Evaluation of Nutrient Concentrations, Sources and Pathways in Three Urban Streams in Durham County, North Carolina - *Some very preliminary results*

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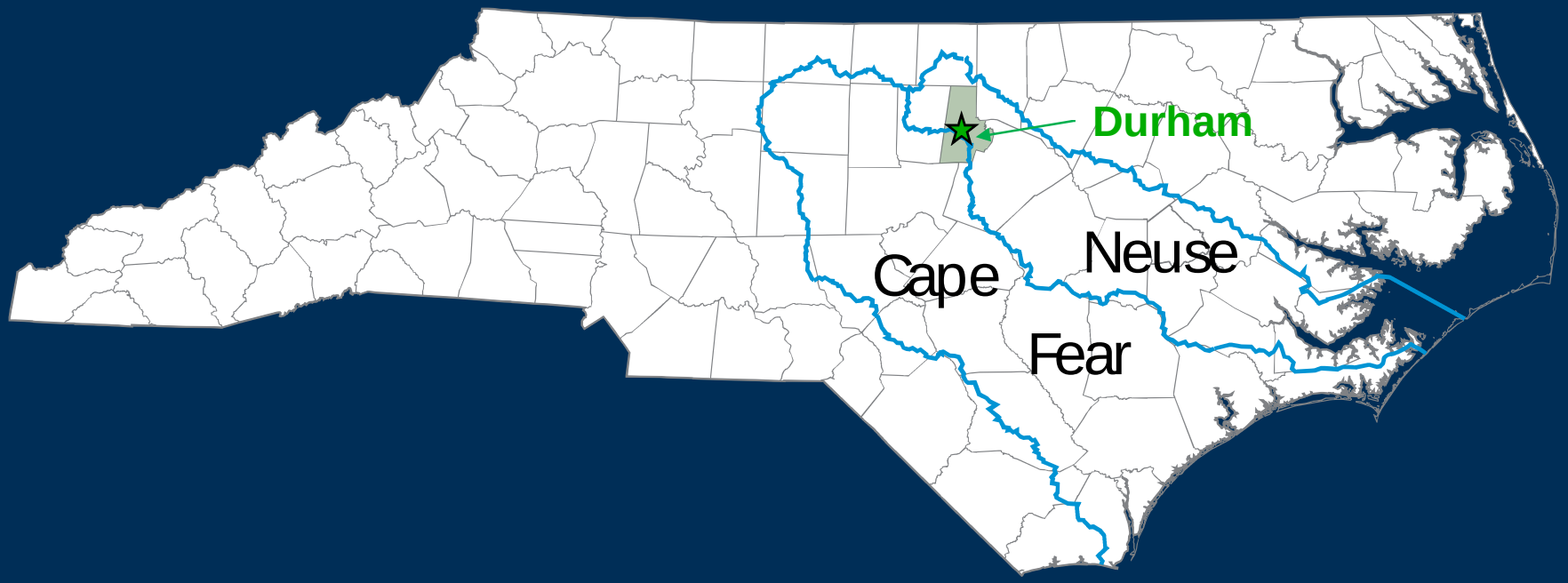
May 3, 2012
NWQMC

U.S. Department of the Interior
U.S. Geological Survey

CITY OF DURHAM
Stormwater Services

Durham County, North Carolina



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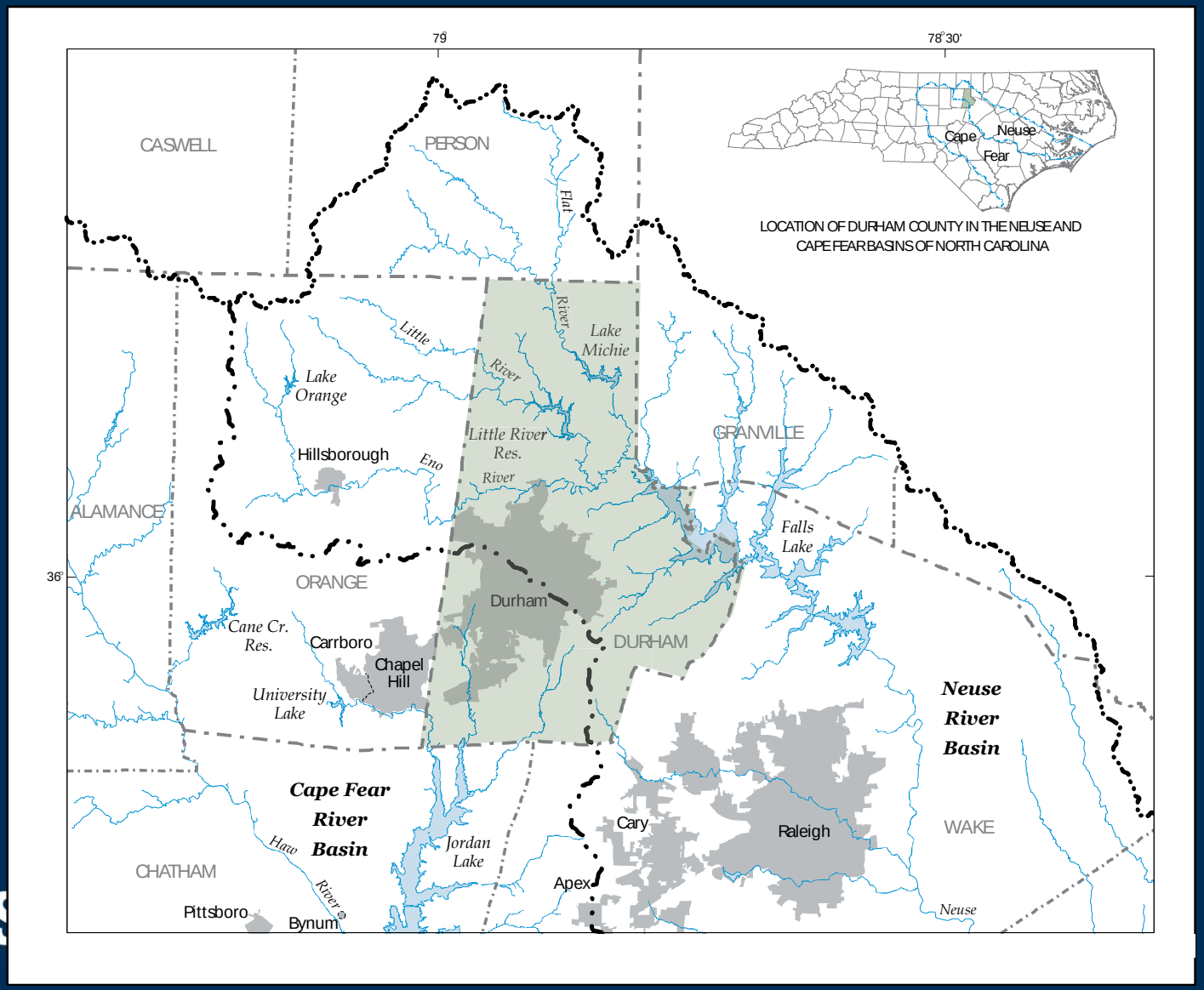
303(d) Listed Reservoirs



Study Background

- NC EMC adopted comprehensive nutrient management strategies for Falls and Jordan reservoirs
  - Reduce nitrogen and phosphorous loads from urban, stormwater, wastewater, and agriculture sources
- Durham Stormwater Services is tasked with implementing best management practices (BMPs)
- BMPs are required for new development and existing development
- Implementing effective BMPs is complex in urban watersheds because of diverse sources

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Research Objectives

- Evaluate nutrient sources in selected tributaries in the vicinity of Durham that feed nutrient-impaired Falls Lake and Jordan Lake
- Document and compare concentrations of nitrogen and phosphorus among 3 urban streams in the Falls Lake and Jordan Lake watersheds
- Evaluate the utility of stable isotopes for characterizing nitrogen sources and transport pathways in urban, low-order streams

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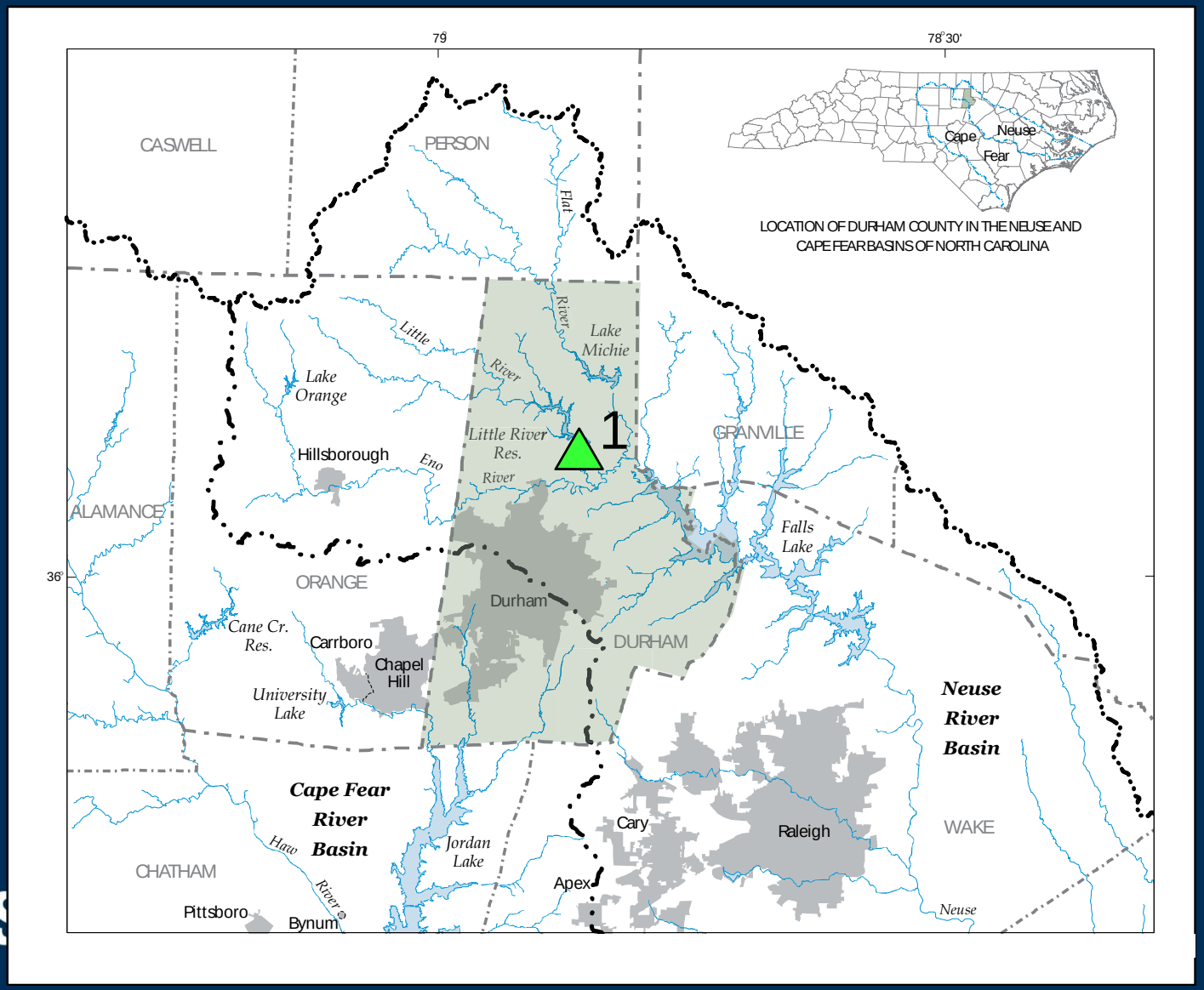
Site 1 – Cabin Branch Creek



Cabin Branch Creek

- Falls Lake watershed
- DA = 3.45 mi^2
- Least developed watershed
- No public sewer
- Assumption that greatest nitrate source is failing septic tanks

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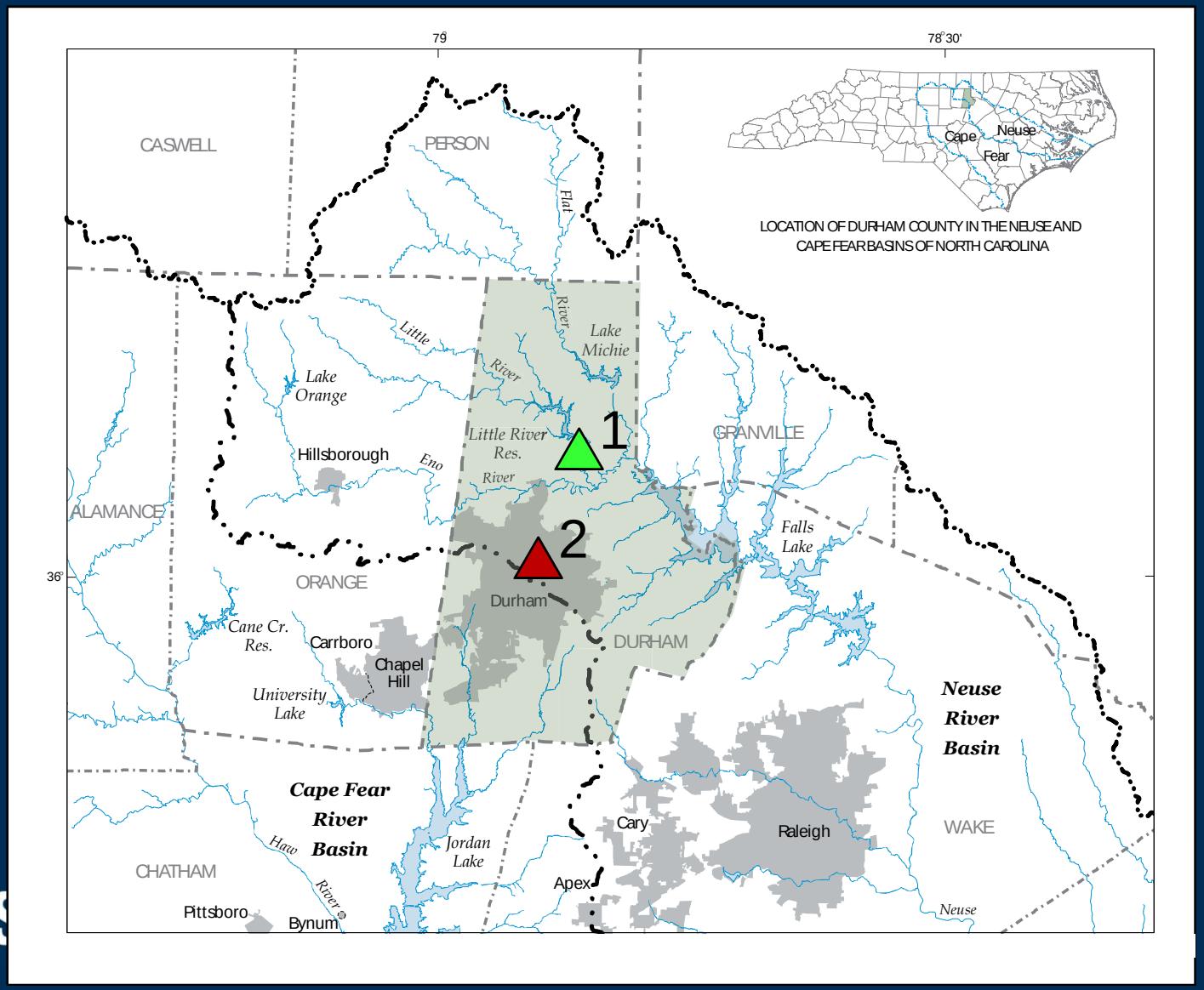
Site 2 – Ellerbe Creek



Ellerbe Creek

- Falls Lake watershed
- DA = 6.01 mi^2
- Urban industrial
- Highest percentage of impervious surface
- Assumption that greatest nitrate source is runoff

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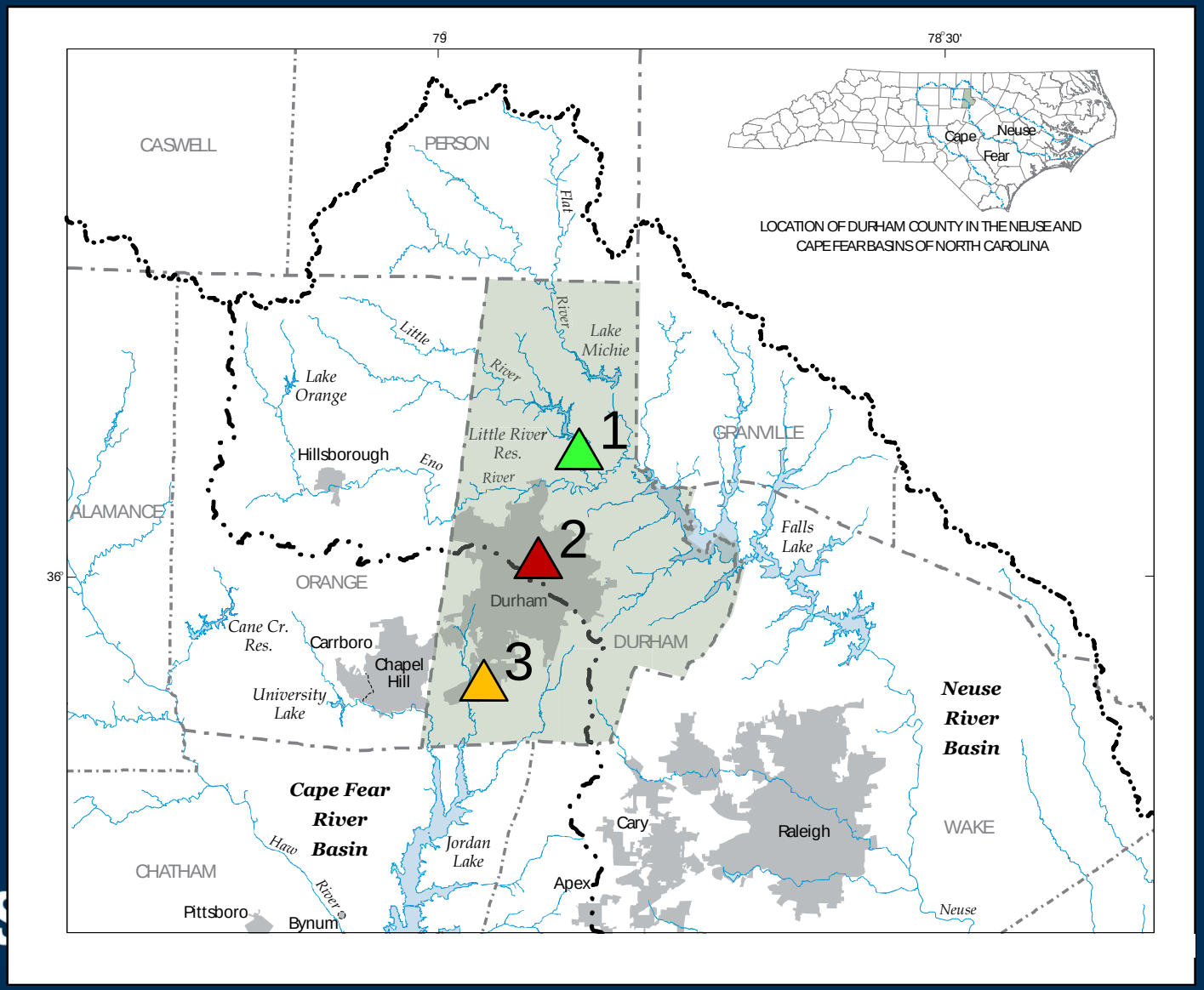
Site 3 – Third Fork Creek



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Third Fork Creek

- Jordan Lake watershed
- DA = 14.79 mi^2
- Urban residential
- Assumption that nitrate is mixed from multiple sources

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Sampling Plan

- One year study began in July 2011
- Nutrient, stable isotopes of water, and stable isotopes of nitrogen samples collected monthly
- Sample results thus far for 7 events
  - 2 stormflow – falling limb
  - 5 baseflow
- Hope for a combination baseflow (75%) and stormflow (25%) samples

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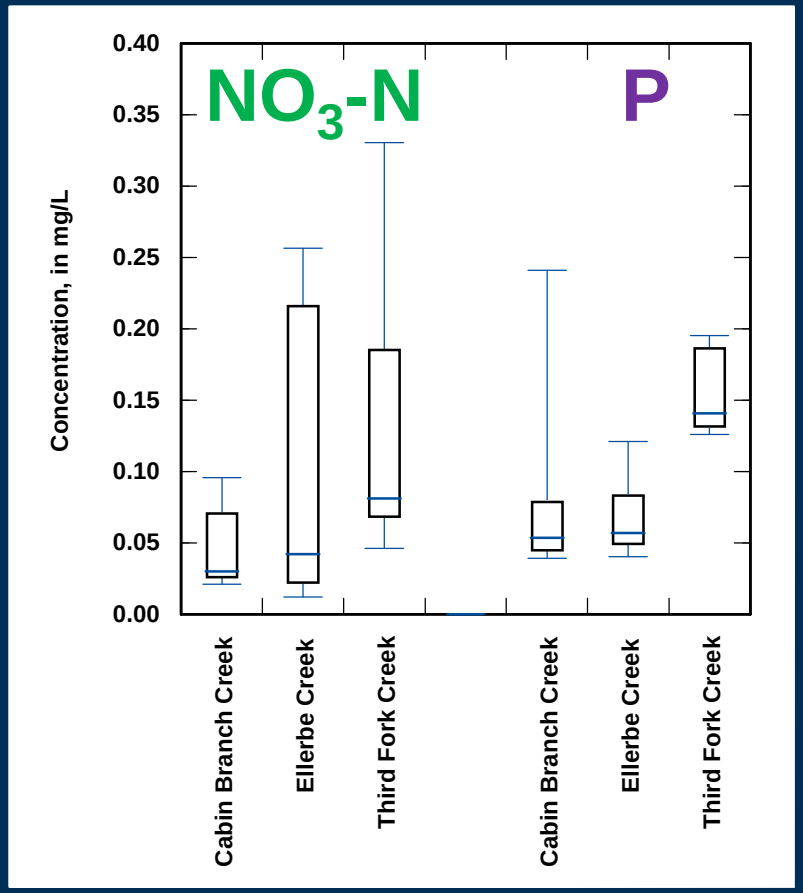
Preliminary results show…

- Good news for City of Durham!
  - Nitrate and phosphorus concentrations are <0.4 mg/L
- Bad news for USGS
  - No nitrate makes source tracking with N isotopes difficult



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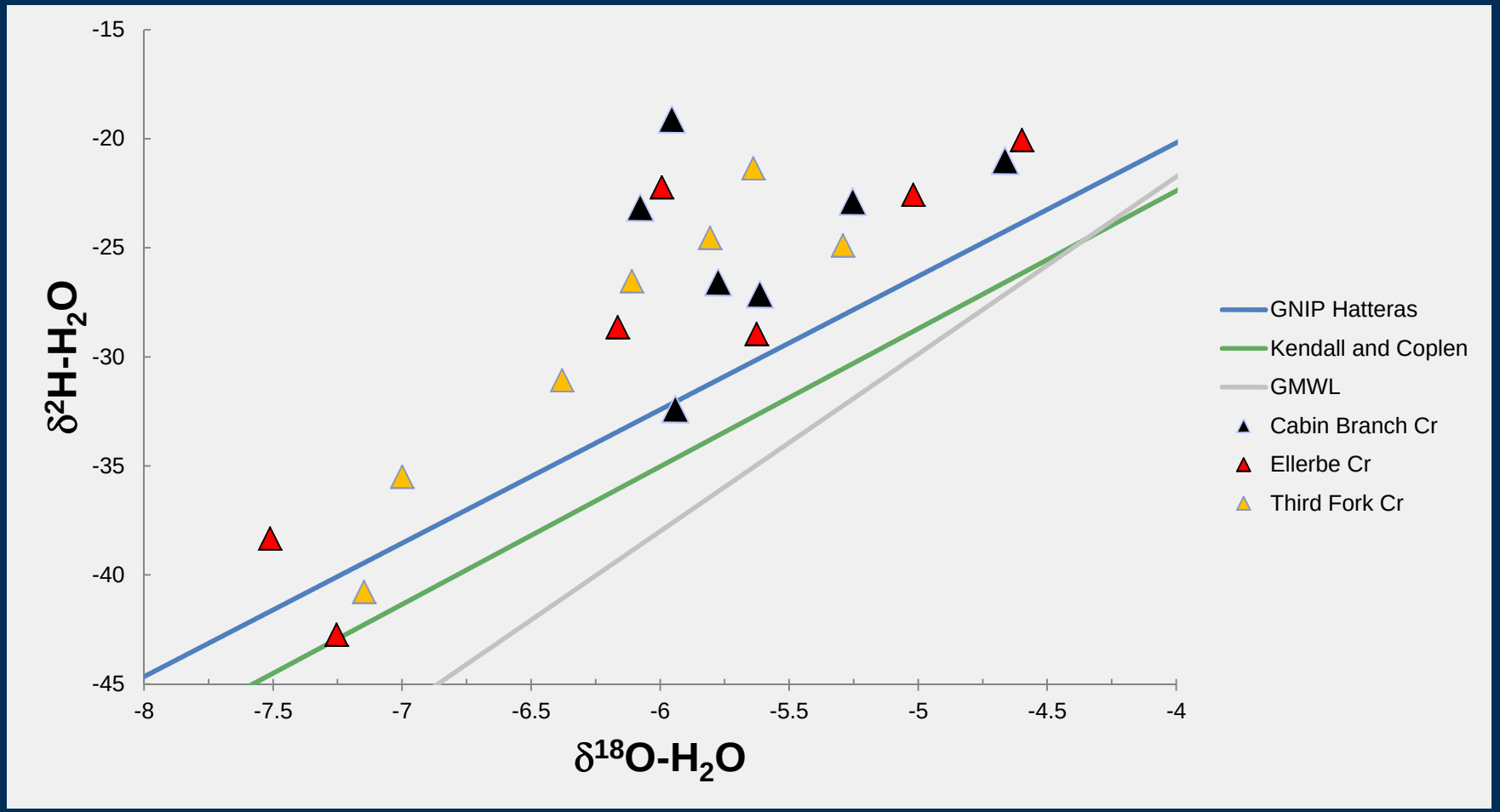
Water Isotopes



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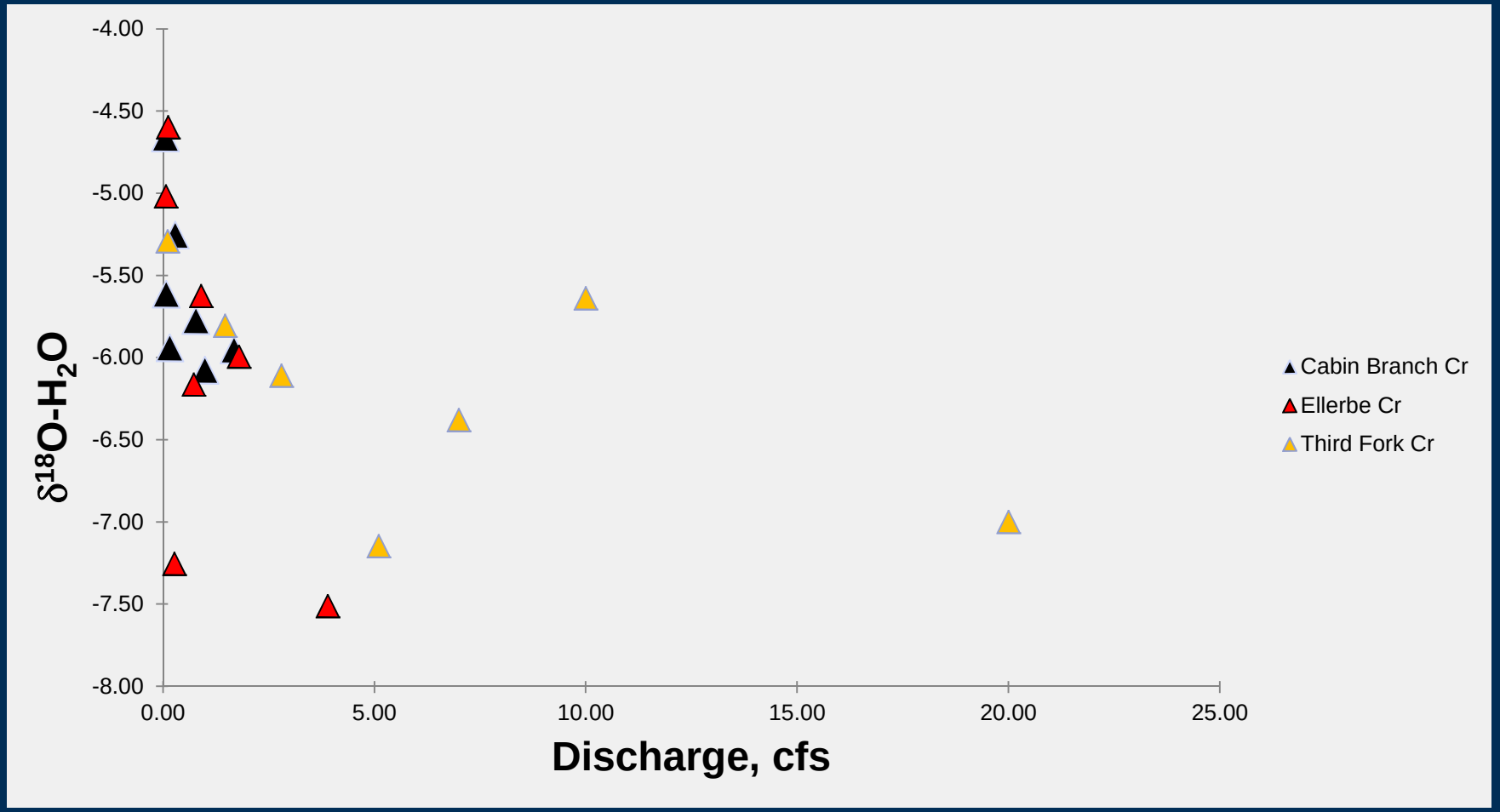
$\delta^{18}O$-H_2O vs Discharge



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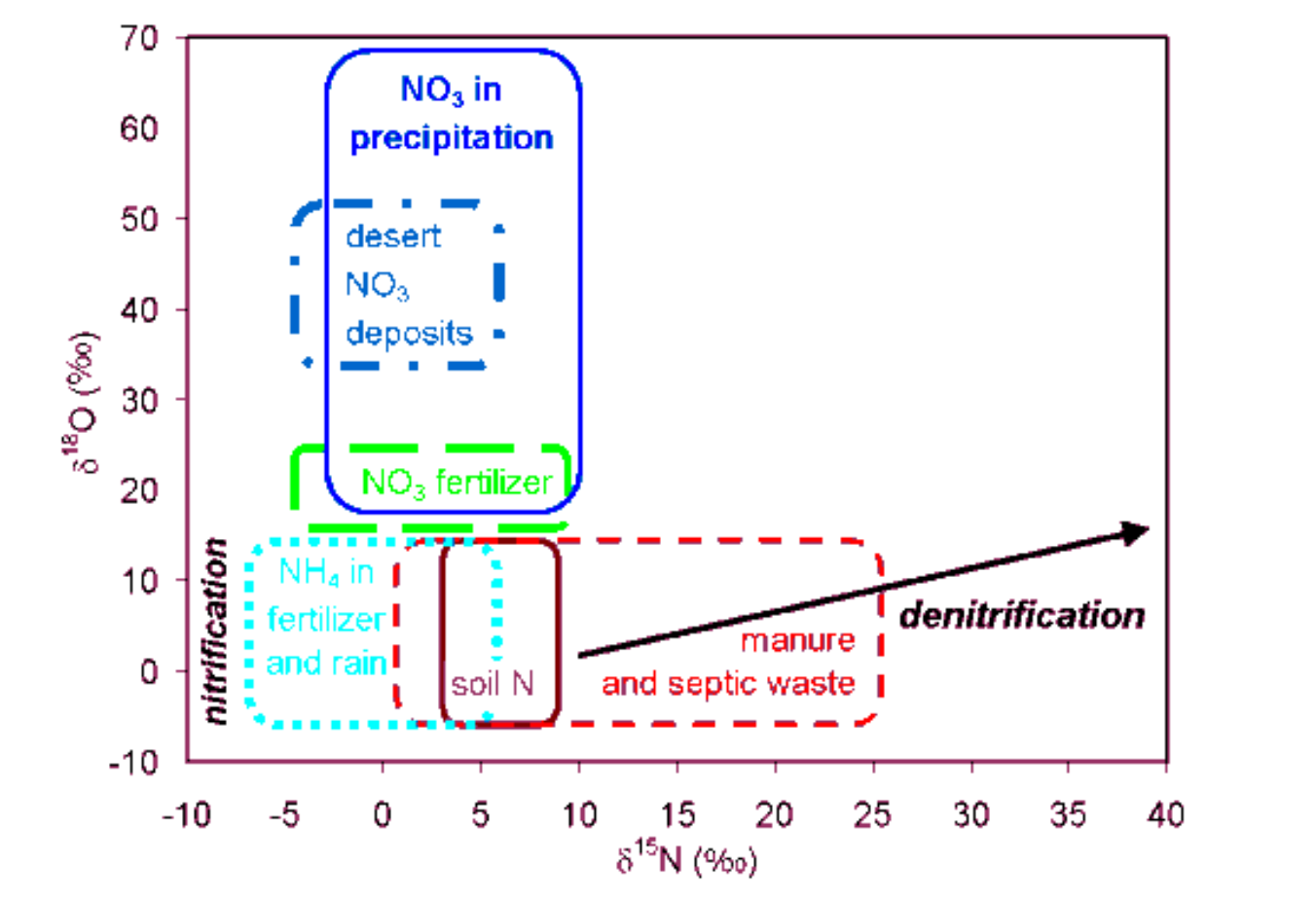
Typical Source Ranges



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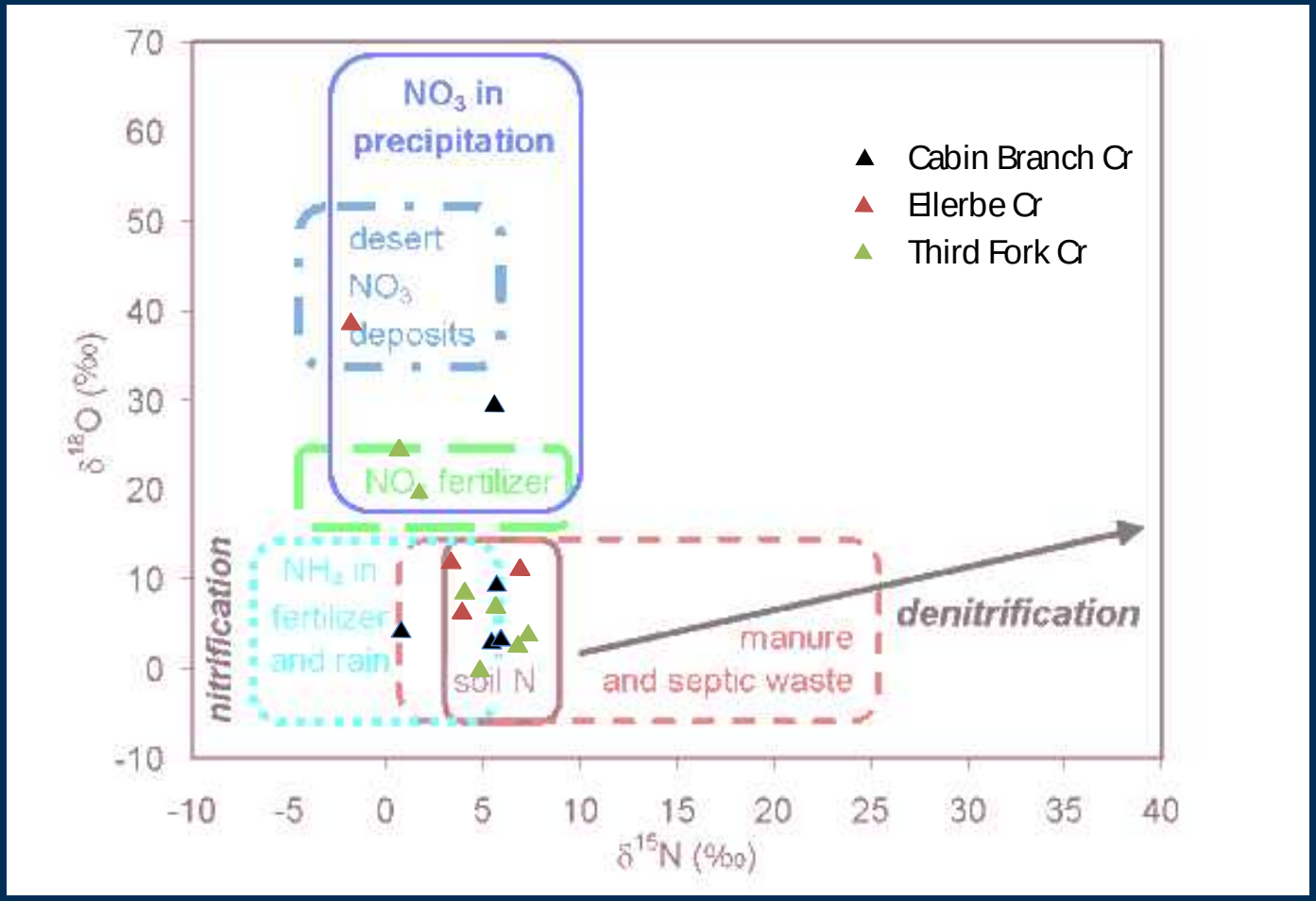
Typical Source Ranges



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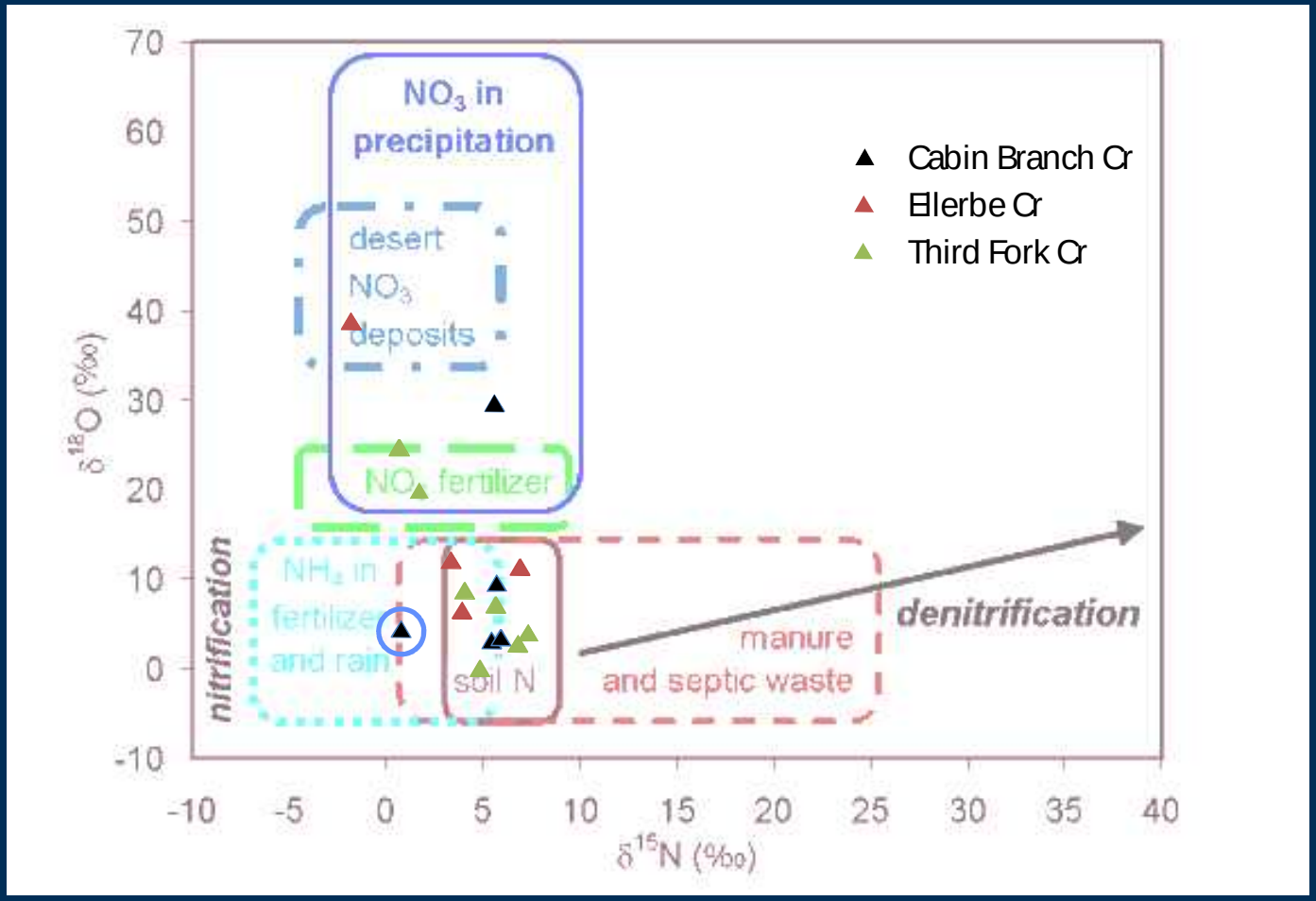

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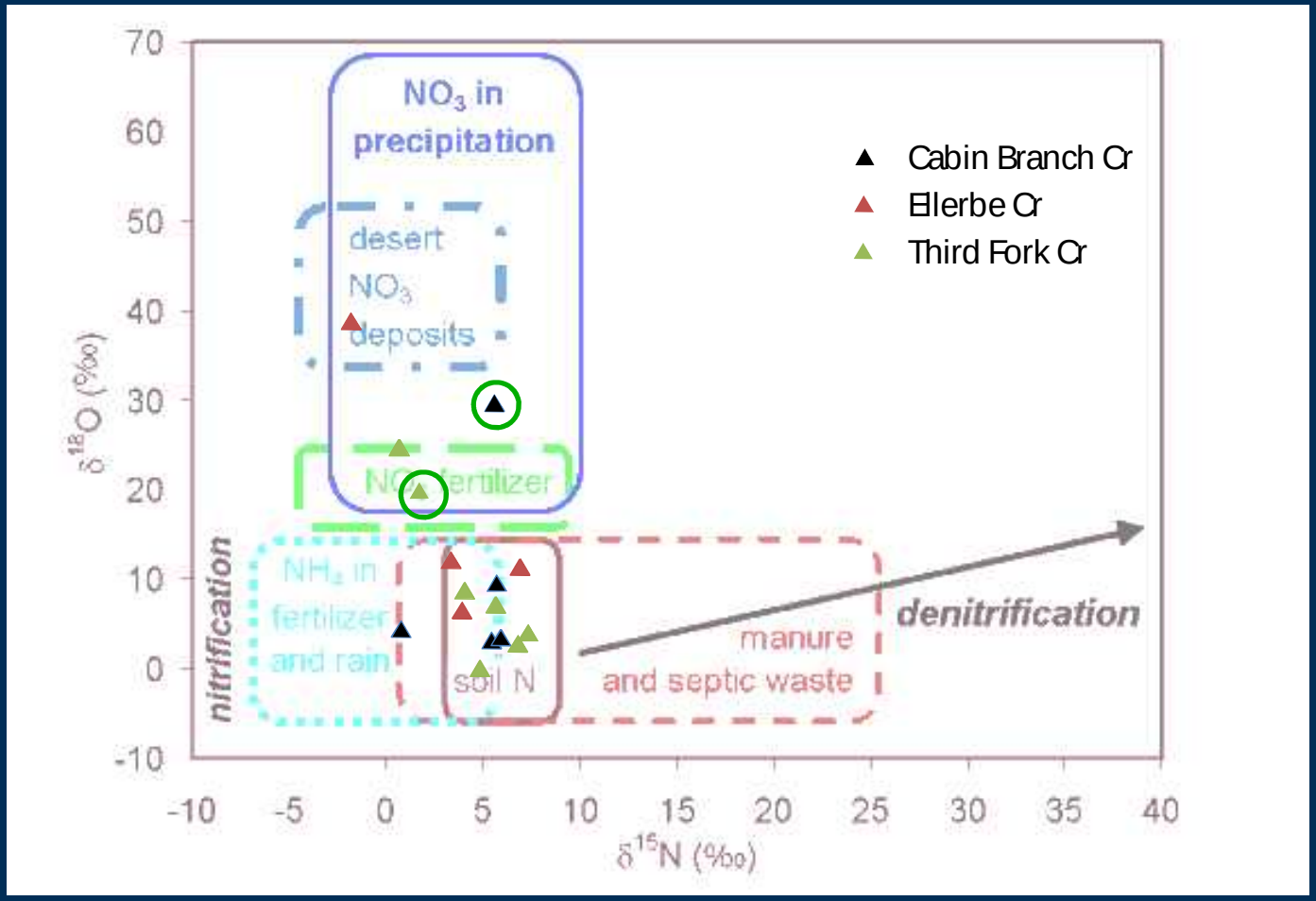
July – low baseflow

Typical Source Ranges



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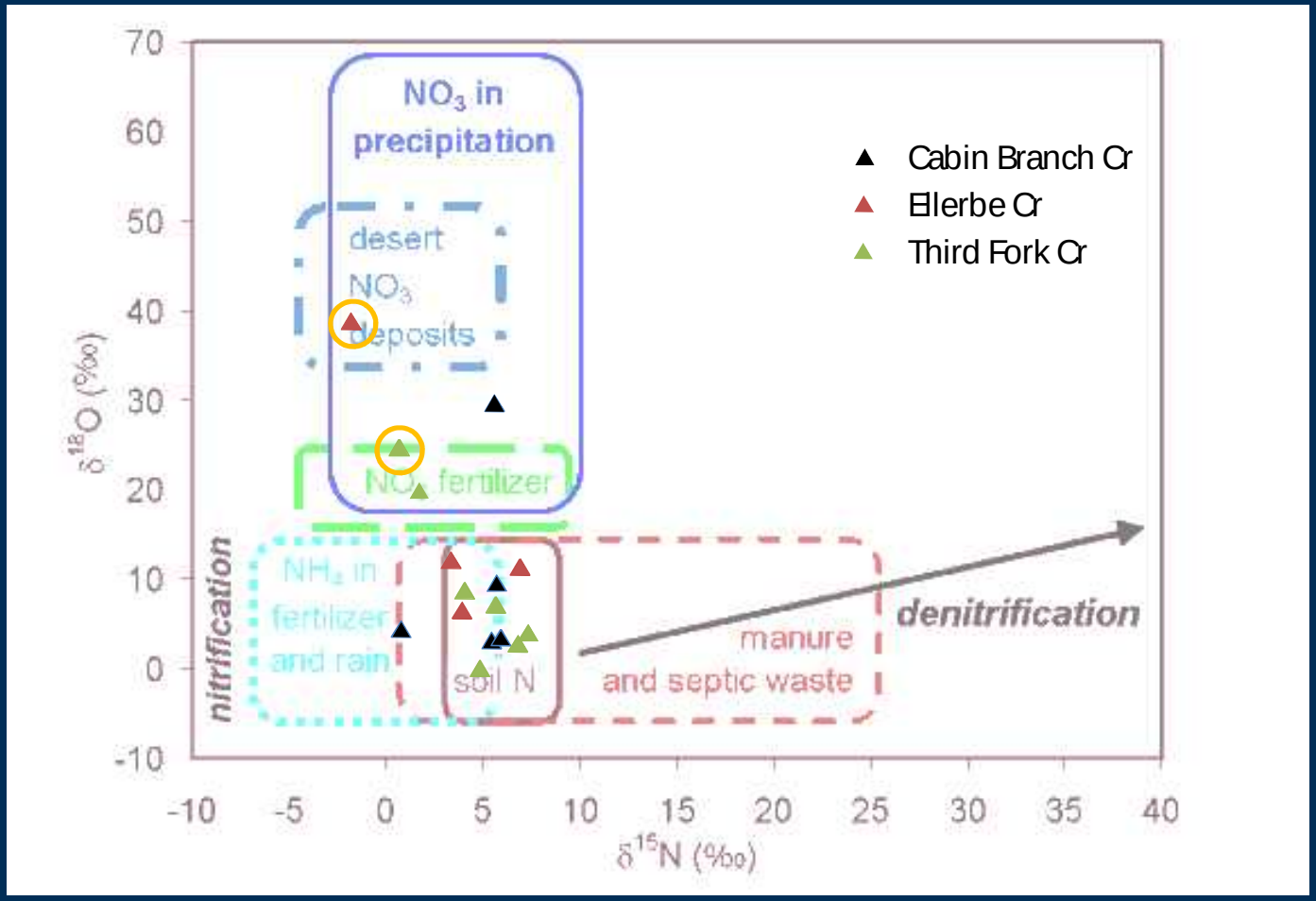
August – Post Irene but very low flow

Typical Source Ranges



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Sept – Falling limb

What have we learned so far?

- In terms of nutrients, healthy urban creeks
- Stable isotopes of water are plotting above the GMWL and LMWL
- Nitrogen stable isotopes suggest atmospheric deposition is an overlooked component
- Cabin Branch Creek does not display adverse effects due to leaking septic tanks

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Questions?

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