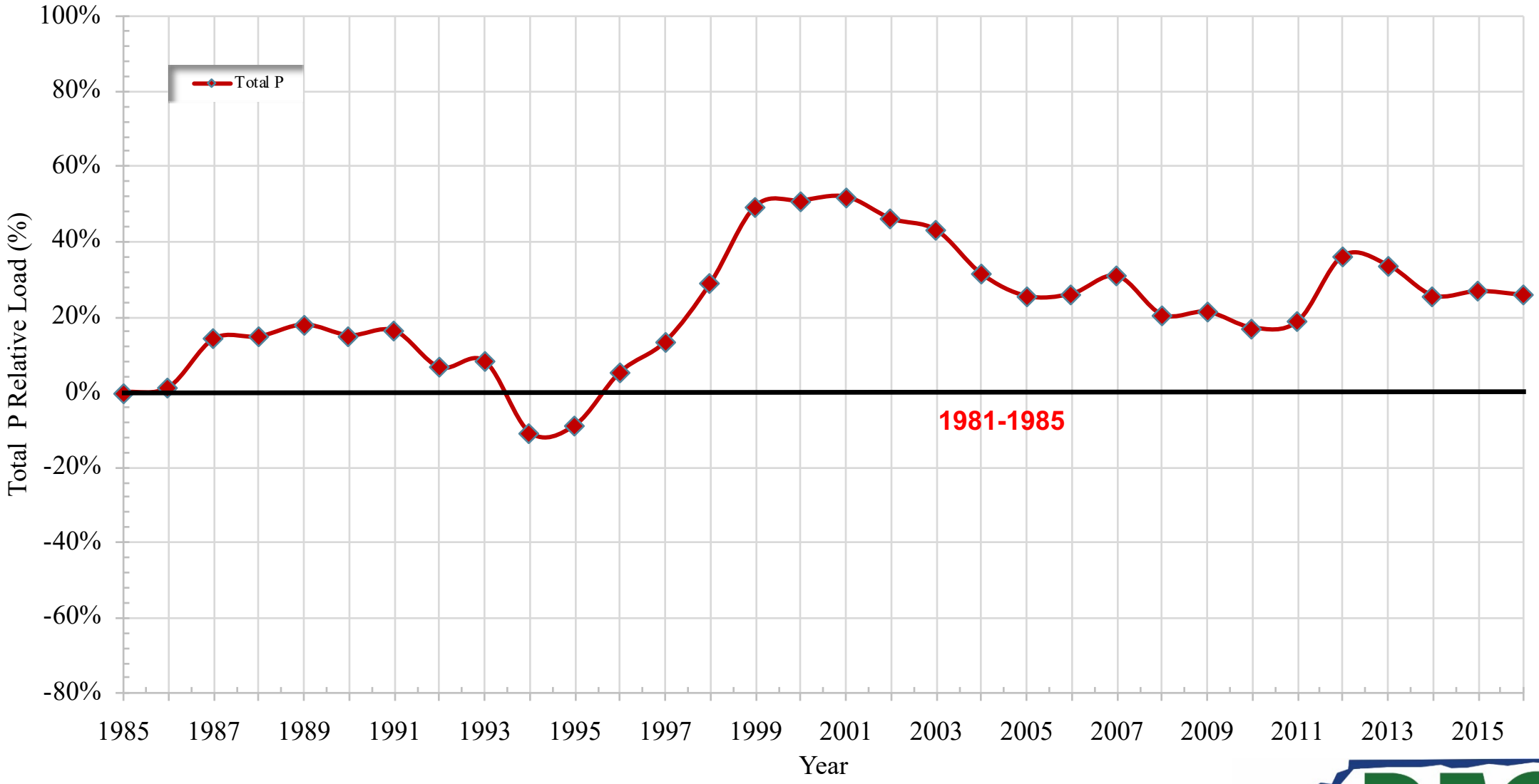


$TKN + NO_3 + NO_2 = \text{Total Nitrogen}$

$NH_3 + \text{Organic N} = TKN$

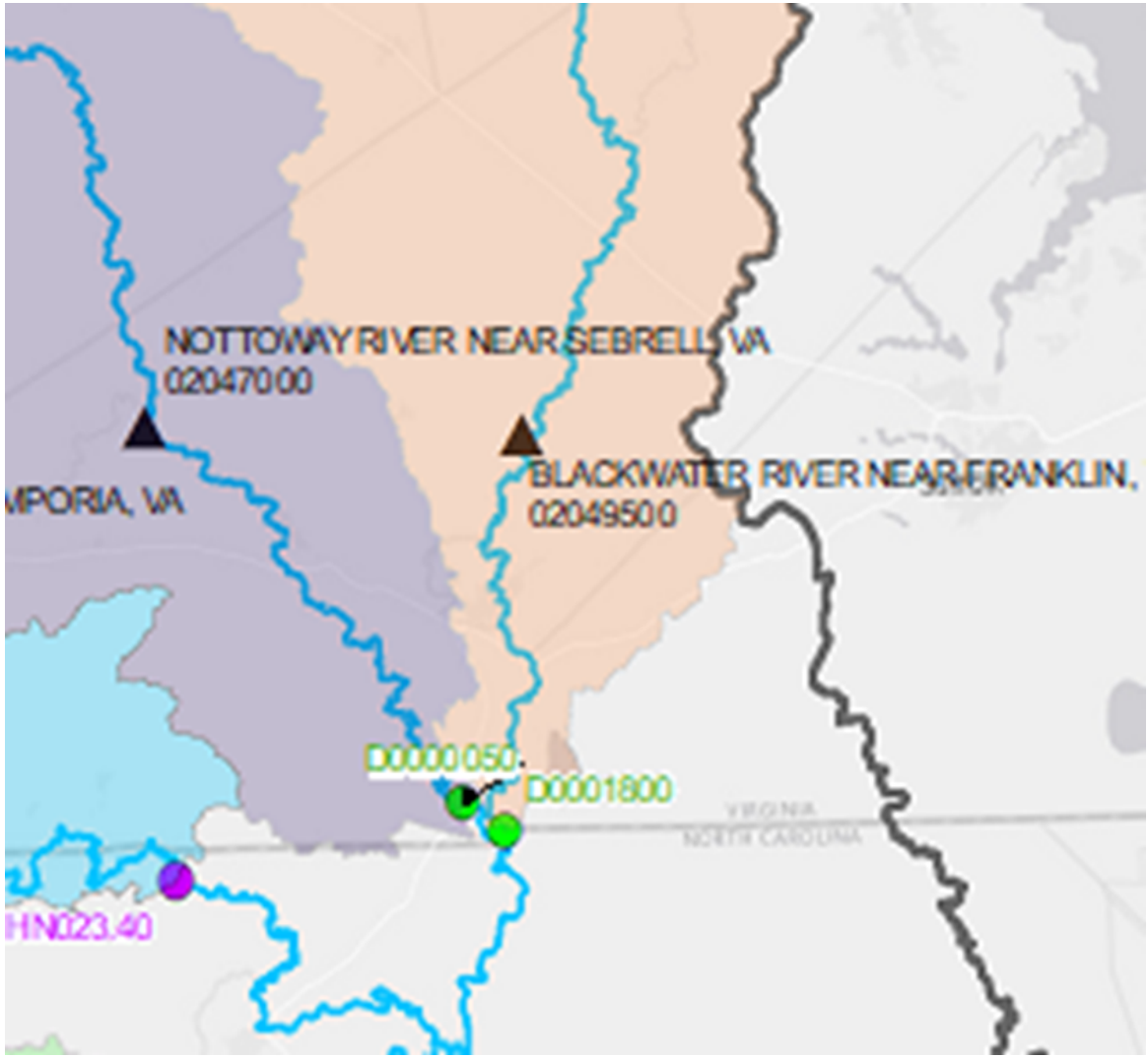
NORTH CAROLINA
Department of Environmental Quality

Phosphorus Reduction for Average Flow Condition for Potecasi Creek Near Union, NC - relative to 1981-1985



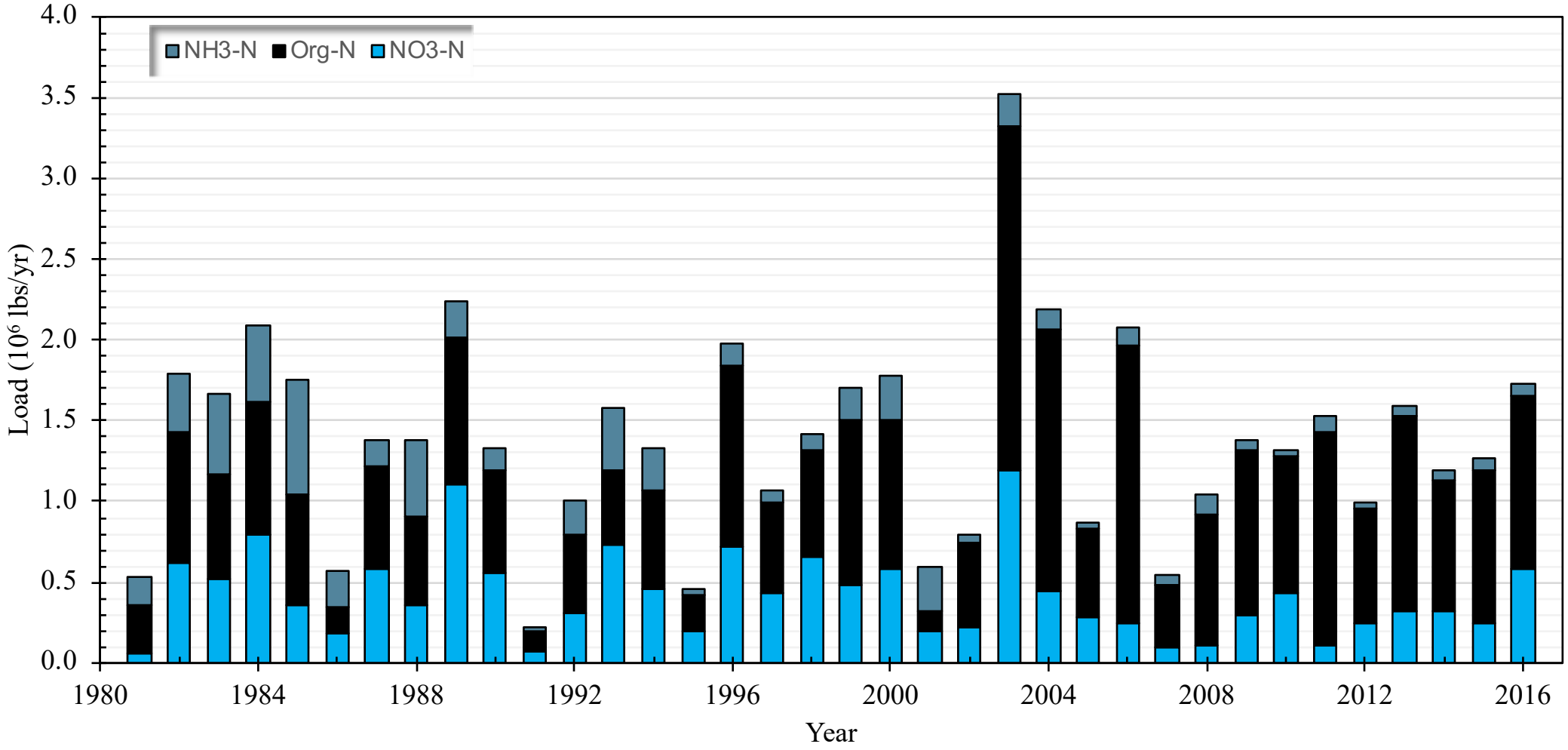
NORTH CAROLINA
Department of Environmental Quality

Blackwater River Near Franklin, VA



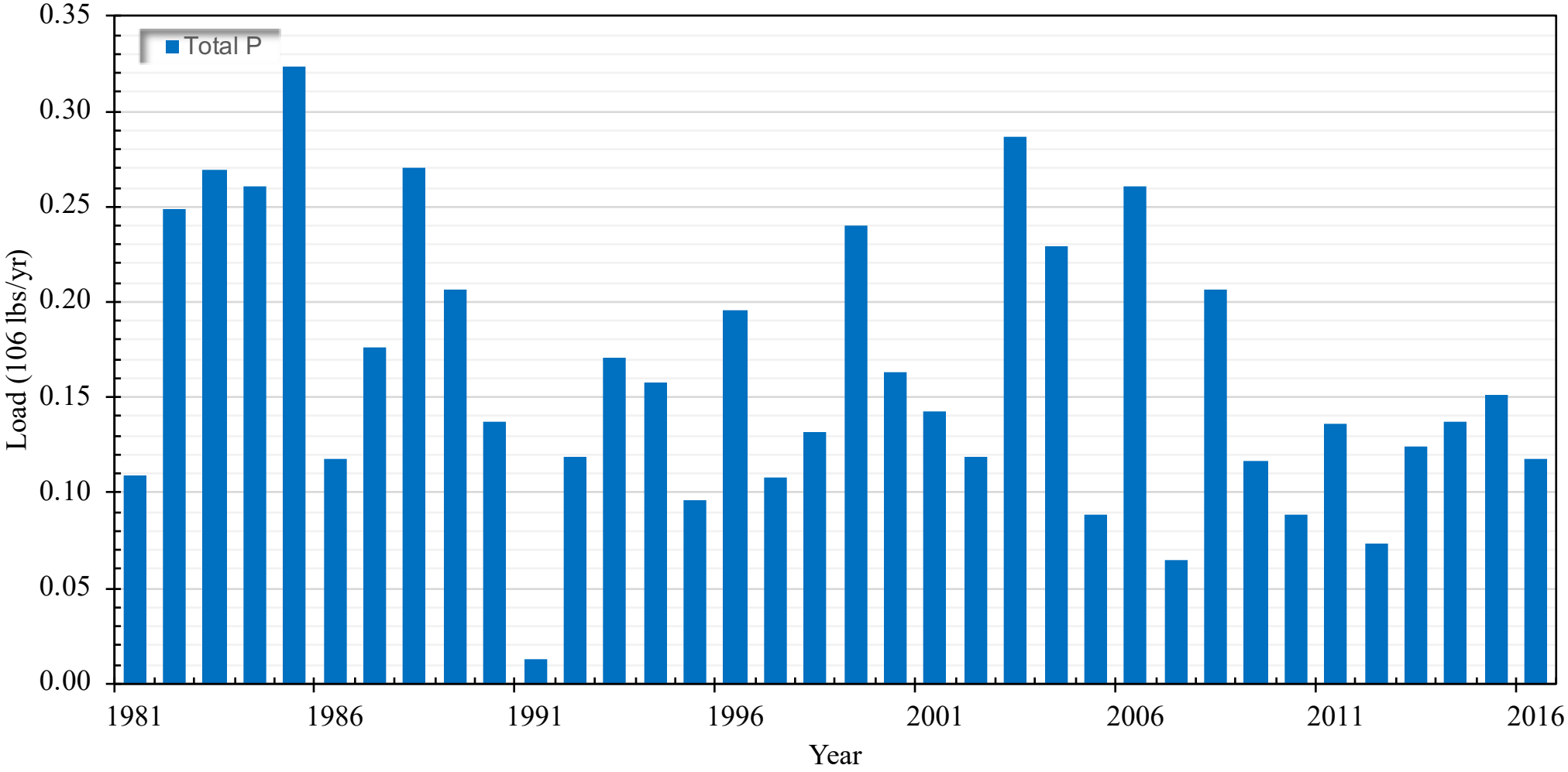
NORTH CAROLINA
Department of Environmental Quality

Annual Total Nitrogen Load for Blackwater River, VA



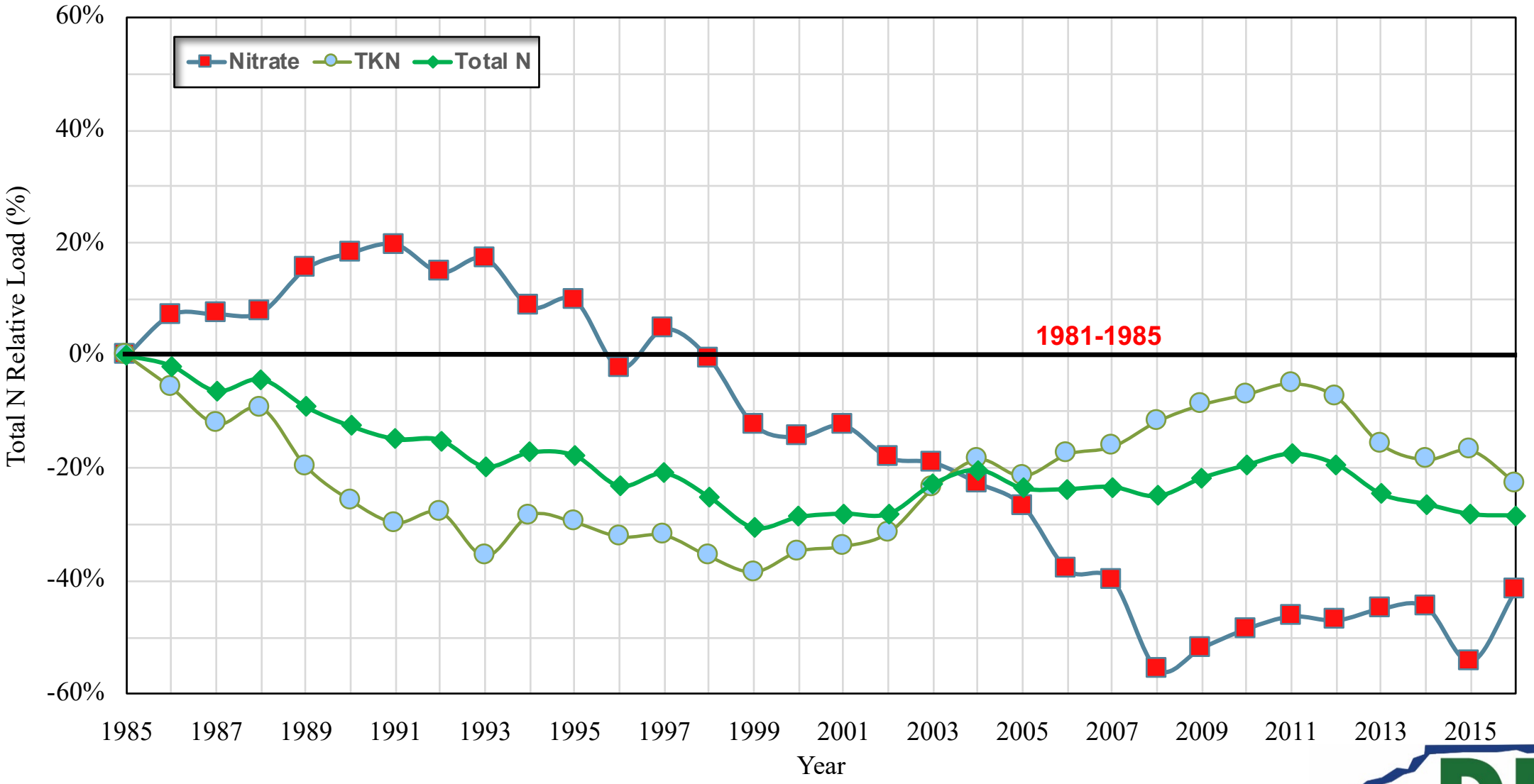
NORTH CAROLINA
Department of Environmental Quality

Total Phosphorus Load for Blackwater River, VA



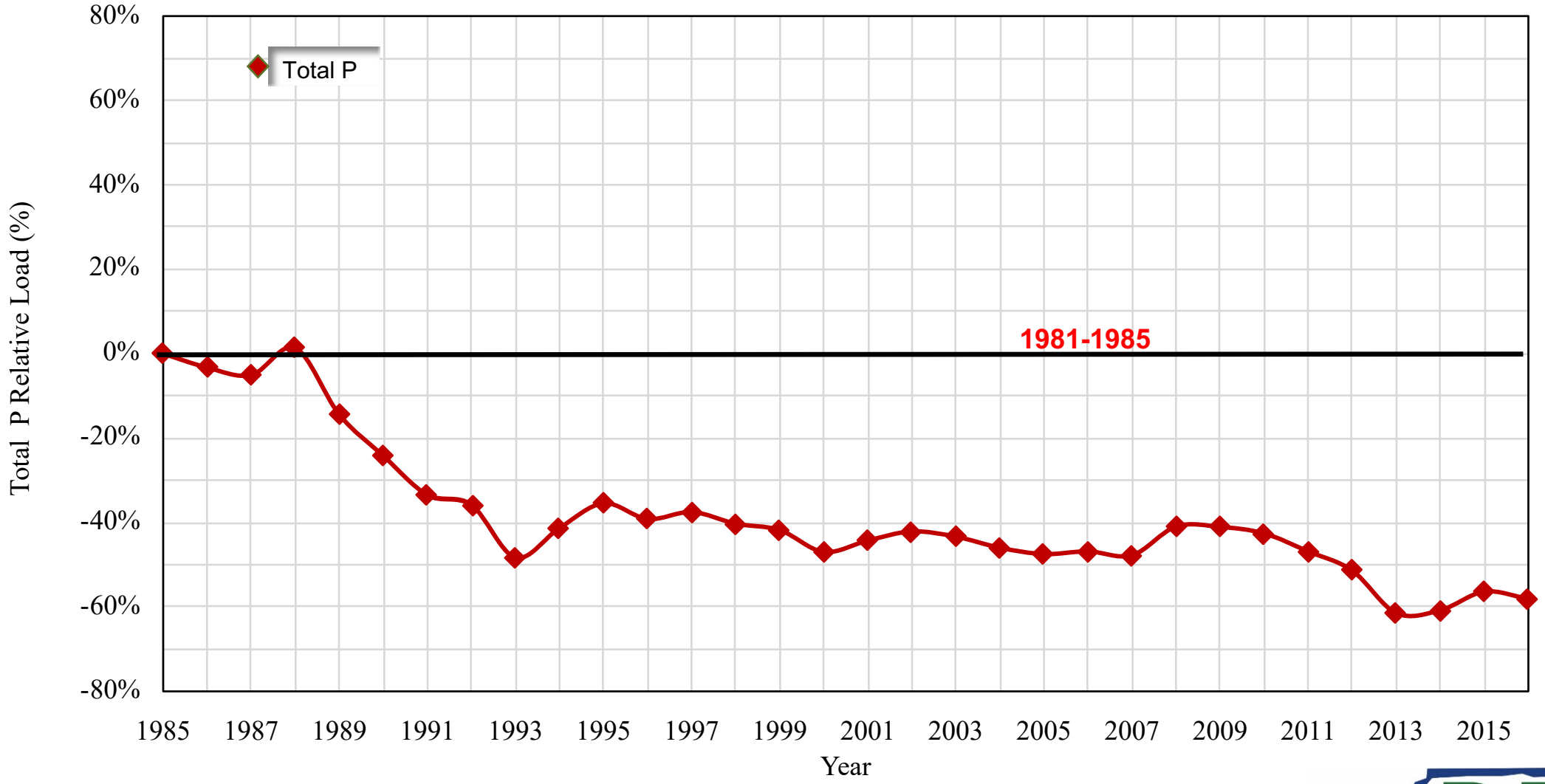
NORTH CAROLINA
Department of Environmental Quality

Nitrogen Reduction for Average Flow Condition for Blackwater River, VA - Relative to 1981-1985



NORTH CAROLINA
Department of Environmental Quality

Phosphorus Reduction for Average Flow Condition for Blackwater River, VA - relative to 1981-1985

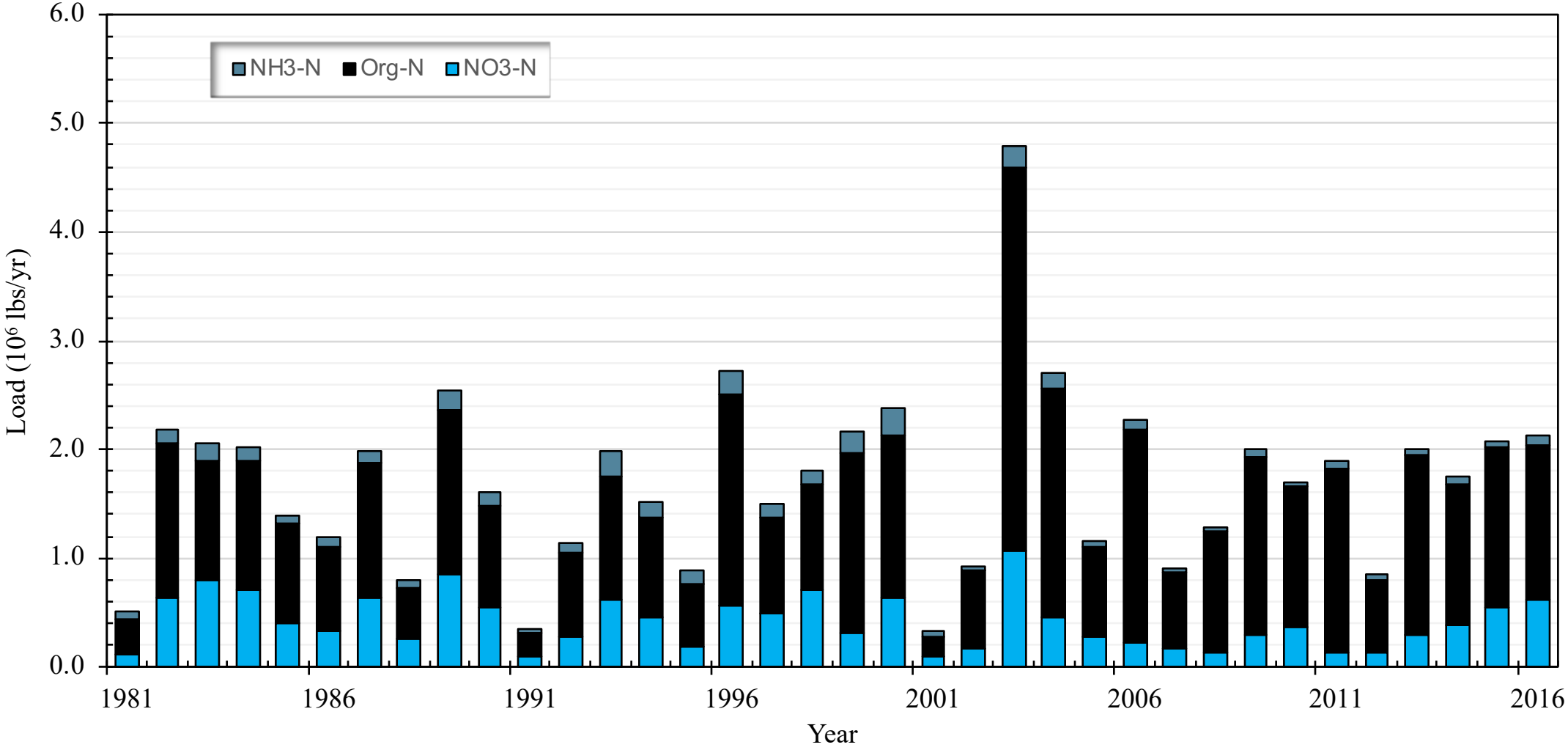


NORTH CAROLINA
Department of Environmental Quality

Nottaway River, VA

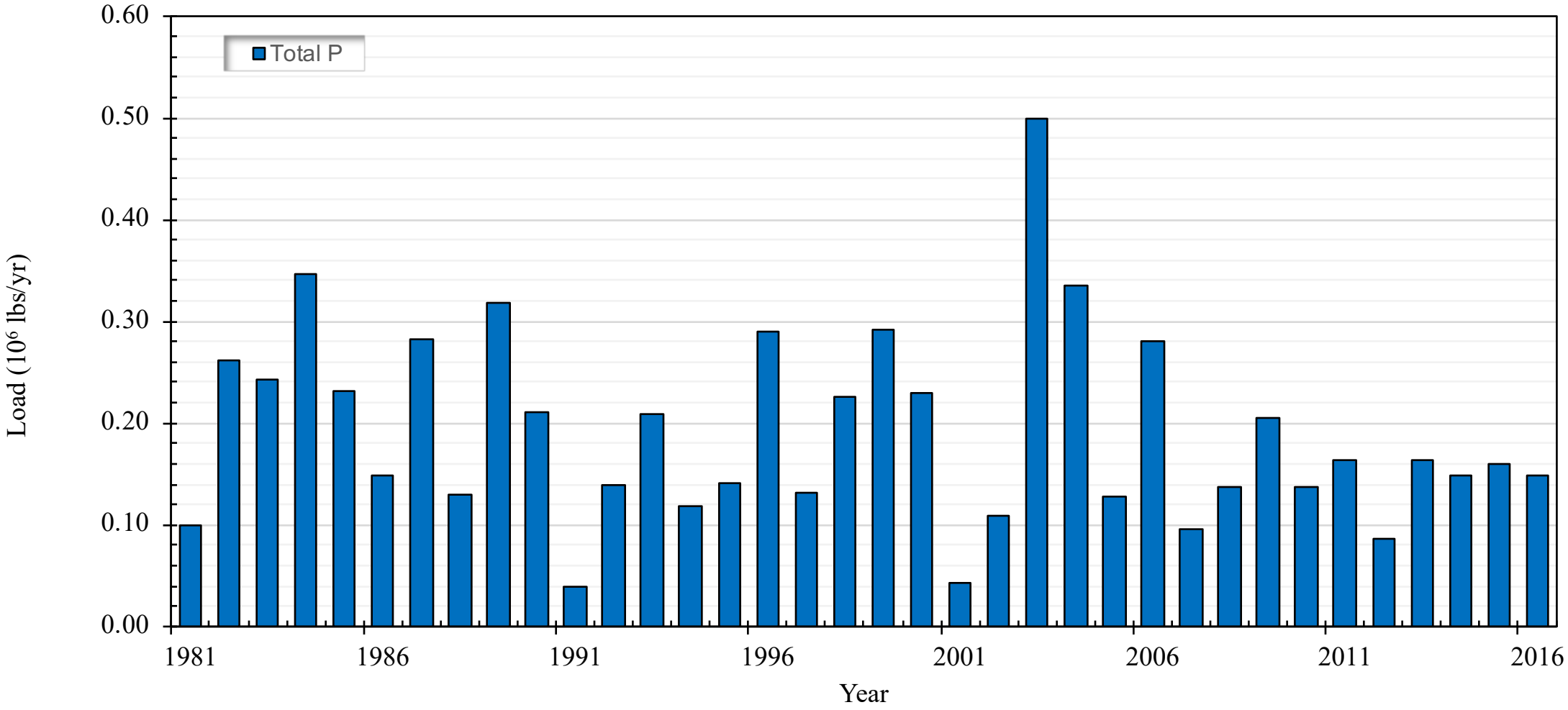
NORTH CAROLINA
Department of Environmental Quality

Annual Total Nitrogen Load for Nottaway River



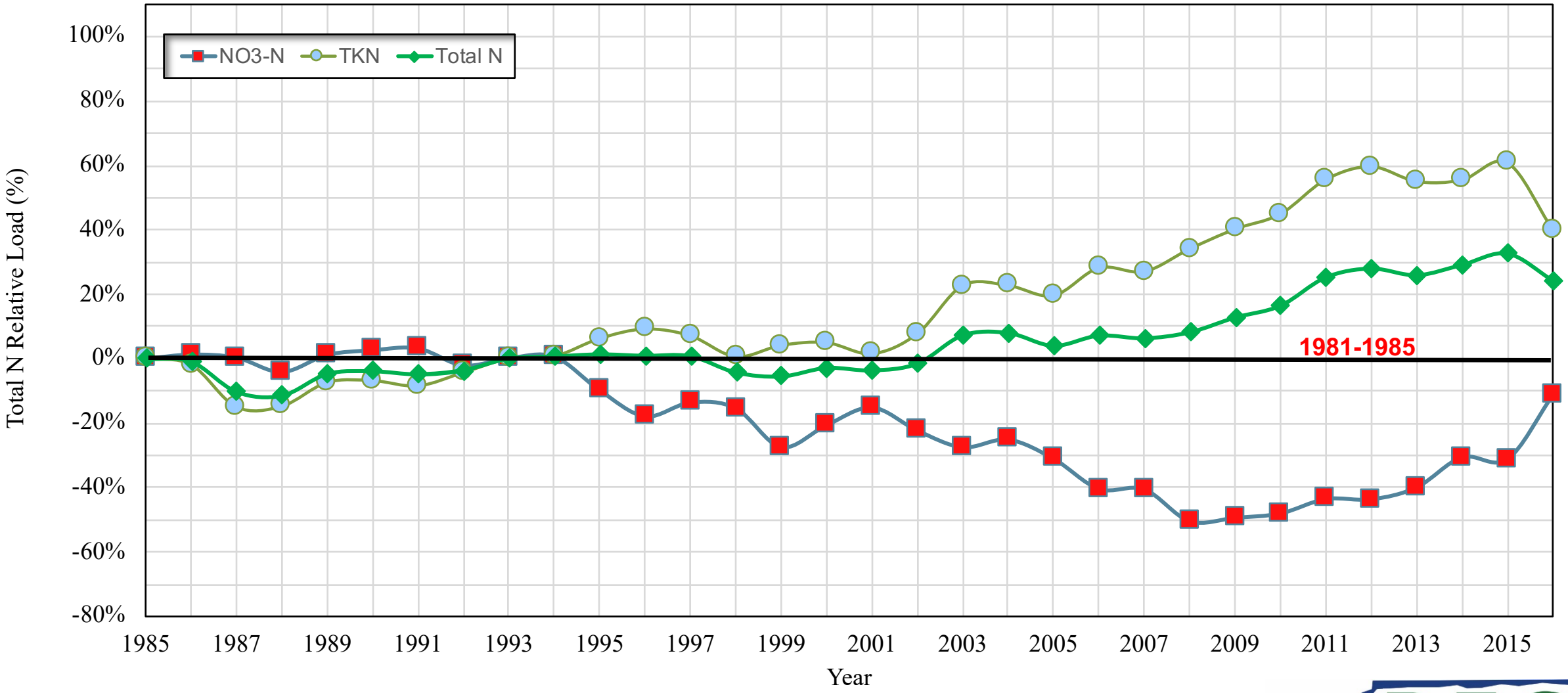
NORTH CAROLINA
Department of Environmental Quality

Total Phosphorus Load for Nottaway River



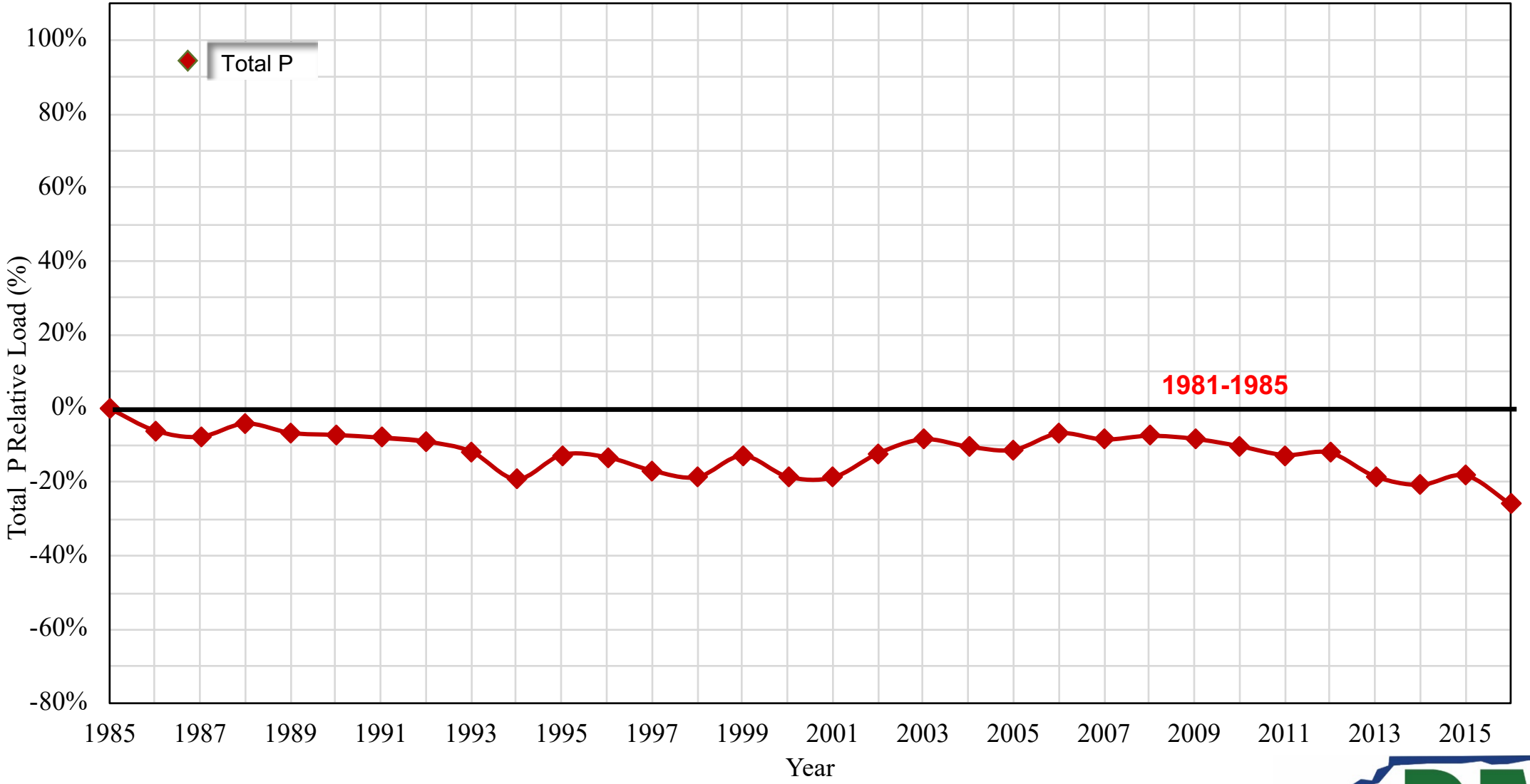
NORTH CAROLINA
Department of Environmental Quality

Nitrogen Reduction for Average Flow Condition for Nottoway River, VA - Relative to 1981-1985



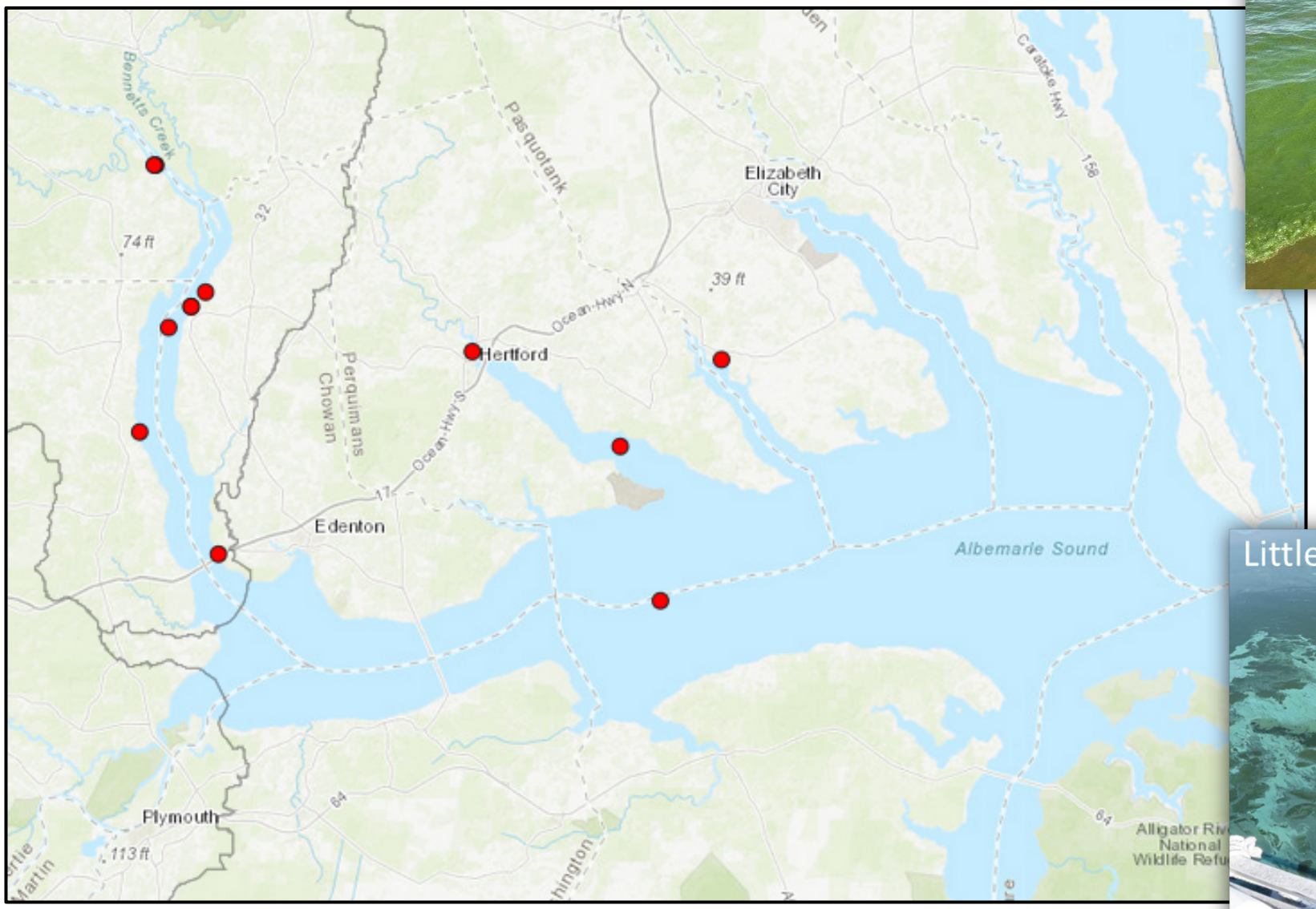
NORTH CAROLINA
Department of Environmental Quality

Phosphorus Reduction for Average Flow Condition for Nottoway River, VA - relative to 1981-1985



NORTH CAROLINA
Department of Environmental Quality

2019 Algal Bloom Monitoring Summary



2019 Monitoring Summary

- 11 confirmed blooms investigated by DWR
- Microcystins detected on 3 occasions
  - Arrowhead Beach (250 ug/L)
  - Leary Landing (190 ug/L)
  - Indian Creek (620 ug/L)
- 3 Press Releases issued by NC DEQ
  - 2 “general warnings”
  - 1 “microcystin detected (preliminary)”
- 3 Press Releases issued by NC DHHS
  - Issued due to very high concentrations of microcystins detected

Relative Probability of Acute Health Effects	Microcystin Concentration (ug/L)
Low	0 – 10
Moderate	10 - 20
High	> 20

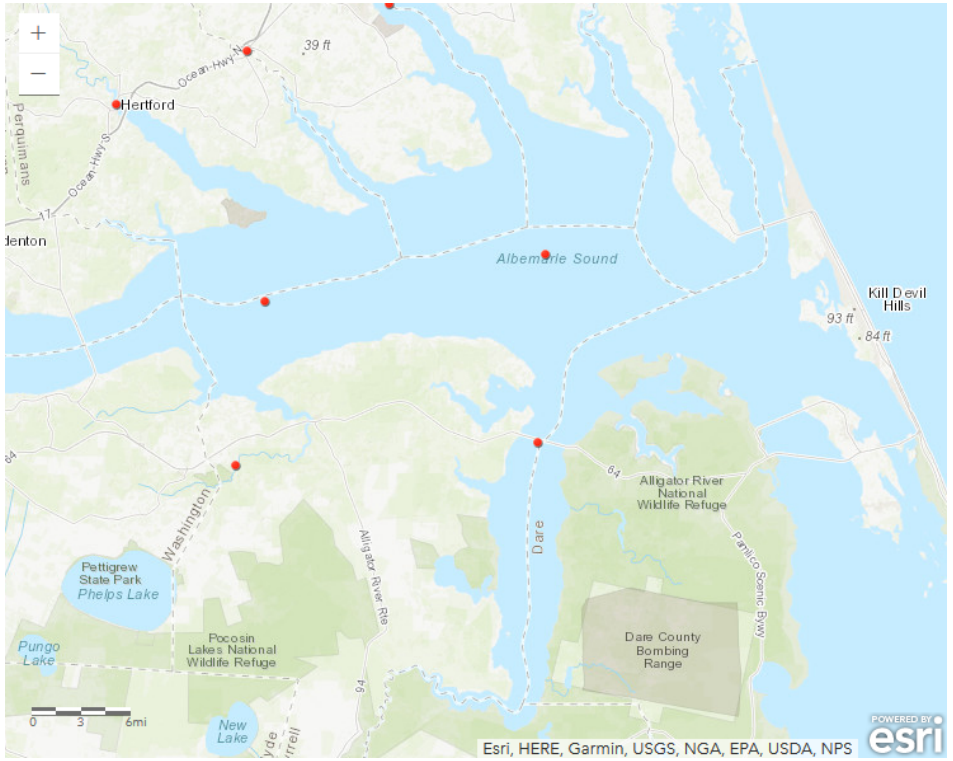
*World Health Organization Recommended Recreational Guidelines

DWR Data Gaps

- Albemarle Sound water quality data
  - USGS, NARS-NCA
- Aquatic life – SAVs, DO sensitive fish
  - DMF, USGS, NARS-NCA
- Bioassays (N. Hall, UNC-IMS)
- Cyanotoxins (DWR, A. Schnetzer, NCSU)
- Clarity optical model?

Photo: Maryland DNR

Photo: NOAA



NORTH CAROLINA
Department of Environmental Quality

Questions?

Contact Information:

Brian Wrenn
Ecosystems Branch Supervisor
Water Sciences Section
Division of Water Resources
919-743-8409
Brian.wrenn@ncdenr.gov