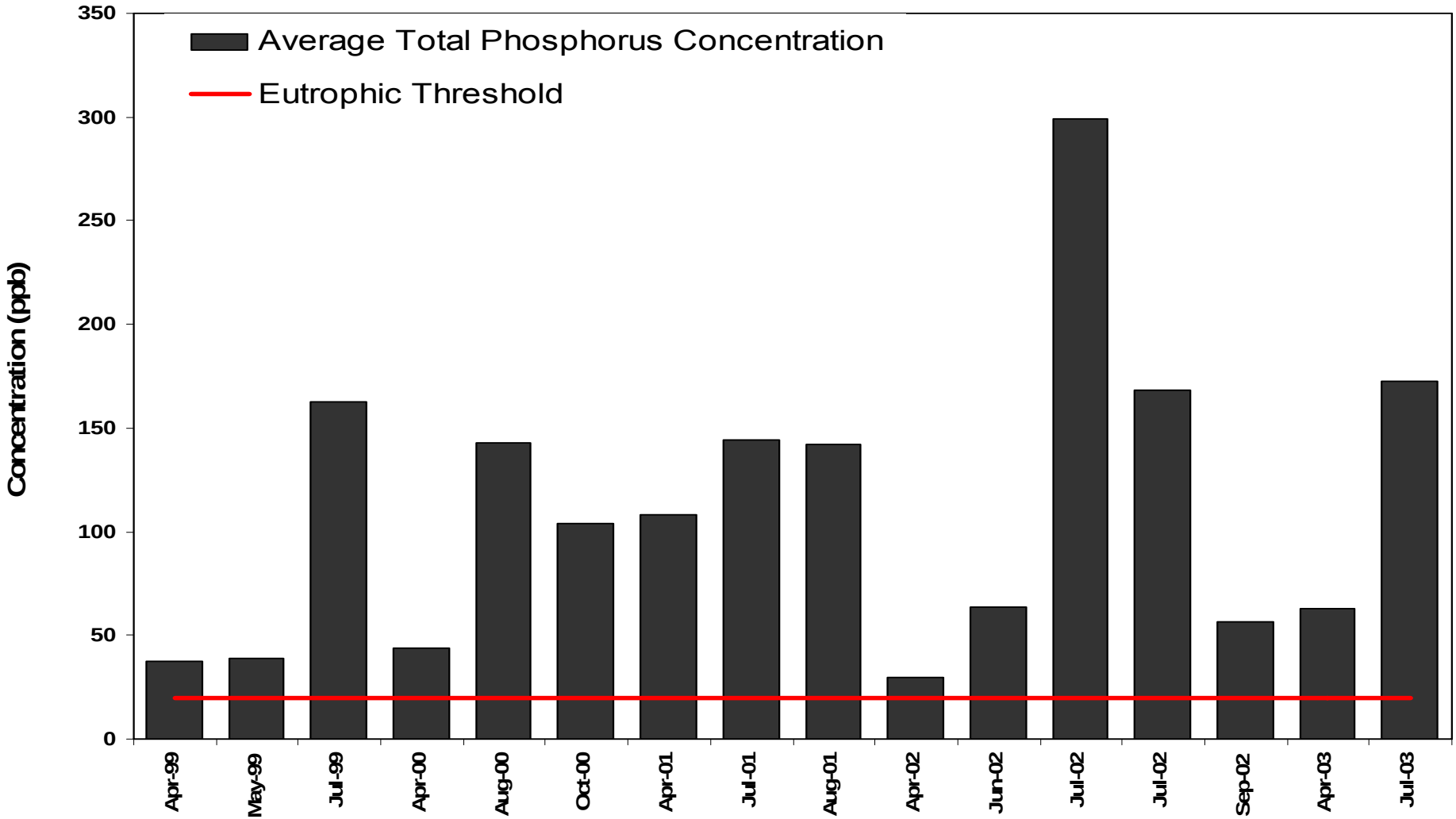
Stormwater Management in Spring Lake

Alan Steinman
Annis Water Resources Institute
Grand Valley State University

Total Phosphorus: Spring Lake



Data: Progressive AE

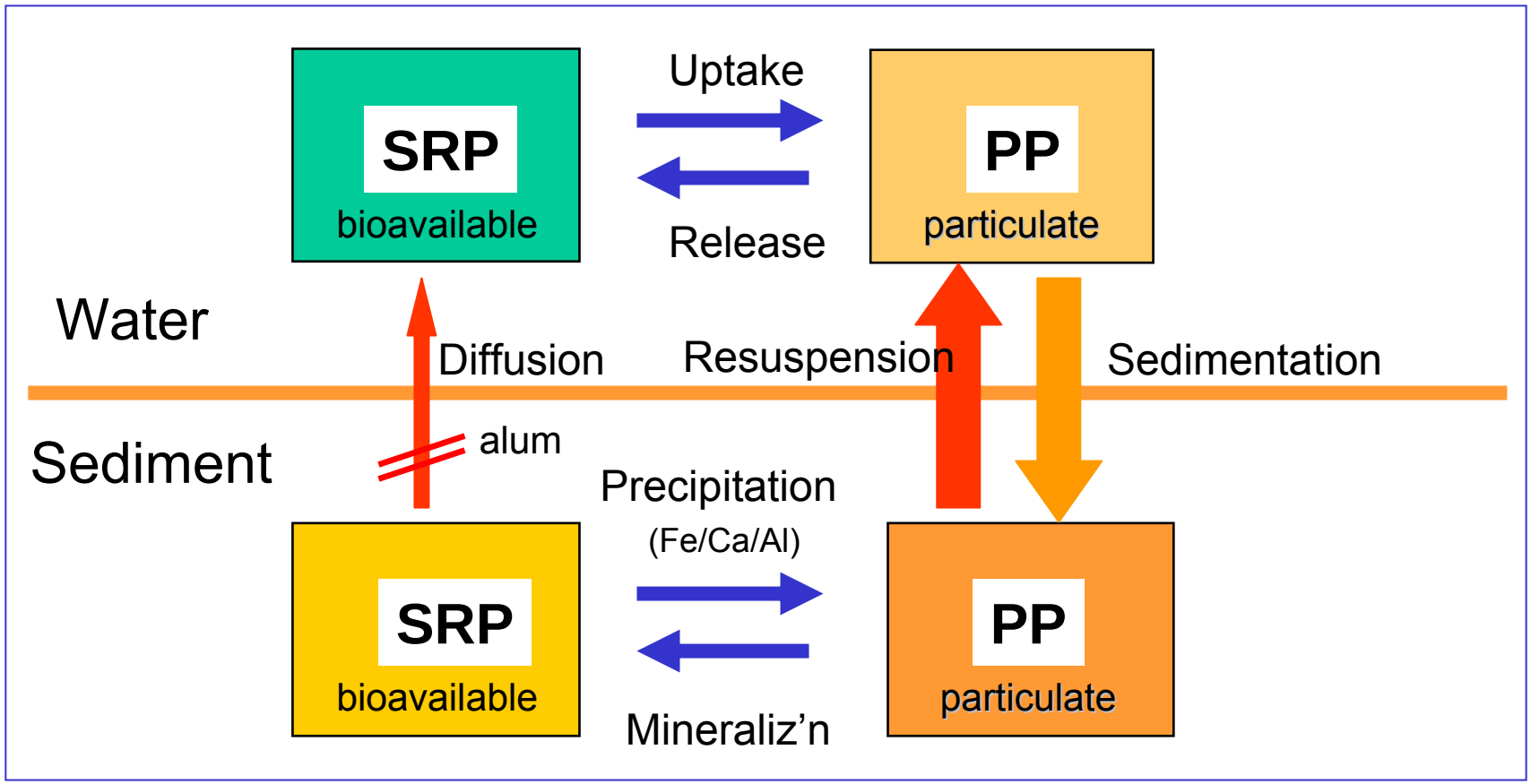
Objectives: Spring Lake Studies

- Compare external vs internal P loading rates

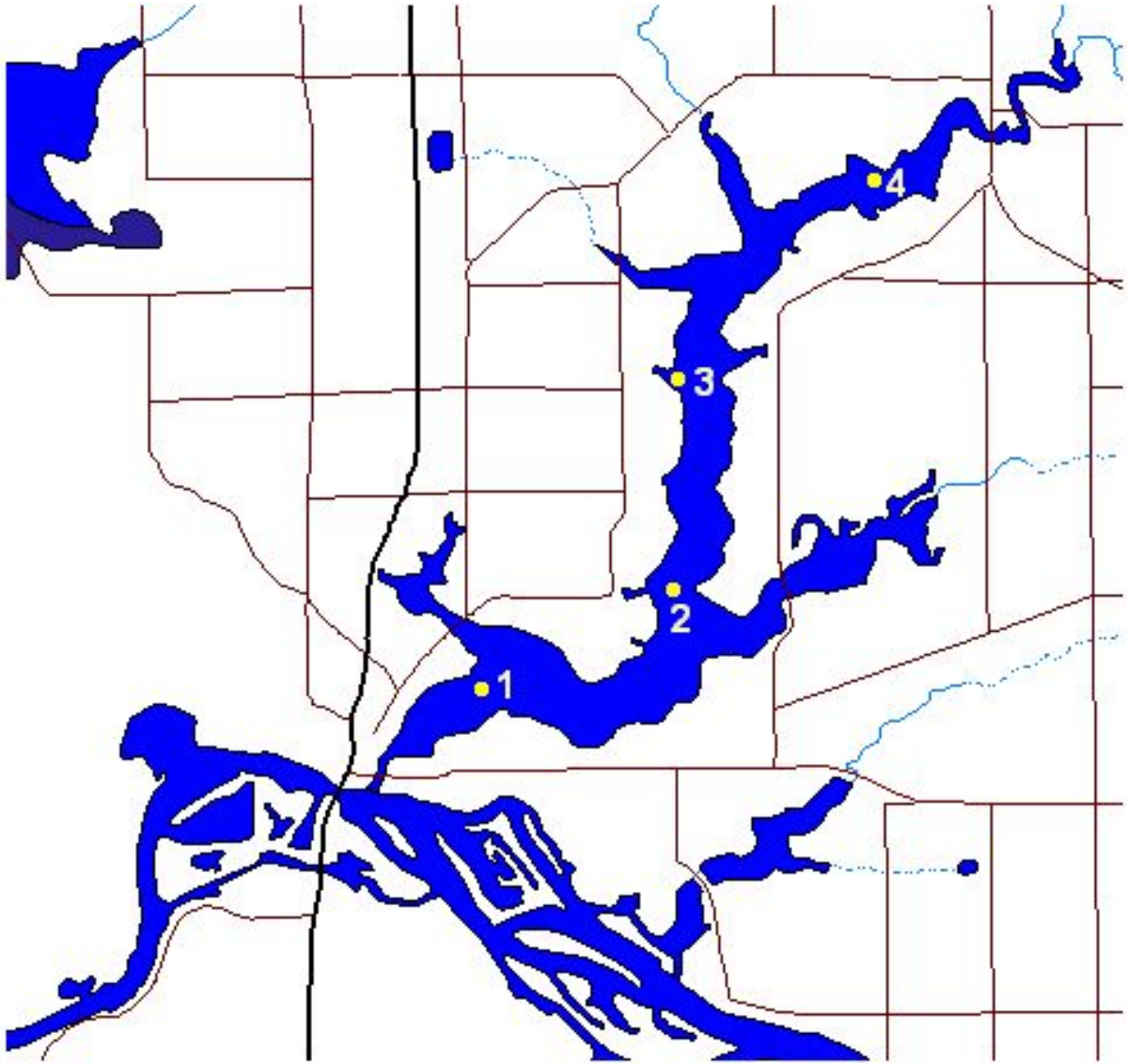
- Determine the effectiveness of alum in reducing internal P loading (lab studies)

- Based on lab studies, assess whole-lake alum application

Sediment-Water Interactions



Sampling Sites – Spring



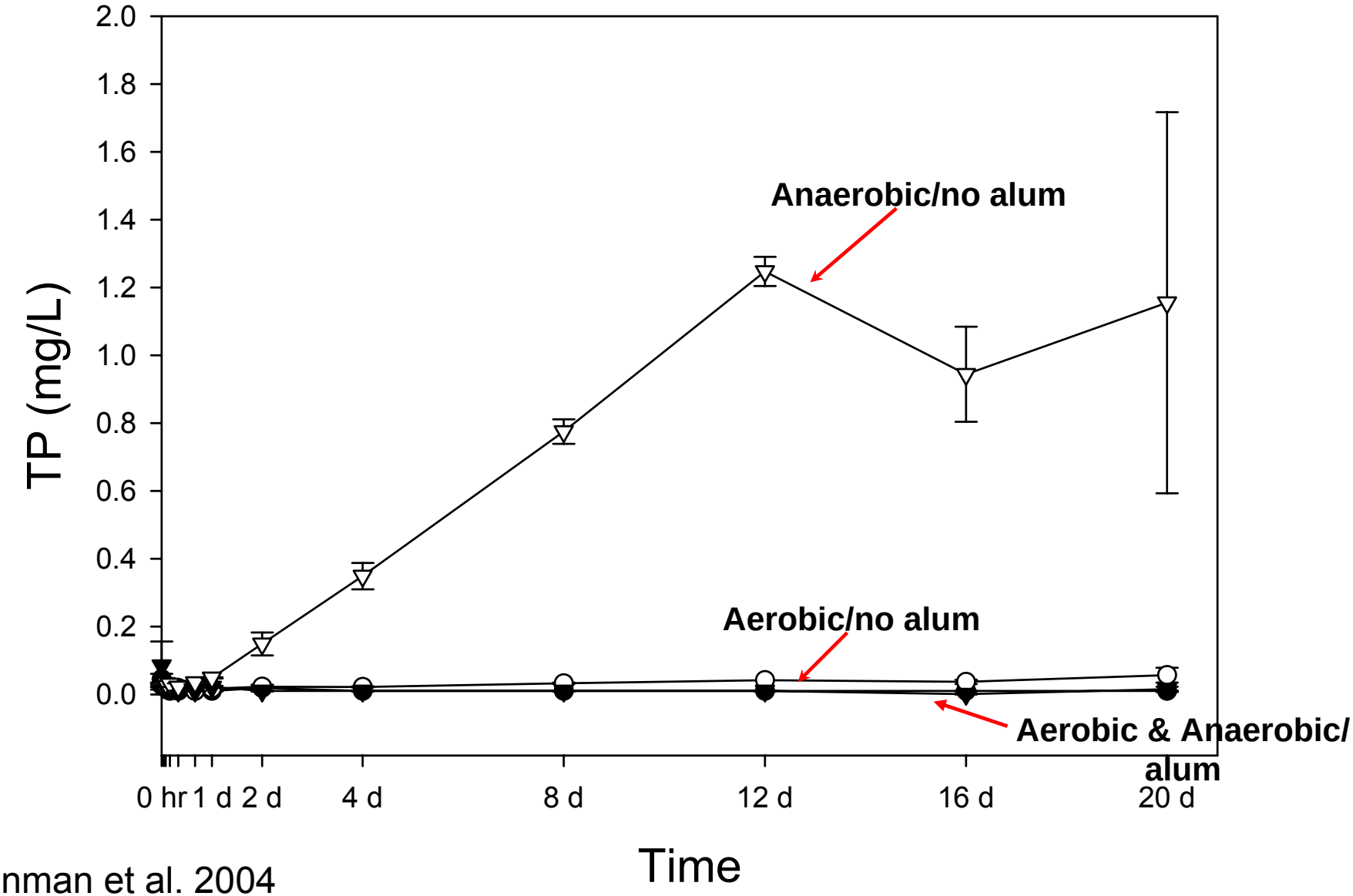

UVM

Experimental Design

Treatment	O_2 vs N_2	Alum vs. no alum	Prediction
1	O_2	Alum	Lowest P
2	O_2	No alum	Low P
3	N_2	Alum	Very low P
4	N_2	No alum	High P

- 3 replicates per treatment

Total Phosphorus: Site



Steinman et al. 2004

TP Load Estimates (tons/yr)

Scenario	External Load*	Mean Internal Load**	Internal:Total Load (%)
Low	2.2	2.7	55%
Medium	3.1	6.2	67%
High	4.7	6.4	58%

*Lauber (1999)

**Steinman et al. (2004)

Alum Application

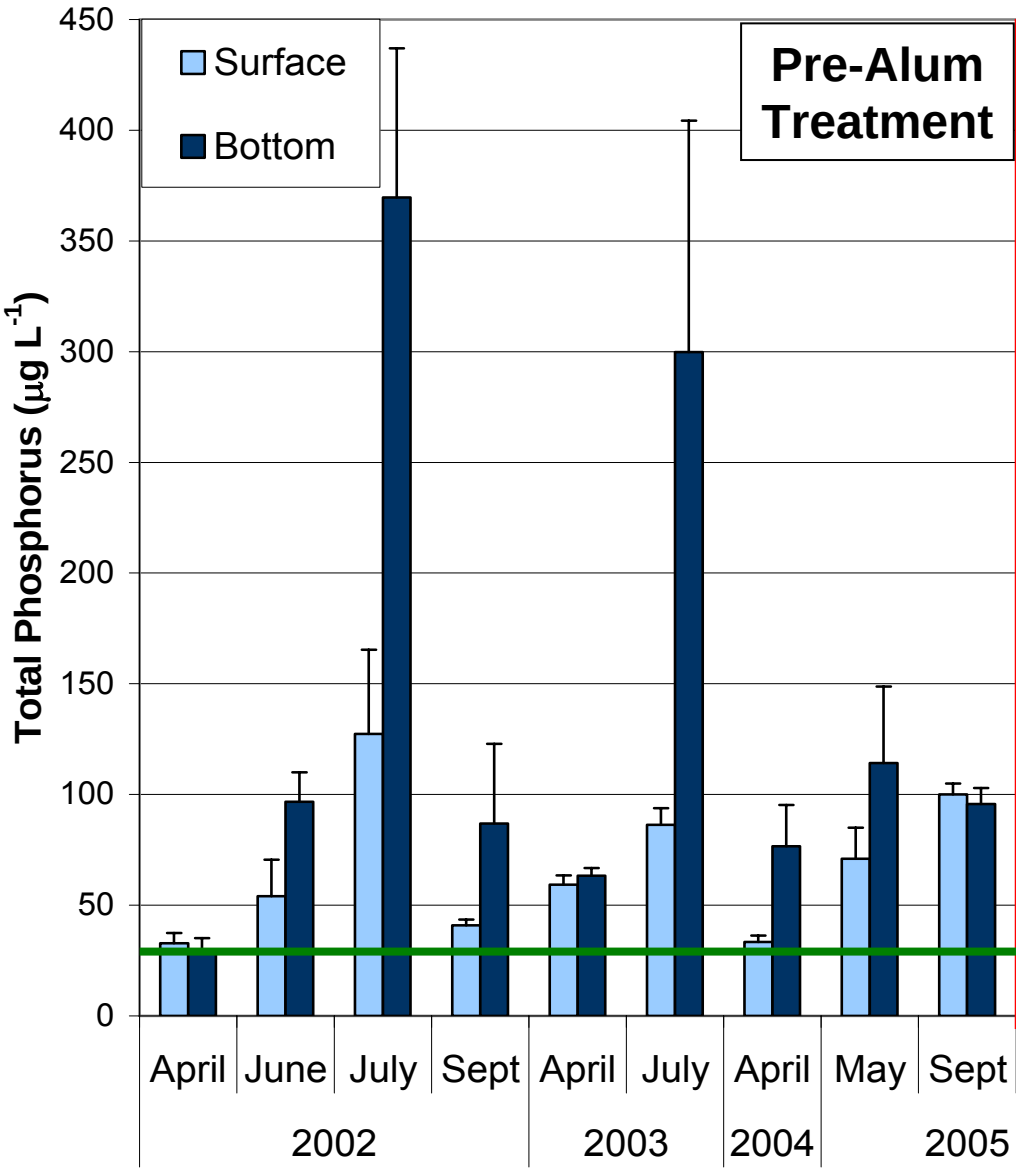
- Application date: Oct—Nov, 2005
- Total application: 1,163,000 gallons
- Surface application using spray nozzles
- Treatment area: ~2.4 km^2 (~46%)
- Treatment dose: ~80 g Al/m^2

Treatment Barge

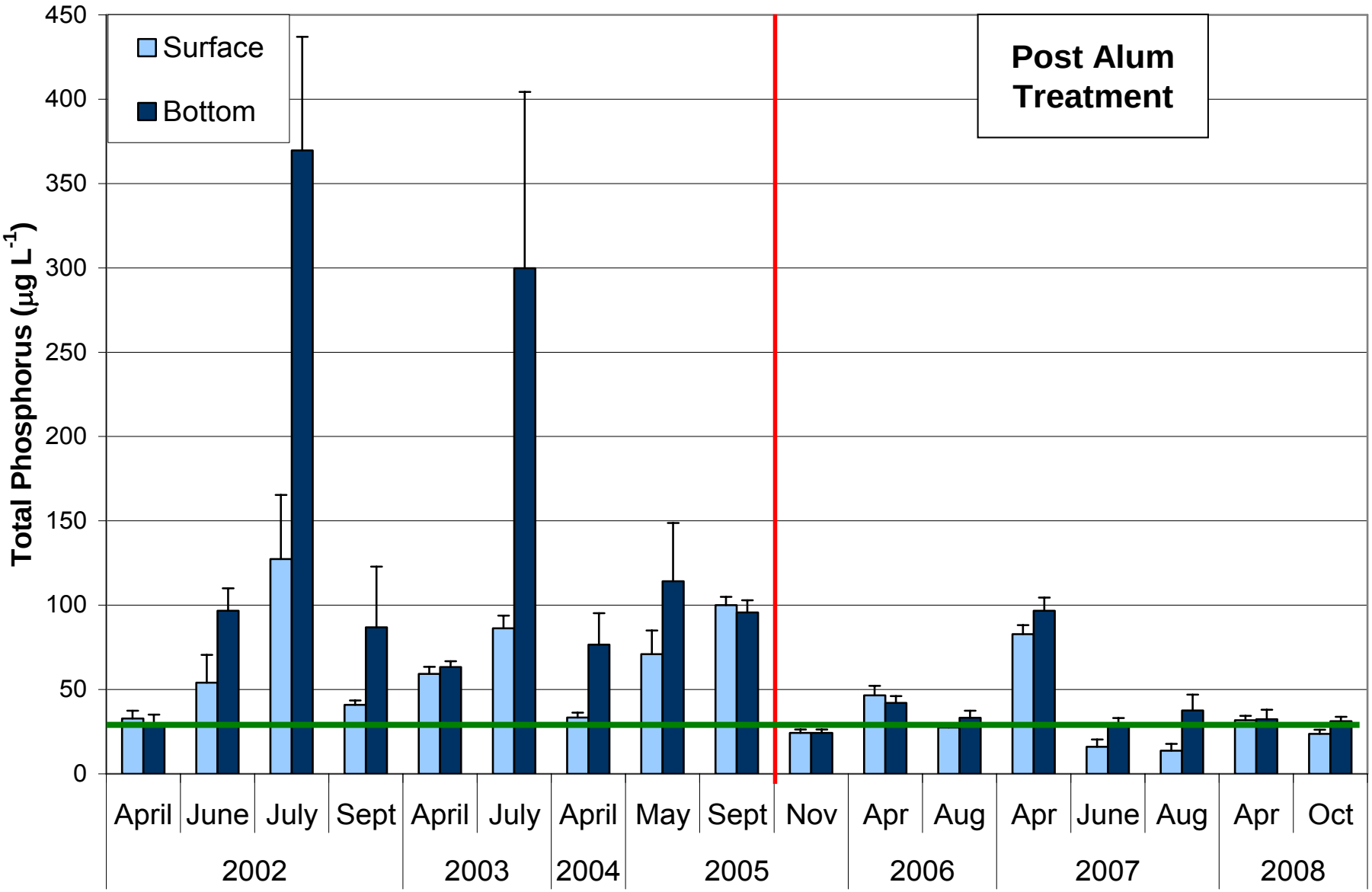
Maximum TP Flux Rates (mg P/m^2/d)

Site	2003 (pre-alum)	2006 (post-alum)
1	26.71	0.33
2	16.02	0.88
3	9.04	0.49
4	10.64	-0.05

Steinman et al. 2008



Source: Progressive AE 2008



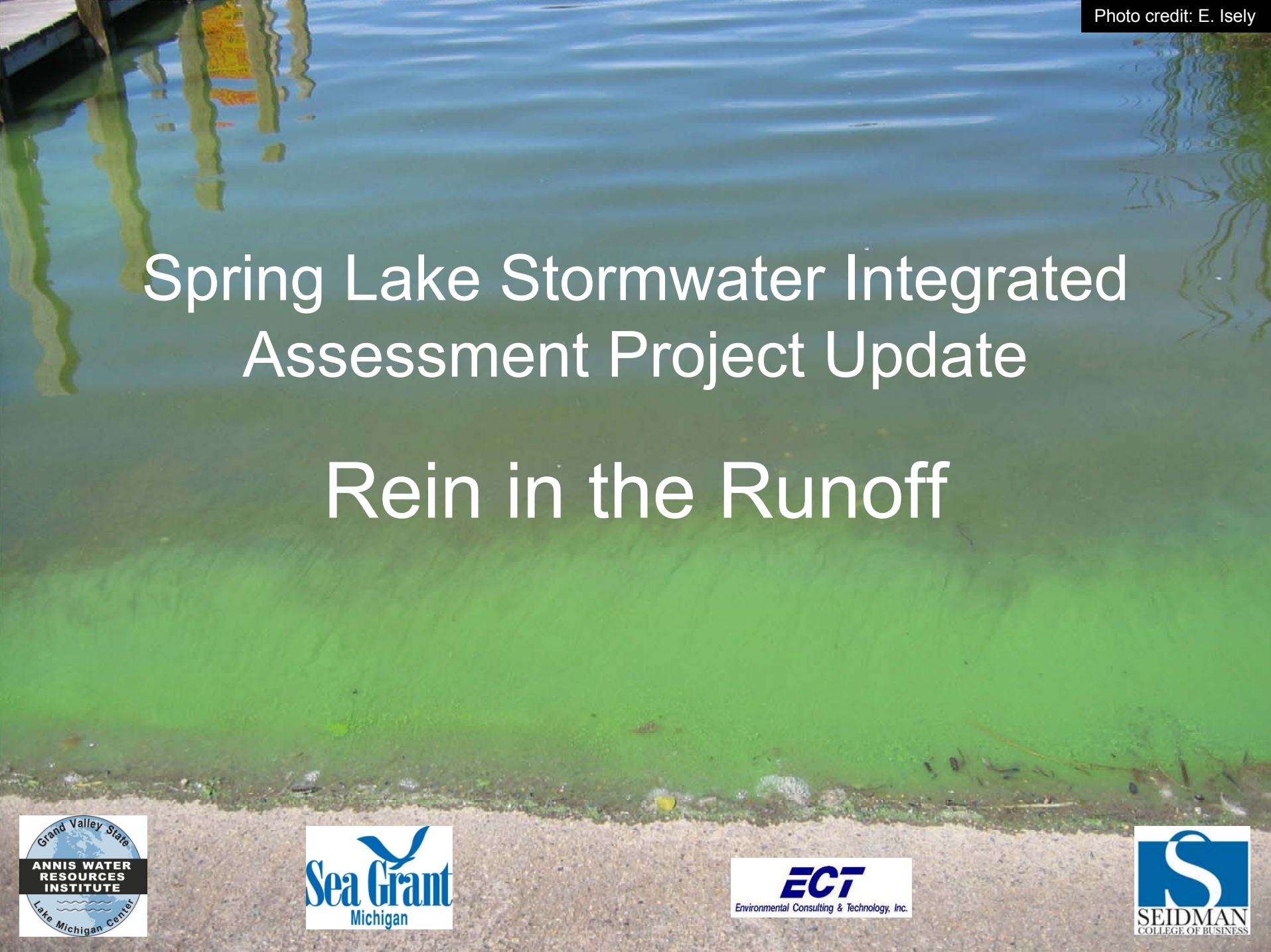
Source: Progressive AE 2008

Concluding Points

- Alum application is not a panacea—it treats the symptom, not the disease

- Controlling the external loading is the ultimate solution to eutrophication in lakes. The more control you have, the longer the alum treatment will last

Changing our behavior



Spring Lake Stormwater Integrated Assessment Project Update

Rein in the Runoff

Grand Valley State ANNIS WATER RESOURCES INSTITUTE Lake Michigan Center

Sea Grant Michigan

ECT Environmental Consulting & Technology, Inc.

SEIDMAN COLLEGE OF BUSINESS

Stormwater Impacts

- Impervious surfaces (e.g., roads) increase runoff volume, velocity, & pollutants
- Reduced recharge to aquifers
- Increased erosion & sedimentation
- Potentially toxic to stream biota

Policy Question

What stormwater management alternatives are available to the Village of Spring Lake and Spring Lake Township that allow for future development and also mitigate the impacts of stormwater and improve the quality of Spring Lake, the Grand River and Lake Michigan?

Photo credit: E. Isely

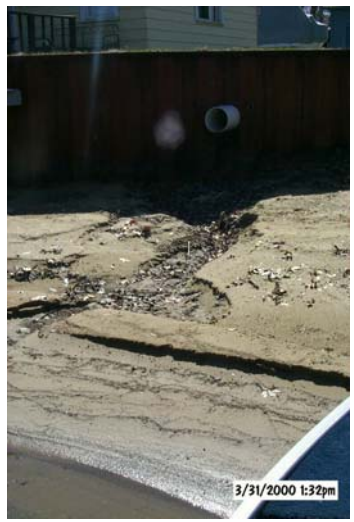


Photo credit: Progressive AE

Photo credit: E. Isely

Project Objectives

- Increase understanding of the causes and consequences of stormwater runoff
- Model build-out scenarios and link to water quality impacts
- Increase stakeholder participation in stormwater control and management
- Identify regulatory mechanisms to improve local stormwater management and control
- Provide alternative BMPs for stormwater mgm't
- Serve as model for other Great Lakes communities

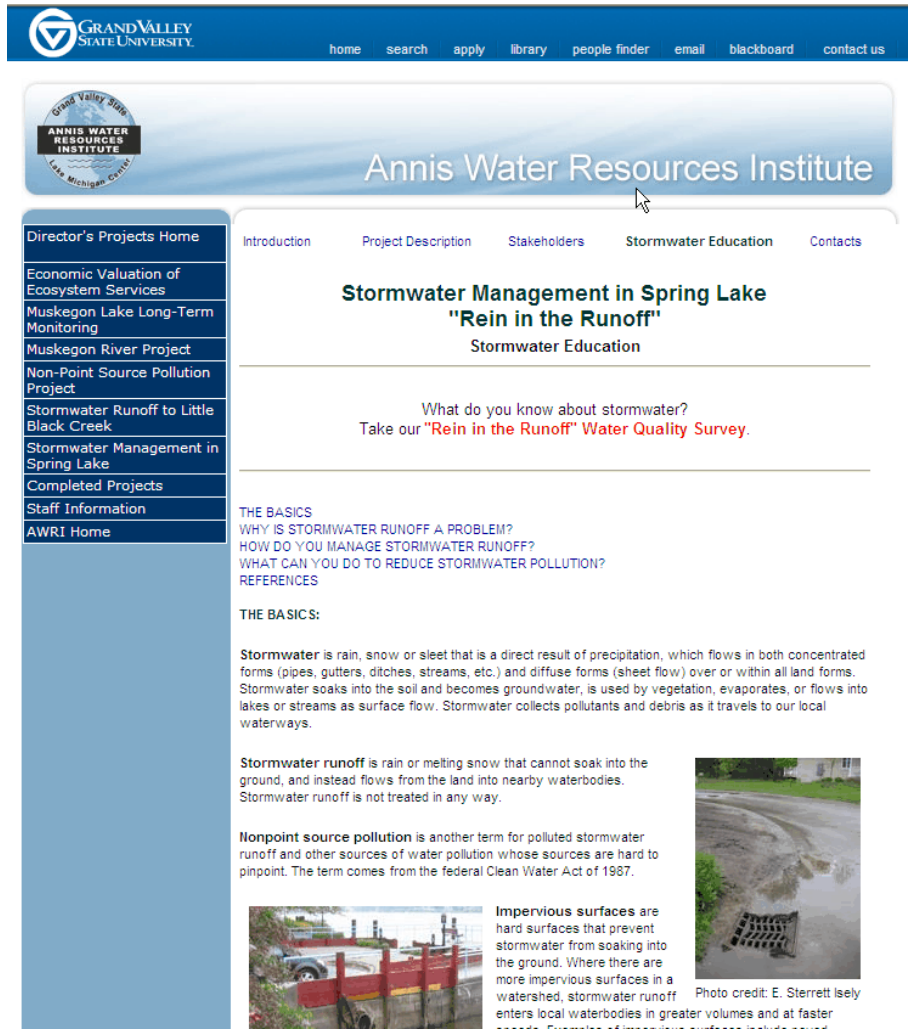
Stakeholder Process

- Stakeholder involvement in all aspects of Integrated Assessment:
  - Public education events
  - Representation on Stakeholder Steering Committee
  - Community group meeting presentations
  - Project website: **http://www.gvsu.edu/wri/reinintherunoff**
  - Opportunities to provide feedback, survey cards and on-line survey
  - Review of completed integrated assessment

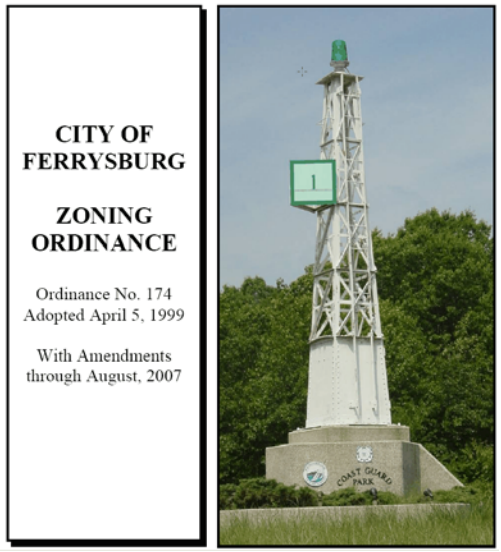
Project Website

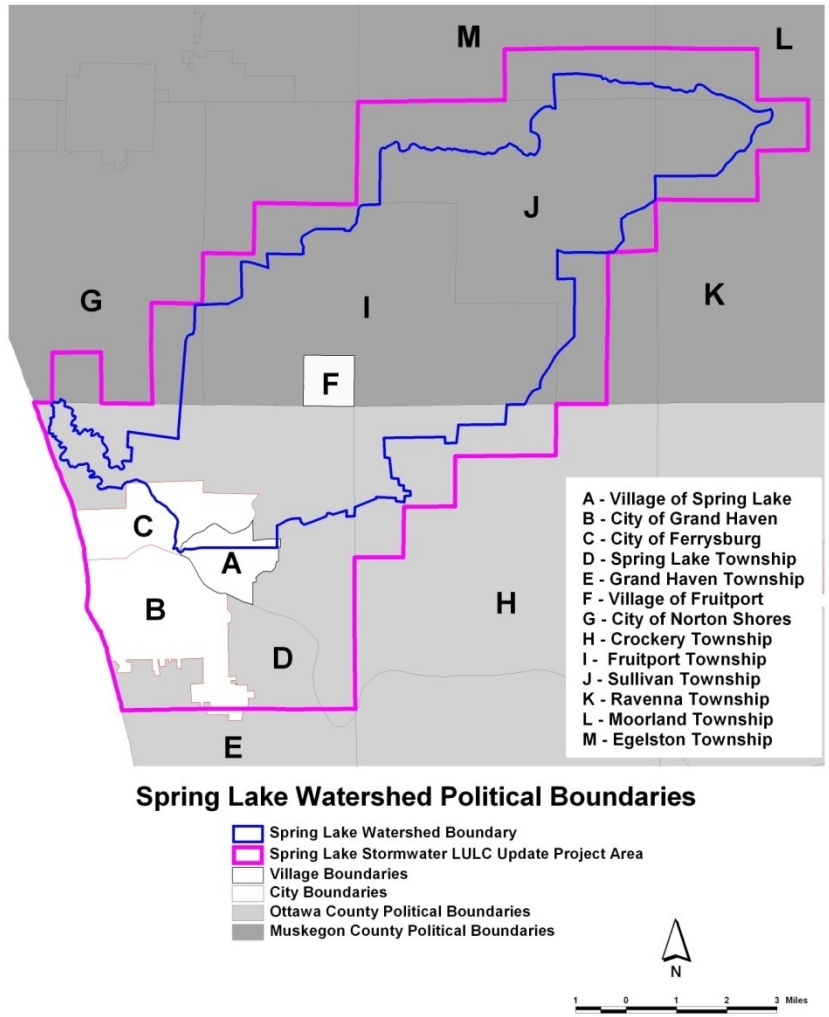
- http://www.gvsu.edu/wri/reinintherunoff

- Web-Pages
  - Introduction
  - Project Description
  - Stakeholders
  - Stormwater Education page
  - Water Quality Survey: http://www.gvsu.edu/wri/waterqualitysurvey

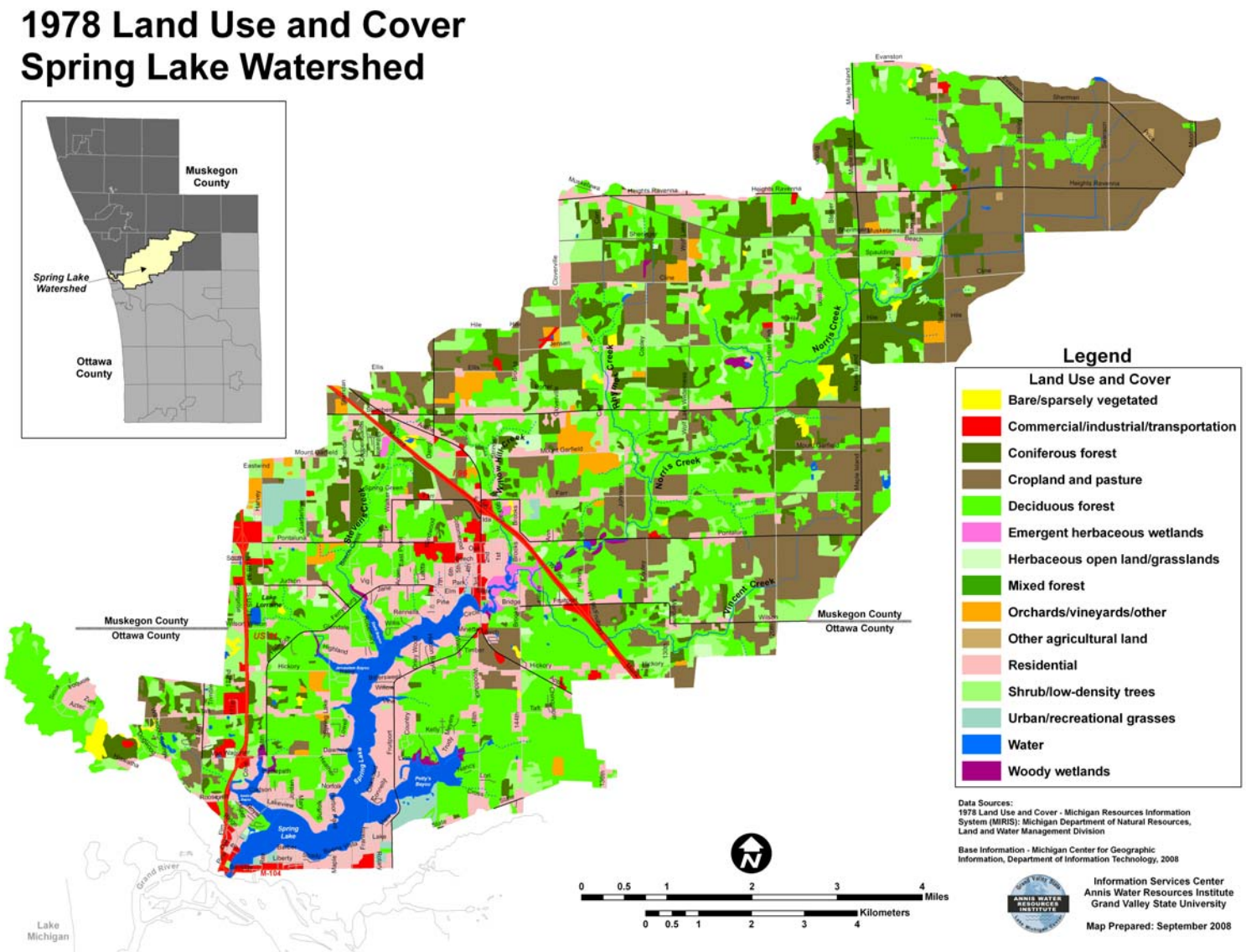


Zoning Ordinances/Master Plans

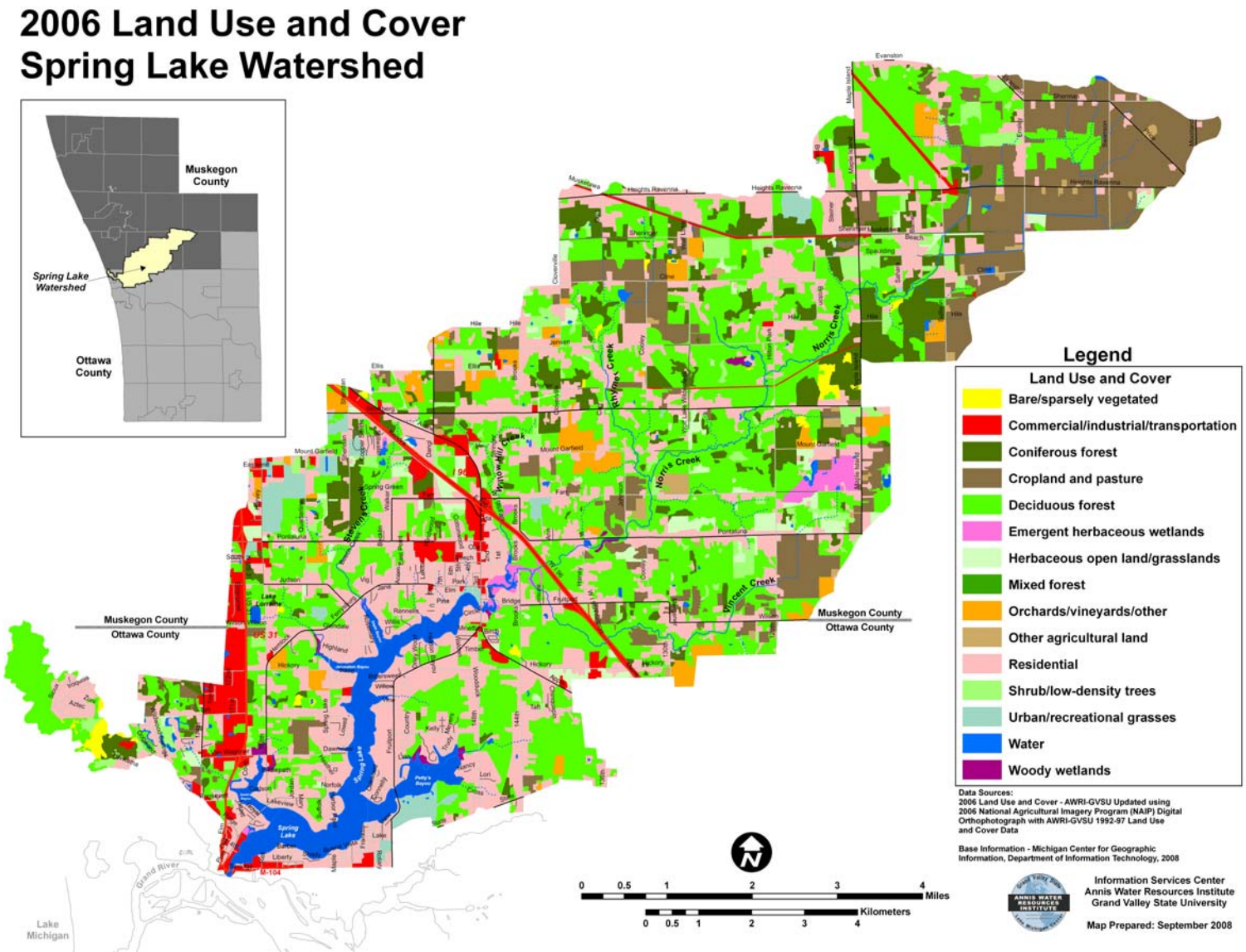




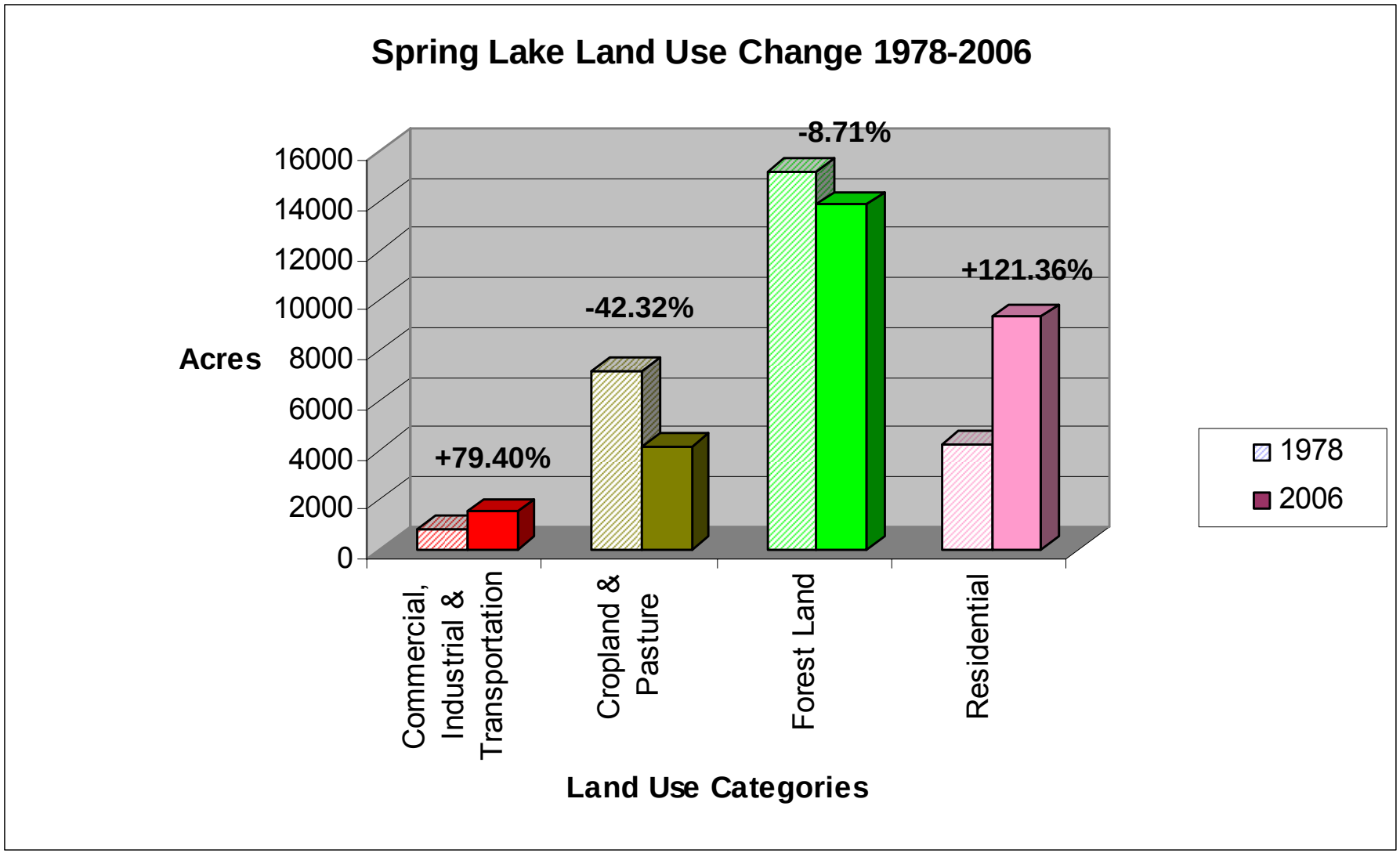
Land Use Change - Then



Land Use Change - Now

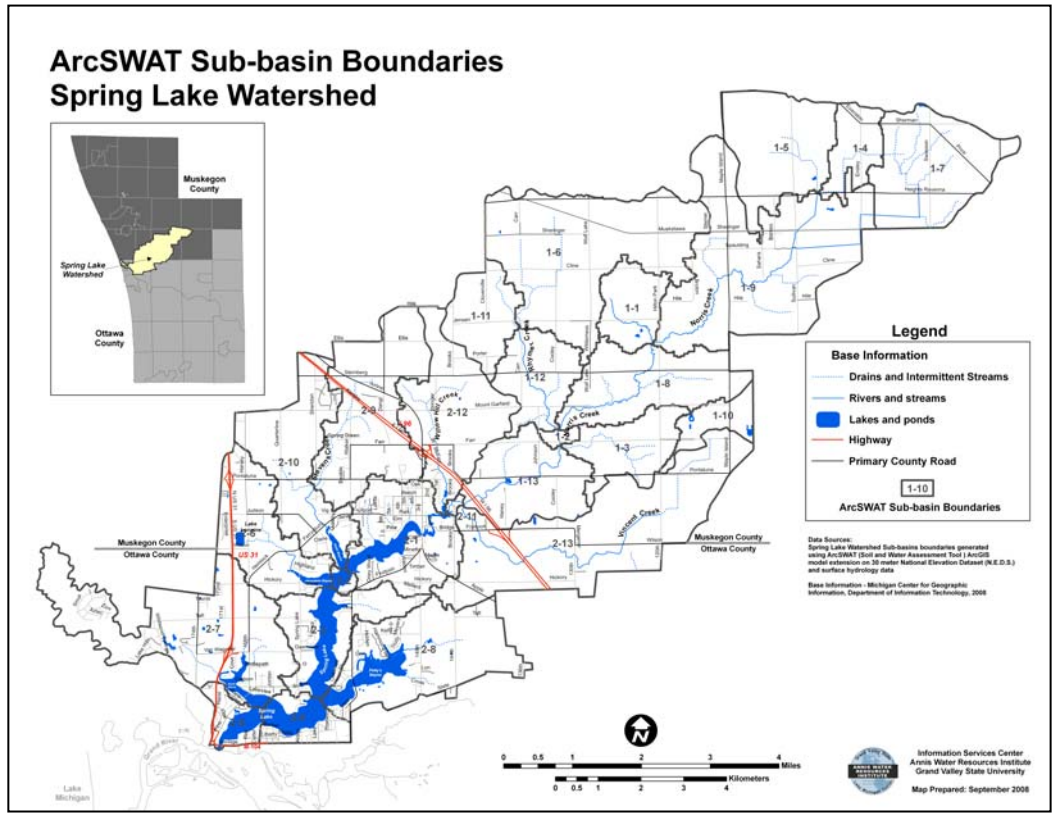


Land Use Change Analysis

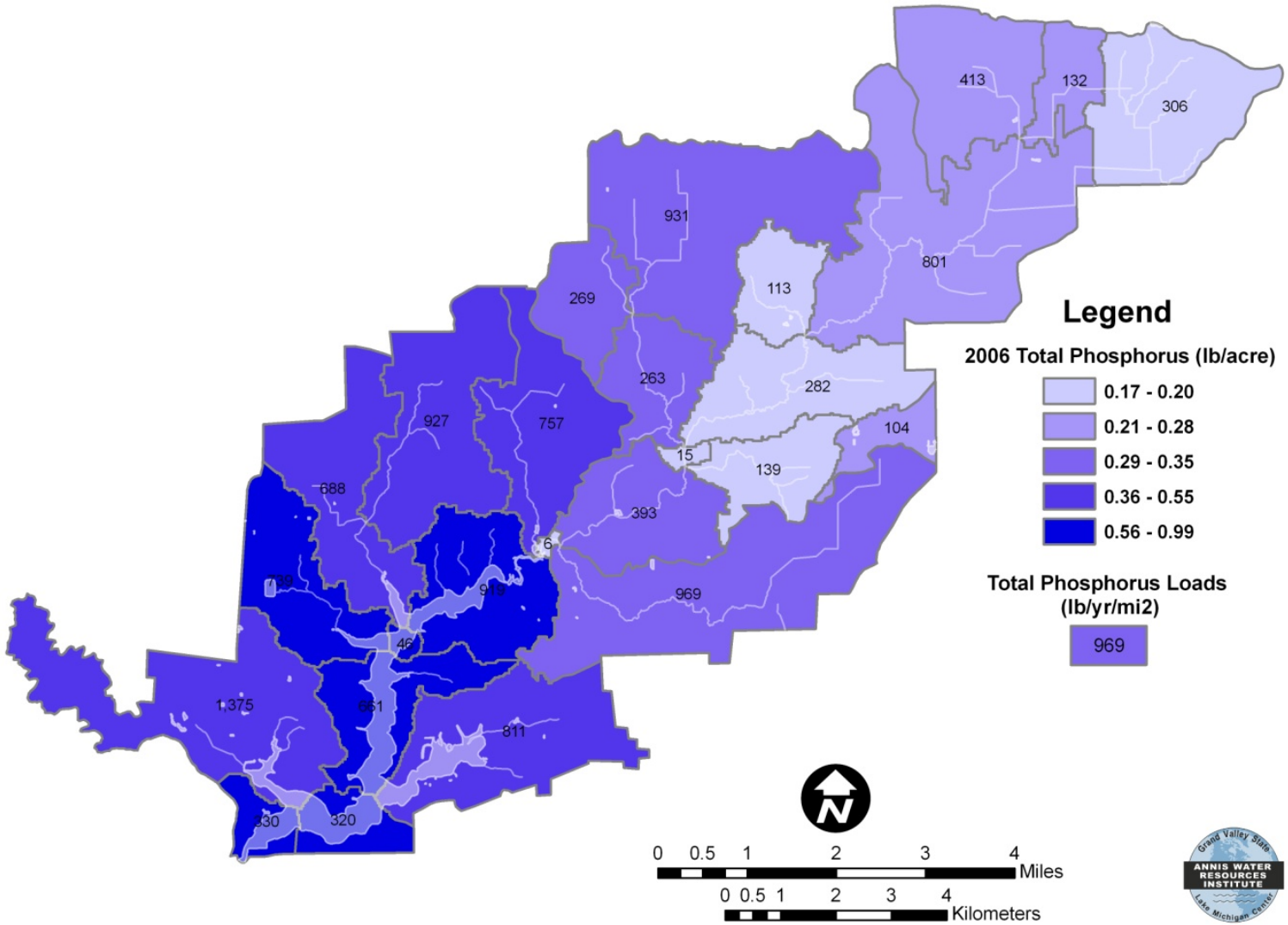


PLOAD

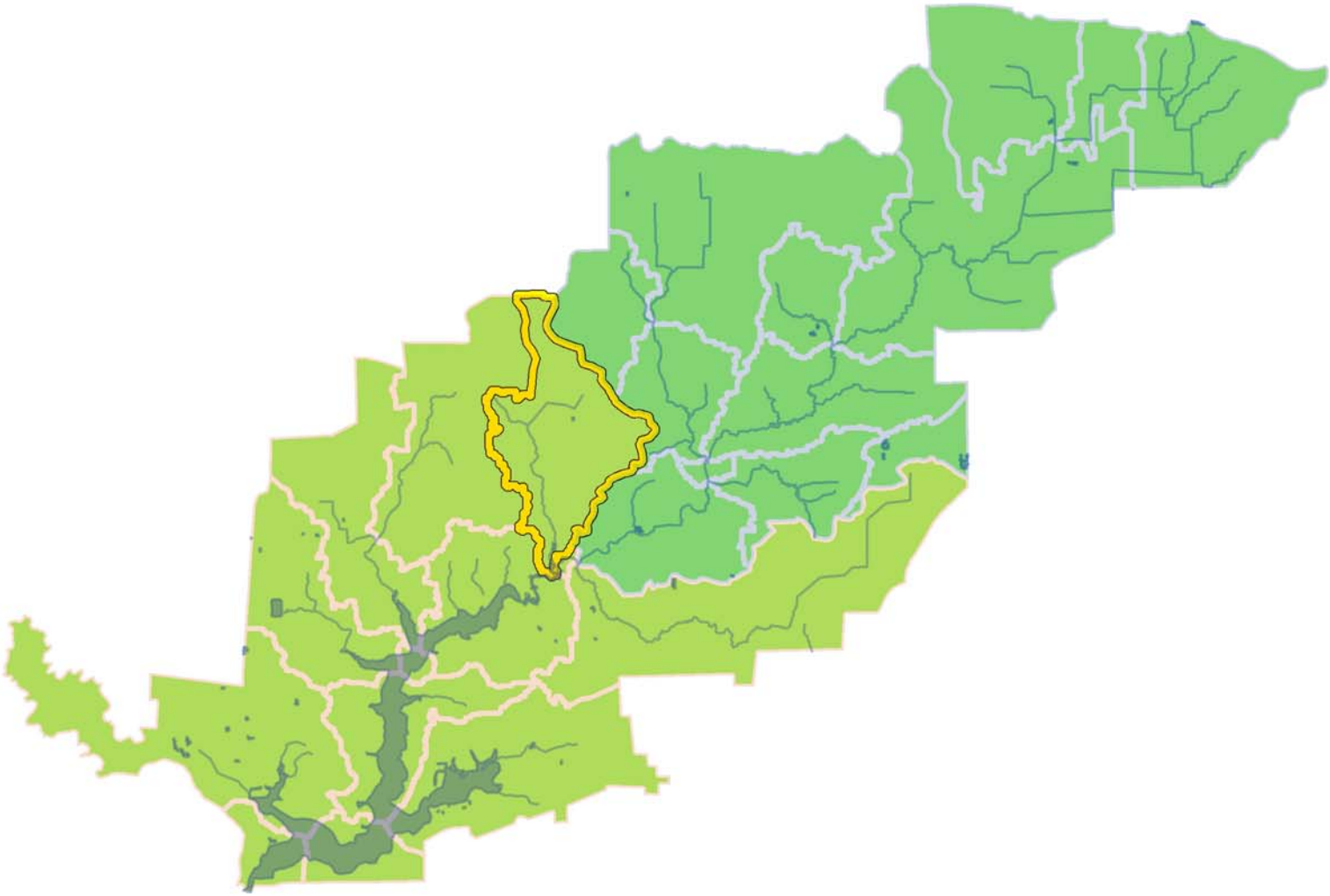
- Simplified GIS-based model
- Estimates annual average nonpoint source pollution
- Can take BMPs into account



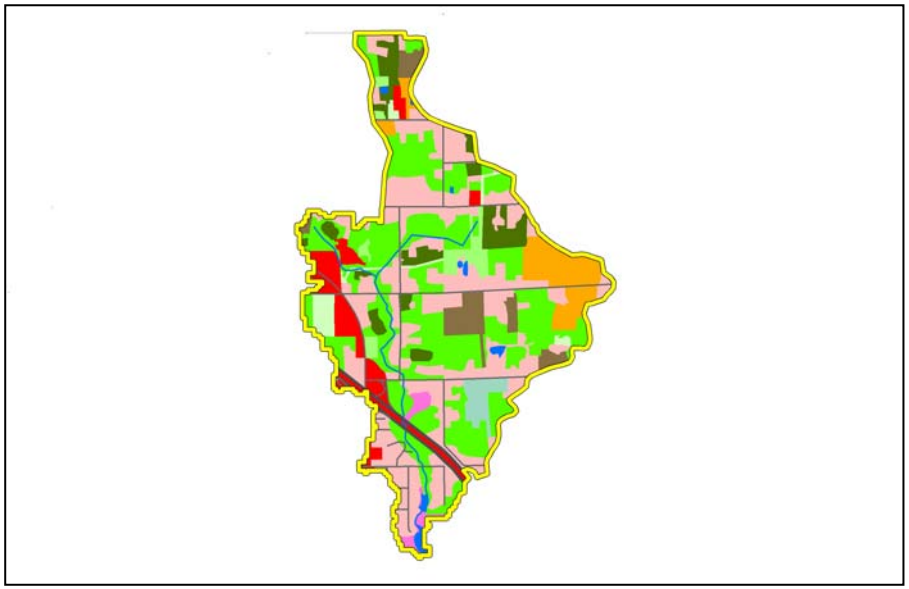
Total Phosphorus

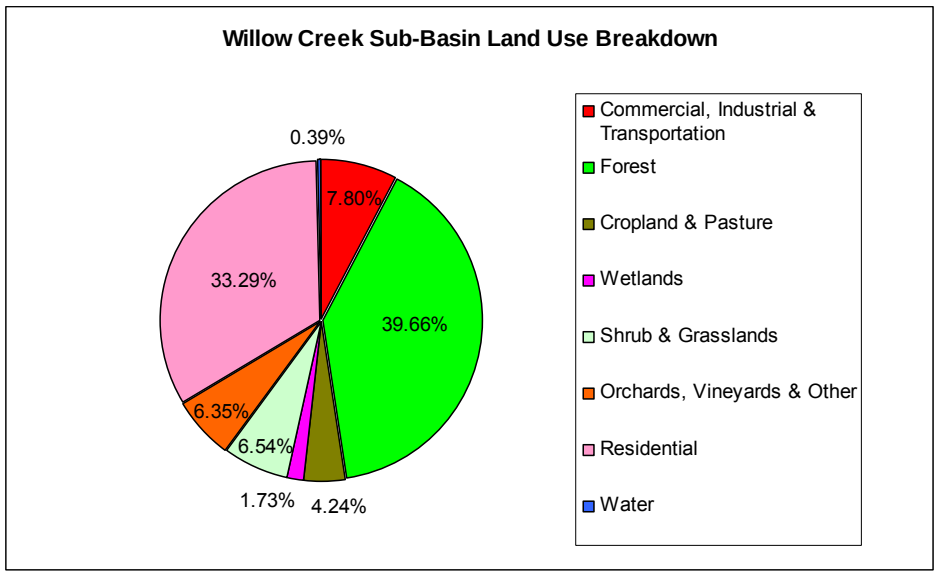


Willow Creek Sub-Basin (2-12)



Willow Creek Land Use (2006)

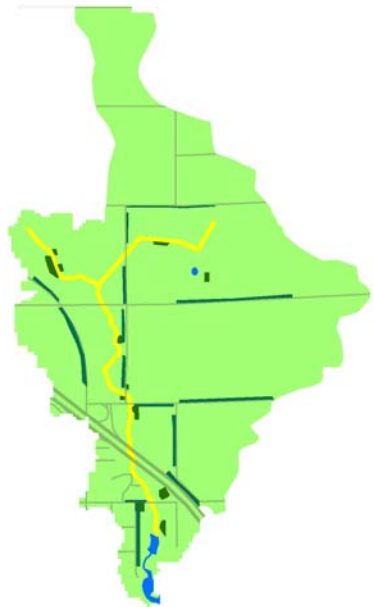




Land Use & Cover Category	Acres
Commercial, Industrial & Transportation	125.65
Forest	638.64
Cropland & Pasture	68.34
Wetlands	27.82
Shrub & Grasslands	105.39
Orchards, Vineyards & Other	102.23
Residential	536.15
Water	6.21
TOTAL	**1610.43**

BMP Application

- Riparian buffers (15 m width): 32.9 acres
- Bioretention (rain gardens): 9.5 acres
- Bioswales (filtering practices): 29.7 acres



Results

Pollutant	Pollutant Load Reduction
Total Nitrogen	↓ 1.82%
Total Phosphorus	↓ 3.31%
Total Suspended Solids	↓ 2.89%

- Pollutant load reductions will vary
  - Different BMPs
  - Combination of BMPs
  - Amount of BMPs

Work Plan / Next Steps

Step 1: Document status/trends of stormwater problem

Step 2: Describe environmental, social, economic causes

- ✓ Presentations to stakeholders/Stakeholder Steering Committee
- ❑ Public meetings (Ongoing)
- ❑ Feedback and input (Ongoing)

Step 3: Generate forecasts

- ✓ Model simulations (PAM, L-THIA, Pload)
- ❑ Stakeholders review future development scenarios

Step 4: Provide technical guidance implementing BMPs

- ❑ Develop menu of site-specific BMPs

Step 5: Present final options

- ❑ Review and revise findings
- ❑ Final report and presentations

Acknowledgements

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- Michigan DEQ