

A Regional, Holistic Approach to Addressing Septic Leachate Pollution in the Flathead Basin

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WESTERN MONTANA
**Conservation
Commission**

Who is WMCC?



UPPER COLUMBIA CONSERVATION COMMISSION



WESTERN MONTANA
**Conservation
Commission**

ESTABLISHED

July 1, 2023

MISSION

Water quality protection +
AIS mitigation & prevention

WHERE WE SERVE



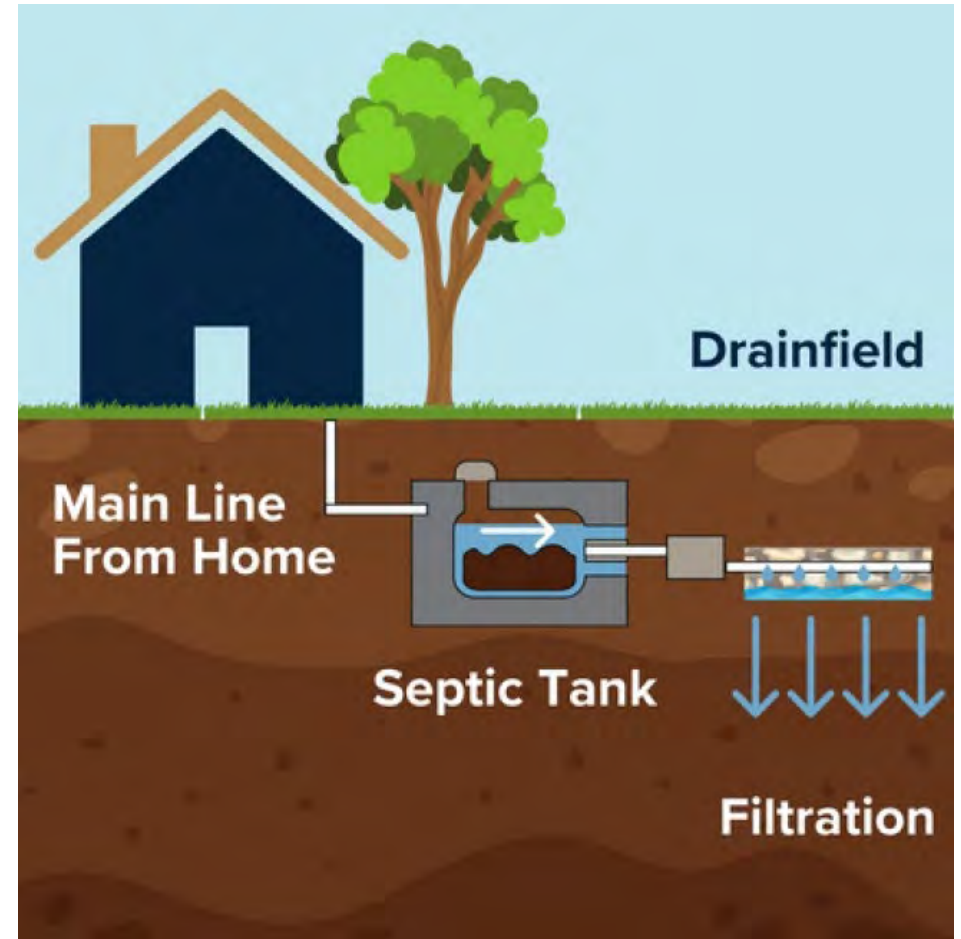


**WMCC acknowledges that we live and work in
the ancestral territories of the Salish, Kalispel,
and Kootenai people.**

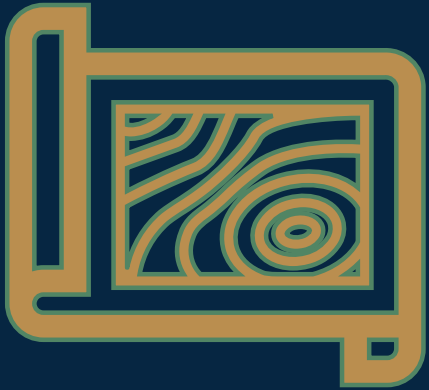
**We honor the path they have always shown us in
caring for these landscapes for generations to
come.**

Septic Leachate

- 1977 – Studies documenting septic leachate pollution in MT and the Flathead Basin
- 2019 – FBC created an Onsite Wastewater Treatment Committee
 - Many factors to the issue – social, economic, political, and cultural
 - Needs to be addressed holistically



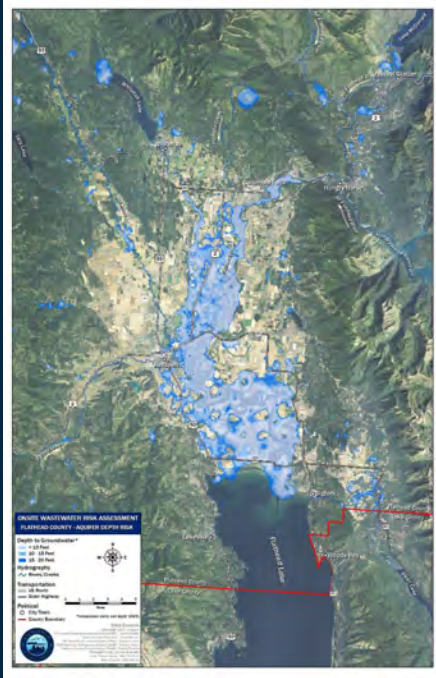
Septic Risk Model



Goal: To identify areas of the Flathead Basin at the highest risk for septic leachate pollution based on:

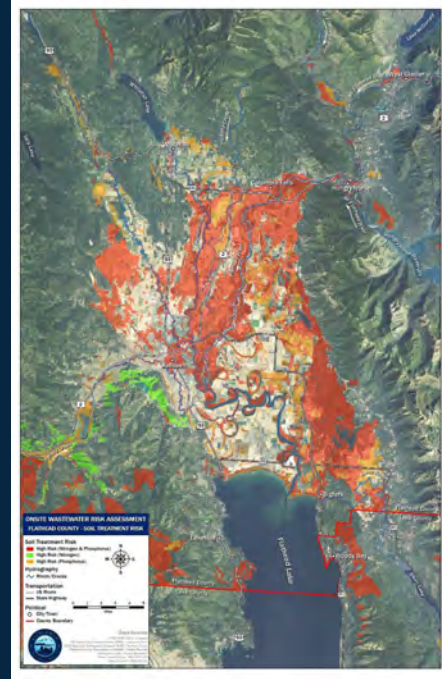
1. Geophysical characteristics
2. The age and density of existing septic systems

Depth to
Groundwater



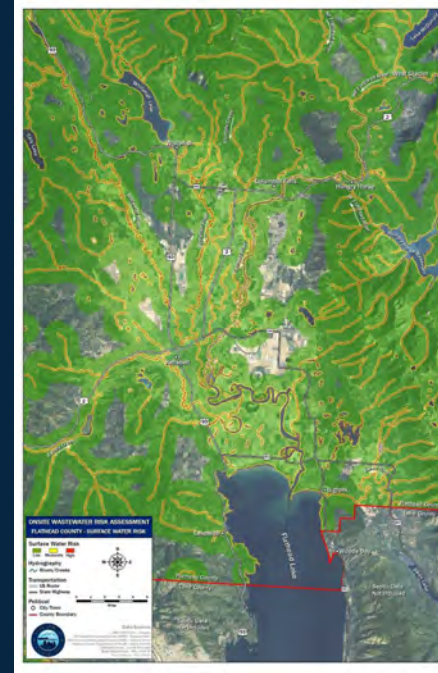
+

Soil
Treatment
for N & P



+

Distance to
Surface
Water



+

Slope



=

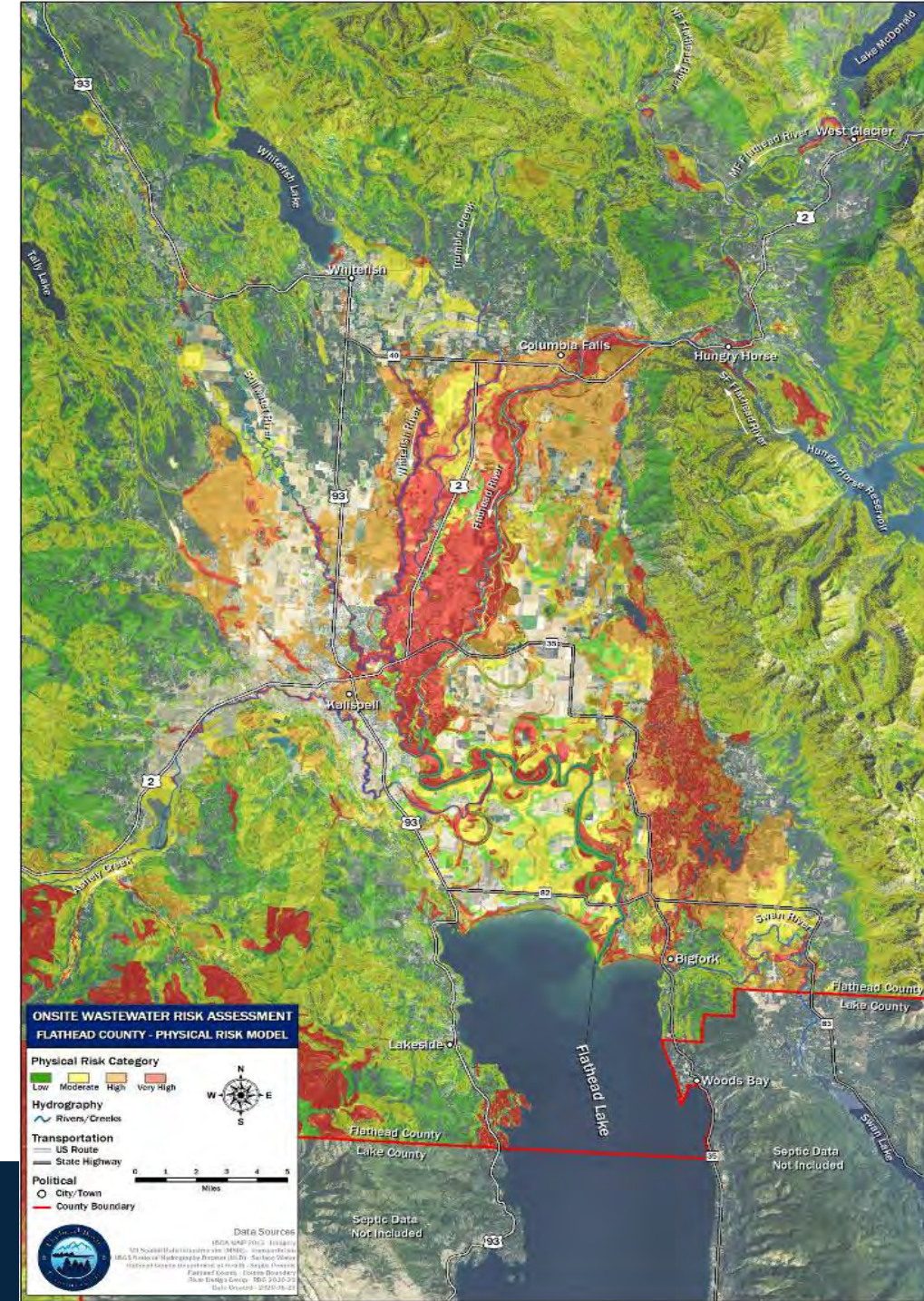
Physical Risk Model

Physical Risk Model

- Developed for Flathead & Lake Counties
- Shows the potential for septic leachate pollution based on geophysical characteristics
- Spatial generalization

Physical Risk Model (Cumulative)	
Risk Category	Value
Very Low	0 – 2
Low	2 – 3
Moderate	3 – 5
High	5 – 7
Very High	7 – 15

Existing Septic Risk Model (Components)			
Feature	Category	Value	
Nitrogen Risk (Soil)	Low	0	
Nitrogen Risk (Soil)	High	3	
Phosphorus Risk (Soil)	Low	0	
Phosphorus Risk (Soil)	High	3	
Groundwater < 10'	High	3	
Groundwater 10' - 15'	Moderate	2	
Groundwater 15' - 20'	Low	1	
Groundwater > 20'	-	0	
Slope (%) 0 - 10	-	0	
Slope (%) 10 - 15	Low	1	
Slope (%) 15 - 25	Moderate	2	
Slope (%) 25 - 60	High	3	
Slope (%) 60 - 90	-	0	
Surface Water 500' – 5000'	Low	1	
Surface Water 100' – 500'	Moderate	2	
Surface Water 0' – 100'	High	3	

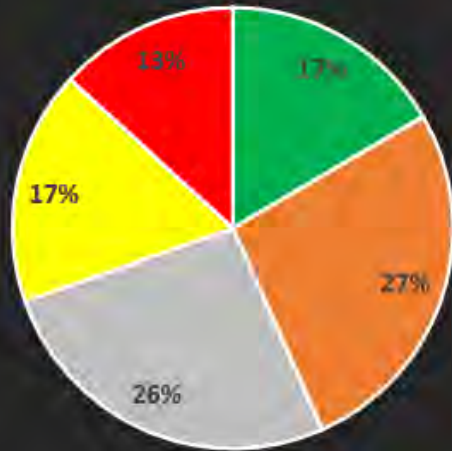


Septic Age Analysis

- Age is a key factor in a system likelihood to underperform
- Data only available for Flathead County

2020–Current Age

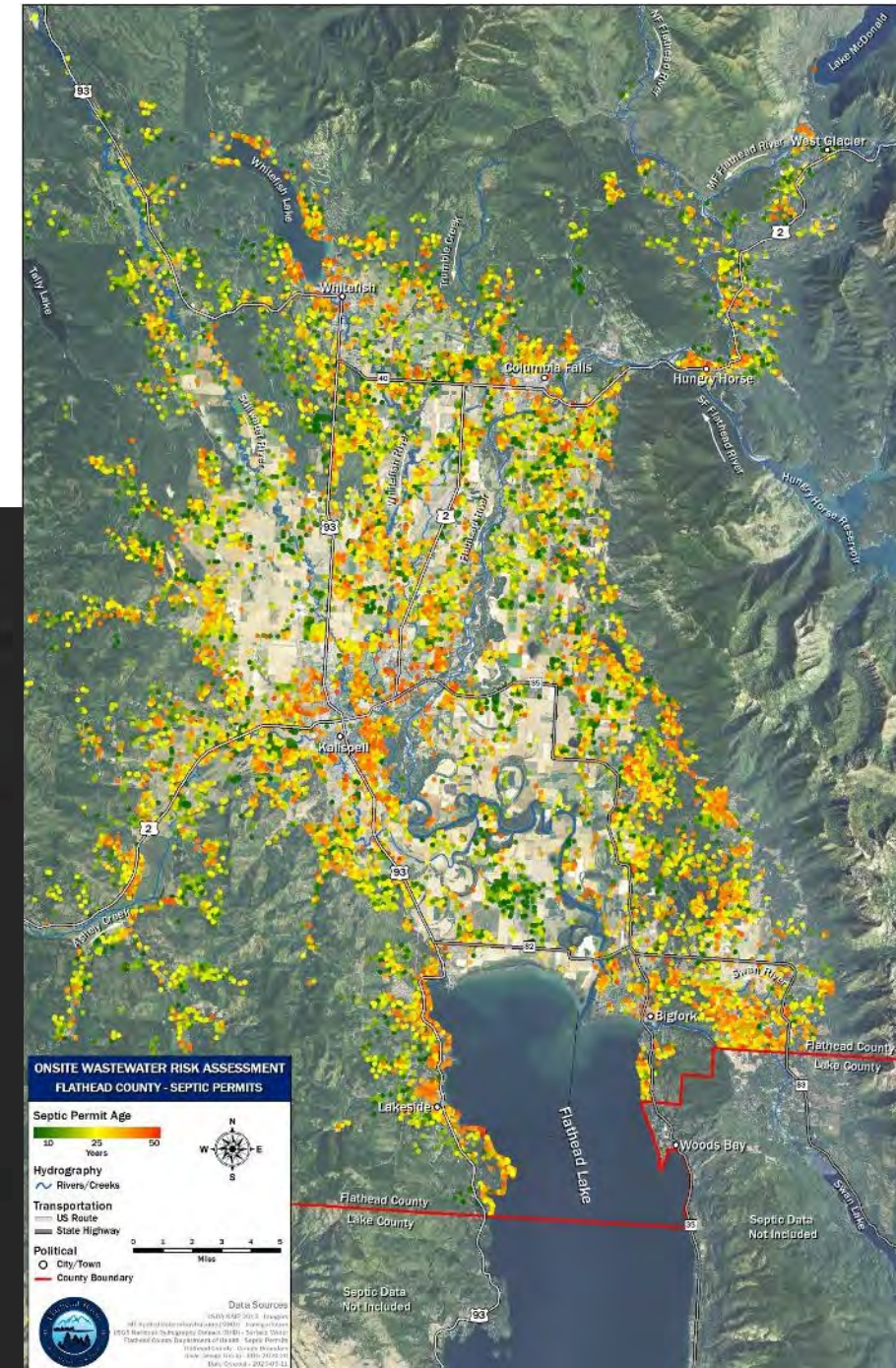
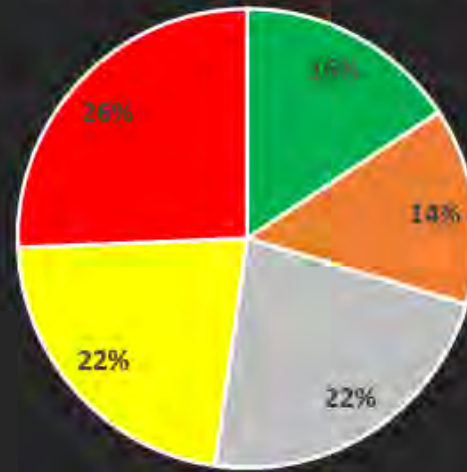
Proportion of Septic Systems in Each Risk Class
Flathead County (Permitted) TN= 21,415



- Low (0 - 10 years)
- Mild (11 - 20 years)
- Moderate (21 - 30 years)
- High (31 - 40 years)
- Extreme (40+ years)

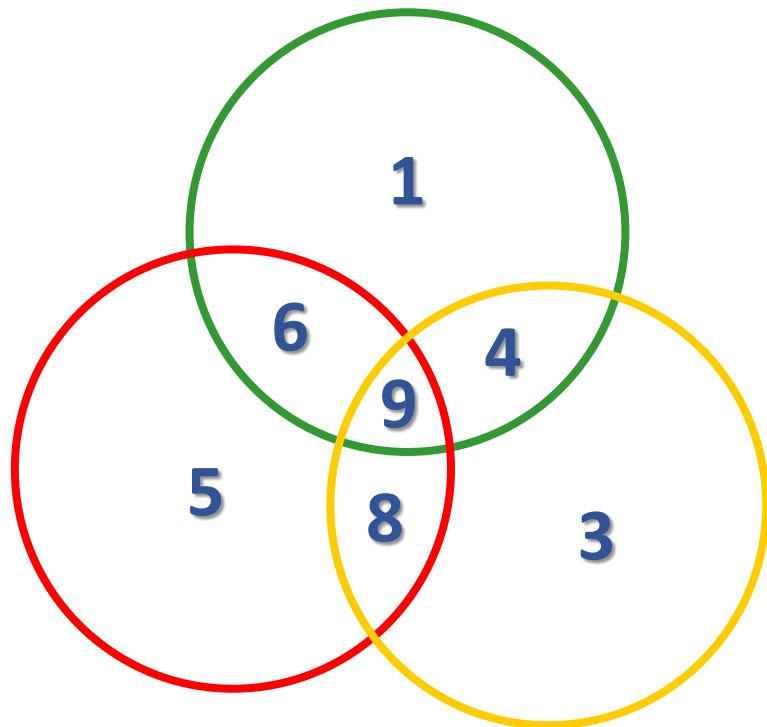
2030–Projection

Proportion of Septic Systems in Each Risk Class
Flathead County (Permitted) TN= 25,415



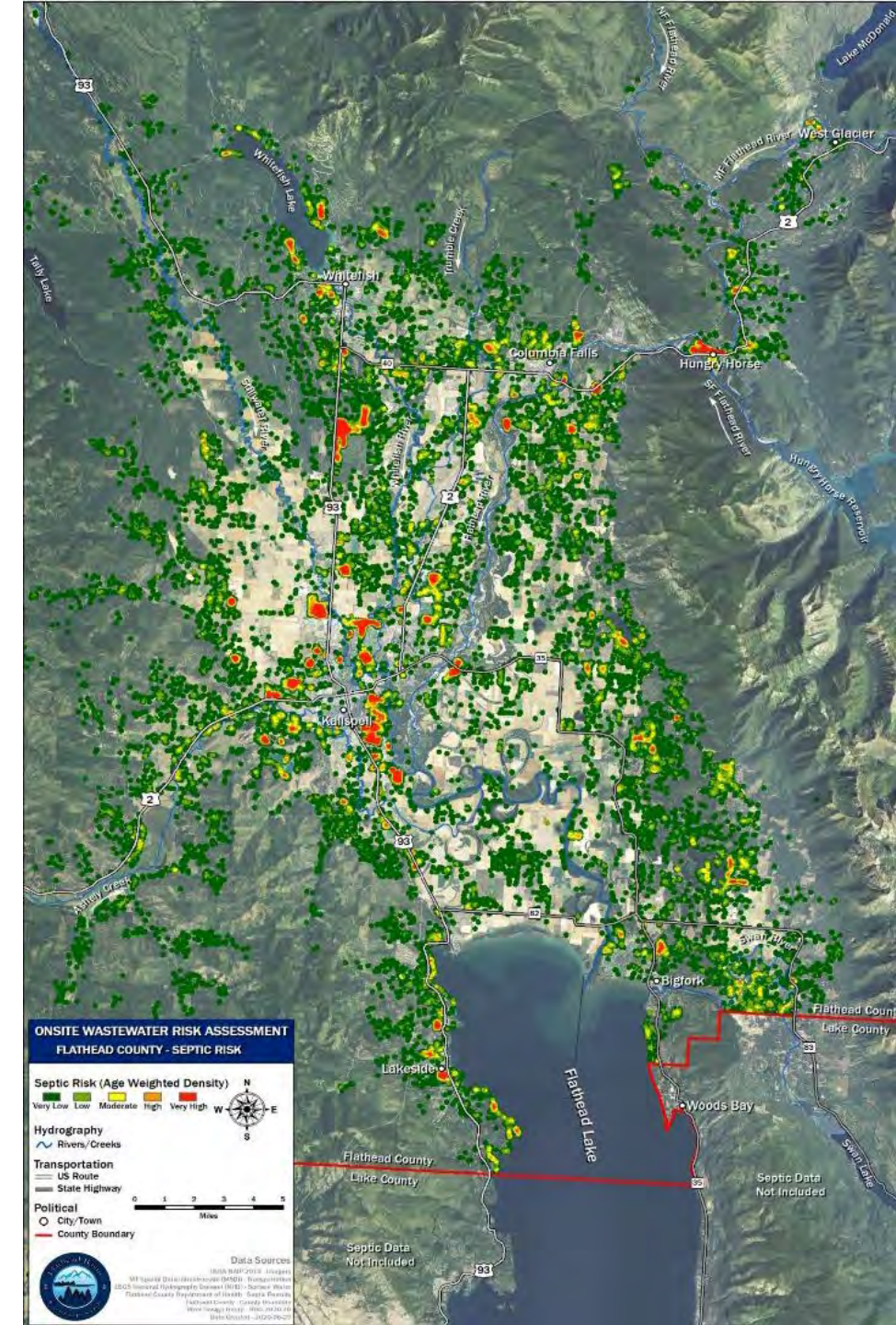
Age-Weighted Density

- 500-ft buffer surrounding septic permit location
- Age risk value assigned to each buffer
- Overlapping buffers added together

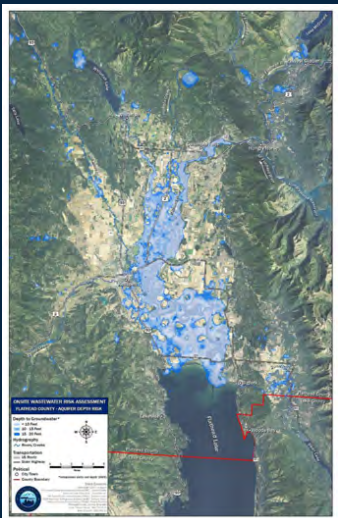


Individual Septic Age Risk Value		
Permit Age	Risk Category	Value
0 – 10	Low	1
11 – 20	Mild	2
21 – 30	Moderate	3
31 – 40	High	4
>40	Extreme	5

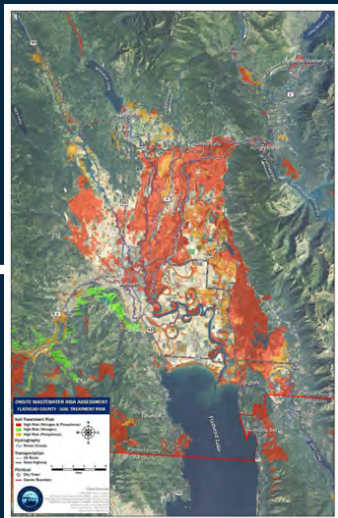
Septic Weighted Age Density Risk Value		
Cumulative Age Value	Risk Category	Value
1 – 5	Very Low	1
6 – 10	Low	2
11 – 20	Moderate	3
21 – 40	High	4
41 - 300	Very High	5



Depth to
Groundwater



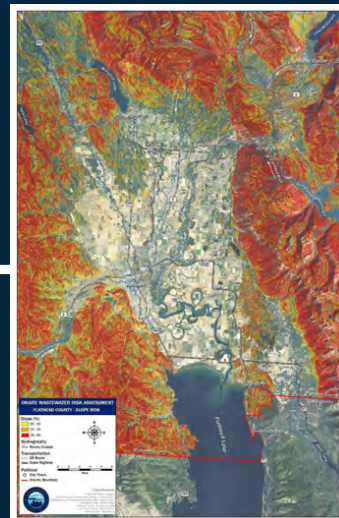
Soil Treatment
Capacity



Distance to
Surface Water



Slope



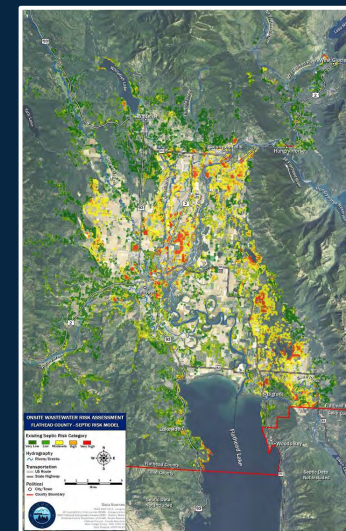
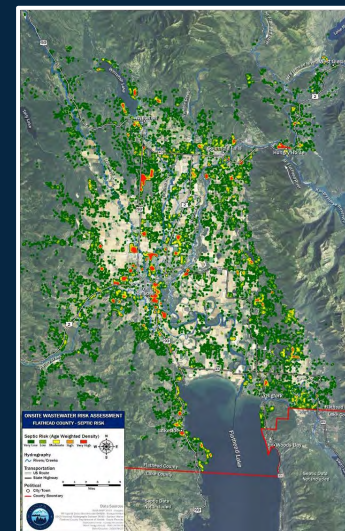
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+

+

X

=



Physical Risk Model

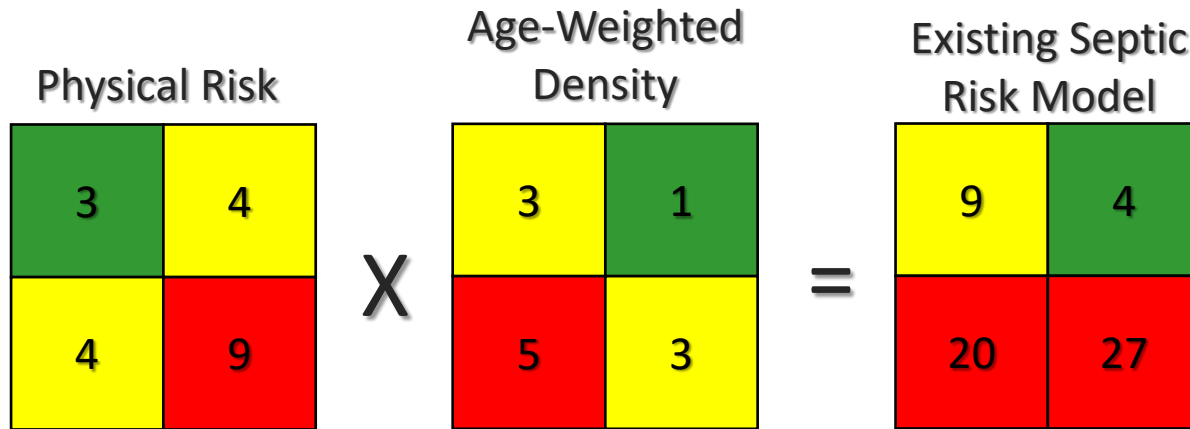
Age & Density of
Existing Septic
Systems

Existing Septic
Risk

To read more
about how model
was created:



Existing Septic Risk Model

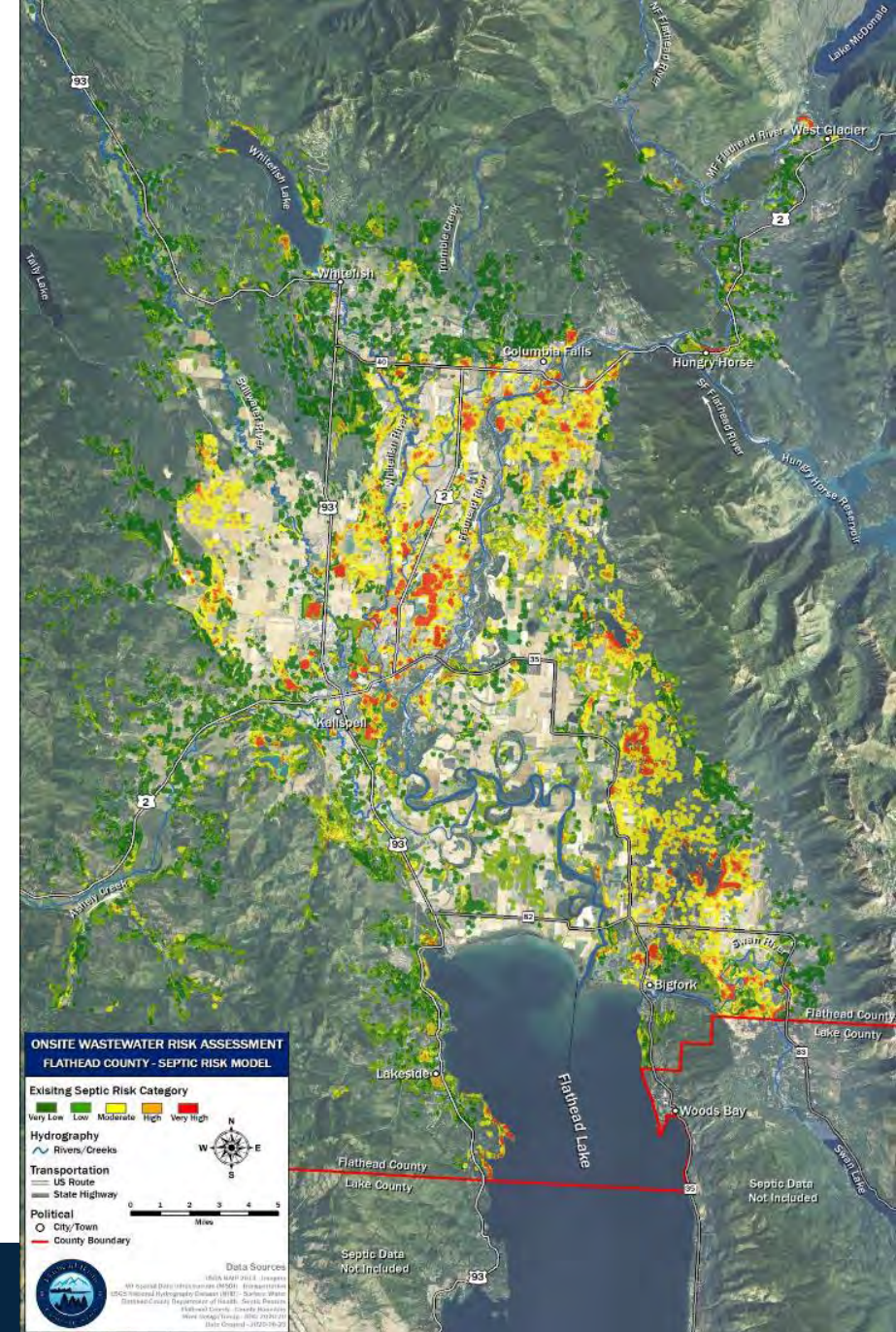


Existing Septic Risk Model	
Risk Category	Value
Very Low	0 – 2
Low	2 – 5
Moderate	5 – 10
High	10 – 15
Very High	15 – 65

To visit the interactive version of this model:



tinyurl.com/FlatheadSepticRisk



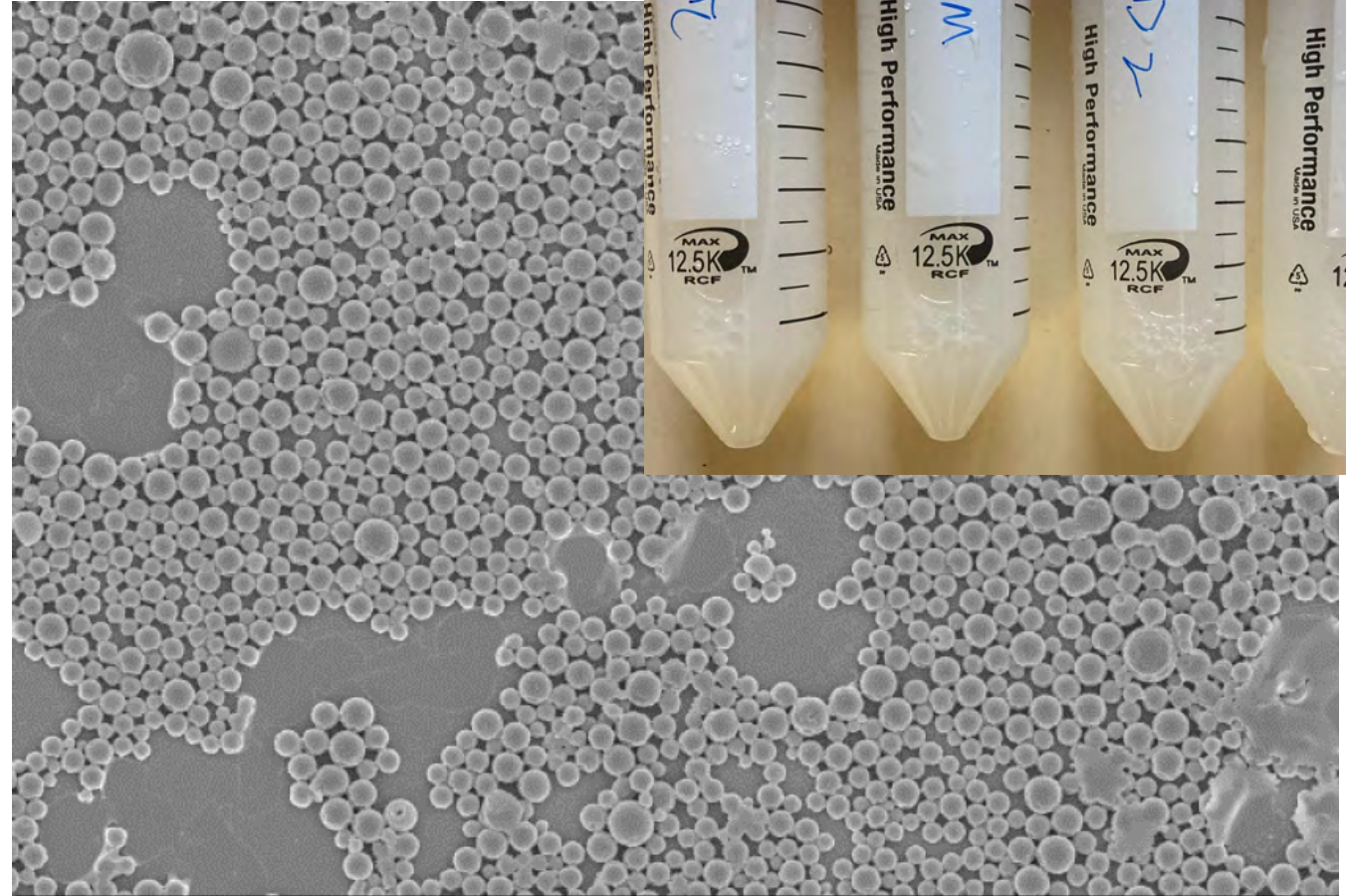
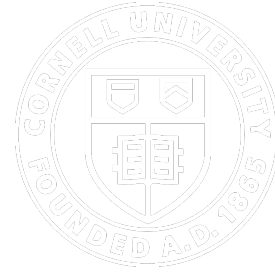
Synthetic DNA Tracer Study



Goal: (1) To evaluate the effectiveness of this novel technology in our ecoregion and (2) to learn more about the hydrologic connection between lakeshore septics and surface water

Tracer Fabrication

- Contracted with Cornell University
- Short, unique strands of DNA that act as a barcode
- Encased in a biodegradable polymer for preservation in environment



1 μm

EHT = 3.00 kV

Signal A = InLens

Image Pixel Size = 29.30 nm

Date : 26 Apr 2021

ZEISS

WD = 6.2 mm

File Name = 4_16.tif

Width = 30.00 μm

Time : 16:27:08

Synthesized DNA incorporated PLGA microspheres under

Study Design



Lake Mary Ronan



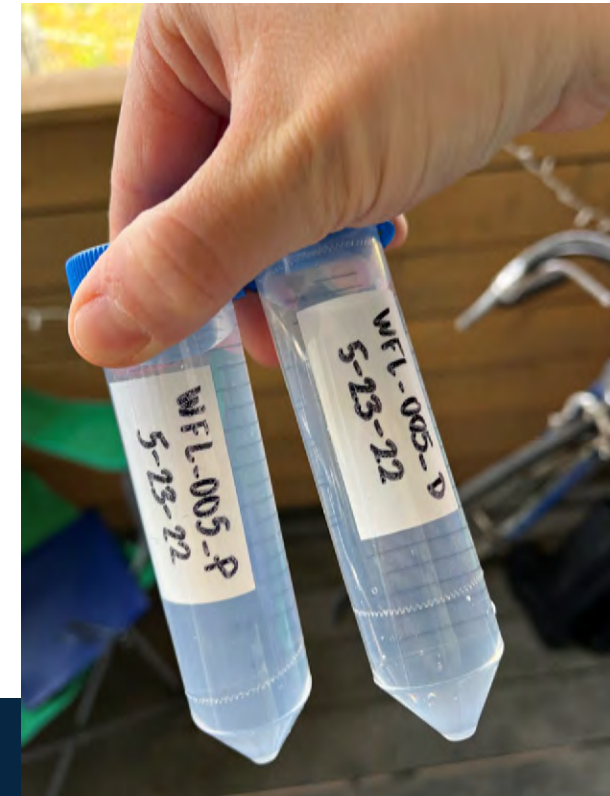
Whitefish Lake

- 8 unique tracers flushed down toilets of 8 homeowners on WFL and LMR
- Chosen because:
 - High density of septics on both lake shores
 - Physical and existing risk models indicate high/very high risk

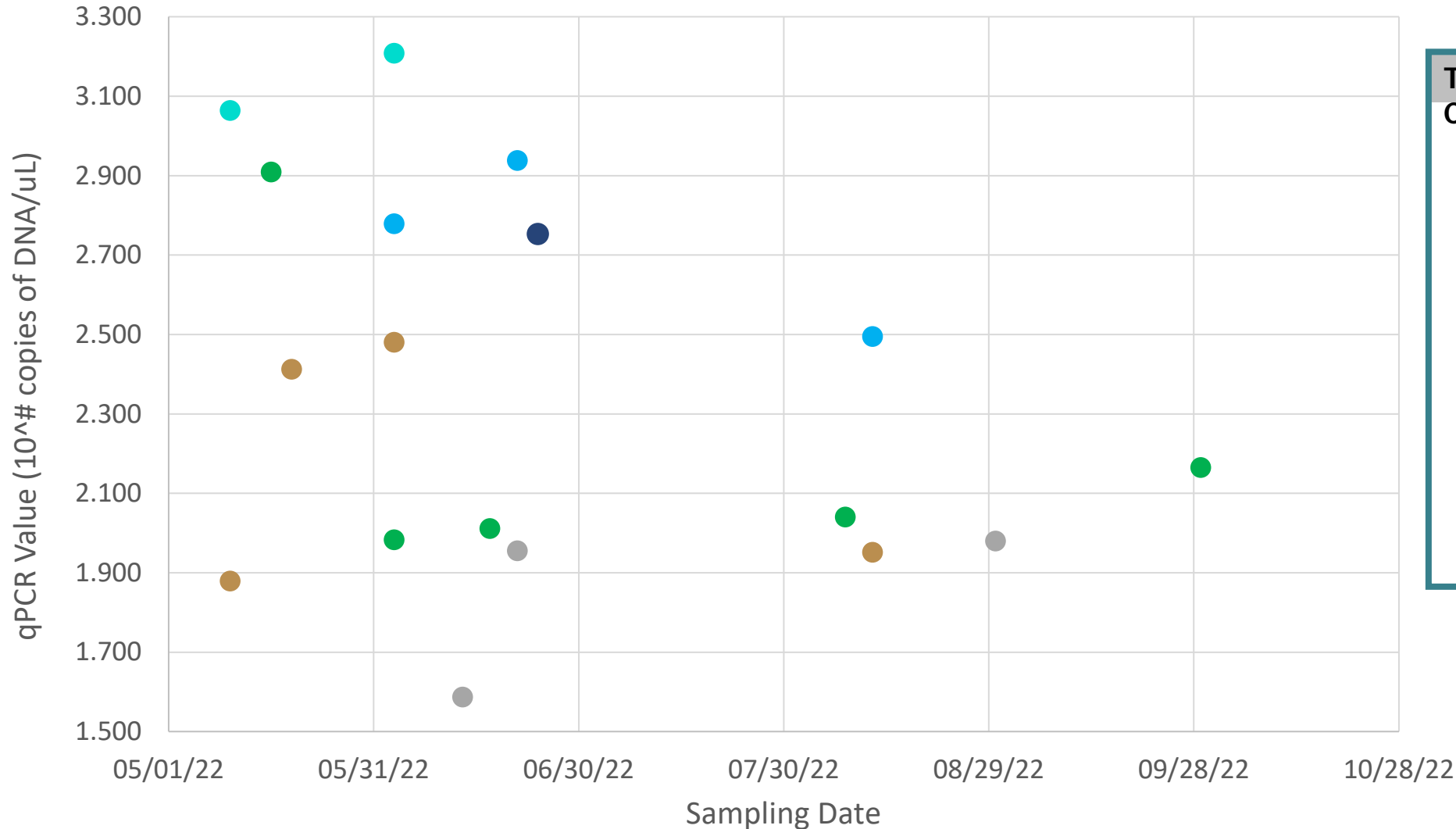
Sampling

2022	May	June	July	August	September	October
Whitefish Lake	★	Every 3 days	Every 5 days		Every 10 days	
Lake Mary Ronan		★	Every 3 days	Every 5 days		Every 10 days

- Process:
 - Van Dorn to collect 3-5 samples across section of shoreline
 - Composted into a 3L carboy
 - Decanted 50mL samples from carboy
- Shipped to Cornell to be analyzed by qPCR

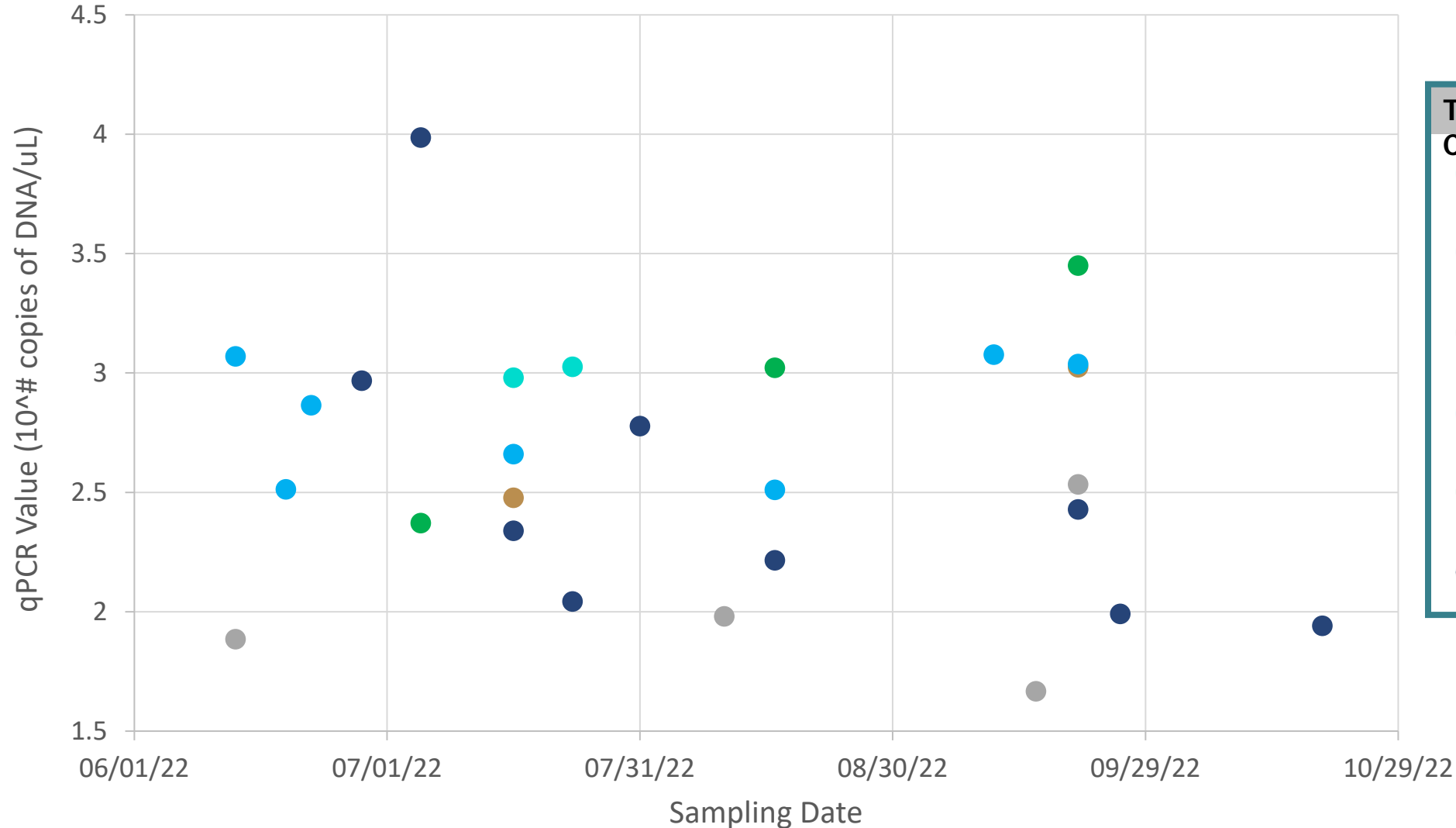


Results – Whitefish Lake



Tracer ID	Existing Risk
T107	High/Moderate
T103	High/Moderate
T104	Very High
TD2	Very High/High
PQT	Very High/High
T6M	Very High

Results – Lake Mary Ronan



Tracer ID Category	Physical Risk
T107	Moderate
T103	High/Moderate
T104	Moderate
TD2	High
PQT	Moderate/Low
T6M	Moderate

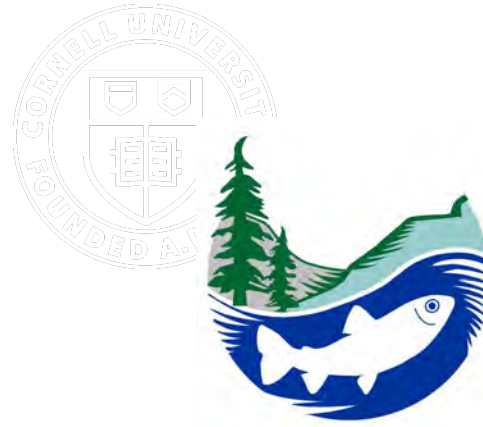
Conclusions

- Synthetic DNA technology appears to work in our ecoregion and in lake environments
- A site-specific analysis would improve understanding of the factors that most influenced a septic system's performance in the study



Acknowledgements

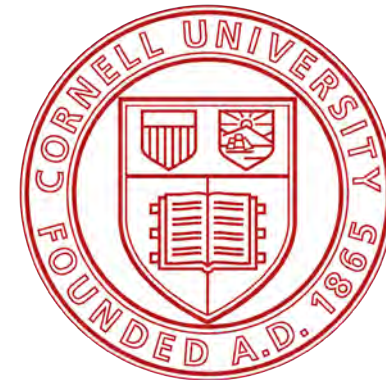
- Ryan Richardson, PG
- Kate Wilson
- Mike Koopal
- Cynthia Ingelfinger
- M. Todd Walter, PhD
- Alban (Zeyu) Li
- Meagan Gilmore
- The incredible Friends of Lake Mary Ronan volunteers
- Participating homeowners
- Members of the FBC Onsite Wastewater Treatment Committee
- All our great partners!



Whitefish Lake
INSTITUTE



RDG
RIVER DESIGN GROUP



Questions?

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MONTANA WATERS



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