



# SOURCE 2STREAM

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and Sediment Control  
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# Saving Lily Lake

## A Neighborhood Landmark

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Emmons & Olivier Resources, Inc.  
Saint Paul, Minnesota



# Agenda

## History of Lily Lake

## Investigations

- Testing + monitoring
- Identifying culprits

## Goals + Methods

- Reduce P load by 145lbs (66 kg)

## Actions

## Outcomes

- Delisting in 2022





# History: Clean, Clear, and Deep

## Lily Lake

- Stillwater, MN



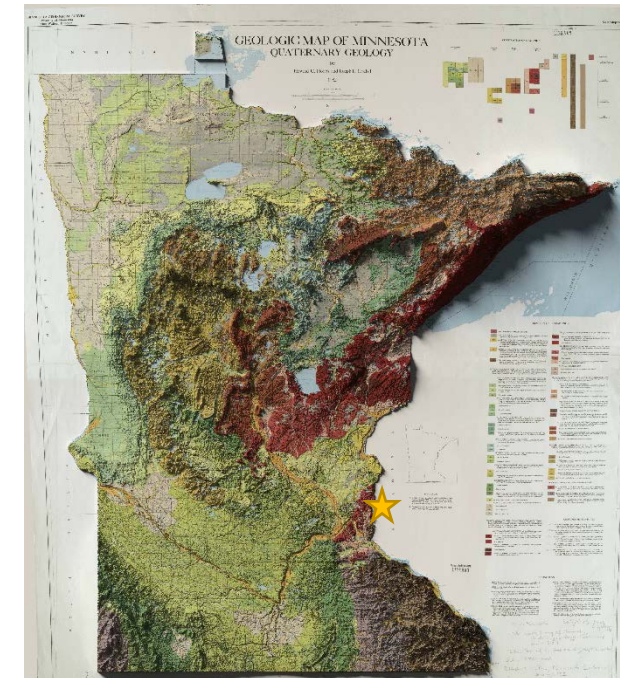
- 41-acre area (16.7 hectare)
- Landlocked
- 18' average depth (5.5 m)
- 50' deep in spots! (15 m)



# History: Clean, Clear, and Deep

## Pre-History

- Lily Lake was formed when glaciers receded from this area of middle America approximately 12,000 years ago
- Water-rich region was inhabited and cared for by Dakota people prior to European settlement in the 1850's





# History: Clean, Clear, and Deep

## Hub of Activity

- Popular for fishing, boating, and swimming
- Lily Lake Ice Company (1870's to 1900's)
- Lily Lake Park (established in 1948)
  - Swimming Beach
  - Fishing Dock
  - Playground
  - Baseball fields
  - Ice Arena
  - Tennis, basketball, pickleball





# History: Rising Concern



1950's - 2000's  
Suburban development  
extends west from St. Croix  
river into area around Lily Lake  
and beyond



# History: Rising Concern



1960-2002

Decades of increasing impervious surfaces in the watershed and untreated stormwater runoff caused Lily Lake's water quality to decline drastically

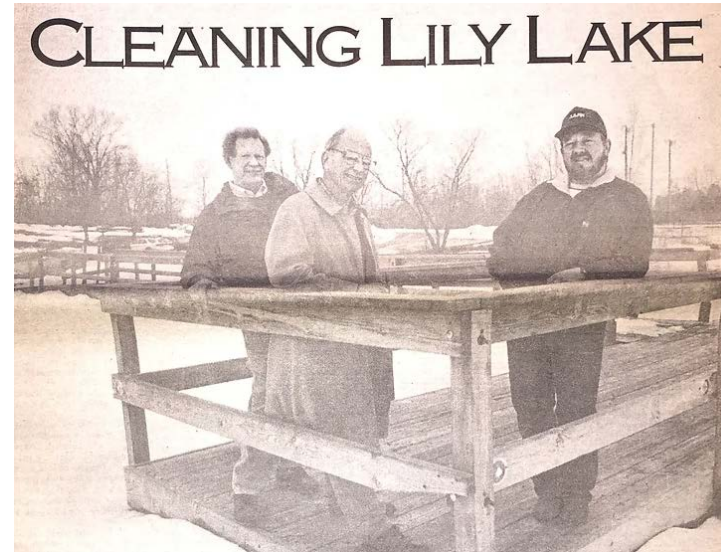


# History: Taking Action



1996

Community-led efforts urged investigation into the sources of pollution and remediation practices; Friends of Lily Lake was formed by concerned citizens



# History: Impaired Water



2002

Minnesota Pollution Control Agency (MPCA) adds Lily Lake to State's Impaired Waters List



As required by the US Clean Water Act MPCA makes a list every two years of lakes and rivers that don't meet water quality standards

- Mercury
- Phosphorus
- Sediment
- Bacteria
- PFOS (in fish tissue)
- Sulfate (hinders wild rice)



# Investigation: Identifying the Issues

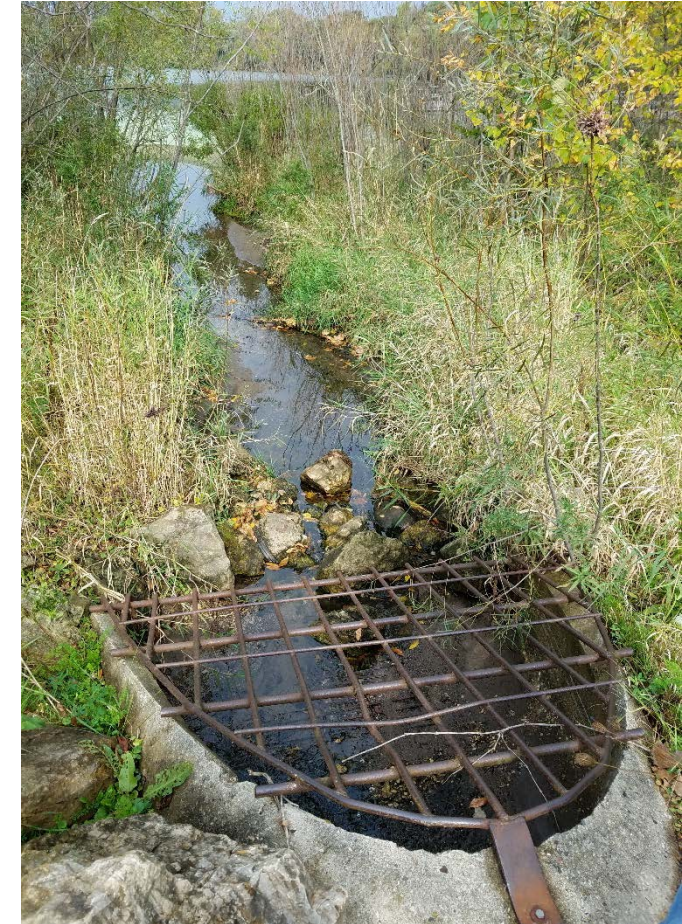
1996-  
2013

## Water Quality Monitoring

- Major phosphorous contributors identified
- Erosion and sedimentation issues identified
- Catchment and drainage area mapping



**MIDDLE ST. CROIX**  
WATERSHED MANAGEMENT ORGANIZATION

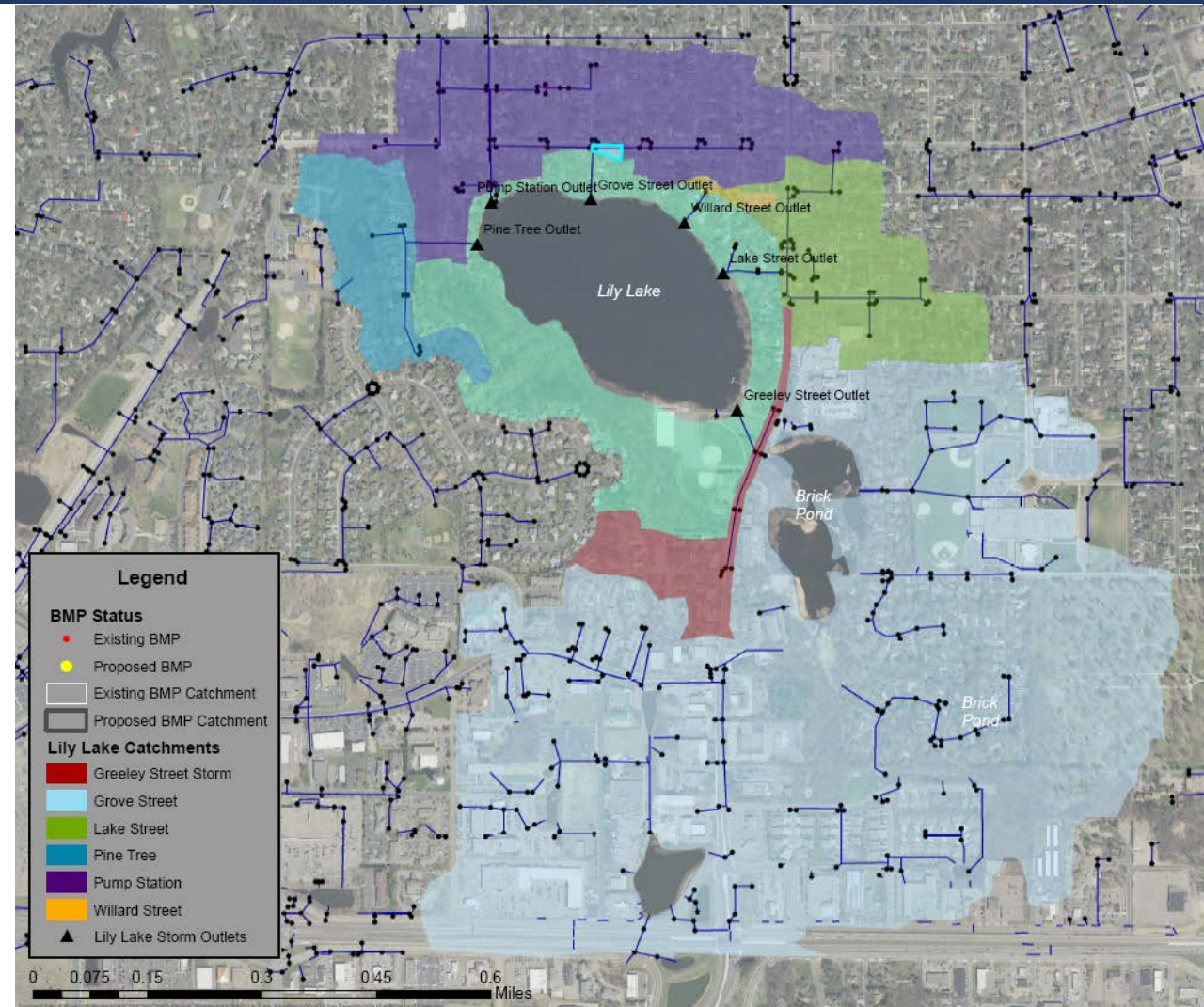




# Investigations: Watershed and Drainage

## 567-Acre Watershed (229.5-ha)

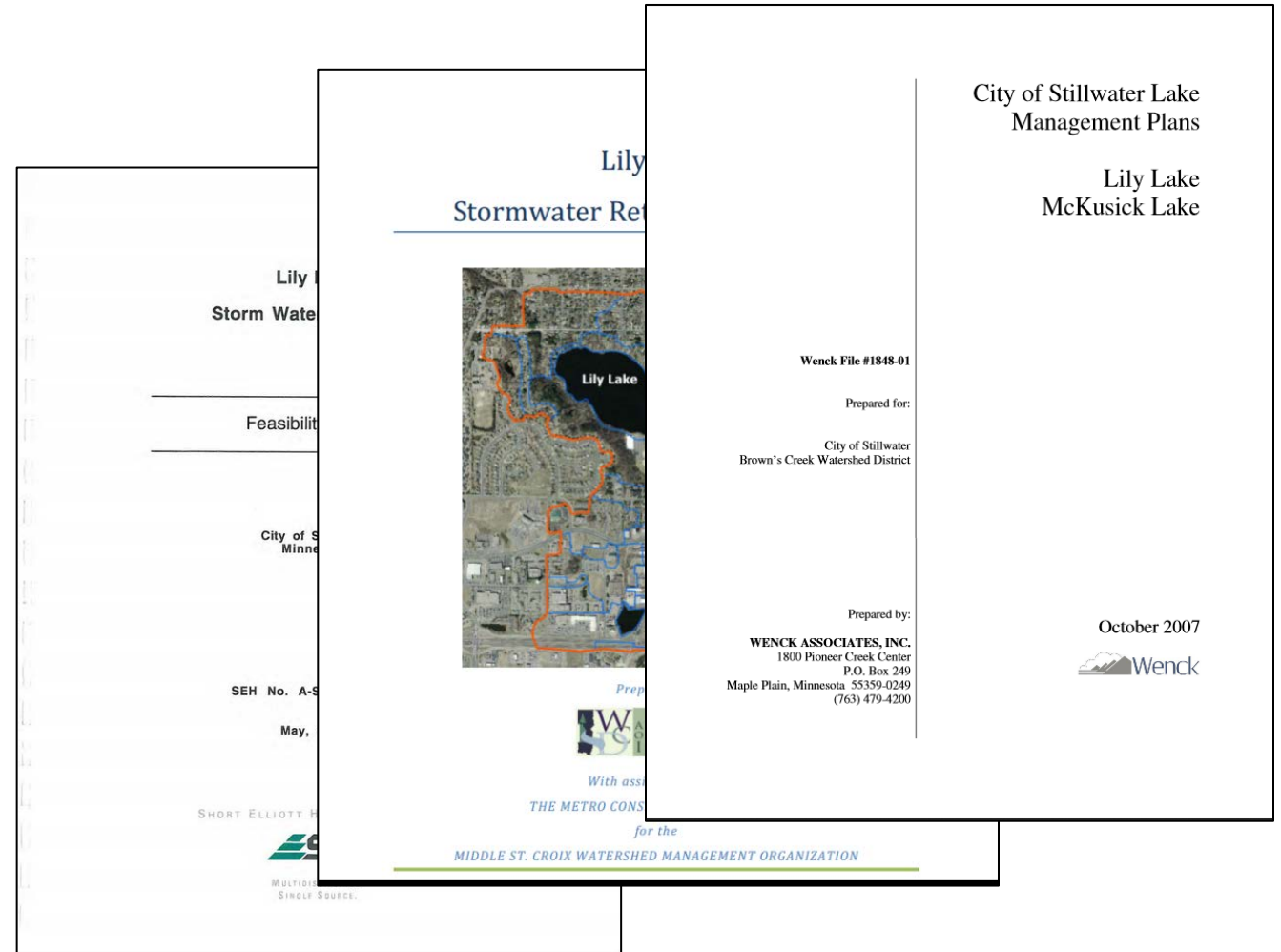
- 60% residential
- 10% institutional
- 239 acres flow directly into Lily Lake through 6 stormwater outlets
- 266 acres flow into Brick Pond and then into Lily Lake via storm outlet under Greeley St
- 90% of runoff to Lily Lake flows through City storm sewer





# Investigation: Lily Lake Management Plan

- 2007 Lily Lake Management Plan
- Recommended managing erosion to reduce sediment transport
  - 145 lb annual P reduction (66 kg)



# Another Crisis: Bacteria

## 2012 Beach Closed

- Another blow to Lily Lake and the community
- Beaches are closed by the state health department after two fatal incidents of *Naegleria fowleri* infection
- Not caused directly by impaired status or stormwater runoff, however, increased impervious and sediment contribute to favorable conditions for this bacteria





# Taking Action: Starting to Reduce P Loading

2007-  
2018

## BMP Installation

- 41 Stormwater BMPs Installed
  - Pervious Paving
  - Gully Stabilization
  - Residential Rain Gardens



# Goals + Methods: Final 45

41 Projects = 100 lbs (45 kg)

- Existing BMPs achieve 69% of required Total Phosphorous load reduction

By 2018 45 lbs remained

- Lily Lake "Final 45" Road Map
- Ultimate goal to remove Lily Lake from the State's Impaired Waters List

WATER QUALITY BMP	YEAR INSTALLED	ESTIMATED P LOAD REDUCTION (LBS/YR)
32 Bioretention Basins 4 Isolator Rows 1 Infiltration Gallery	2010-2018	<b>14.7</b> (6.6 kg)
Greeley Gully Stabilization	2018	<b>40.0</b> (18 kg)
Lakeview Hospital Gully Stabilization	2017	<b>4.7</b> (2 kg)
MnDOT Hwy 36 Reconstruction Stormwater Wet Ponds (2)	2016	<b>8.0</b> (3.6 kg)
Diasorin Bioretention Basin and Stormwater Reuse	2015	<b>14.0</b> (6.4 kg)
Lake Street Gully Stabilization	2010	<b>6.1</b> (2.8 kg)
Driving Park Road Gully Stabilization	2008	<b>7.9</b> (3.6 kg)
Curve Crest Cry Pond	2007	<b>4.7</b> (2 kg)

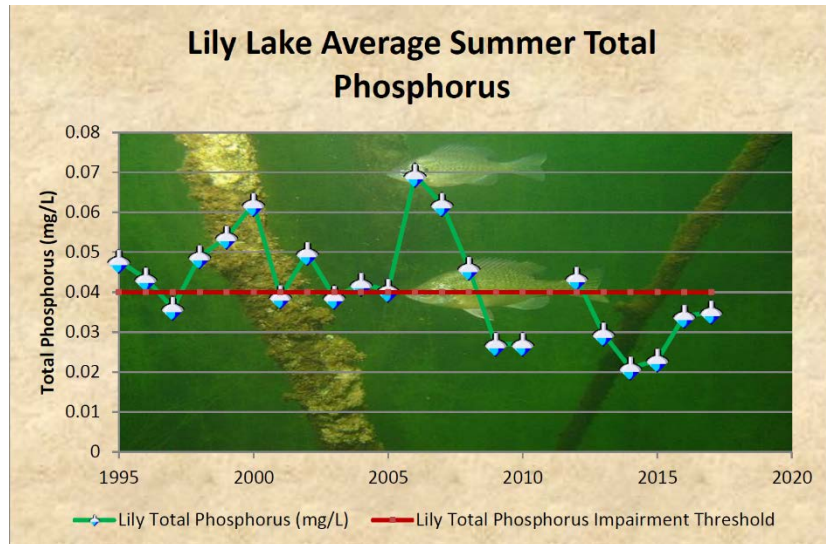
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# Taking Action: Improving Trend

## 2014 Continued Monitoring

- In 2014 Lily Lake demonstrated a statistical improving trend for total phosphorous.
- First time this trend has emerged since monitoring started in 1988.



## Middle St. Croix Watershed Management Organization 2014 Water Monitoring Report



Prepared For:



Prepared by:



# Goals: Final 45

## Meet TP standards

- In-lake phosphorous  $< 0.04$  mg/L

## Chl-a or Secchi meet standards

- Chl-a  $< 14$   $\mu\text{g/L}$  (amount of algae growing)
- Secchi depth  $> 1.4$  m

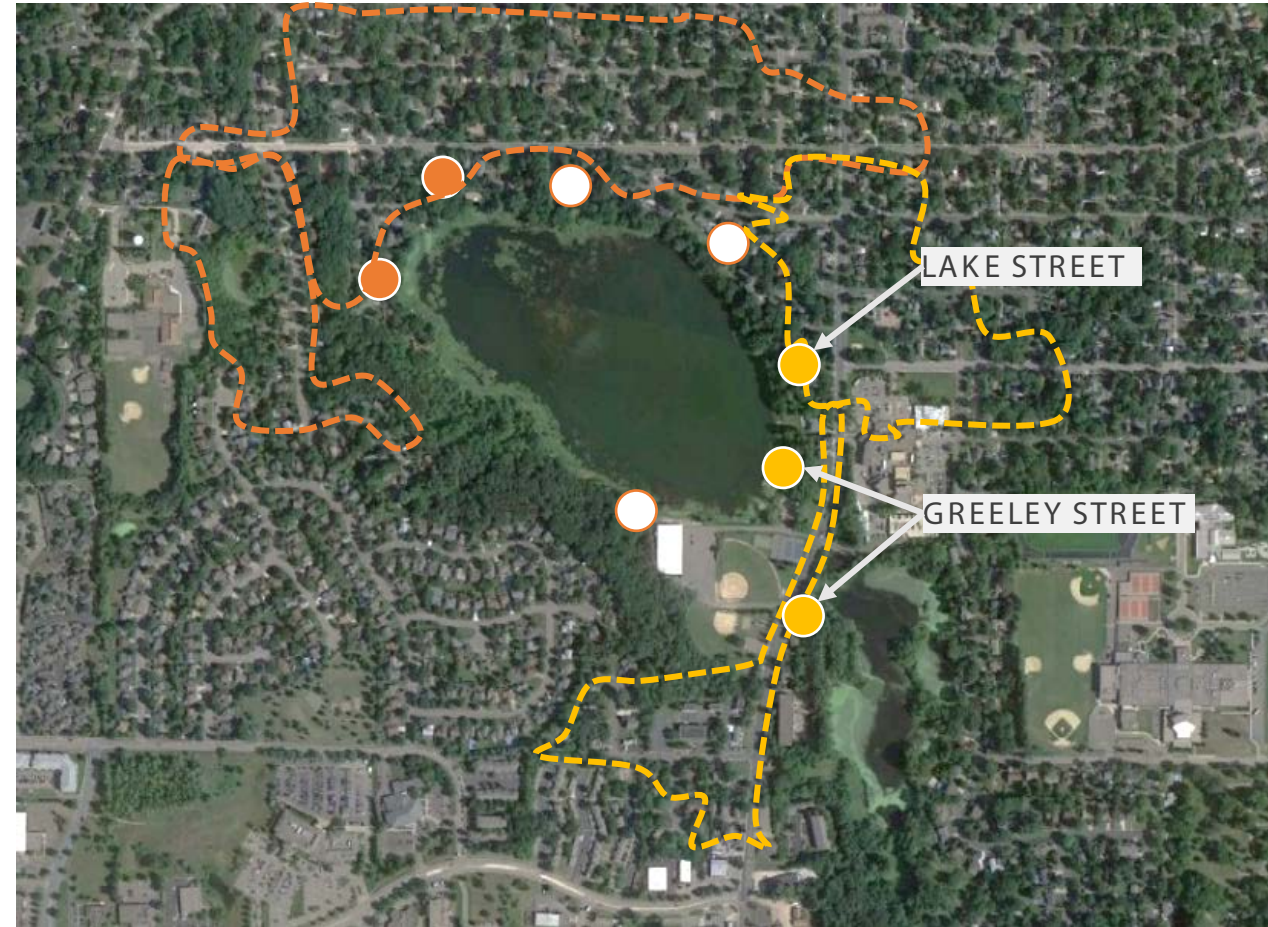




# Investigation: Specifying the Problem

## Targeted monitoring + SWA

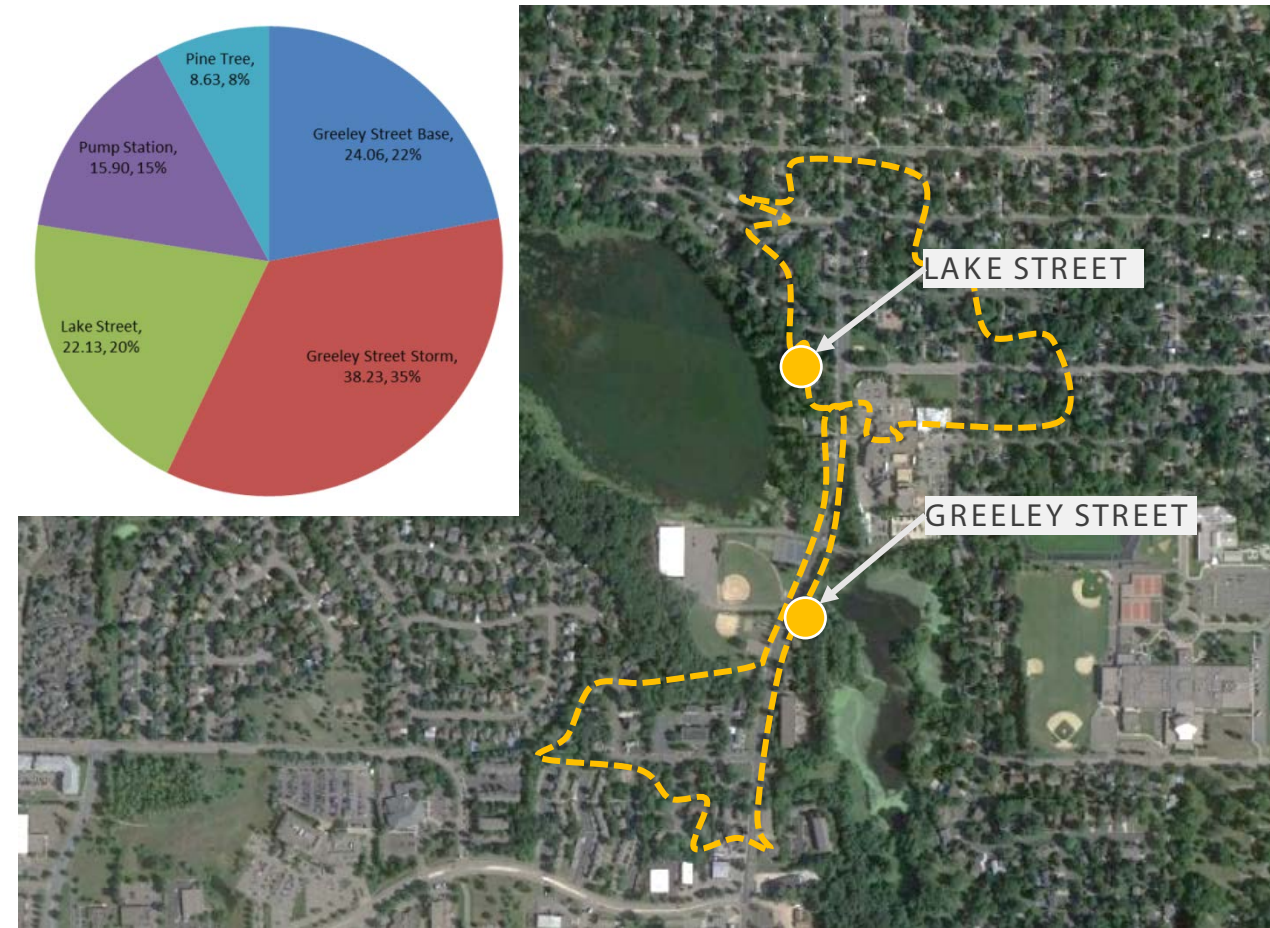
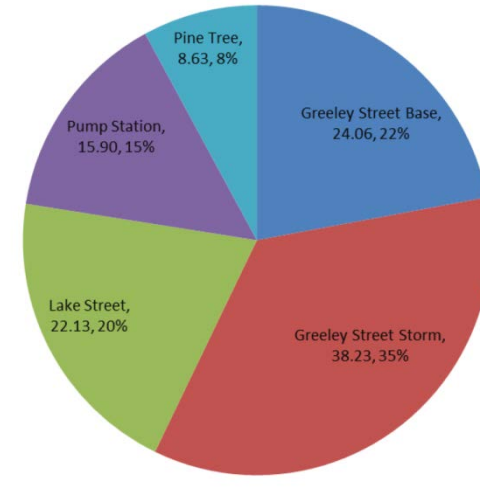
- Accurate sub-catchment mapping
  - Drainage area
  - impervious surface coverage
  - Connectivity
  - existing BMPs
- Outfall monitoring
  - 5 of 8 outfalls responsible for 95% of Phosphorus import
- WinSLAMM Modeling
  - Potential BMPs identified



# Goals + Methods: Final 45

## Final 45 Planning

- Feasibility + Civic Engagement
  - Articles, open houses, Lily Lake Lake Association Meetings
  - City Council, City Parks, County Commissioners meetings
- 2 projects chosen for further refinement
  - Greeley Street + Lake Street catchments
    - Able to provide P load reduction
    - Available land
    - Support from City and residents

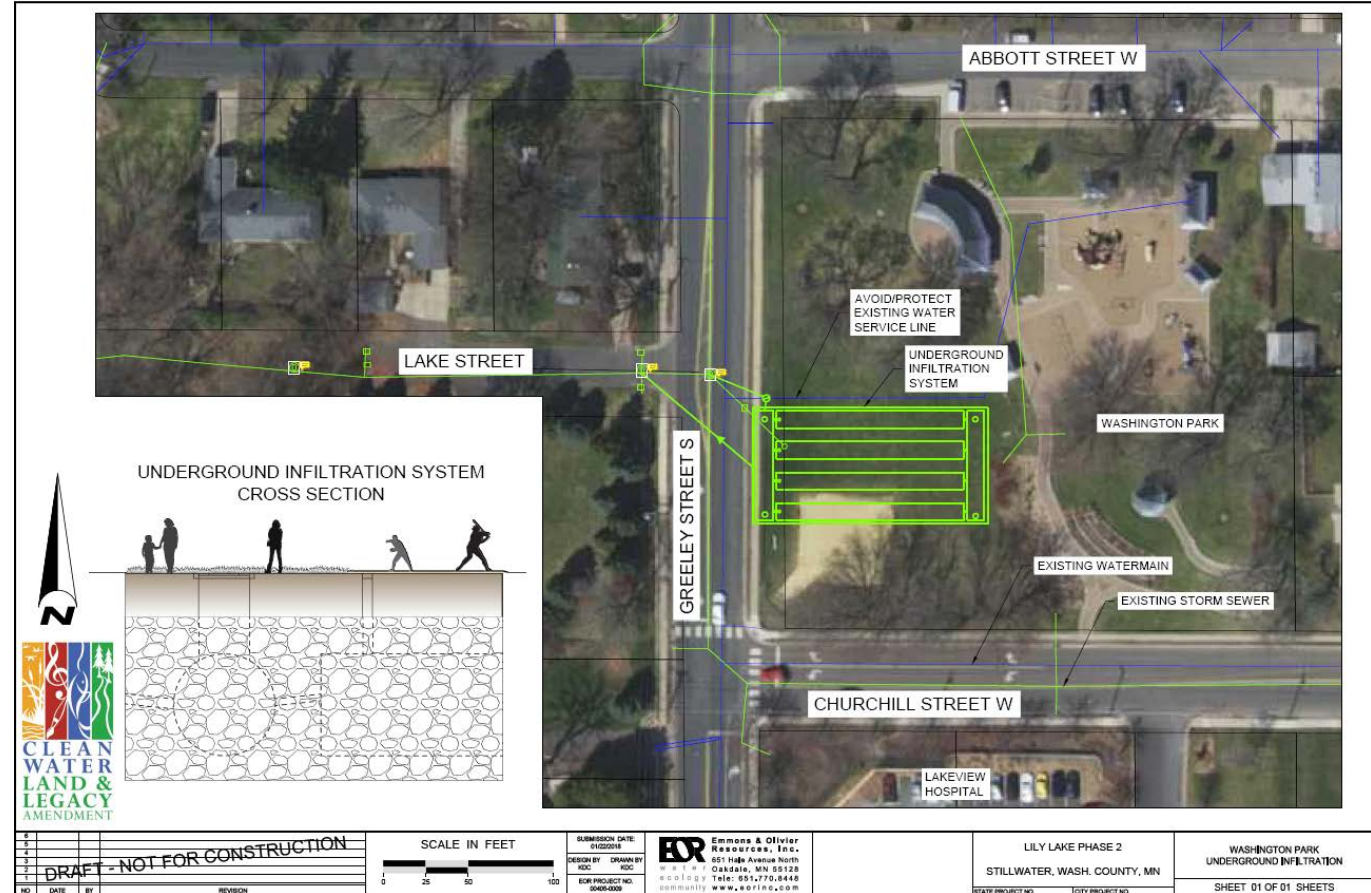
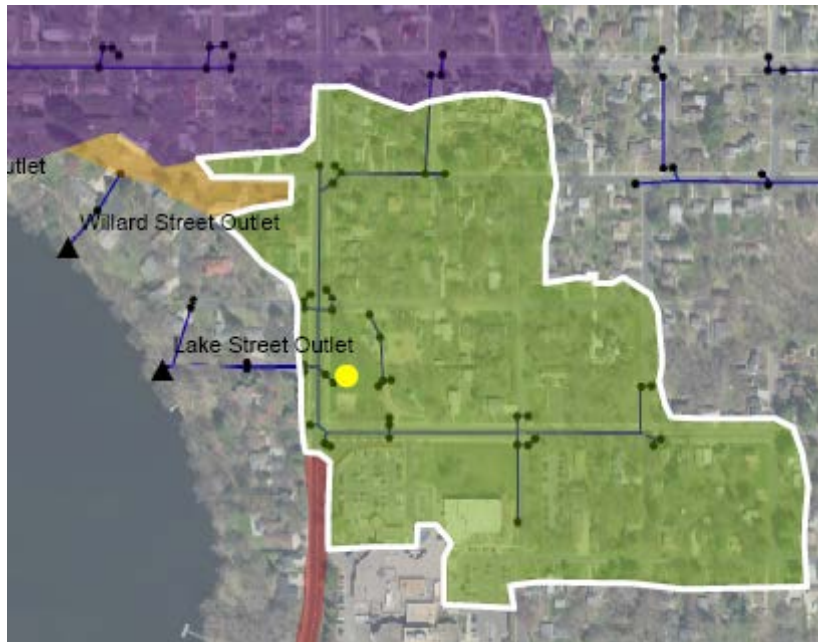




# Methods: BMP Feasibility

## Lake Street Catchment Project

- Hospital Area
  - 20% of phosphorus loading
  - Space available in existing park

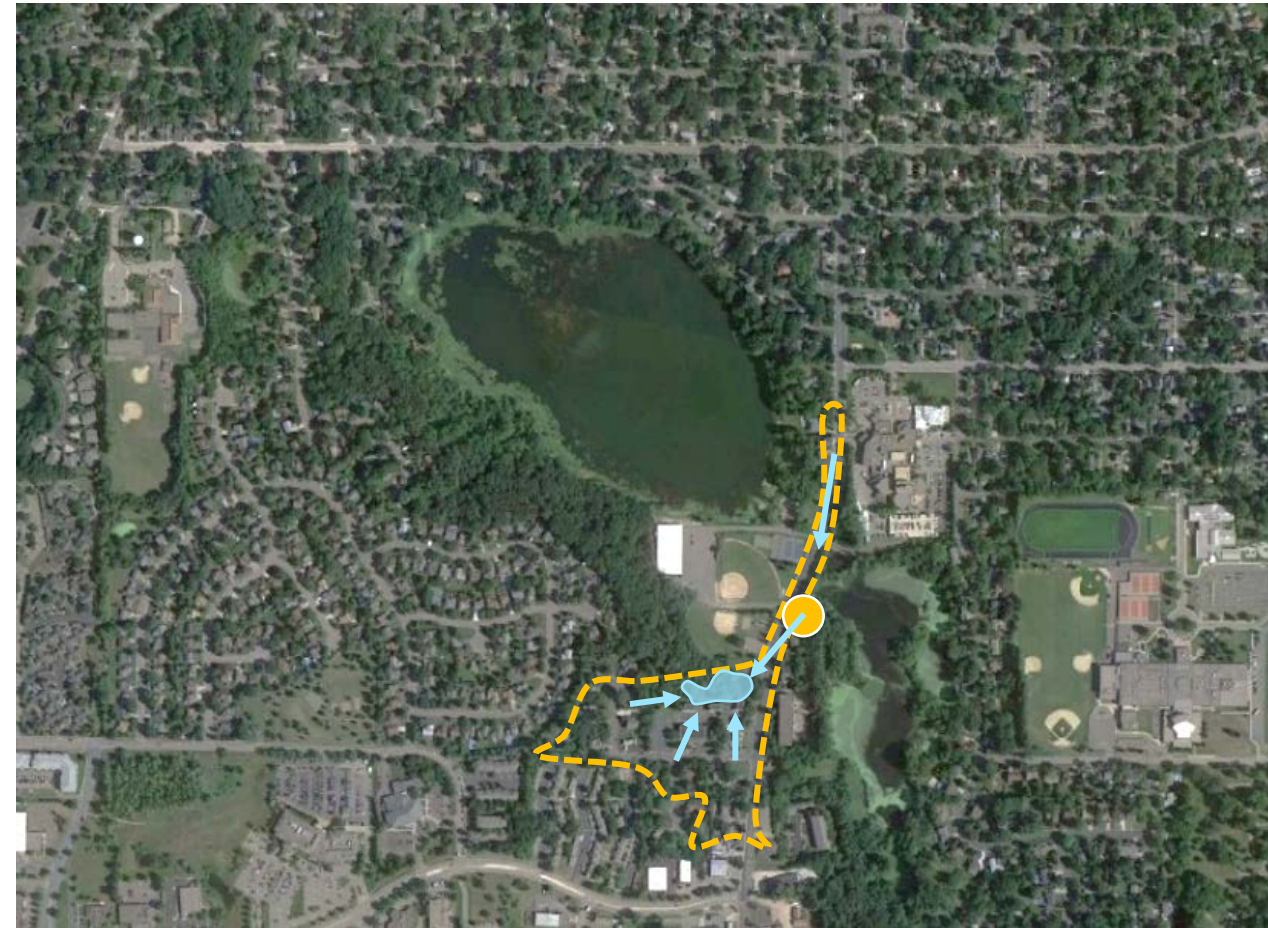
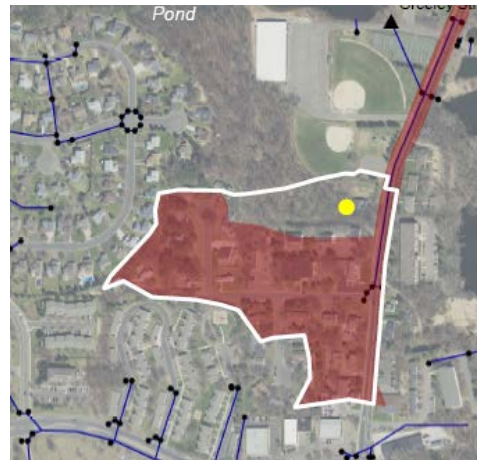
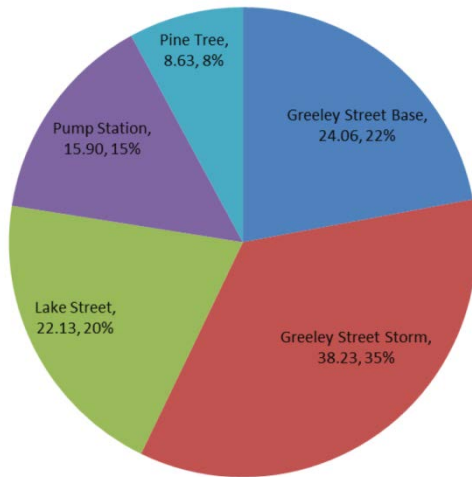




# Methods: BMP Feasibility

## Greeley Storm Catchment

- 17.3 acres (7 hectare)
- Flows from Greeley Street + Brick Pond overflow
- Highly “flashy” with steep slopes





# Methods: BMP Planning

## Lily Lake Infiltration Basin

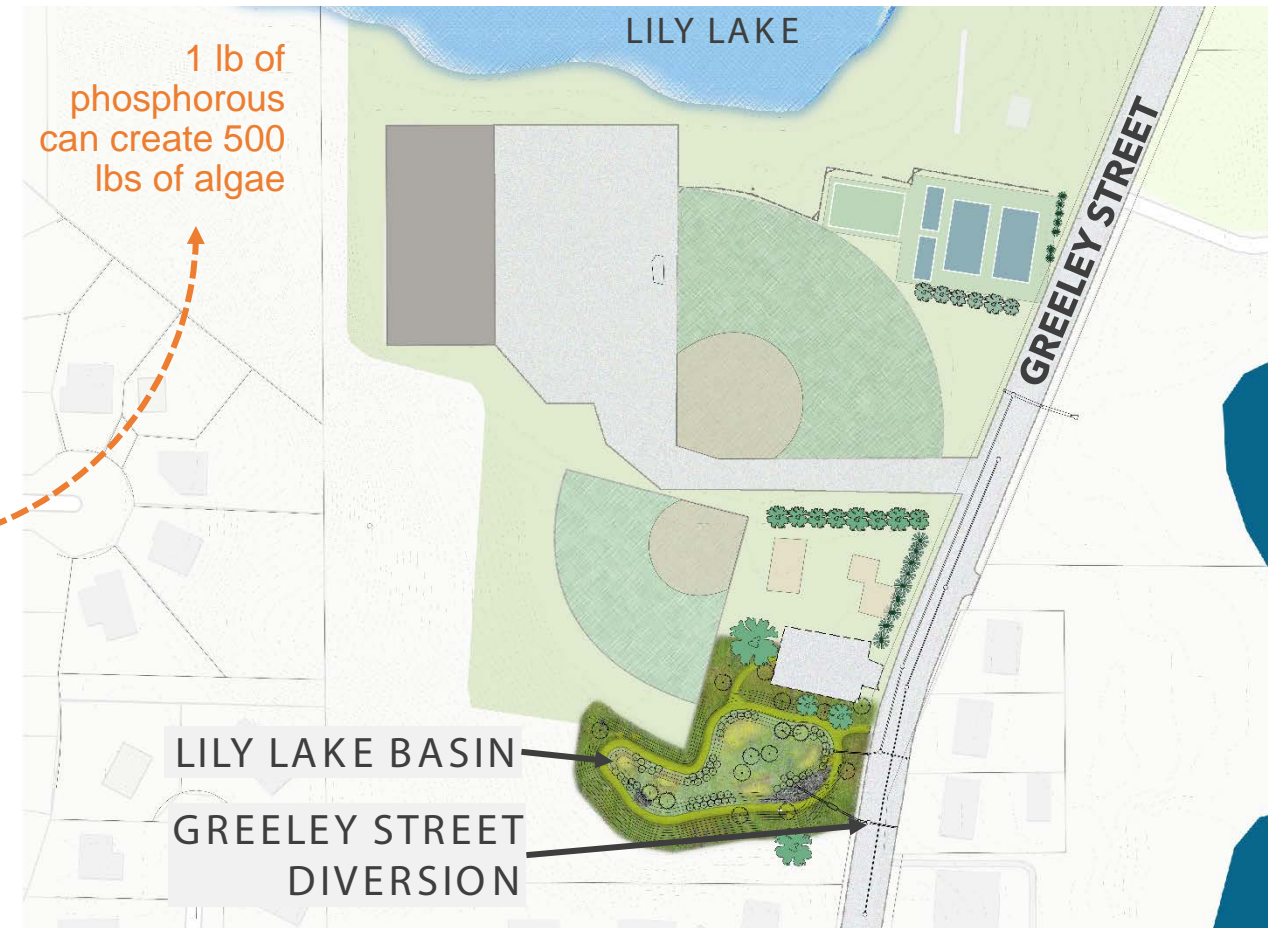
- 15,000 square feet (140 m<sup>2</sup>)
- Diverts all flow from Greeley Street into basin
- Native soils infiltrate more than 2.5" per hour (63.5 mm)



# Methods: Lily Lake Park Infiltration Basin

## An ecological landscape amenity

- Treats runoff from 48 acres (19 ha)
- 20,000 cubic feet live storage (566 cubic meters)
  - Accommodates a 1.1" storm
- 1.4 acres of new native vegetation + habitat
- 45 lbs of phosphorous removed annually (20.4 kg)





# Methods: Lily Lake Park Infiltration Basin

## Construction Begins

- Grant funds provided the Minnesota Clean Water Land and Legacy Fund
- Land and \$\$ provided by City of Stillwater
- Bids Received May 2021
- Low Bidder = \$250,000 USD





# Methods: Lily Lake Park Infiltration Basin

A community park feature

- Walking Trails
- Water quality signage
- Volunteer Planting Day (over 1300 plants)





# Celebrating Success: “Delisting Party”



September 30, 2022

Friends of Lily Lake hosted a party to celebrate the “de-listing” of the lake



Bringing the fire from the lake



Bonfire ceremony



Burning the letter that notified them of the listing of Lily Lake on the state Impaired Waters List

# Celebrating Success: A Clean and Clear Lake



De-Listing Goal:  
Secchi reading of 1.4m or greater



August 2022:  
Secchi disk reading of 7.6m (25')



# Outcomes: Inspiration

## 50+ Water Bodies de-listed

- Set example for improving local water quality
- Implement large-scale improvements through state funds and local partnerships
- Show that it is possible to reverse negative trends and “save” a lake
  - Storm drain maintenance
  - Homeowner rain gardens





# Partners: Long-Term Team Effort

“The Lily Lake delisting was a massive multi-year, multistakeholder project —both public and private —that took thousands of hours of collaboration and outreach”

-Bryan Pynn | WCD | Watershed Restoration Specialist

- Washington Conservation District
- Middle St Croix Watershed Management Organization
- City of Stillwater, Minnesota
- Clean Water Land and Legacy Amendment
- EOR, Wenck, SEH, Stantec





# Thank you



Britta Hansen, OALA

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visit us at: [www.eorinc.com](http://www.eorinc.com)





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