A Successful Lake Management Program for Lake Mitchell

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PROFESSIONAL ENGINEERS AND SCIENTISTS
SPECIALIZING IN WATER RESOURCES

Tonight's Agenda

1. General Review of FYRA Engineering and Qualifications
2. The Challenges Ahead for Lake Mitchell
3. FYRA's 7-Step Process
4. Dispelling Myths and FAQs
5. Potential Project Costs
6. Next Steps

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Water Resources Focus Areas

Dams

Lakes and Water Quality

Rivers and Streams

Stormwater

Levees

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Water Quality Challenges

Algal Blooms

Algal Toxins

Low Clarity

Fish Kills

Recreation/Property
Value Declines

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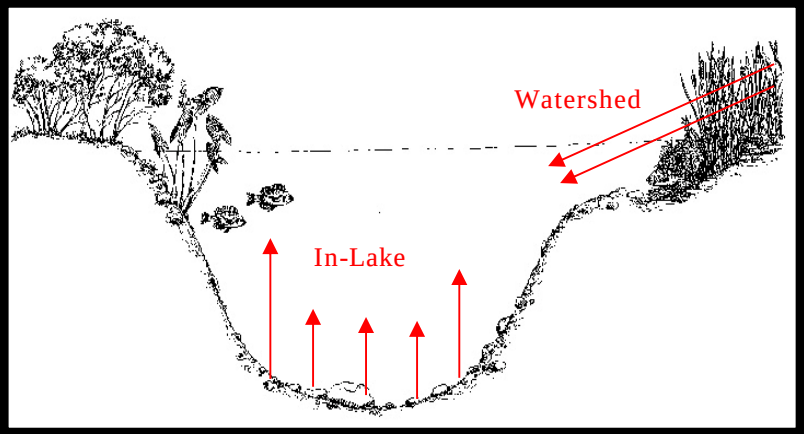
Nutrient Sources in Lakes

- Phosphorus (P) is the key nutrient driving water quality problems in lakes
- P originates from within and outside of lakes
- Successful lake restorations primarily focus on P management



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External Nutrient Sources

Septic Systems

Lawn Fertilizers

Agriculture

Stormwater

Livestock

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Internal Nutrient Sources

- **Leaching from bottom sediments**
- Shoreline erosion
- Sediment resuspension
  - Wind
  - Boating
  - Fish

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Internal Nutrient Sources

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Internal Nutrient Sources

- Leaching from bottom sediments
- Shoreline erosion
- **Sediment resuspension**
  - **Wind**
  - **Boating**
  - **Fish**

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Characteristics of Lake Mitchell

Characteristic	Lake Mitchell
Lake Type	Reservoir
Surface Area (ac)	670
Mean Depth (ft)	13.3
Max Depth (ft)	29.0
Detention Time (d)	77
Watershed Area (ac)	350,960
WS:L	524 : 1
TMDL	1997: Phosphorus

Source: Numberg & Osgood, 2002

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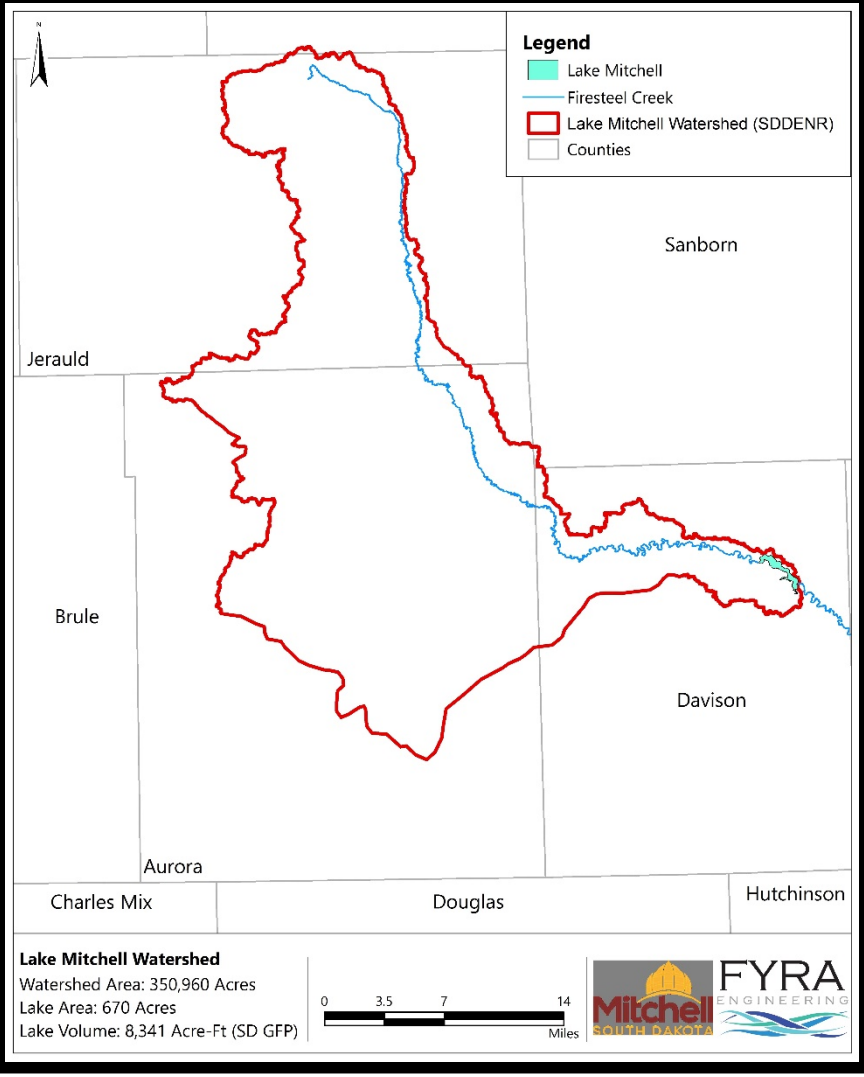
Lake Mitchell Watershed



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Average Summer Water Quality

Parameter	Lake Mitchell
Total Phosphorus (µg/L)	318
Dissolved Phosphorus (µg/L)	245
Secchi Disk Depth (in)	24.9
Chlorophyll *a* (µg/L)	19.1
Dominate Algae	*Aphanizomenon*
Trophic State	Hypereutrophic

Source: Numberg & Osgood, 2002

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7 Steps of Lake Management

1. **Problem definition**
2. Water budget and nutrient mass balance
3. Pollutant load and lake response modeling
4. Management plans
5. Alternatives/cost analysis
6. Management practice design and implementation
7. Water quality monitoring

Community Based Planning

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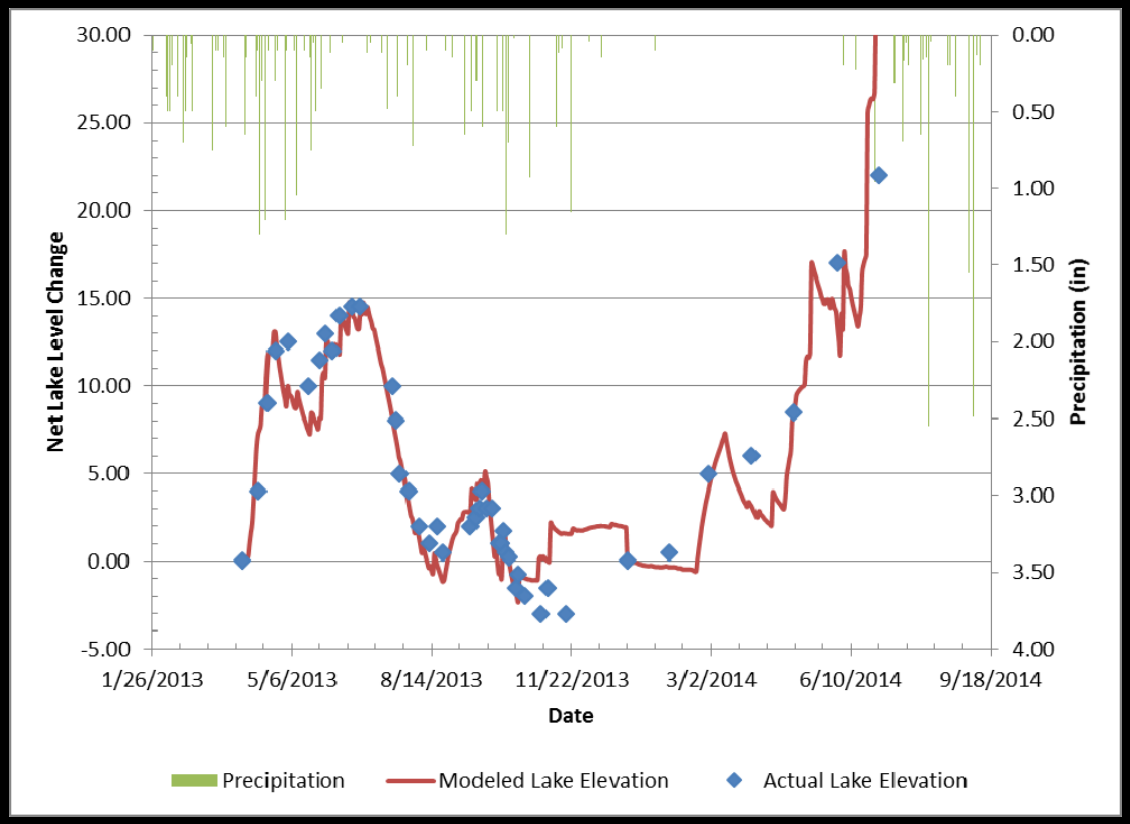
7 Steps of Lake Management

2. Water budget and nutrient mass balance



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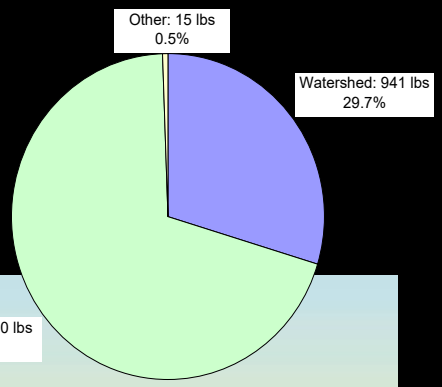
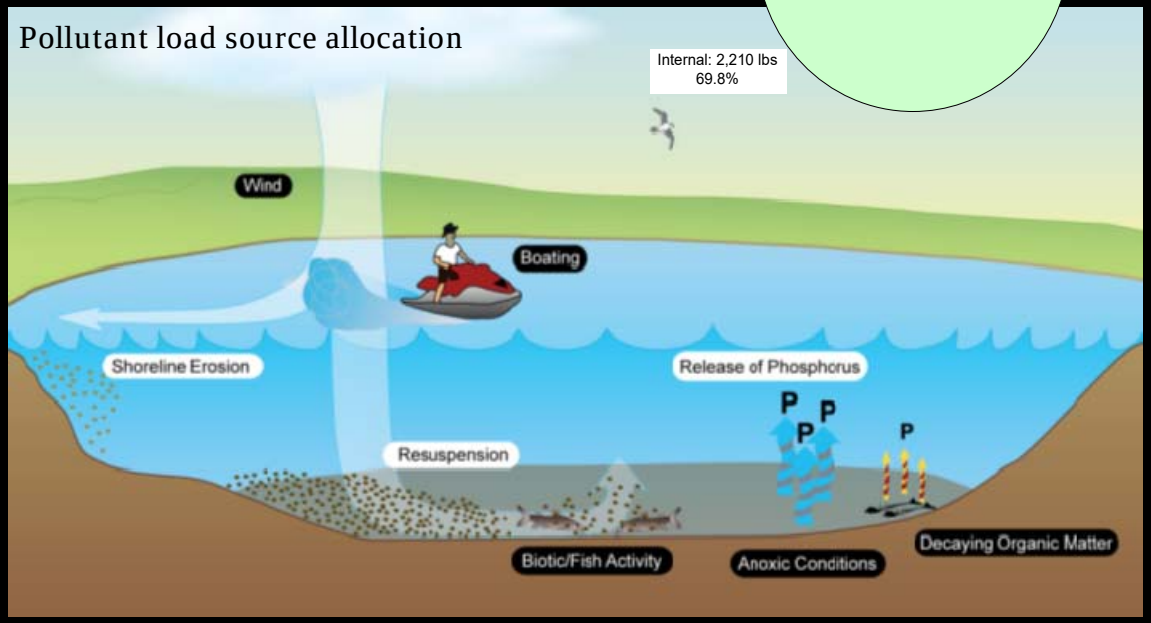
7 Steps of Lake Management

3. Pollutant load and lake response modeling





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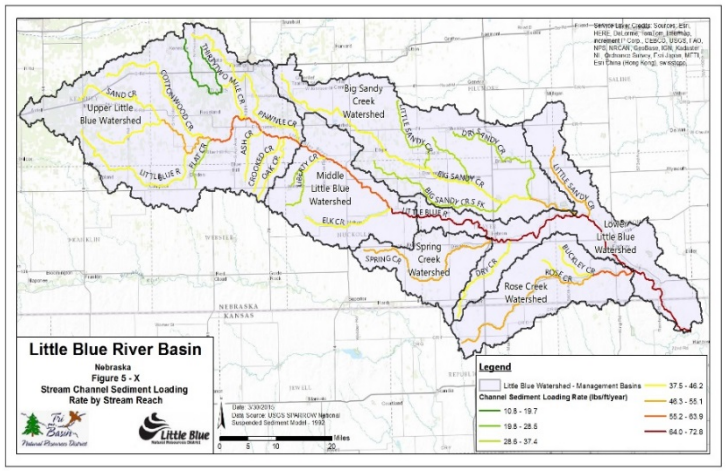
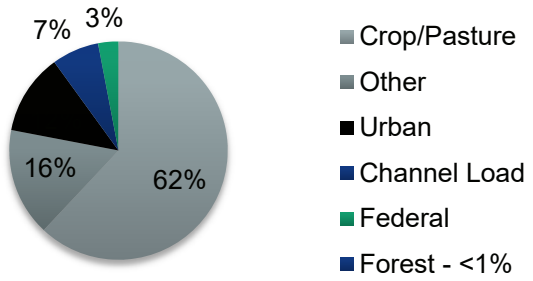
7 Steps of Lake Management

4. Management plans





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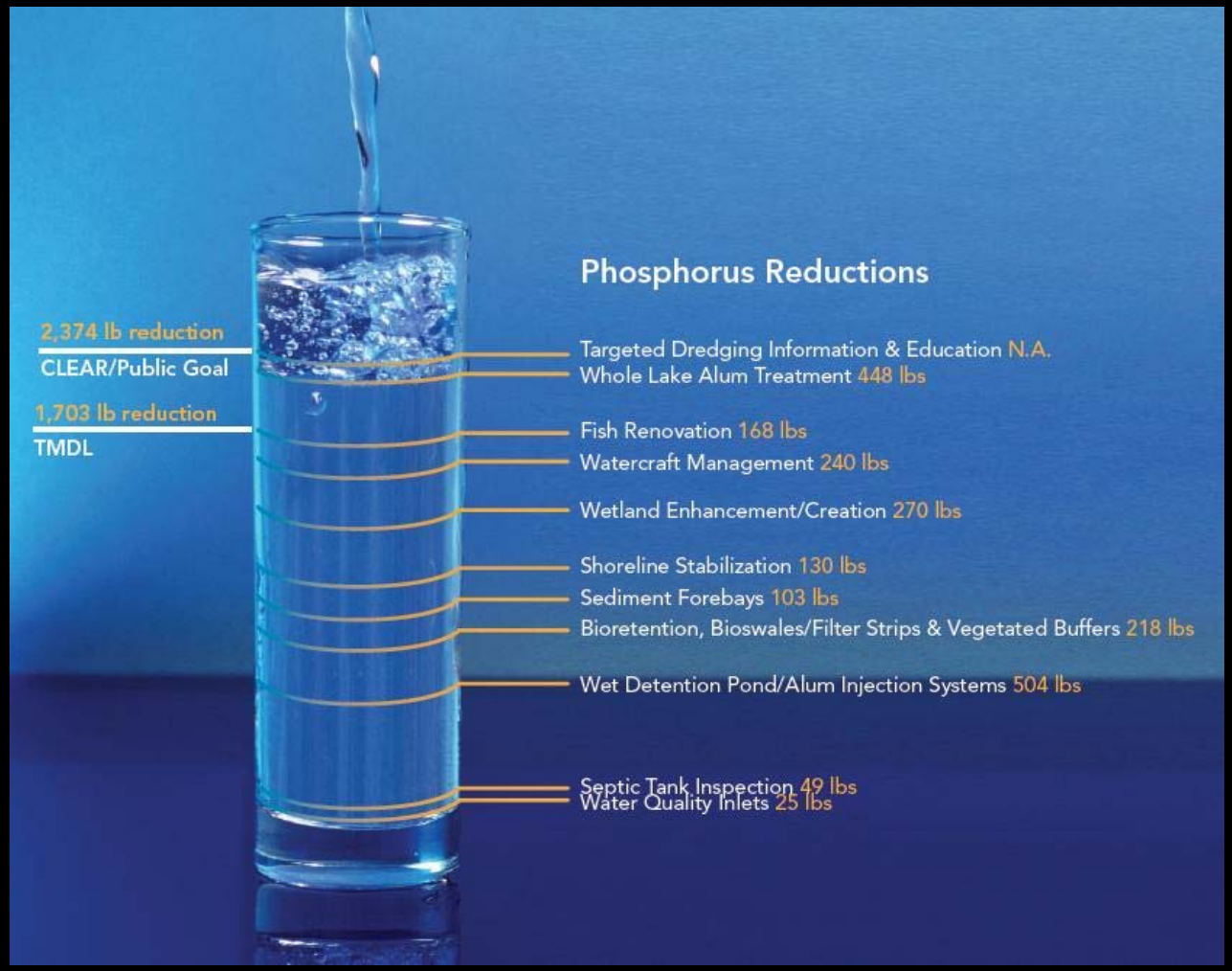
7 Steps of Lake Management

5. Alternatives/cost analysis



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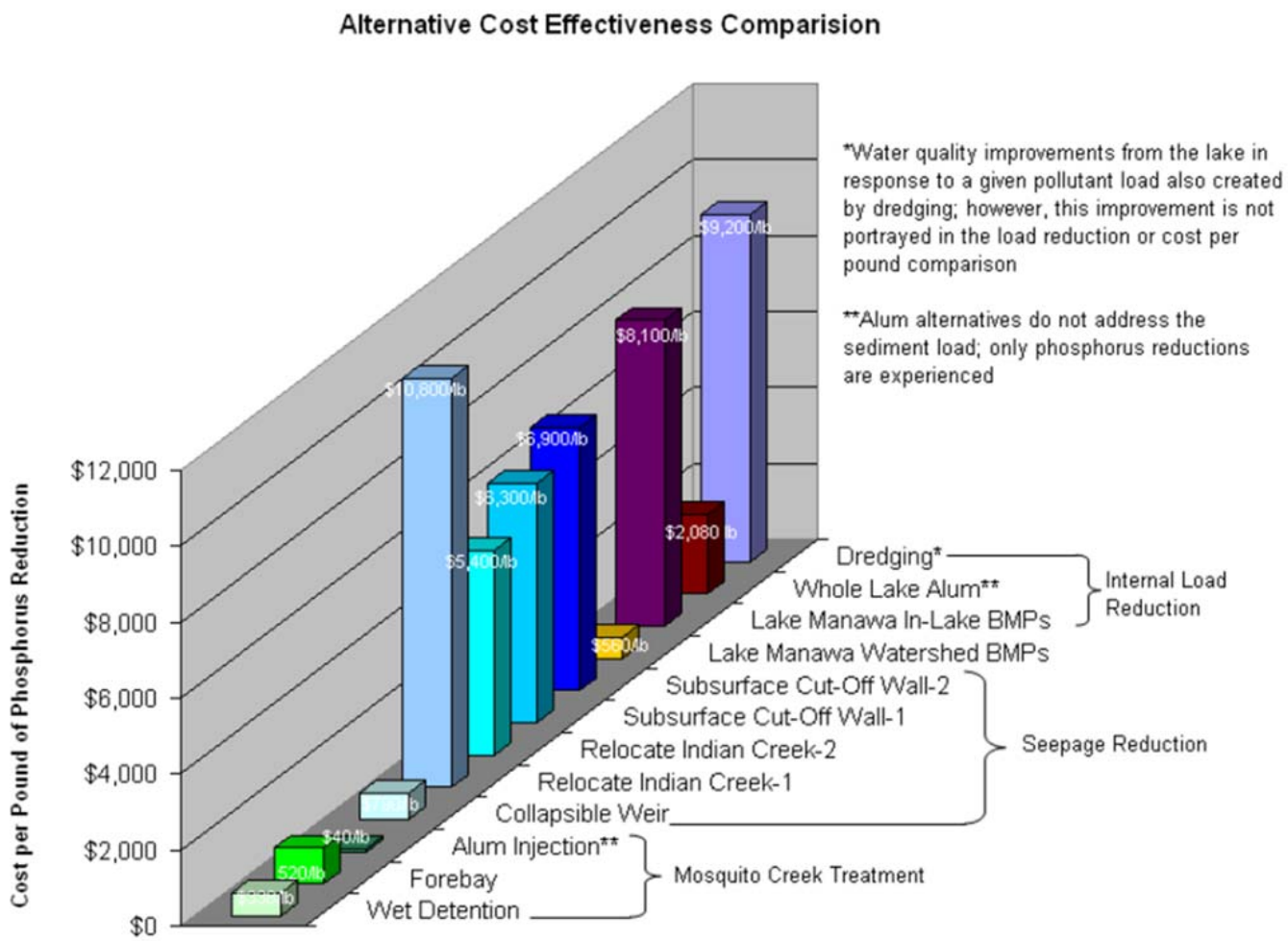

7 Steps of Lake Management

6. Management practice design and implementation

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7 Steps of Lake Management

7. Water quality monitoring

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Community Based Planning

- Watershed Advisory Council
  - determines issues/identifies benefits of water quality improvement
  - sets goals for the project
  - builds consensus and support
- Technical Advisory Team made up of agencies and local leaders to provide technical and financial resources
- FYRA organizes, guides and facilitates the CBP process

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Sustainability, Results & Expectations

Sustainability

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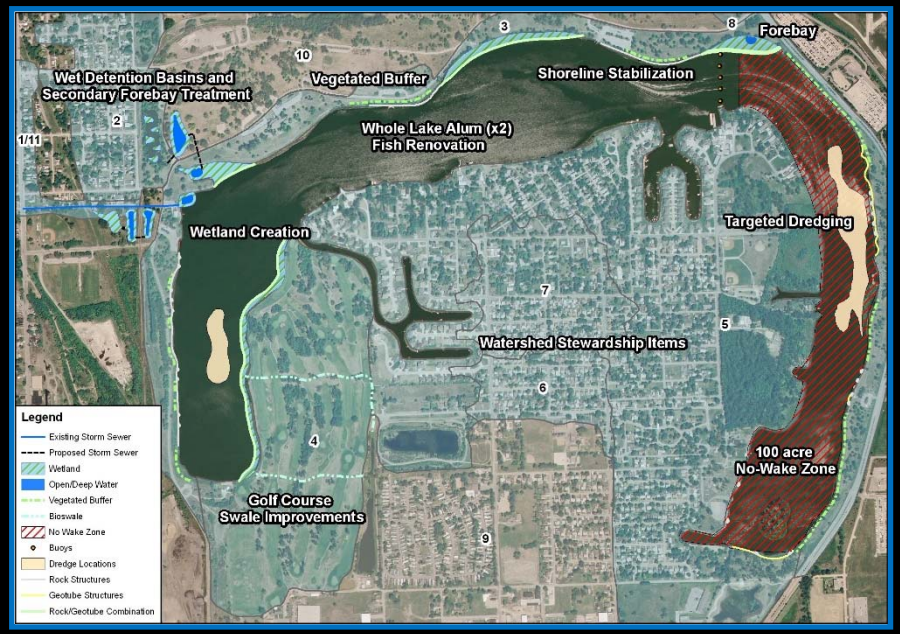
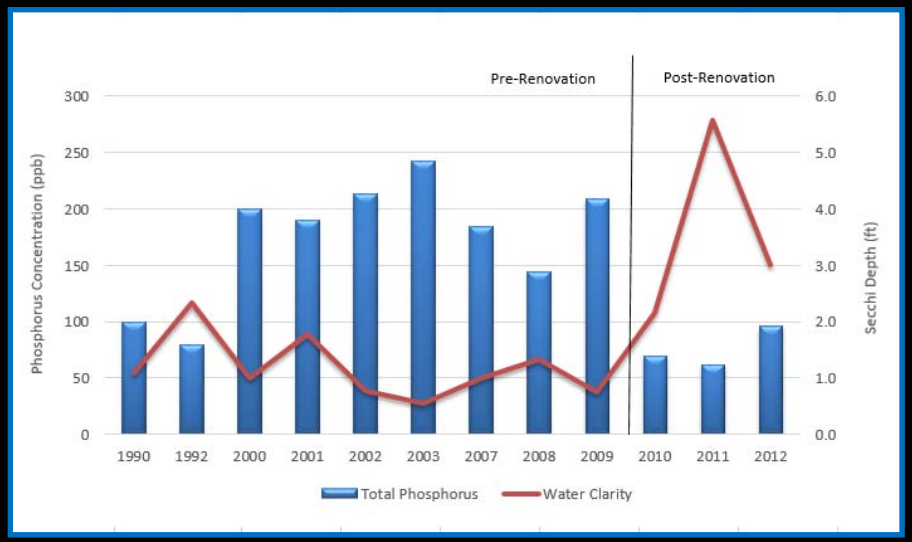
Sustainability, Results & Expectations

Results





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Sustainability, Results & Expectations

Expectations

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Dispelling Myths and FAQs

We Don't Need Another Study!

FYRA is not proposing a study. The Scope of Work we are proposing;

1. Develops a tool that can be used to formulate a plan

2. Quantifies and segregates the source of nutrients

3. Identifies (through the identification of sources) agencies and grant programs available to help meet nutrient reduction goals

4. Begins the public educational process and brings potential partnership agencies to the table to help establish goals for the lake

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Dispelling Myths and FAQs

This money could be better spent on some things we already KNOW need to happen

Right now, nobody knows what potential effects any BMP may have on nutrient reduction. Until a calibrated tool is developed to predict lake response, you may be wasting your money.

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Dispelling Myths and FAQs

We'd be better off hiring somebody local

FYRA came to Lake Mitchell. We know you are facing big challenges. We embrace challenging projects (including divided communities.) FYRA does lake restoration projects different than others. We are proposing something of a paradigm shift in how these projects are done here in South Dakota. Local engineers do not have the experience we have at FYRA. Lake Mitchell <u>needs</u> focused expertise on this project.

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Dispelling Myths and FAQs

The challenges we're facing are too big to overcome

First, no challenge is too big to overcome. The question is, what expense/effort is necessary to meet goals and expectations.

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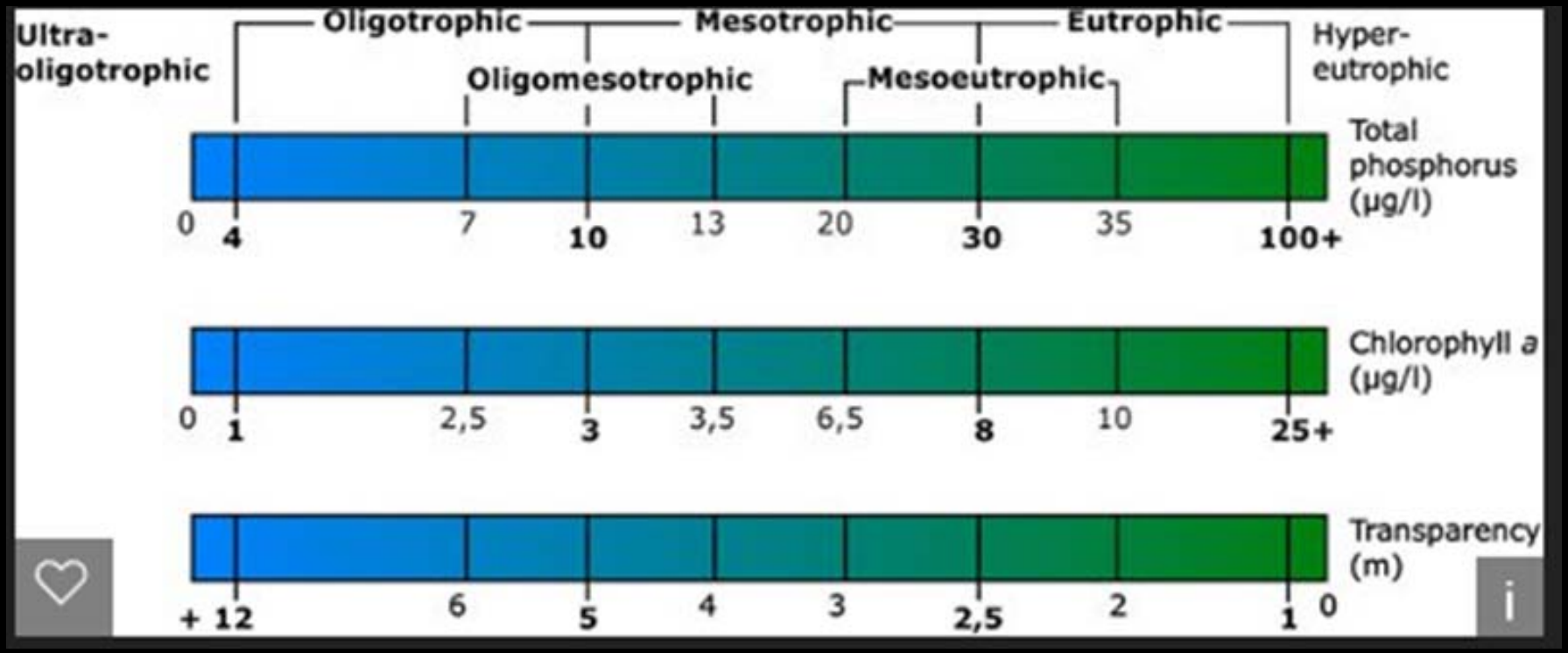
Dispelling Myths and FAQs

The challenges we're facing are too big to overcome



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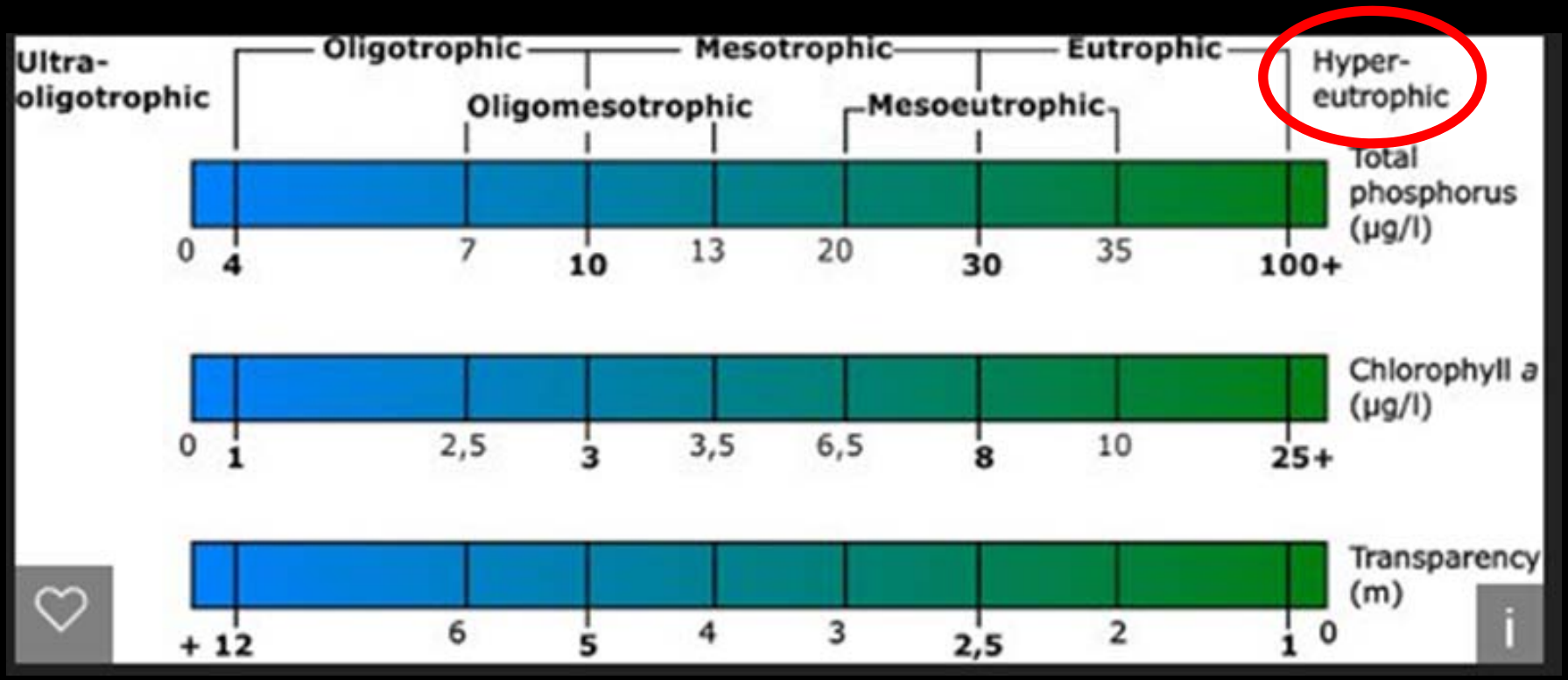
Dispelling Myths and FAQs

The challenges we're facing are too big to overcome

318 mg/l



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Dispelling Myths and FAQs

What does project success look like?

PROJECT SUCCESS means achieving the goals and expectations set forth by the stakeholders.

Short Term, that is achieved through benchmarks set through the CBP process. The first benchmark is doing something.

Long Term, it means reaching the goals set forth in the CBP process coupled with a plan to sustain the progress made.

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Dispelling Myths and FAQs

We already know what the problems are…..

Nutrient source identification is only part of the solution. These sources need to be identified quantitatively and not just qualitatively. If we keep the cows from wallowing in the drainageways upstream, how much does that reduce nutrient delivery to Lake Mitchell? What part of the total nutrient reduction needed to meet clarity and quality goals does this effort represent? No one knows the answer to these questions today.

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Dispelling Myths and FAQs

How much is this going to cost?

The further into the project we try and predict costs, the less accurate we will be.

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Lake Mitchell Restoration Project: Phase I

1. **Problem definition**
2. **Water budget and nutrient mass balance**
3. **Pollutant load and lake response modeling**
4. Management plans
5. Alternatives/cost analysis
6. Management practice design and implementation
7. Water quality monitoring

Community Based Planning

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1. Problem Definition Tasks

1. Analyze available data
2. Basin inventory
3. Identify data gaps
4. Collect additional data
5. Review information with client
6. Task 1 Fee: $25,020

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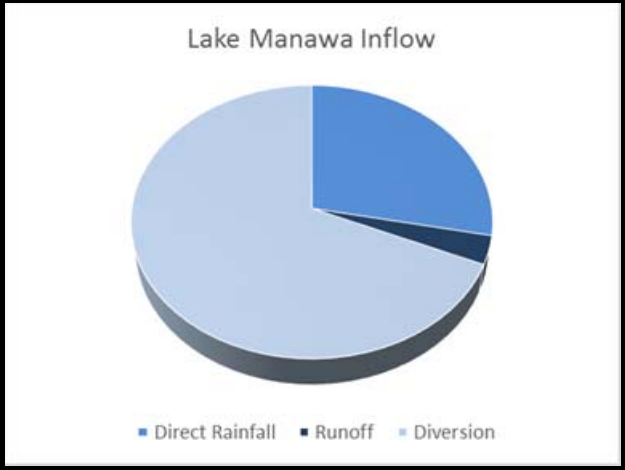
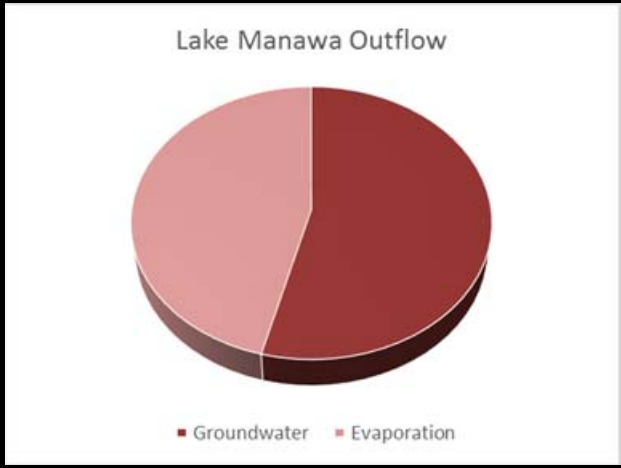
2. Water Budget/Nutrient Mass Balance Tasks

1. Gather and prepare existing data
2. Model construction
3. Model calibration and adjustment
4. Model reporting
5. Review information with client
6. Task 2 Fee: $10,830





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3a. Pollutant Load Tasks

1. SPARROW analysis
2. Watershed/STEPL modeling
3. Figures and sub-basin summaries
4. Review information with client
5. Task 3a Fee: $12,665

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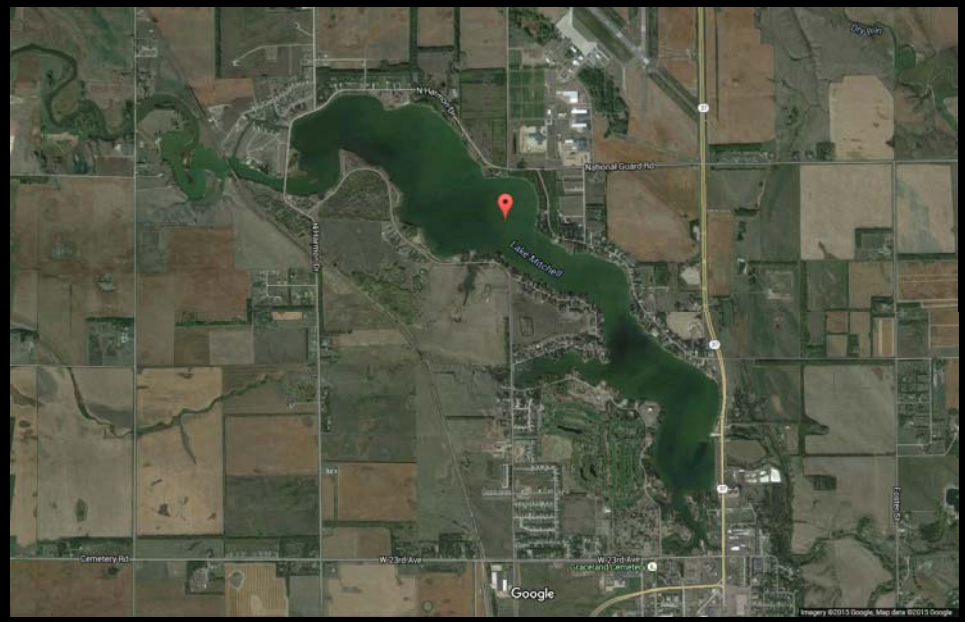
3b. Lake Response Modeling Tasks

1. Gather and prepare existing data
2. Model construction
3. Model calibration and adjustment
4. Model reporting
5. Review information with client
6. Task 3b Fee: $10,810



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4. Community Based Planning

1. Conduct public meeting
2. Establish Watershed Advisory Committee (WAC)
3. Establish Technical Advisory Committee (TAT)
4. Define committee goals and tasks
5. Review process and progress with client
6. Task 4 Fee: $14,400

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Total Phase I Fee

Problem Definition Tasks Task 1 Fee: $25,020

Water Budget/Nutrient Mass Balance Task 2 Fee: $10,830

Pollutant Load Task 3a Fee: $12,665

Lake Response Modeling Task 3b Fee: $10,810

Community Based Planning Fee: $14,400

Total Phase I Fee: $73,725

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Future Phases

Phase 1: TOOL DEVELOPMENT PHASE

- Build Predictive Model(s)
- Begin CBP Process
- Identify and Begin I&E and work on "low hanging fruit"

Phase 2: PROJECT FORMULATION PHASE

- Build partnerships with stakeholder agencies
- Develop project alternatives
- Seek out funding opportunities
- Refine goals, objectives and financing plan

Phase 3: PROJECT IMPLEMENTATION PHASE

- Construct Project
- Implement Better Management Practices

Phase 4: MONITORING PHASE

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