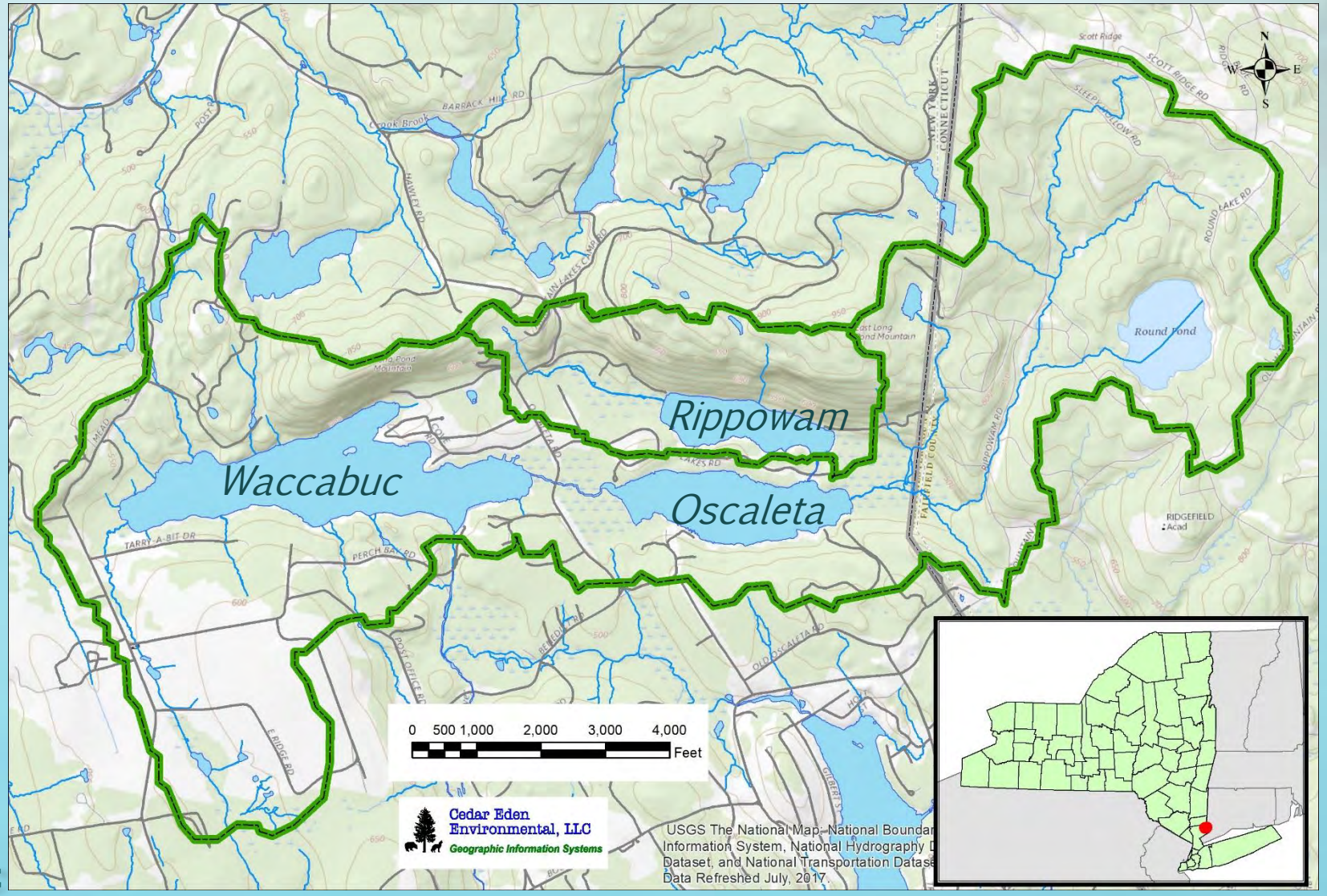
Lake & Watershed Management Plan Development for Three Connected Lakes

Town of Lewisboro, Westchester County, NY

Michael R. Martin, CLM

NYSFOLA Annual Conference – May 4, 2019

Location of the Three Lakes Watersheds



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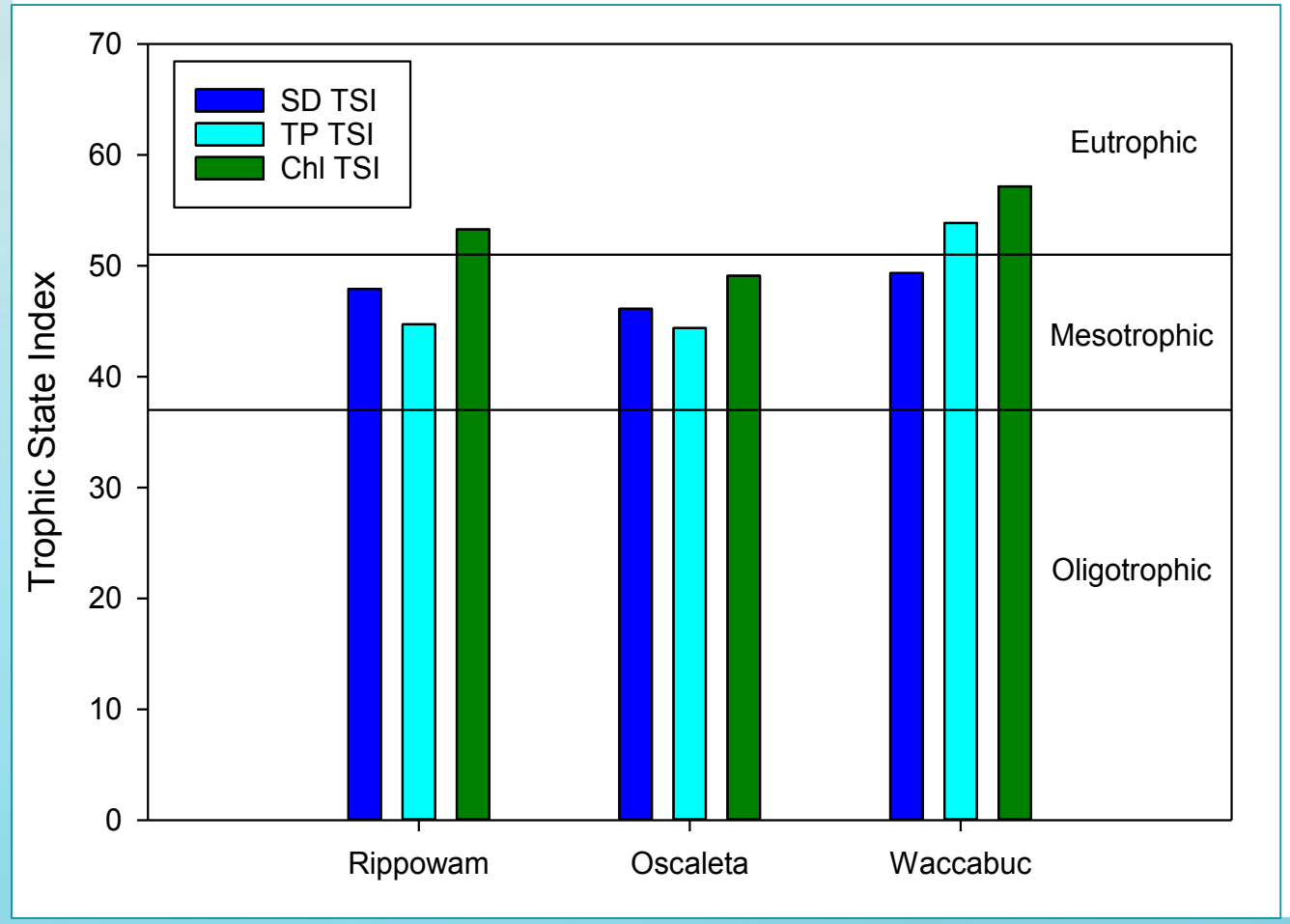
Problem Statement

- Excess Nutrients
- Hypolimnetic Anoxia
- Harmful Algal Blooms
- Excessive growth of aquatic macrophytes



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Background

- Initial investigations began in 2003
- Lake and Watershed Management Plan in 2004
- CSLAP Monitoring 2004 to Present
- Management Plan Implementation 2004 to Present
- Management Plan Update began in 2018

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Selected Morphological Characteristics

Lake Characteristic	Lake Rippowam	Lake Oscaleta	Lake Waccabuc
Surface Area	33.9 ac 13.7 ha	65.2 ac 26.4 ha	138.0 ac 55.9 ha
Maximum Depth	20 ft 6.1 m	36 ft 10.8 m	44 ft 13.4 m
Mean Depth	13.5 ft 4.1 m	19.4 ft 5.9 m	23.3 ft 7.1 m
Lake Volume	150 million gallons 566,536.1 m^3	412 million gallons 1,557,959.9 m^3	3696 million gallons 13,990,063.4 m^3
Hypolimnion Volume	0.1 million gallons 456 m^3	61 million gallons 230,898 m^3	369 million gallons 1,398,107 m^3
Flushing Rate	4.7 times/year	3.2 times/year	1.4 times/year
Phosphorus Retention Coefficient	0.48 percent	0.48 percent	0.55 percent

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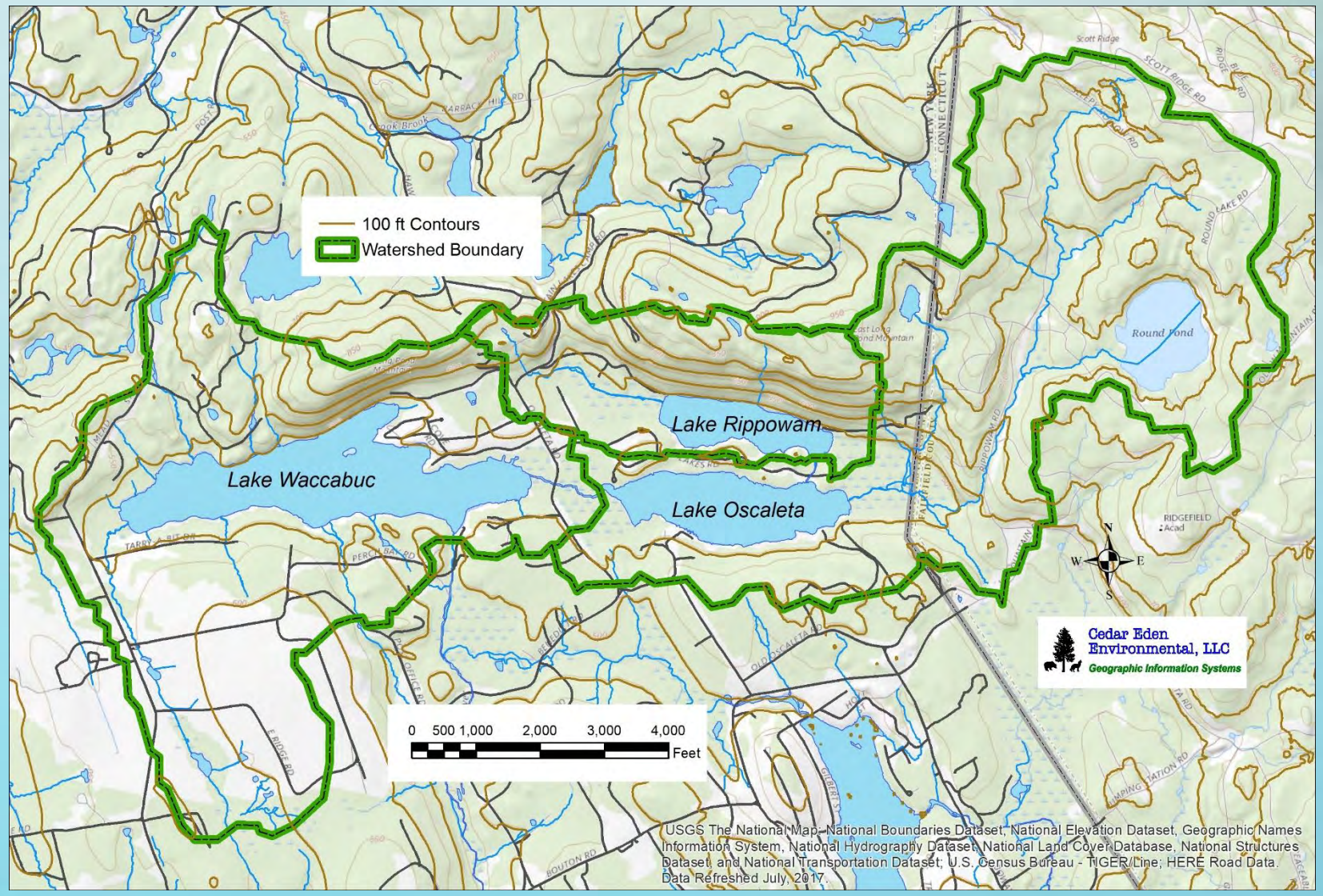
The Watershed

Watershed Characteristics

- Rippowam
  279 acres
- Oscaleta
  1,282 acres
- Waccabuc
  2,196 acres



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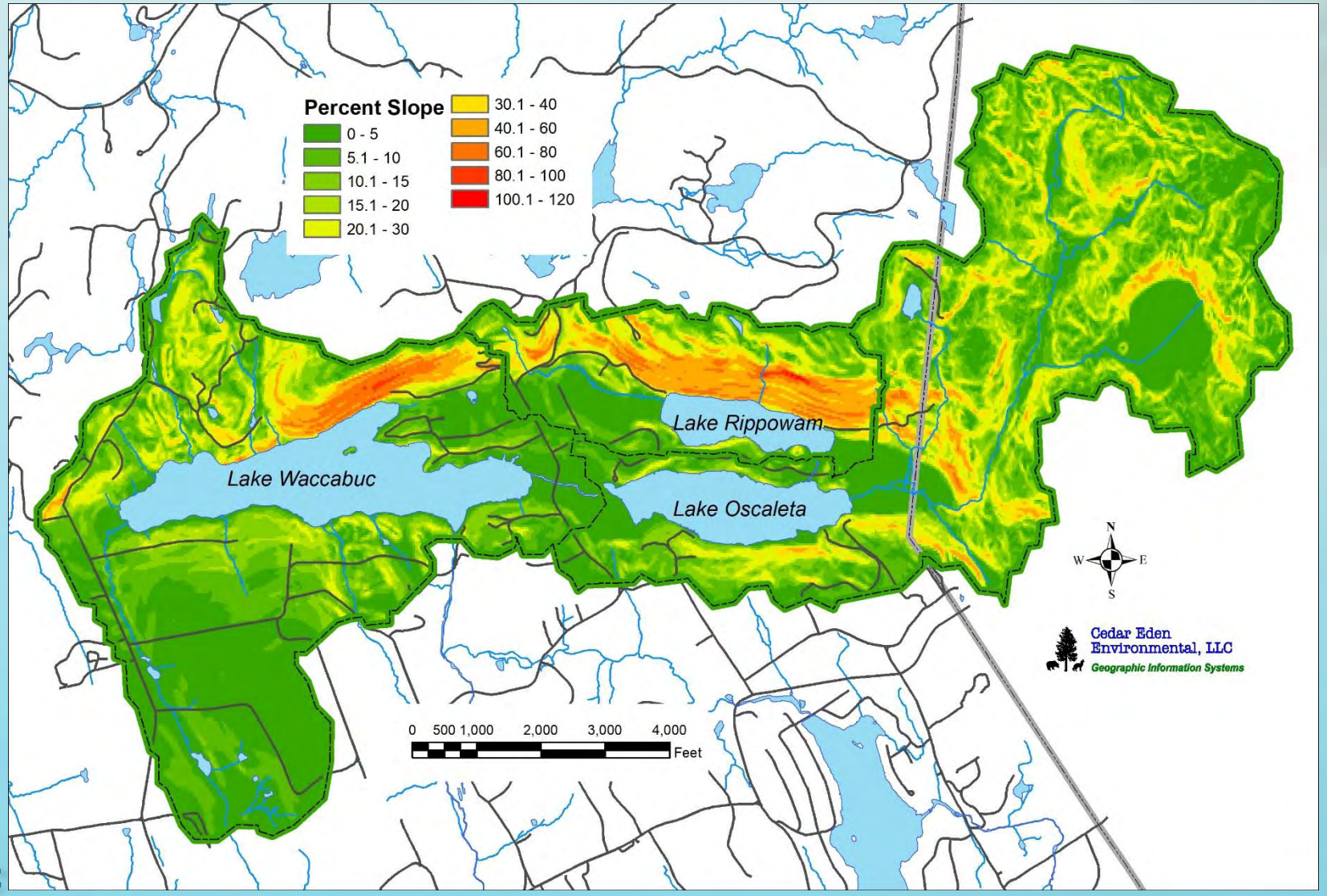
Topography



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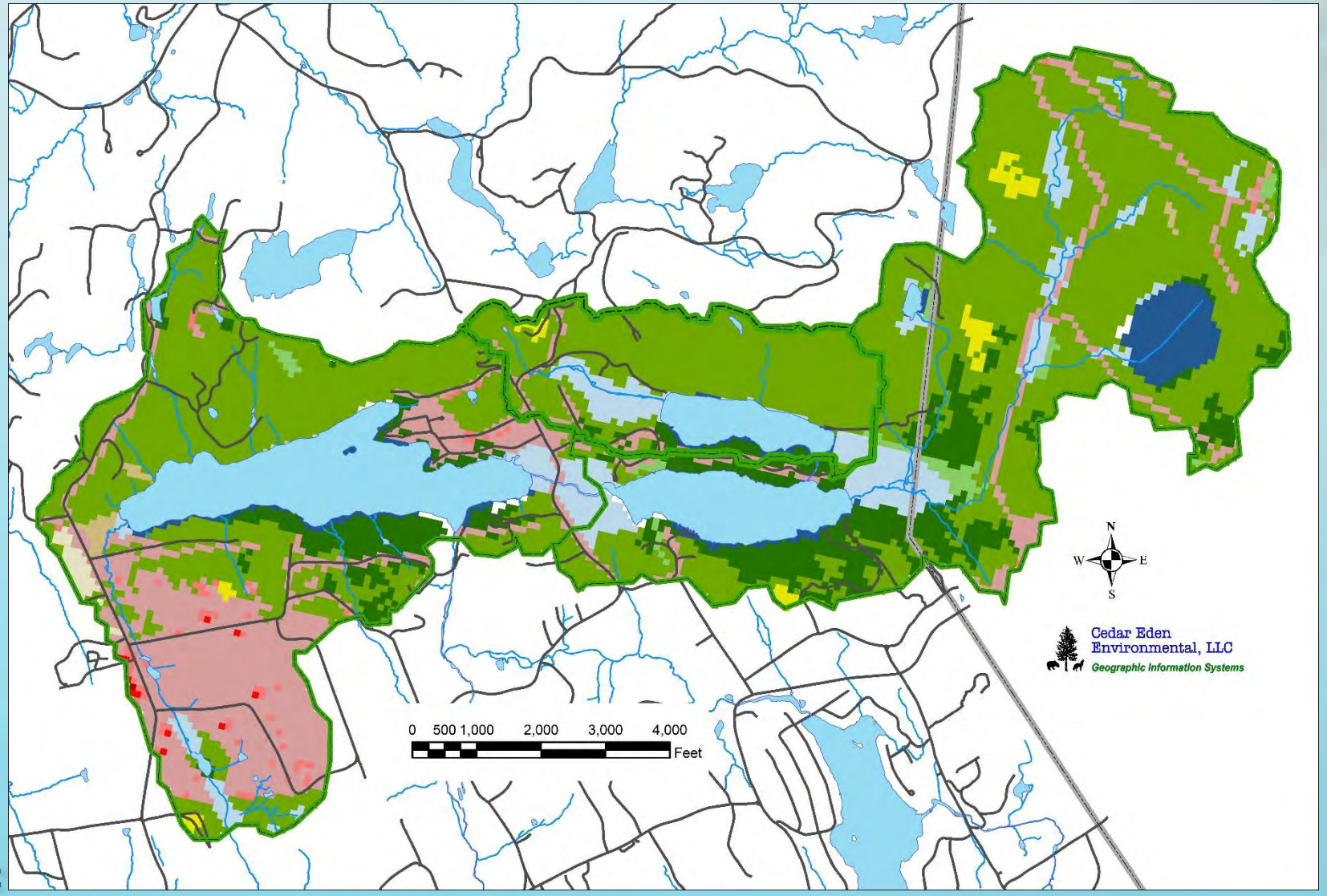
Land Use

2011 NLCD Land Cover

Land Use Class

- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Grassland/Herbaceous
- Pasture/Hay
- Woody Wetlands
- Emergent Herbaceous Wetlands



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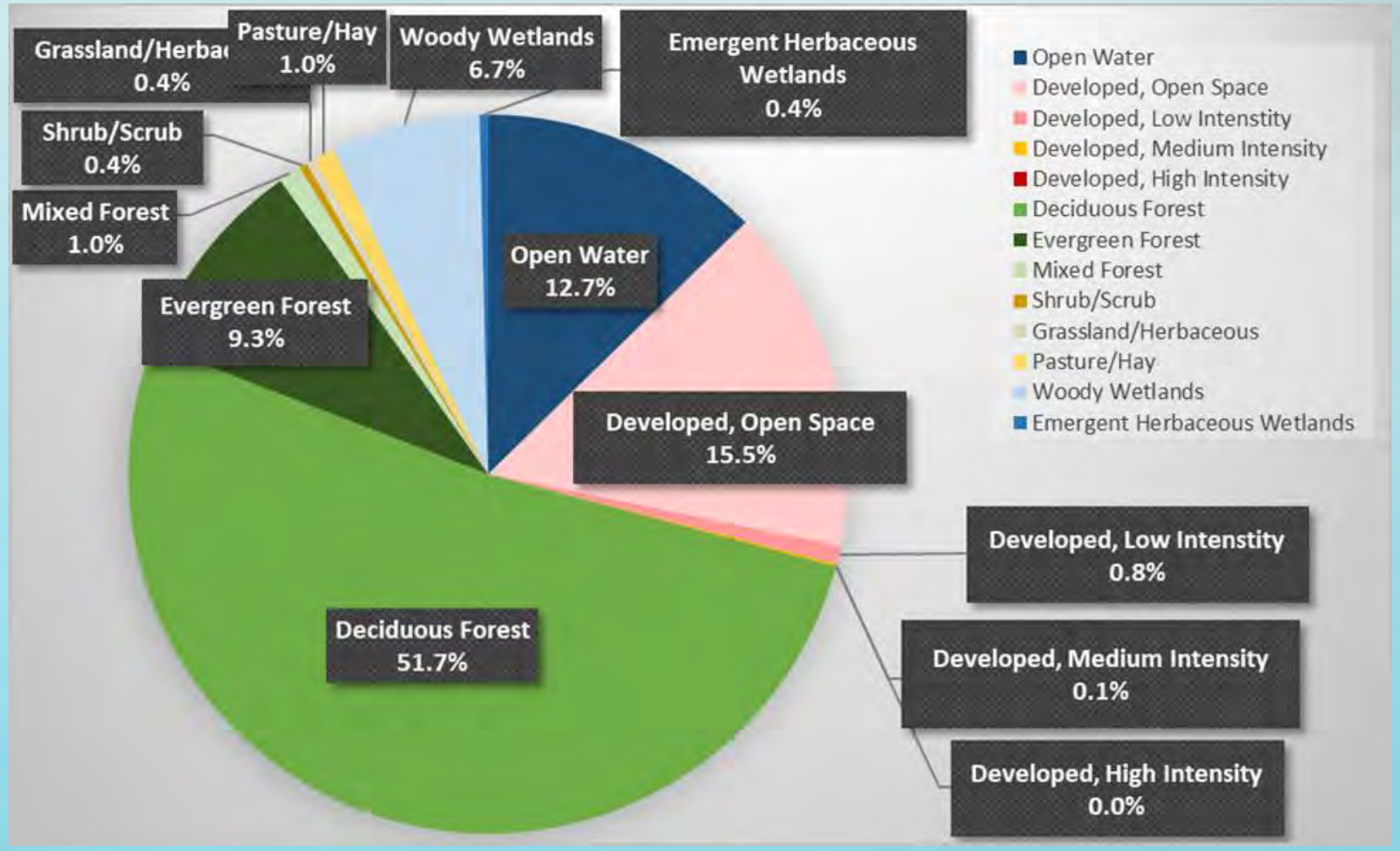

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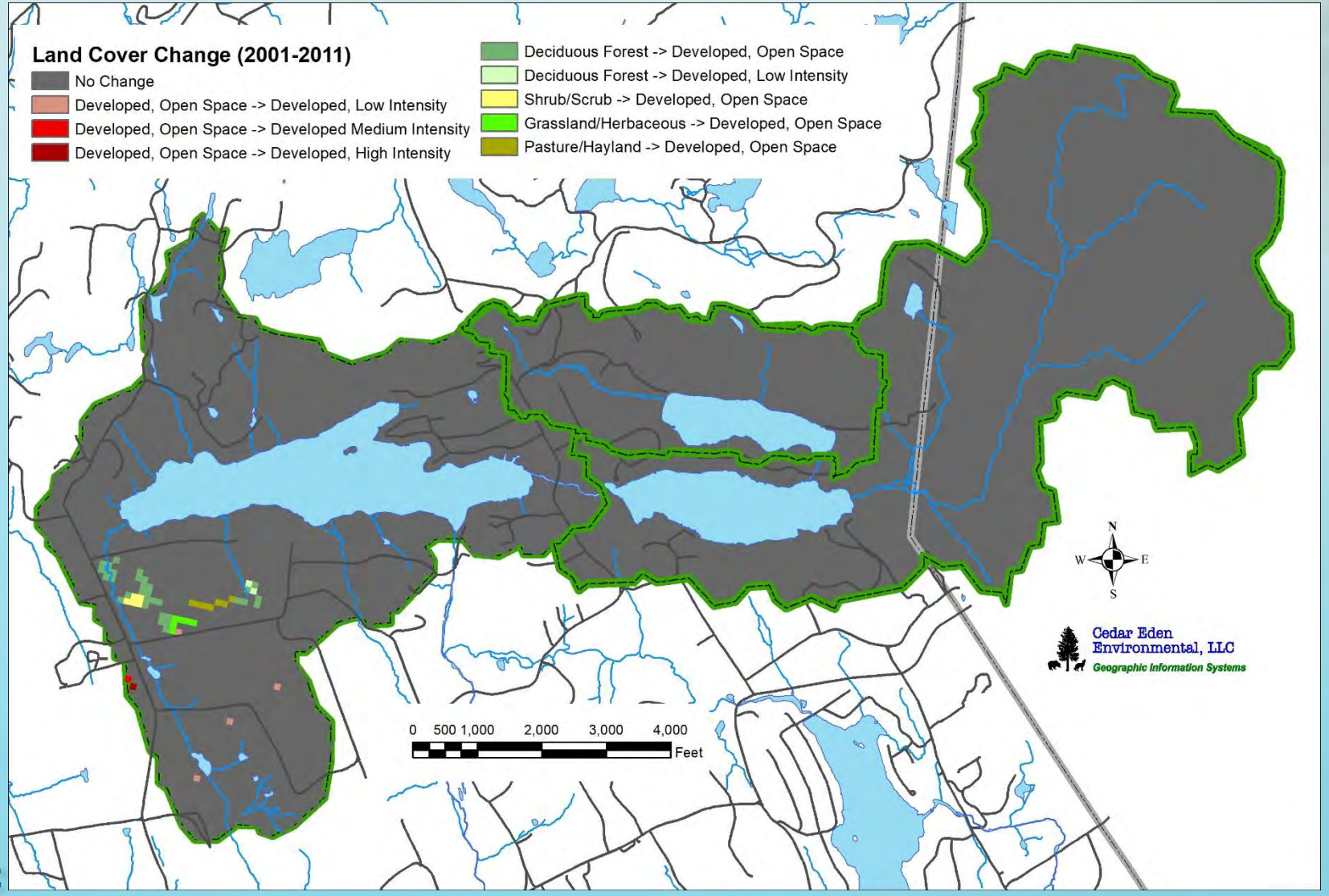
Land Use Change 2001-2011



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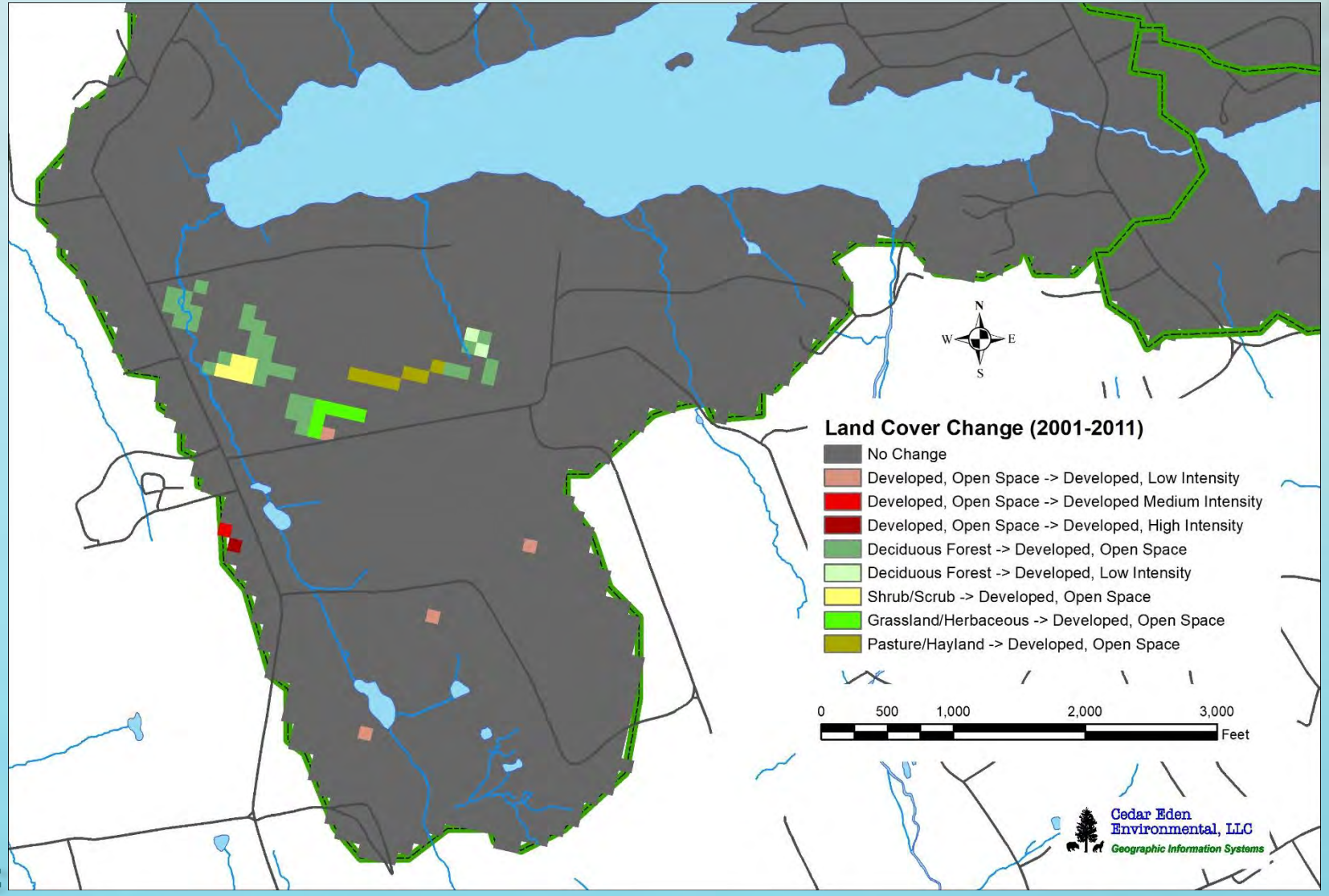
Land Use Change 2001-2011

- Approx. 13 acres



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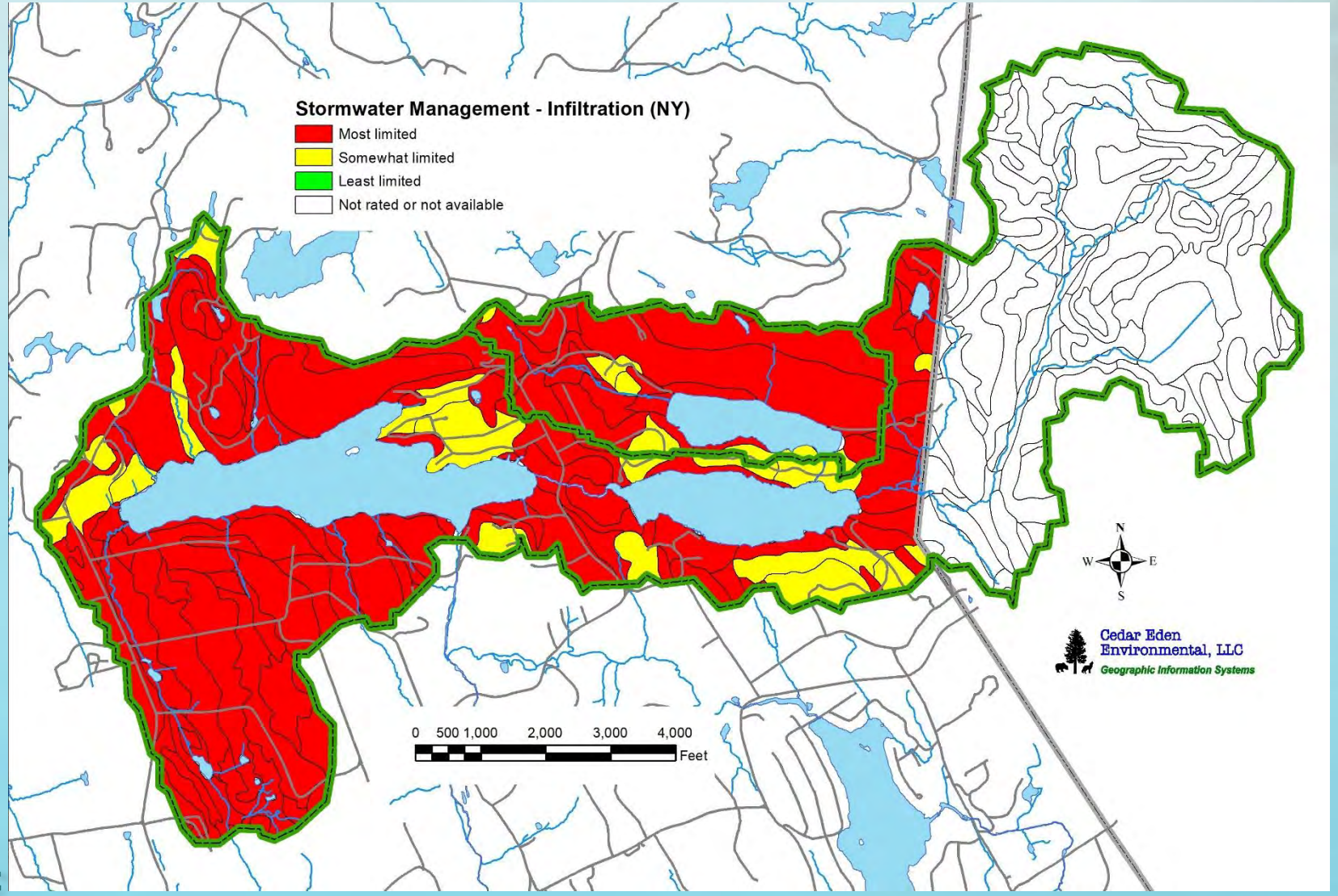
Soil Limitations for Stormwater Management



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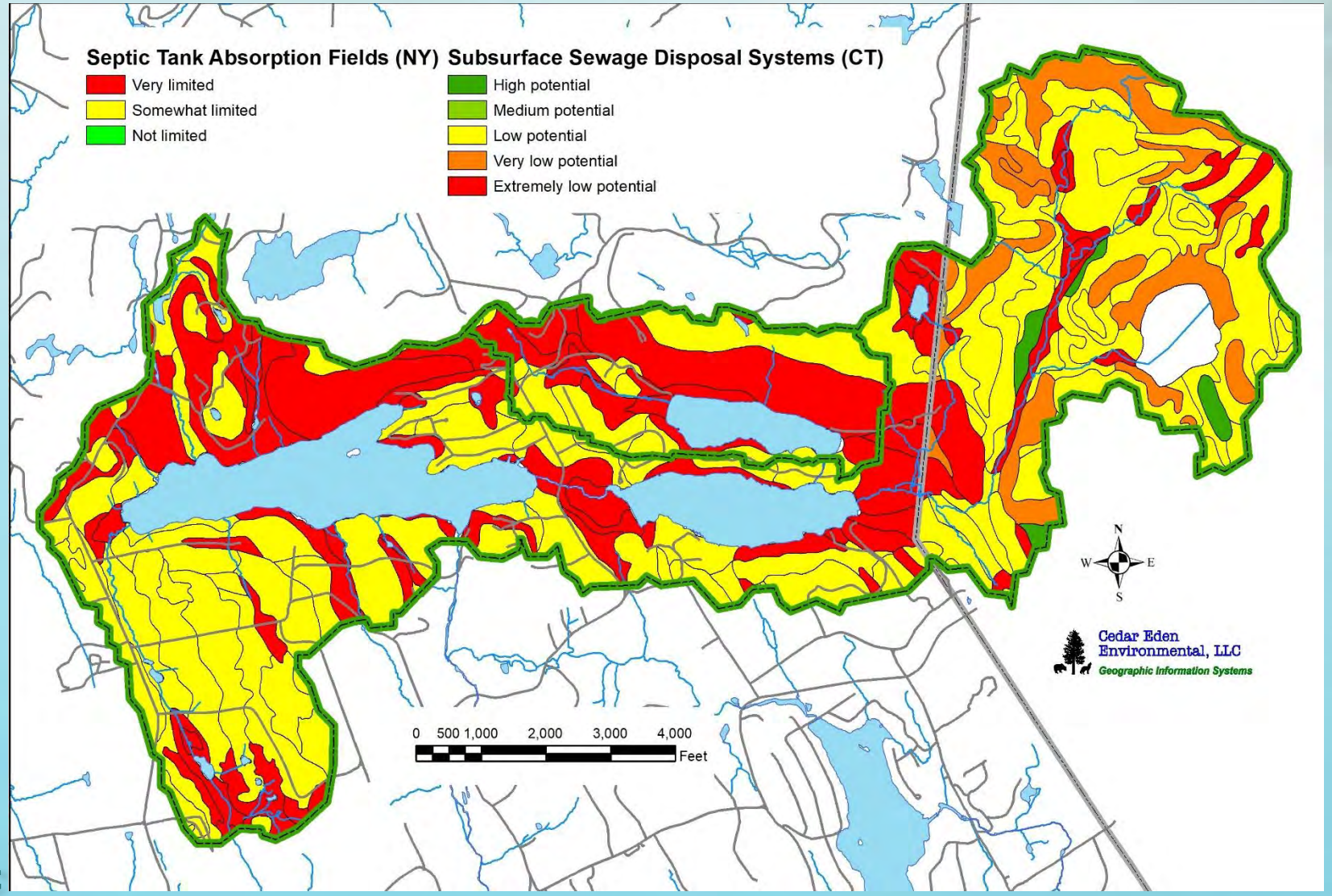
Soil Limitations for Septic Systems



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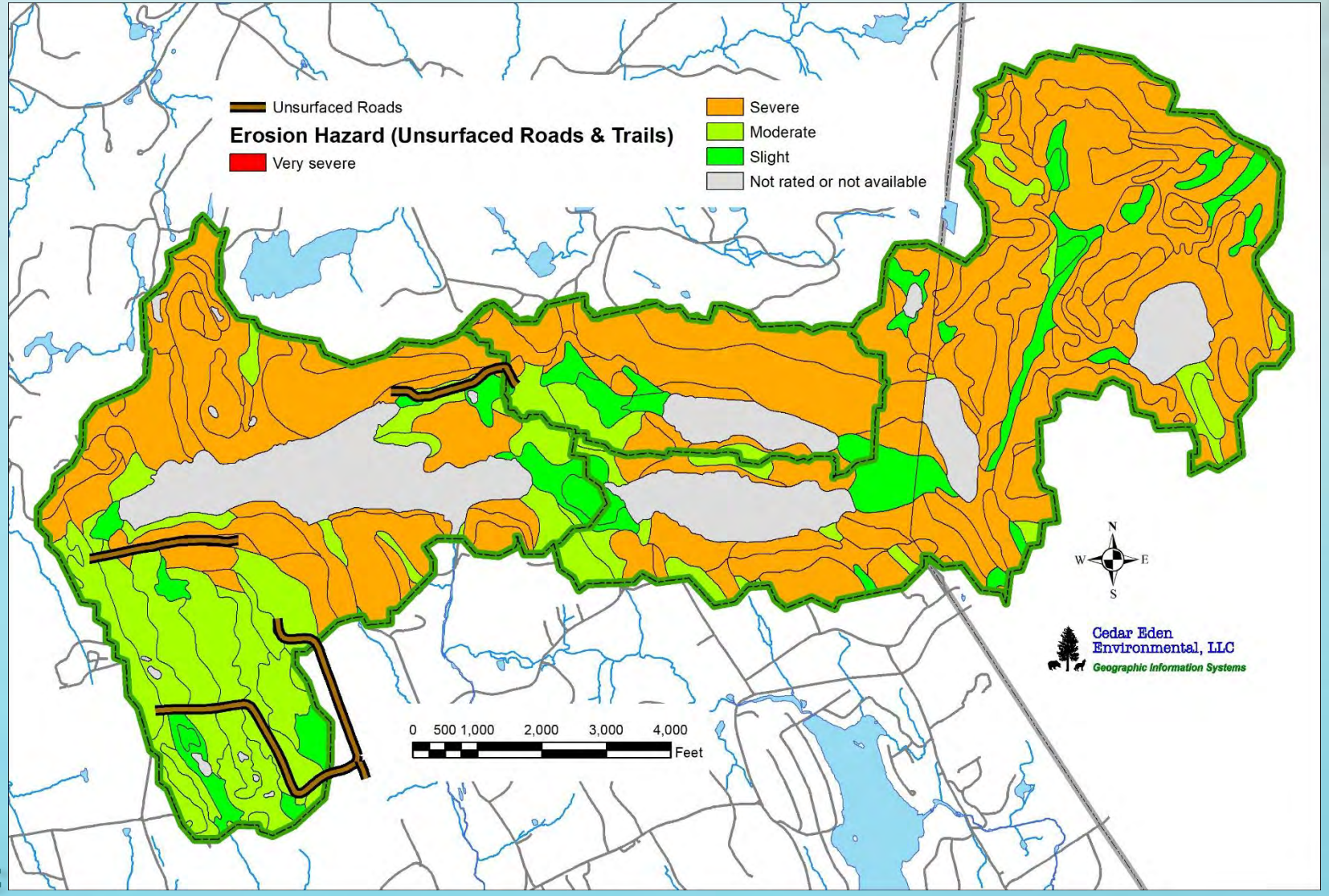
Soil Erosion Hazard for Unsurfaced Roads



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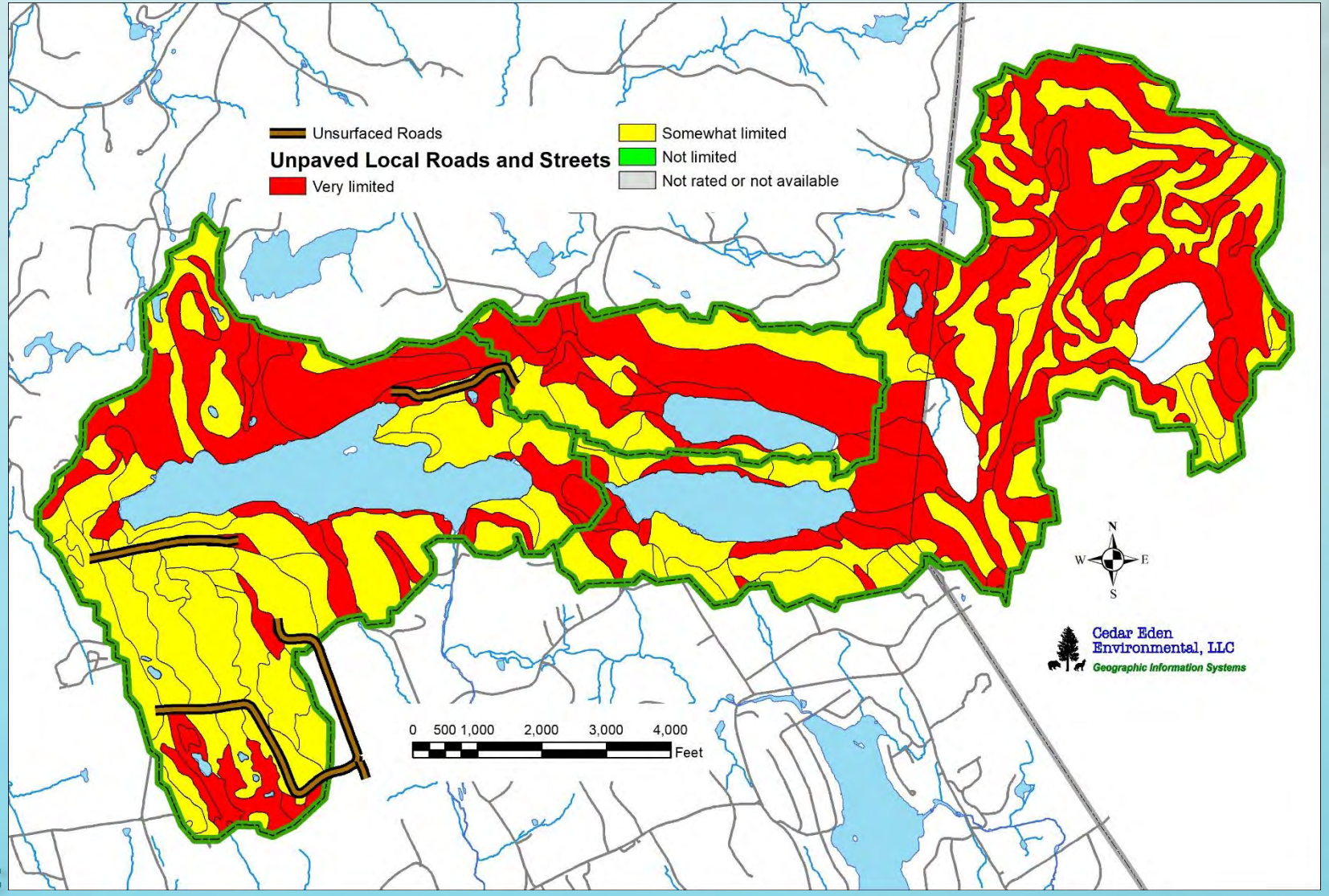
Soil Limitation for Unpaved Local Roads



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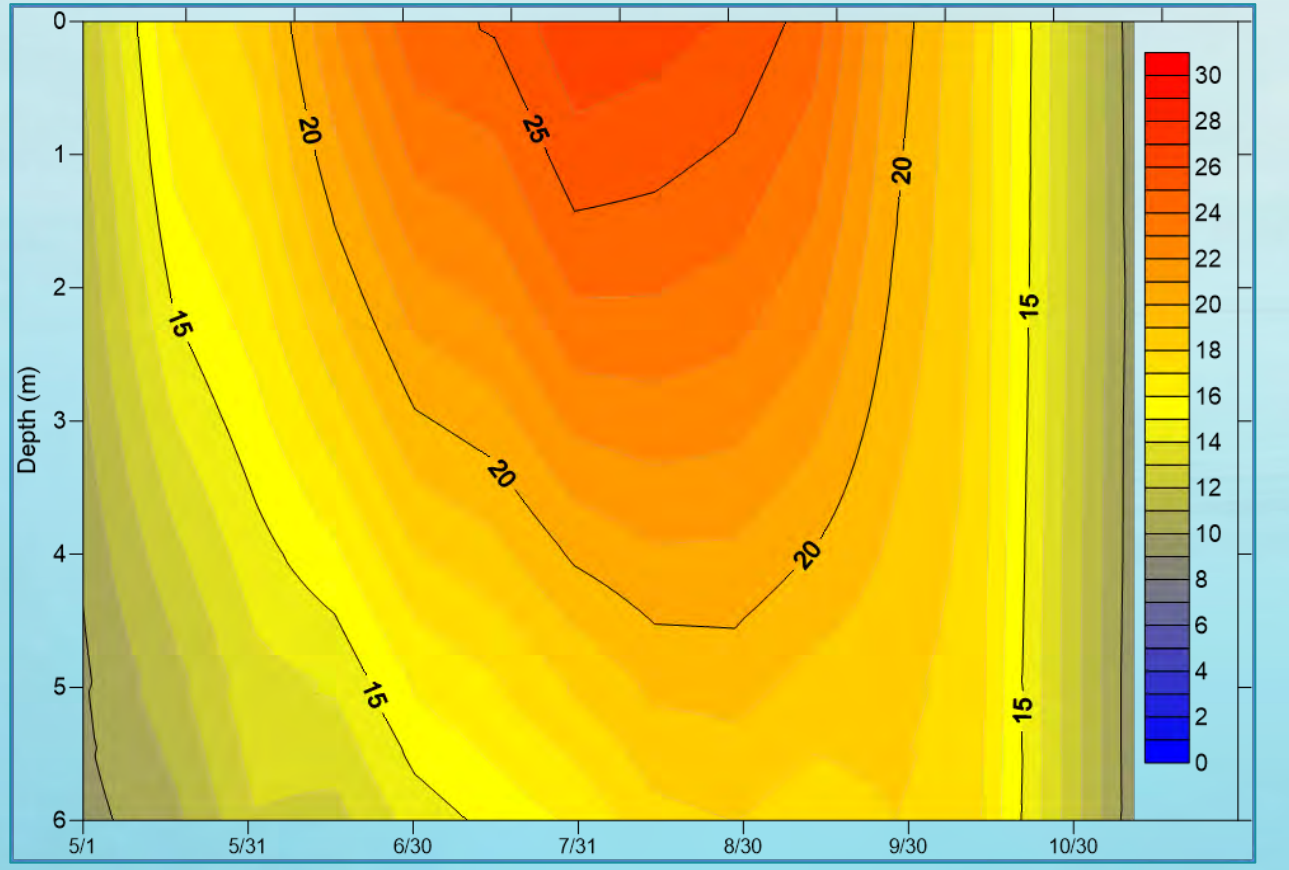
Water Quality

Lake Rippowam Dissolved Oxygen & Temperature

Temperature Isopleths



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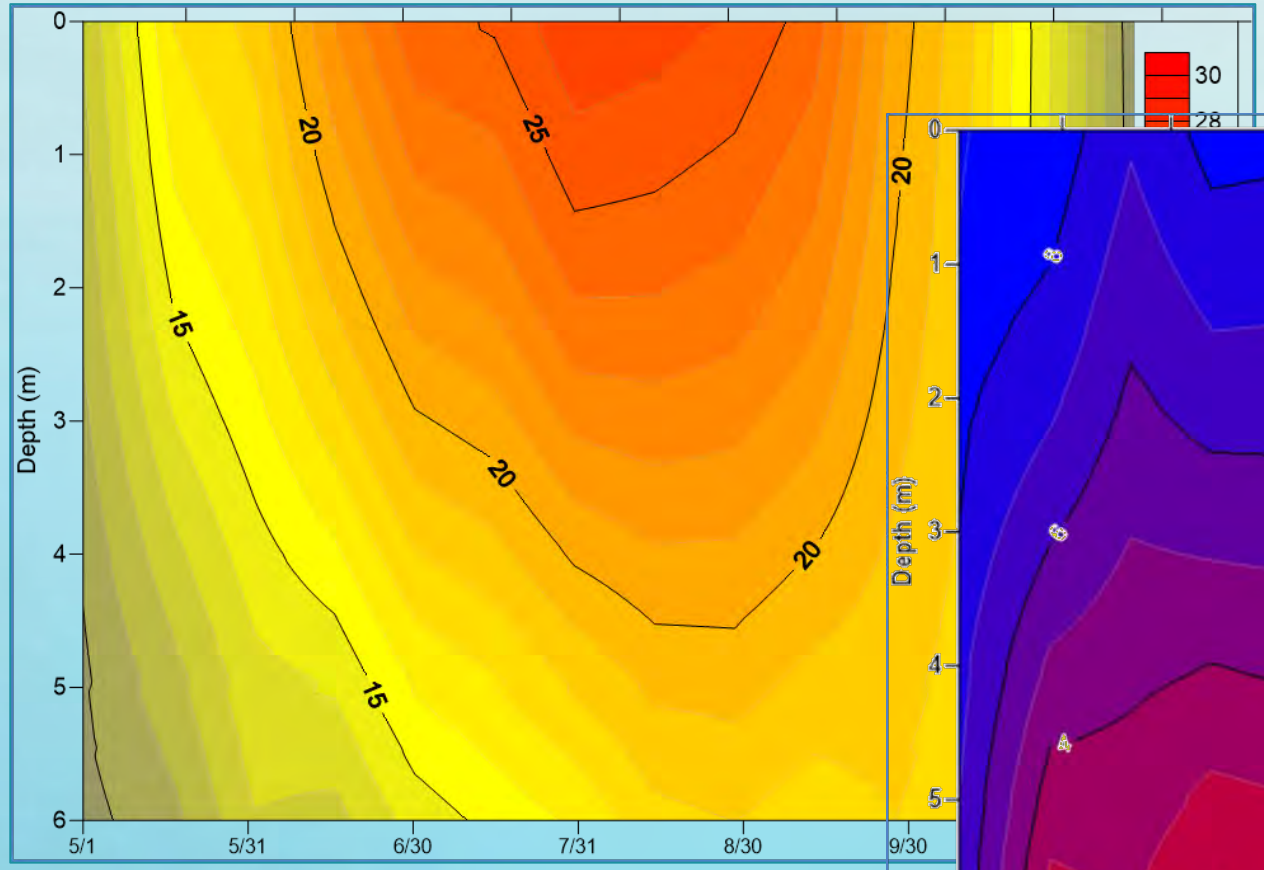
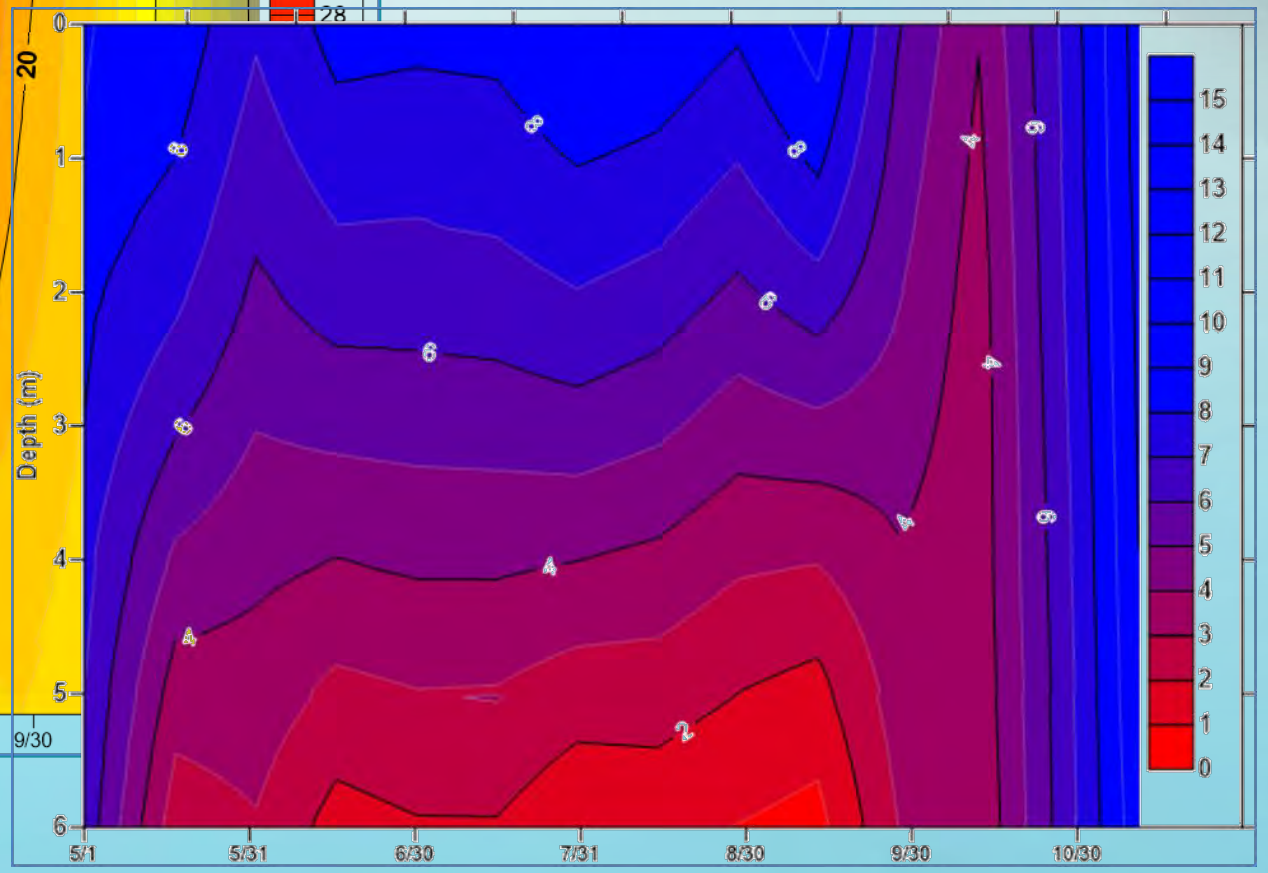
Lake Rippowam Dissolved Oxygen & Temperature

Temperature Isopleths



Dissolved Oxygen Isopleths



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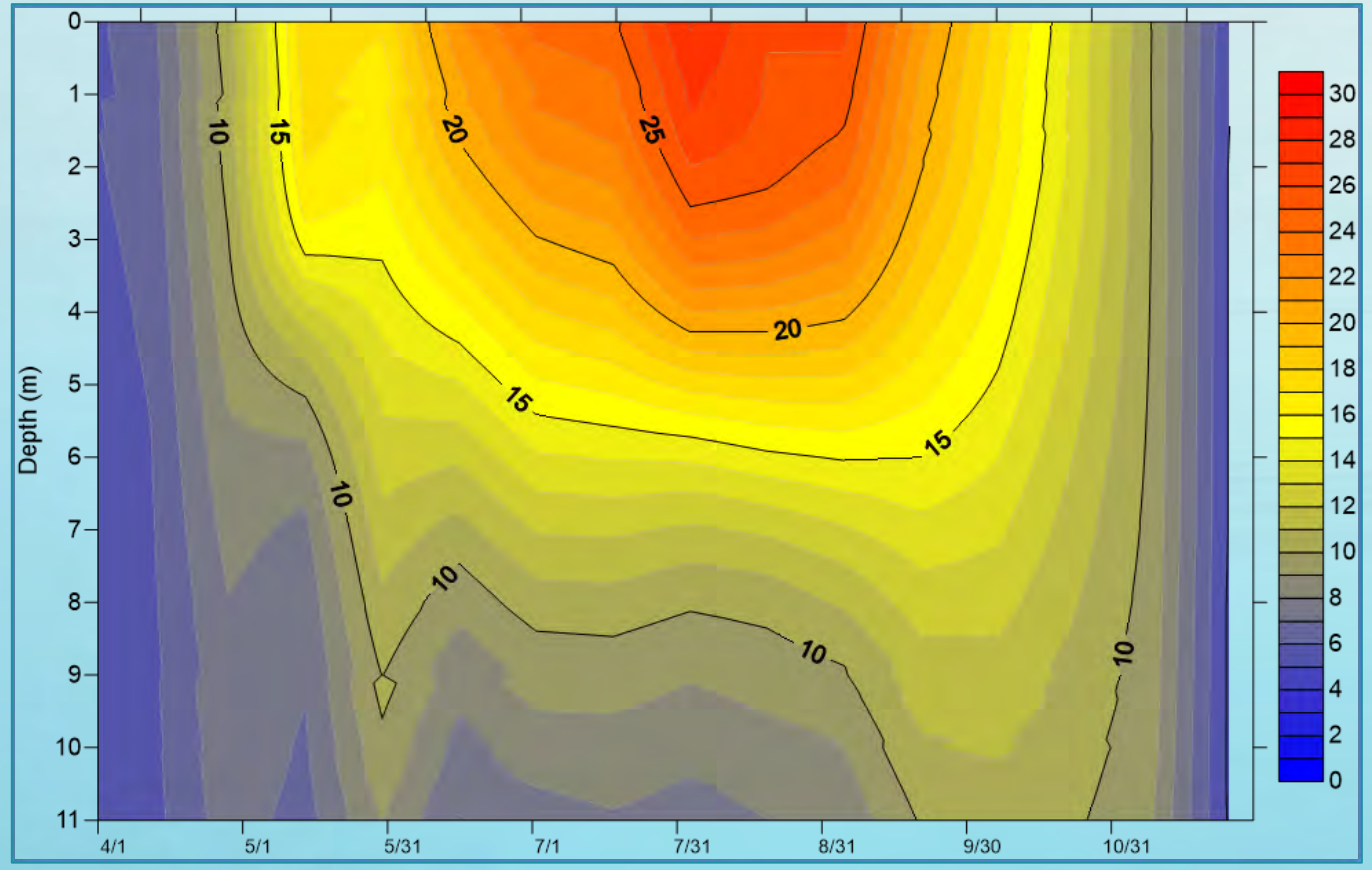
Lake Oscaleta Dissolved Oxygen & Temperature

Temperature Isopleths



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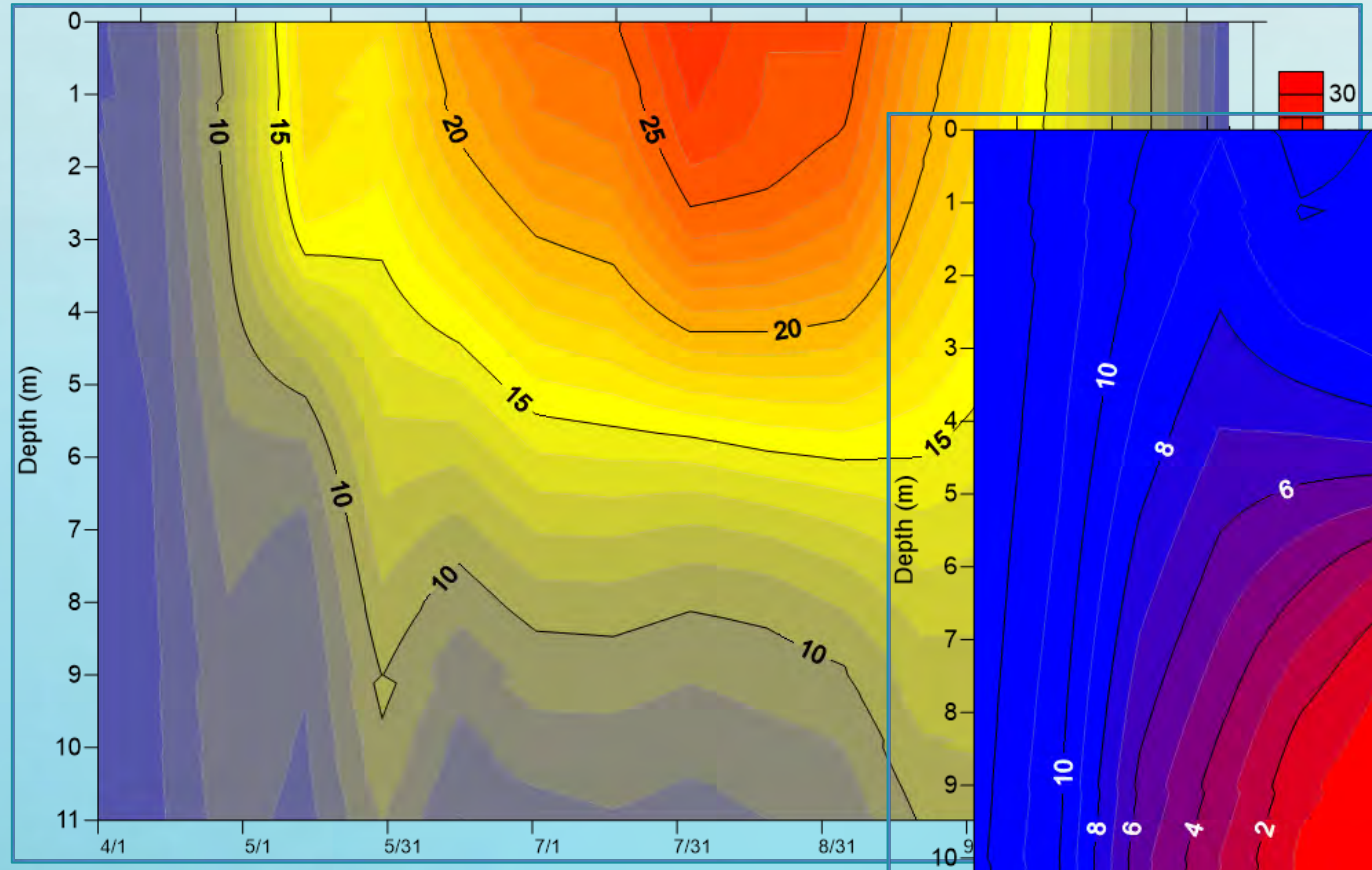
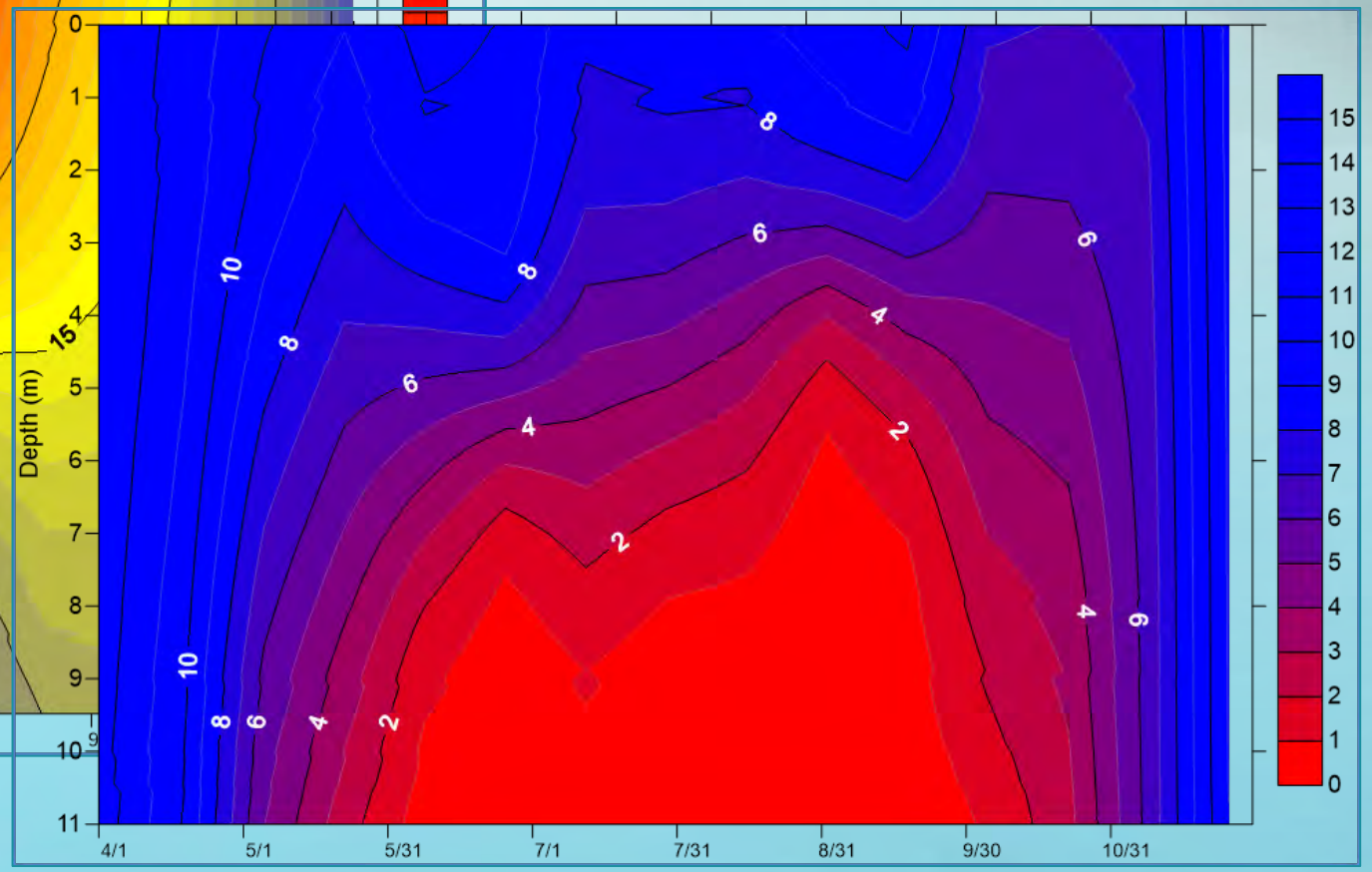
Lake Oscaleta Dissolved Oxygen & Temperature

Temperature Isopleths



Dissolved Oxygen Isopleths



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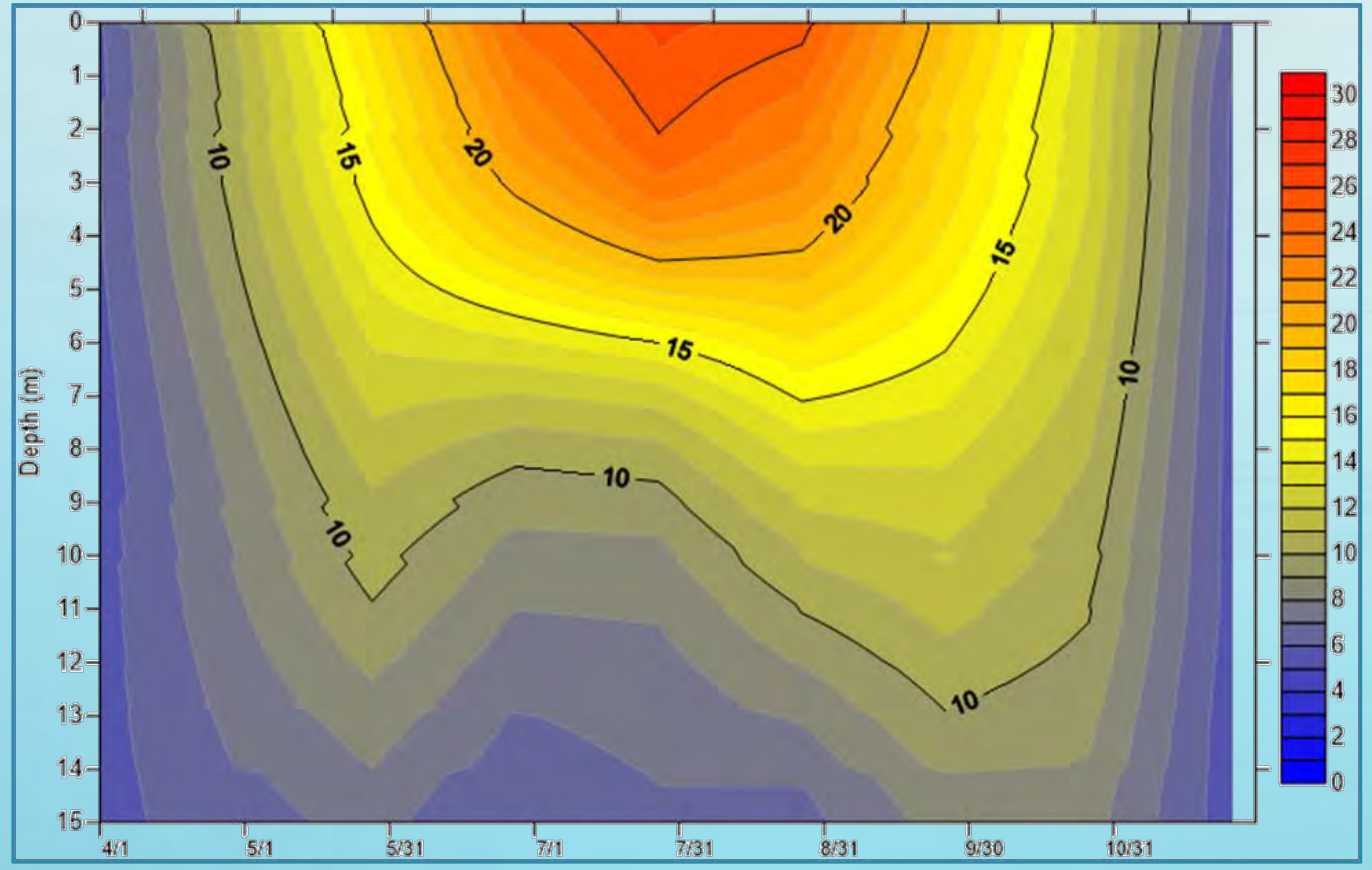
Lake Waccabuc Dissolved Oxygen & Temperature

Temperature Isopleths



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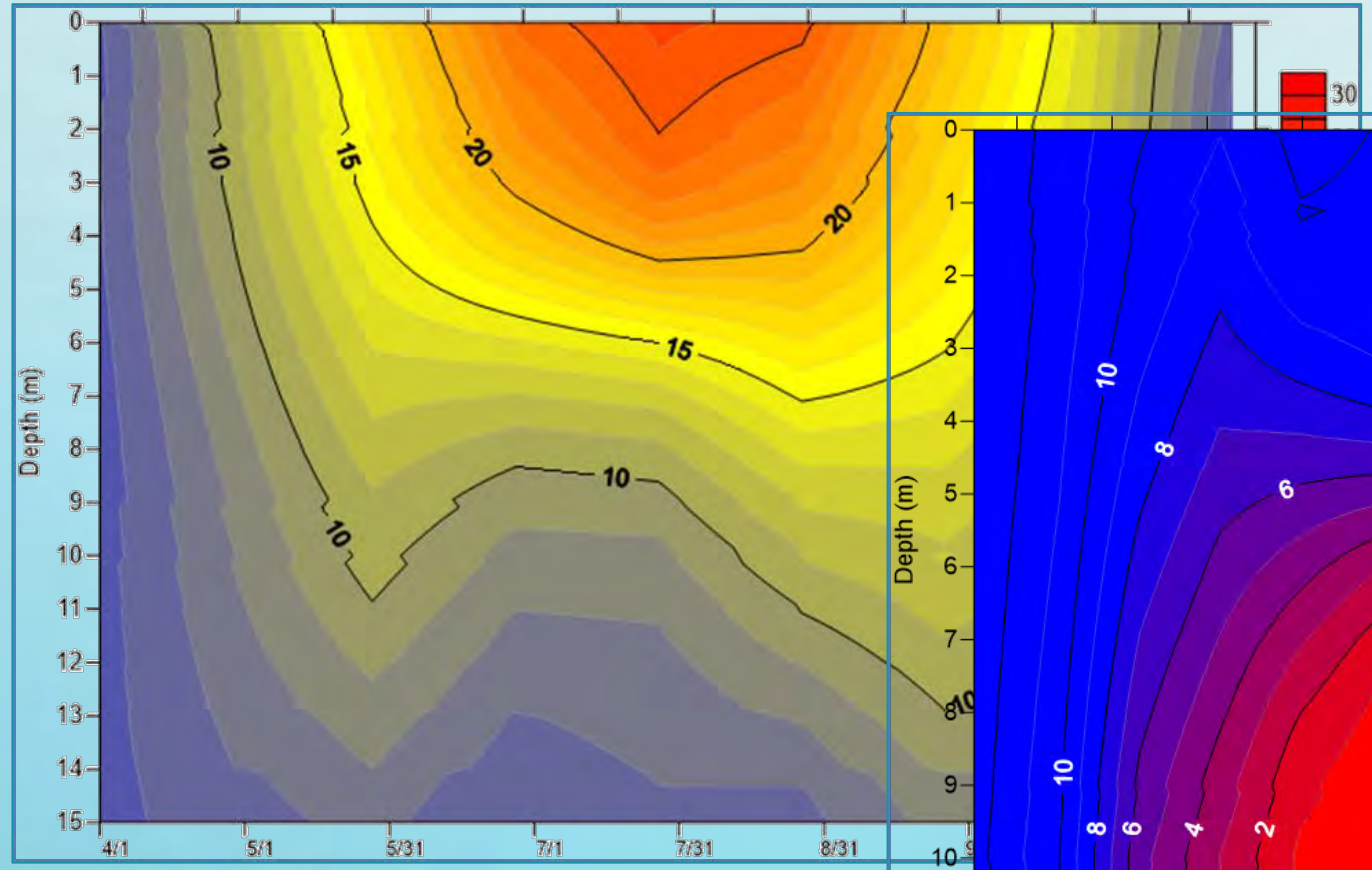
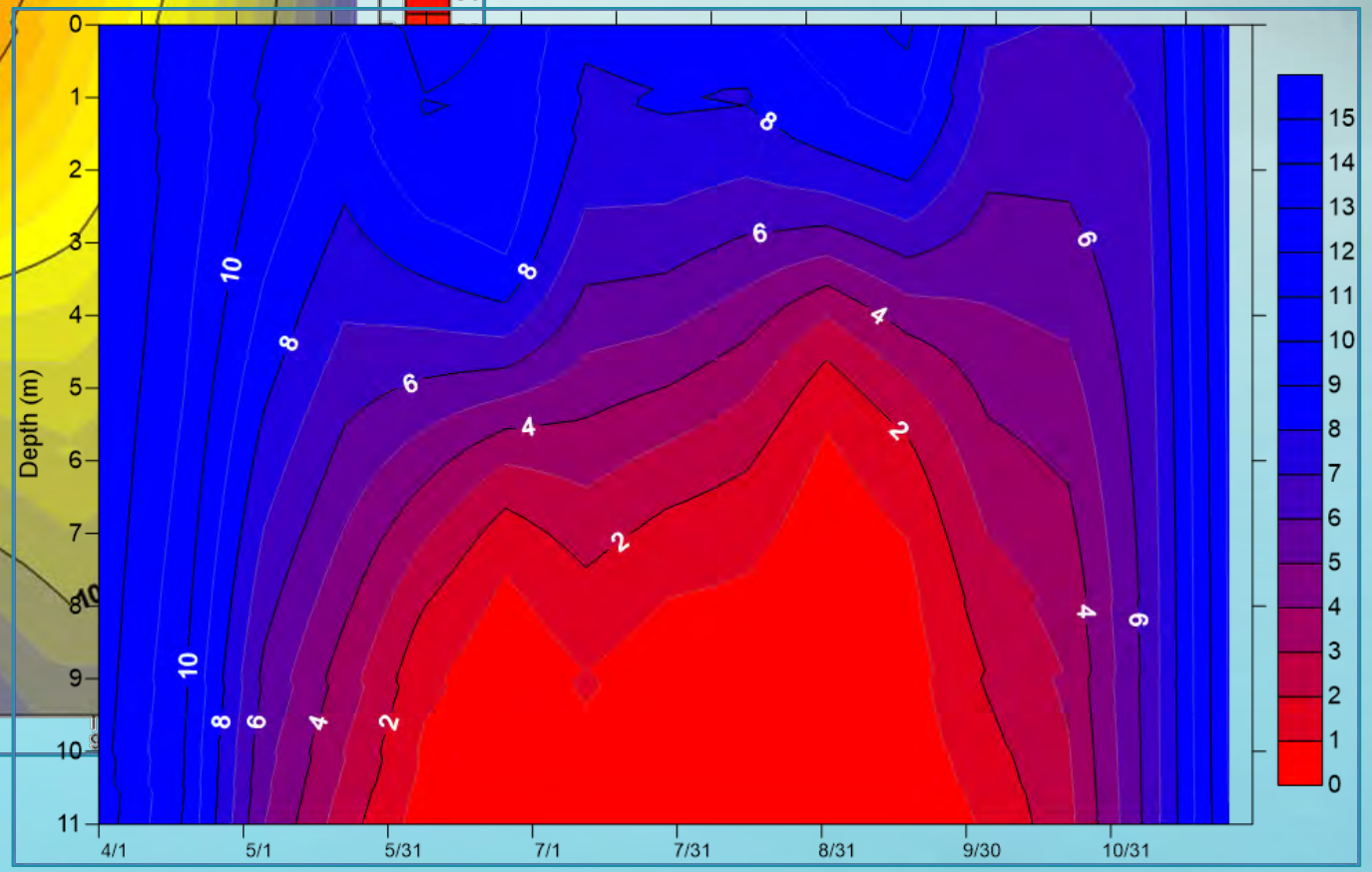
Lake Waccabuc Dissolved Oxygen & Temperature

Temperature Isopleths



Dissolved Oxygen Isopleths



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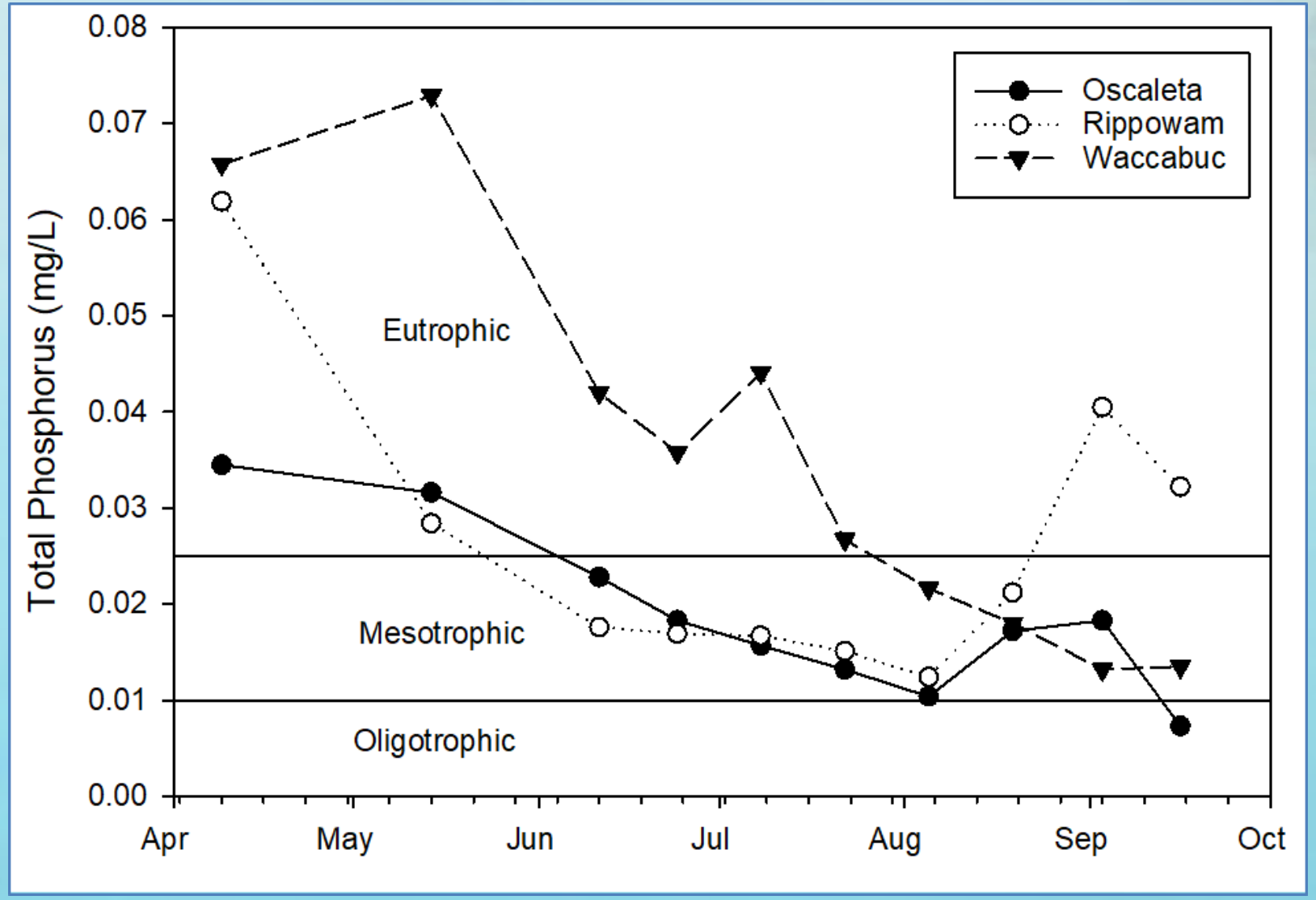
Total Phosphorus (epilimnia)



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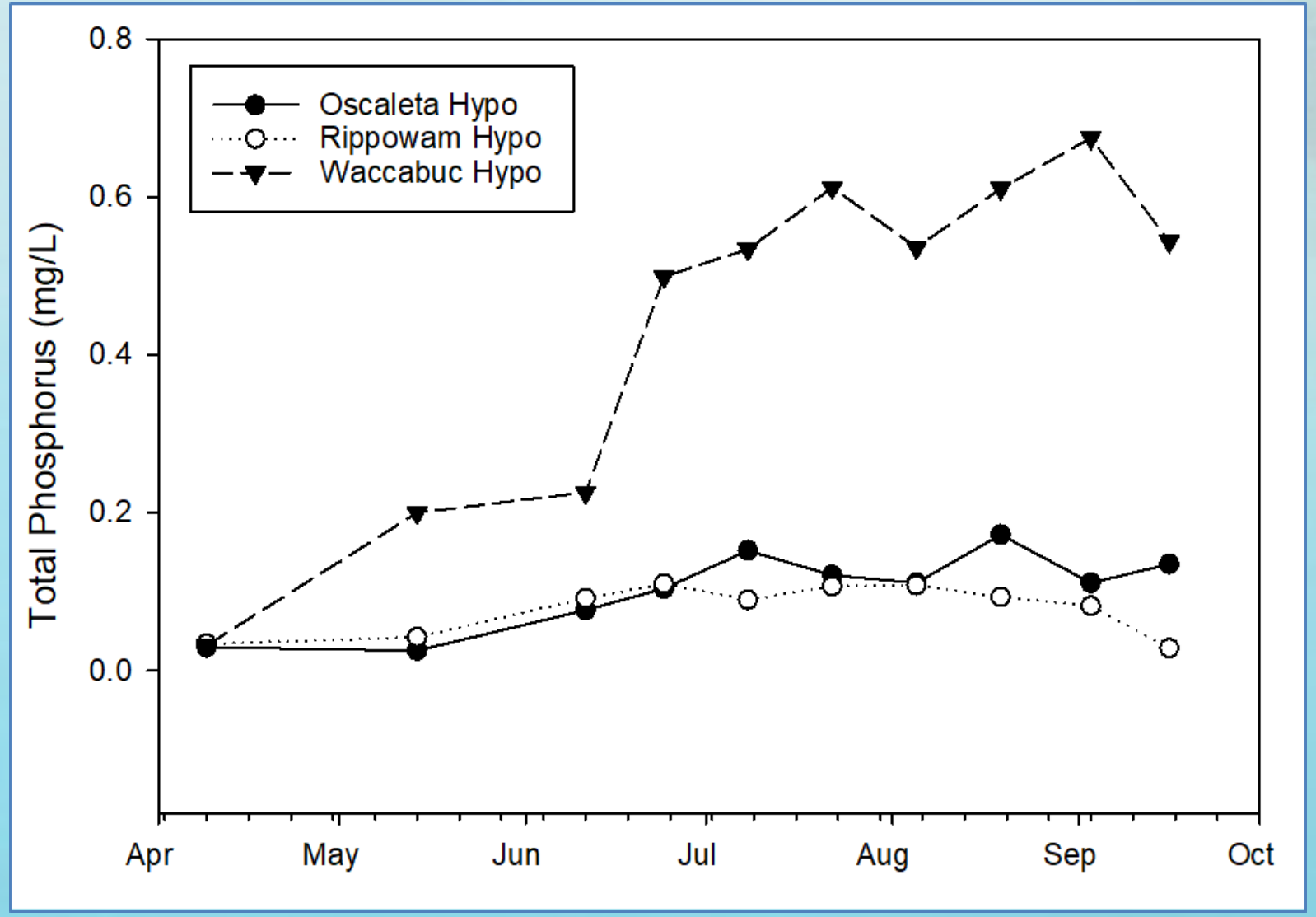
Total Phosphorus (hypolimnia)



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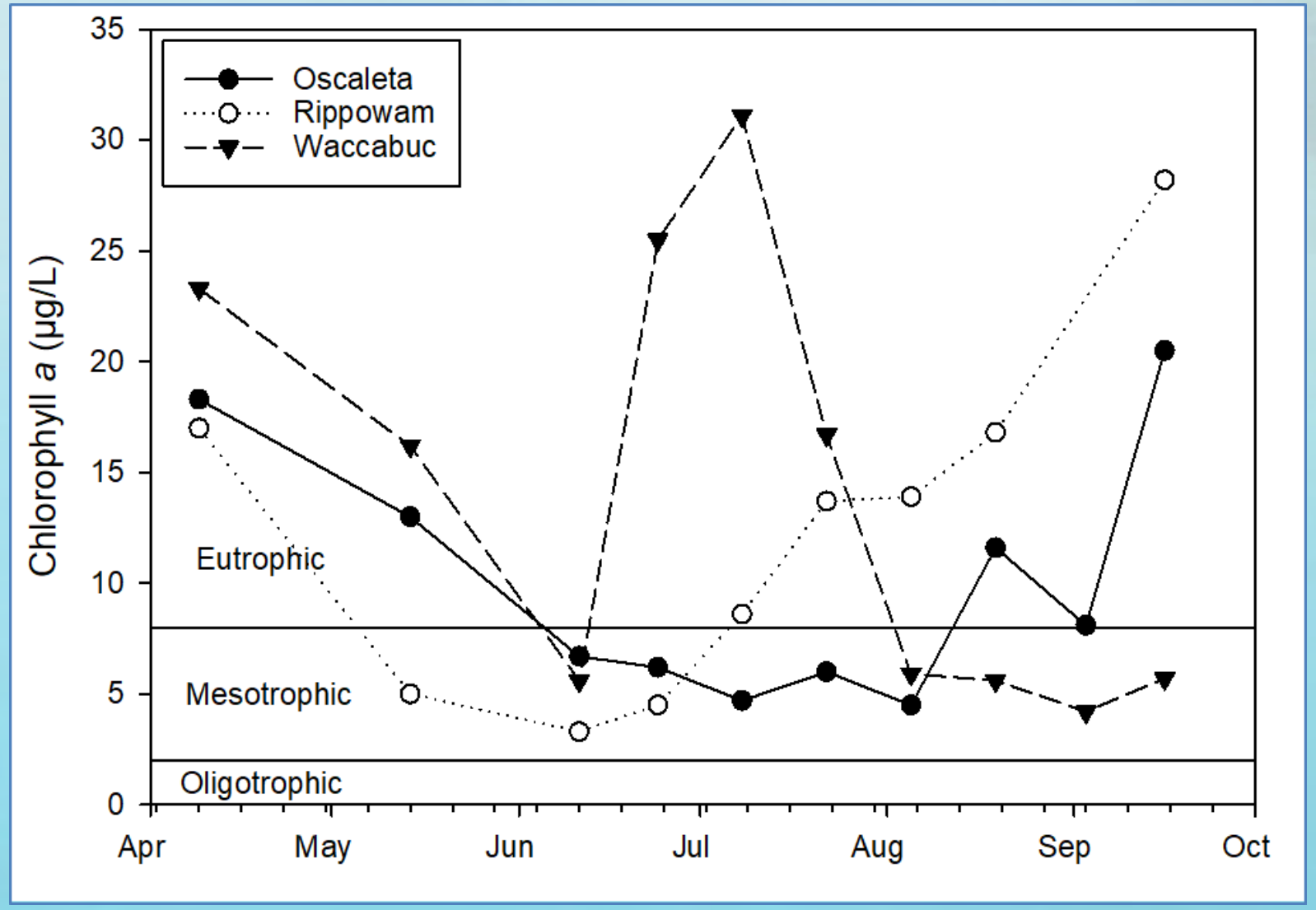
Chlorophyll *a*



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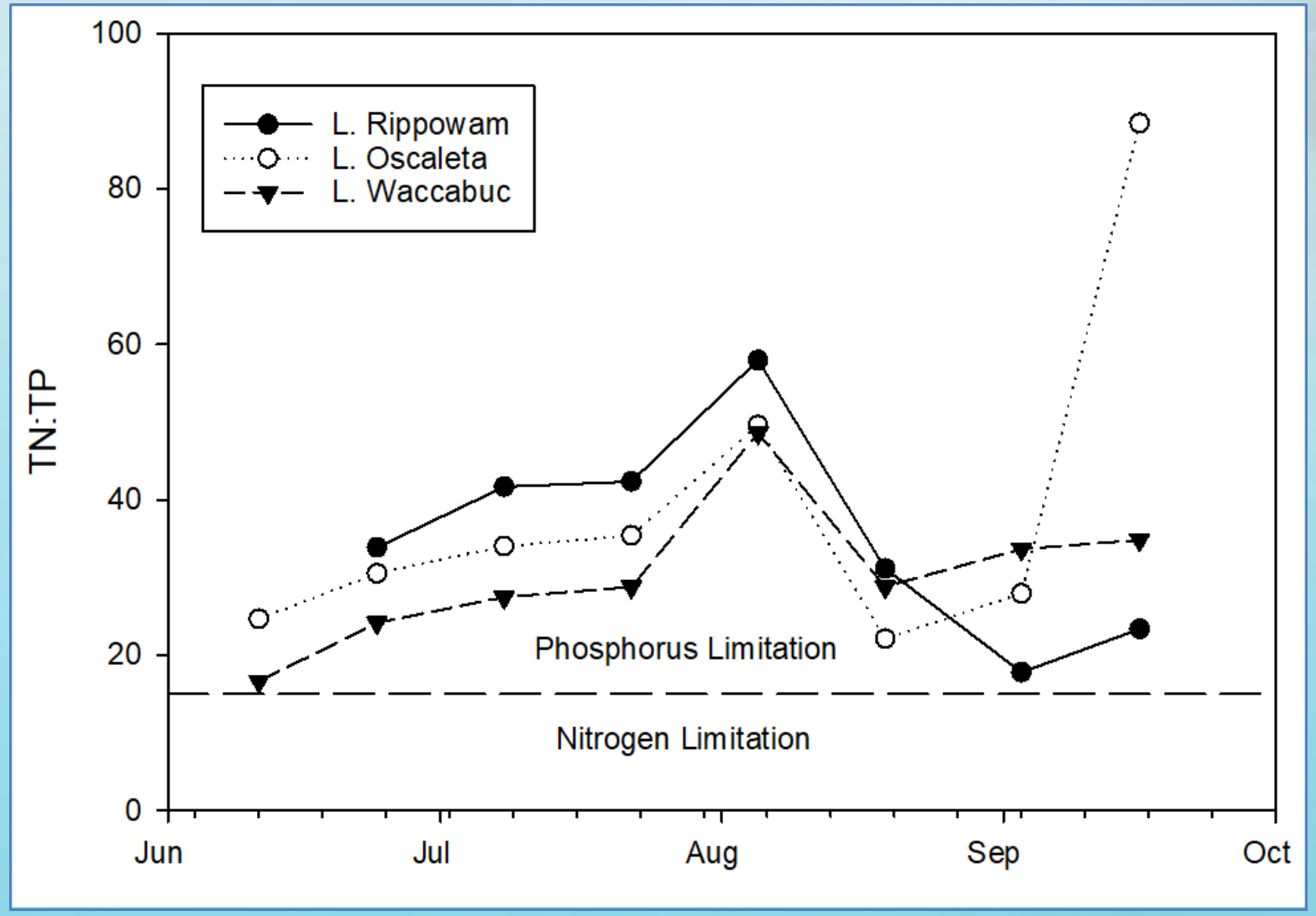
Limiting Nutrient



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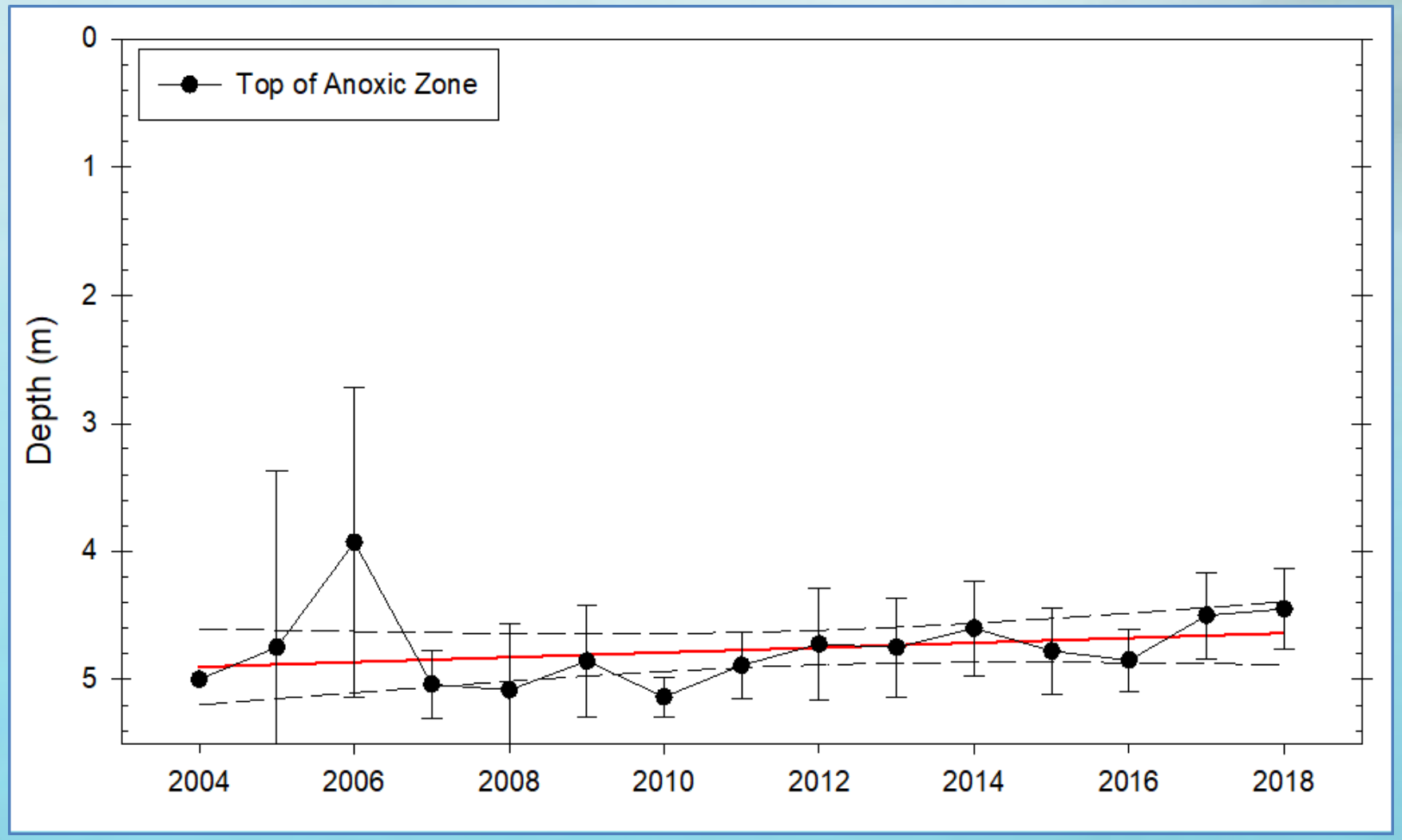
Lake Rippowam Anoxia Trend



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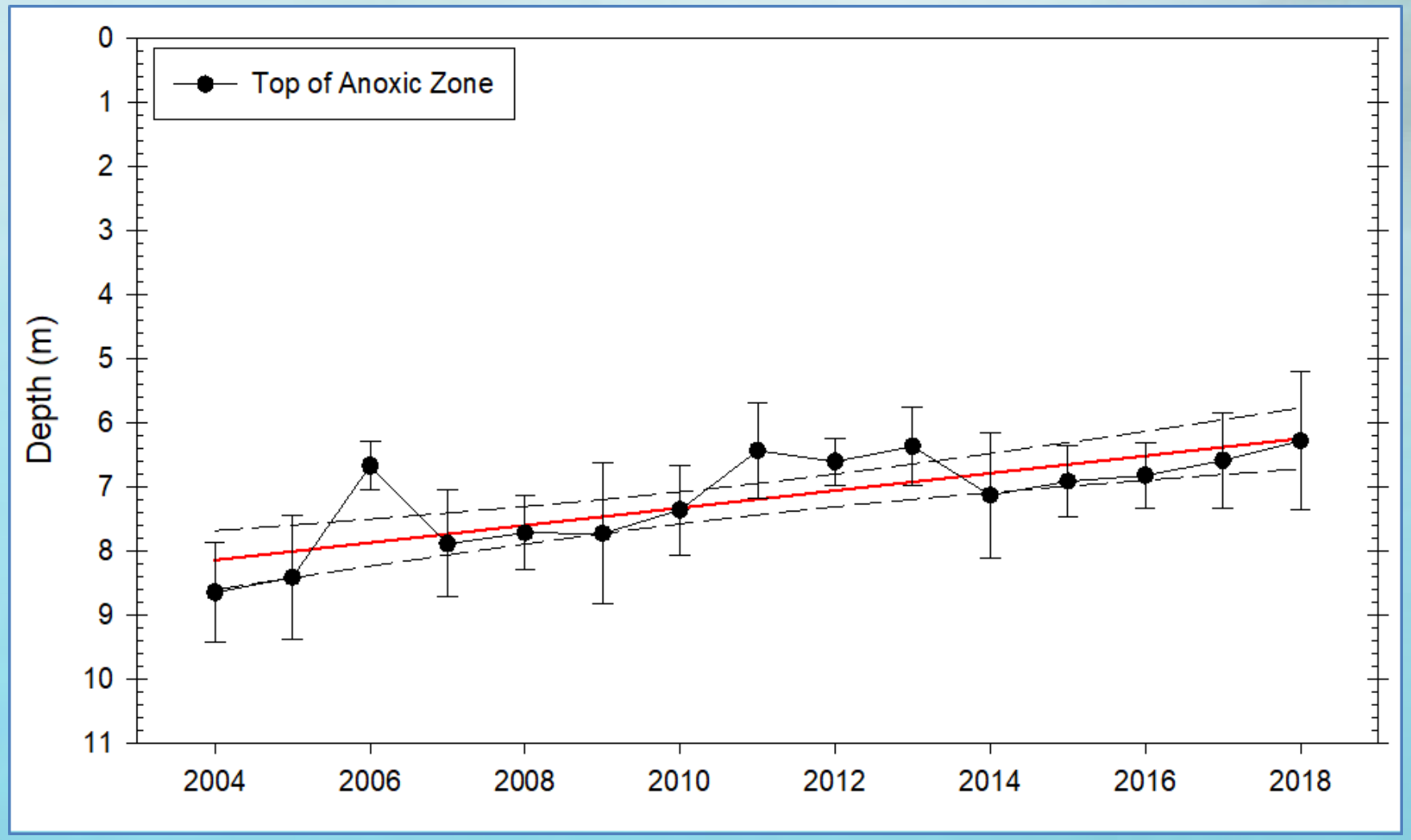
Lake Oscaleta Anoxia Trend



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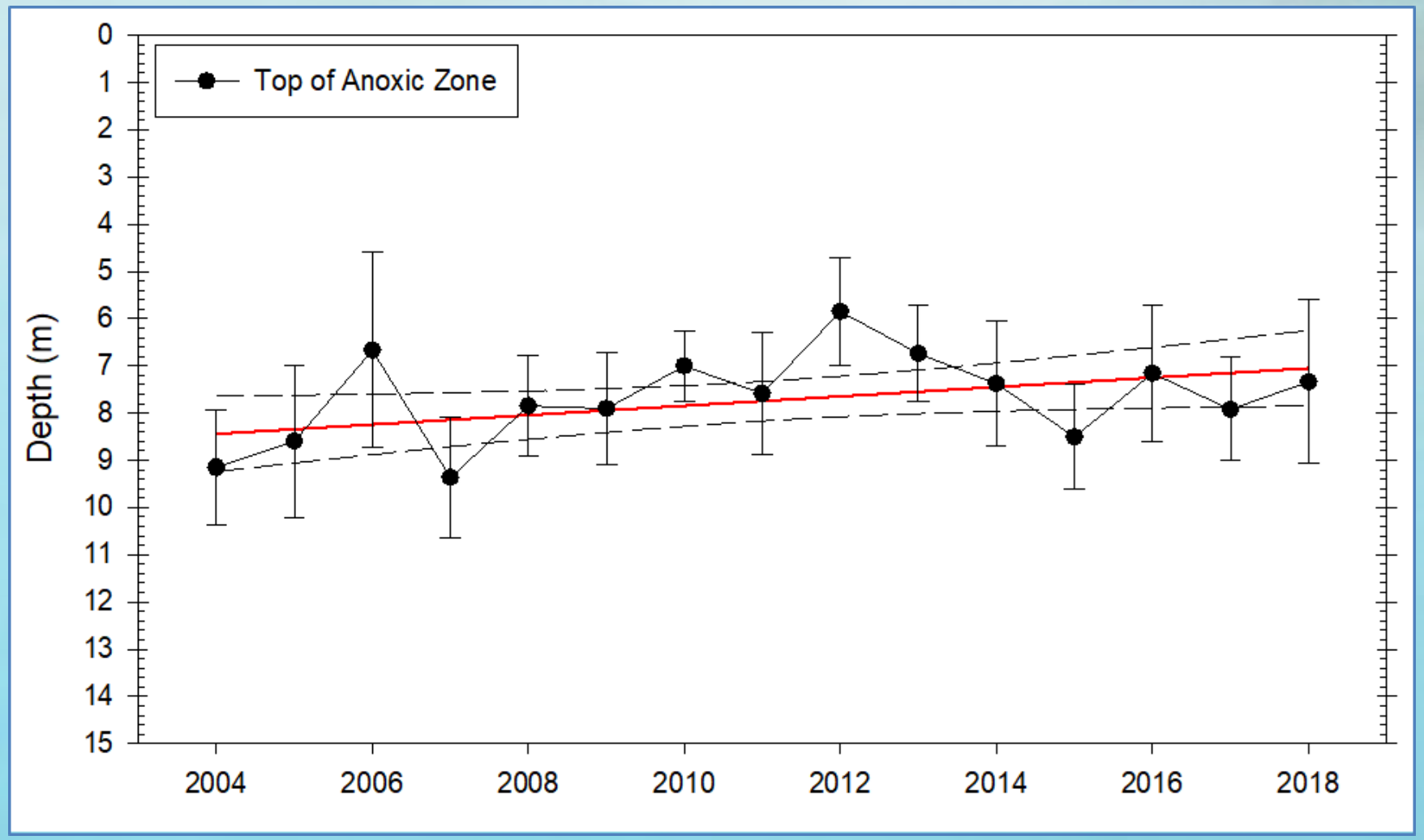
Lake Waccabuc Anoxia Trend



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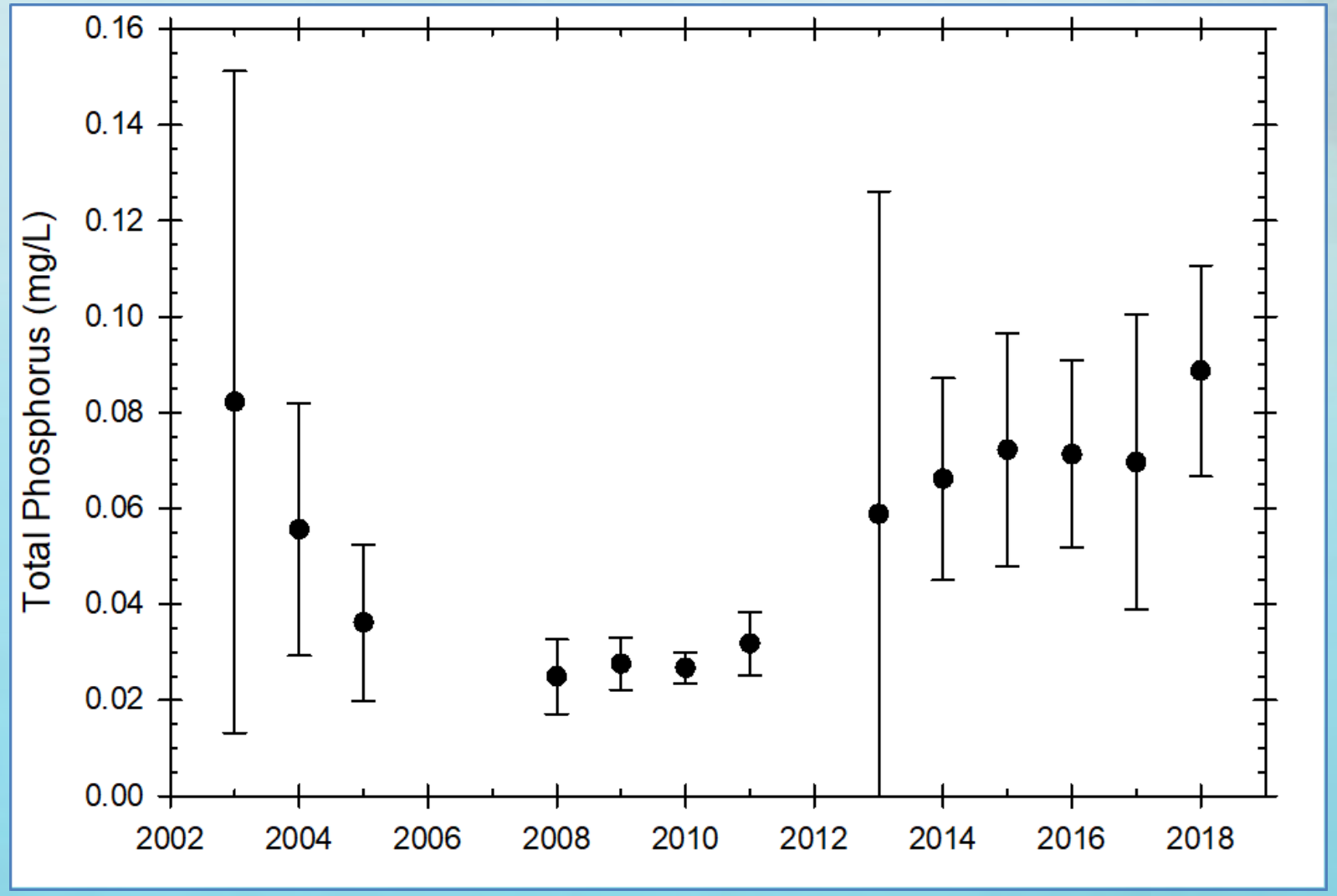
Lake Rippowam Hypolimnetic TP Trend



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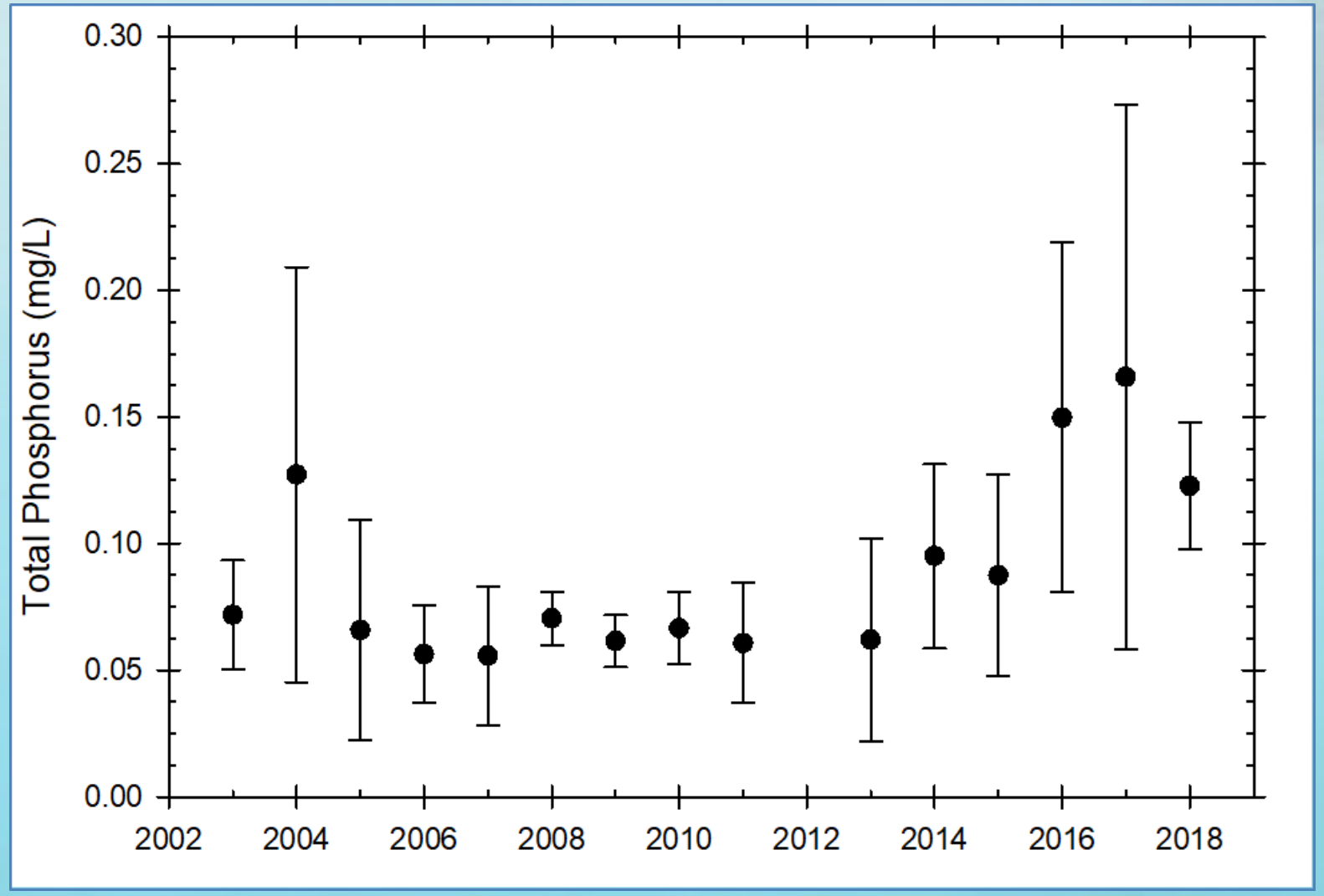
Lake Oscaleta Hypolimnetic TP Trend



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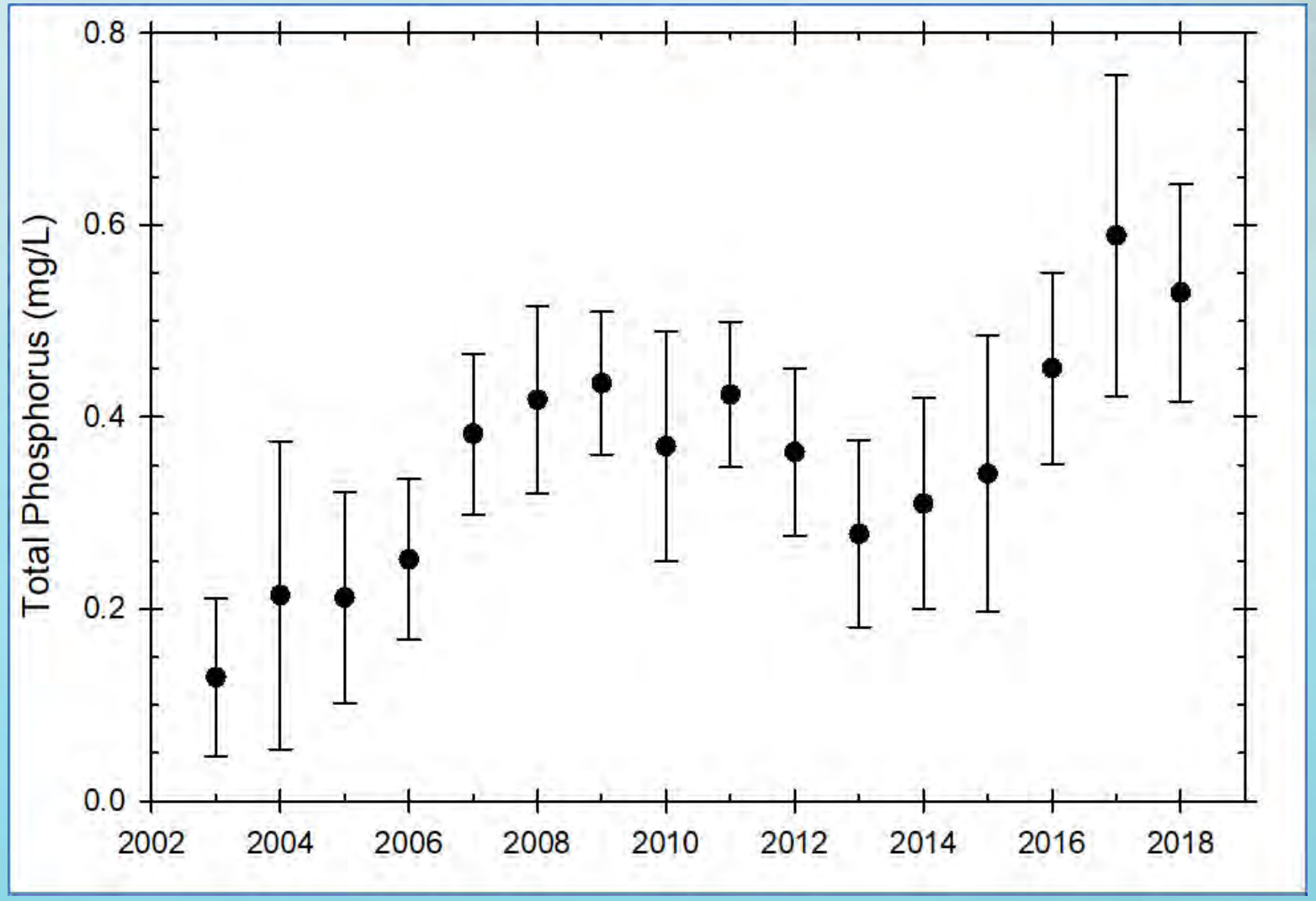
Lake Waccabuc Hypolimnetic TP Trend



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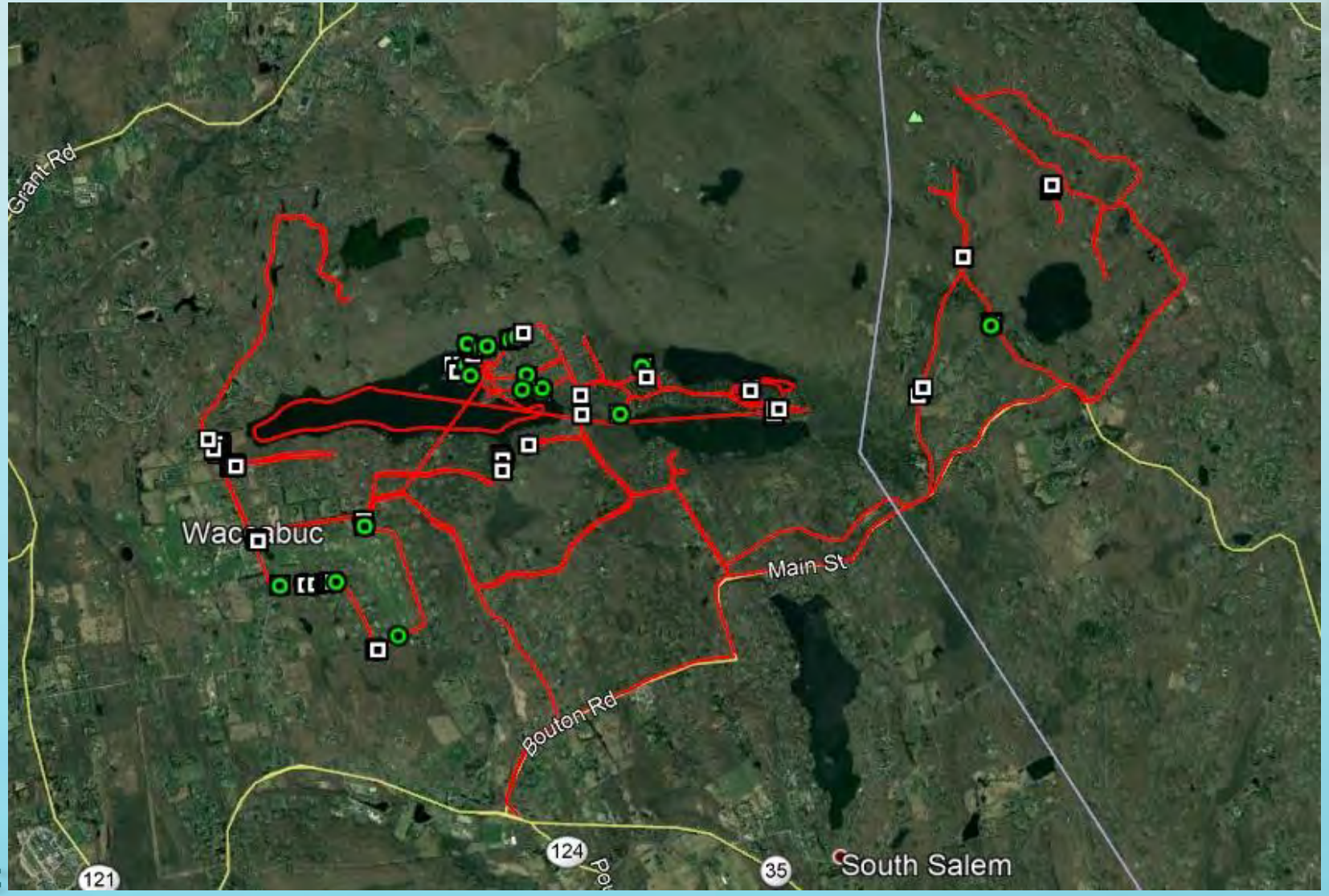
Watershed NPS Investigation

Watershed NPS Areas



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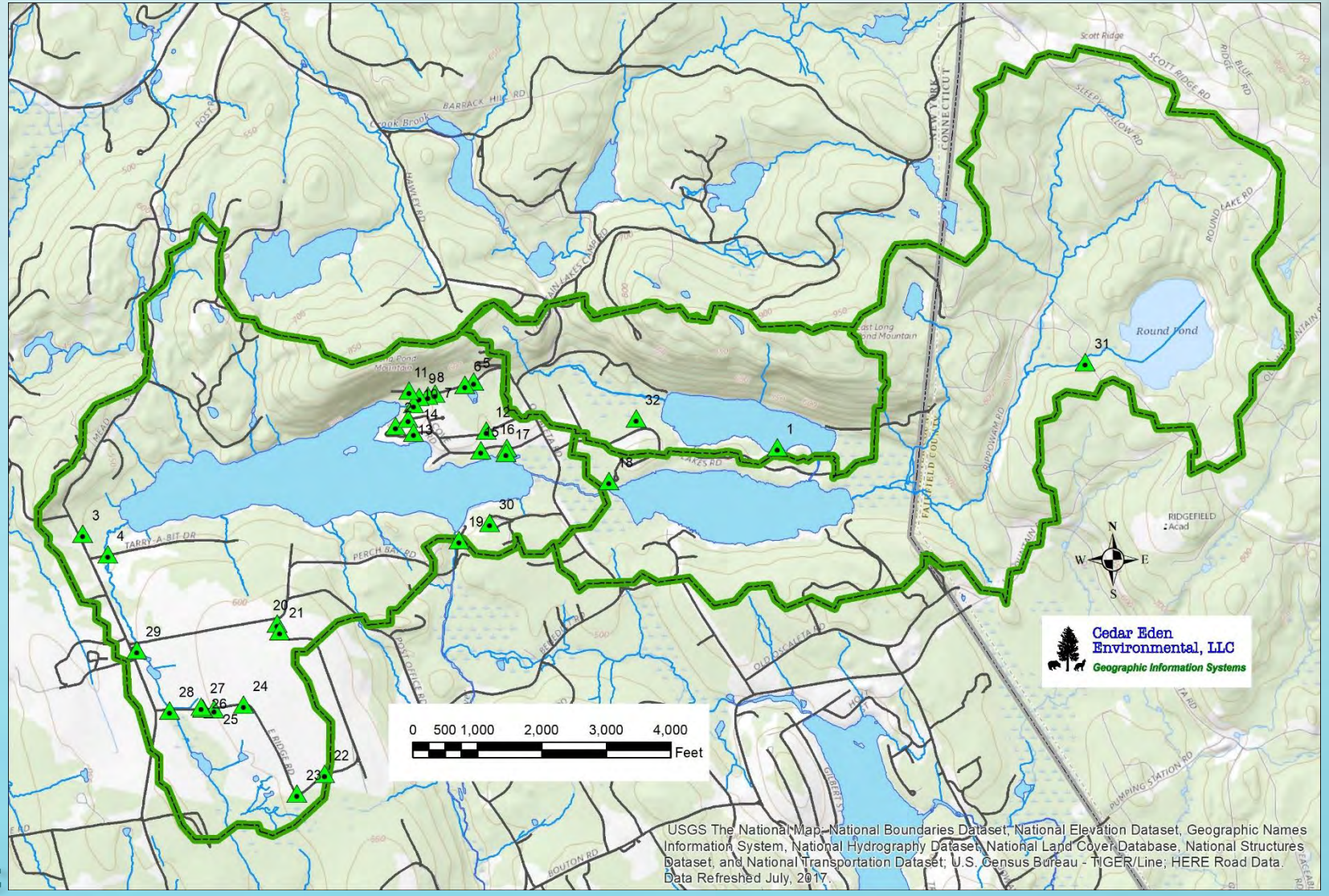
Watershed NPS Areas



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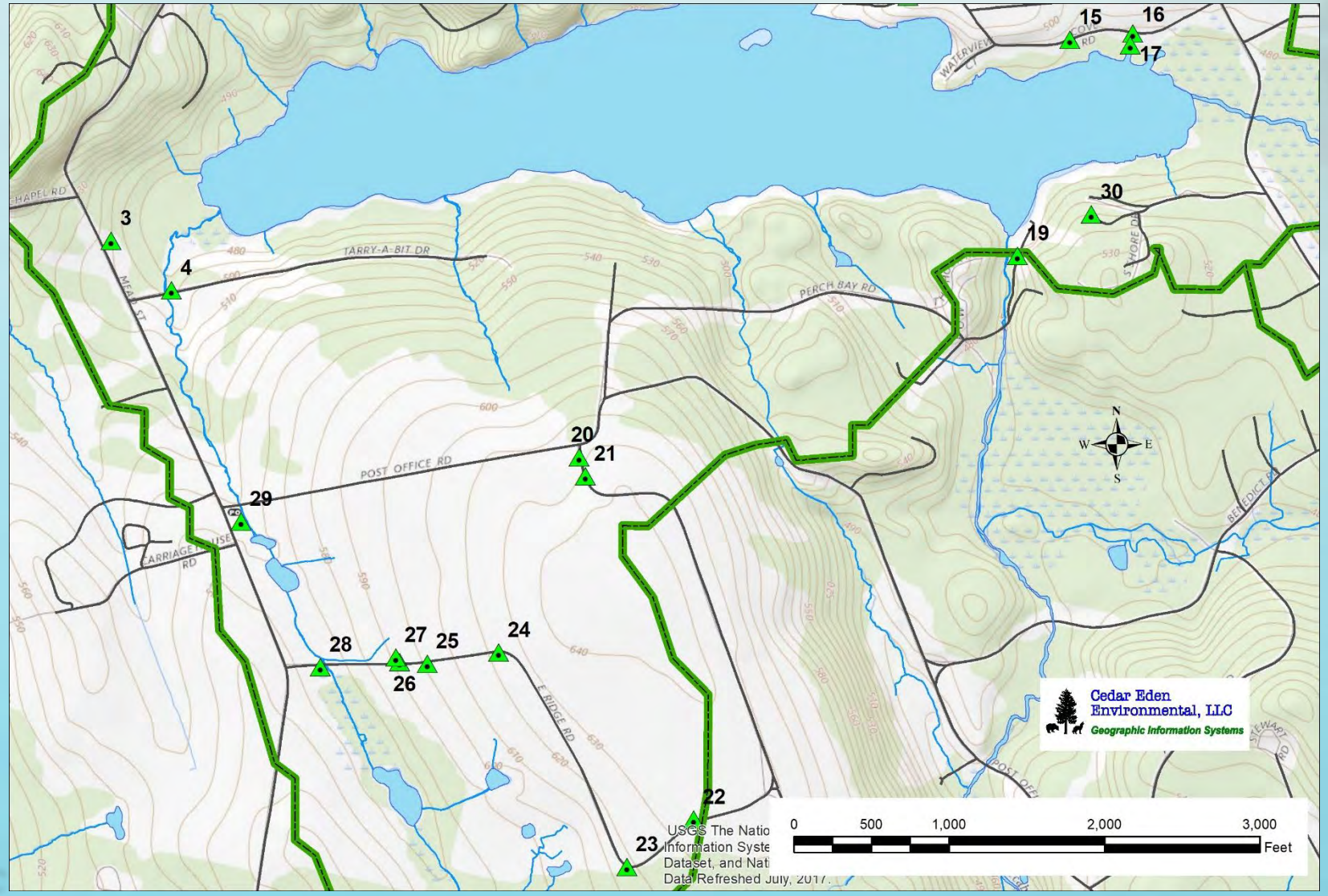
Watershed NPS Areas



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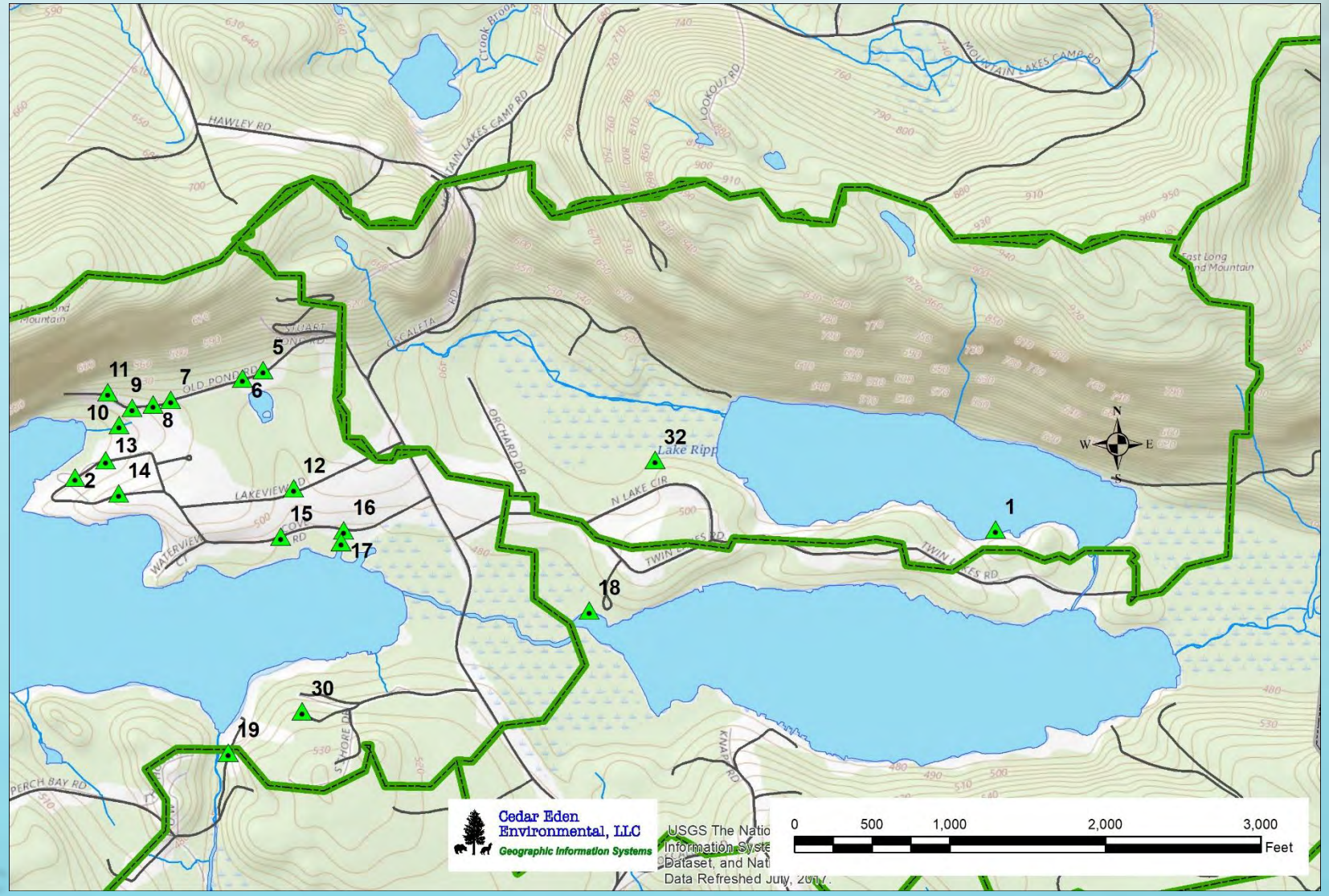
Watershed NPS Areas



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Eroding Gravel Roads

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Stormwater Runoff

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Stormwater Runoff

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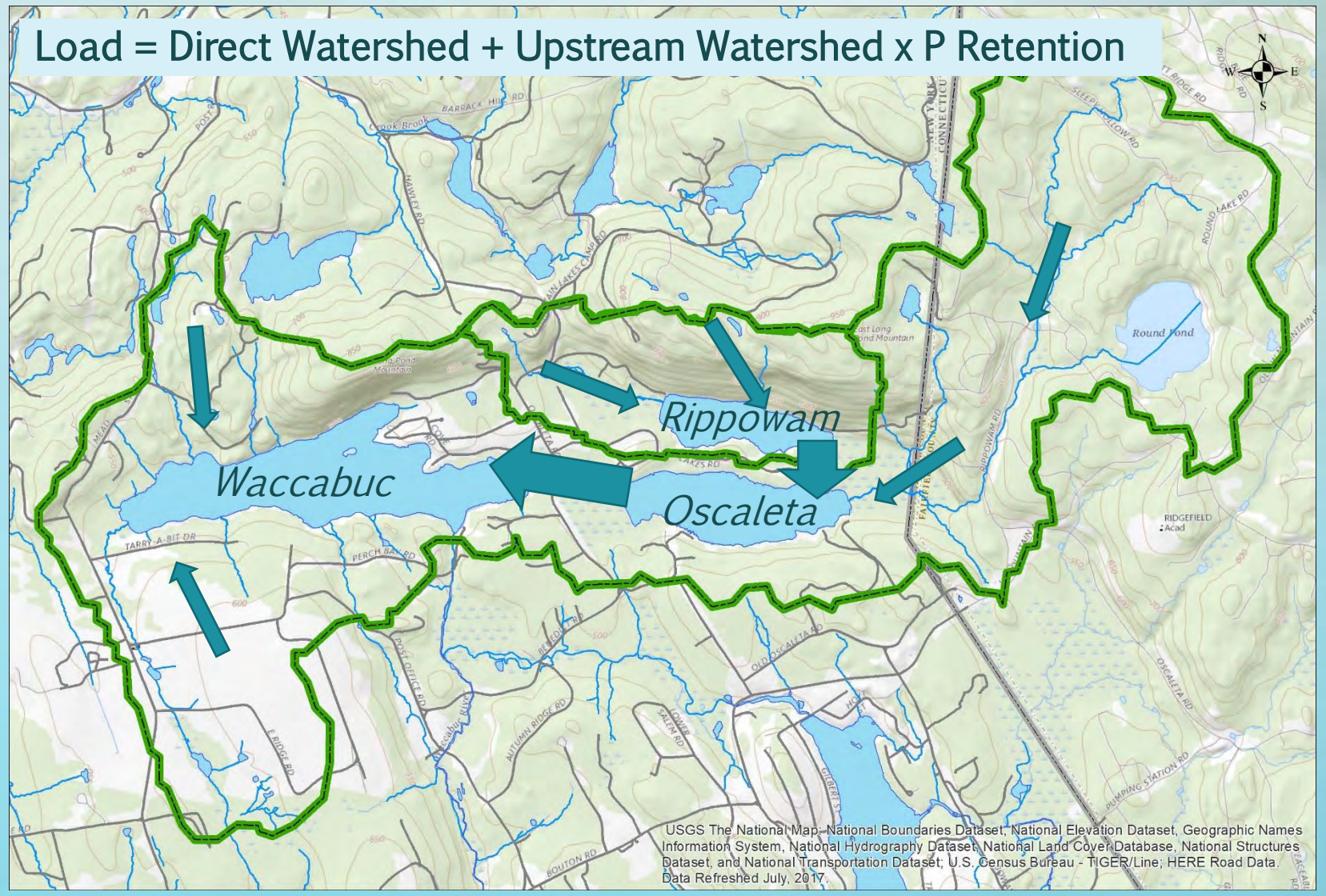
Pollutant Budgets

Pollutant Budgets for Lake Chains

- Rippowam 279 acres
- Oscaleta 1,282 acres
- Waccabuc 2,196 acres



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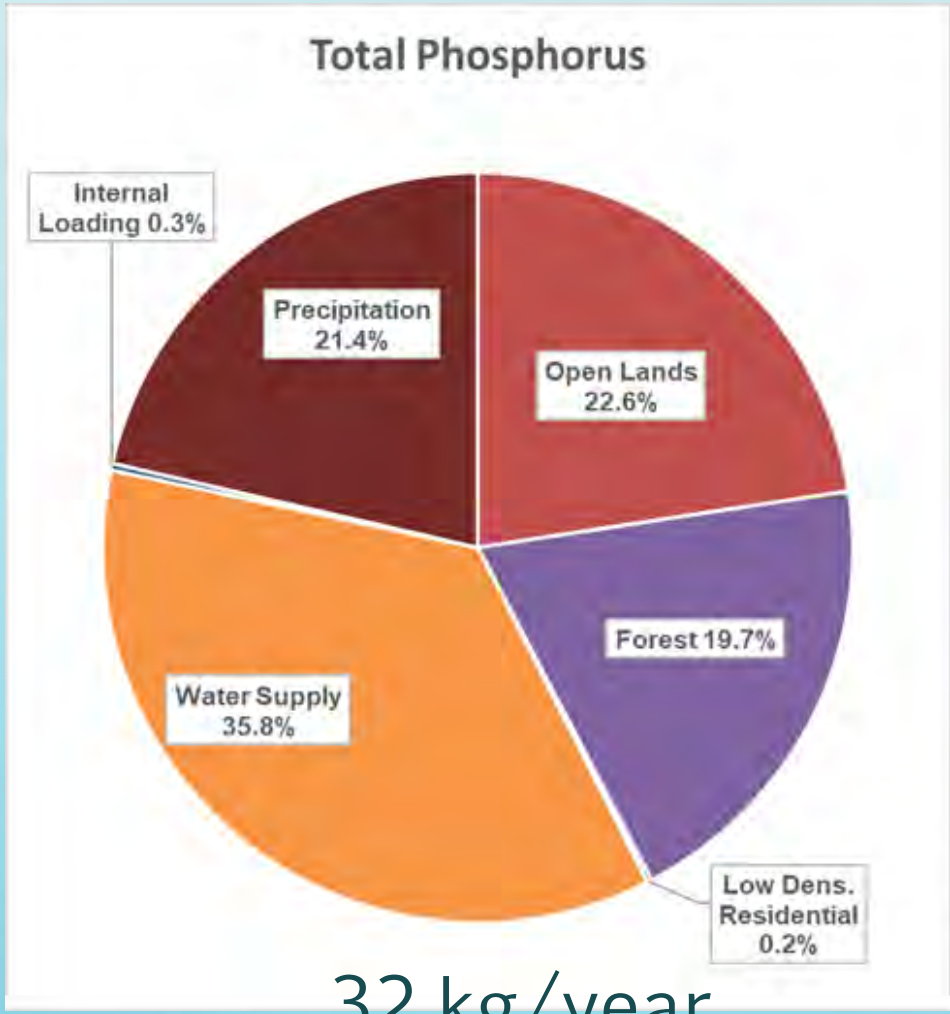
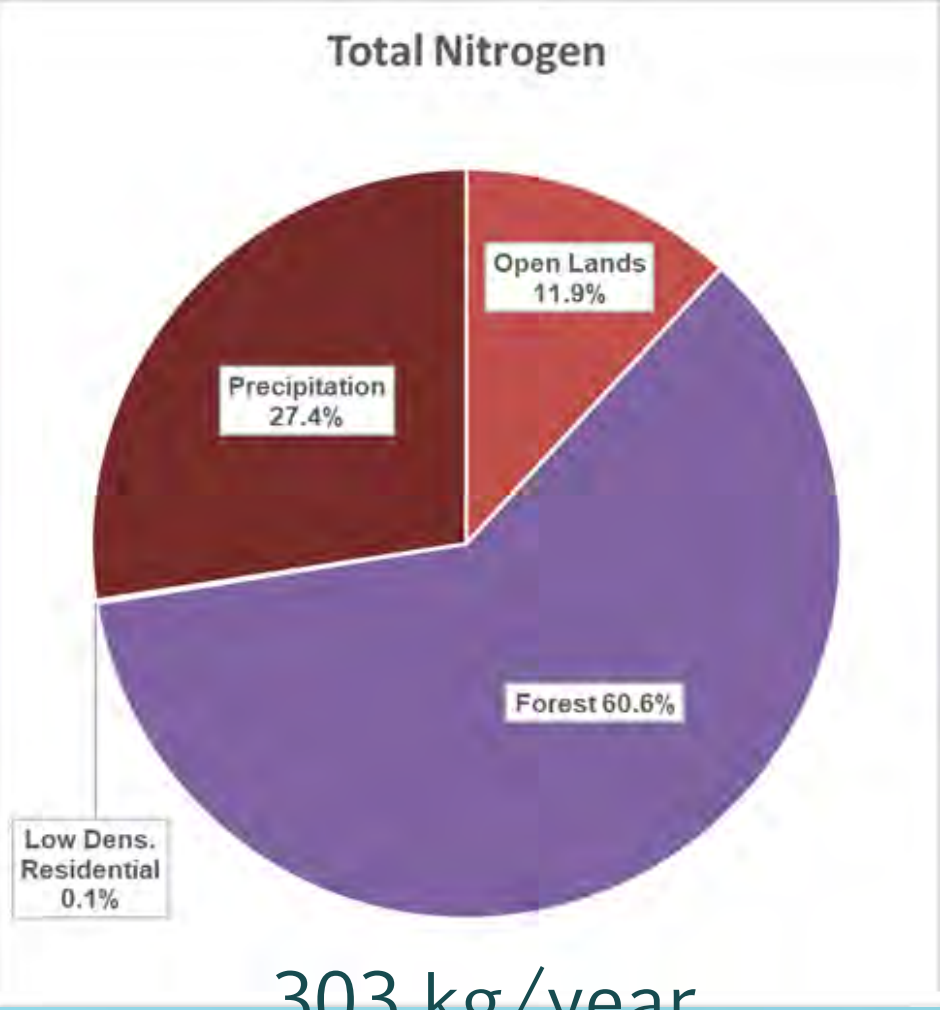
Lake Rippowam Annual Pollutant Budgets



32 kg/year



303 kg/year

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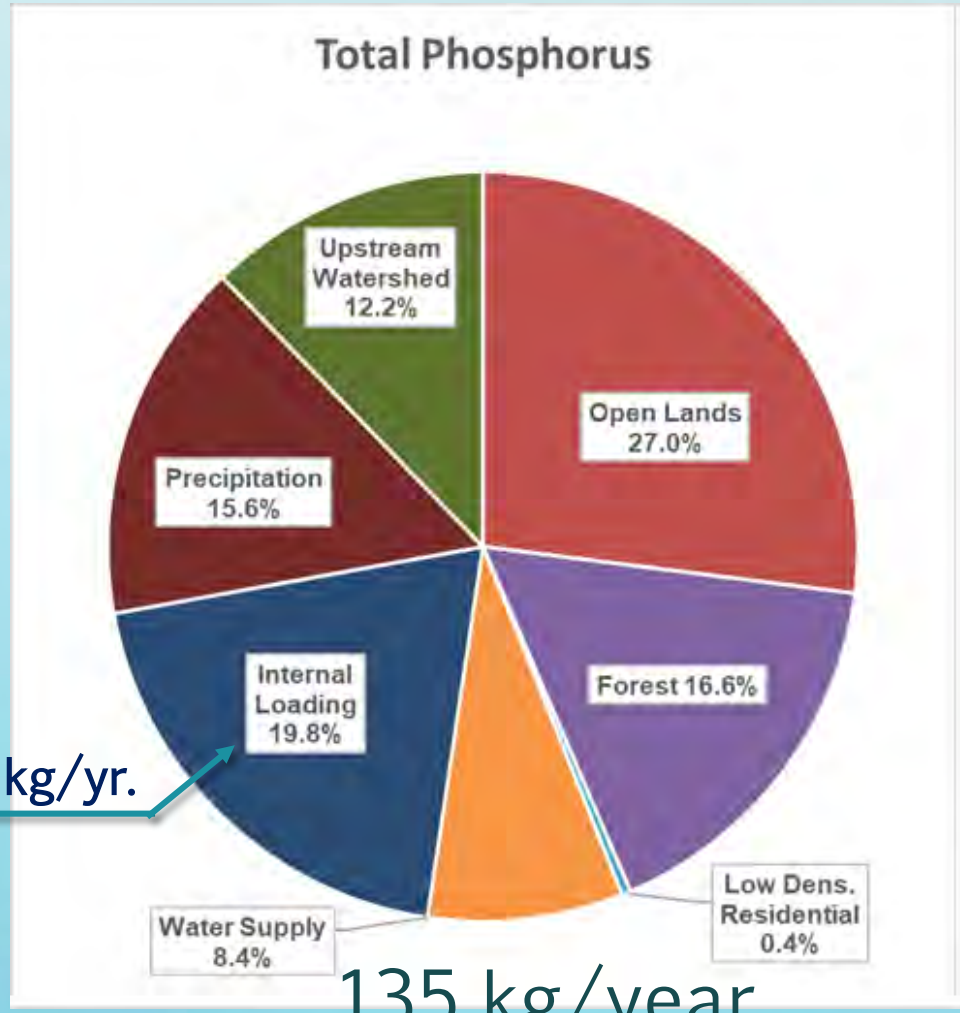
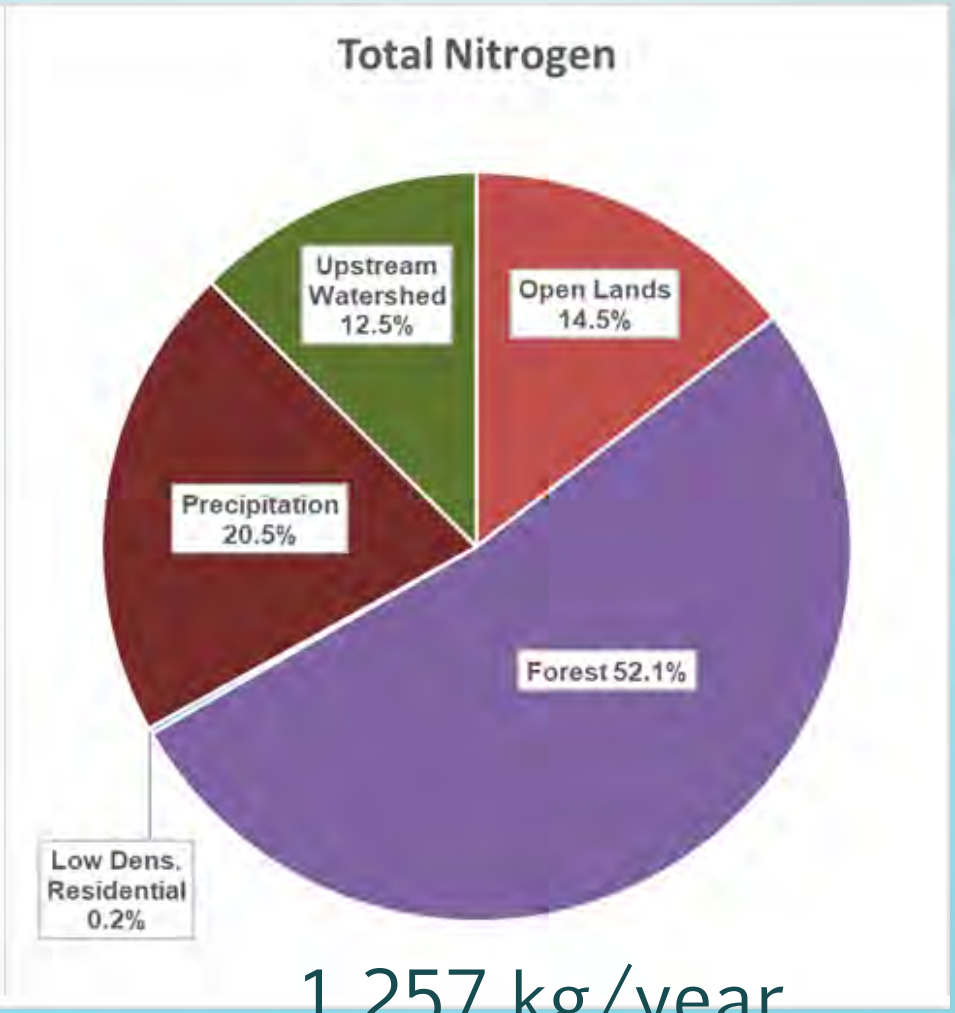
Lake Oscaleta Annual Pollutant Budgets



27 kg/yr.

135 kg/year



1,257 kg/year

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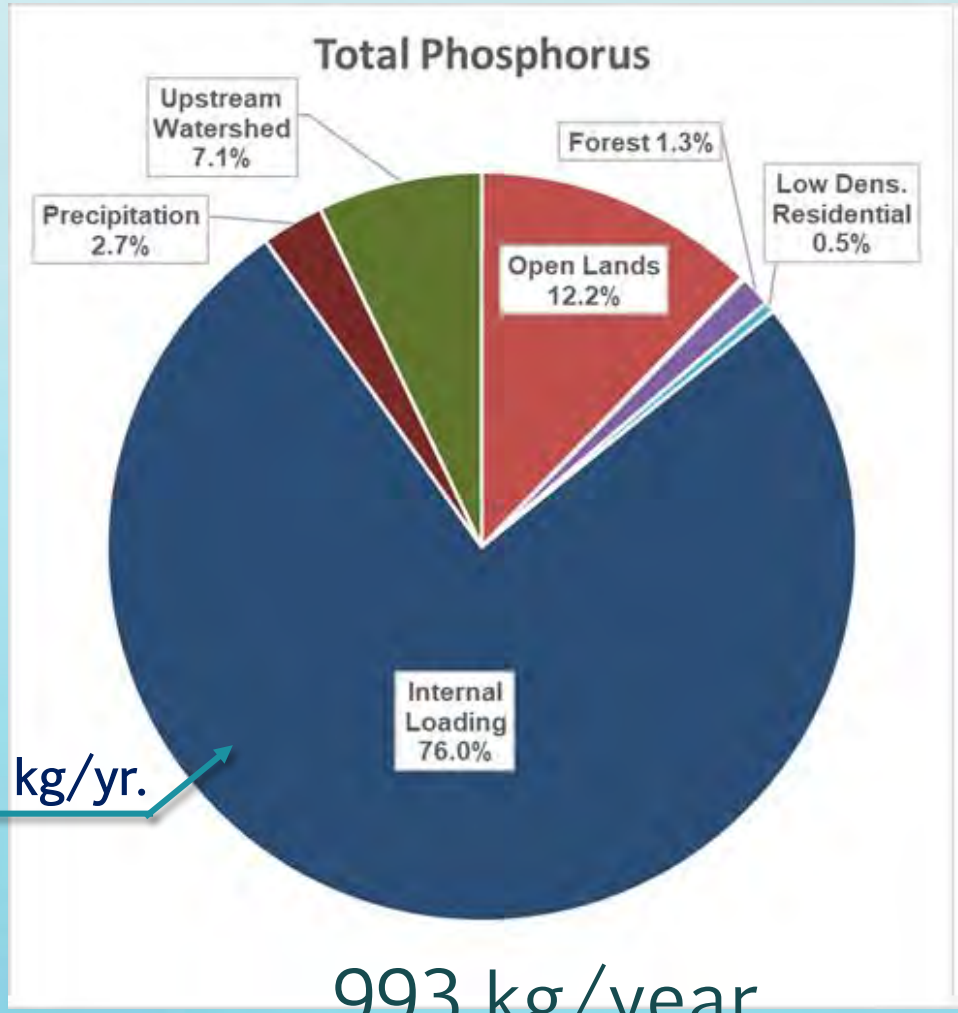
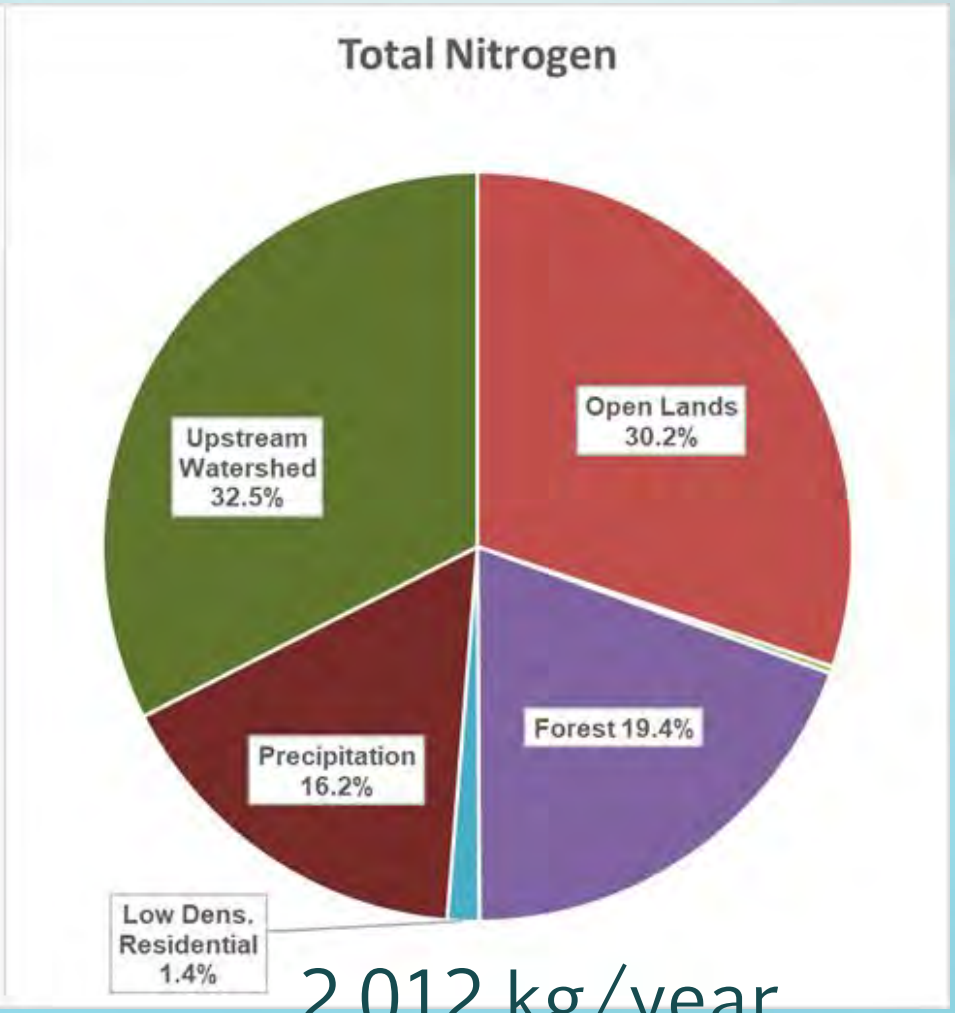
Lake Waccabuc Annual Pollutant Budgets



847 kg/yr.

993 kg/year



2,012 kg/year

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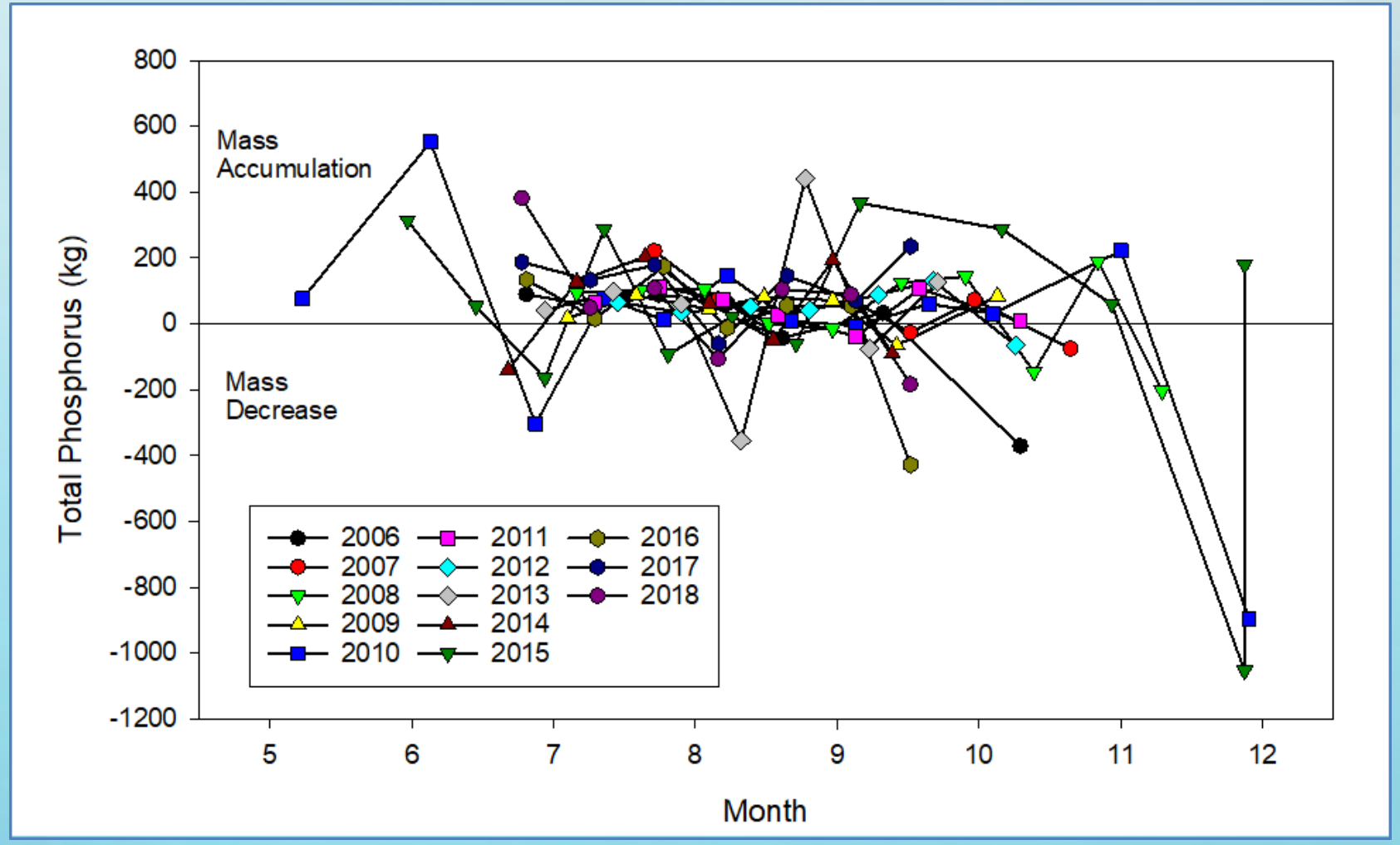
Lake Waccabuc Internal Loading



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Phosphorus Reduction to Reach 0.020 mg/L and Recommended Management Practices

- Lake Rippowam: 12.6 kg/year (39 percent)
  - Switching to alternate water supply anti-corrosion measure (36%)
  - Modest changes in SW management of impervious surface runoff
- Lake Oscaleta: 34.5 kg/year (26 percent)
  - Switching to alternate water supply anti-corrosion measure (27%)
  - Modest changes in SW management of impervious surface runoff
  - Minimizing internal phosphorus load (Aeration, Alum or PhosLock®) (20%)
- Lake Waccabuc: 874 kg/year (88 percent)
  - Minimizing internal phosphorus load (Aeration, Alum or PhosLock®) (76%)
  - Moderately aggressive stormwater management
    - Dirt & gravel roads, Impervious surfaces, Untreated runoff from paved roads

Cedar Eden Environmental, LLC

Thank you . . .

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