



# Lake Dalecarlia Watershed Diagnostic Study Public Meeting

PRESENTER:  
Tom Estrem with Cardno

November 15, 2021

## Topics Discussed

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- Project Review-Goals

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- Review of Watershed Characteristics

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- Assessment Tasks Completed

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- Results of Sampling

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- Management  
Considerations/Recommendations

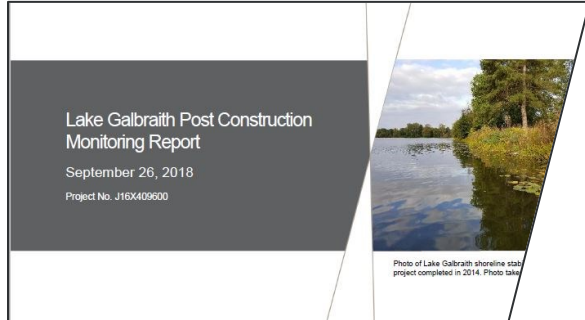
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- Questions

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# Lake Dalecarlia Watershed Diagnostic Study Overview

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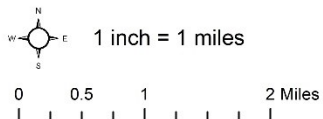


## > Goal of Study

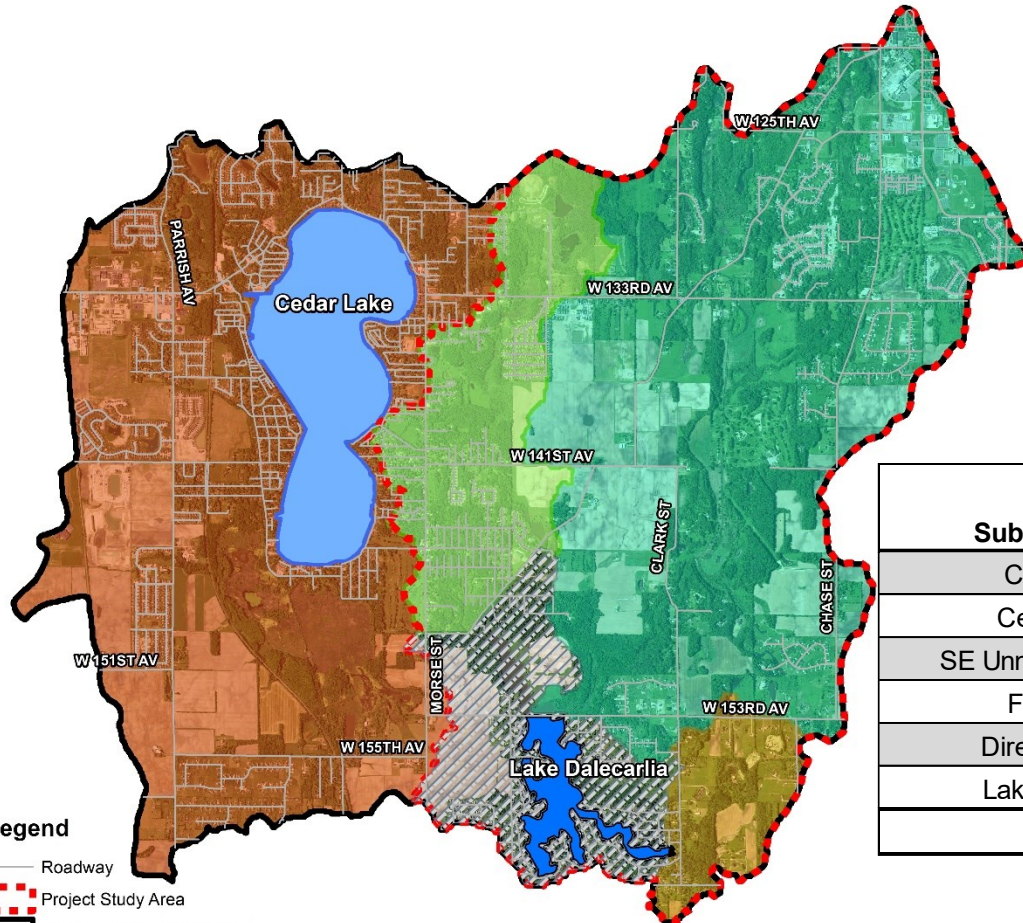
- Document existing water quality conditions within the watershed (Tributaries) and in Lake Dalecarlia
- Develop management recommendations
- Study includes watershed downstream of Cedar Lake

## > Study Tasks

- Watershed tour
- Tributary Sampling – 8 sites – 6 events
- In-lake sampling – 1 event in summer
- Sediment assessment in lake and Foss Ditch trap
- Comprehensive project report
- Minimum of two public meetings
- In-kind service credit provided to LDPOA (\$2,600 available)



## Subwatershed Map

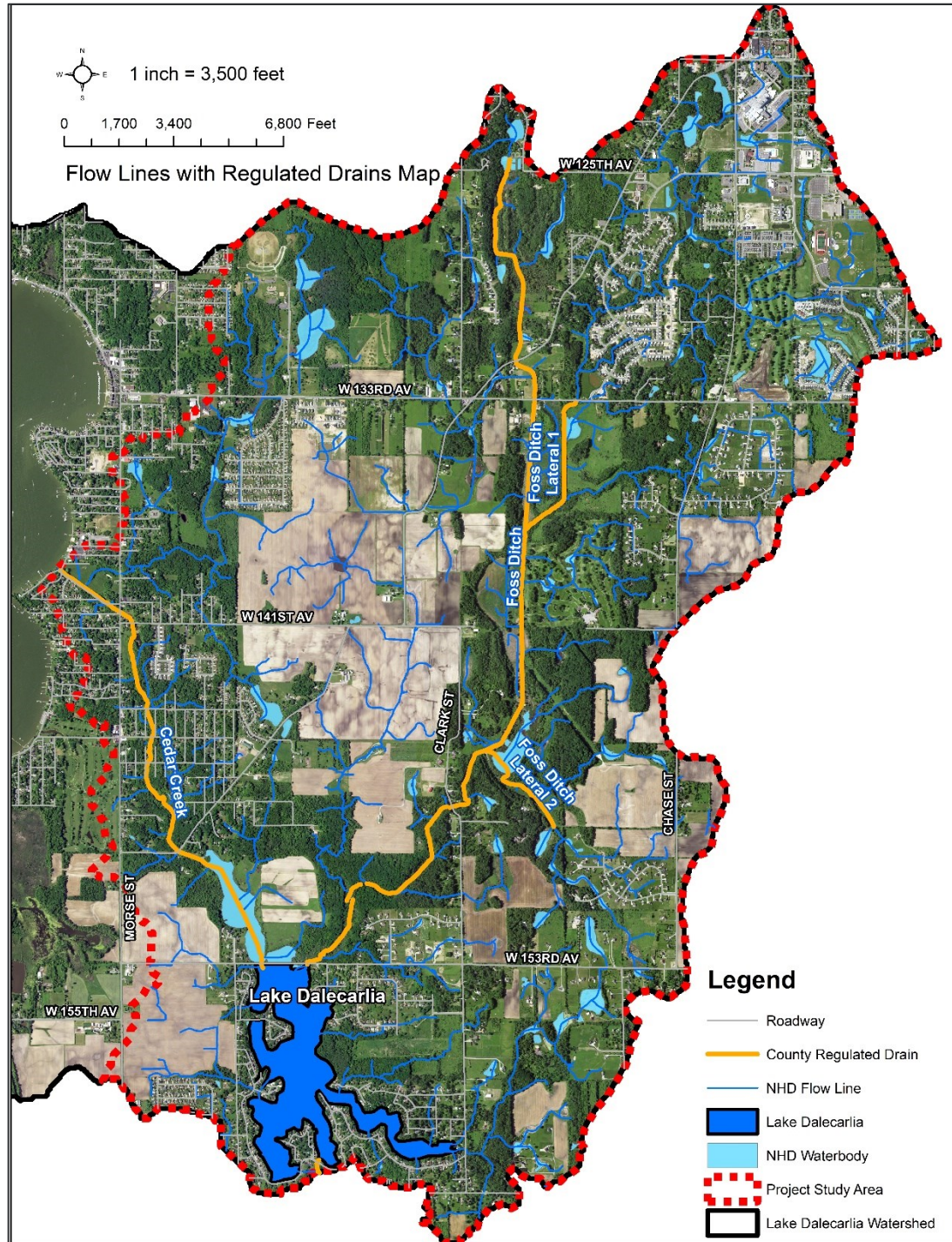


Subwatershed	AREA		DRAINAGES	
	Acres	Hectares	Feet	Miles
Cedar Lake	5233	2118	307194	58.20
Cedar Creek	1249	506	78165	14.82
SE Unnamed Tributary	470	190	26191	4.97
Foss Ditch	4940	1999	307033	58.10
Direct Drainage	883	357	77604	14.69
Lake Dalecarlia	172	70	-	-
<b>TOTAL</b>	<b>12947</b>	<b>5240</b>	<b>796187</b>	<b>150.78</b>

## Legend

- Roadway
- Project Study Area
- Lake Dalecarlia Watershed
- Cedar Lake
- Lake Dalecarlia
- Cedar Creek Subwatershed
- Cedar Lake Subwatershed
- SE Unnamed Tributary Subwatershed
- Foss Ditch Subwatershed
- Direct Drainage

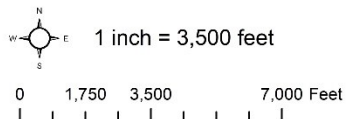




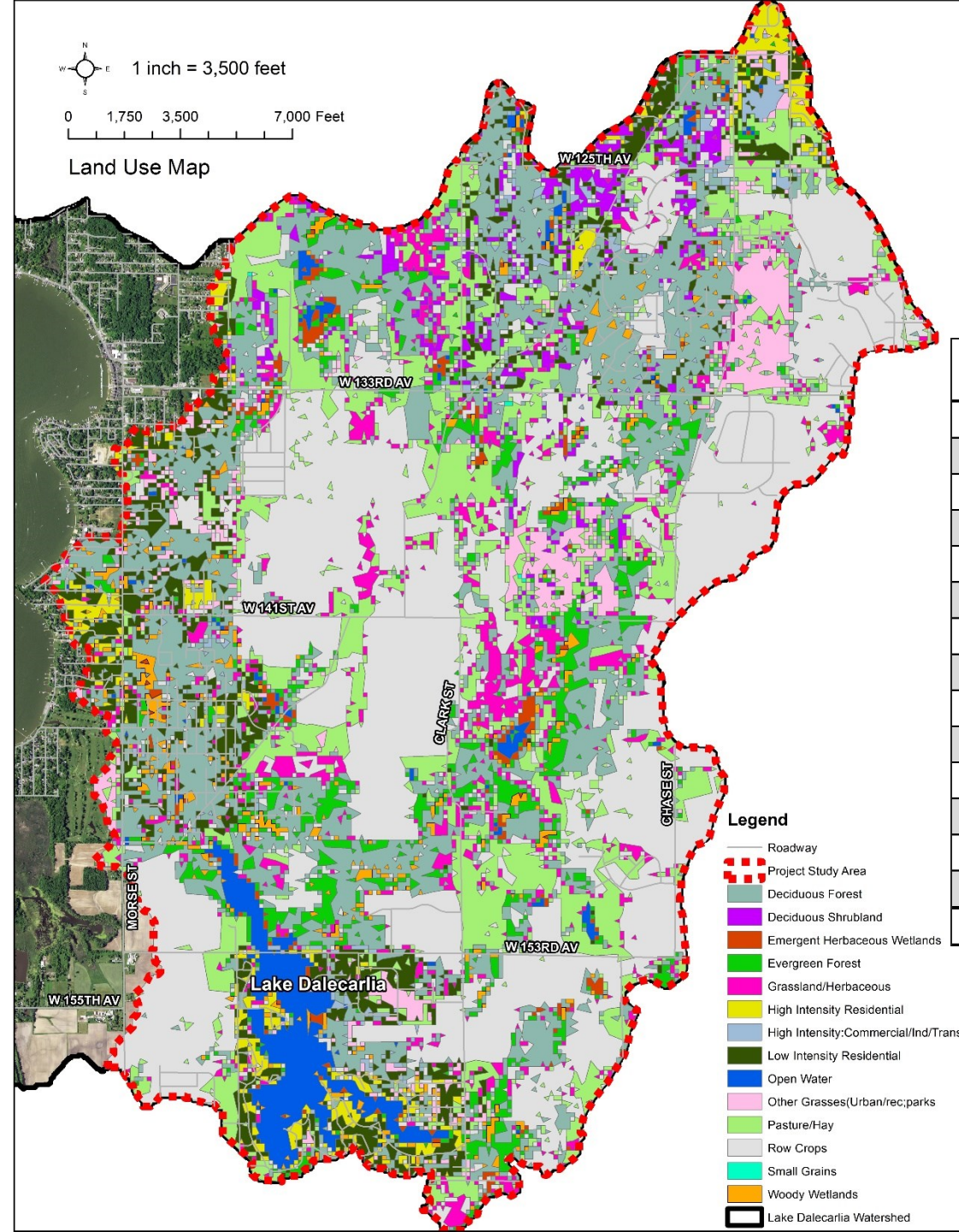
## Lake County Regulated Drains:

- Cedar Creek
- Foss Ditch
- Foss Ditch Lateral 1
- Foss Ditch Lateral 2





Land Use Map



**Legend**

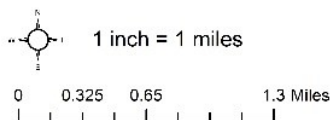
- Roadway
- Project Study Area
- Deciduous Forest
- Deciduous Shrubland
- Emergent Herbaceous Wetlands
- Evergreen Forest
- Grassland/Herbaceous
- High Intensity Residential
- High Intensity:Commercial/Ind/Trans
- Low Intensity Residential
- Open Water
- Other Grasses(Urban/rec;parks
- Pasture/Hay
- Row Crops
- Small Grains
- Woody Wetlands
- Lake Dalecarlia Watershed

Classification	Acres	Relative Percent (%)
Row Crops	2622.6	34.0
Deciduous Forest	1626.9	21.1
Pasture/Hay	1074.3	13.9
Low Intensity Residential	499.5	6.5
Grassland/Herbaceous	375.8	4.9
Evergreen Forest	340.6	4.4
Other Grasses(Urban/rec;parks	278.6	3.6
Open Water	239.0	3.1
High Intensity Residential	169.4	2.2
Deciduous Shrubland	168.6	2.2
Woody Wetlands	151.6	2.0
High Intensity:Commercial/Ind/Trans	93.3	1.2
Emergent Herbaceous Wetlands	72.4	0.9
Small Grains	1.1	0.0
<b>TOTAL</b>	<b>7713.8</b>	<b>100</b>

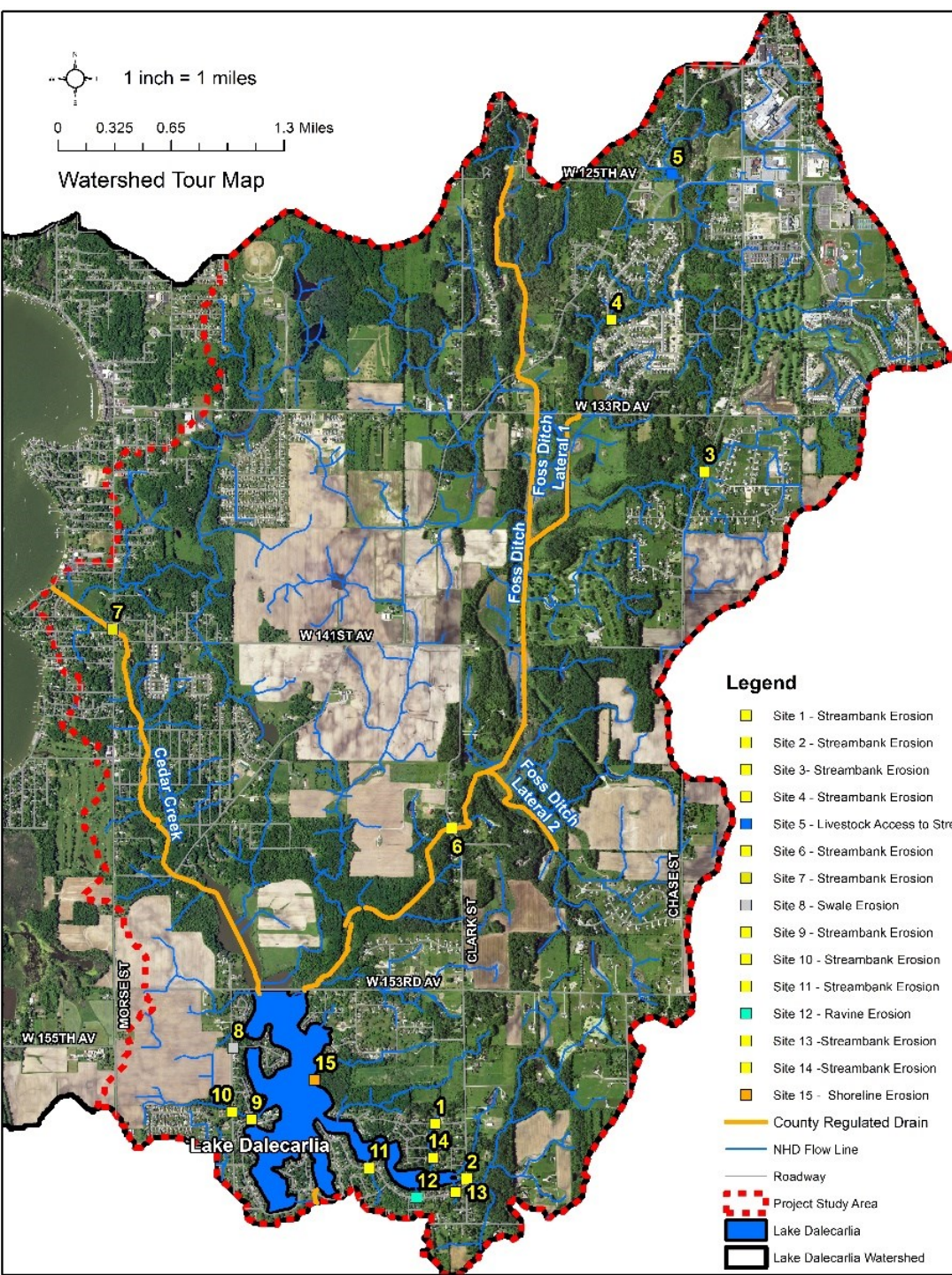








Watershed Tour Map



#### Legend

- Site 1 - Streambank Erosion
- Site 2 - Streambank Erosion
- Site 3 - Streambank Erosion
- Site 4 - Streambank Erosion
- Site 5 - Livestock Access to Stream
- Site 6 - Streambank Erosion
- Site 7 - Streambank Erosion
- Site 8 - Swale Erosion
- Site 9 - Streambank Erosion
- Site 10 - Streambank Erosion
- Site 11 - Streambank Erosion
- Site 12 - Ravine Erosion
- Site 13 - Streambank Erosion
- Site 14 - Streambank Erosion
- Site 15 - Shoreline Erosion
- County Regulated Drain
- NHD Flow Line
- Roadway
- - - Project Study Area
- Lake Dalecarlia
- Lake Dalecarlia Watershed

**Watershed Tour completed on April 15, 2022**

#### Identify Issues:

- Numerous drainage instability issues around lake.
- Streambank erosion.
- Potential animal access to stream.
- Shoreline erosion.
- Increased residential development.

#### Positive Items:

- Modified tillage practices on most agricultural fields
- Cedar Creek nice floodplain in locations
- Stable stream reaches





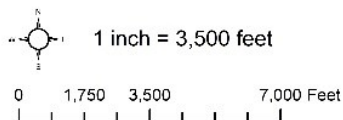
Streambank Erosion: (Top) Site 1; (Bottom) Site 10



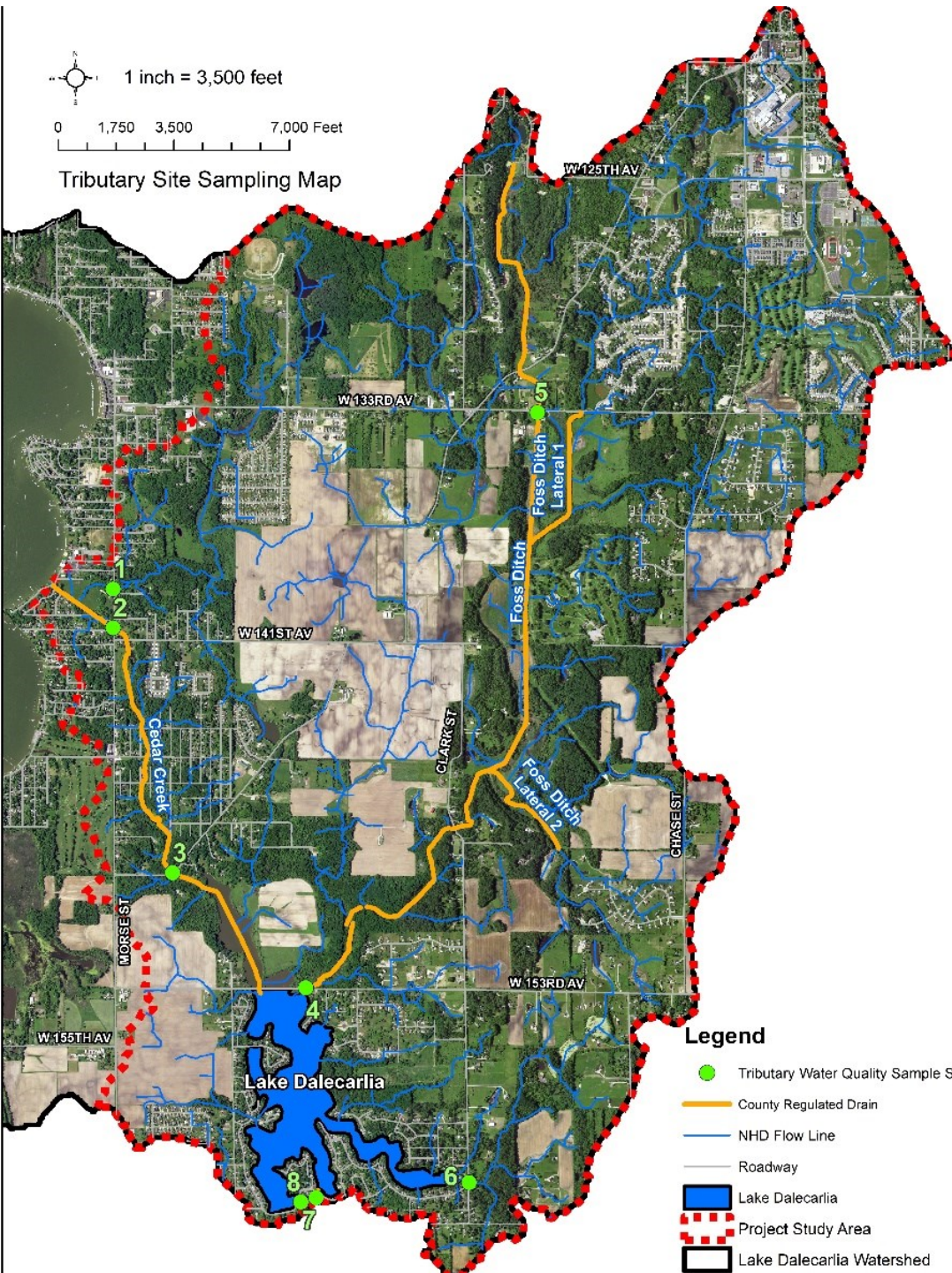
Streambank Erosion: (Top Site 3); (Bottom) Site 14







Tributary Site Sampling Map



## Tributary/Watershed Sampling

### Sites:

1. Unnamed Trib to Cedar Creek Morse Rd
2. Cedar Creek at Morse Rd
3. Cedar Creek at Reeder Rd
4. Foss Ditch at 153<sup>rd</sup> Ave
5. Foss Ditch at W 133<sup>rd</sup> Ave
6. Unnamed Tributary Clark St
7. East Lake outlet
8. West Lake outlet

**Sampled during 6 events:** April, May, June, August (2 events), September

\*Low water levels in 2021 resulted in some difficulty sampling storm events.

Physical and Chemical metrics assessed.

### Legend

- Tributary Water Quality Sample Site
- County Regulated Drain
- NHD Flow Line
- Roadway
- Lake Dalecarlia
- Project Study Area
- Lake Dalecarlia Watershed



Site	2021 Mean Values						
	NH3-N (mg/L)	NO3--N (mg/L)	TP-P (mg/L)	SRP-P (mg/L)	<i>E. coli</i> (MPN/100 mL)	TSS (mg/L)	Discharge (cfs)
Site 1 - Unnamed Tributary to Cedar Creek at Morse St.	0.036	0.161	0.159	0.0715	2966	37.7	1.455
Site 2 - Cedar Creek at Morse St.	0.278	0.180	0.188	0.0445	3643	38.3	3.969
Site 3 - Cedar Creek at W 149th Ave. (Reeder Rd.)	0.145	0.149	0.232	0.0258	627	79.6	*
Site 4 - Foss Ditch at 153rd Ave.	0.135	0.783	0.146	0.0571	517	15.7	7.527
Site 5 - Foss Ditch at 133rd Ave.	0.215	0.199	0.241	0.0921	3091	48.1	1.431
Site 6 - Unnamed Tributary at Clark St.	0.048	0.399	0.135	0.0673	3927	44.8	1.229
Site 7 - Eastern Lake Outlet	0.154	0.160	0.160	0.0437	63	35.4	0.572
Site 8 - Western Lake Outlet	0.27175	0.132	0.197	0.0437	132	41.1	6.930

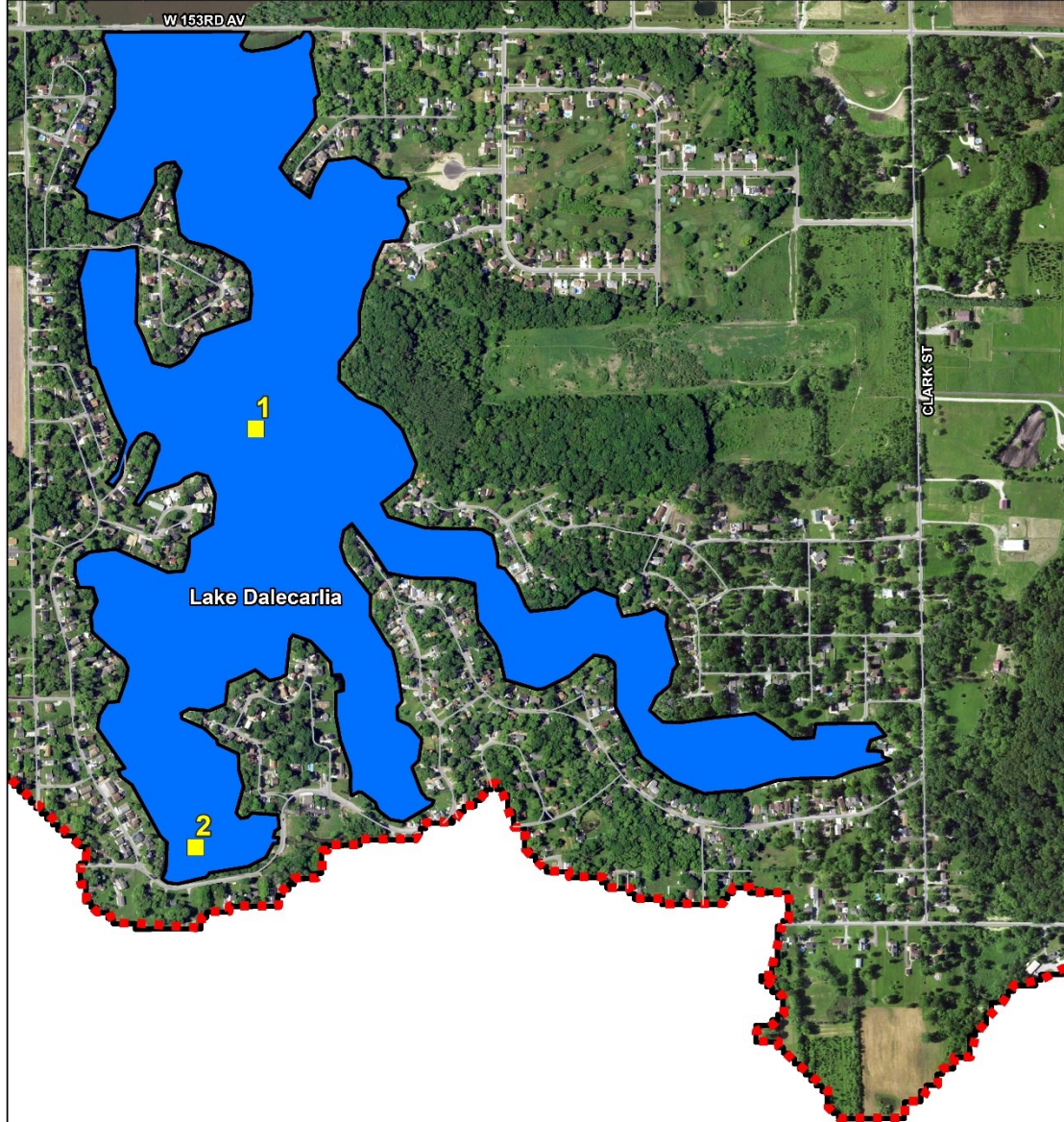
### Trends Observed:

- **Ammonia (NH3-N)** - Exceeded at most site (except Site 1)
- ***E. coli*** concentrations variable at all sites.
  - Lake outlets low below State Standard,
  - Foss Ditch Site 4 lowest from other sites
  - State Standard is 235 MPN/100 mL
- **Nitrate (NO3)** concentrations low- all below 1.0 which is good
- **Total phosphorus (TP-P)**- overall high- Would like to see below 0.1 mg/L
- **Soluble Reactive Phosphorus (SRP)** – similar to Total phosphorus high
- **Total Suspended Solids (TSS)** – less than 25 mg/L is acceptable- only Site 4 Foss Ditch achieved.
- Site 4: Foss Ditch had the most stable parameters throughout sampling period
  - chemical concentrations lower at downstream end
  - TSS lowest at Site 4-suggest sediment trap is working

Site	2021 Mean Values				
	Temp (°F)	DO (mg/L)	% Sat	pH	Cond. (µs/cm)
Site 1 - Unnamed Tributary to Cedar Creek at Morse St.	62	6.19	65.1	6.88	560
Site 2 - Cedar Creek at Morse St.	65	6.09	65.7	7.06	421
Site 3 - Cedar Creek at W 149th Ave. (Reeder Rd.)	68	5.50	61.6	6.54	428
Site 4 - Foss Ditch at 153rd Ave.	63	5.43	62.6	6.87	778
Site 5 - Foss Ditch at 133rd Ave.	62	6.18	67.8	6.78	742
Site 6 - Unnamed Tributary at Clark St.	63	6.77	69.9	6.88	396
Site 7 - Eastern Lake Outlet	71	8.02	91.2	7.50	521
Site 8 - Western Lake Outlet	71	7.46	85.9	7.59	531

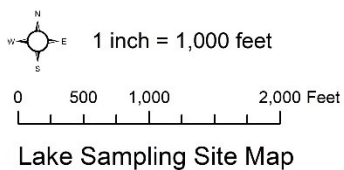
- All Physical Parameters were acceptable during the sampling period, with the exception of dissolved oxygen (DO).
  - DO did go below 4.0 mg/L at a couple of sites at different times.
  - Indiana standard is 4.0 mg.
- **More detailed analysis to come in report, plus loading rates.**





## Samples collected on August 17, 2021

- 2 locations
  - Center of lake (Site 1)
  - Near west outlet (Site 2)
- **Data Collected**
  - Water sample collected at top and bottom of water column
    - Epilimnion (surface)
    - Hypolimnion (bottom)
  - Temperature/Dissolved oxygen profile
  - Light extinction profile
  - Secchi Disk (water clarity)



### Legend

- Lake Sampling Site
- Roadway
- Lake Dalecarlia
- Project Study Area
- Lake Dalecarlia Watershed

Site Name	Date	Secchi Disk (ft)	pH	Cond. (µs/cm)	Turbidity (NTU)	NH3-N (mg/L)	NO3--N (mg/L)	SRP-P (mg/L)	TP-P (mg/L)
Site 1 Epilimnion	8/17/2021	0.8	7.53	501	54.90	<0.0098	<0.0060	0.039	0.162
Site 1 Hypolimnion	8/17/2021	-	7.75	479	69.90	<0.0098	<0.0060	0.035	0.179
Site 2 Epilimnion	8/17/2021	0.8	7.48	466	-	<0.0098	<0.0060	0.029	0.162
Site 2 Hypolimnion	8/17/2021	-	7.46	465	-	<0.0098	<0.0060	0.0217	0.166

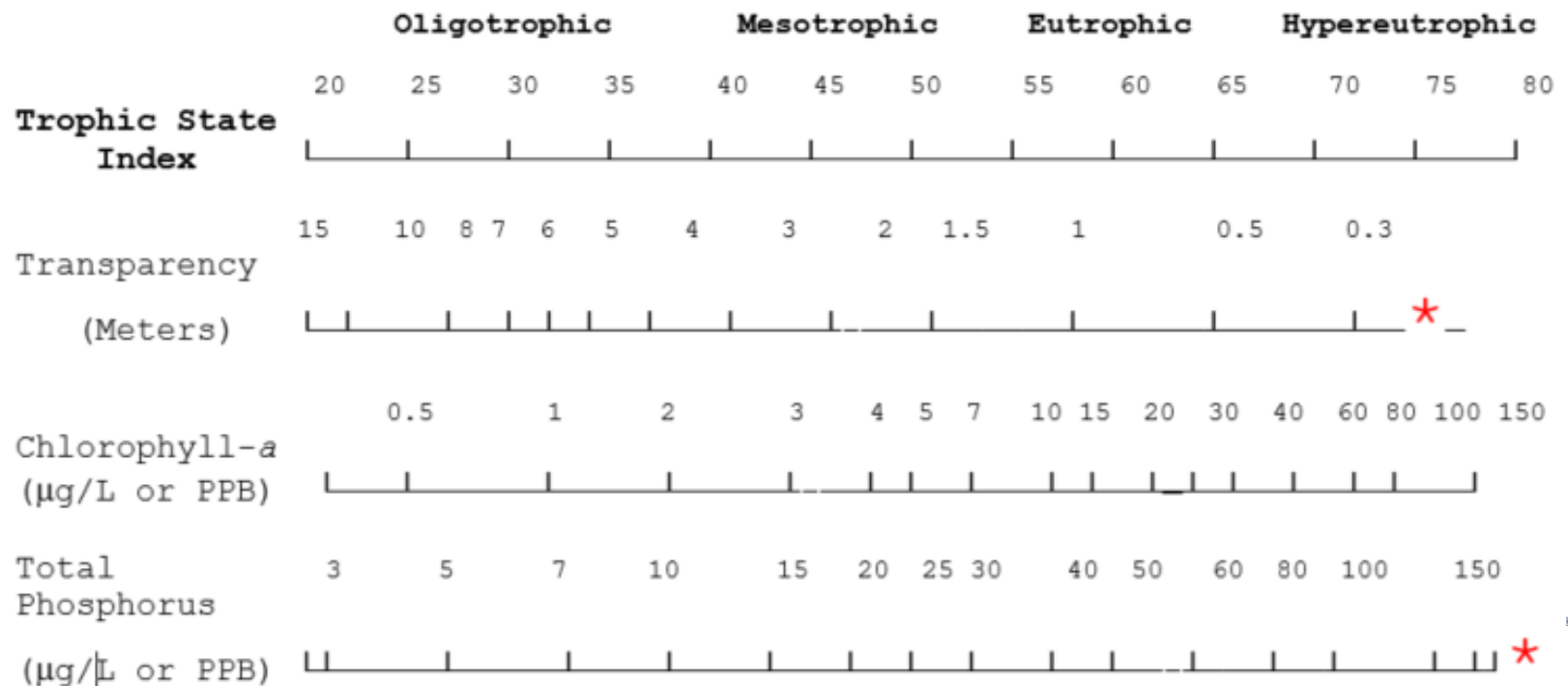
- No change in characteristics from top to bottom of water column
  - Too shallow to stratify
  - No internal release of phosphorus from sediments suggested-also why SRP is low.
- Secchi Disk reading very low – poor water clarity
- pH and conductivity normal
- Ammonia and Nitrate low because water column is oxygenated.
- Total phosphorus is high
- Adequate dissolved oxygen within water column - all above 6 mg/L
- Light extinction profile estimates 1% light level is at 2.75 ft
  - Below 2.75 feet suggest no aquatic plants can grow.

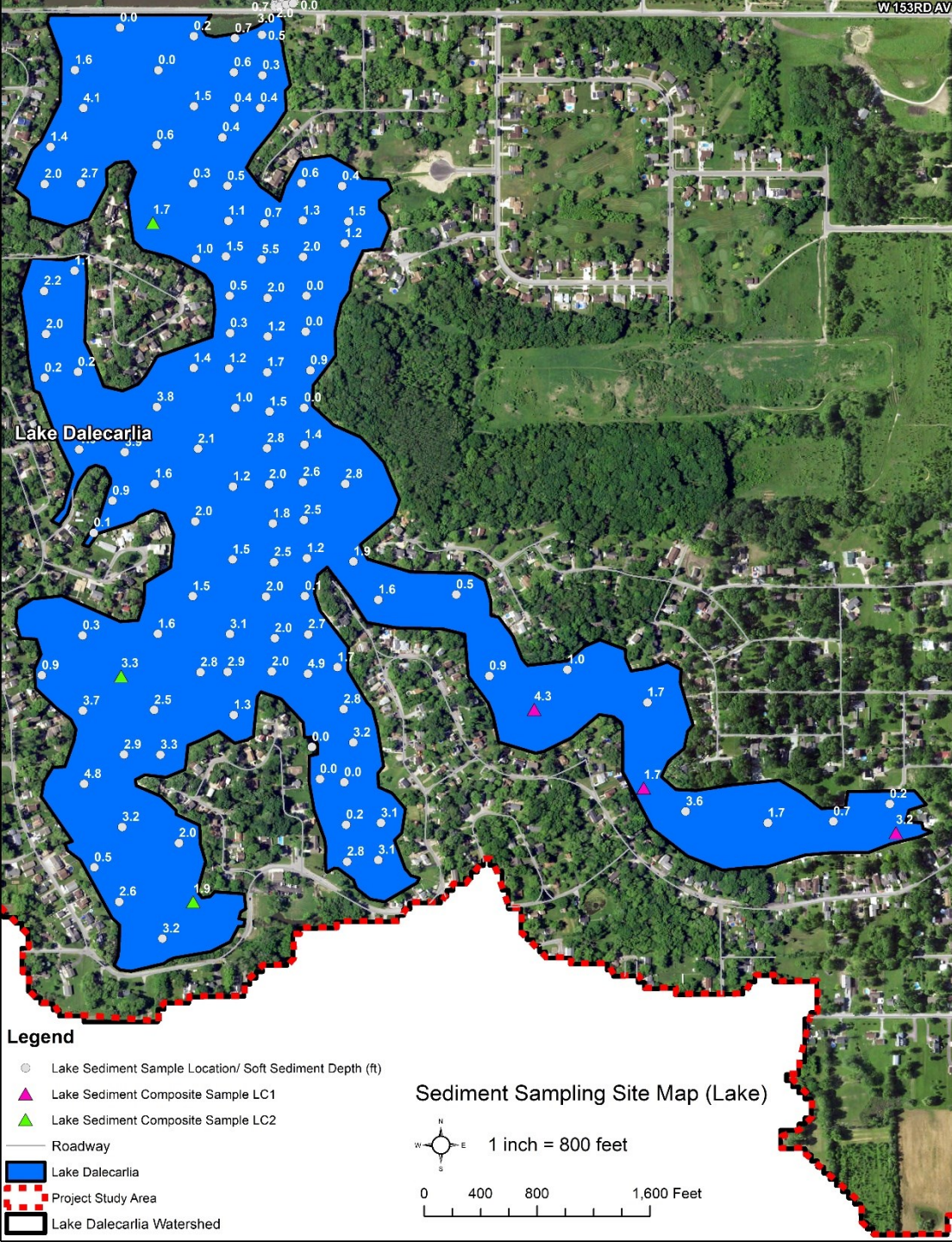


Water quality characteristics of 456 Indiana lakes sampled from July and August 1998 through 2004 by the Indiana Clean Lakes Program (Jones, n.d.). Means of epilimnion and hypolimnion samples were used.

Site Name	Secchi Disk (ft)	NH3-N (mg/L)	NO3--N (mg/L)	SRP-P (mg/L)	TP-P (mg/L)
Minimum	0.3	0.004	0.010	0.010	0.010
Maximum	32.8	22.500	9.400	2.840	2.810
Median	6.9	0.818	0.275	0.120	0.170
Lake Dale Site 1	0.8	<0.0098	<0.0060	0.037	0.171
Lake Dale Site 2	0.8	<0.0098	<0.0060	0.025	0.164

## CARLSON'S TROPHIC STATE INDEX





- Average loose sediment depth 1.7 ft
- Range 0 – 4.8ft
- Sediment was primarily silt or sand
- **Total estimated loose sediment volume = 398,599 cubic yards**
- Two sediment samples from lake analyzed for RCRA 8 Metals and nutrients-results on following slide.





Chemical	Result (mg/kg-dry)			Soil Direct Contact Exposure, Residential Screening Level (mg/kg) <sup>1</sup>	Soil Migration to Groundwater, Residential Screening Level (mg/kg) <sup>1</sup>	Exceeded Screening Level
	LC1	LC2	FDC			
Arsenic	13	38	3.7	9.5	5.9	Yes: LC1, LC2; No: FDC
Barium	93	140	16	21000	1700	No
Cadmium	0.27	0.37	0.084	99	7.5	No
Chromium	17	23	3.9	100000	1000000	No
Lead	24	35	5.7	400	270	No
Mercury	0.051	0.053	<0.016	3.1	2.1	No
Selenium	<1.1	<1.1	<1.1	550	5.3	No
Silver	<0.15	<0.16	<0.16	550	16	No

- Arsenic only chemical to exceed Indiana Department of Environmental Management (IDEM) screening levels. (more research into why this might be).
- Nitrogen and Phosphorus levels in sediments were high.
- Potential follow-up modeling for the Foss Ditch sediment trap to be completed as part of project report.

# Recommendations and Management Considerations

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- Additional analysis and discussion to be presented in final report. Take into consideration goals of the LDPOA.
- **Priority Management areas at this time**
  - Continue to treat lake for algae
  - Discuss regular scheduled maintenance of Foss Ditch sediment trap with County
  - Work with POA members to implement best management practices around the lake and direct drainage areas.
    - Limit lawn waste to lake
    - Eliminate or reduce lawn fertilizer
    - Native vegetation and buffers along shoreline
  - Address watershed tour sites highlighted for erosion issues within the POA footprint
    - Shoreline erosion
    - Streambank, ravine and swale erosion
  - Assess ability to dredge lake. Cost estimates, spoils areas.
  - Develop partnerships for watershed management:
    - Producers
    - County Surveyor for streambank stabilization on regulated drains
    - Municipalities
    - USDA, NRCS

## Remaining Items to complete

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- Submit Draft Report by end of year
  - Additional phosphorus modeling
  - General cost estimates
  - Foss Ditch modeling potentially
  - Investigate potential funding sources
- Final Report in January/February
- Additional public meeting if requested in 2022



# Thank you

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For more information

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