

Using 106 and 319 Programs for Lake Restoration on the Fond du Lac Reservation

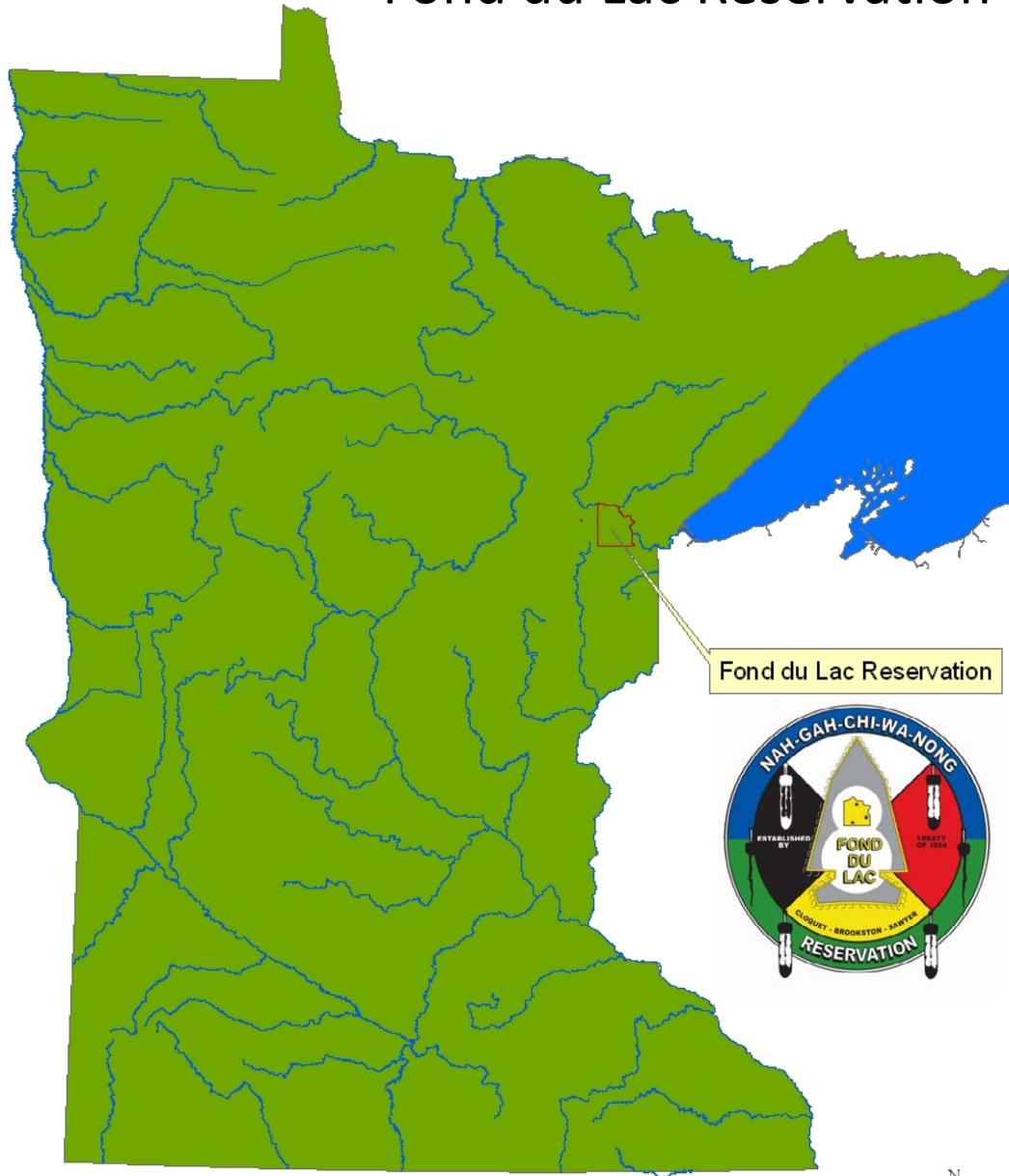


Kari Jacobson Hedin

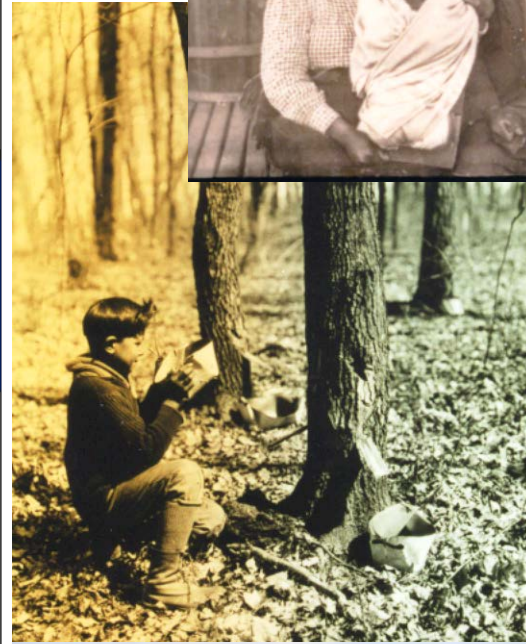
Fond du Lac Environmental Program

Office of Water Protection

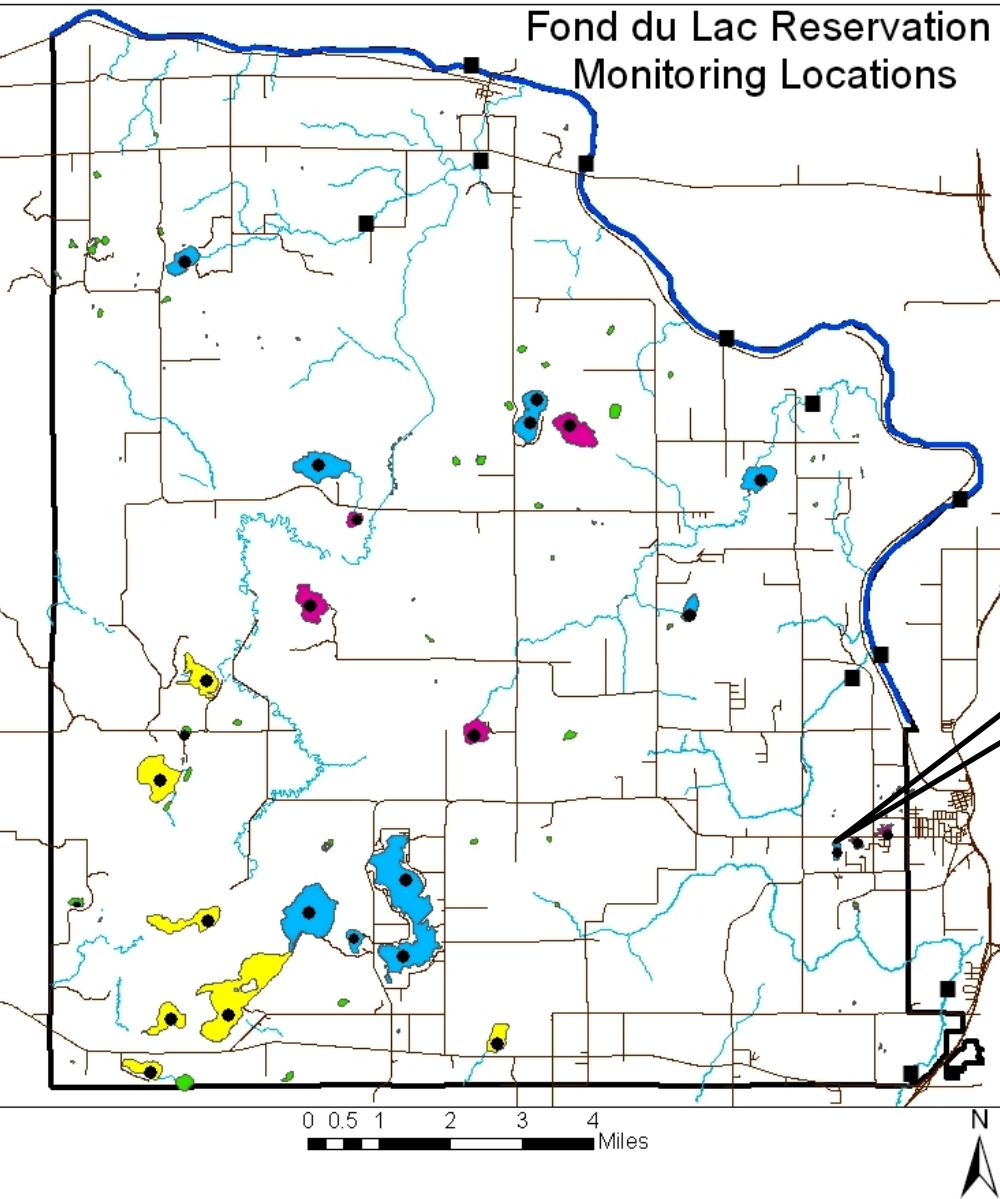
Fond du Lac Reservation



Fond du Lac Reservation



Fond du Lac Reservation Monitoring Locations













Fond du Lac's Water Resources:

- 23 lakes
- 6 streams
- St. Louis River
- 47% of land base is wetland

Third Lake

Legend

Lake Type

- | | | | |
|---|---------------------------|---|-------------------------|
|  | Other Lakes |  | Streams |
|  | Primary Fisheries Lakes |  | St. Louis River |
|  | Secondary Fisheries Lakes |  | Lake monitoring point |
|  | Wild Rice Lakes |  | Stream monitoring point |
|  | Roads | | |
|  | Fond du Lac Boundary | | |

Microsoft Access - ChemistryData - Microsoft Access

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Records: New Save Delete More

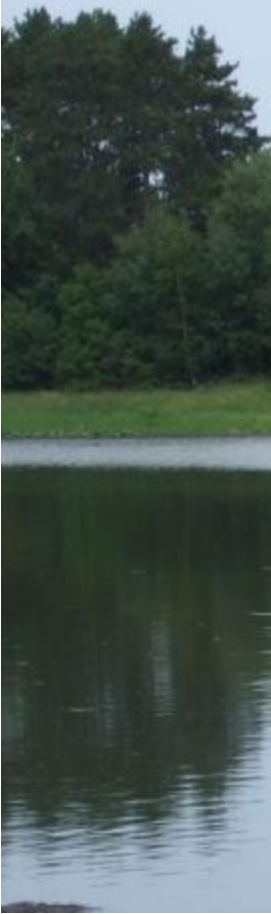
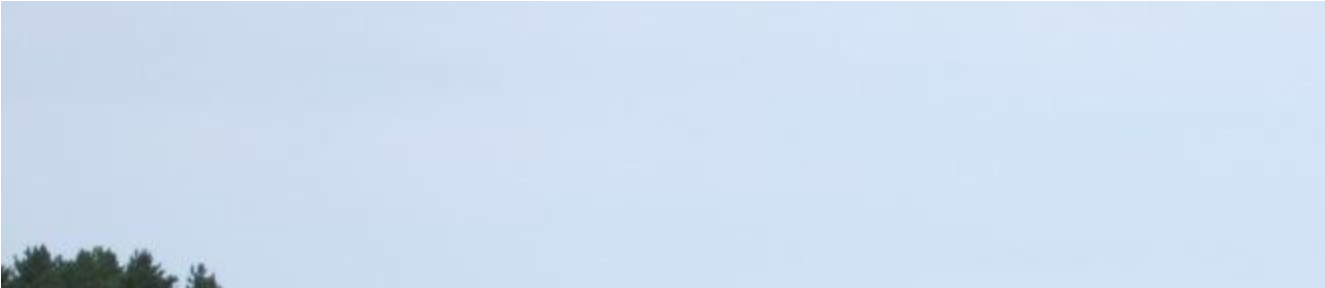
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Window: Size to Fit Form Switch Windows

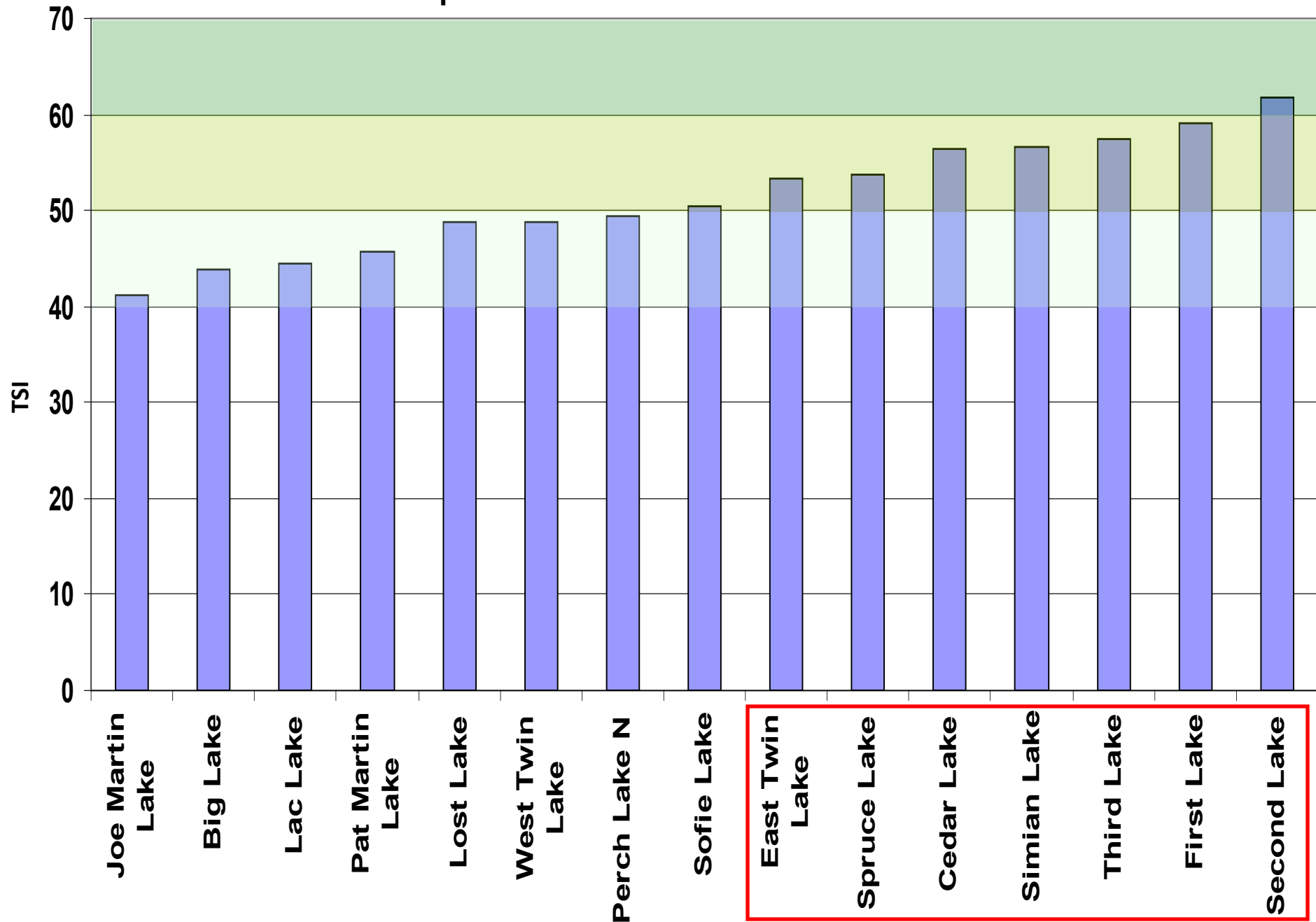
Find: Find Go To Select

StationName	SampleDate	Parameter	Matrix	Result	Units	Qualifier	AnalysisDate	Lab	Method
Third Lake	8/12/2004	Nitrogen, Total Kjeld	Surface water	0.7	mg/L		8/25/2004	Era	EPA 351..
Third Lake	8/12/2004	Phosphorus, Ortho	Surface water	0.001	mg/L	ND	8/13/2004	Era	EPA 365..
Third Lake	8/12/2004	Phosphorus, Total	Surface water	0.026	mg/L		8/23/2004	Era	EPA 365..
Third Lake	8/12/2004	Selenium, Total	Surface water	5	µg/L	ND	8/18/2004	Era	EPA 200..
Third Lake	8/12/2004	Solids, Total Suspen	Surface water	3	mg/L	J	8/19/2004	Era	USGS I-37
Third Lake	8/12/2004	Sulfate	Surface water	2	mg/L	J	8/18/2004	Era	ASTM D5
Third Lake	8/12/2004	Total Hardness	Surface Water	26.2	mg/L as CaCO3		8/12/2004	On-site	SM 2340
Third Lake	8/12/2004	True Color	Surface Water	8	Pt-Co		8/12/2004	On-site	Hach 802
Third Lake	8/12/2004	Zinc, Total	Surface water	5	µg/L	ND	8/18/2004	Era	EPA 200..
Third Lake	10/7/2004	Alkalinity	Surface Water	22.4	mg/L as CaCO3		10/7/2004	On-site	SM 2320
Third Lake	10/7/2004	Apparent Color	Surface Water	91	Pt-Co		10/7/2004	On-site	Hach 802
Third Lake	10/7/2004	Chlorophyll a	Surface Water	16.8	ug/L			NRRI	SM 1020
Third Lake	10/7/2004	Dissolved organic Ca	Surface Water	10.79	mg/L			NRRI	APHA 51:
Third Lake	10/7/2004	Nitrogen, Ammonia	Surface water	0.02	mg/L	ND	10/26/2004	Era	SM 18TH
Third Lake	10/7/2004	Nitrogen, Nitrate + N	Surface water	0.01	mg/L	ND	10/26/2004	Era	EPA 353..
Third Lake	10/7/2004	Nitrogen, Total Kjeld	Surface water	0.7	mg/L		10/20/2004	Era	EPA 351..
Third Lake	10/7/2004	Phosphorus, Ortho	Surface water	0.001	mg/L	ND	10/8/2004	Era	EPA 365..
Third Lake	10/7/2004	Phosphorus, Total	Surface water	0.035	mg/L		10/18/2004	Era	EPA 365..
Third Lake	10/7/2004	Solids, Total Suspen	Surface water	4	mg/L		10/12/2004	Era	USGS I-37
Third Lake	10/7/2004	Total Hardness	Surface Water	31.2	mg/L as CaCO3		10/7/2004	On-site	SM 2340
Third Lake	10/7/2004	True Color	Surface Water	27	Pt-Co		10/7/2004	On-site	Hach 802
Third Lake	5/4/2005	Alkalinity	Surface Water	24.4	mg/L as CaCO3		5/5/2005	On-site	SM 2320
Third Lake	5/4/2005	Apparent Color	Surface Water	81	Pt-Co		5/5/2005	On-site	Hach 802
THIRD LAKE	5/4/2005	Arsenic, Total	Surface water	3	µg/L	ND	5/5/2005	Era	EPA 200..
THIRD LAKE	5/4/2005	Cadmium, Total	Surface water	1	µg/L	ND	5/5/2005	Era	EPA 200..
THIRD LAKE	5/4/2005	Chloride	Surface water	9.8	mg/L		5/11/2005	Era	SM 18TH
Third Lake	5/4/2005	Chlorophyll a	Surface Water	5.45	ug/L			On-site	SM 1020
THIRD LAKE	5/4/2005	Chromium, Total	Surface water	2	µg/L	ND	5/5/2005	Era	EPA 200..
THIRD LAKE	5/4/2005	Copper, Total	Surface water	1	µg/L	ND	5/5/2005	Era	EPA 200..
THIRD LAKE	5/4/2005	Lead, Total	Surface water	5	µg/L	ND	5/5/2005	Era	EPA 200..
THIRD LAKE	5/4/2005	Nickel, Total	Surface water	2	µg/L	ND	5/5/2005	Era	EPA 200..
THIRD LAKE	5/4/2005	Nitrogen, Ammonia	Surface water	0.02	mg/L	ND	5/19/2005	Era	SM 18TH
THIRD LAKE	5/4/2005	Nitrogen, Nitrate + N	Surface water	0.01	mg/L	ND	5/20/2005	Era	EPA 353..
THIRD LAKE	5/4/2005	Nitrogen, Total Kjeld	Surface water	0.8	mg/L		5/18/2005	Era	EPA 351..
THIRD LAKE	5/4/2005	Phosphorus, Ortho	Surface water	0.001	mg/L	ND	5/5/2005	Era	EPA 365..
THIRD LAKE	5/4/2005	Phosphorus, Total	Surface water	0.028	mg/L		5/16/2005	Era	EPA 365..
THIRD LAKE	5/4/2005	Selenium, Total	Surface water	3	µg/L	ND	5/5/2005	Era	EPA 200..
THIRD LAKE	5/4/2005	Solids, Total Suspen	Surface water	3	mg/L	J	5/9/2005	Era	USGS I-37
Third Lake	5/4/2005	Total Hardness	Surface Water	26.6	mg/L as CaCO3		5/5/2005	On-site	SM 2340

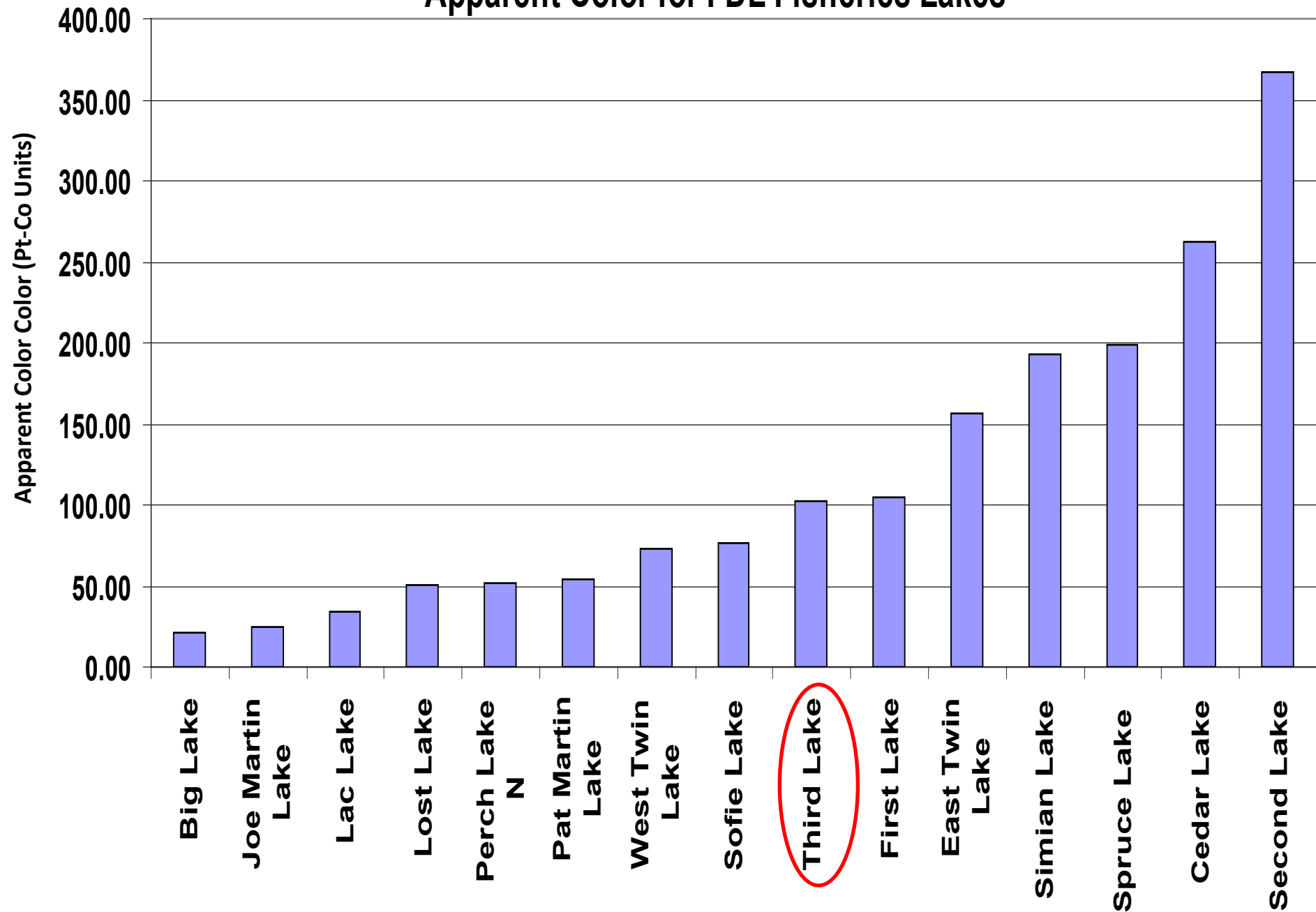




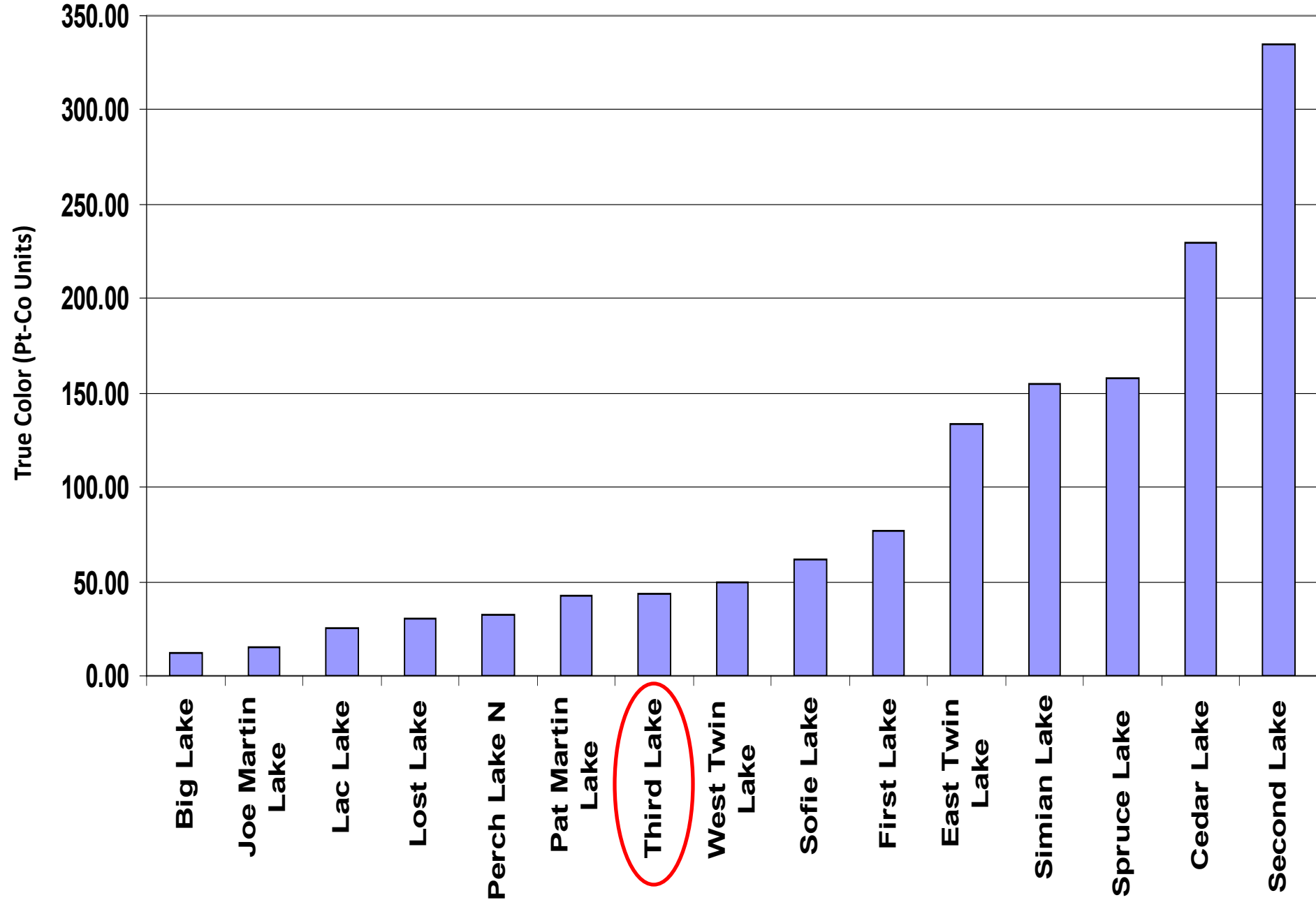
Trophic State Index for FDL Fisheries Lakes



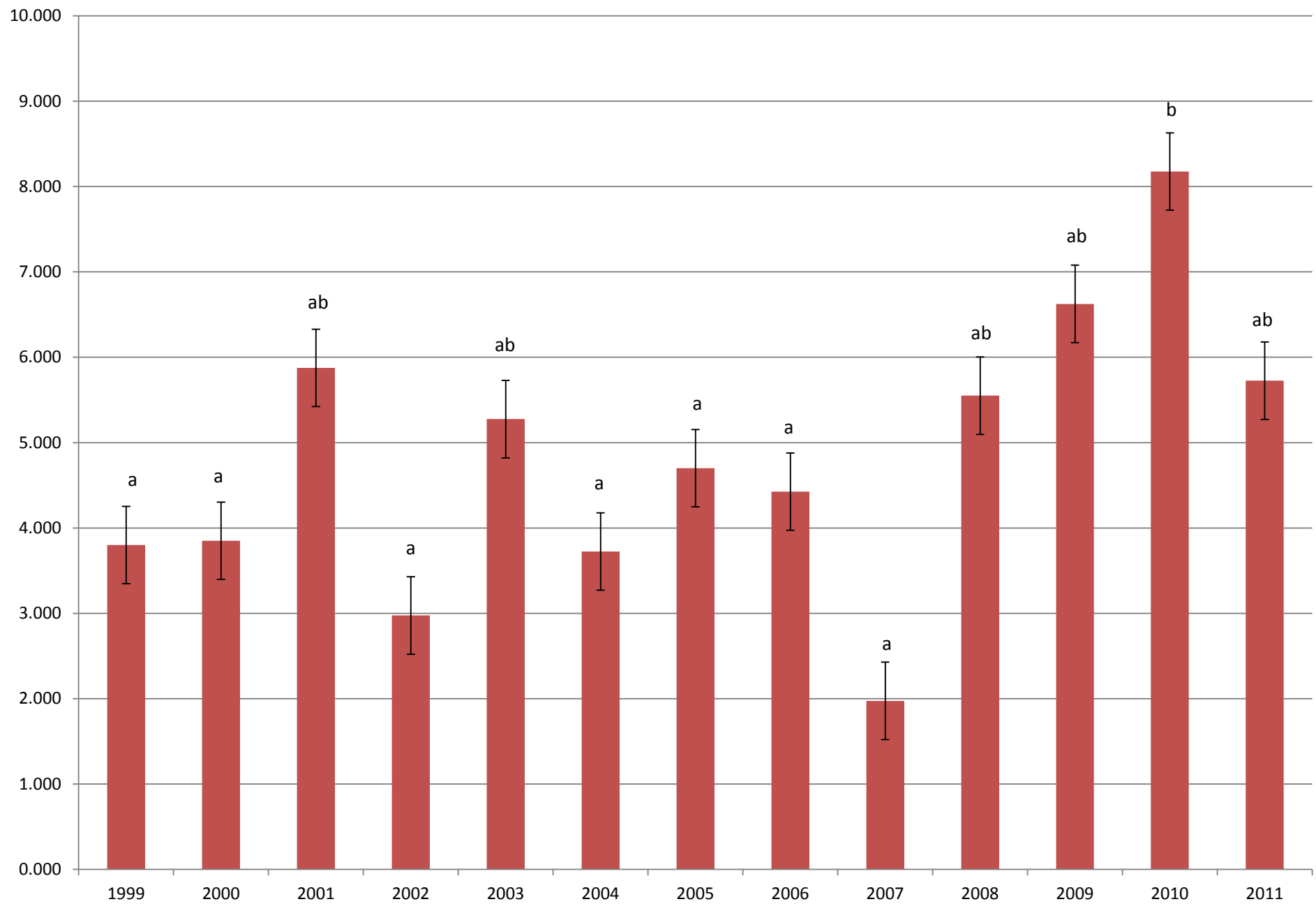
Apparent Color for FDL Fisheries Lakes



True Color for FDL Fisheries Lakes



Average Secchi Depth (ft)

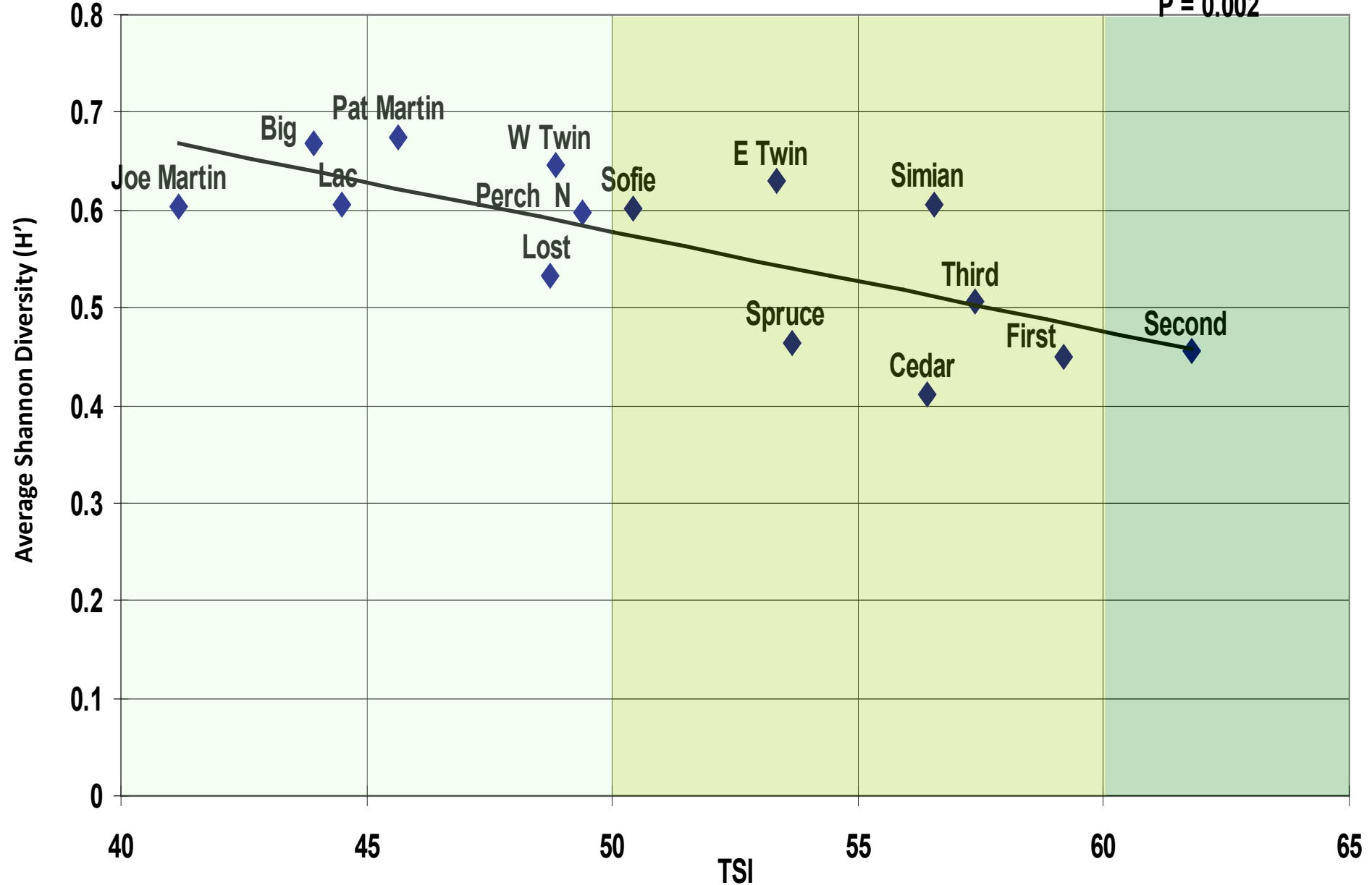


Zooplankton Species Diversity vs Trophic State Index for FDL Fisheries Lakes

$$y = -0.0102x + 1.0867$$

$$R^2 = 0.5212$$

$$P = 0.002$$

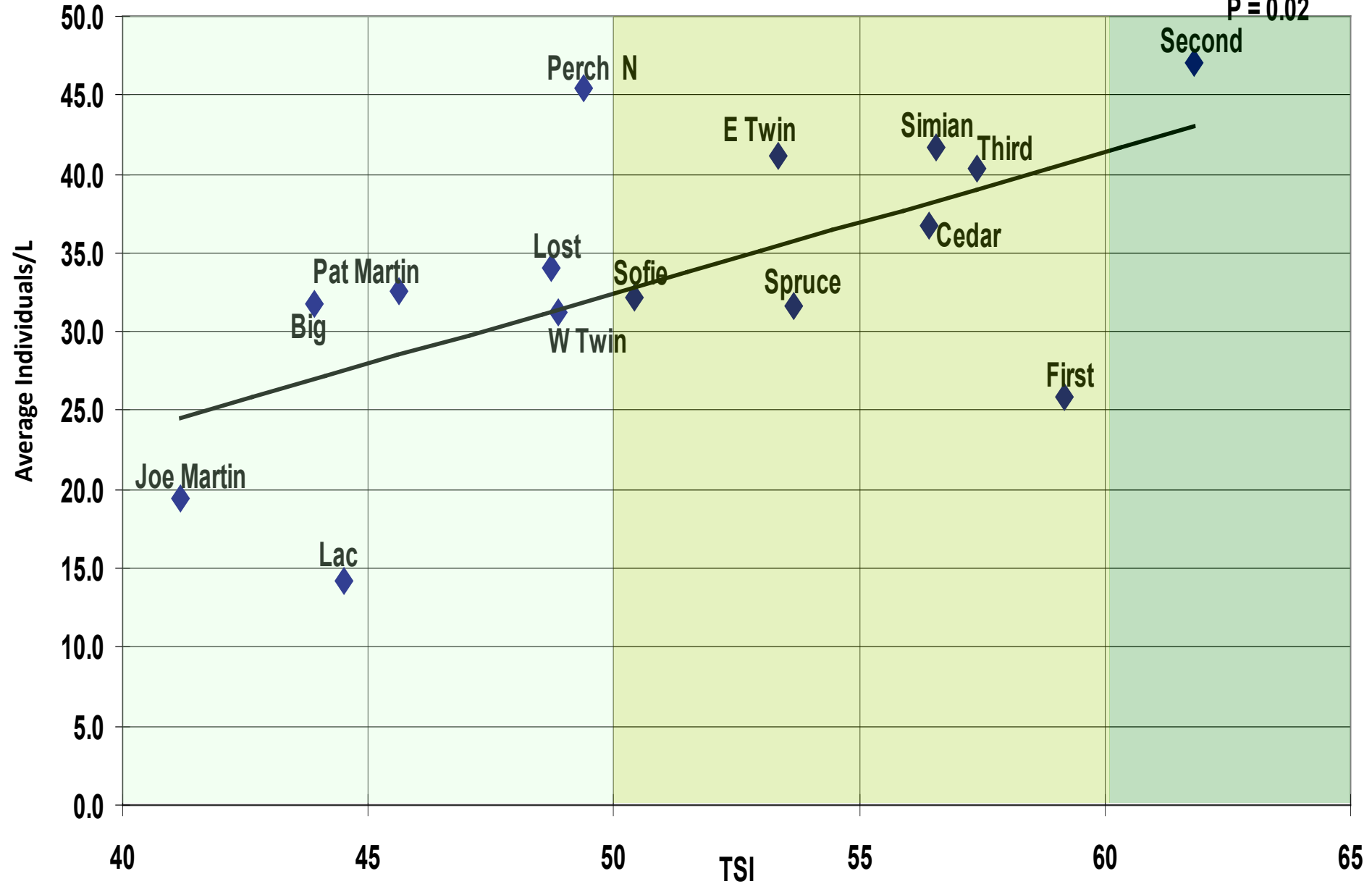


Zooplankton Abundance vs Trophic State Index in FDL Fisheries Lakes

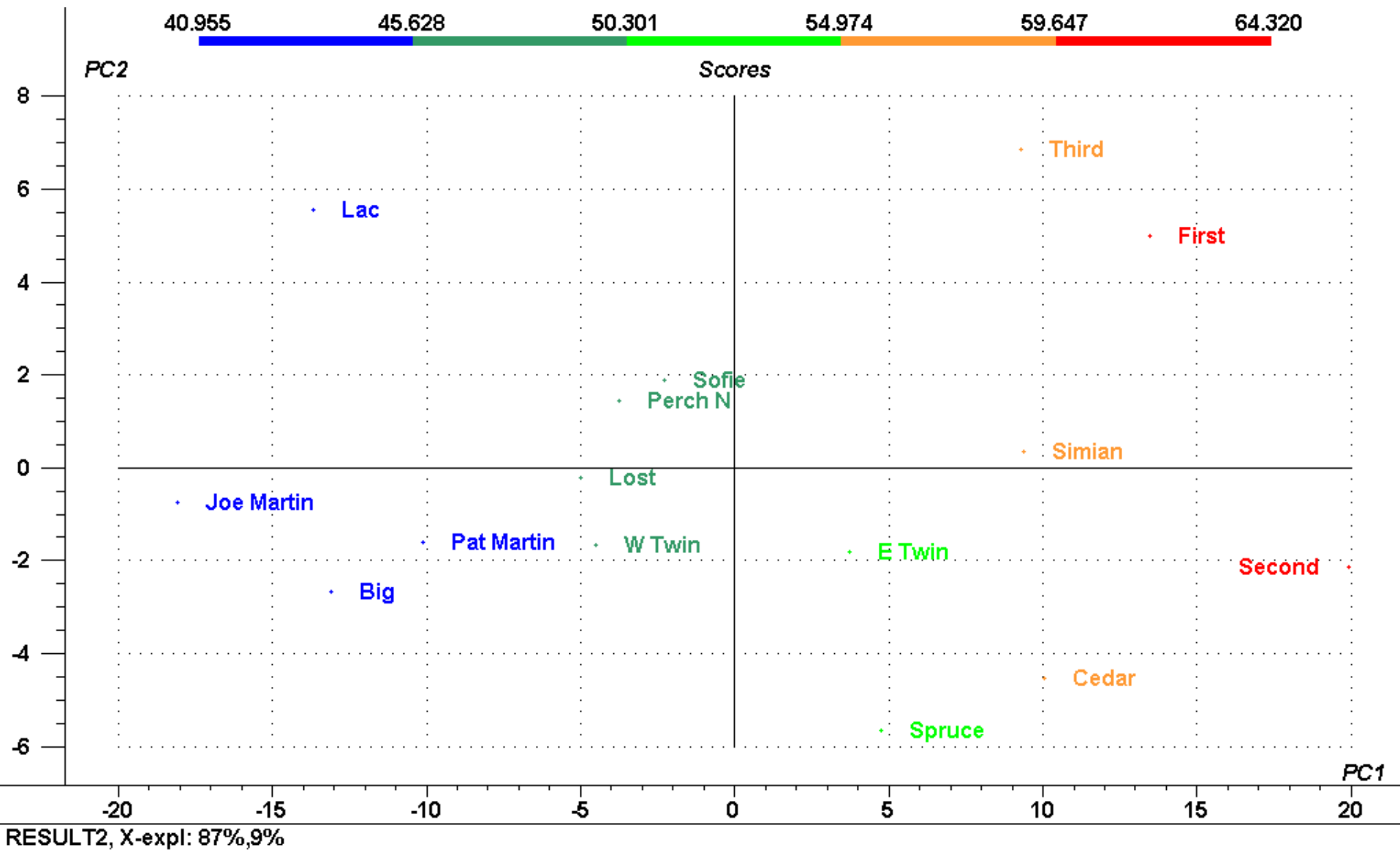
$$y = 0.8944x - 12.282$$

$$R^2 = 0.3655$$

$$P = 0.02$$



PCA of Lake Chemistry Data



2 PCs explain 86% of variance in the data

Total Phosphorus explains most of the difference between lakes

319 Competitive Grant

- Relies heavily on FDL's Tribal Non-Point Source Assessment and Management Report
- Made possible by 10 years of monitoring data on Third Lake
- Addresses both watershed and in-lake nutrient sources
- Education component
- Isolated basin

Project Goals

- Educate Band members and Third Lake homeowners and learn what they know about the lake
- Work with horse farm owner to reduce external nutrient inputs
- Apply alum to reduce internal nutrient recycling
- Targeted monitoring to note effects of nutrient reduction
- 90% reduction of phosphorus in the water column due to external and internal nutrient load reductions

First Year (2011)

- Public meeting
- Lake sediment coring
- Targeted monitoring
- Working with owner of horse farm
- Surveys



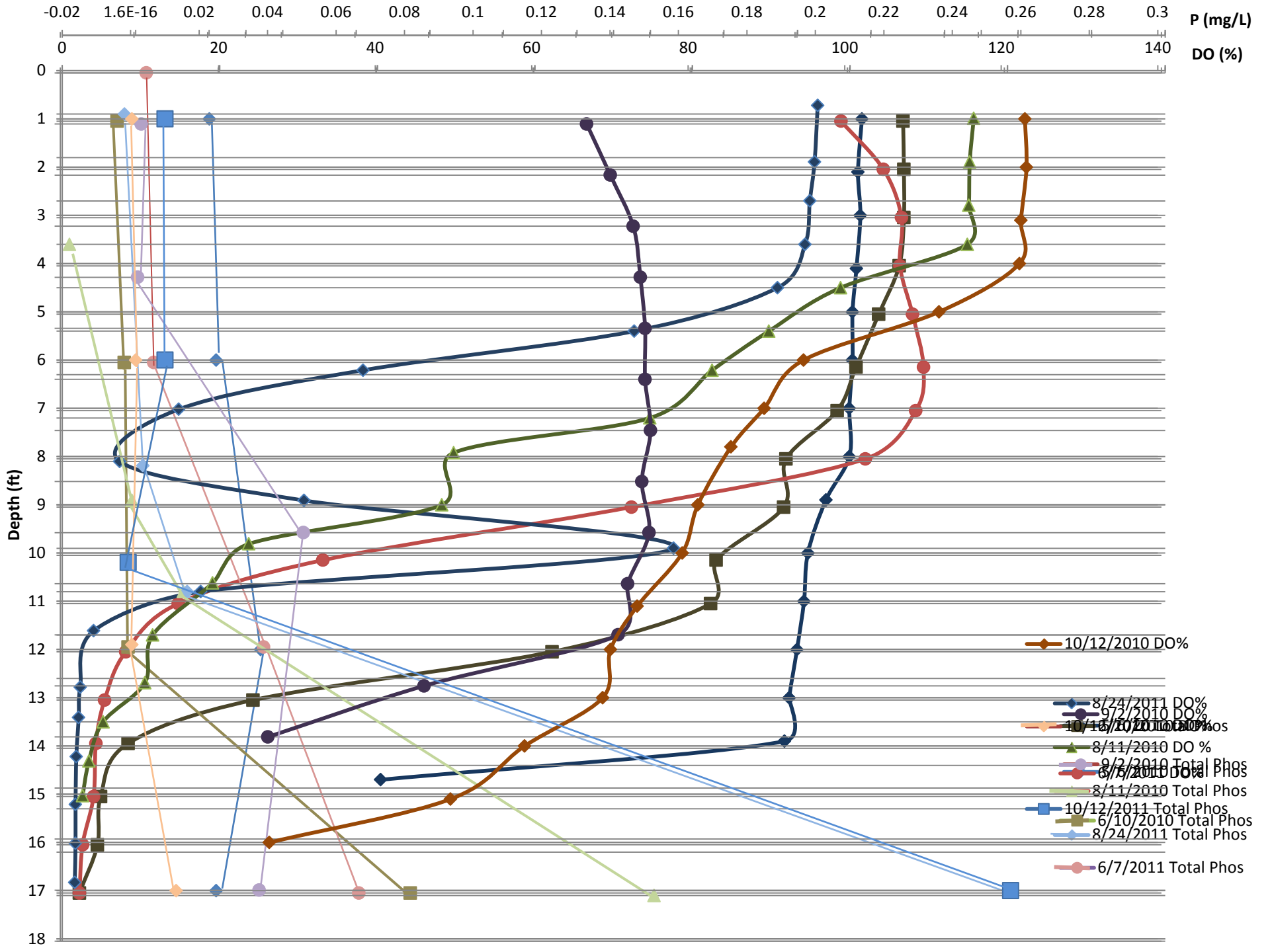
Lake Coring

Targeted Monitoring



- **Physical:** Secchi depth, general chemistry, color, alkalinity/hardness, nutrients, vertical profile of DO, temp, turbidity, and conductivity
- **Biological:** algae, zooplankton, aquatic vegetation, fish





Site Visit

Natural Resources
Conservation Service

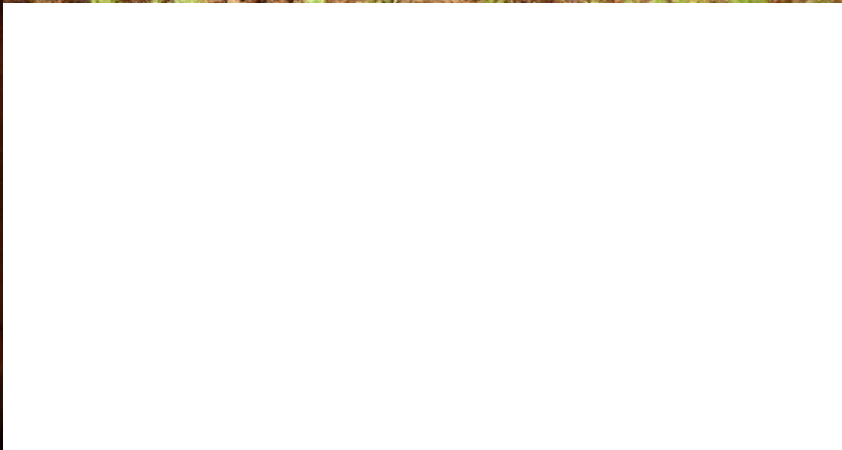
Fond du Lac Reservation

Horse Farmer









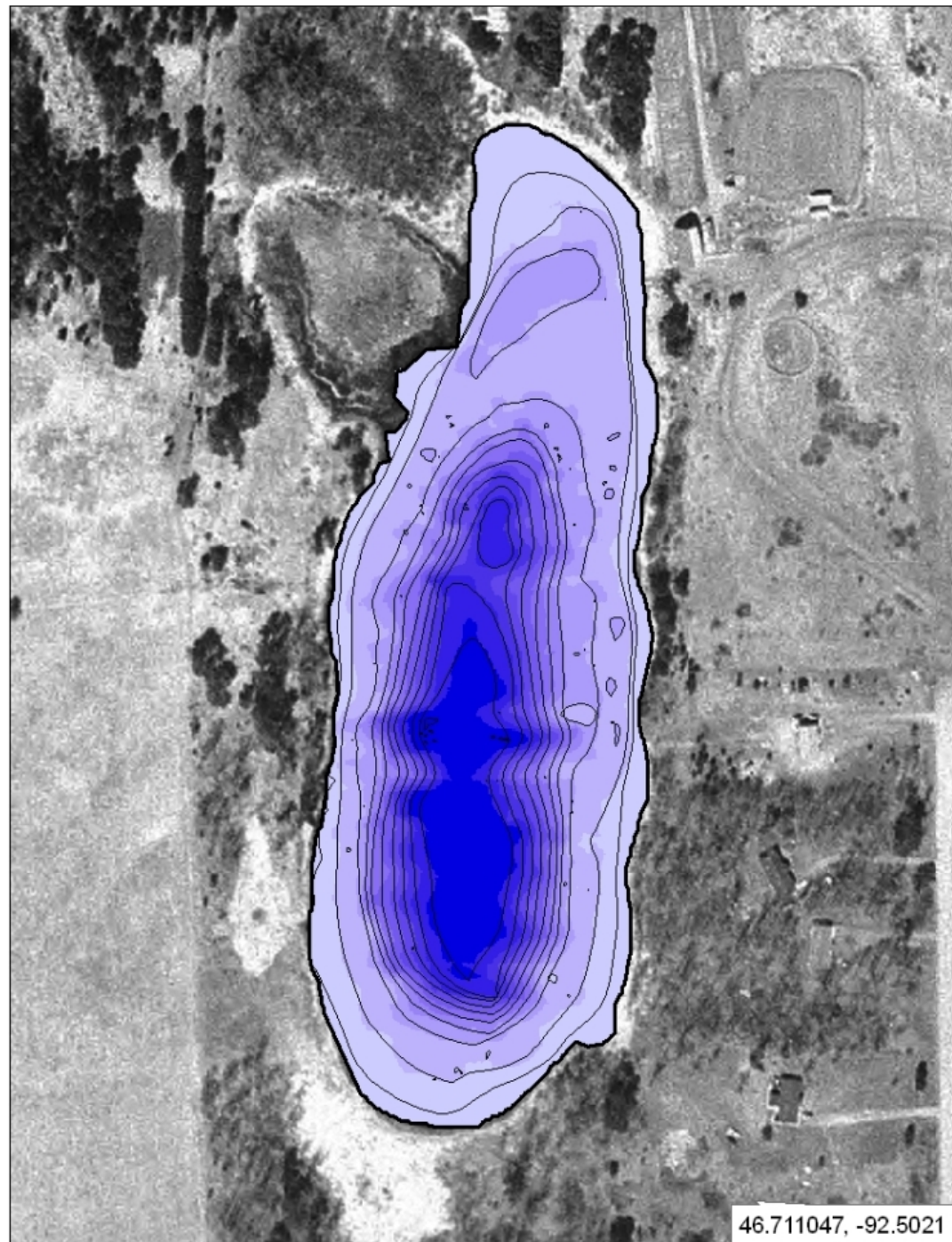


Next Year

- Alum treatment
- Continued monitoring
- Fish and aquatic plant assessments
- Brochure on our lake restoration efforts

Long-Term Goals

- Remove impairments
- Meet lake-specific nutrient criteria
- Fisheries management



Questions?

