MINNESOTA POLLUTION CONTROL AGENCY

Project 1007 – Progress Update

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January 14, 2020

Agenda

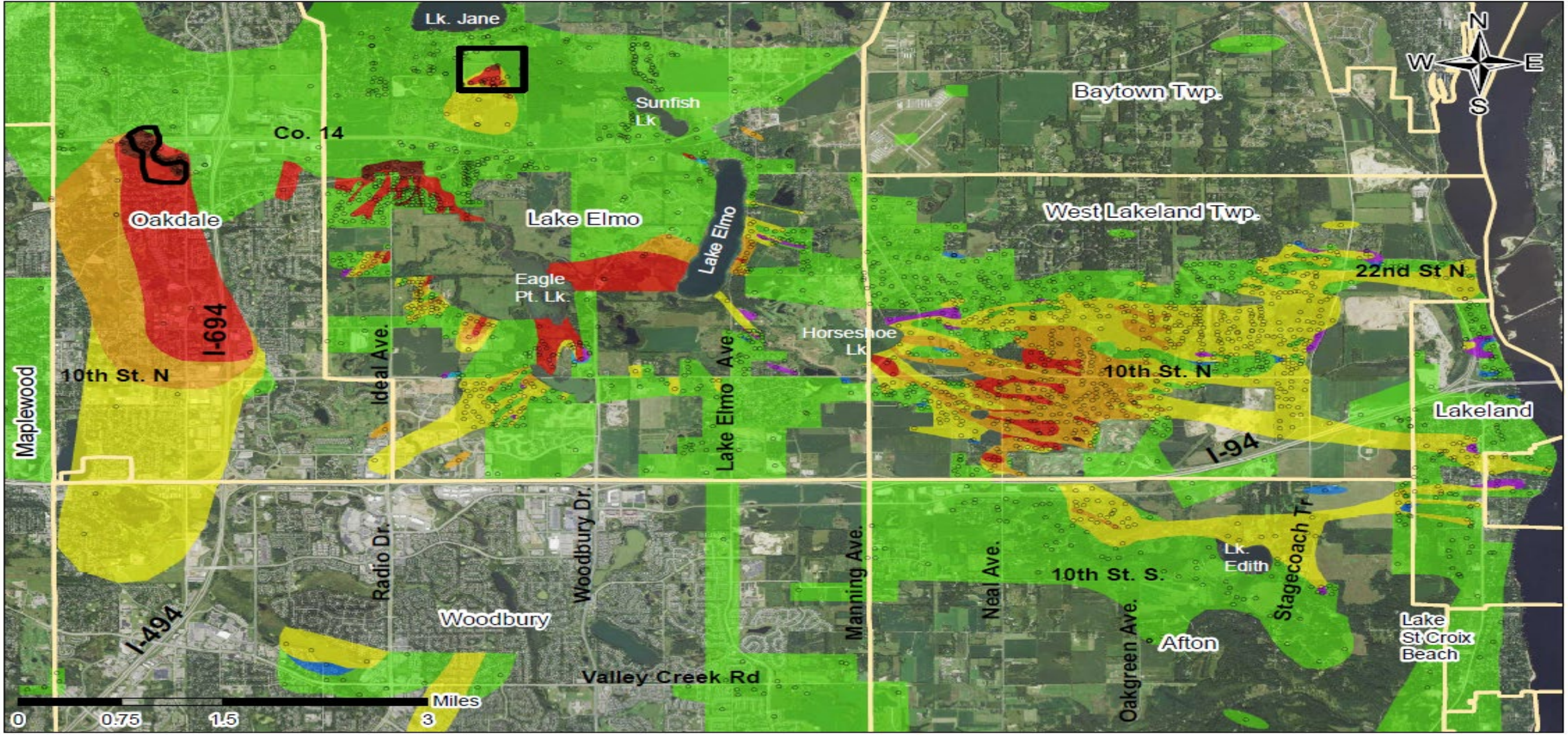
- Overview of Project Phases and Schedule
- Review of Settlement Requirements & Location
- A Complex Problem
- Below Ground Investigation
- Results of Above Ground Investigation
- Health Risks
- Conclusions and Next Steps

3M Settlement Language

- As part of the 3M Agreement and Order, the MPCA is conducting "a source assessment and feasibility study regarding the role of the Valley Branch Water District's project known as Project 1007 in the conveyance of PFCs in the environment."

Project 1007 was constructed to relieve flooding in the VBWD. These homes were flooded in the mid-1980s, before the project was completed.

White Bear Lake
Mahtomedi
Sunnybrook Lake
Grant
Stillwater
Oak Park Heights
Echo Lake
Weber Pond
Long Lake
Pine Springs
Capaul's Pond
Klawitter Pond
Silver Lake
Tri-Lakes Area
Lake DeMontreville
Lake Olson
Lake Jane
Clear Lake
Goetschel Pond
Cloverdale Lake
McDonald Lake
Acorn Lake
Lake Elmo
Baytown Twp.
Sunfish Lake
North St. Paul
Ramsey County
Washington County
Raleigh Creek
Beutel Pond
Friedrich's Pond
Bay Lake
Lake St. Croix
Legion Pond
Downs Lake
Lake Elmo
Oakdale
Farney Creek
Eagle Point Lake
West Lakeland Twp.
Horseshoe Lake
Mergens Pond
Rose Lake
Goose Lake
Kramer Pond
West Lakeland Storage Sites
Rest Area Pond
Fahlstrom Pond
Woodbury
Lake Edith
Lakeland



PFOS – East Metro PFAS Area – North of I-94

Investigation Progress

Baseline Sampling Event

Fall 2019

Beta Phase Investigation

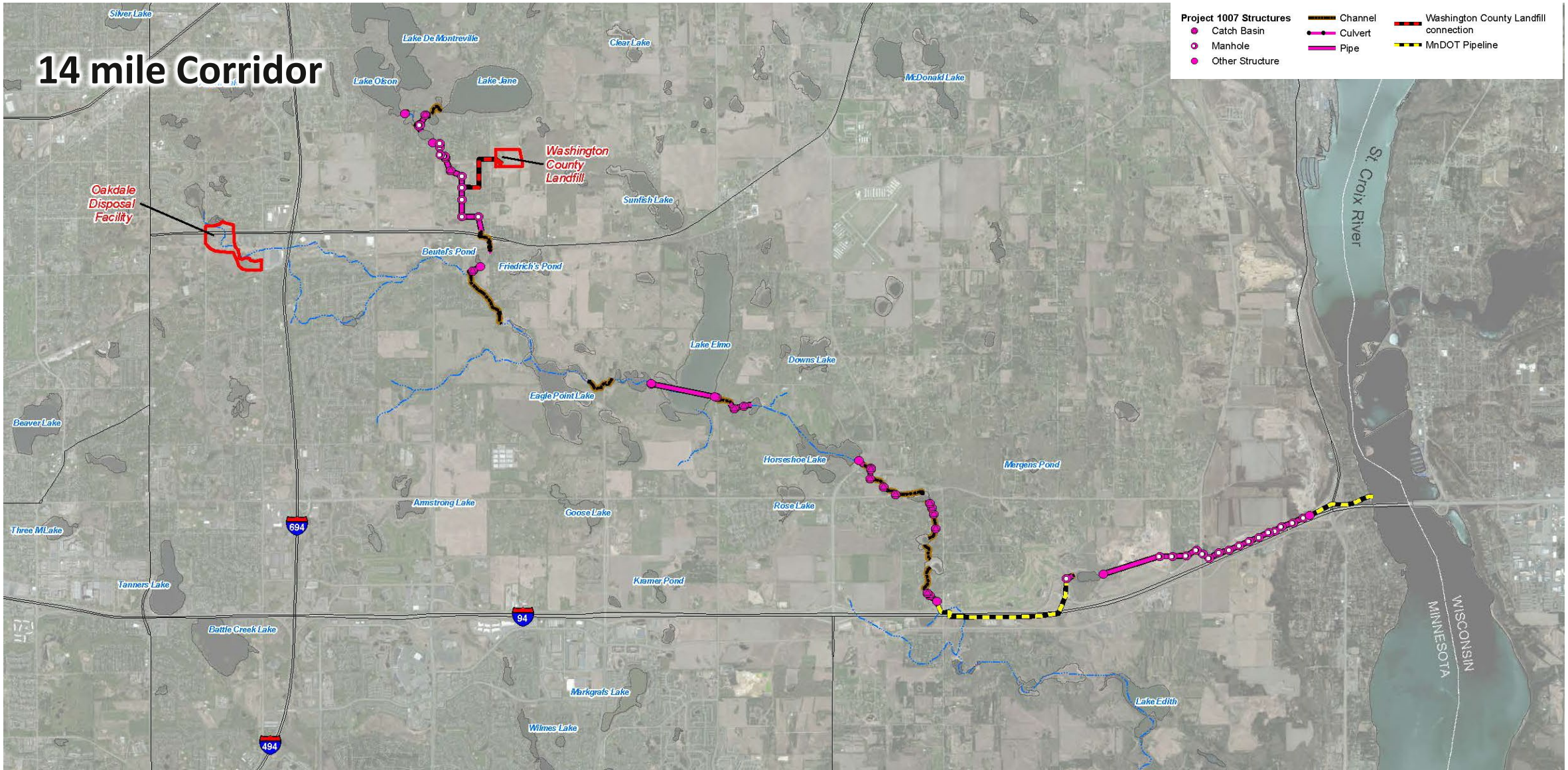
Fall 2019 – Summer 2020

Focused Investigation

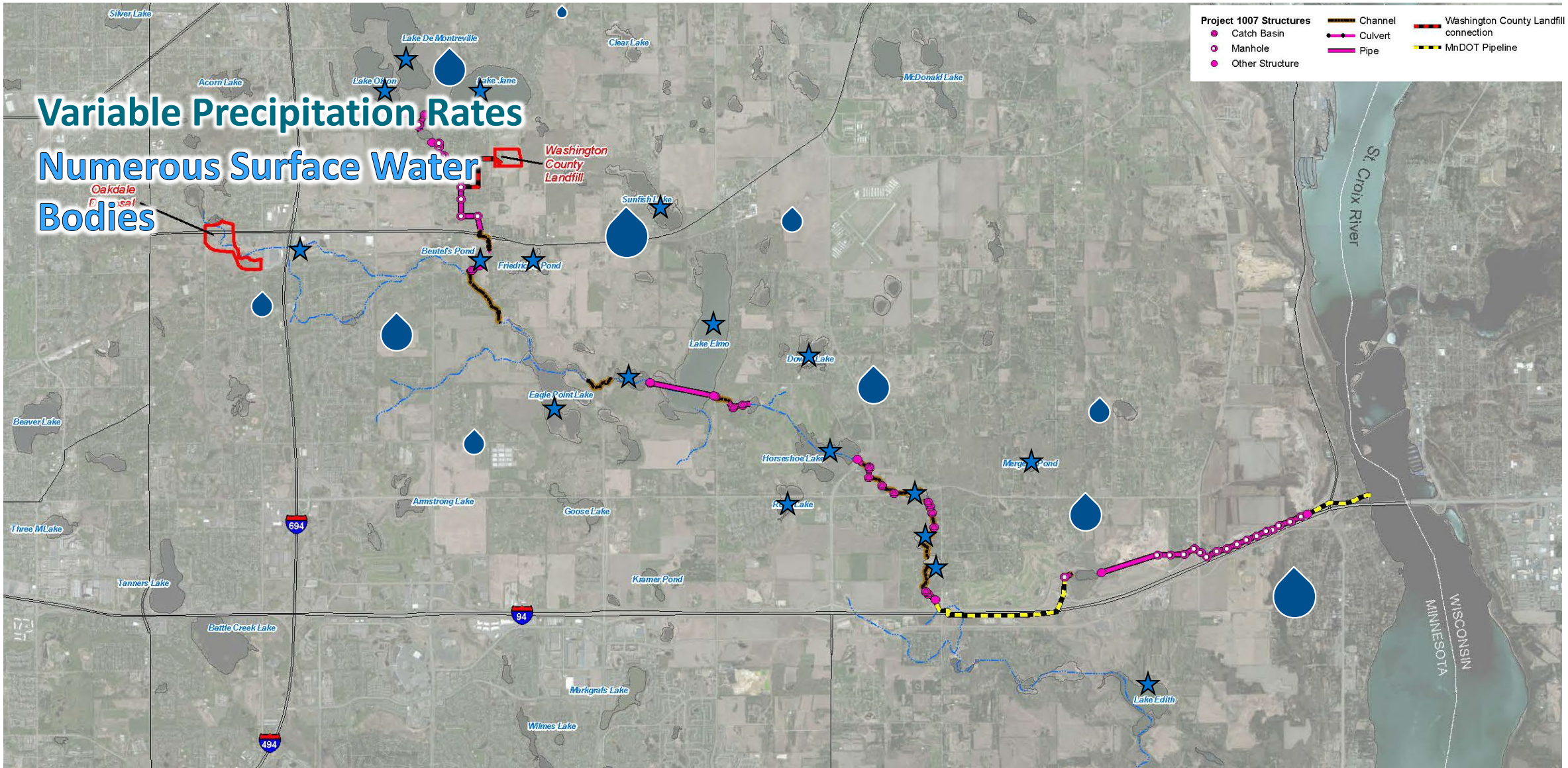
Summer 2020 - 2021

What Do We Need to Consider?

Project 1007 | A Complex Problem



Project 1007 | A Complex Problem



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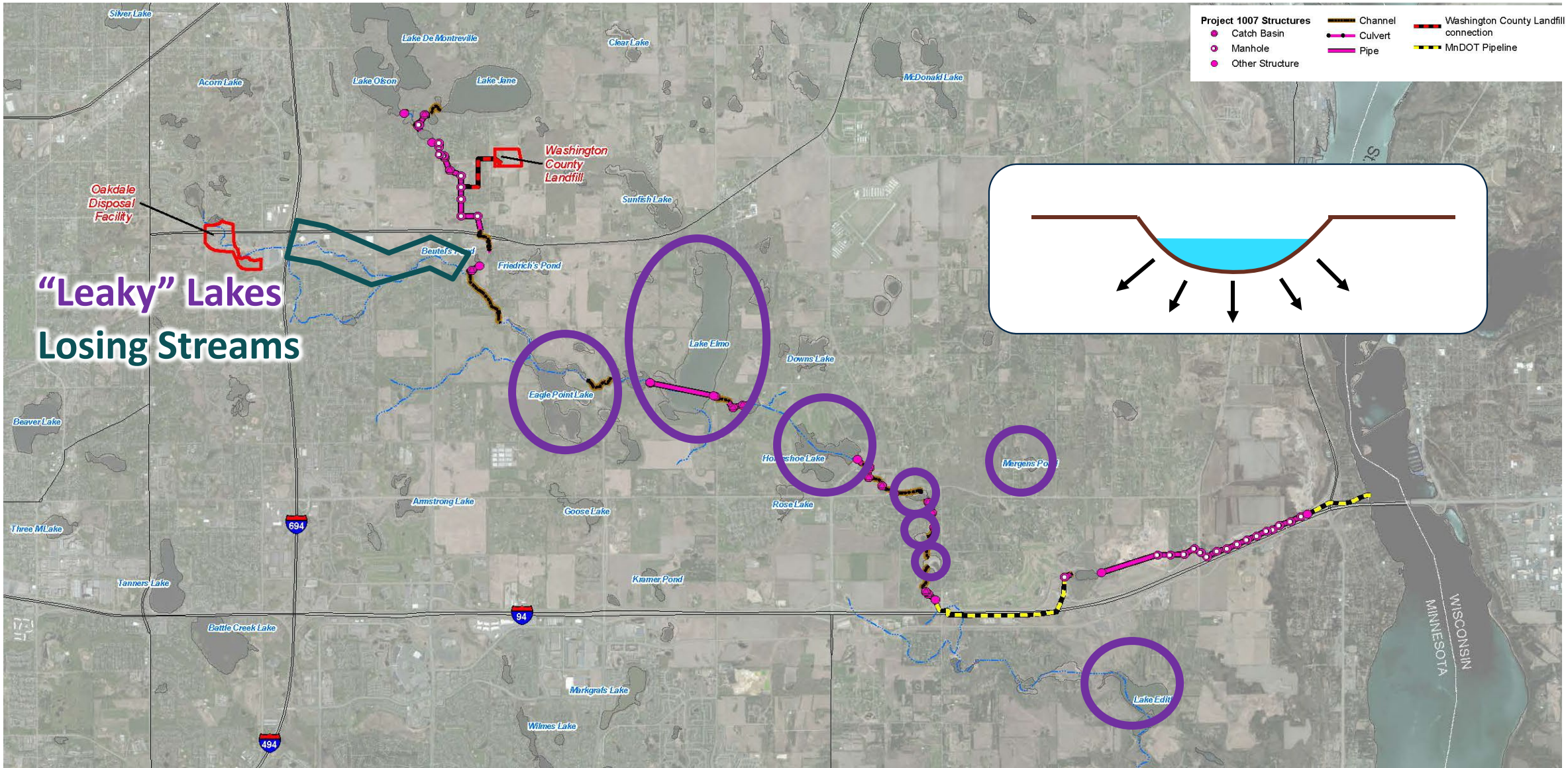

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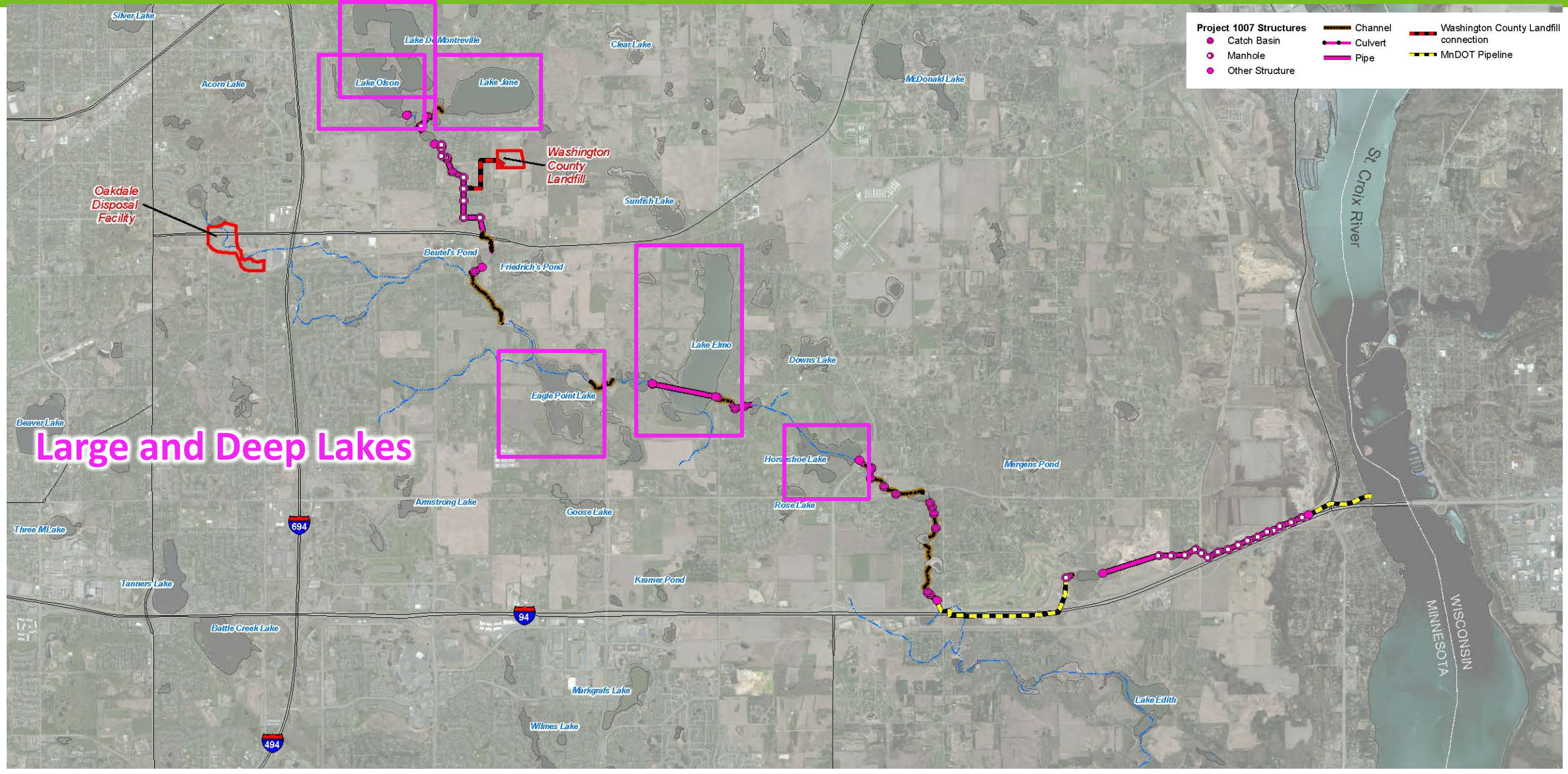
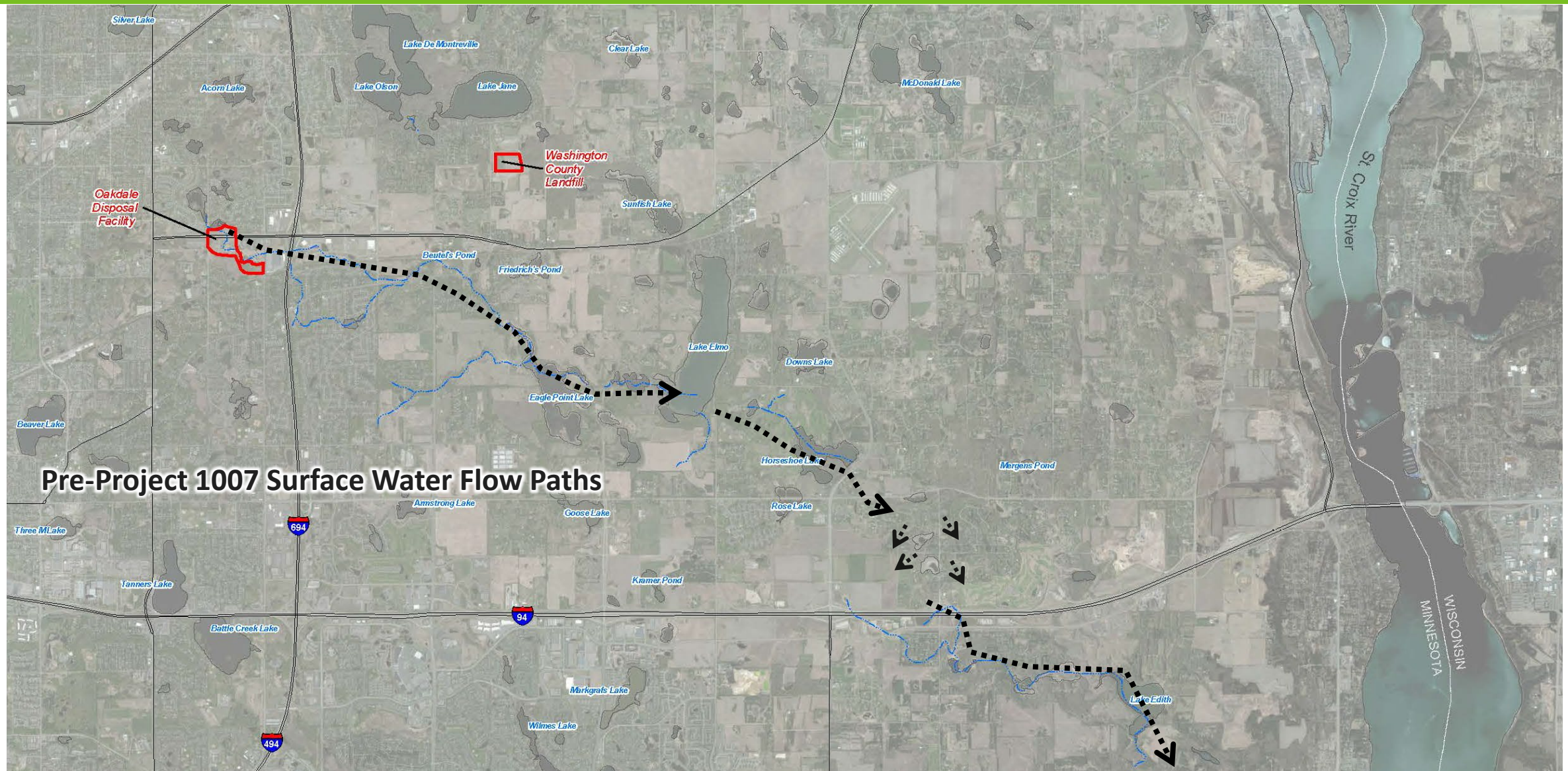
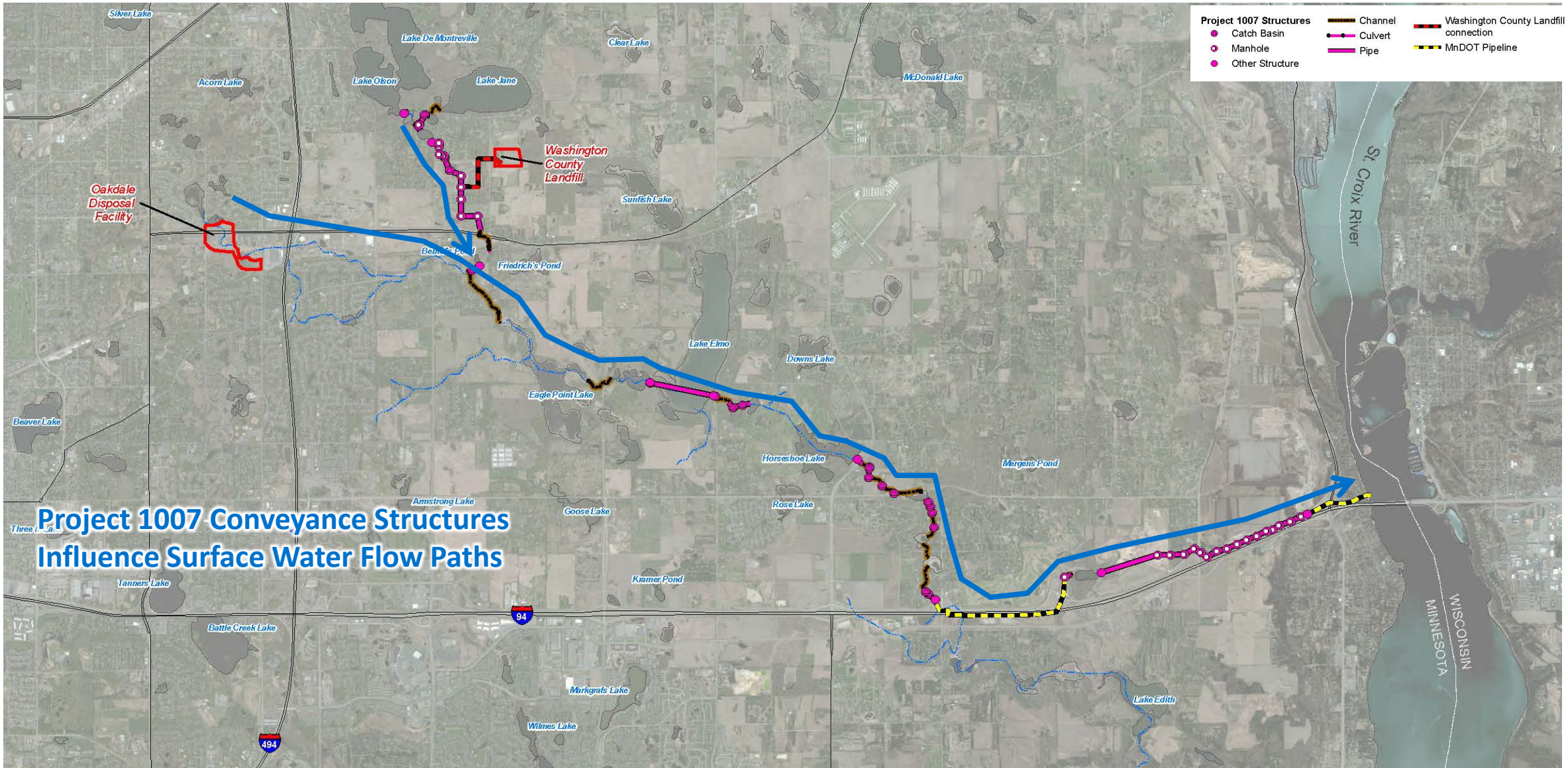


Project 1007 | A Complex Problem

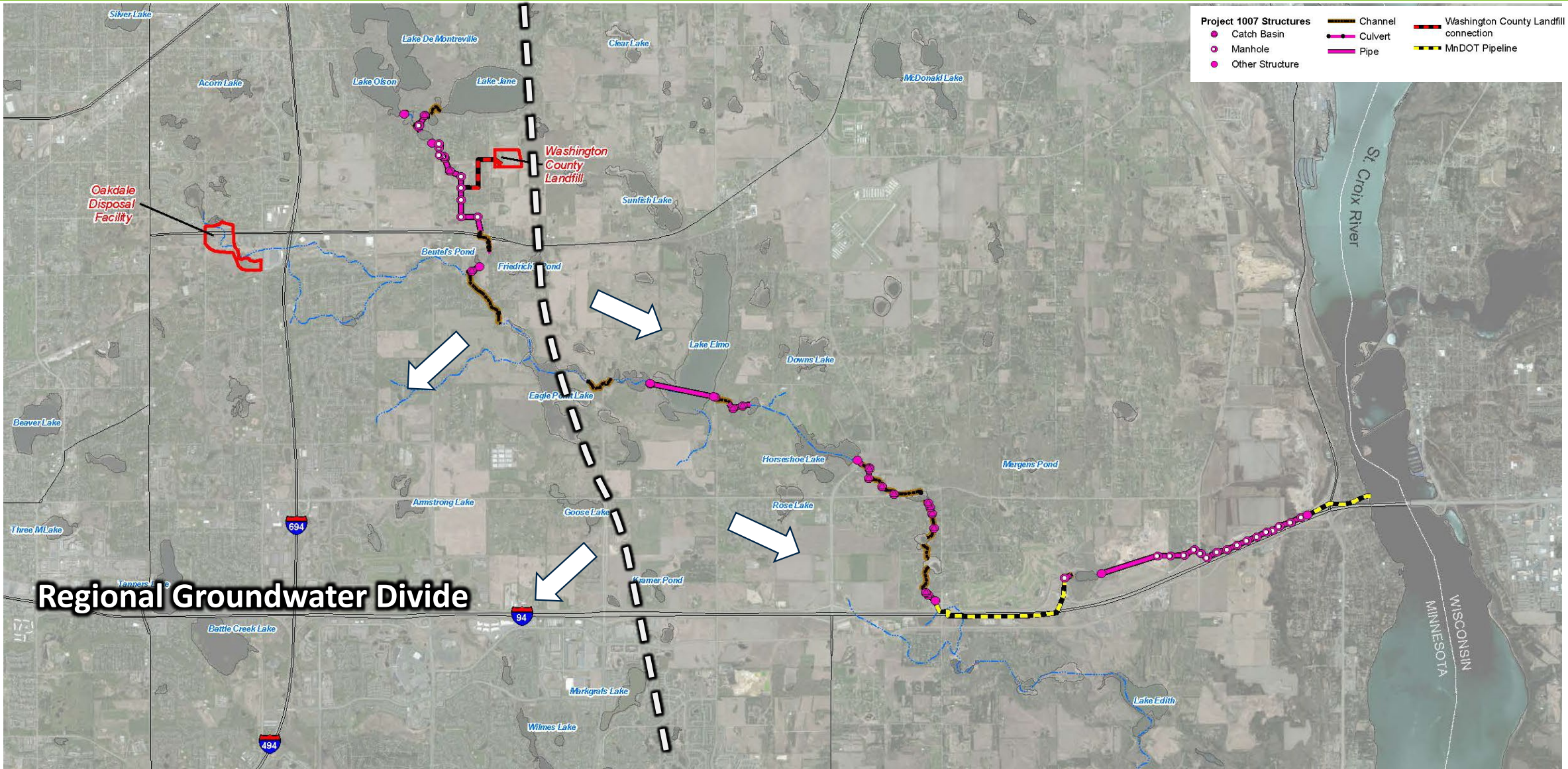


Pre-Project 1007 Surface Water Flow Paths

Project 1007 | A Complex Problem



Project 1007 | A Complex Problem



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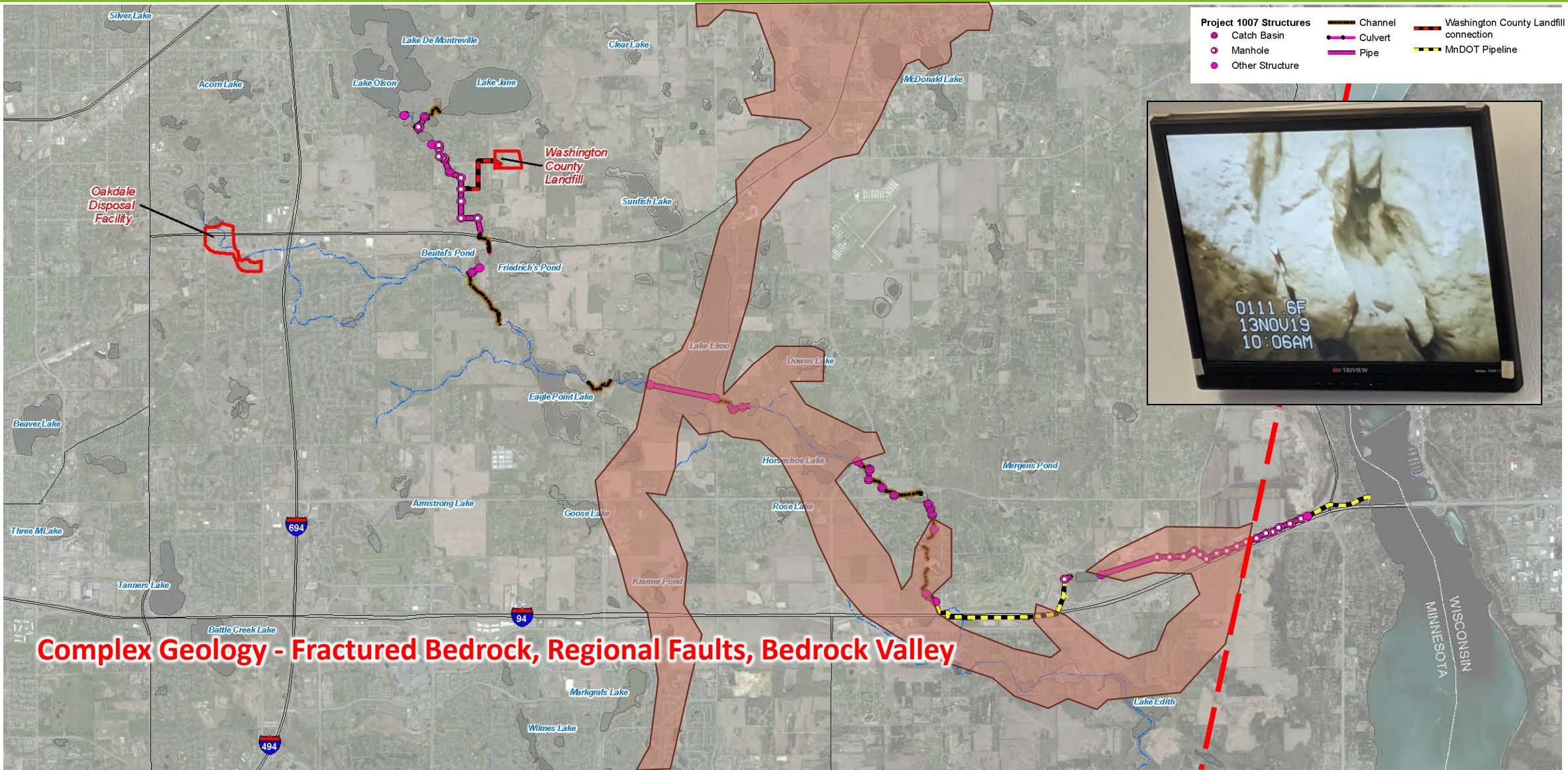

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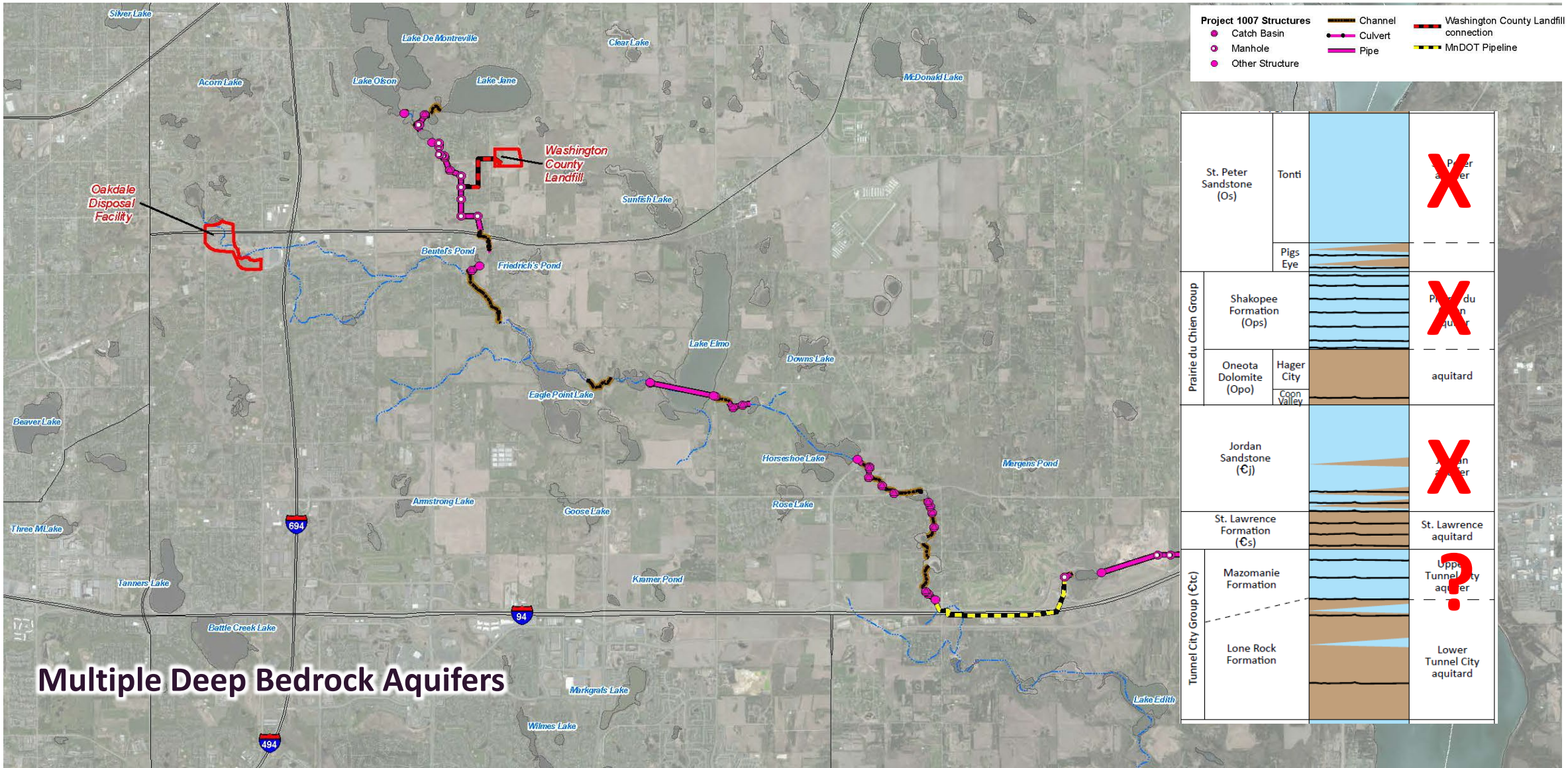

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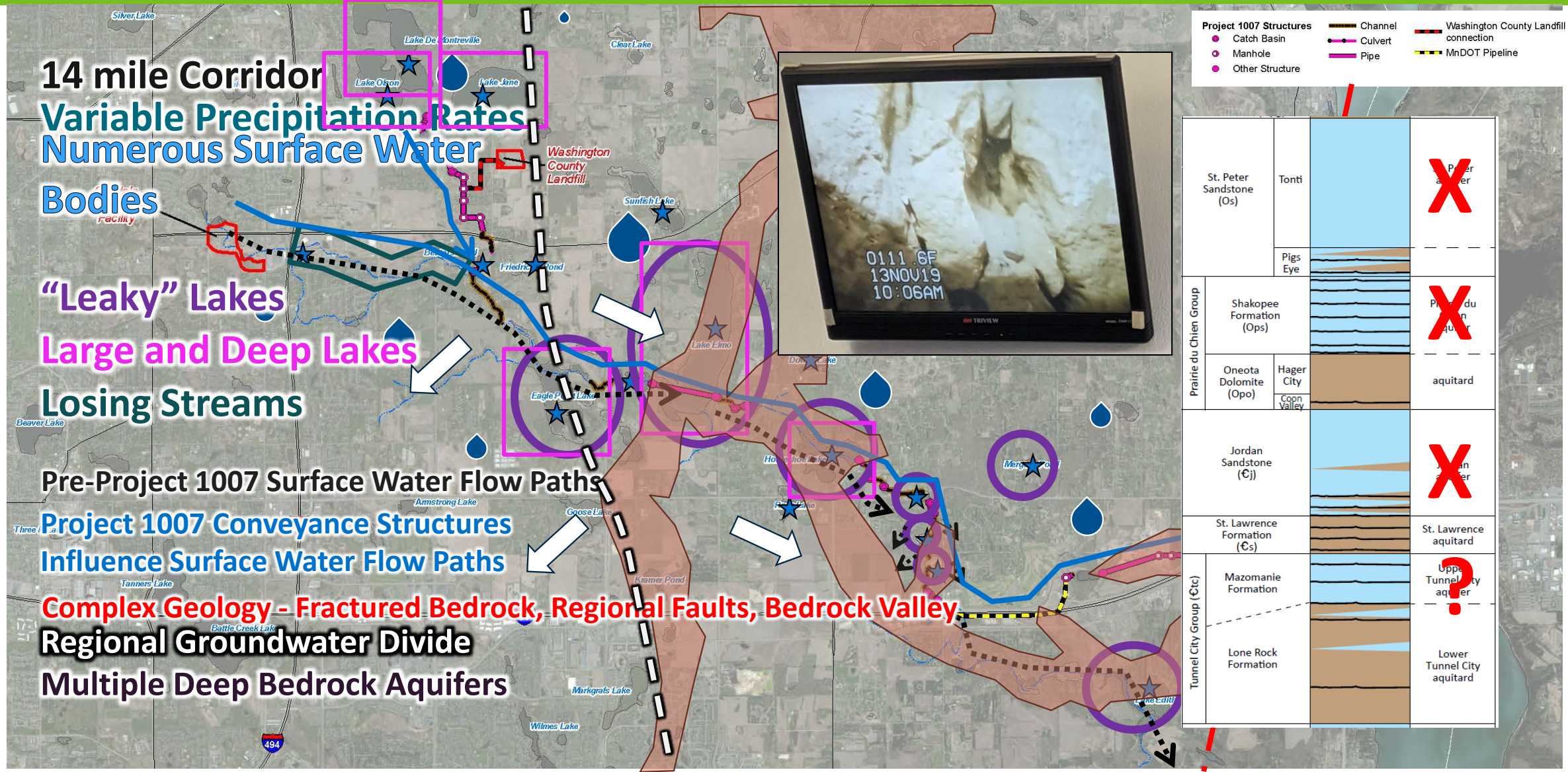
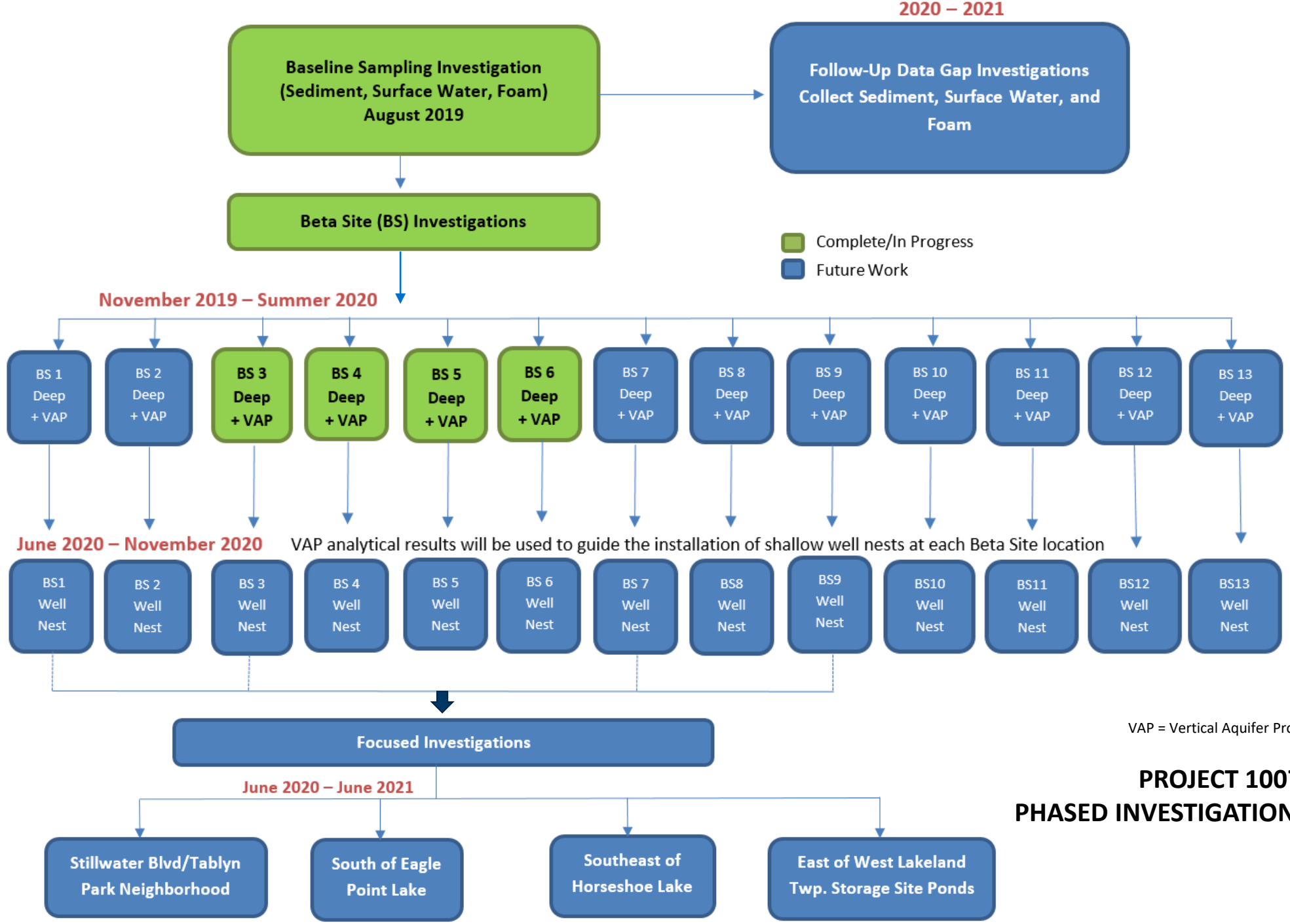
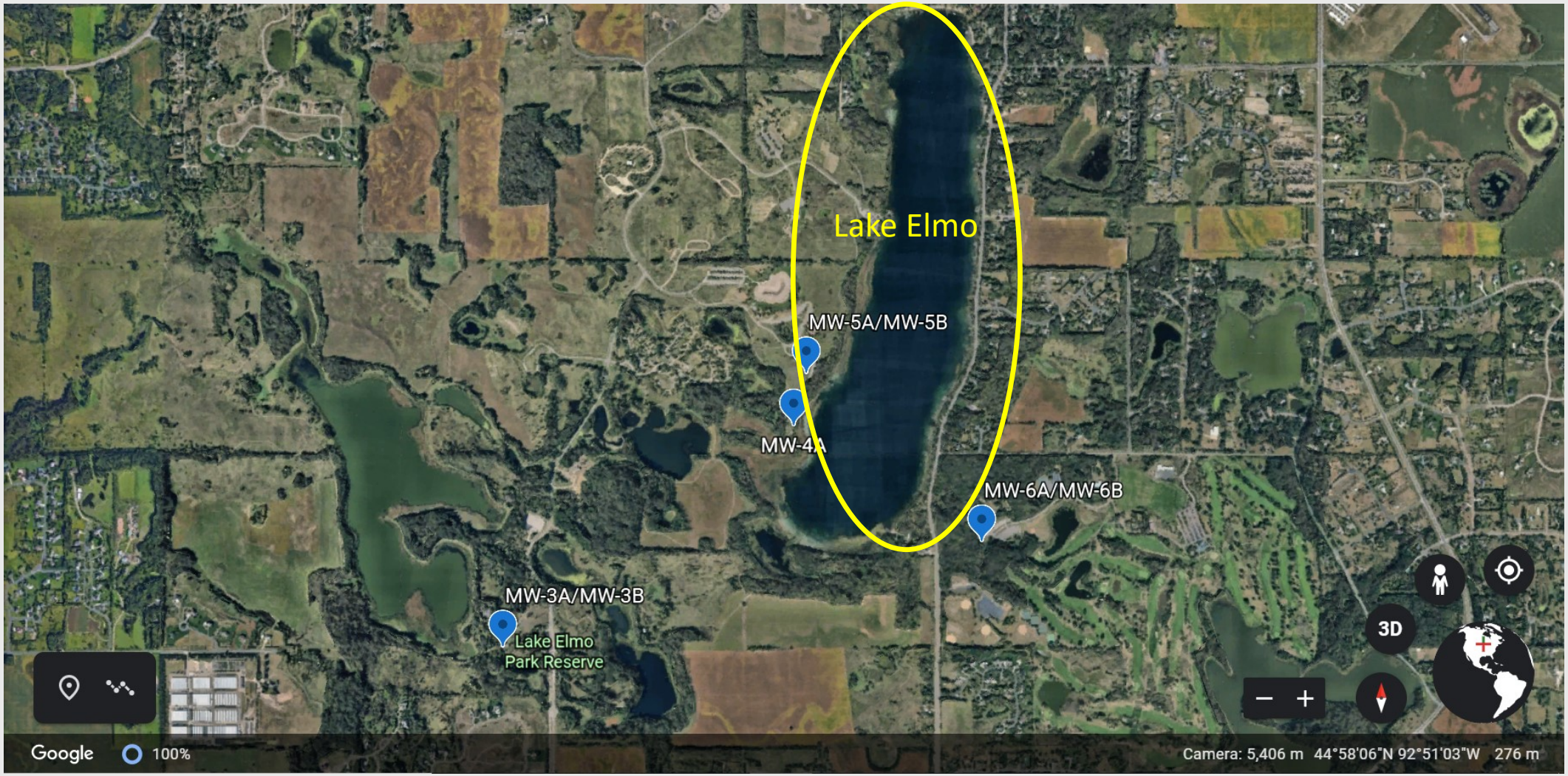




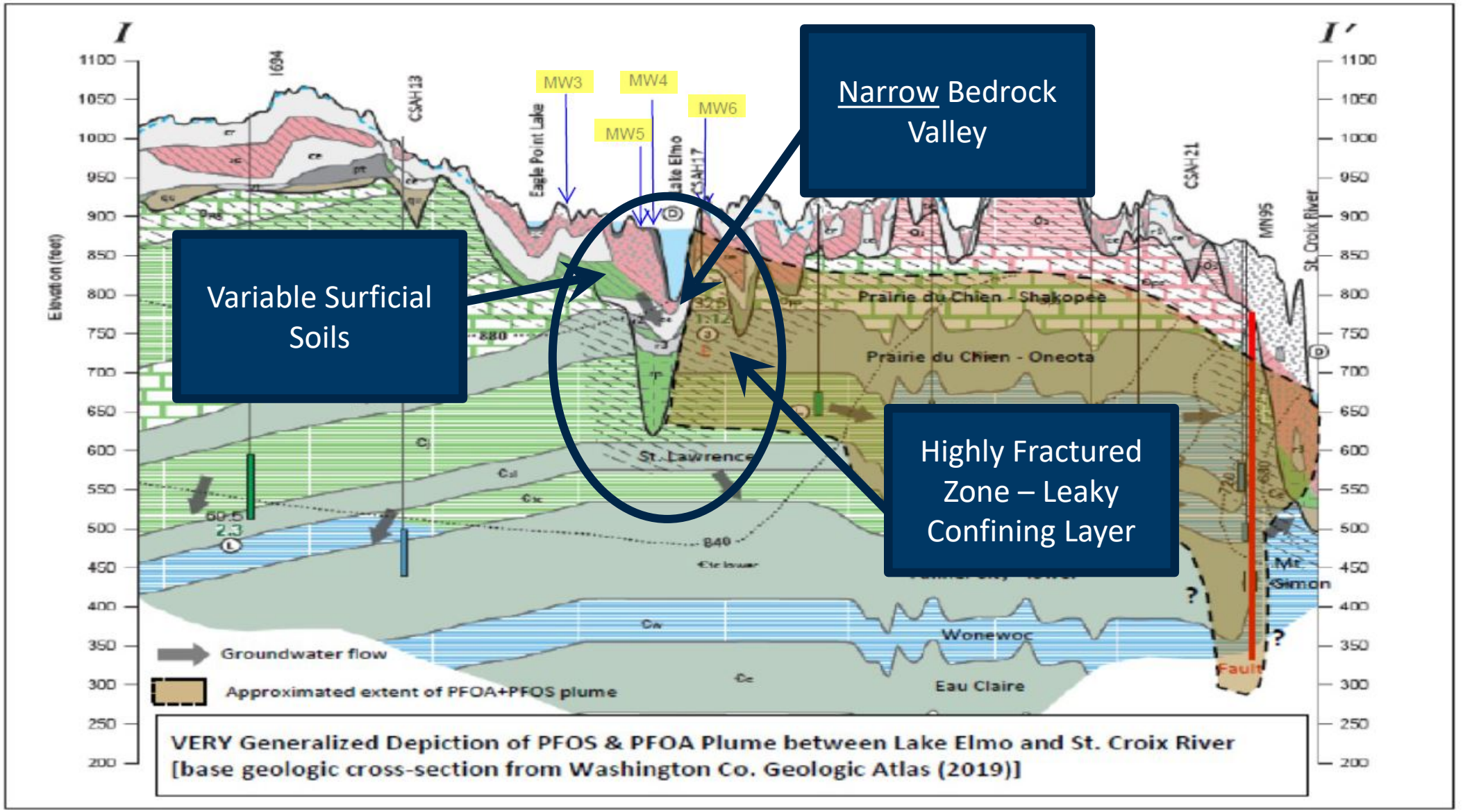
VAP = Vertical Aquifer Profiling

PROJECT 1007
PHASED INVESTIGATION APPROACH

Beta Phase Drilling Locations



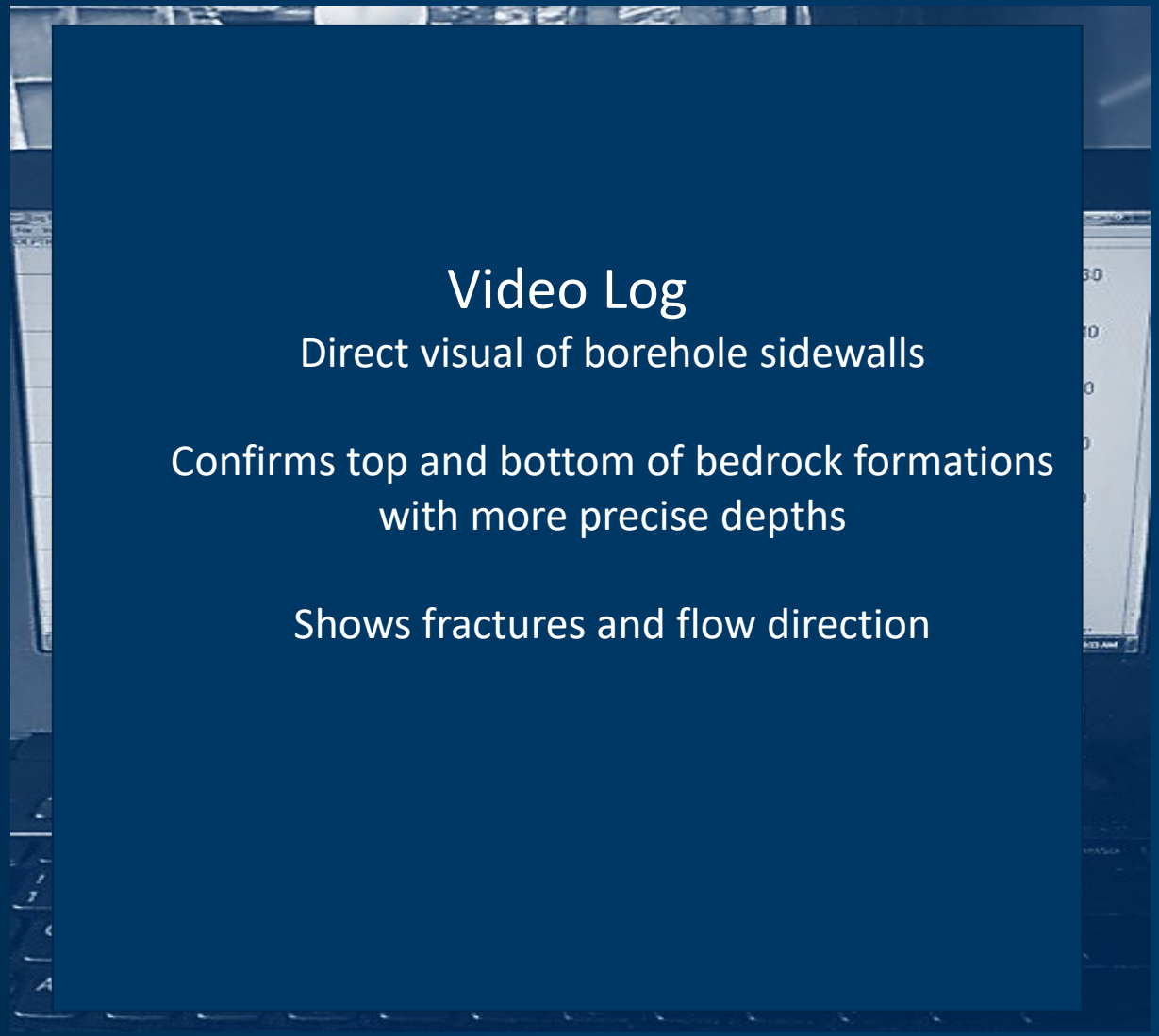
Bedrock Findings
Preferential Pathways



Beta Phase Investigation
Methods of Investigation

Beta Investigation Borehole Video and Geophysical Tools

High Resolution Data = Better Understanding of PFAS Migration



Video Log

Direct visual of borehole sidewalls

Confirms top and bottom of bedrock formations with more precise depths

Shows fractures and flow direction

Natural Gamma Log

Confirms top and bottom of bedrock formations

Caliper Log

Measures borehole diameter

Electro-Magnetic Flowmeter

Measures ambient vertical flow speed

Multi-Parameter E-Log

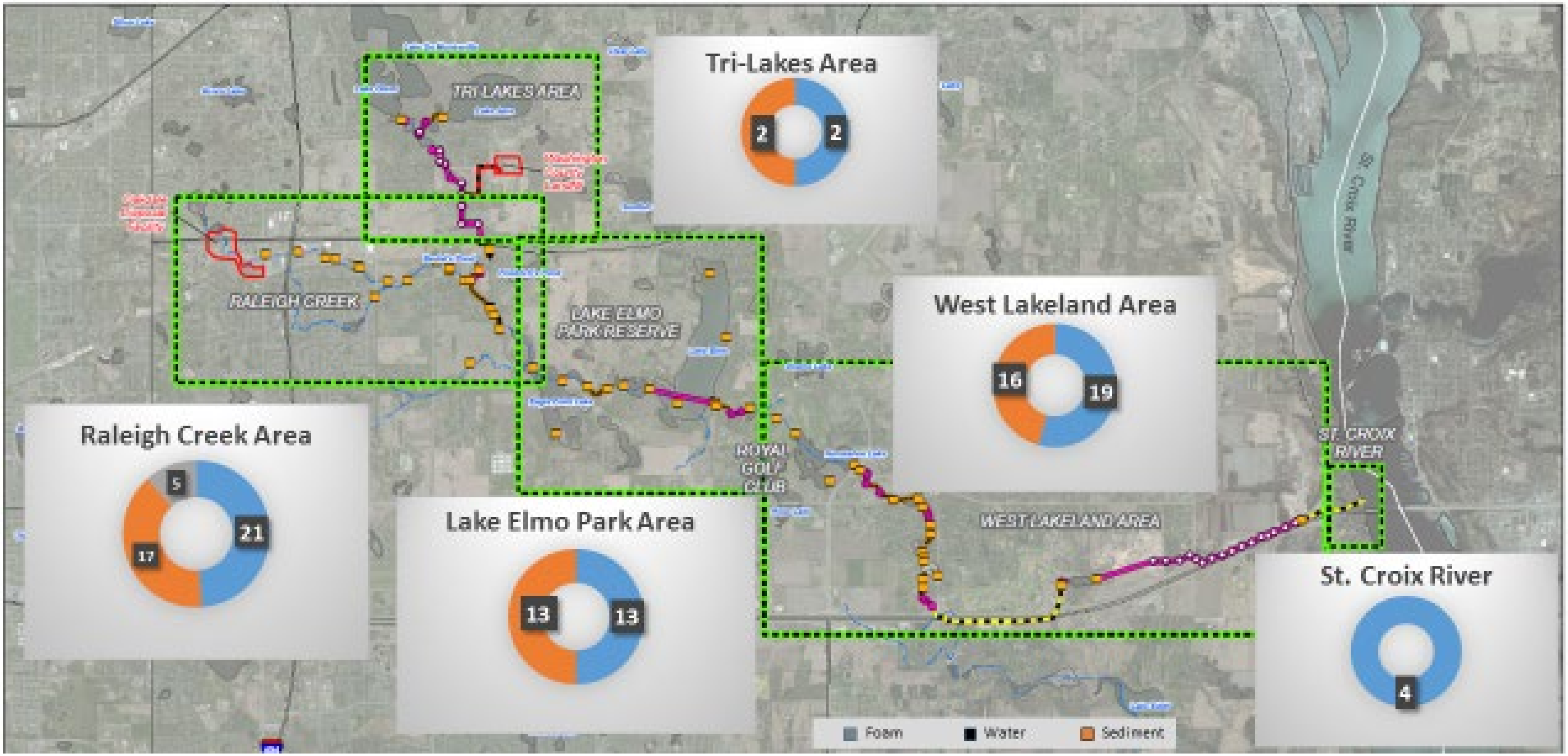
Measures fluid/single point/normal resistivity and temp

Changes in diameter, flow, and temperature can all serve to indicate significant fractures

Beta Investigation Sample Collection Groundwater and Soil Strategy

- Groundwater and soil samples in surficial glacial units *while* drilling.
- Sampling depth intervals based on soil cuttings from the adjacent deeper well.
- Groundwater samples collected at:
  - Top of the water table
  - Intervals of finer-grained and coarser-grained soils
  - Immediately above first bedrock formation
- Soil samples collected at:
  - Intervals coincident with groundwater samples
  - Zone immediately above water table and first bedrock
  - Any potential confining layers

Baseline Sampling Analytical Results

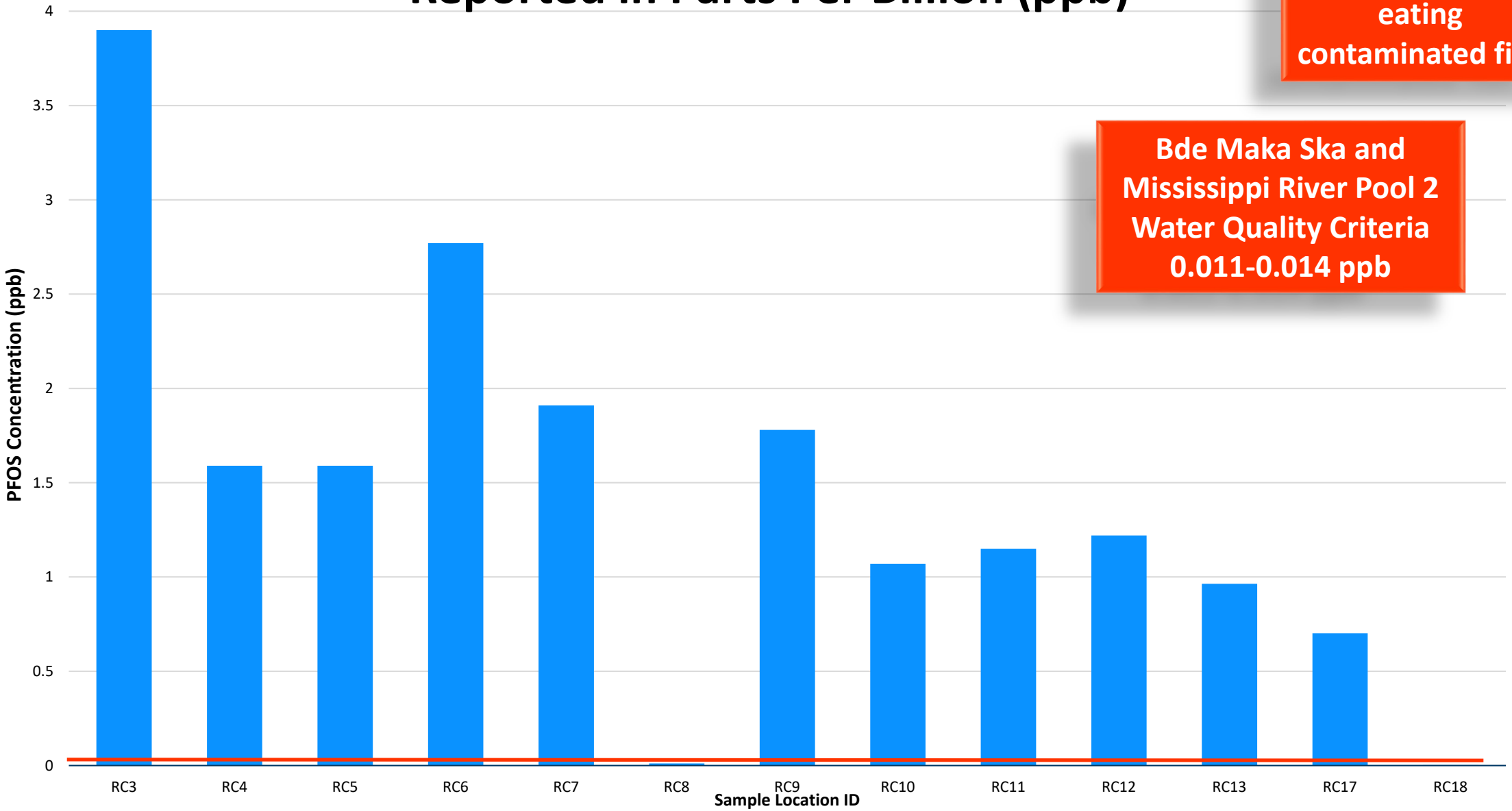


Project 1007 Overview Map
Sampling Areas and Sample Counts - Baseline Investigation

Surface Water PFOS Results
Raleigh Creek Area
Reported in Parts Per Billion (ppb)

Water Quality Criteria protect people from eating contaminated fish

Bde Maka Ska and Mississippi River Pool 2 Water Quality Criteria 0.011-0.014 ppb



1/24/2020

Surface Water PFOS Results
West to East – Project 1007 Area
Reported in Parts Per Billion (ppb)

Water Quality Criteria protect people from eating contaminated fish

Bde Mka Ska and Mississippi River Pool 2 Water Quality Criteria 0.011-0.014 ppb

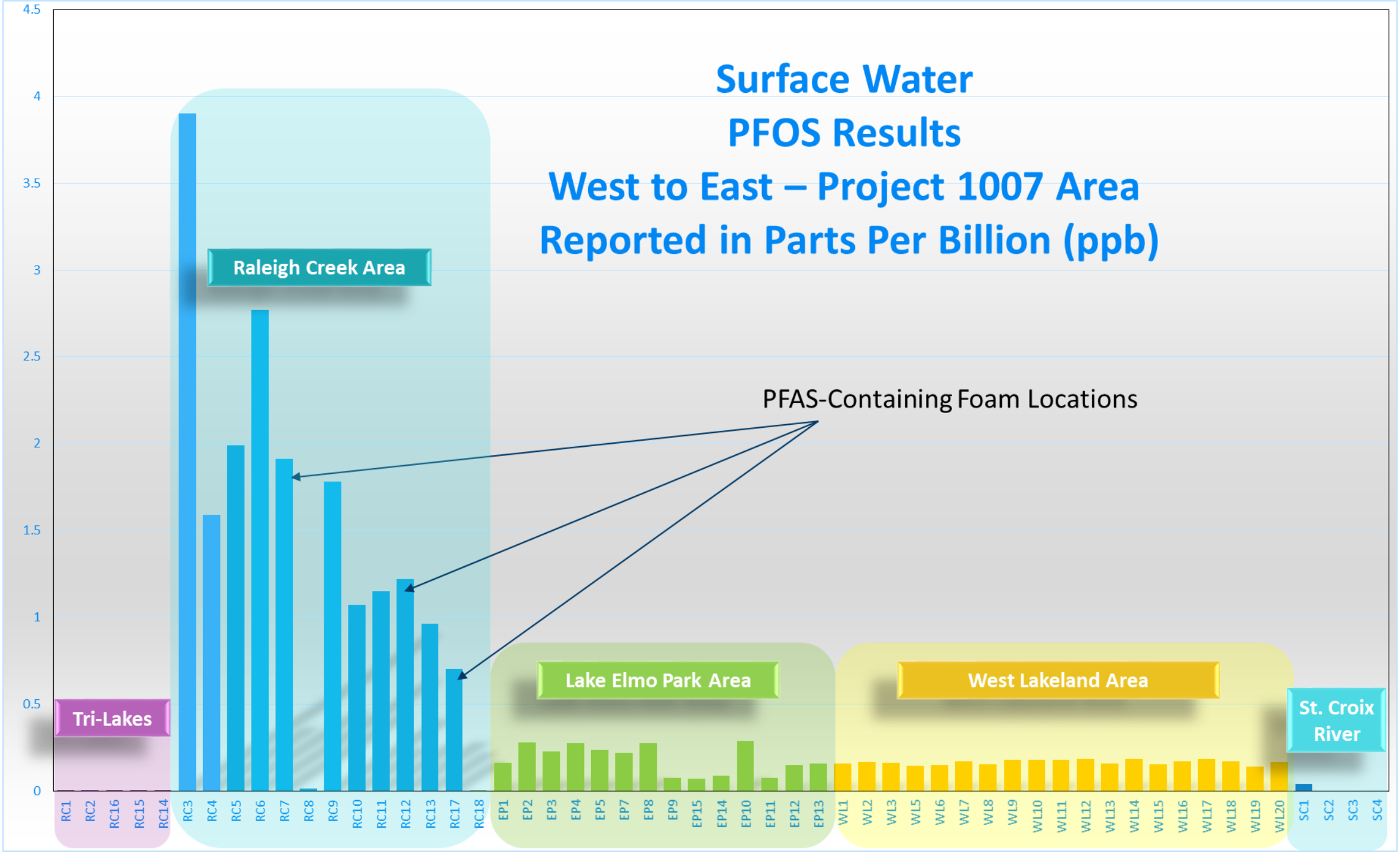
PFOS Concentration (ppb)

4.5
4
3.5
3
2.5
2
1.5
1
0.5
0

Tri-Lakes
Raleigh Creek Area
Lake Elmo Park Area
West Lakeland Area
St. Croix River

RC1 RC2 RC16 RC15 RC14 RC3 RC4 RC5 RC6 RC7 RC8 RC9 RC10 RC11 RC12 RC13 RC17 RC18 EP1 EP2 EP3 EP4 EP5 EP7 EP8 EP9 EP15 EP14 EP10 EP11 EP12 EP13 WL1 WL2 WL3 WL5 WL6 WL7 WL8 WL9 WL10 WL11 WL12 WL13 WL14 WL15 WL16 WL17 WL18 WL19 WL20 SC1 SC2 SC3 SC4

Sample Location ID


Surface Water
PFOS Results
West to East – Project 1007 Area
Reported in Parts Per Billion (ppb)
PFAS-Containing Foam Locations
Tri-Lakes
Raleigh Creek Area
Lake Elmo Park Area
West Lakeland Area
St. Croix River
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
RC1 RC2 RC16 RC15 RC14 RC3 RC4 RC5 RC6 RC7 RC8 RC9 RC10 RC11 RC12 RC13 RC17 RC18
EP1 EP2 EP3 EP4 EP5 EP7 EP8 EP9 EP15 EP14 EP10 EP11 EP12 EP13
WL1 WL2 WL3 WL5 WL6 WL7 WL8 WL9 WL10 WL11 WL12 WL13 WL14 WL15 WL16 WL17 WL18 WL19 WL20
SC1 SC2 SC3 SC4

Surface Micro Layer (SML)

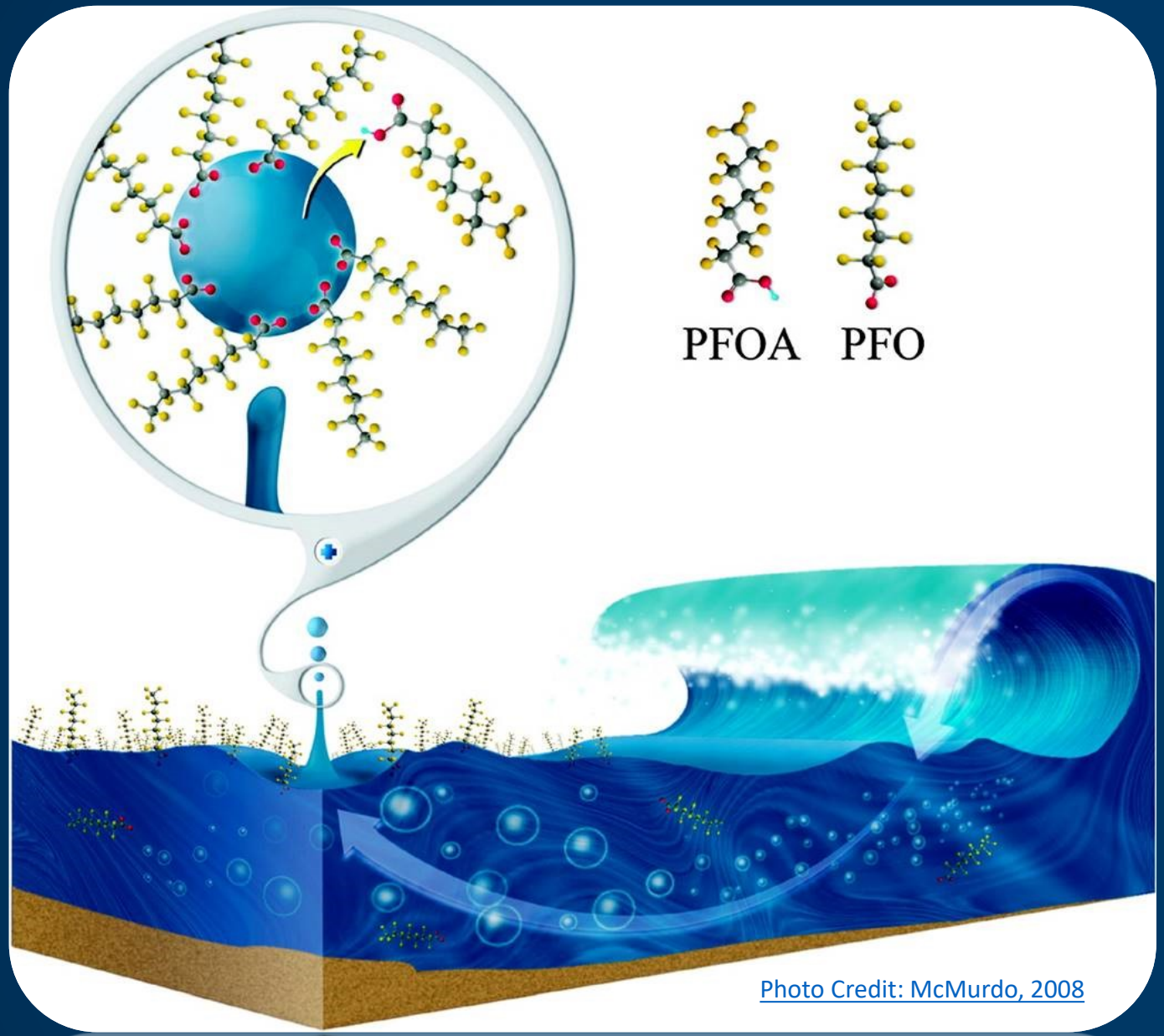


Photo Credit: McMurdo, 2008

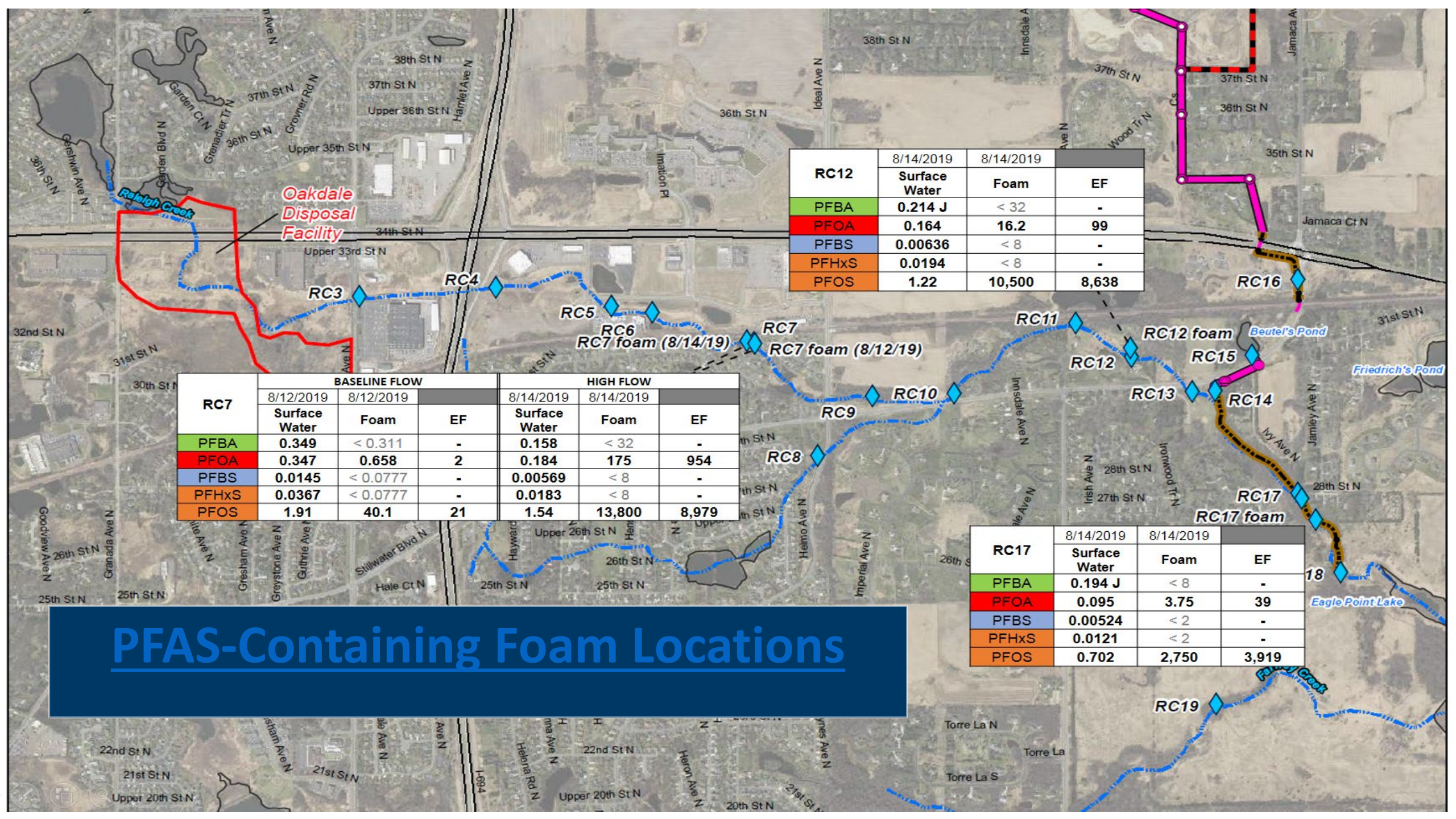
Approximately 50 um (0.05mm) thick.

An interface of gaseous exchange. High carbon content.

Documented reservoir of surface-active chemicals, including fatty acids, surfactants, PFAS and other compounds.

PFAS-Containing Foam Appearance

PFAS-Containing Foam Appearance



RC12	8/14/2019 Surface Water	8/14/2019 Foam	EF
PFBA	0.214 J	< 32	-
PFOA	0.164	16.2	99
PFBS	0.00636	< 8	-
PFHxS	0.0194	< 8	-
PFOS	1.22	10,500	8,638

RC7	BASELINE FLOW 8/12/2019 Surface Water	BASELINE FLOW 8/12/2019 Foam	BASELINE FLOW EF	HIGH FLOW 8/14/2019 Surface Water	HIGH FLOW 8/14/2019 Foam	HIGH FLOW EF
PFBA	0.349	< 0.311	-	0.158	< 32	-
PFOA	0.347	0.658	2	0.184	175	954
PFBS	0.0145	< 0.0777	-	0.00569	< 8	-
PFHxS	0.0367	< 0.0777	-	0.0183	< 8	-
PFOS	1.91	40.1	21	1.54	13,800	8,979

RC17	8/14/2019 Surface Water	8/14/2019 Foam	EF
PFBA	0.194 J	< 8	-
PFOA	0.095	3.75	39
PFBS	0.00524	< 2	-
PFHxS	0.0121	< 2	-
PFOS	0.702	2,750	3,919

PFAS-Containing Foam Locations

Comparison of Foam Results to Oakdale Disposal Site Historic Monitoring Well Data

(Units in PPB)

Sample ID	Date	PFBA	PFBS	PFHXS	PFOA	PFOS
Groundwater - ODS Pre Pump-Out Start-Up	3/10/2005	---	73.5	227	73,767	13,367
Foam - RC7	08/12/19	<.31	<.08	<.08	.66	40.09
Foam - RC7	08/14/19	<32	<.8	<8	175.40	13,800
Foam - RC12	08/14/19	<32	<8	<8	16.22	10,500
Foam - RC17	08/14/19	<8	<2	<2	3.75	2,751
Foam - RC17A	08/14/19	<.32	<.08	<.08	.50	595.30

Wisconsin's PFAS Foam Experience

PFAS foam
on a large creek

PFAS foam
on a large creek

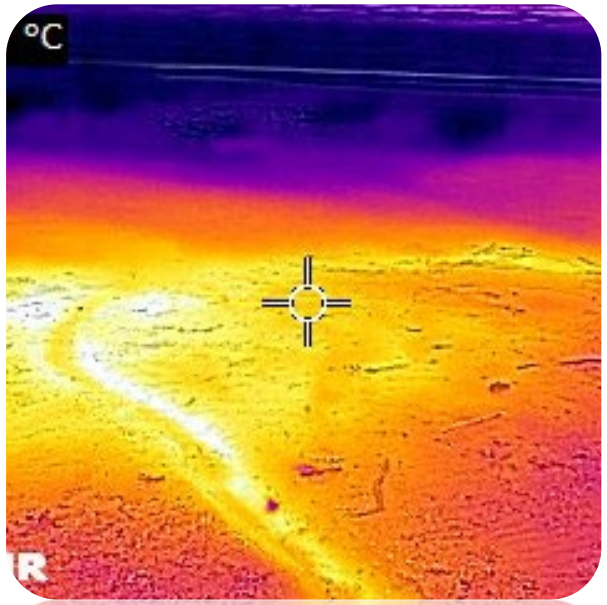
PFAS foam in a
drainage ditch

River with previously low
level PFAS

Michigan's PFAS Foam Experience

Dock on a lake with nearby sources.

Frozen Foam



Infrared Camera imaging for source area seeps.

Frozen foam islands

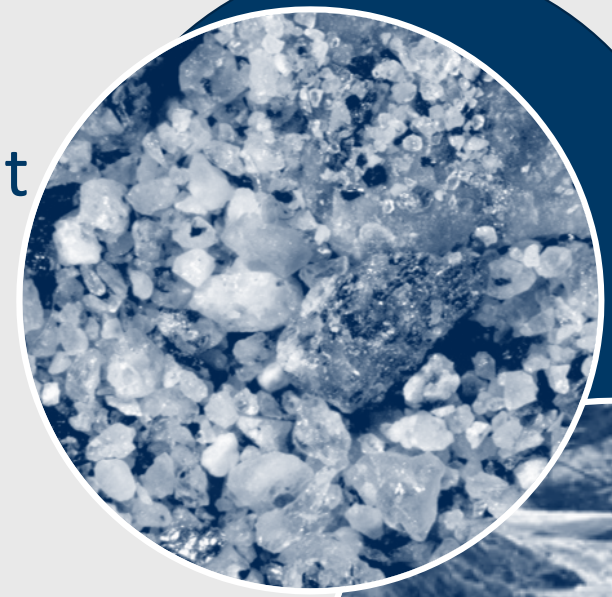
PFAS Risk Assessment Values

Human Health Concerns

- People and pets should avoid contact with foam
- Wash skin/fur that has come into contact with suspected PFAS-containing foam with soap and water
- Surface water concentrations of PFAS are *much* lower, indicating water is safe for recreation
- Additional data will be collected
- MDH will conduct additional recreational risk assessment to verify these conclusions

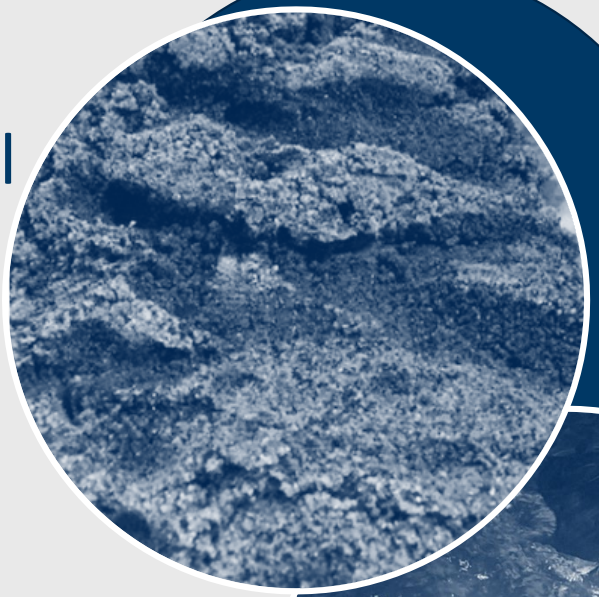
Non-Drinking Water Health Risk Values

Sediment

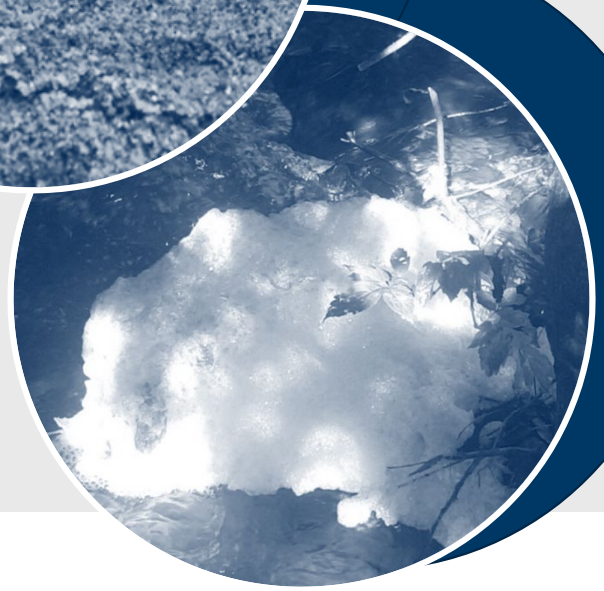


Surface Water

Soil



Foam



NEXT STEPS

Investigating

Communicating

Coordinating

- Across programs/Agencies
- Appropriate Response Actions

Evaluating

- Oakdale Disposal Controls
- Health and Environmental Risks
  - Drinking Water, Groundwater, Ecosystem Receptors

Conclusions

What has been completed in 1 year?

- ✓ Road Map for Comprehensive Investigation
- ✓ First Phase Complete
- ✓ Second Phase In-Progress

Investigation continues through 2021

Complex problem – no easy fix to forever chemicals

PFAS-containing foam can be found in PFAS-impacted surface water

People and pets should avoid foam

Thank you

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