Targeted Conservation: How to use Data and Economics to Maximize the ROI of Conservation

2025 National No-Tillage Conference

Mike Kinney, District Administrator
Comfort Lake-Forest Lake Watershed District

CLFLWD
WATERSHED DISTRICT

33rd Annual NATIONAL NO-TILLAGE CONFERENCE
January 7-10, 2025 • Louisville, Ky.

Presenter

Mike Kinney, District Administrator

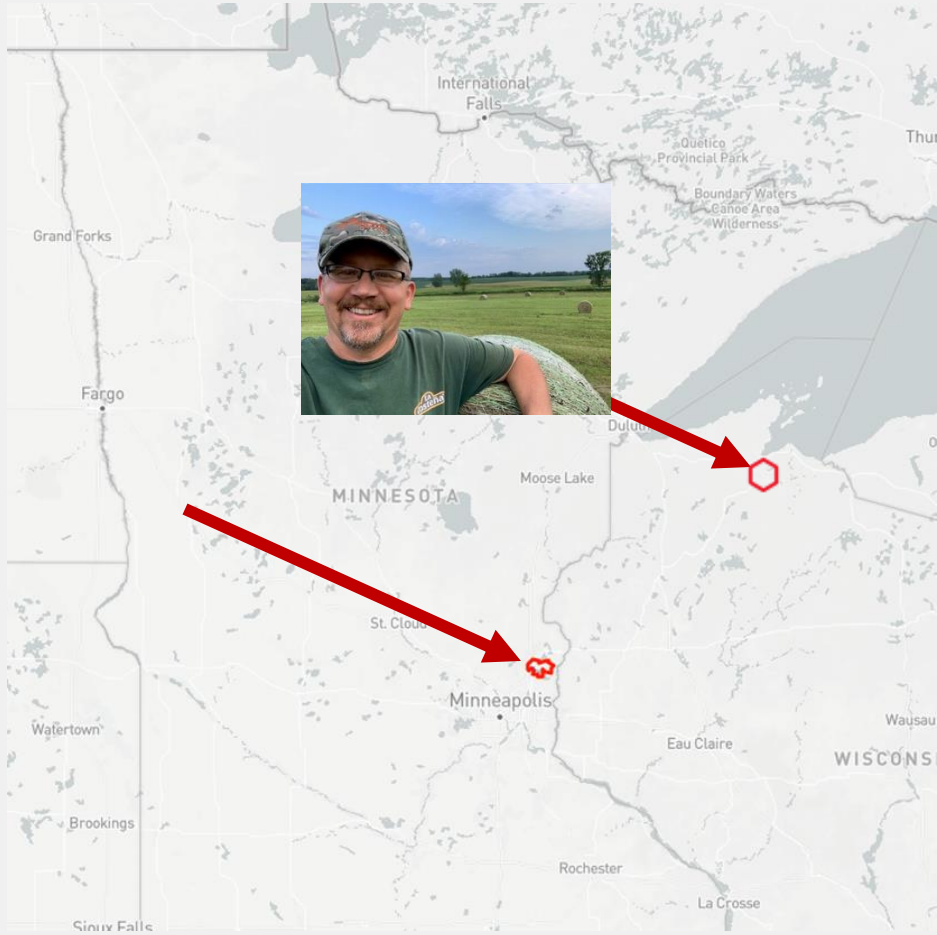
Comfort Lake-Forest Lake Watershed District

- Administrator at CLFLWD since 2014
- >30+ years of experience in watershed mgmt.
- Background in farming, agronomy, economics, project mgmt., hydrogeology, water resources
- Aim to balance economics/ROI with conservation & WQ improvements by maximizing fiscal and staff resources with highly focused work at CLFLWD

Watershed Location:

Comfort Lake-Forest Lake Watershed District

- Office in Forest Lake, MN
- Northeast Twin Cities Metro Area
- Lower St. Croix River Basin
- Watershed district boundaries based on hydrologic boundaries
- Intersection w/ multiple counties, cities



Session objectives:

- Learn about pioneering ways to quickly identify water quality issues on a watershed wide scale.
- Using data and economics to assess what BMPs or projects fit your budget and ROI goals.
- Learn about innovative approaches and incentives for landowners to help reach watershed conservation and water quality goals.
- Q: How many of you are involved in farmer led councils, conservation groups, school boards, town boards or committees, etc.?

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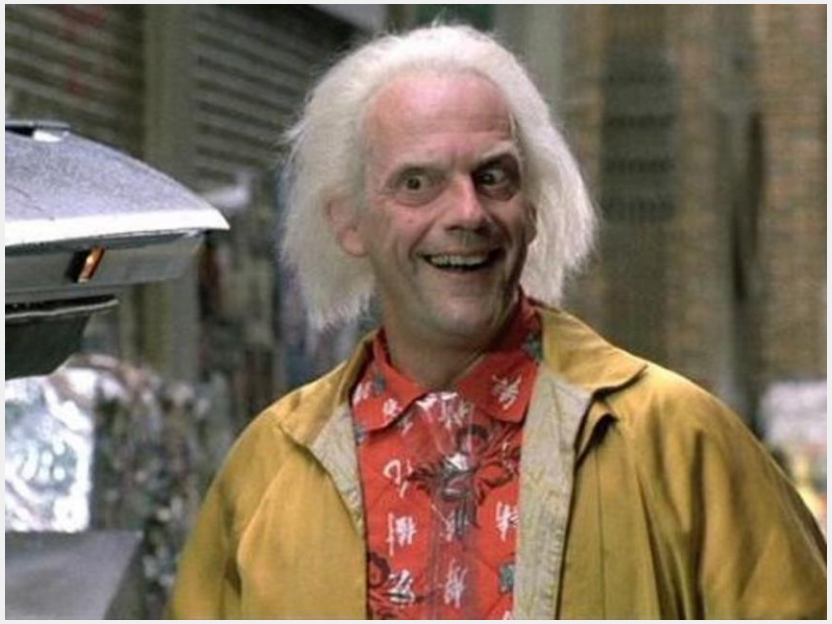
- Q: How many of you are involved in farmer led councils, conservation groups, school boards, town boards or committees, etc.?

Question?

- Does your agency, organization or non-profit have unlimited funds?

  If you answered **YES**; the rest of this presentation is optional.



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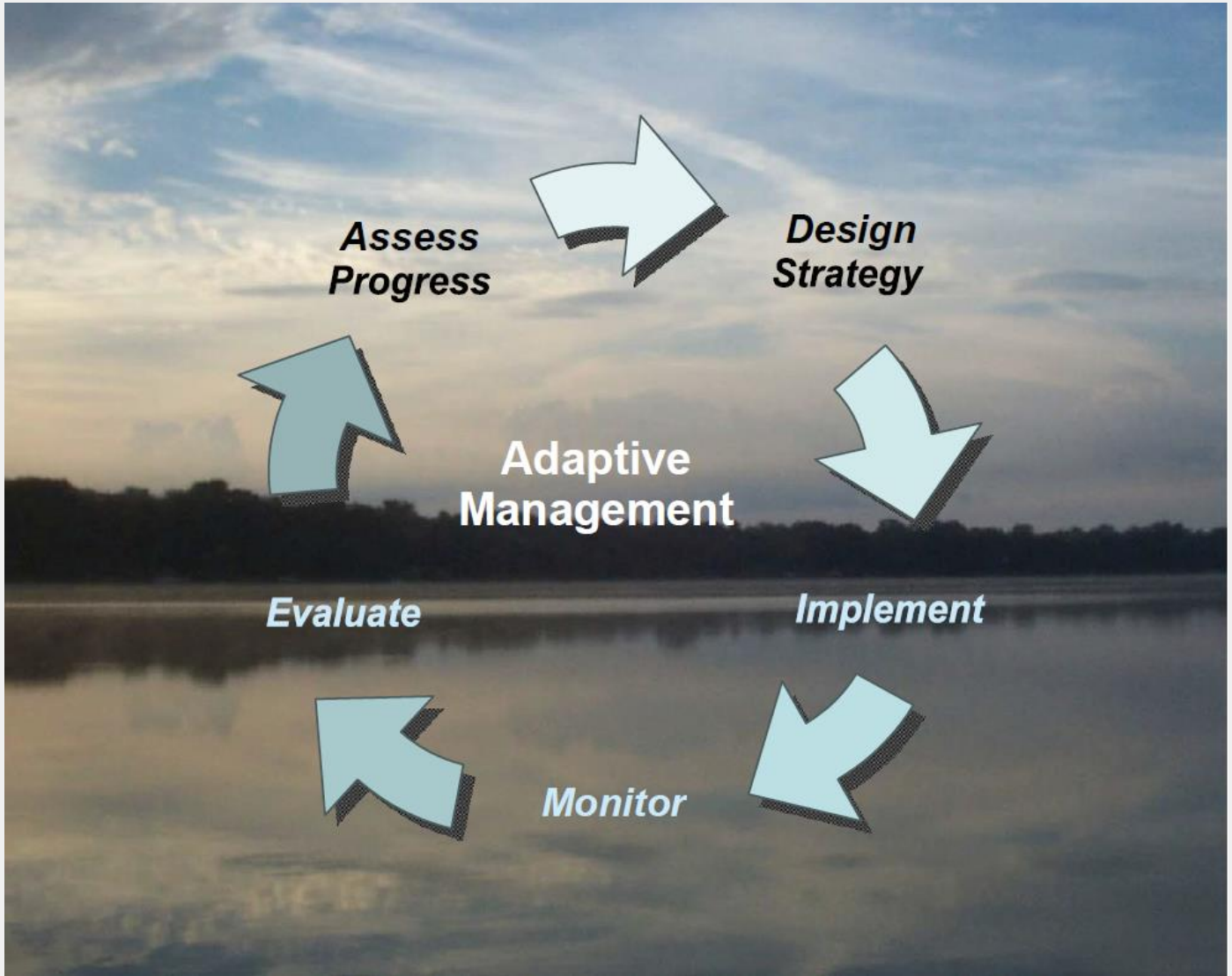
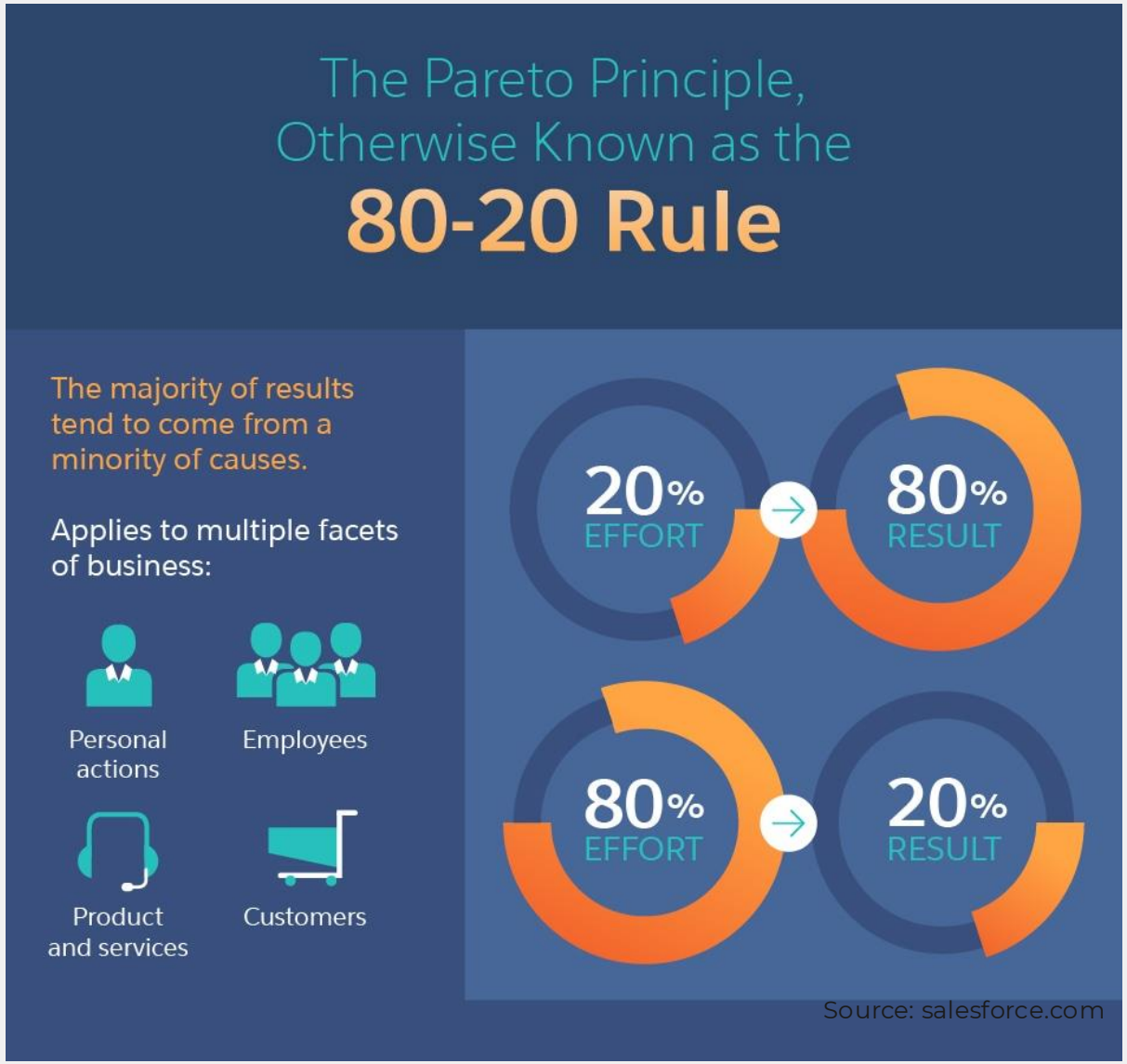
Adaptive Management



Pareto Principle – 80/20 Rule

- **Applies to all conservation work as well as business**
- **Sequential Diagnostic Monitoring identifies the**
  - **20% of effort (projects) needed to achieve**
  - **80% of the result (nutrient reductions, sediment, etc.)**



3 Types of Monitoring Available

Baseline Monitoring

- Used to establish lake and river conditions
- Limited in function but the most commonly used data points

Sequential Diagnostic Monitoring

- **Starts from the water body of concern and systematically works upstream**
- **Both time (patience) to collect samples, and timing of collection are important**

Effectiveness Monitoring

- **Used post-construction to verify data used for calculations.**

Merging Adaptive Management, Sequential Diagnostic Monitoring and Economics

1. Focused diagnostic monitoring of impaired waterbodies highlights the nutrient hot spots with the greatest ROI.
2. Process develops side benefits
   - E.g., wetland habitat, groundwater improvements
3. Takes the randomness out of the selection process (Not all projects are good projects)
4. Good data = results = grant dollars
   - Ranks high in competitive programs
5. Continuous process of improvement

Prioritized, Targeted, Measurable

Prioritized, Targeted, Measurable

Prioritize

- Identify priority resources (e.g., lakes)
- Identify priority concerns
- Identify measurable goals

Target

- Location
- Activity Type
- Timing

Measure

- **Desktop analysis is NOT enough**
- **Collect real data**
- Cost-effective DIY options exist

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The role of lake sediment cores in real-world lake management

Sediment core shortly after collection

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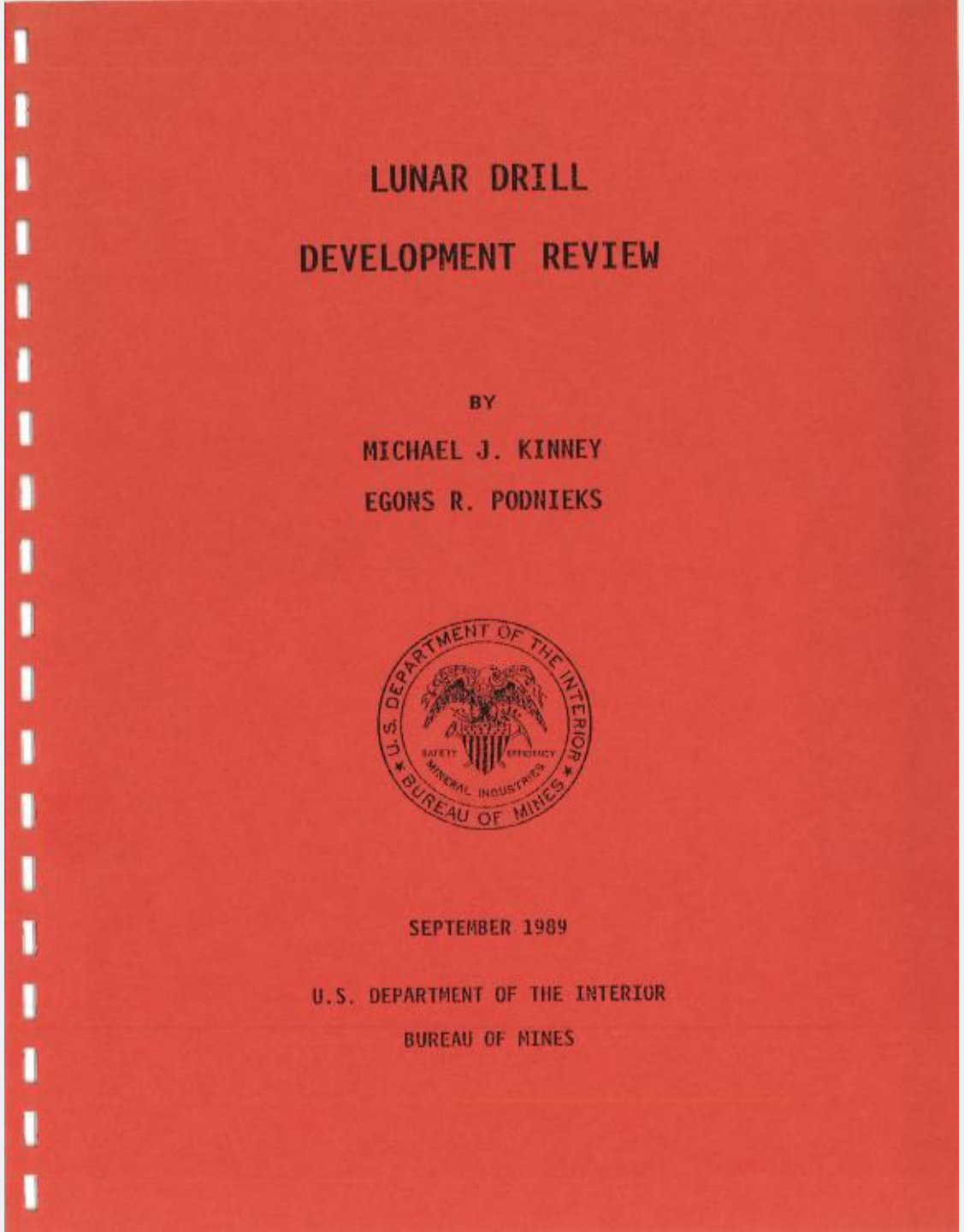
Use the knowledge and experience that others have already learned.


LUNAR DRILL

DEVELOPMENT REVIEW

BY

MICHAEL J. KINNEY

EGONS R. PODNIEKS

SEPTEMBER 1989

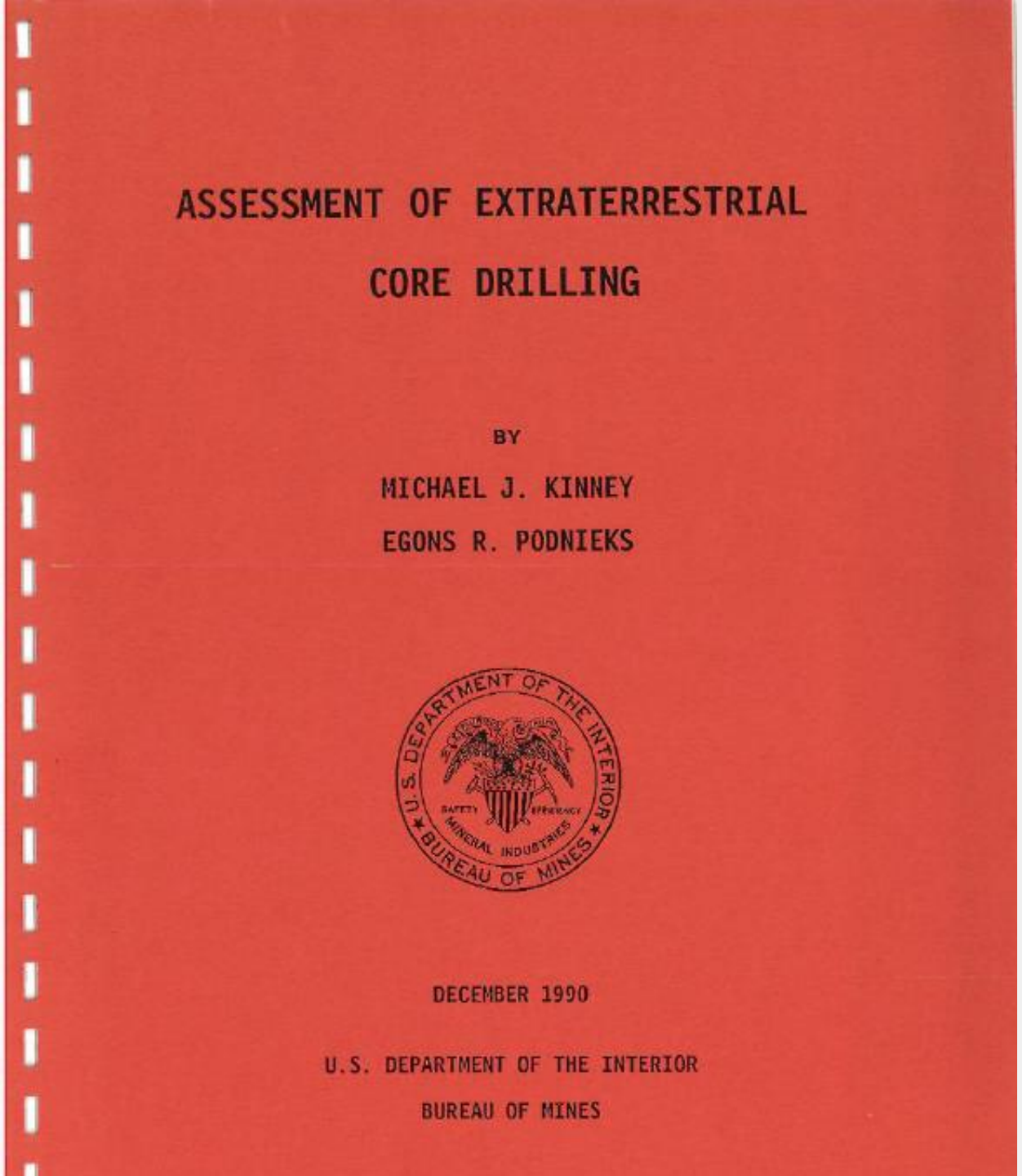
U.S. DEPARTMENT OF THE INTERIOR

BUREAU OF MINES

Research objective was to provide a recommendation for the Mars Sample Return Mission…

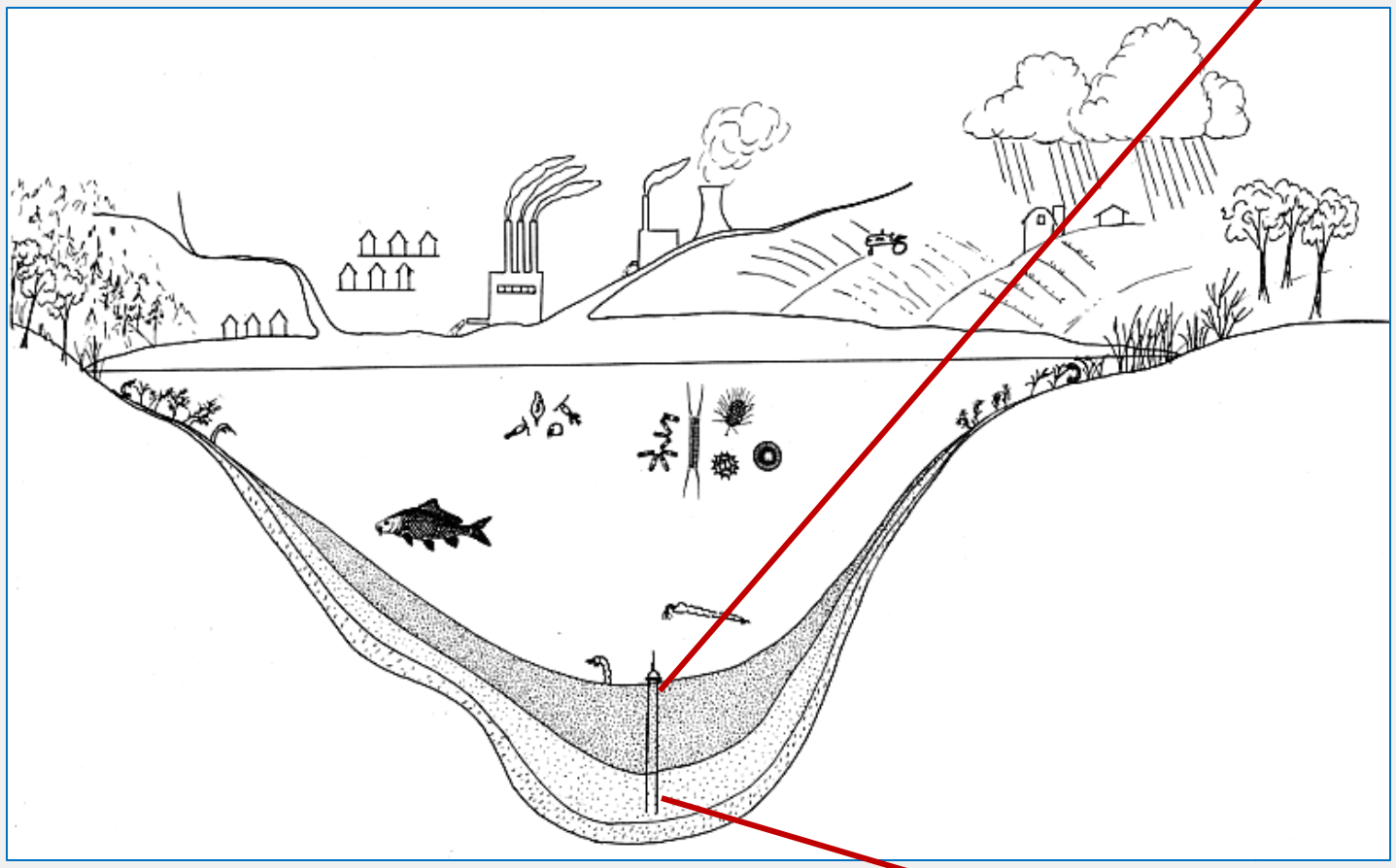
Then scheduled for the late 1990's.

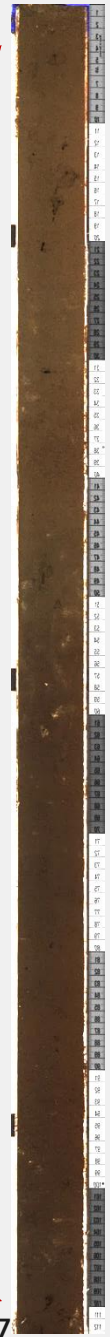
But it's still in the planning phase.



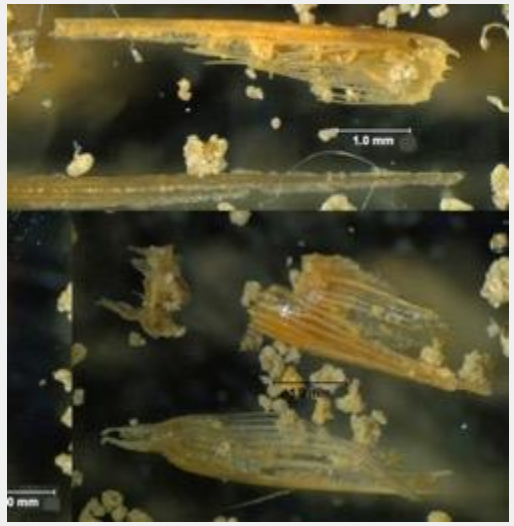
Sediment in lakes

- Every lake accumulates sediments
- Go back 10s-1000s years
- Tools for guiding mgmt
- How much/when did they change?
- Are they getting better?



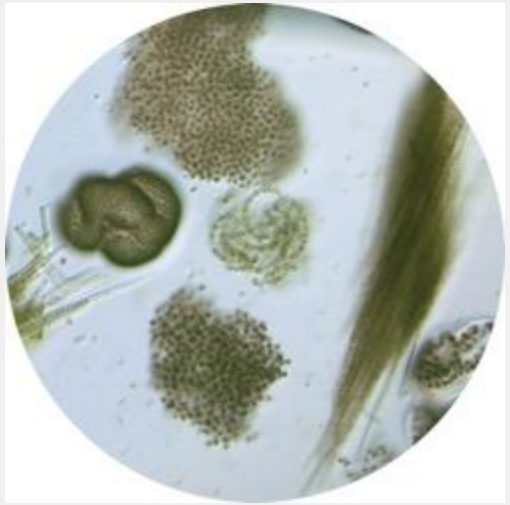


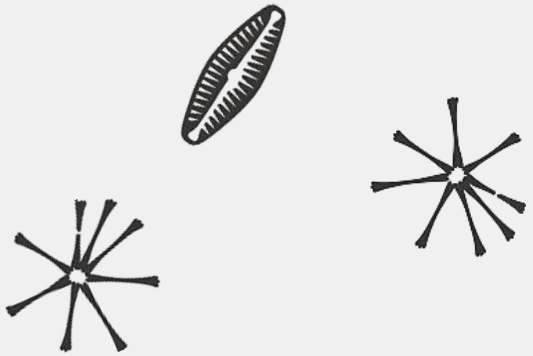
What we can measure in a core



Pb-210
Minerals
Organics
Plants
Algae
Pollen
Fish
Insects
Diatoms

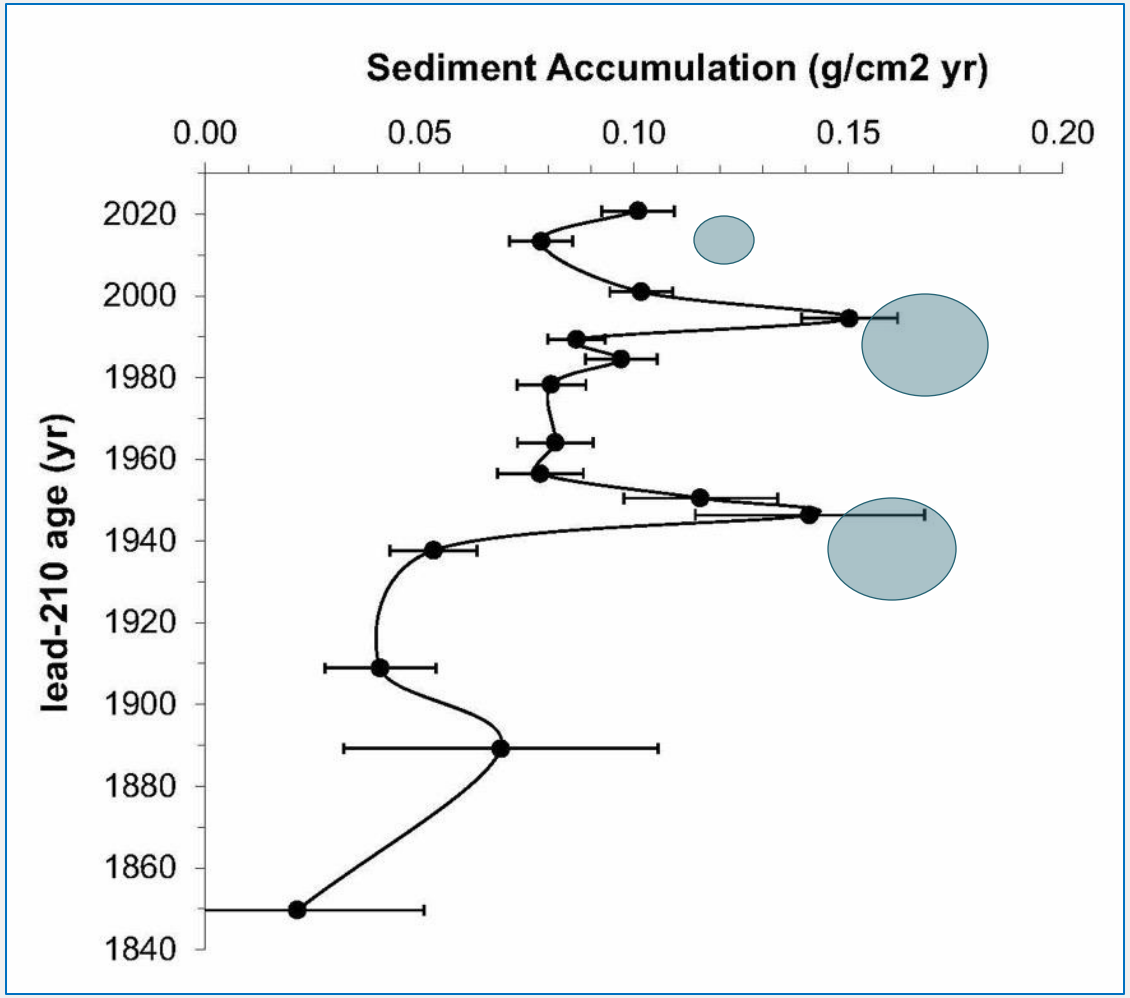
Zooplankton
eDNA
AIS
P-fractions
Silica
Cyanotoxins
Isotopes
Pigments



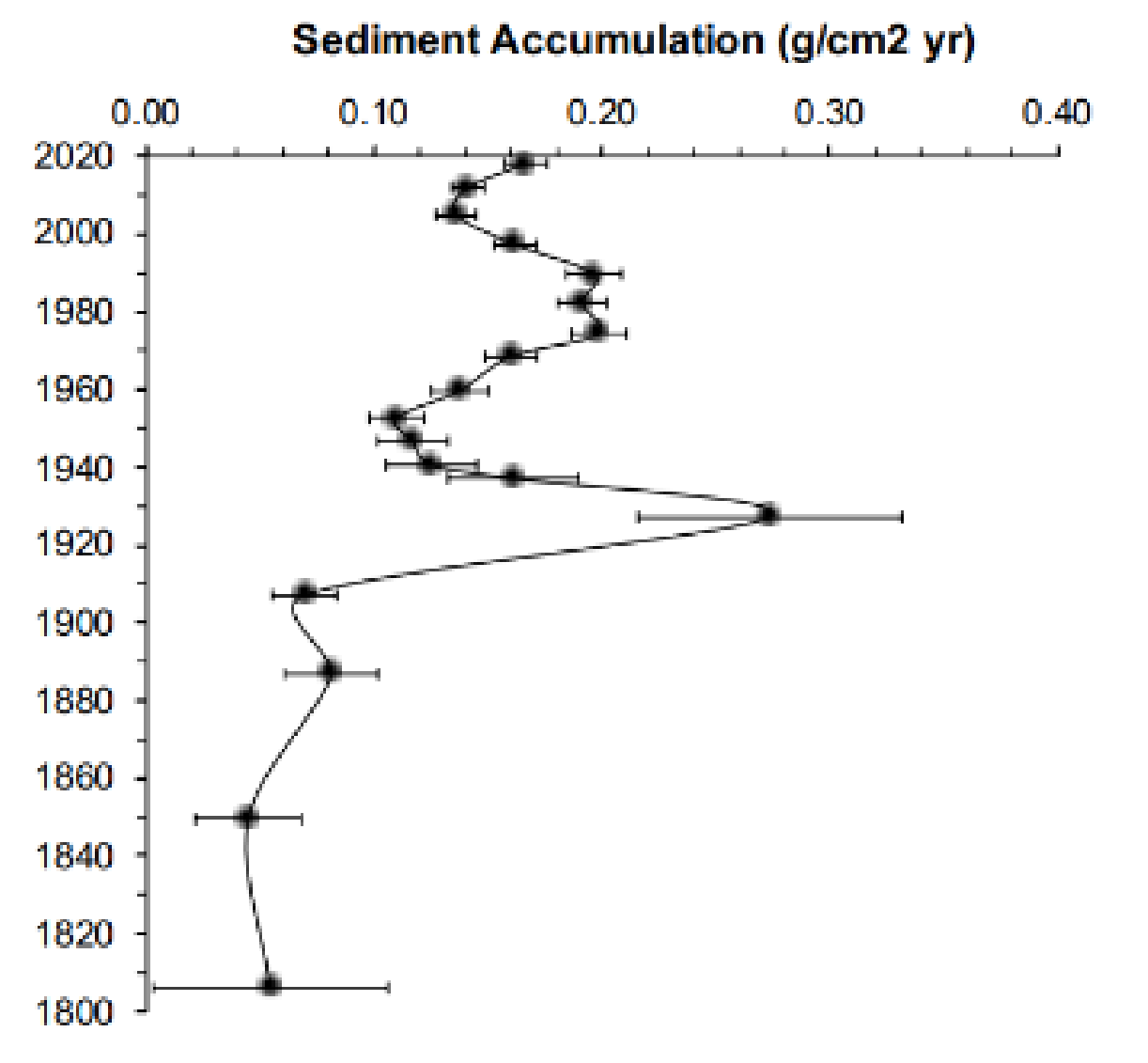


What the cores tell us, Little Comfort

- Sharp **rise in the sedimentation** rate in the 1940s
- BSi flux, TP flux, and algal pigment concentrations all **increased in the 1940s** and have remained elevated
- Timing of disturbance coincides with **highway construction** between Comfort and Little Comfort



Sedimentation Rate – Bone Lake



- Rise in the sedimentation rate in the 1920s/30s and again in 1970s/1980s.
- Some decline since the peak in 1990s.
- Current sed rate is about double what it was in the late 1800s/early 1900s.

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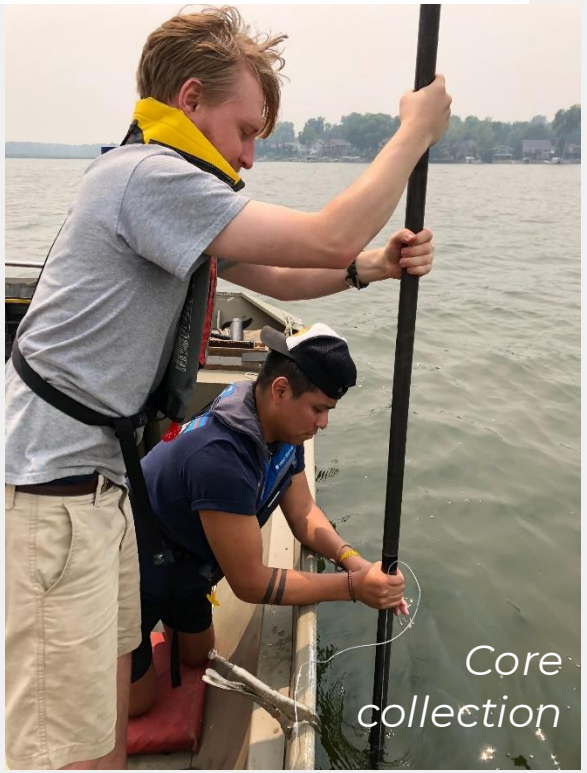
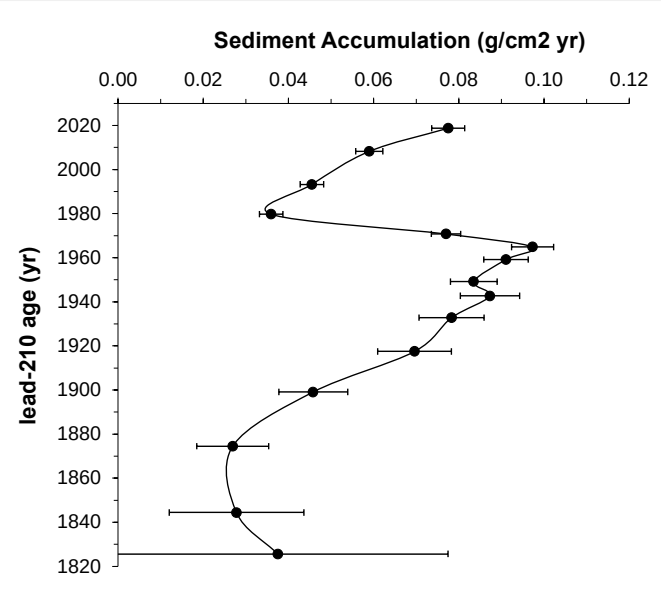
Forest Lake Deep Sediment Cores

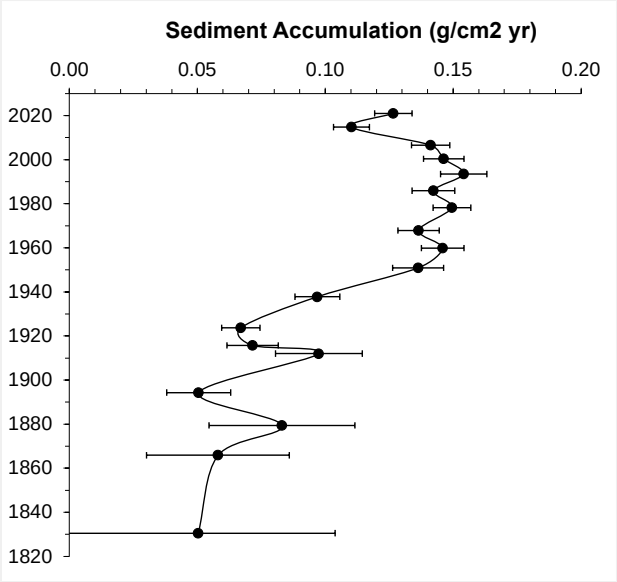
- Cores collected on all 3 basins in 2021, results provided in 2022
- Results show history of the lake, pre-settlement conditions, and inform what water quality goals are achievable

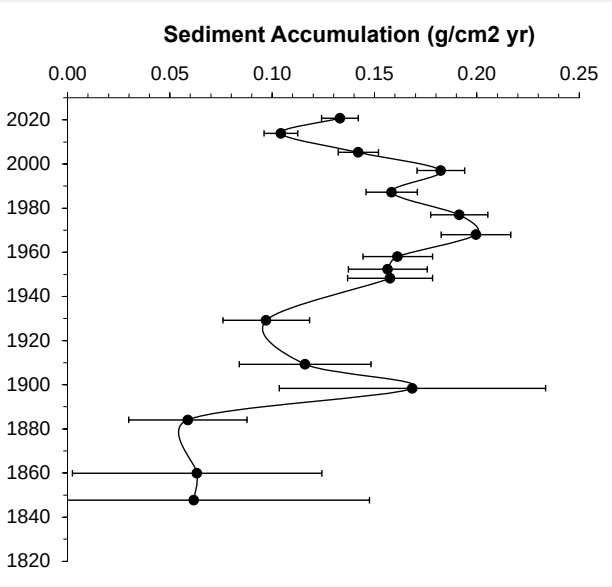


Sedimentation Rate – Forest Lake

West Basin | Central Basin | East Basin

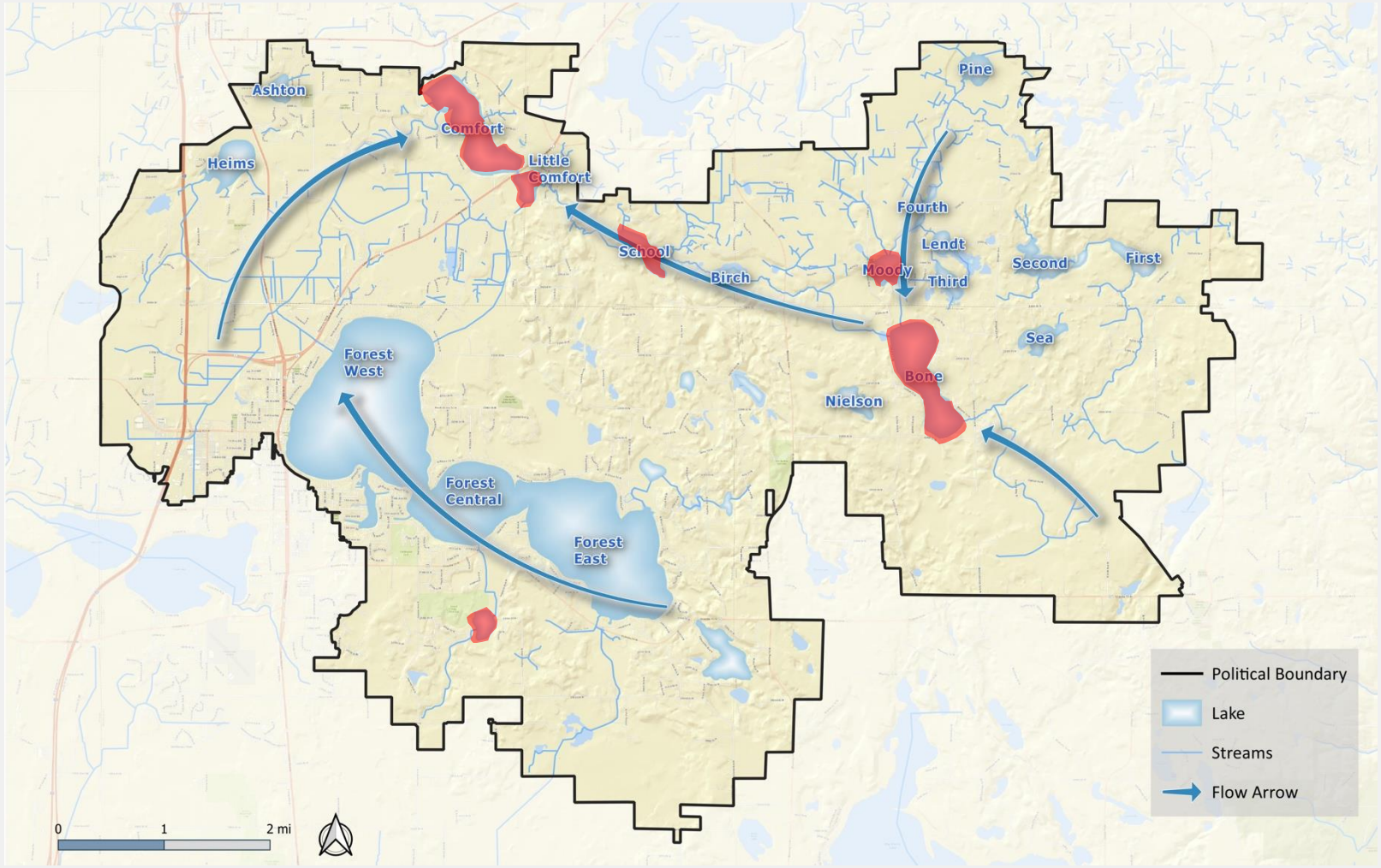






- Sed rate highest in East basin, lowest in West basin.
- Increases in sed rate in all basins in late 1800s/early 1900s (consistent with Phase I and II lakes).
- Similar patterns in Central and East basins – both show declines in sedimentation in recent decades, with potential reversal of that pattern in most recent years.
- West basin shows steady rise in sed rate since the 1980s.

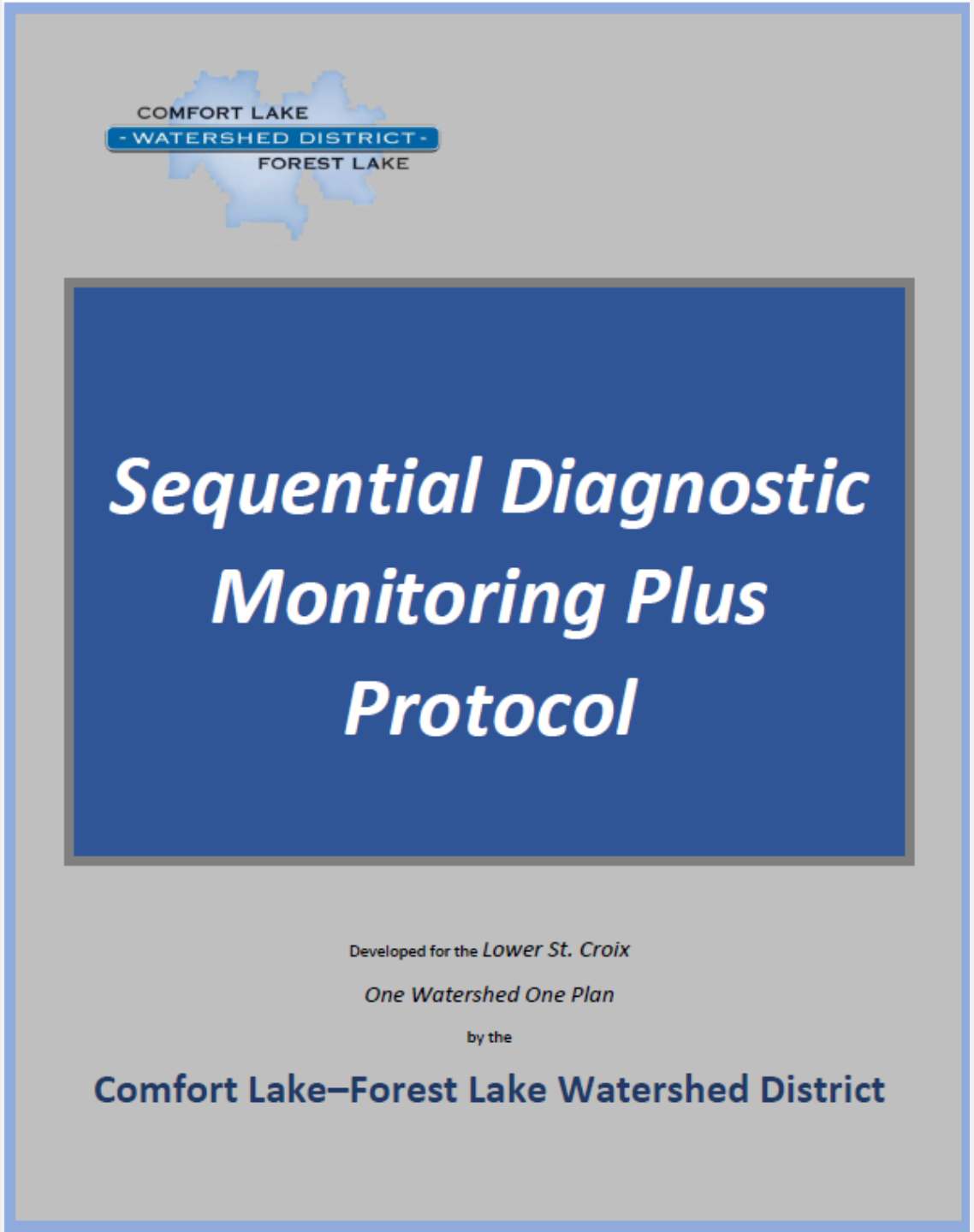
Targeted Top-Down Approach



Nutrient-impaired lakes w/ TMDL shown in red: Moody, Bone, Shields, School, Little Comfort, Comfort

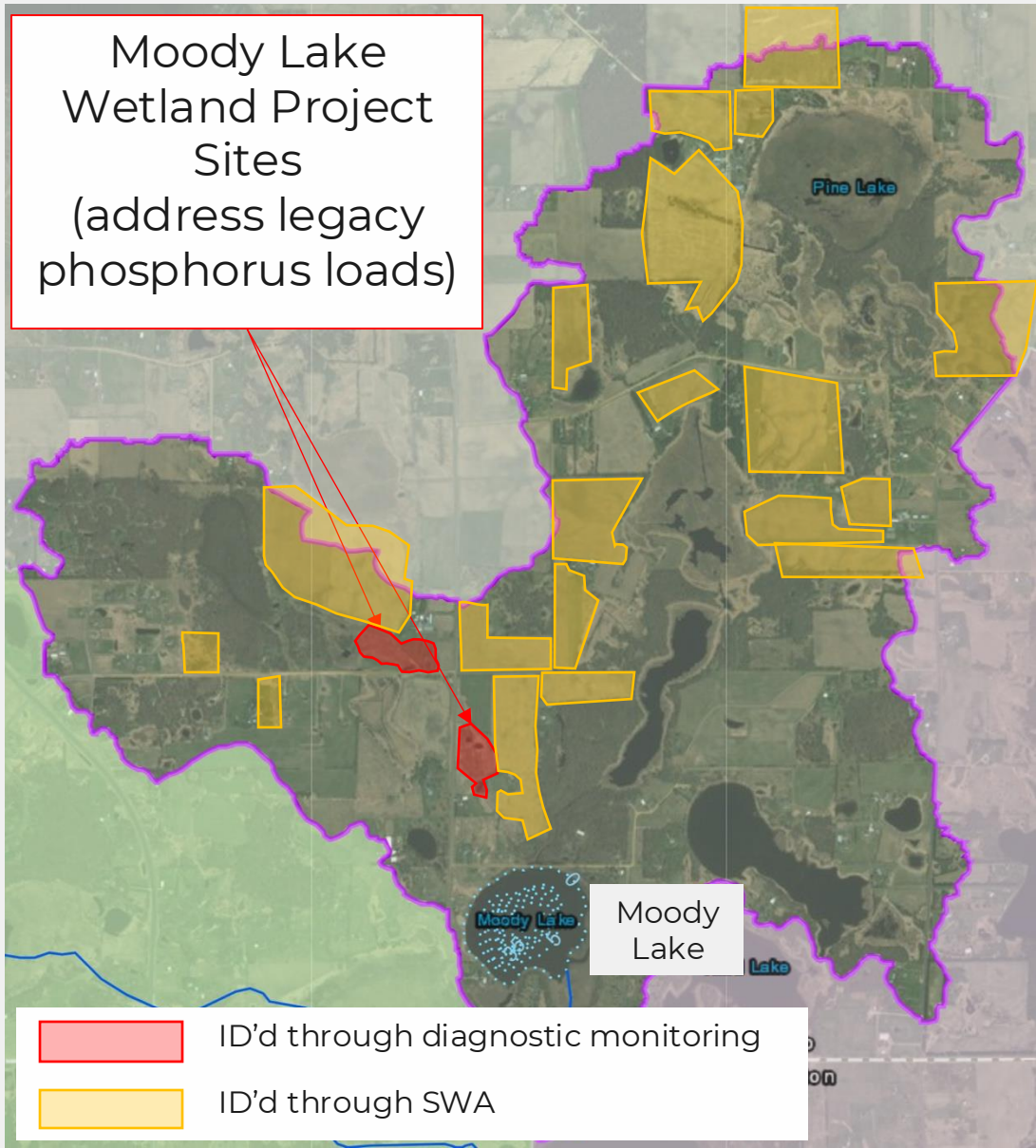
“Legacy Load” Targeting Protocol

www.clflwd.org/documents



Targeting – CLFLWD Real-Life Example

- Completed in late 2014, the SWA (SubWatershed Analysis) model recommended projects on 19 different sites costing roughly $1.5M.



ROI: What it is. And what it is NOT.

80/20 Rule (a.k.a. the Pareto Principle)

Vilfredo Pareto: 80% of Italy's wealth is owned by 20% of the population

Can be applied to almost any system; including conservation and farming.

Legacy Load Targeting Process

Sequential Diagnostic Monitoring

Calibrated Hydrologic & Hydraulic Computer Model

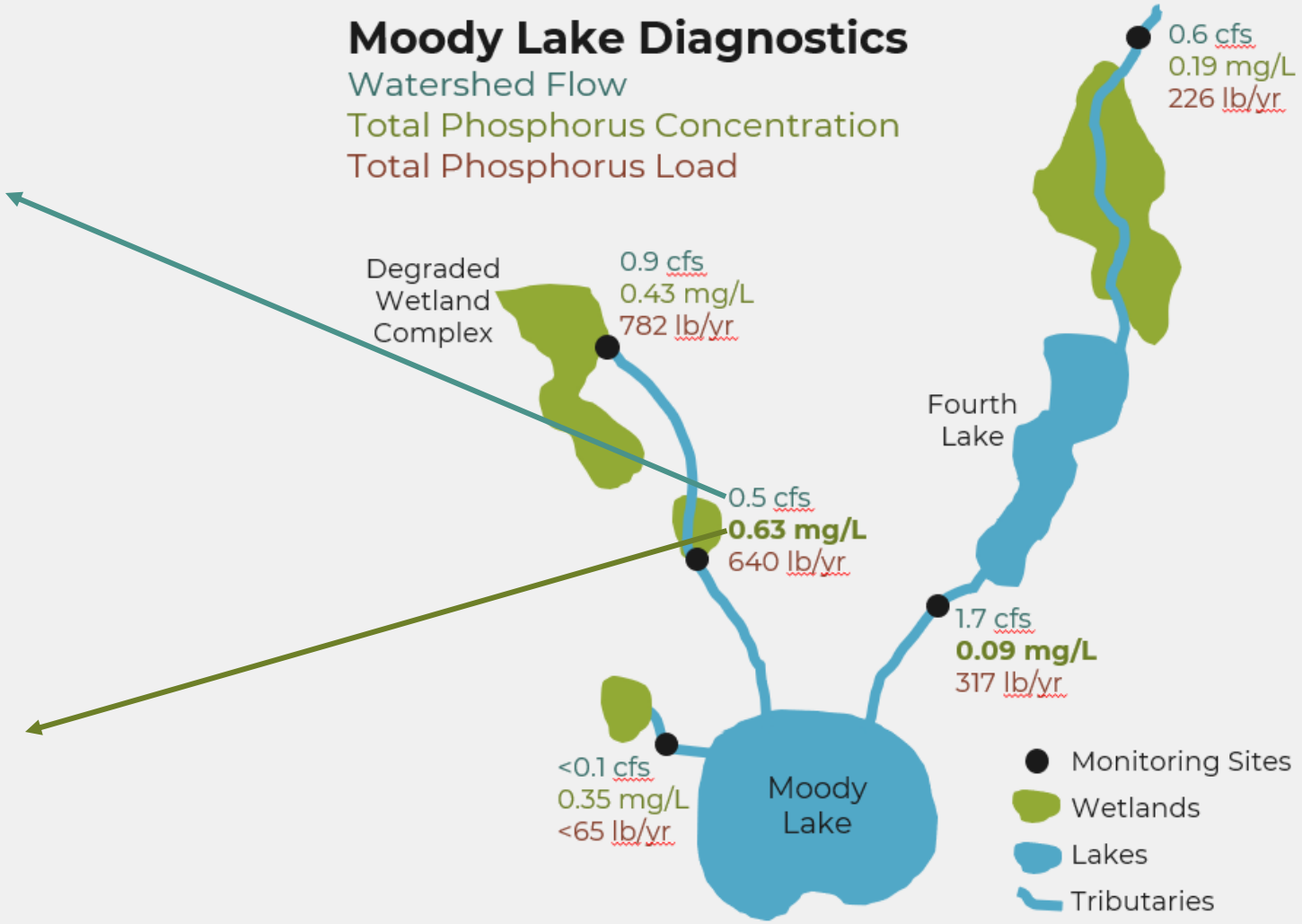
Historic Aerials/Land Use

Landowner Knowledge/History

Moody Lake Sequential Diagnostic Monitoring

Treat 25% of the flow

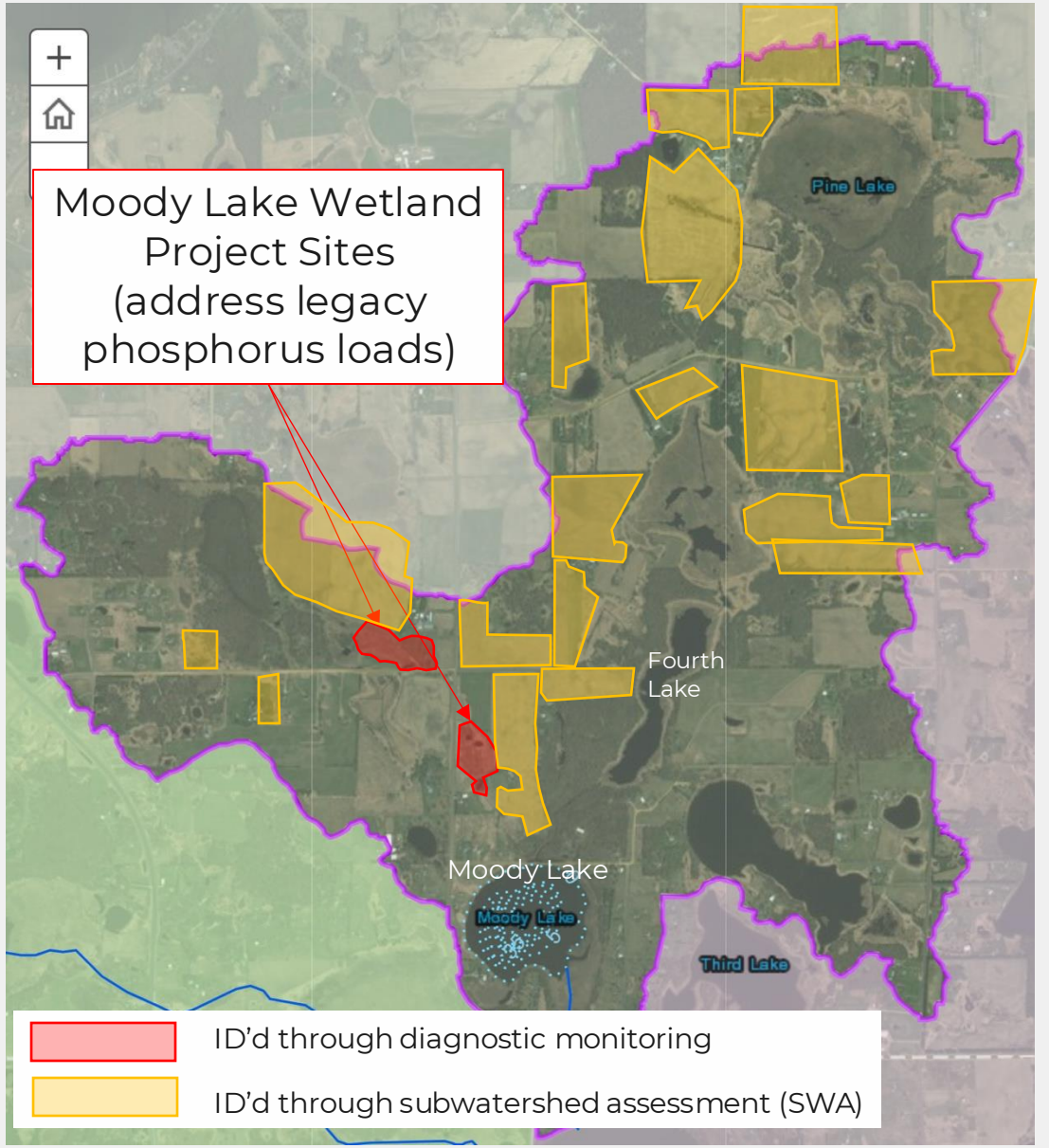
Achieve 80% of the goal



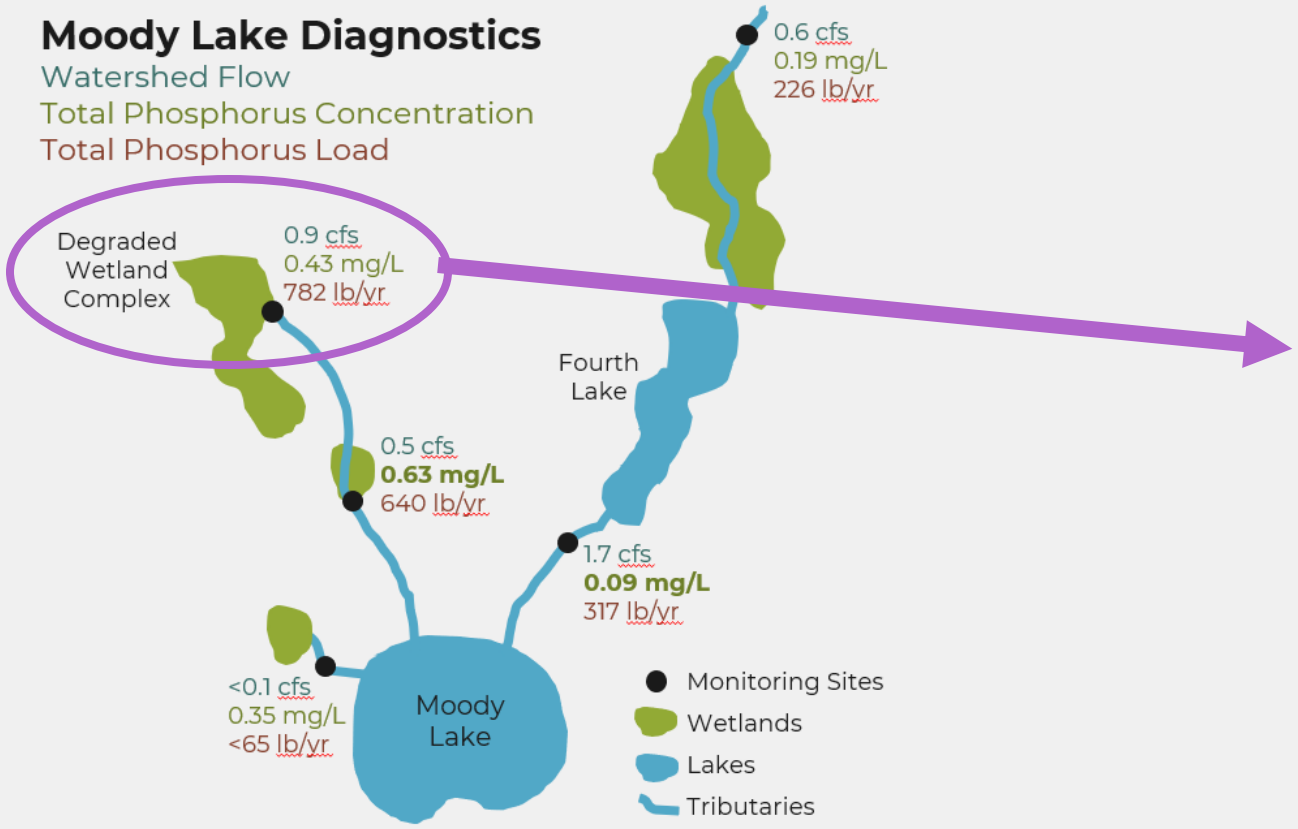
Moody Lake Monitoring vs Desktop

- 80% of nonpoint source pollution may be coming from 20% (or less) of the watershed

- Could have implemented dozens of projects all over the watershed without achieving this reduction



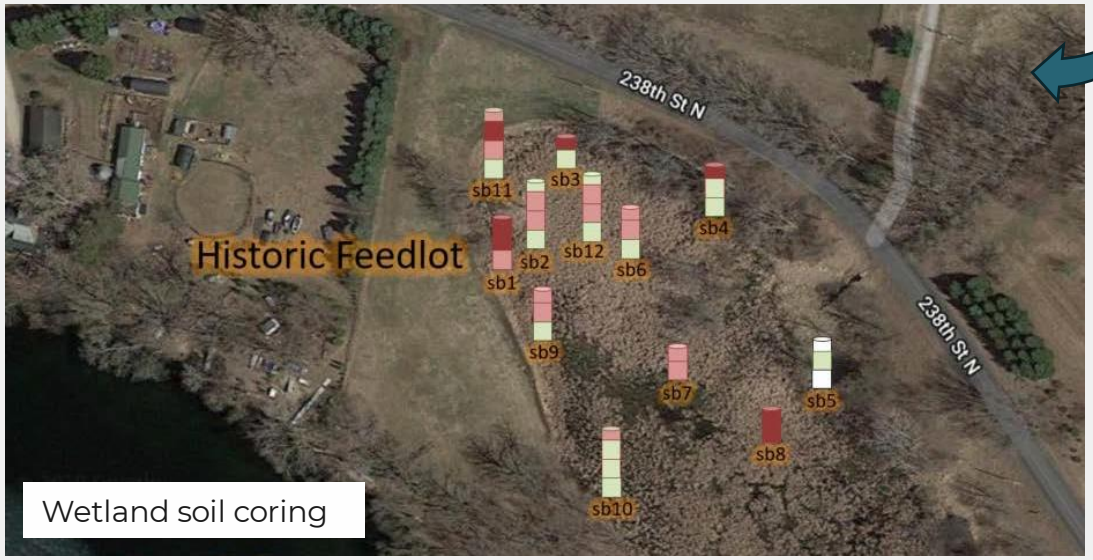
Moody Lake Historic Aerials & Land Use



Historic Barnyard on Moody Lake NW Tributary

Bone Lake Historic Aerials & Land Use

- Bone Lake is located just south of Moody Lake
- Similar land use
  - Cultivated cropland
  - Decades of cattle farming
- Wetland soil coring uncovered the secret



Wetland soil coring


1964 aerial image showing historic dairy feedlot

Present day

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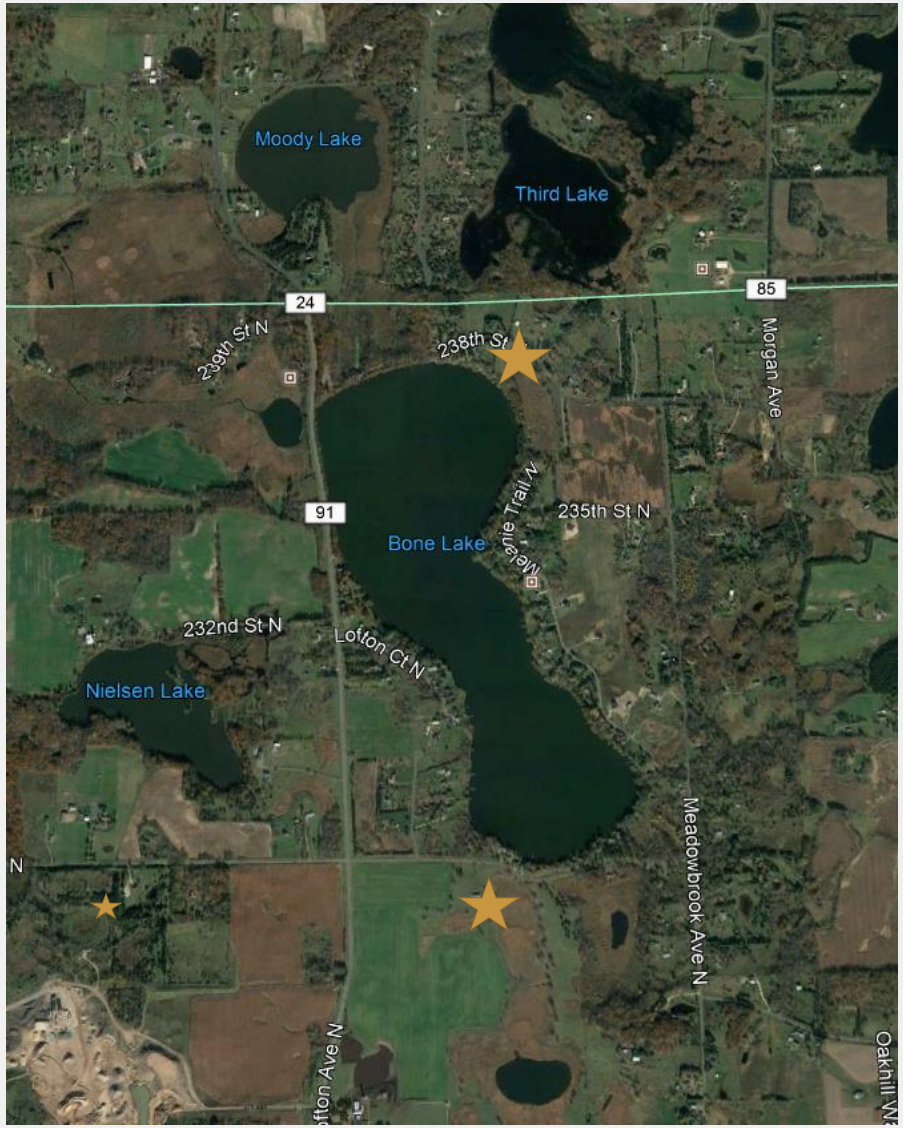
Moody and Bone Lake Wetland Cores



Moody and Bone Lake Wetland Cores

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Sothern Bone Lake Wetland

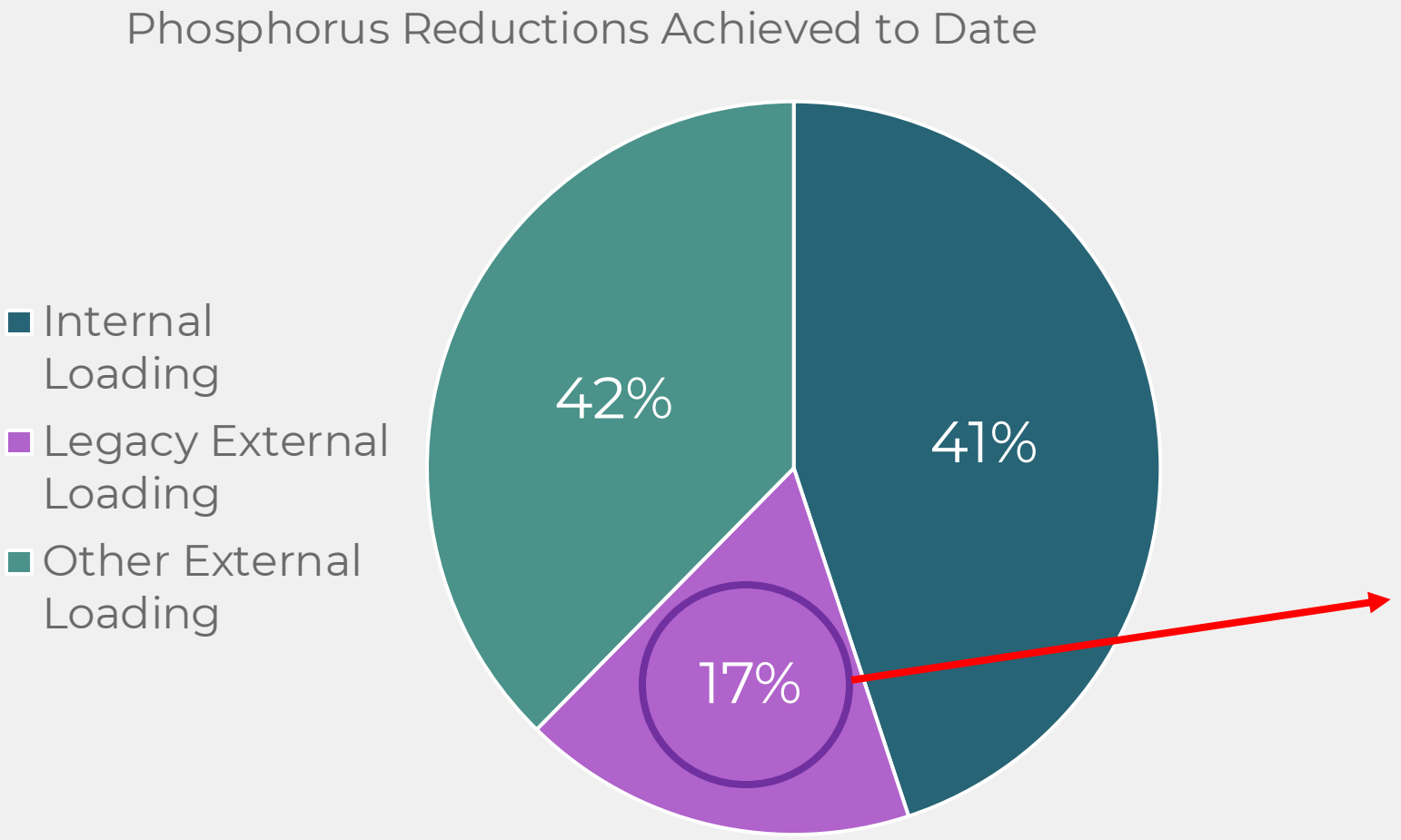
Moody Round Barn Wetland

Resident Knowledge and Local History

Legacy loading sources are often hidden

In both cases, Watershed District staff spoke to current landowners and/or long-time residents about historic land management on properties/wetlands

Phosphorus Load Sources in the CLFLWD



Legacy Loading Sites (29% of external load)

- Historic feedlots
- May no longer be in operation
- Phosphorus hot spots shown in data
- Cattle visible in historic aerial imagery

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Targeted – Cost-Effectiveness

Project Prioritization Framework – Real CLFLWD Examples Project	Lifetime Cost Per Pound of Phosphorus Reduced ($/lb TP)	Total Pounds of Phosphorus Reduced at Target Waterbody (lb/yr)	Priority Tier
Moody Lake Wetland Rehab & Alum Treatment	$60/lb	769	1
Shields Lake Stormwater Reuse & Alum Treatment	$93/lb	1,007	
Bixby Park Wetland Project	$100/lb	93	
3rd Lake Pond Project	$145/lb	56	
Forest Lake Enhanced Street Sweeping	$243/lb	168 (cumul.)	
Hilo Lane Stormwater Retrofit	$615/lb	12	2
Residential Raingarden Cost-Share Project	$1,694/lb	0.17	3

Targeted – Cost-Effectiveness

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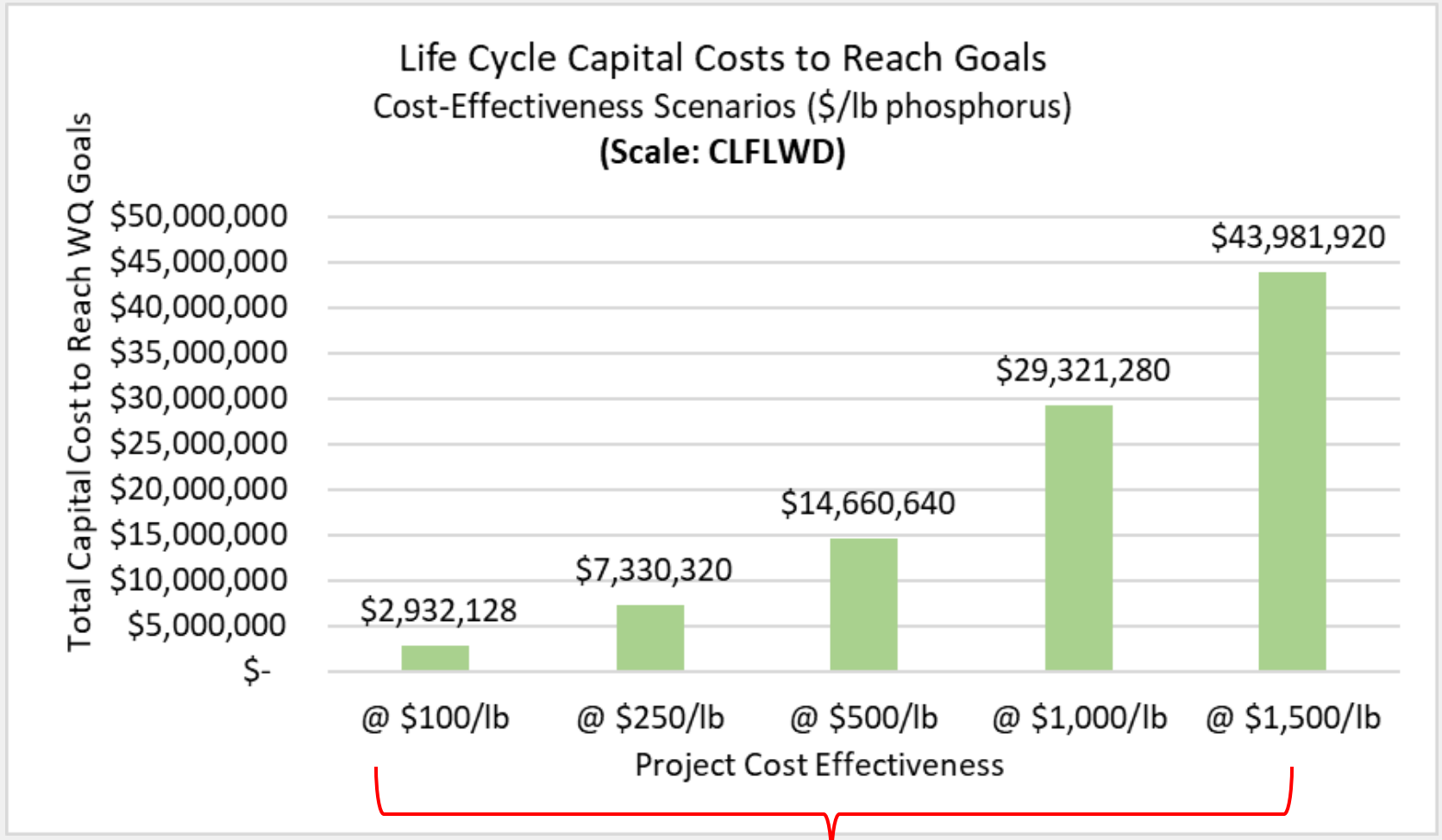
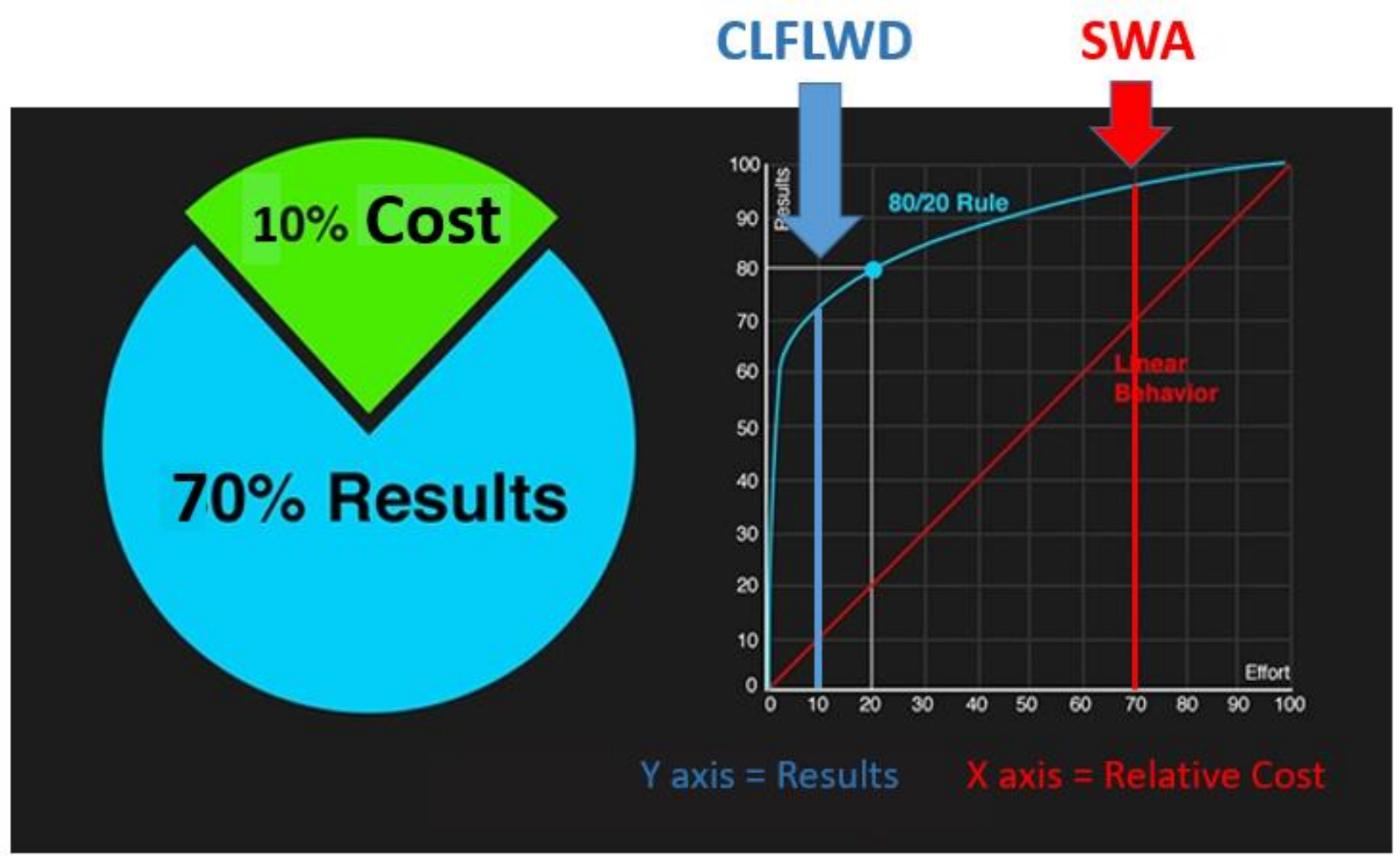


Estimated P load reduction = 2,932 lb/yr (CLFLWD Watershed Management Plan & 6-Lake TMDL)

“The only thing that is constant, is change.”

Be open to constantly questioning all aspects of your operation/organization = continuous process improvement



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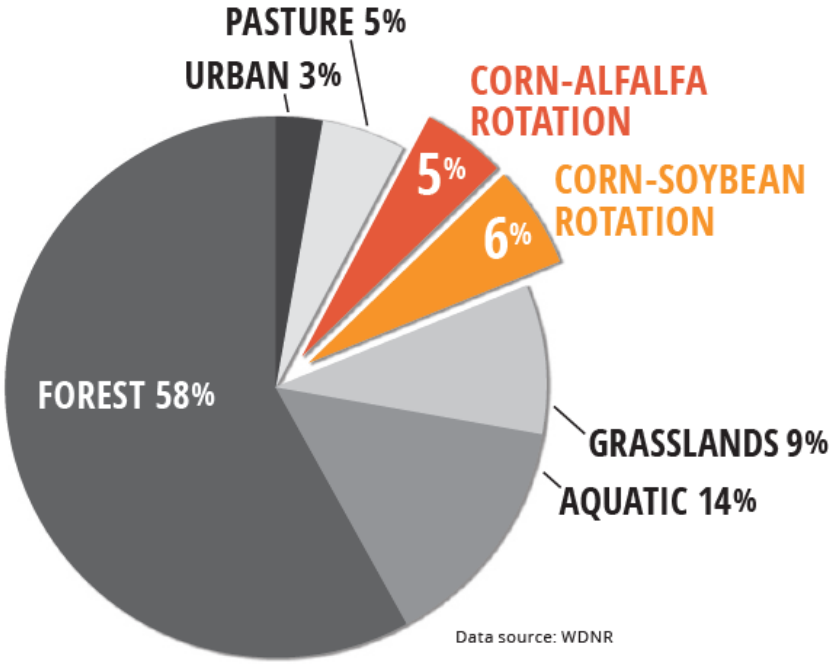
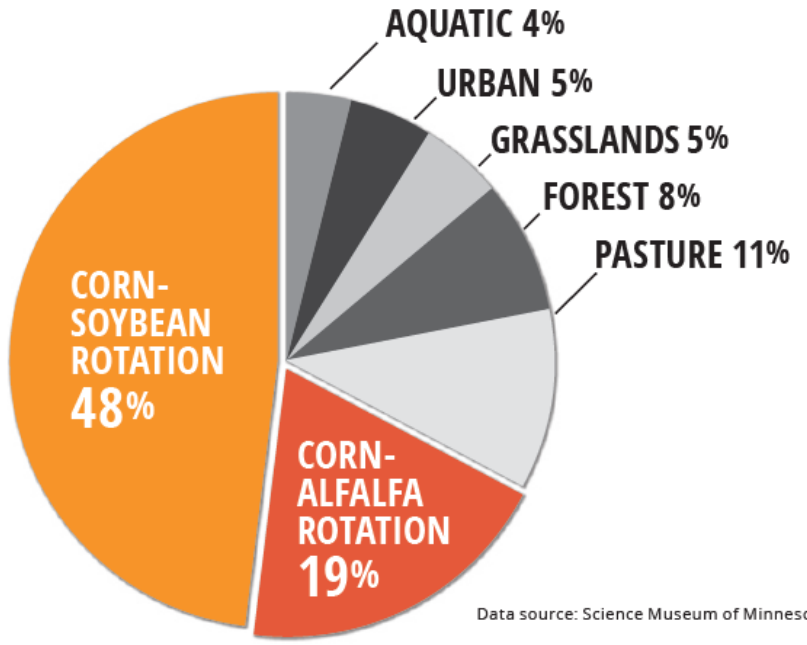
St. Croix Watershed Cropland Practices for Reducing P Loss

TYPES OF LAND USE
within the St. Croix watershed



Data source: WDNR

ESTIMATED RUNOFF SOURCES OF PHOSPHORUS
entering Lake St. Croix



Data source: Science Museum of Minnesota

SDM Identified cropland fields

Goal: Reduce phosphorus and sediment loading at Forest and Bone Lakes.

Objectives: Reduce soil loss and nutrient loading from priority row crop fields.

Actions:

1. Identify priority row crop fields
2. Enter into short term rental agreements
3. Convert to perennial forage

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Farmer Led Council Activities

Low-cost education efforts

- Farm Meetings
- Morning coffee hours
- Publication subscriptions

MRTN – Maximum Return to Nitrogen

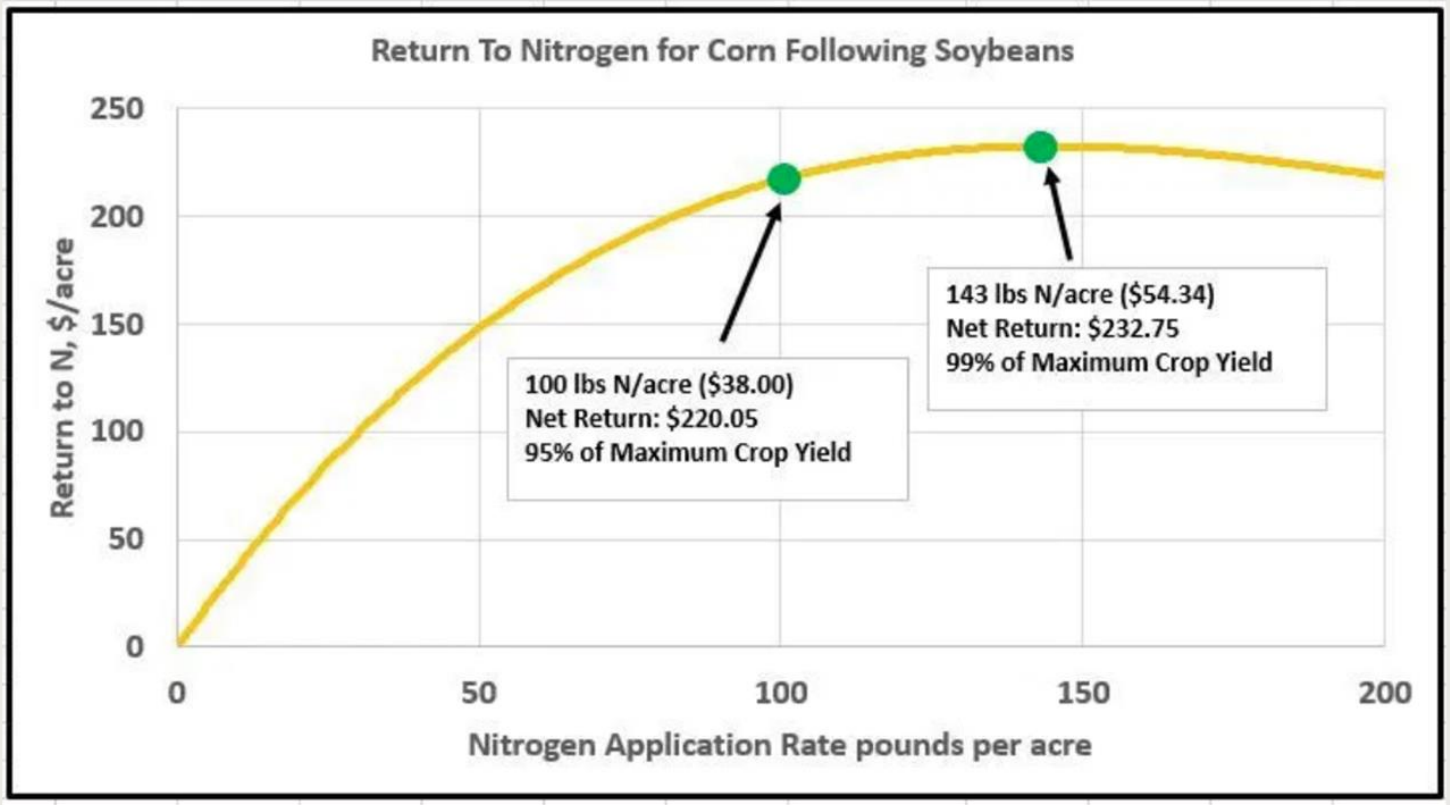

Fig. 3. Graph comparing the economic return of 100 pounds of nitrogen applied per acre versus 143 pounds per acre.

Source: Jones, Chris. https://www.iihr.uiowa.edu/cjones/make-america-mrtn-again/?doing_wp_cron=1570740207.0114619731903076171875

MRTN – Maximum Return to Nitrogen

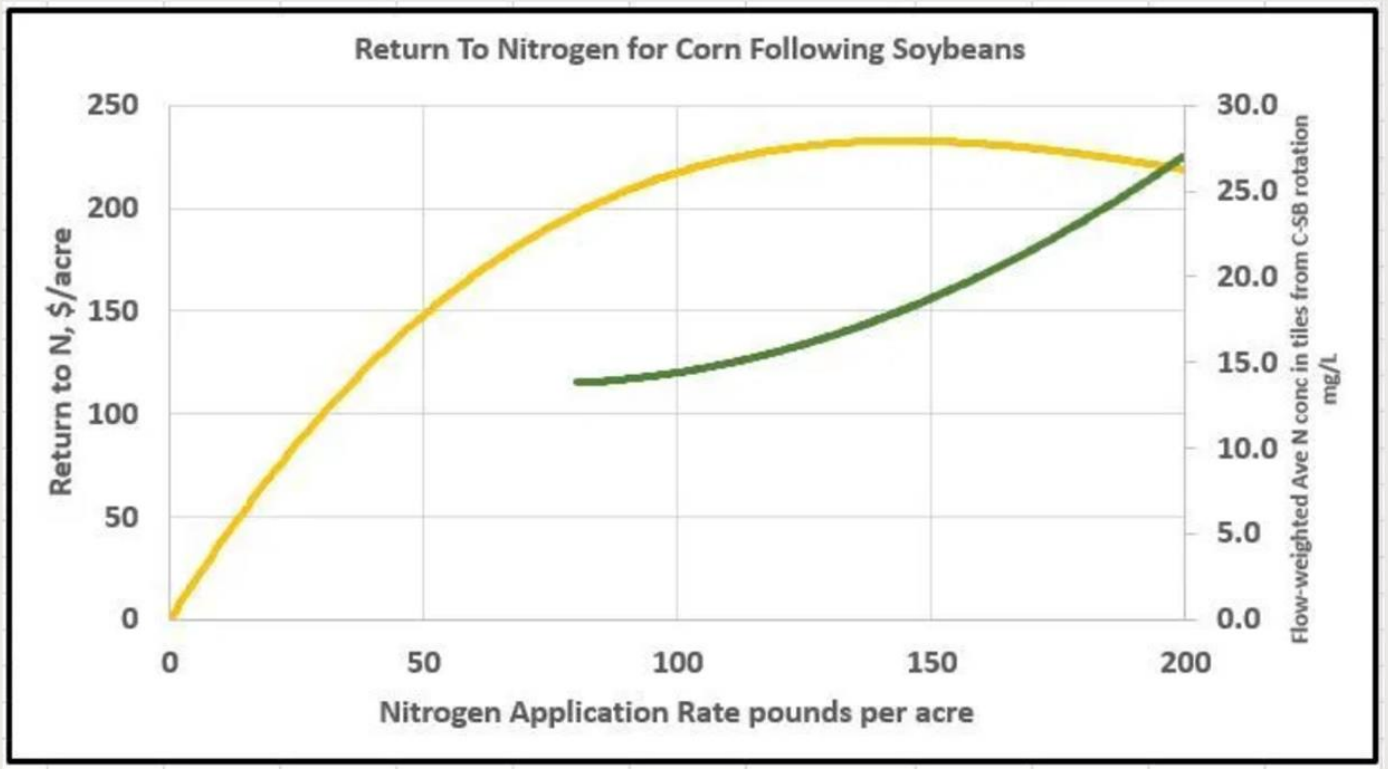

Fig. 4. Graph comparing economic return of applied nitrogen (gold) versus tile water nitrate concentrations (green). The gold line corresponds to the y-axis on the left; the green line to the y-axis on the right.

Source: Jones, Chris. https://www.iihr.uiowa.edu/cjones/make-america-mrtn-again/?doing_wp_cron=1570740207.0114619731903076171875

MRTN – Maximum Return to Nitrogen

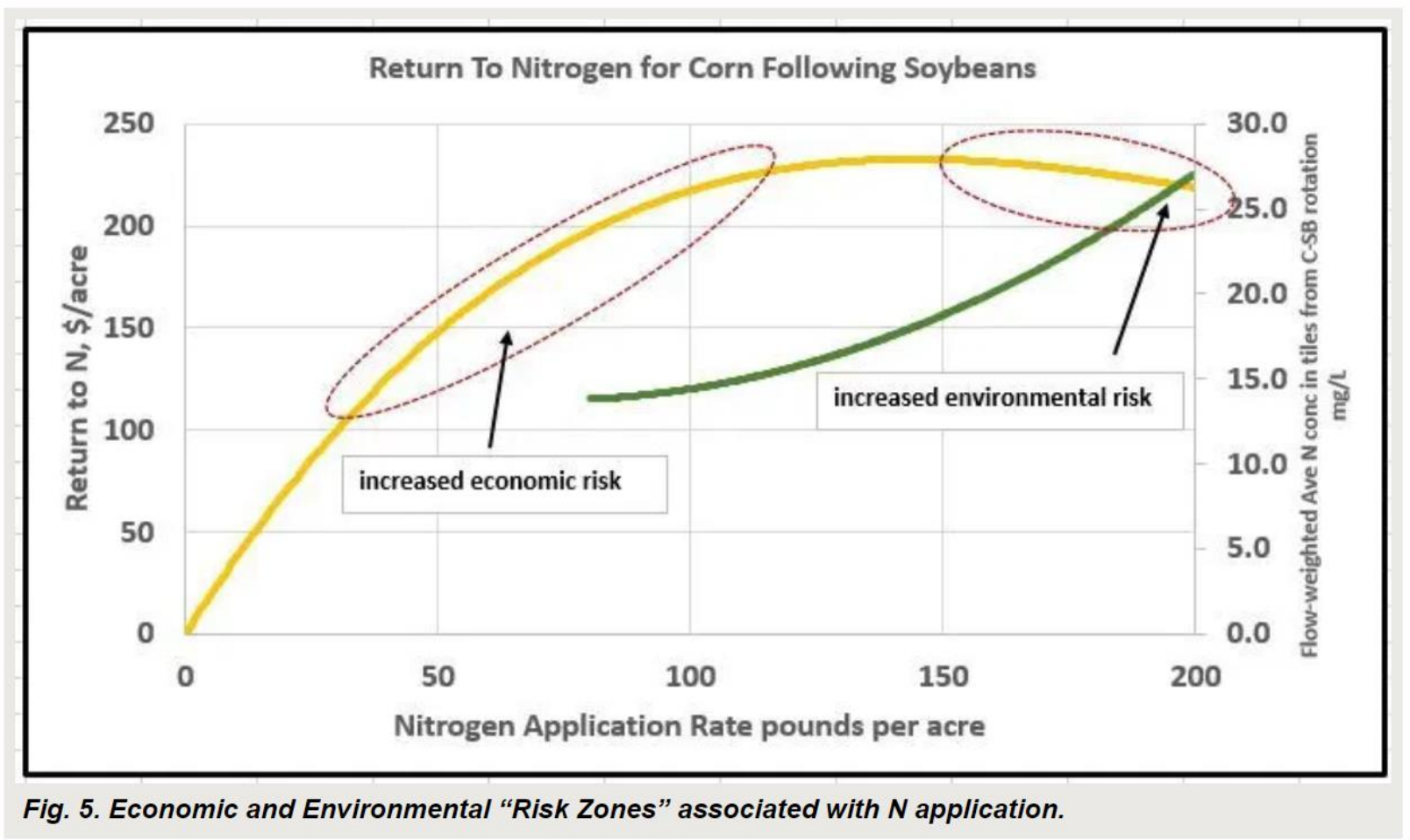

Fig. 5. Economic and Environmental "Risk Zones" associated with N application.

Source: Jones, Chris. https://www.iihr.uiowa.edu/cjones/make-america-mrtn-again/?doing_wp_cron=1570740207.0114619731903076171875

MRTN – Maximum Return to Nitrogen

Illinois Fertilizer & Chemical Association MRTN sponsored trials

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Clean Tillage in the Red River Watershed.

Poor infiltration = flooding, loss of C, more costs, etc.

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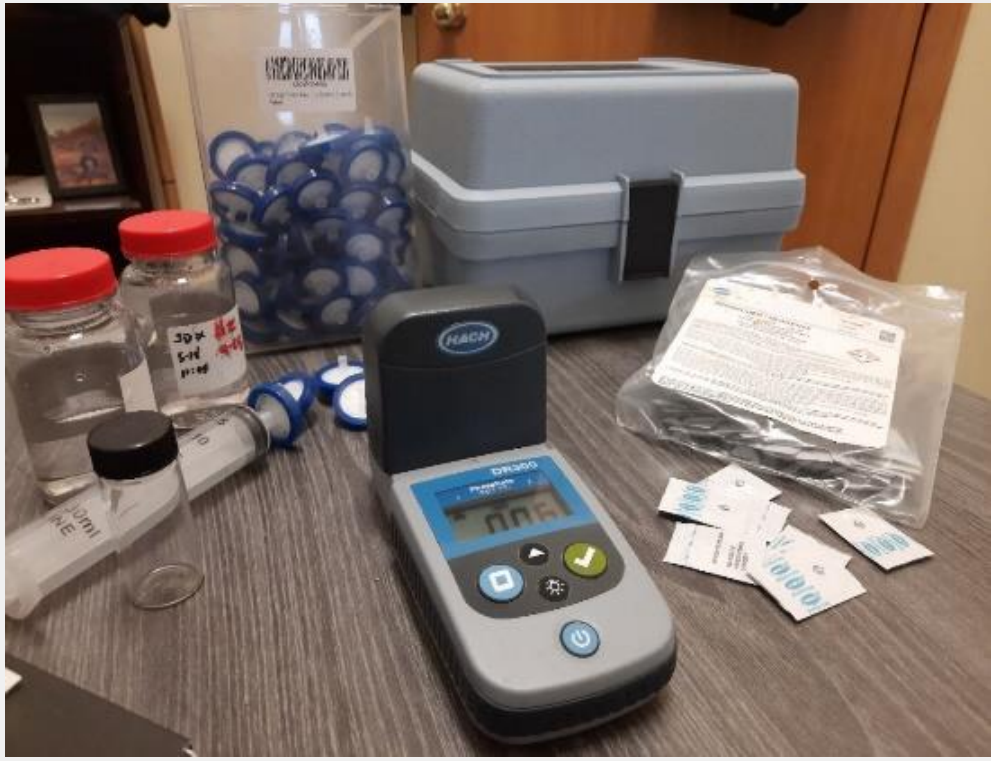
Clean Tillage in the Red River Watershed

Session objectives:

- Learn about pioneering ways to quickly identify water quality issues on a watershed wide scale.
- Using data and economics to assess what BMPs or projects fit your budget and ROI goals.
- **Learn about innovative approaches and incentives for landowners to help reach watershed conservation and water quality goals.**
- Q: How many of you are involved in farmer led councils, conservation groups, school boards, town boards or committees, etc.?

Low-Cost DIY Monitoring

- Staff led – no consultants needed
- No laboratory costs
- Good first step in diagnostic monitoring or a great preliminary screening tool
- Immediate results
- Costs – a few dollars per sample
  - Initial setup ~$700
  - After that, $0.40 per sample + staff time
  - ~10 mins per sample (collection and processing/analysis)
- Limitations
  - Precision
  - One nutrient or form per colorimeter – example: orthophosphate
  - Lack of flow data – no calculation of flow-weighted mean nutrient concentrations



Citizen Assisted DIY Monitoring

- Staff lead – Volunteer implemented
  - Volunteers collect samples
  - Submit to staff for analysis
- Benefits
  - Cost savings
  - Collection during precipitation events – during off hours
  - Community engagement
- Limitations
  - Volunteer recruitment, training and coordination is time consuming
  - Less control over data collection
- DIY colorimeter technology evaluation ongoing - precision / accuracy as compared to commercial laboratory analysis

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Urban sources – lawns

Enhanced Street Sweeping

- Targeted street sweeping studies (tree canopy analysis/pollutant removal estimates)
- **High ROI at $182/lb. of P removed.**

UNIVERSITY OF MINNESOTA | EXTENSION

YOU ARE INVITED TO REGISTER AND ATTEND

City of Forest Lake Stormwater Tour & Workshop

Protecting our lakes and groundwater through successful partnerships and projects

Tuesday, September 11, 2018

4:00 p.m. – 7:30 p.m.

Tour and workshop begins and ends at
Forest Lake City Center, 1408 Lake Street South

Over the past three years, partners in Forest Lake have leveraged state and local funding and worked together to minimize the impacts to lakes, rivers and groundwater from stormwater runoff. This program will feature

- The new enhanced street sweeping program to prevent and minimize water pollution.
- Innovative stormwater harvest and reuse systems at the Forest Lake Area High School and Forest Hills Golf Club.
- Dinner followed by a discussion to explore and identify future projects.

Who Should Attend

- Forest Lake City Council; Planning Commission; Parks, Trails & Lakes Commission; Staff
- Comfort Lake – Forest Lake Watershed District board members, staff, and CAC members
- Rice Creek Watershed District board members, staff, and CAC members
- Clear Lake and Forest Lake Lake Association board members
- Washington County and Washington Conservation District – District 1 Representatives
- State agency liaisons

Registration required by Wednesday, September 5th
Space is limited. Dinner is included. There is no cost for the program, however your commitment to attend is appreciated.

1. Register online at http://z.umn.edu/forestlake
2. By email* to Larisa Jenrich at jenri001@umn.edu
3. By calling* Larisa Jenrich at 651-480-7732

**Registration requires your name, affiliation, phone, email, and any dietary restrictions.*

CLFLWD
WATERSHED DISTRICT

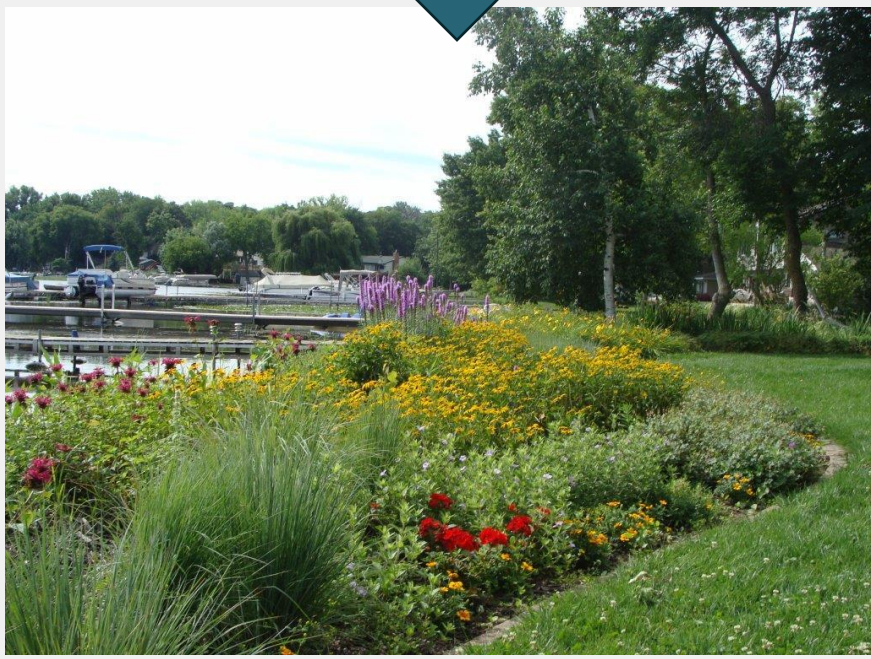
Enhanced Street Sweeping

Adaptive Management would allow the City to sweep more often based on observations which they did throughout the fall months.

Scenario	Description	# Sweepings/ Route/Year	Predicted Phosphorus Recovery			
			Forest Lake		Clear Lake	
			Weight (lb)	$/lb	Weight (lb)	$/lb
Baseline	Spring and fall only, mainly contract sweeping	2	109	$613	50	$346
Base Priority	Additional sweepings mainly in spring and fall	4-7	157	$183	72	$241
Enhanced (Recommended)	Optimal cost-effectiveness ($/lb TP)	7-12	190	$182	80	$229
Maximum	Maximum effort using 1 sweeper only	7-28	216	$207	88	$249

Natural Shoreline Restoration

- Shorelines are vanishing – about half of MN's shorelines have already been lost
- Mowed shorelines allow 7-9x more pollutants to enter the lake than a more naturally vegetated shoreline
- Losing habitat and biodiversity in addition to the land itself eroding away



South Fork Hay River Priority Watershed Project:
Property Tax Credit Pilot Program

- Started in 1994
- Citizen and farmer led committee (4 farmers, ag lender, Vo Ag instructor, lake association member, farm org member)

- **A property tax payment of $6/ac for Non-HEL & $8/ac for HEL – required a NM plan and conservation plan to "T".**

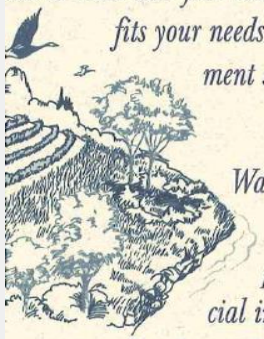
- **Sliding scale payment for barnyard and other BMPs based on lbs. of Phosphorus reduced.**

- Funding limited the program to roughly 50% of available cropland

Funding is Available

Starting right now, there are incentive cost-sharing funds available through r Priority Watershed Project.

As an eligible landowner, you not get financial assistance to install water lity practices, you also get technical assis- nce to make sure your conservation plan fits your needs and manage- ment style.



The Priority Watershed Project is ready to provide finan- cial incentives for r practices. Funding is limited, so -up will be by a first-come, first-serve is.

Talk to one of your watershed loyees to find out more about this incentive program.

Practices & Rates for Incentive Payments & Cost-Sharing

SOUTH FORK HAY RIVER PRIORITY WATERSHED POLLUTION REDUCTION INCENTIVE PROGRAM (PRIP)

Cropland

Farm plan to "T" and 590 Nutrient Management Plan
Annual Payment:
$6.00/acre for NHEL fields $8.00/acre for HEL fields

Barnyard

Cropland plans have to be implemented prior to receiving barnyard incentive.
Payment Scale (one-time payment):

- 20% reduction receives $10/lb
- 30% reduction receives $20/lb
- 40% reduction receives $30/lb
- 50% reduction receives $40/lb
- 60% reduction receives $45/lb
- 70% reduction receives $50/lb
- 80% reduction receives $55/lb
- 90% reduction receives $60/lb
- 100% reduction receives $70/lb

Stream Corridor Management

Management Plan required
Annual Payment is $2.00/acre
One-time Payment $0.25/ft of streambank

Woodland

Annual Payment is $2.00/acre for exclusion

Cost-Shared Best Management Practices:

Agricultural Sediment basins	70%
Critical Area Stabilization	70%[1]
Grade Stabilization Structures	70%
Grassed Waterways	70%
Land Acquisition	50%[2]
Manure Storage Facilities	70% and 50%[3]
Manure Storage Facility Abandonment	70%
Milking Center Waste Control	70%
Pesticide Handling Spill Control Basin	70%
Shoreline and Streambank Protection	70%[1]
Structural Urban BMPs	70%
Well Abandonment	70%
Wetland Restoration	70%[1]

[1] Easements may be entered into in conjunction with these BMPs.

[2] Cost-sharing is available to aquire land for the construction of an urban structural practice or to aquire land which is contributing or will contribute nonpoint source pollution.

[3] Cost-share at 70% for first $20,000 of cost and at 50% for remaining cost, not to exceed $35,000.

Steps to Cleaner Water

Landowners are contacted

This is where we are now. Project staff are contacting landowners to explain how the program works.

An agreement is drafted

If you decide to participate in the program, then you work with the county staff to develop a conservation and nutrient management plan designed specifically for your farm. From there, other practices can be discussed to see what fits into your farm management plan.

An agreement is signed

Signing an agreement is an important step. With it, you agree to carry out and maintain the practices which *you* have selected. The agreement outlines what will be done, estimated costs and completion dates.

Greenway Corridor & Flood Storage

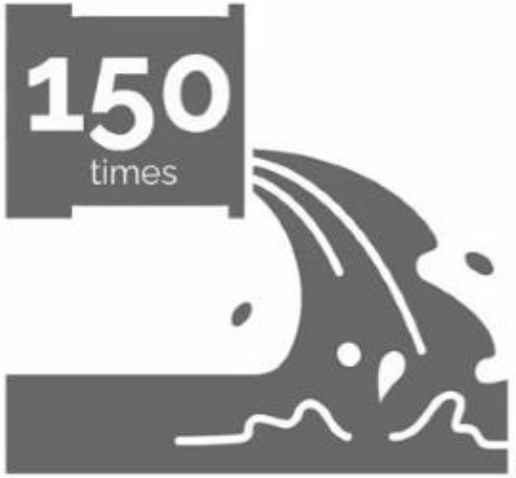
- Floodplain Vulnerability Assessment in progress
  - Identify highest risk flood-prone areas and at-risk communities
  - Ultimately identify and prioritize flood mitigation strategies (e.g., flood storage, infrastructure upgrades, community preparedness)

- Partnerships and grant seeking are key
  - County hazard mitigation plans
  - Other watershed management organizations have done/are doing similar work

- Greenway Corridor is one avenue for implementation – various examples of greenways can be found throughout the state/country
  - Interagency coordination and public outreach will be critical

Today's Extremes Bring Risks & Costs to Minnesotans

Wastewater overflows into Minnesota lakes & streams



on average per year due to wet weather

Current flood risks threaten

29,000
miles of roads

13,000
residential properties

across Minnesota.

Extreme weather events have caused insurance premiums to increase

across Minnesota since 1998

Insurance Federation of Minnesota, MPCA, 2024, NCA5, 2023

Key Takeaways

1. Follow the 80/20 Rule.
2. Focus on diagnosing issue – watch for patterns.
3. Process develops side benefits
   E.g., wetland habitat, groundwater improvements
4. Takes out randomness (Not enough time to do everything)
5. Good data = results
6. Continuous process of improvement

Contact Info

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District Administrator

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