Lake Francis

Lake ID: 47000200

Lake Name	Surface Area	Average Depth	Maximum Depth	Lake Volume	Residence Time	Littoral Area	Depth Class	Total Draining Area
Francis	1025	10.2	17	10,436	12.9	100%	Shallow	11,111

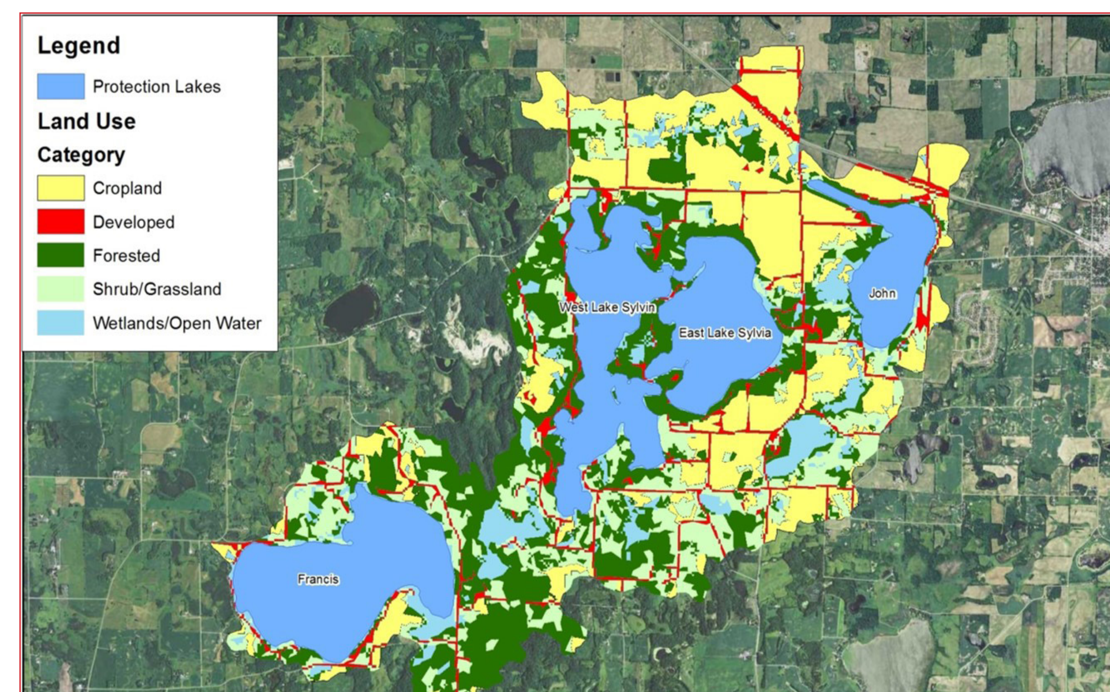


Figure 1. Land Use

Background

The Crow Lakes Protection and Resource Investigation Project furthers CROW's diagnostic and assessment program by using a TMDL-like process to assess and protect high valued lakes. The Project's "virtual TMDL" studies evaluated lake water quality relative to MPCA eutrophication standards, assessed external and internal TP loads, quantified maximum TP allocations, and identified TP reduction (or stabilization) plans or strategies for source areas. The Project will focus on ten lakes: Minnie-Belle, Manuella, Stella, Lake Washington, Francis, West Sylvia, East Sylvia, John, Charlotte, and Martha. These lakes are located throughout Meeker and Wright counties, are highly used recreational lakes with adjacent park lands: Greater Minnesota Girl Scout Council on Lake Charlotte (48.53 acres); Koinonia Retreat Center on East Sylvia (86.4 acres); St. John's Lutheran Camp on both East/West Sylvia (39.2 acres); and Lake Manuella Park (2 acres). These key lakes are parts of lake chains in which the whole chain is not impaired, and the protection strategies developed through this project will complement the TMDL implementation efforts to focus on comprehensively managing the chain as a system.

All of the lakes are significant because they provide quality water to the North Fork Crow River which is locally and regional important because it empties into the Mississippi River 20 miles upstream from the Minneapolis Water Plant intake. The Mississippi River provides drinking water to Minneapolis and Saint Paul and provides most of the flow to the lower Mississippi Recreational area and the lower Mississippi Wildlife Refuge before flowing into Lake Pepin. The Crow River is a major river system in Meeker and Wright County that directly drains a significant portion of each. It is a major recreational area in its own right, but also flows into the Mississippi River; a premier small-mouth bass fishery. At Project completion, diagnostic studies and implementation plans for non-impaired chain of lakes in the North Fork Crow River Watershed will be complete.

Common Internal Phosphorus Sources

1. Stormwater
    *Fertilizer
    * Organic material and leaves
    * Agricultural runoff
2. Precipitation
3. Degraded wetlands
4. Construction runoff
5. Geese

Common External Phosphorus Sources

1. Sediment Anoxia
    * Chemical loading
2. Invasive Species
    * Curly leaf pondweed and Eurasian water milfoil
    * Carp and bullhead
3. Degraded Fishery
    * Decreased plankton grazing

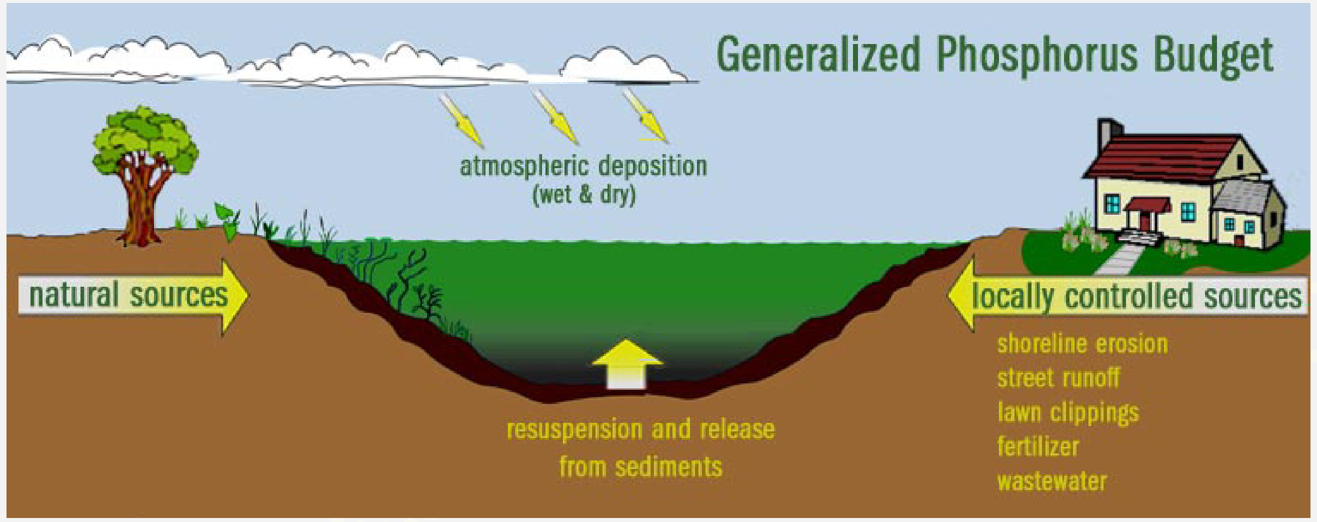


Figure 2. General phosphorus budget

Implementation Vision

Findings in the core results show that the sources of phosphorous that are currently impacting Lake Francis originate primarily from external sources and failing septic systems (approximately 62%). Although aluminum treatments would have a positive impact on controlling internal phosphorus, these solution would costly, somewhat temporary, and very little impact improving lake conditions. A long term implementation vision that would both improve and preserve water quality and sustainability in the lakeshed will need to include the installation of shoreline habitat, vegetative buffers, and agricultural best management practices. For instances where a particular source is defined, the use of an iron-enhanced filter may be appropriate. In addition to on-field practices, the lakeshed community may want to assess and explore culvert drainage and sub-surface tile drainage leading to the lake. Septic systems are indicated as a minor issue in the phosphorous models; however it is still important to maintain and be cautious of their effluent. Referencing the map on the left, the yellow areas indicate medium priority areas to targeting, prioritizing, and influencing changes. No high load source areas were modeled.

Next steps also include pursing and acquiring funding to support implementation projects and planning. Below is a chart with financial opportunities that could be applied for by local partners. Expectations for approved funding from the state, include cash matches and partnerships. These grants are highly competitive and funded applications have willing landowners and specified projects identified.

Sponsoring Entity	Grant Name	Deadline	Grant Size	Match Requirements	Notes
Board of Water and Soil Resources	FY Clean Water Fund RFP	Late summer	Varies	25%	There are various pools of funds that are all very competitive.
MN Department of Natural Resources	Expedited Conservation Project (ECP)	Early fall	Up to $50,000	10% (non-state match)	Projects must occur on public lands or water that are open to all seasons of hunting and/or fishing
MN Department of Natural Resources	Conservation Partners Legacy	Early fall	Up to $400,000	10% (non-state match)	Projects must occur on public lands or waters or lands protected by permanent conservation easements
MN Pollution Control Agency	Section 319	Spring	No ceiling on request	40% (cash and/or in-kind)	Funds used to develop locally based solutions to nonpoint source pollution and TMDL solution.

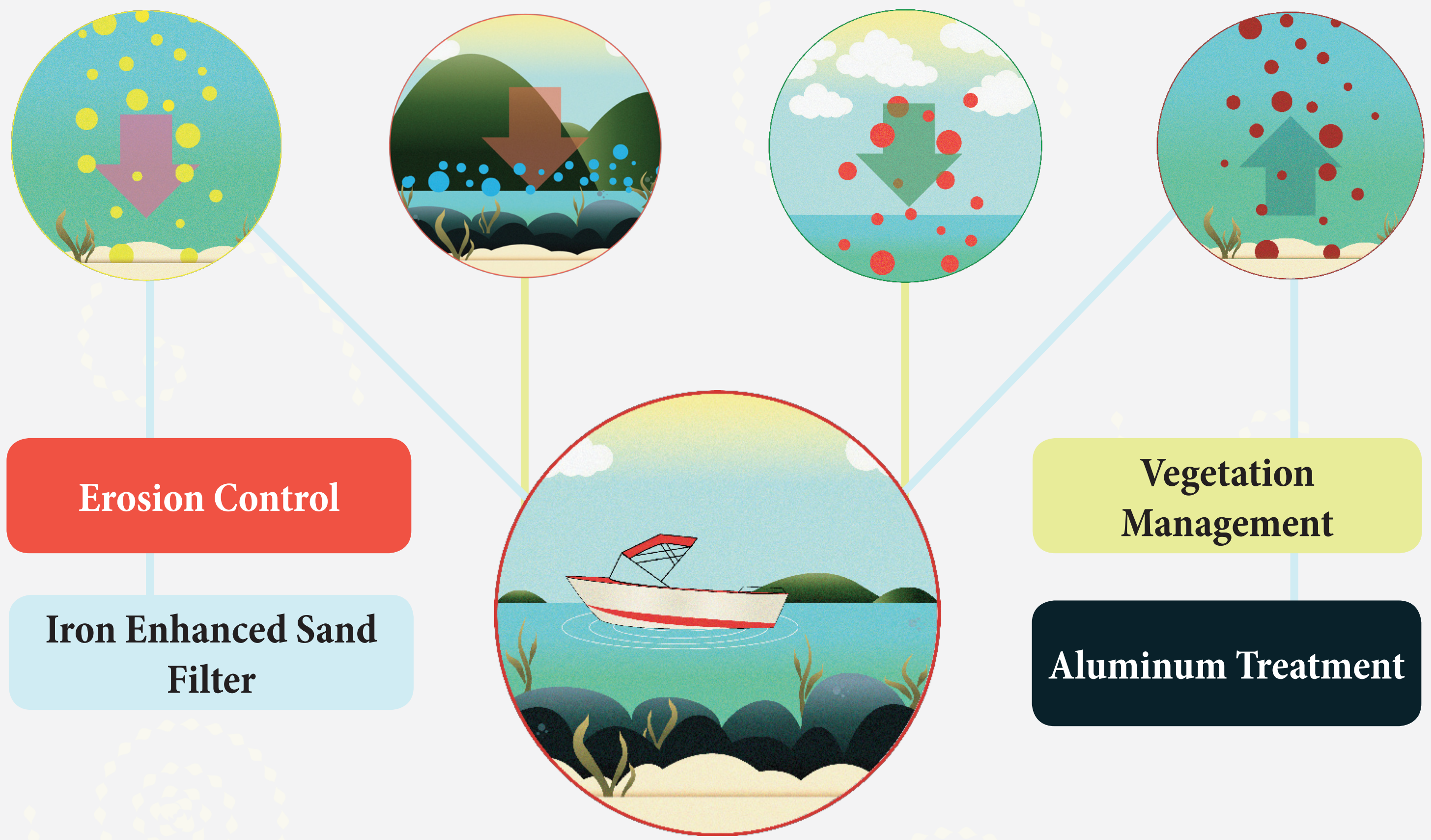
Core Results

External 51% of Loading

Septic Systems 11% of Loading

Atmospheric 37% of Loading

Internal 1% of Loading



Internal Release = 0.0 mg/m²/day

The total amount of phosphorus found in the sediment was relatively low compared to other lakes in the region (within the lower 25% quartile) and the samples, under controlled conditions, exhibited very little internal loading of phosphorous into the water column. Of the low levels of phosphorus in the lake, a majority of it originates from incoming runoff and streams.

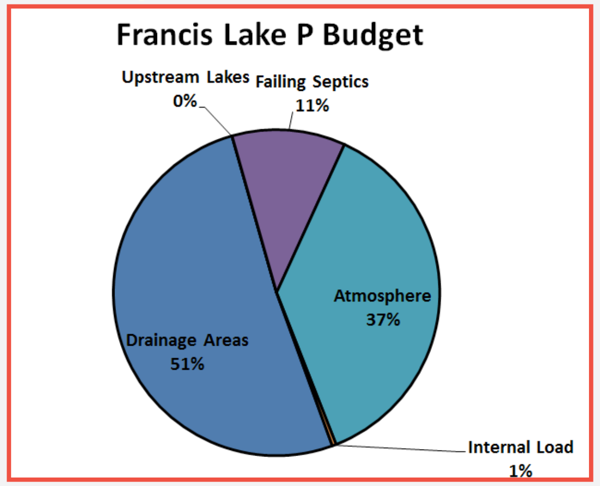


Figure 3. Phosphorus loading

Implementation Costs

E **Agricultural BMPs:** Practices that can be installed on the landscape to manage and control external phosphorus movement and sources, include:

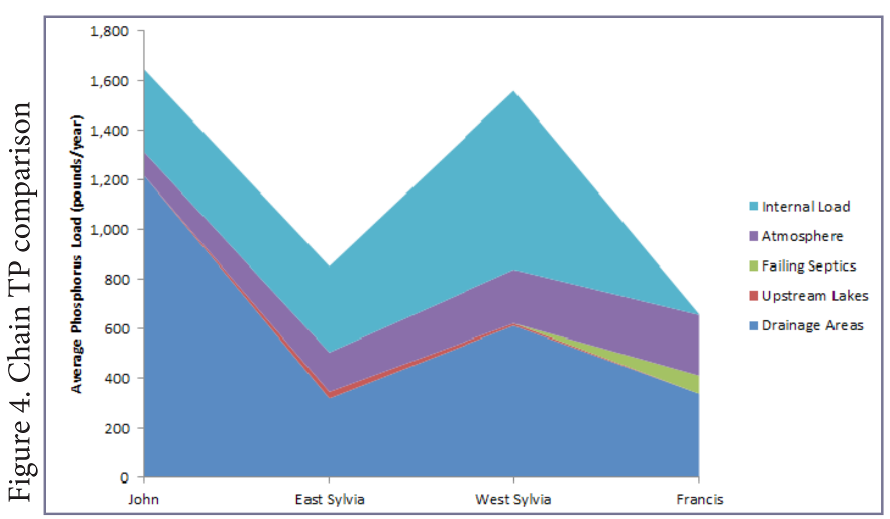
- Detention basins or settling ponds, which slow down water and keep water on the field. **Cost:** varies depending on size, treatment level, and planning needs.
- Iron enhanced sand filters, which remove dissolved constituents from stormwater and drainage water. **Cost:** Varies depending on size, treatment level, and planning needs.
- Wetland restorations, which improves water quality and wildlife habitat. **Cost:** $1,000-$6,000 per acre.
- Water and sediment control basin (WASCOB), which is an embankment that is perpendicular to the flow direction on hillslopes and slows peak flow rates and soil erosion. **Cost: $100 to $150** per linear foot for construction of berm and seeding, **$1,200 - $2,000**.
- Grassed waterways, which are swales or graded channels that stabilize underlying soil and prevent soil erosion by slowing sheet runoff. Cost: **$2,000 to $3,000** per acre for shaping and seeding.

U **Iron-Enhanced Sand Filtration:** BMPs that incorporate filtration media mixed with iron that removes several dissolved constituents, including phosphate, from stormwater. Although not appropriate in every circumstance, iron-enhanced sand filters may be applied in the same manner as other filtration practices and are more suited to urban land use with high imperviousness and moderate solids loads. Because the primary treatment mechanisms are filtration and chemical binding and not volume reduction, vegetating the filter is not needed and my impair the filter function. **Cost:** costs vary dramatically depending on the size and treatment level of the iron enhanced sand filter. Planning level costs have been associated with each proposed iron-enhanced sand filter.

I **Submerged Aquatic Vegetation Management:** Reestablishment of the submerged vegetation population is typically accomplished through whole-lake draw downs, which exposes lake sediments to drying and consolidates the sediments while promoting nitrogen loss through denitrification. Other methods are available, but prove less reliable for meeting outcomes. **Cost:** $500 per acre for mechanical removal & $300 per acre for chemical removal.

I **Aluminum Sulfate Application:** Aluminum sulfate (alum) is a chemical routinely used to reduced the amount of phosphorous release from sediments in lakes with high internal phosphorus in their nutrient budgets. This situation typically occurs when watershed reductions have been implemented, high internal phosphorus loading persist due to historic loadings, and with lakes in small watersheds with low watershed phosphorus loading. Typically, these lakes have few watershed BMPs that can be implemented, which makes alum treatments an attractive option. **Cost:** $3,500 per acre of applied aluminum sulfate.

Figure 4. Chain TP comparison



> "Lake Francis is protected due to large volume and very small watershed, but vegetation management is very important for this waterbody"
>
> Wenck & Associates

Critical Implementation Areas

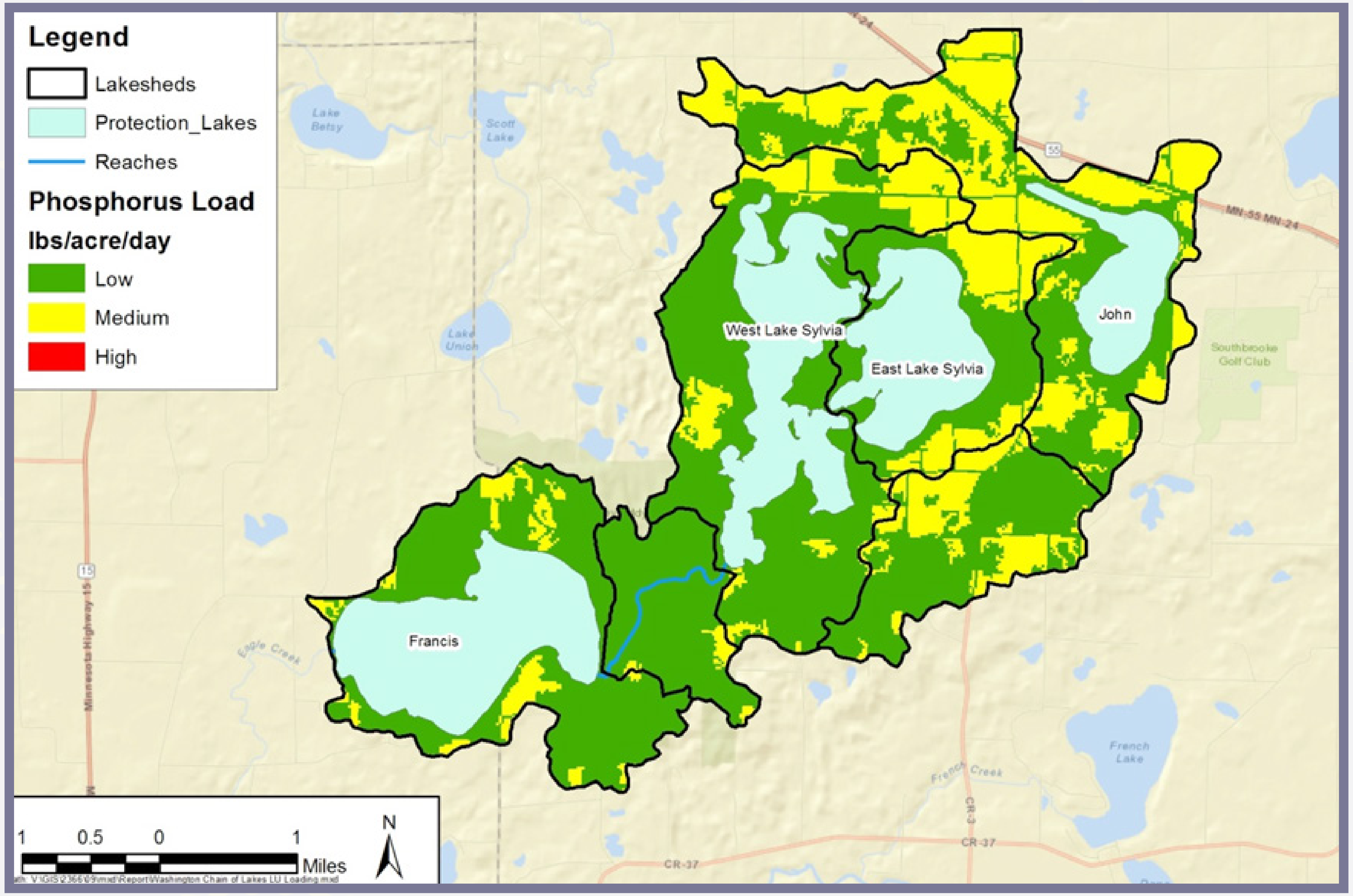


Figure 5. Spatial TP loading