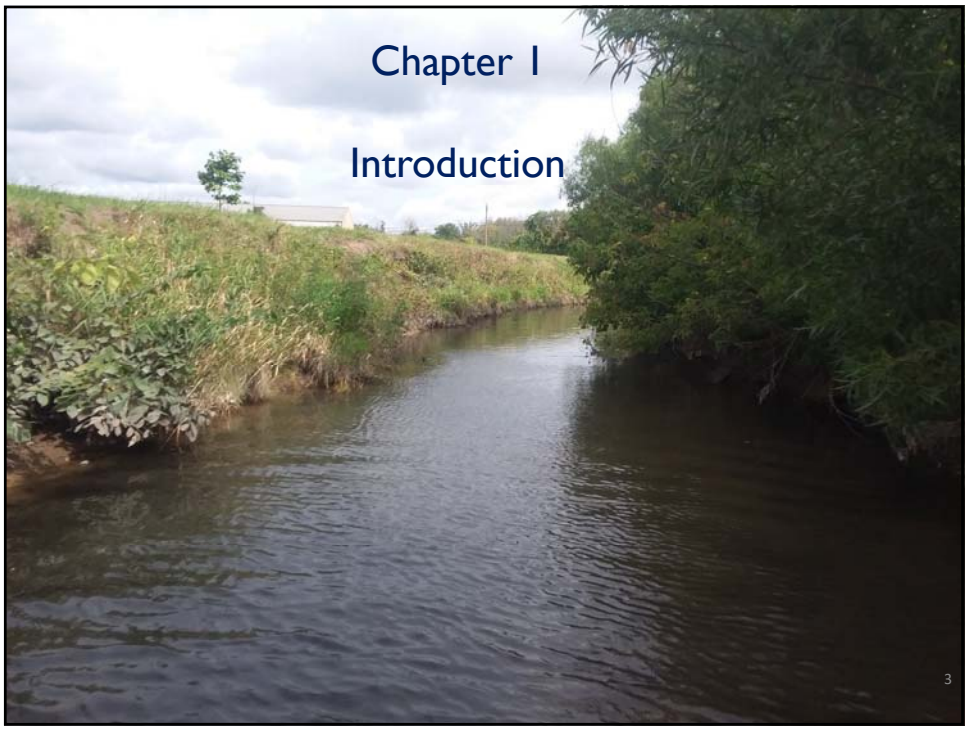
Agenda

OAK CREEK WATERSHED FUTURE

- Review draft Chapter 1
- Review draft Chapter 2
- Review draft Chapter 3
- Presentation by Dr. Julie Kinzelman, City of Racine Public Health Department



Chapter 1

- This chapter describes:
  - The purpose of the plan
    - Brief watershed description
    - USEPA 9 Key Element watershed plan requirements
  - The planning process
    - Focus issues
    - Advisory Group
    - Outreach
  - Plan format and organization

Chapter 1

OAK CREEK WATERSHED FUTURE

USEPA Nine Key Elements

1. Identify pollutant sources to be controlled
2. Estimates of load reductions from management measures
3. Description of management measures to implement and critical areas
4. Estimates of amounts of technical and financial assistance needed
5. Information and education component
6. Implementation schedule
7. Description of interim milestones for determining whether the plan is being implemented
8. Criteria for determining whether load reductions are being achieved
9. A monitoring component

Chapter 1

OAK CREEK WATERSHED FUTURE

USEPA Nine Key Elements

1. Identify pollutant sources to be controlled
2. Estimates of load reductions from management measures
3. Description of management measures to implement and critical areas

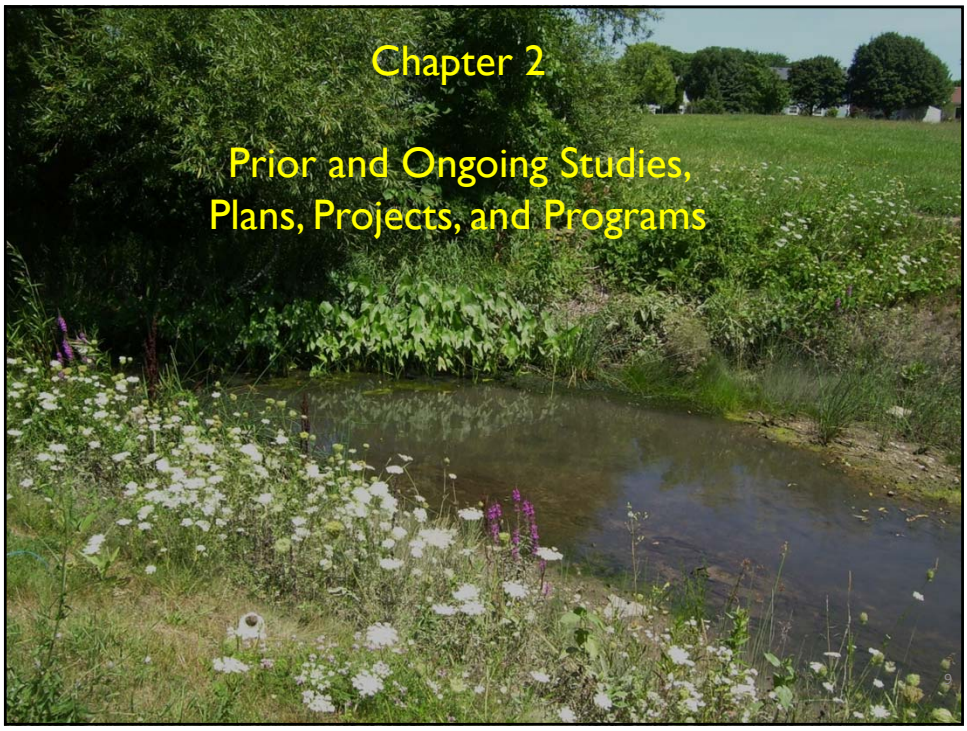
First 3 elements characterize and set goals to address pollution sources

USEPA Nine Key Elements

Remaining 6 elements determine specific resources and criteria to implement and evaluate the plan.

4. Estimates of amounts of technical and financial assistance needed
5. Information and education component
6. Implementation schedule
7. Description of interim milestones for determining whether the plan is being implemented
8. Criteria for determining whether load reductions are being achieved
9. A monitoring component

- Plan focus issues
  - Water quality
  - Recreational access and use
  - Habitat conditions
  - Targeted stormwater drainage and flooding issues
- The plan will also address the status of the Mill Pond and the associated dam



Chapter 2

- This chapter:
  - Summarizes the recommendations from the regional water quality management plan update (RWQMPU) for Oak Creek
  - Assesses implementation status of recommendations from the RWQMPU
  - Collates and reviews related plans for the Oak Creek watershed that address the watershed restoration plan (WRP) focus issues
  - Reviews recent projects in the watershed that address the WRP focus issues
  - Reviews programs and initiatives that are active or available in the Oak Creek watershed

Chapter 2

- The RWQMPU made recommendations in eight broad areas:
  - Land use
  - Point source pollution abatement
  - Rural nonpoint source pollution abatement
  - Urban nonpoint source pollution abatement
  - Instream water quality management
  - Inland lake water quality management
  - Auxiliary water quality management measures
  - Groundwater management

Chapter 2

- Examples of recommendations:
  - Land use
    - Develop according to approved local land use plans
    - Preserve environmental corridors, natural areas, and the most productive farmland
  - Urban nonpoint source pollution abatement
    - Chloride reduction, fertilizer management, and pet litter management programs
  - Instream water quality management
    - Restore wetlands, woodlands and grasslands adjacent to stream channels

Chapter 2

- Examples of recommendations:
  - Inland lake water quality management
    - Conduct aquatic plant surveys when conducting aquatic plant management
  - Auxiliary water quality management measures
    - Household hazardous waste and unused pharmaceutical collection programs
    - Water quality monitoring
  - Groundwater management
    - Protect important groundwater recharge areas

Chapter 2

- Implementation of recommendations:
  - Recommendations that reflect existing, ongoing regulatory requirements
    - Regulation of sewage treatment plant and industrial discharges through the Wisconsin Pollutant Discharge Elimination System permit program
    - State ban on phosphorus-containing fertilizers
    - County and municipal pet waste ordinances
    - State, MMSD, and municipal construction erosion control ordinances

Chapter 2

- Implementation of recommendations:
  - Recommendations that are in various stages of implementation
    - Construct and maintain local sanitary sewer systems
    - Preserve environmental corridors and natural areas
    - Household hazardous waste and unused pharmaceutical collection programs
    - Water quality monitoring programs
    - Remove abandoned bridges and culverts

Chapter 2

- Implementation of recommendations:
  - Recommendations not yet implemented
    - Consider changes in municipal water system corrosion control to reduce phosphorus loading
    - Convert marginally productive agricultural lands to wetland or prairie conditions
    - Implement waterfowl control programs, where needed

Collation and Review of Related Plans

- Land use plans
- Stormwater drainage, stormwater management, and flood control plans
- Sanitary sewer service area plans
- Environmental plans
  - Water quality, water supply, natural areas green infrastructure, comprehensive watershed plans
- Park and open space planning

Examples of Related Plans

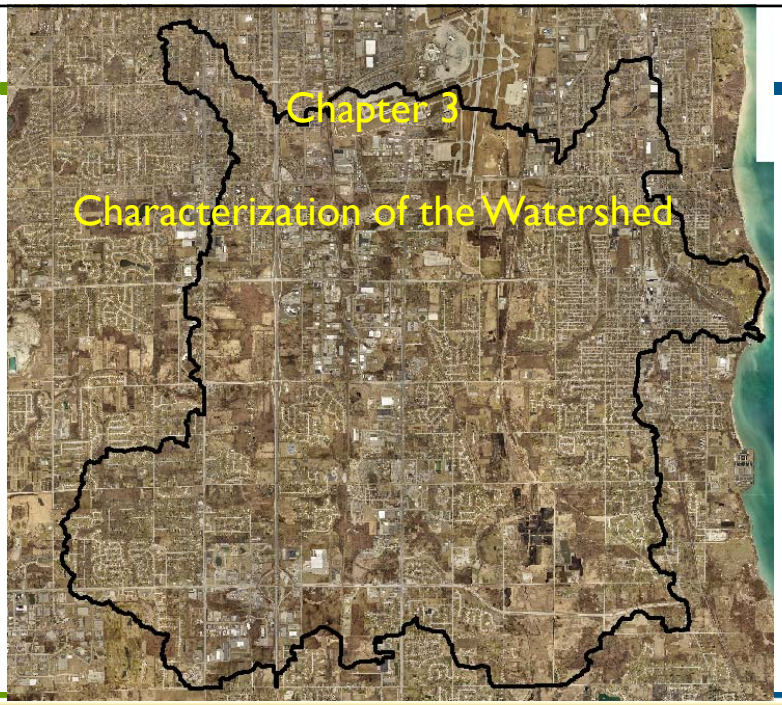
- Regional plans – Land use, water quality, park and open space
- Watershed plans – RWQMPU, WDNR watershed plans
- MMSD plans – Watercourse, green infrastructure, and conservation plans
- Milwaukee County plans – Park and open space, land and water resource management plans
- Local municipality plans – Land use, parks, stormwater management plans
- Plans for individual sites – Park restoration plans

Review of Recent Projects

- 1000 Friends of Wisconsin audit of municipal codes and ordinances for barriers to use of green infrastructure
- Drexel Town Square development
  - Wetland and prairie restoration
  - Stormwater ponds, floating islands, bioswales, permeable pavement
- Grant Park Bioblitz
  - Survey of all species present at the site in June 2016

Programs Active or Available in the Watershed

- MMSD Greenseams
  - Voluntary purchases of undeveloped lands for flood storage/control
- Citizen-based/Community-based monitoring programs
  - Monitoring of water quality and organisms
- Education programs
  - Respect Our Waters – stormwater education
  - Nature centers

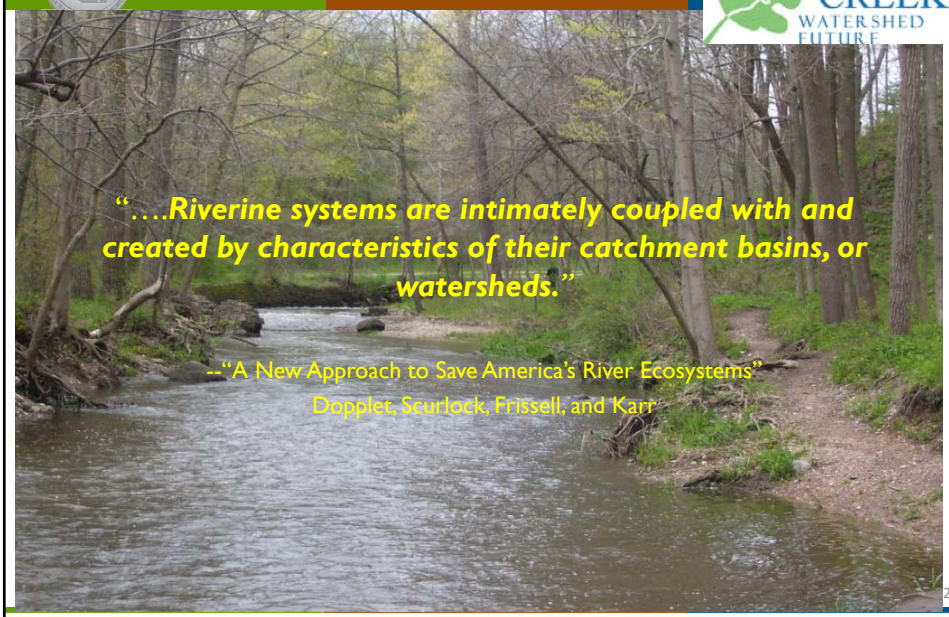


Chapter 3

Characterization of the Watershed

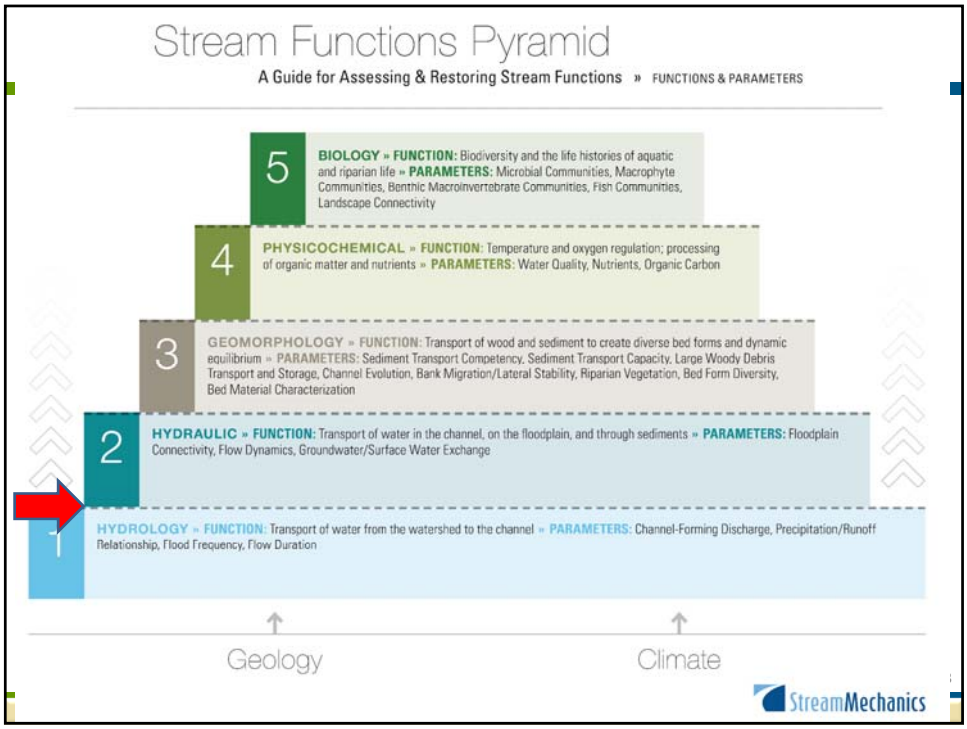
Chapter 3

OAK CREEK WATERSHED FUTURE



"….Riverine systems are intimately coupled with and created by characteristics of their catchment basins, or watersheds."

--"A New Approach to Save America's River Ecosystems"
Dopplet, Scurlock, Frissell, and Karr

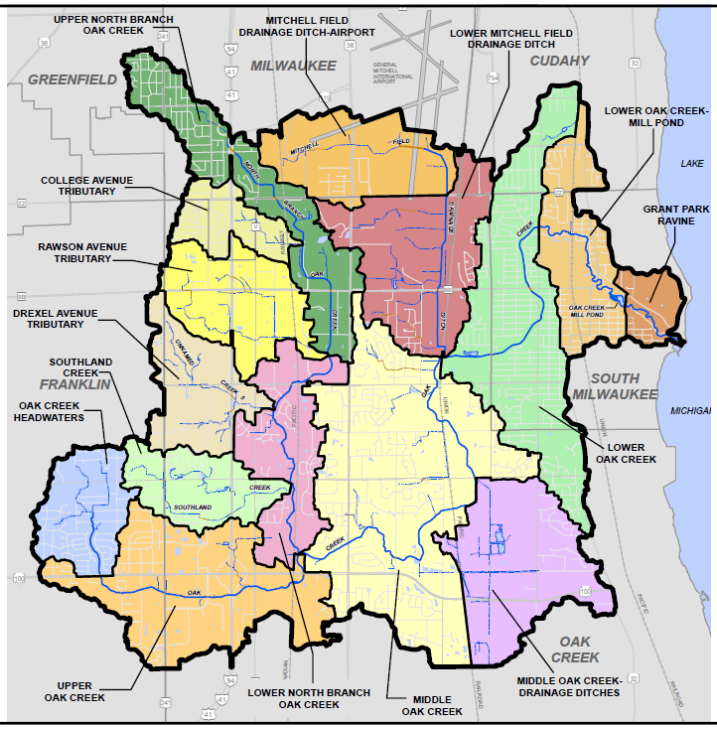


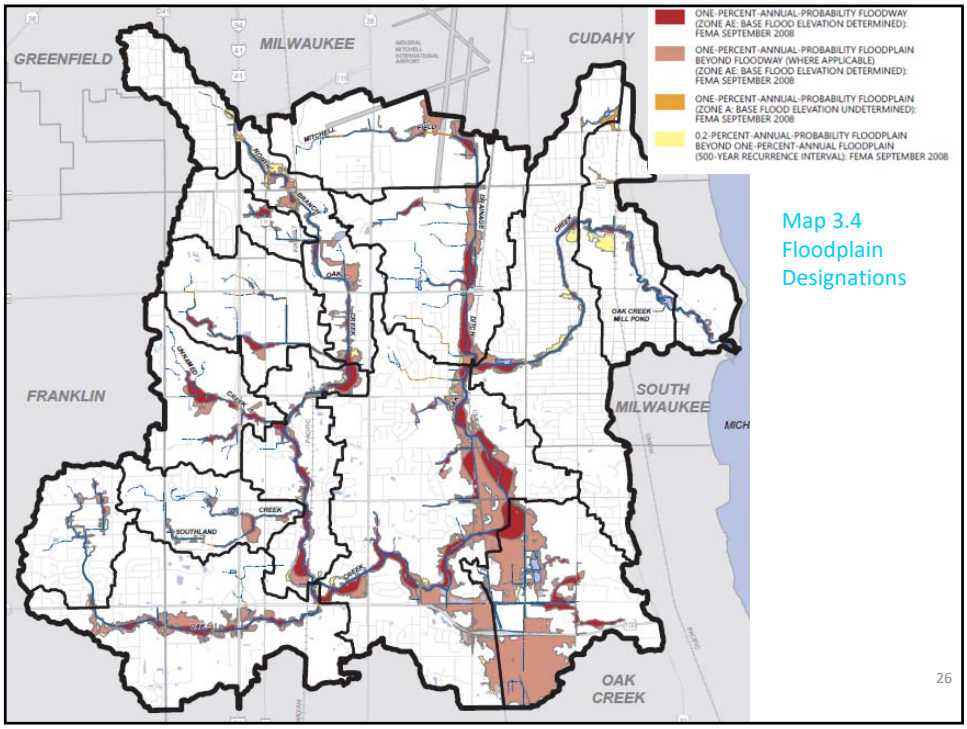
Chapter 3

OAK CREEK WATERSHED FUTURE

- This chapter presents information on human-made and natural features of the watershed…..
  - Human-Made Features
    - Subwatersheds
    - Assessment Areas
    - Civil Divisions
    - Demographics
    - Land Use
    - Impervious Surface
    - Sanitary Sewer Service Areas
  - Natural Features
    - Climate
    - Pre-Settlement Vegetation
    - Topography
    - Geology
    - Soils
    - Land Slopes
    - Environmental Corridors and Natural Areas
    - Groundwater

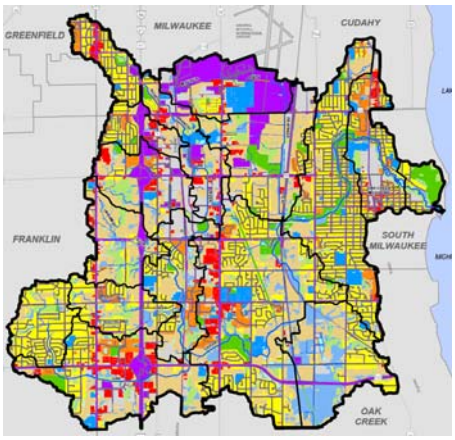
Map 3.2
Assessment Areas





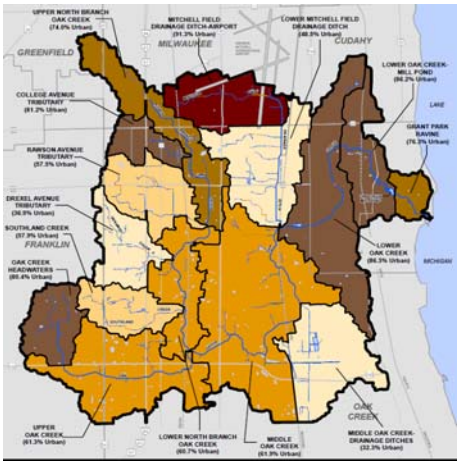
Map 3.4
Floodplain
Designations

Map 3.7
Existing Land Use: 2015



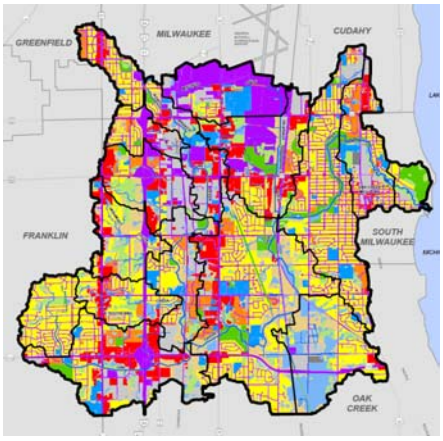
- SINGLE-FAMILY RESIDENTIAL
- MULTI-FAMILY RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- TRANSPORTATION, COMMUNICATIONS, AND UTILITIES
- GOVERNMENT AND INSTITUTIONAL
- RECREATION
- WETLANDS
- WOODLANDS
- AGRICULTURAL, UNUSED, AND OTHER OPEN LANDS
- EXTRACTIVE AND LANDFILL
- SURFACE WATER

Map 3.8
Percent Urban Land Uses: 2015



- 0% TO 50%
- 51% TO 60%
- 61% TO 70%
- 71% TO 80%
- 81% TO 90%
- 91% TO 100%

Map 3.9
Planned Land Use: 2050



- SINGLE-FAMILY RESIDENTIAL
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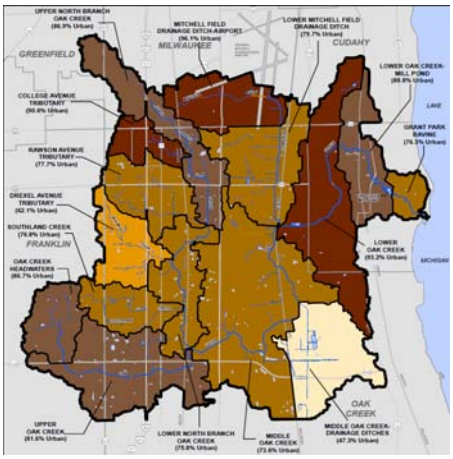
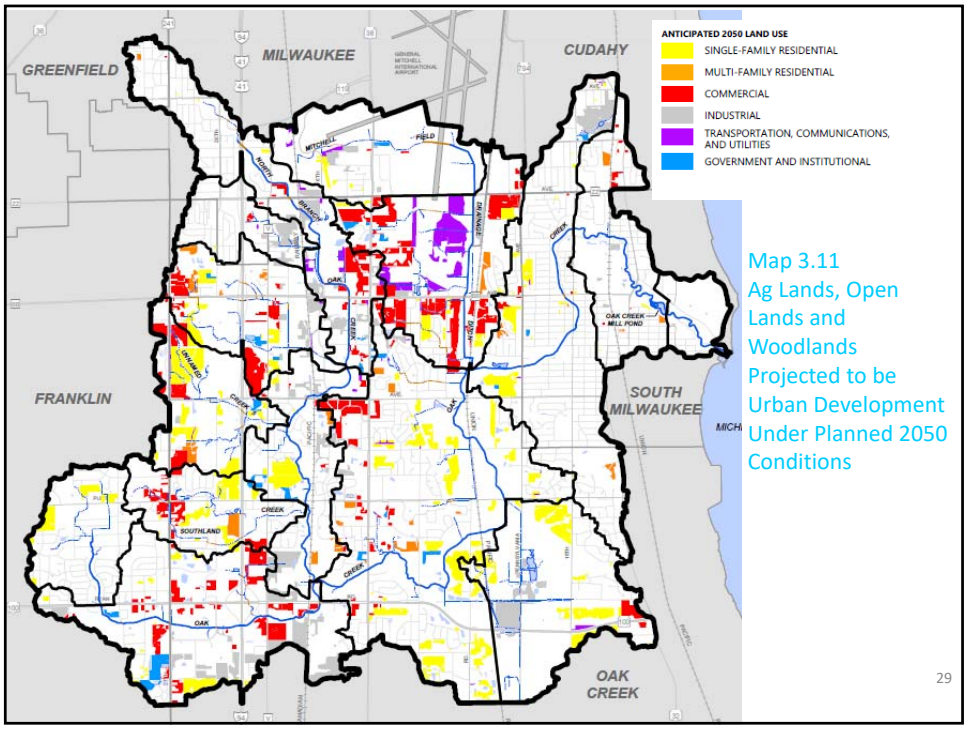
Map 3.10
Percent Urban Land Uses: 2050

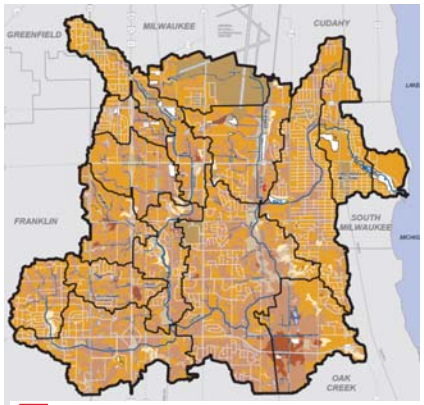


- 0% TO 50%
- 51% TO 60%
- 61% TO 70%
- 71% TO 80%
- 81% TO 90%
- 91% TO 100%



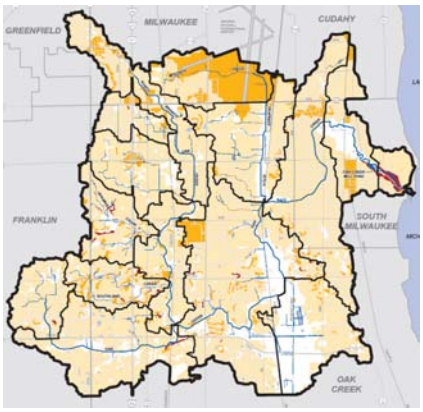
Map 3.11
Ag Lands, Open Lands and Woodlands Projected to be Urban Development Under Planned 2050 Conditions

Map 3.15
Hydrologic Soil Groups

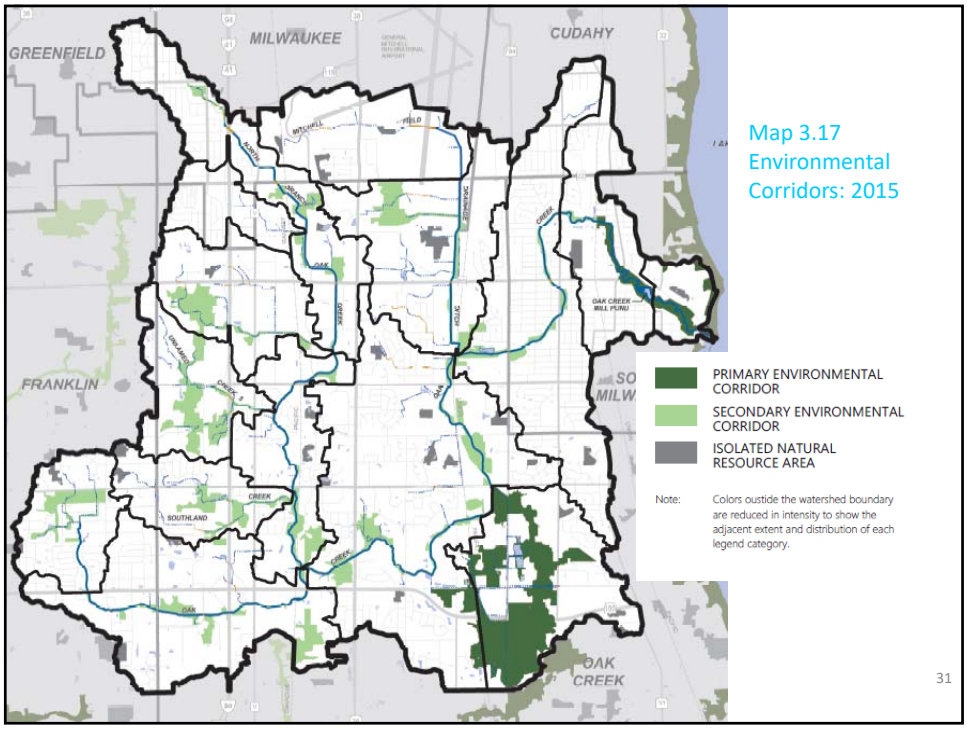


GROUP A: WELL DRAINED SOILS
GROUP A/D: WELL DRAINED SOIL/VERY POORLY DRAINED SOIL
WELL DRAINED IF WATER TABLE IS LOWERED THROUGH PROVISION OF A DRAINAGE SYSTEM, VERY POORLY DRAINED IF WATER TABLE IS NOT LOWERED
GROUP B: MODERATELY DRAINED SOIL
GROUP B/D: MODERATELY DRAINED SOIL/VERY POORLY DRAINED SOIL
MODERATELY DRAINED IF WATER TABLE IS LOWERED THROUGH PROVISION OF A DRAINAGE SYSTEM, VERY POORLY DRAINED IF WATER TABLE IS NOT LOWERED
GROUP C: POORLY DRAINED SOILS
GROUPS C/D: POORLY DRAINED SOILS/VERY POORLY DRAINED SOILS
POORLY DRAINED IF WATER TABLE IS LOWERED THROUGH PROVISION OF A DRAINAGE SYSTEM, VERY POORLY DRAINED IF WATER TABLE IS NOT LOWERED
GROUP D: VERY POORLY DRAINED SOILS
VERY HIGH RUNOFF POTENTIAL
UNDEFINED SOILS

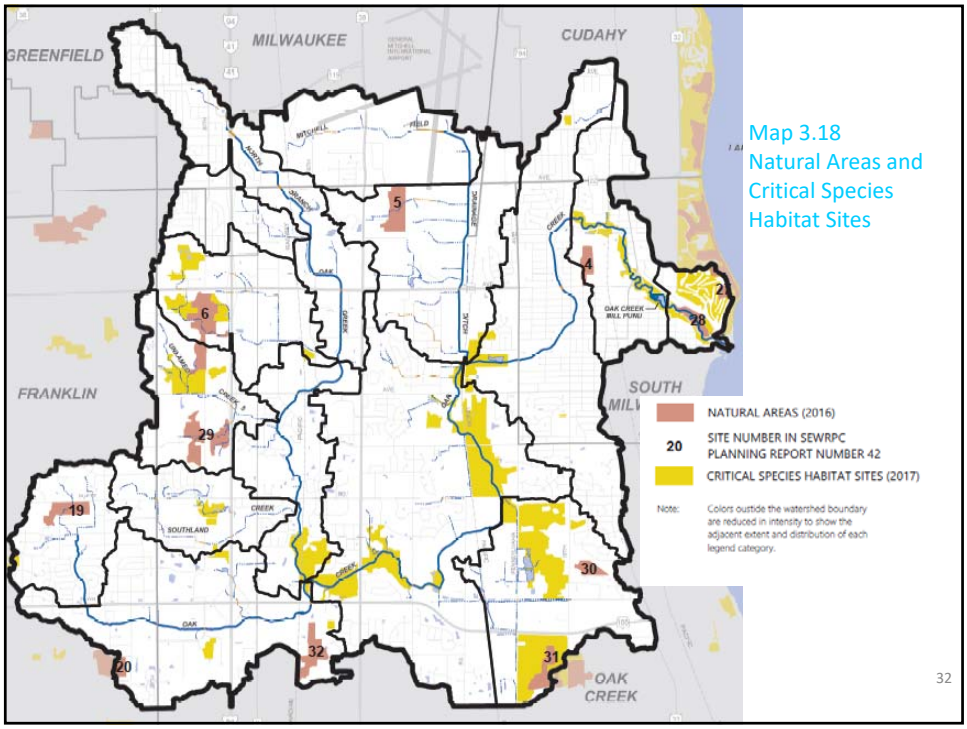
Map 3.16
Soil Slopes and Erodible Lands



SLIGHT SLOPES
(LESS THAN 2 PERCENT)
MODERATE SLOPES
POTENTIALLY HIGHLY ERODIBLE LAND
(2 TO 5 PERCENT)
STEEP SLOPES
HIGHLY ERODIBLE LAND
(6 TO 12 PERCENT)
VERY STEEP SLOPES
VERY HIGHLY ERODIBLE LAND
(GREATER THAN 12 PERCENT)



Map 3.17
Environmental Corridors: 2015



Map 3.18
Natural Areas and Critical Species Habitat Sites

Historical 1837 Plat Map

Historical 1891 USGS Map

Figure 3.6 Comparison of Surface Water Features from Historical Maps

Historical 1958 USGS Map

Chapter 3 Summary

- Chapter 3 Helps Us….
  - Learn the "Lay of the Land"
  - Look Into the Past, Present, and the Future
  - Begins to Reveal Problem Areas as well as Highest Quality Areas
  - Provides Some of the Information Necessary to Quantify the Impairments of the Watershed
  - Begins to Open Doors to Solutions to Those Impairments

Chapter 4 Inventory

- Detailed inventory of the state of the watershed
  - By Chapter 3 assessment areas
  - Water quality – standards, monitoring data, impairments, loading calculations
  - Current flow conditions – flooding, stormwater
  - Habitat – field surveys for stream and biota
  - Recreational access and use – current amenities and use

Chapter 4 Inventory

- Sources of monitoring data
  - Wisconsin DNR
  - US Geological Survey
  - Milwaukee Metropolitan Sewerage District
  - City of Racine Public Health Department
  - SEWRPC
  - Other relevant water quality and natural resources data sources

Website and Contact Information

- Communication
  - SEWRPC website for Draft chapters, meeting materials, and providing comments

  www.sewrpc.org/OakCreekWRP
- Comment sheets are available
- Contact
  - Laura Herrick – Chief Environmental Engineer
    262-953-3224 or lherrick@sewrpc.org

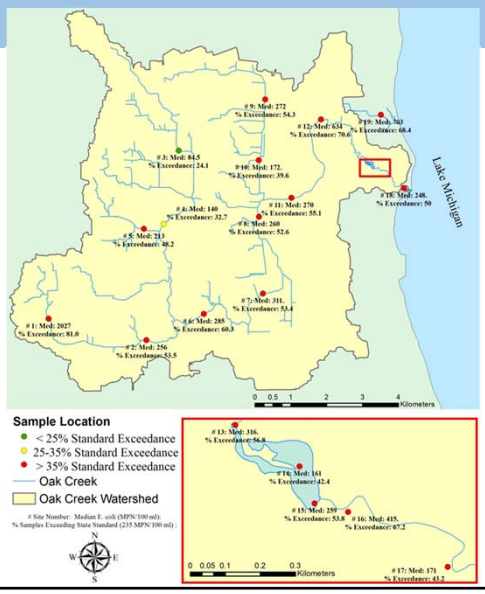
Oak Creek Watershed Assessment

City of Racine Public Health Department
Adrian Koski, Lanae Turner, Kwabena Boateng, Jacob Jozefowski
Dr. Julie Kinzelman, Dr. Jessica Orlofske

Study Components

- Main stem and tributary surface water quality assessment
- Mill Pond Dam impoundment assessment
- Stormwater outfall assessment
- Macroinvertebrate survey
- Nearshore Lake Michigan water quality assessment

Identifying Sources of Pollution



- Visual Observation
- Site Surveys (indicators + conditions)
- Source Tracking

Chemical & Microbial Indicators

- pH
- Temperature
- Turbidity
- Conductivity
- Detergents
- Chlorine
- Copper
- Phenols
- Nutrients
- *E. coli*
- Microbial Source Tracking Markers

Surface Water Quality Assessment

- 19 surface water monitoring sites (Nov 2015 – June 2016)
  - Water temperature, total suspended solids, turbidity, total phosphorus, total nitrogen, organic nitrogen, inorganic nitrogen, dissolved oxygen, pH, specific conductivity
  - *E. coli* (6/29/15-8/29/16)
- 16/19 surface water monitoring sites assessed for habitat conditions
- 12/19 surface water monitoring sites were assessed for macroinvertebrates using the Hilsenhoff (Family Level) Biotic Index (Oct 2015)
- 3/16 surface water monitoring sites were assessed for biological oxygen demand (BOD)(July 2015 – Aug 2016).

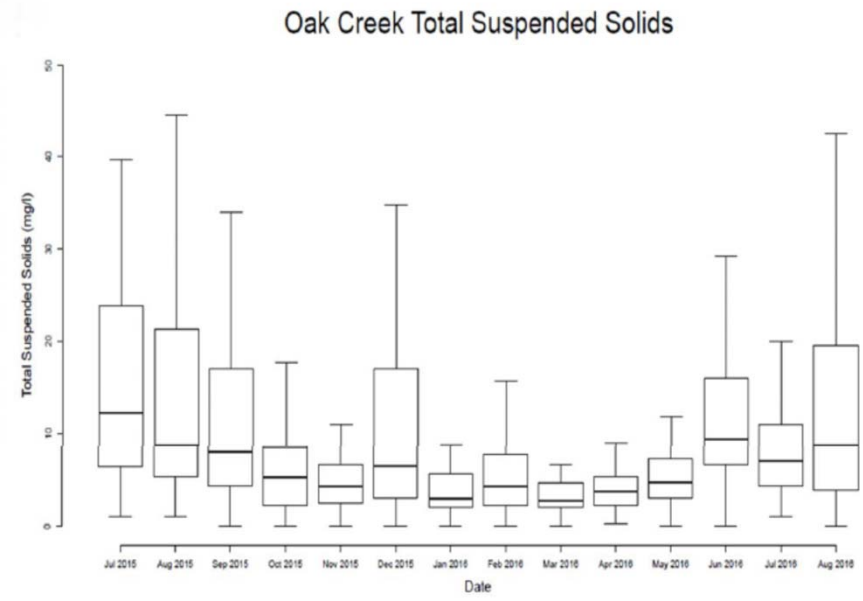


Figure 4: *Boxplot of Oak Creek Total Suspended Solids by Month. Bars denote minimum (lowermost) and maximum (uppermost). Box represents first (25%, bottom) and third (75%, top), Median is represented by the line within the box.*

49

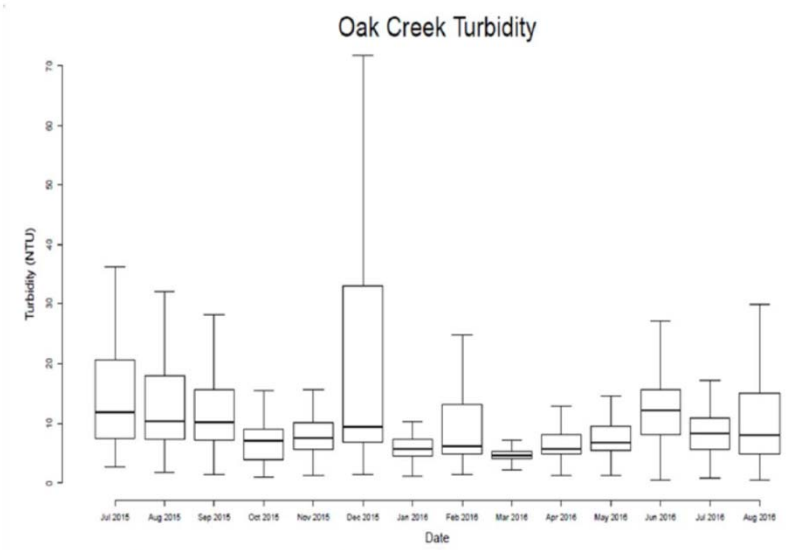


Figure 5: *Boxplot of Oak Creek Turbidity by Month. Bars denote minimum (lowermost) and maximum (uppermost). Box represents first (25%, bottom) and third (75%, top), Median is represented by the line within the box.*

52

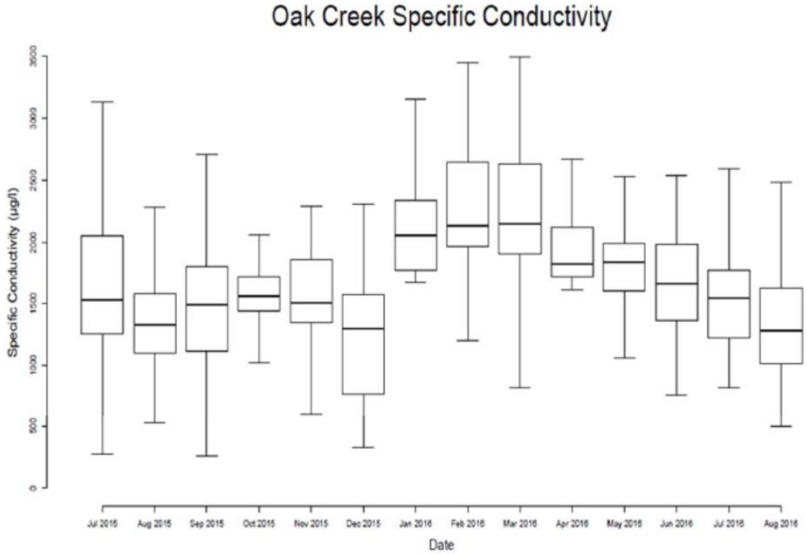


Figure 8: *Boxplot of Oak Creek Specific Conductivity by Month. Bars denote minimum (lowermost) and maximum (uppermost). Box represents first (25%, bottom) and third (75%, top), Median is represented by the line within the box.*

Decision Tree Approach

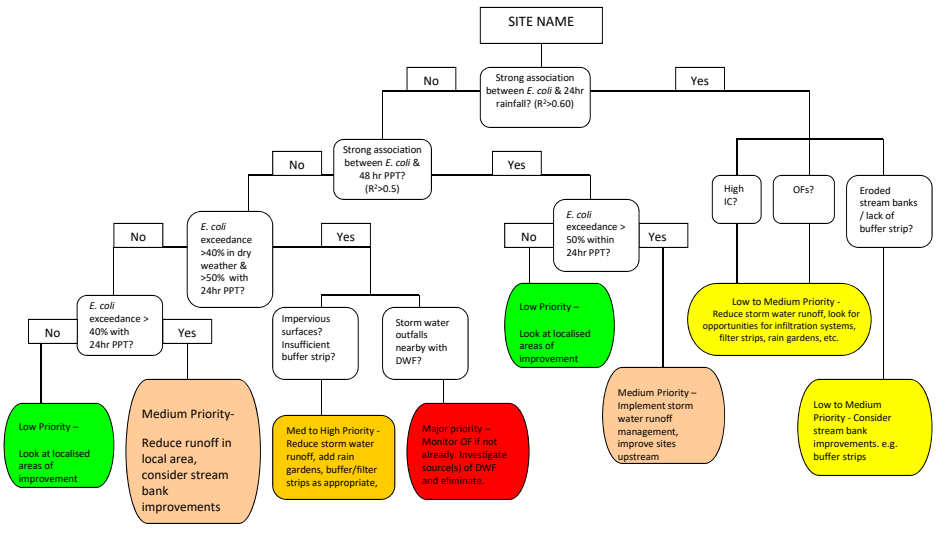
Decision Trees

Decision trees were created by analyzing the physical (extent of stream bank erosion, width of buffer strips, amount of impervious cover, and presence of stormwater infrastructure), microbiological (*E.coli* concentration), and environmental (antecedent precipitation) properties of each sampling location. Each site's path from the root to the leaf was determined by the decision criteria at each node of the decision tree. This method is not as comprehensive as other forms of data analysis; however, it is an informative tool for individuals or communities to begin the process of prioritizing restoration work within the watershed.

Each sampling site was classified as low, medium, medium-high, or high priority for future investigation and/or restoration.

Jozefowski, et al. 2016

Template decision tree developed from correlation of water quality parameters, environmental parameters and physical assessments



Southwood Dr.

Location and Surrounding Area

This site is located on the Upper Mainstem of Oak Creek, in Franklin, WI. Located in a green corridor, the predominant land use upstream of this site is moderate density residential.

Stream Bank Conditions

The narrow buffers along the stream bank primarily consist of shrubs and trees, with intermittent reed grass. This stream reach is highly channelized and has minimal stream-bank erosion.

Infrastructure

A legacy concrete structure extends across the streambed 230 feet upstream from the sampling site. Two stormwater outfalls are located under the bridge (Southwood OF East and Southwood OF West); their pollution potential was relatively low. Outfall 105, located upstream of this sampling site, had exceedances of *E. coli* and positive hits for human specific *Bacteroides* and *Lachnospiraceae*.

Other Comments

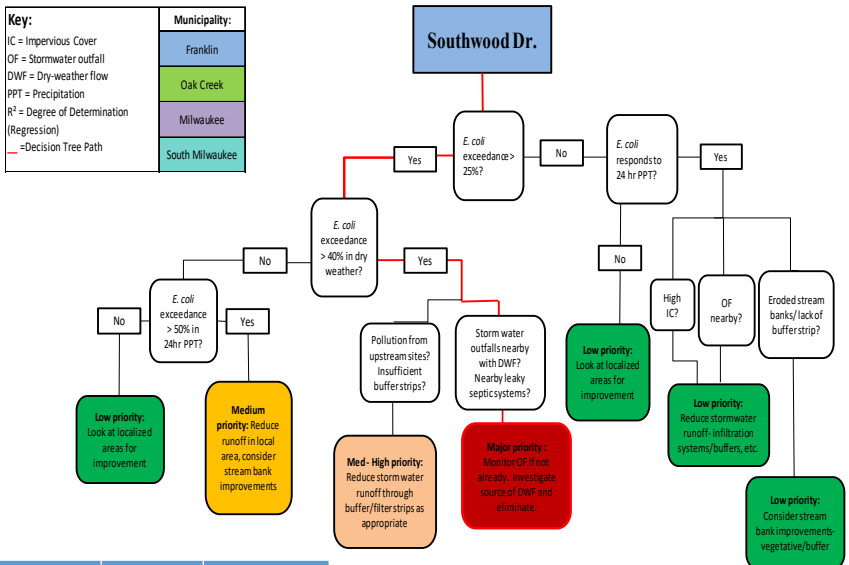
The Southwood Drive site has significantly higher *E. coli* concentrations than the other surface water sites included in this study. Outfall 105 is a likely contributor and should be further investigated.

Aerial view of sampling site (red arrow) and surrounding land use.

Concrete legacy structure extends across the stream bed 70 m upstream of site.

Stream reach near sampling site is highly channelized.

Riparian vegetation near sampling site consisting of shrubs, trees and reed grass.



Filter Name	Filter Date of Sample	Filtration Volume (ml)	Bacteroides CN/100 ml	Lachnospiraceae CN/100 ml
Southwood OF E	1/25/2016	200	231	1584
15th Ave OF	2/1/2016	100	3395	26748
15th Ave OF	2/8/2016	100	1113	11381
Southwood OF E	2/8/2016	100	<1	2715

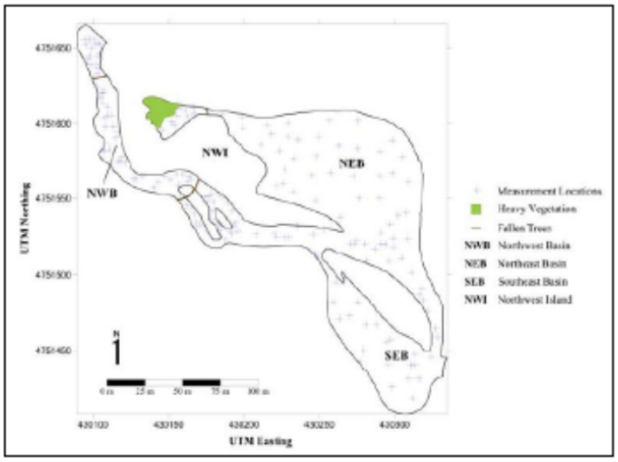
Human Bacteroides Genetic Marker	
High	> 5000 CN/100 mL
Moderate	1000 - 5000 CN/100 mL
Low	< 1000 CN/100 mL

Mill Pond Dam Impoundment Assessment

- June – August 2015/Additional samples in 2016
- Samples were collected weekly or semi-weekly from 7 locations
  - Water temperature, pH, specific conductivity, DO (concentration and percent saturation), TSS, turbidity/transparency and E. coli
- Nutrients (total nitrogen/nitrogenous components and total phosphorus) assessed once
- Chlorophyll-a assessed once from each location
- Additional TSS samples were collected from June 2015 through August 2016 and evaluated to determine the flux of suspended solids into and out of the dam impoundment

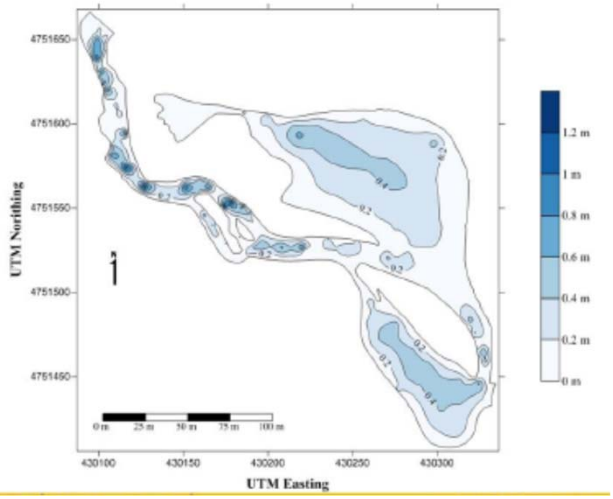
Is the Dam Impoundment Supportive of Recreational Uses?

- Depth measurements at least every 15 m
- Measured with a rope marked in 0.3 m increments.
- Locations measured with GPS.
- Map created in Surfer 12
- Surface area and basin volume calculated using Surfer 12 gridding reports
- Results compared to 1970 bathymetric survey



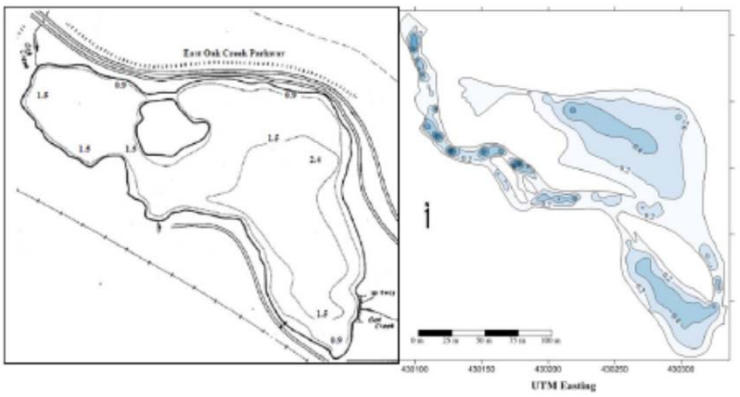
2015 Measurements

- Mean depth: 0.22 m
- Maximum Depth: 1.3 m
- Water depth < 0.9 m in 99.9% of the impoundment
- Area: 17,000 m²
- Volume: 3,800 m³



Changes over Time

- 1970 vs. 2015
  - A large island and two sandbars have formed
  - 87% decrease in water volume (25,200 m³)
  - 46% decrease in maximum depth (1.1 m)
  - 23% decrease in surface area (5,000 m²)



91.7% of samples collected from the Mill Pond Dam impoundment exceeded recreational water quality standards

Recommendations

- Unsuitable for canoe or kayak
- Unsuitable for bathing
  - Risk of entrapment in the accumulated fine sediment
  - High exceedance rate of recreational contact standards *(E.coli)*
- *E. coli* within the impoundment originate from upstream sources
- Community discussion needed to determine if substantial investments required to utilize impoundment for recreational use is realistically obtainable

Does the Dam Impoundment Sequester Upstream Pollutants?

Parameter	Sampling Frequency	Method
Water Temperature	Weekly	In Situ Measurment (YSI Pro Plus)
Total Suspended Solids	Weekly	Standard Methods 2540
Turbidity	Weekly	EPA Method 180.1
Specific Conductivity	Weekly	In Situ Measurment (YSI Pro Plus)
pH	Weekly	In Situ Measurment (YSI Pro Plus)
Dissolved Oxygen	Weekly	In Situ Measurment (YSI Pro Plus)
E. coli	Weekly	Idexx Colilert
Total Phosphorus	Monthly	EPA Method 365.1
Nitrate + Nitrite	Monthly	Standard Methods 4500-F
Total Kjeldahl Nitrogen	Monthly	EPA Method 351.2
Total Nitrogen	Monthly	Calculated (TKN+ NO_3+NO_2)

Sampling Locations

Results

TSS and Turbidity

- All analysis produced similar results for TSS and Turbidity
- Suspended sediment concentration elevated within and downstream of the impoundment
- Impact is spatially limited
- Dam impoundments are typically a sink for sediments
- Filling of impoundment with sediment reduced storage capacity

Results (cont.)

- **TSS and Turbidity**
  - Impoundment acts as a source of sediment to downstream areas, when not influenced by precipitation
  - Can negatively impact habitat by:
    - Reducing water clarity
    - Burying fish eggs
    - Suffocating aquatic insects
  - Previous studies identified multiple contaminates within Oak Creek sediment
  - Further study needed to determine if there are contaminates bound to sediment leaving impoundment

Nutrient Loading

- **Nutrients**
  - Impoundment sediment likely source of downstream TP increase
  - The strong relation between reach wide TP, TKN, and NO3 + NO2 and TSS indicates that a large proportion of the nutrients are attached to sediment

Stormwater Outfall Assessment

- 111 stormwater outfalls were considered
- 106/111 were selected for field surveys
  - Determination of dry weather flow and photo-documentation
- 31/111 were noted to have dry weather flow
  - 24/31 of which were selected for additional testing
  - Water temperature, turbidity, pH, specific conductivity, total chlorine, detergents, copper, phenols, and *E. coli*
  - Monitoring occurred from Dec 2015 to Aug 2016
  - 91 samples representative of dry weather flow and 50 categorized as wet weather discharge (n = 141)
- Microbial source tracking markers (human-specific Bacteroides and Lachnospiraceae)
  - Provide supportive information for illicit discharge investigations
  - Is there a likely sewage source?

Outfall 105

Outfall 105

42.87828200°, -87.96668900°

DWF PRESENT

15th Avenue

42.92487000°, -87.87110000°

DWF PRESENT

Results - Chlorine

- Total residual chlorine (mg/l) was measured in 140/141 stormwater outfalls samples collected from 24 outfalls
- 90 samples were collected during dry weather and 50 samples during wet weather flow
- Median residual chlorine concentrations ranged from below the level of detection to 0.56 mg/l.
- 50% or more of the samples collected from Outfalls 24, 52, and 70 exceeded the residual chlorine guideline value of 0.10 mg/l.

Results – Detergents (Surfactants)

- Detergents concentrations (mg/l linear alkylbenzene sulfonate equivalent) were measured in 140/141 stormwater outfall samples from 24 outfalls
- 90 samples were collected during dry weather flow and the remaining 50 samples during wet weather
- 53 samples had detergent concentrations above the detection limit
- Median detergent concentrations ranged from below the level of detection to 0.25 mg/l
- Six water samples from four outfalls exceeded the guideline value of ≥0.50 mg/l

Stormwater Outfall Results

- Most stormwater outfall samples were within state standards or recommended guidelines for turbidity, pH, water temperature, copper, and phenols
- Some outfalls exceeded state standards or recommended guidelines for specific conductivity (4 outfalls), chlorine (3 outfalls), detergents (6 outfalls), E. coli (11 outfalls), and microbial source tracking markers (14 outfalls)
- Results were analyzed collectively utilizing a weight of evidence approach in order to classify outfalls as either high (6 outfalls), medium (15 outfalls), or low (3 outfalls) priority for future investigations and remediation

Recommendations

Stormwater Outfalls: Priority for Future Work and Justification

Outfall Name	Priority	Turbidity [A] >14 NTU	pH [A] > 9.0 or < 6.0	Specific Conductivity [A] >2,000 µS	Residual Chlorine [A] >0.10 mg/l	Detergents [B] >0.50 mg/l	*E. coli* [B] >10,000 MPN/100ml	Positive MST Markers [B]	Dry Weather *E. coli* [B,C]	Dry Weather MST Markers [B,C]	Limited Samples [C]	Justification for Prioritization
21	Moderate			X		X		X		X		Potential Sewage Contamination
24	Moderate				X			X		X		Total Residual Chlorine Frequently Elevated
25	High					X	X	X	X	X		Potential Sewage Contamination & High *E. coli*
27	Moderate							X		X		Potential Sewage Contamination
44	High			X			X	X	X	X		Potential Sewage Contamination & High *E. coli*
49	High						X	X	X	X		Potential Sewage Contamination & High *E. coli*

Macroinvertebrate Survey

- 12 surface water sites were quantitatively assessed using Hilsenhoff (Family Level) Biotic Index (October 2015)
- Sites were selected for sampling based on accessibility and the presence of sufficient water depth and flow to meet the minimum number of invertebrates required for the WI DNR sampling guidelines (WDNR 2000)
  - Distributed throughout the watershed, including the mainstem, branches and tributaries
  - Locations immediately above and below the Mill Pond Dam
- Water chemistry assessed during each sampling event (pH, dissolved oxygen (%), and conductivity (µS/cm) using a calibrated YSI 556 Multiparameter Meter

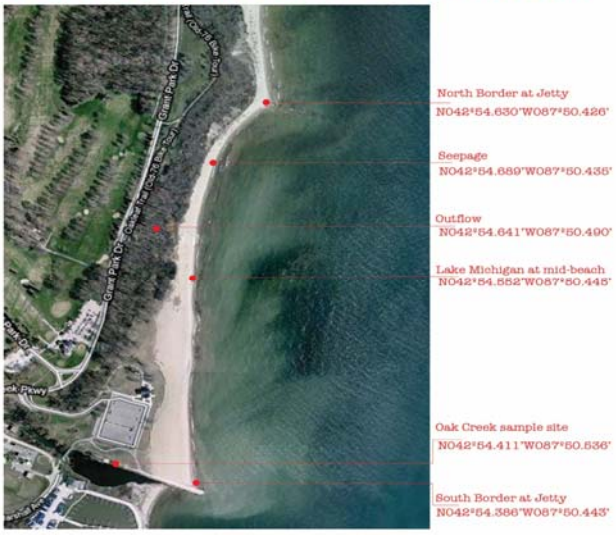
Survey Results

- 7,632 aquatic invertebrates were collected
- Arranged geographically from upstream to downstream, little variation seen in invertebrate abundance until immediately upstream and downstream of dam impoundment
- Many moderate to high tolerance (high HBI = lower water quality)
  - E.g. Oak Leaf Trail
- Few sensitive and less tolerant (low HBI = higher water quality)
  - E.g. culvert riffle off of Nicholson Avenue and immediately below dam
- Overall…substantial to severe impairment when compared to regional reference streams

Nearshore Lake Michigan Water Quality

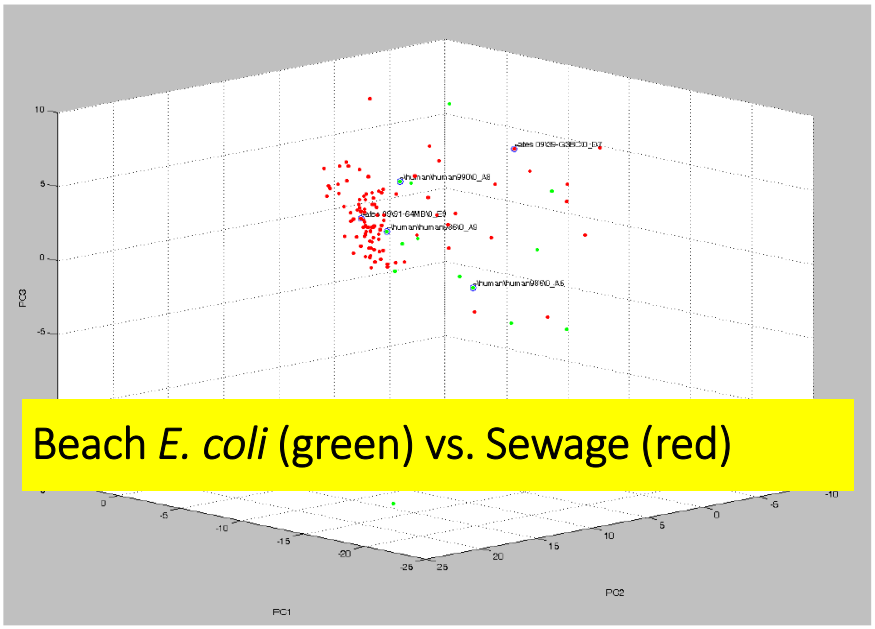
- Regulatory BEACH Act samples collected from mid-May to August each year of study
- Determination of Oak Creek as a potential pollution source impacting nearshore recreational water quality
- Community Profiling
  - Look for relational similarities in environmental samples
  - May provide indications as to common sources
  - Conducted in conjunction with UWM School of Freshwater Sciences (2016)

Grant Park Beach



Microbial Source Tracking

PC 3D Racine Isolates vs. Human Sources:

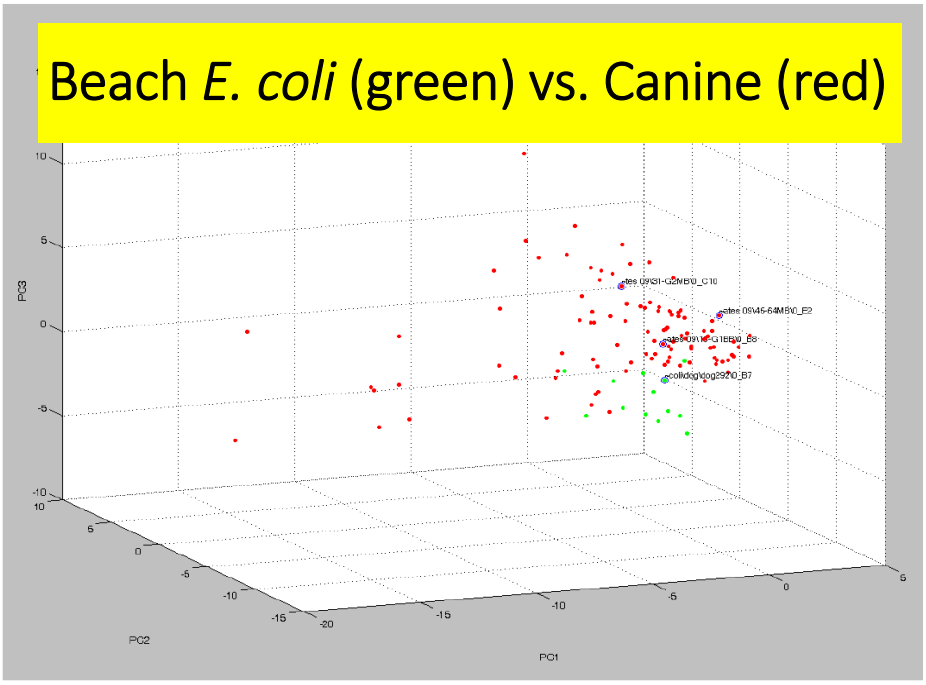


Beach *E. coli* (green) vs. Sewage (red)

Microbial Source Tracking

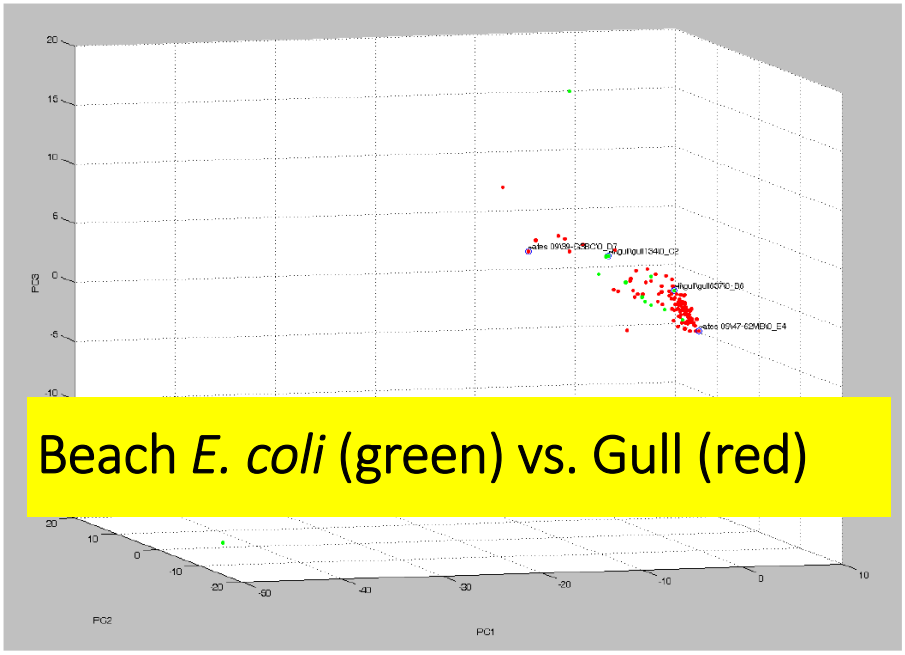
PC 3D Racine Isolates vs. Canine Sources:

Beach *E. coli* (green) vs. Canine (red)



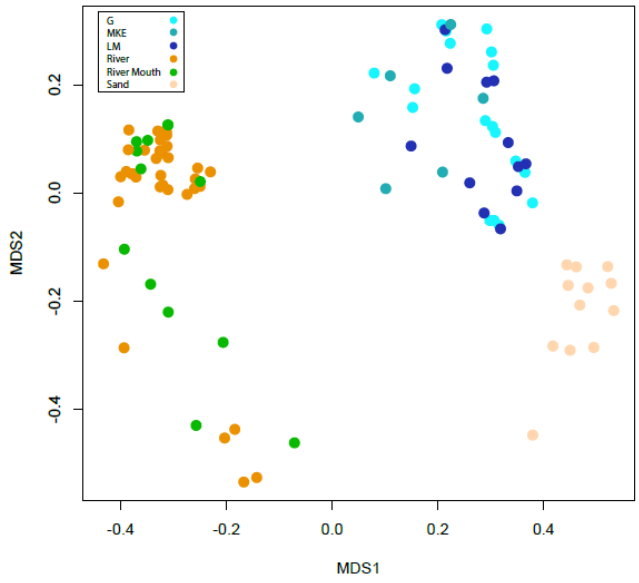
Microbial Source Tracking

PC 3D Racine Isolates vs. Avian (Gull) Sources:



Beach *E. coli* (green) vs. Gull (red)

Community Profiling



7 Bridges Creek

Location and Surrounding Area

This site is located on Lake Drive, just south of Badger Avenue, in the Kinnickinnic Watershed. Seven Bridges Creek is a direct tributary to Lake Michigan, which discharges at the north end of Grant Park. Predominant land use is residential upstream of the sampling site and recreational/parkland downstream.

Stream Bank Conditions

The stream channel upstream of the sampling location is enclosed in conduit. The streambank condition downstream of the sampling location is eroded. Riparian buffer vegetation consists of predominantly trees and shrubs.

Infrastructure

A sanitary sewer lift station is located immediately upstream of the sampling location.

Other Comments

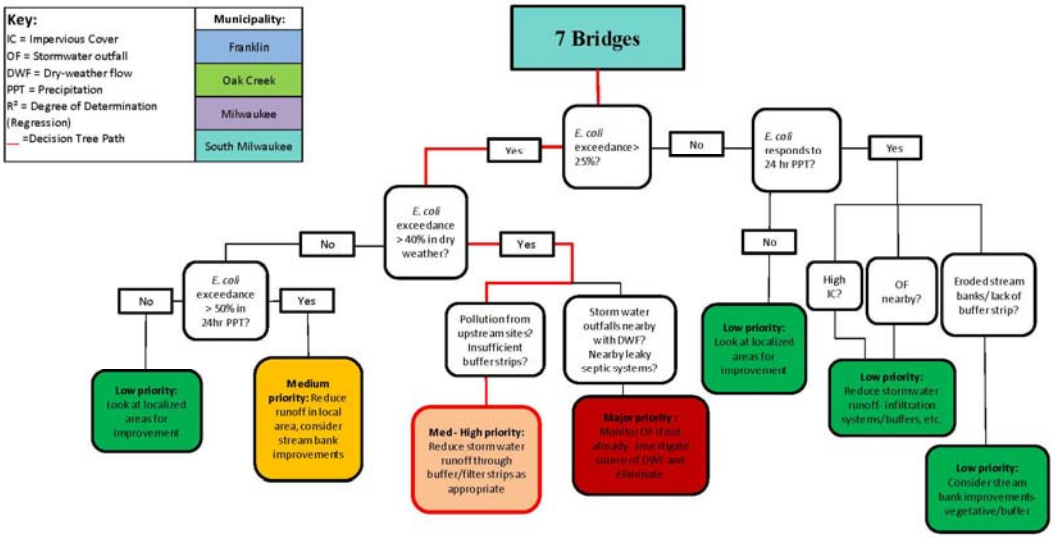
This site had consistently high *E. coli* counts and merits further investigation. Previous research indicated that 7 Bridges Creek might have an adverse impact on nearshore surface water quality. Although outside of the Oak Creek Watershed, it is important to understand the relative contributions of the two bracketing tributaries on Lake Michigan.

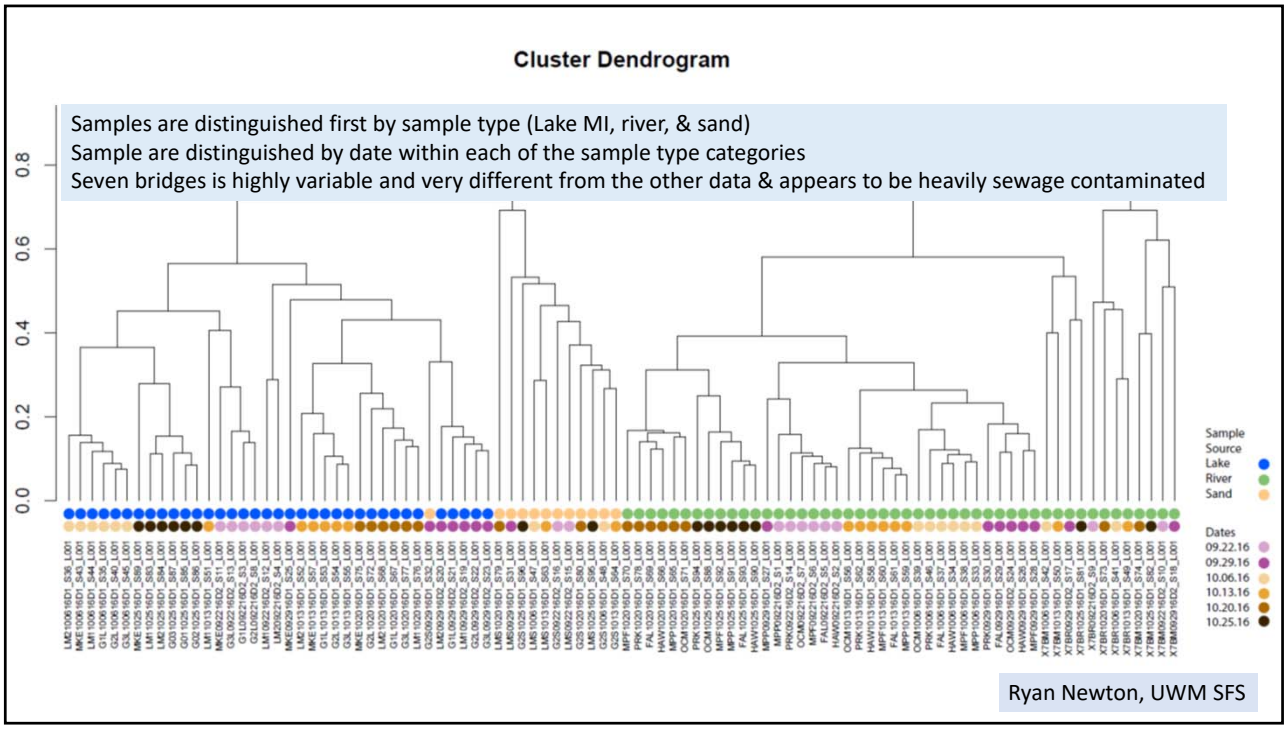
Aerial view of sampling site (red dot) and surrounding land use.

Stream bank upstream of the site is enclosed in conduit.

Looking downstream from the sampling site.

Lift station immediately upstream of sampling site.




Cluster Dendrogram
Samples are distinguished first by sample type (Lake MI, river, & sand)
Sample are distinguished by date within each of the sample type categories
Seven bridges is highly variable and very different from the other data & appears to be heavily sewage contaminated
0.0
0.2
0.4
0.6
0.8
Sample Source
Lake
River
Sand
Dates
09.22.16
09.29.16
10.06.16
10.13.16
10.20.16
10.25.16
Ryan Newton, UWM SFS


Thank You for Listening!!