MICHIGAN SEPTIC SUMMIT | 11.06.19

Protecting Fresh Water from Septic System Pollution

FLOW
FOR LOVE OF WATER

Liz Kirkwood, Executive Director, FLOW
Dr. Joe VanderMeulen, Publisher, Nature Change
#misepticsummit

Thank you to all of our Michigan Septic Summit sponsors!

Thanks to Our Community Partners:

- Au Sable Institute
- Clean Water Action
- Leelanau Clean Water
- Michigan Resource Stewards
- Tip of the Mitt Watershed Council
- The Watershed Center Grand Traverse Bay

FLOW's Sixth Great Lake: Michigan's Groundwater Crisis

FLOW

FLOW

Purpose of the Septic Summit

- To learn about recent and emerging research on the human health and environmental risks posed by old and failing septic systems.
- To characterize local and regional programs and regulations.
- To foster continued dialogue toward more effective about how to reduce risks posed by old and failing septic systems in Michigan.

MICHIGAN SEPTIC SUMMIT | 11.06.19

Desired Outcomes

- Greater recognition and understanding of the risks posed by old and failing septic systems.
- Better understanding of local, regional and state options for controlling the risks posed by septic systems.
- Momentum and a discussion on how to work together for adopting pollution control measures across Michigan.

10:10 – 10:30 a.m.

FLOW

Basics: Construction & Maintenance of Septic Systems (Old & New)

Scott Kendzierski, Dir. Env. Health Services, Health Dept. of Northwest MI

Scott Kendzierski, REHS, MS
Director of environmental Health Services
Health Department of Northwest Michigan

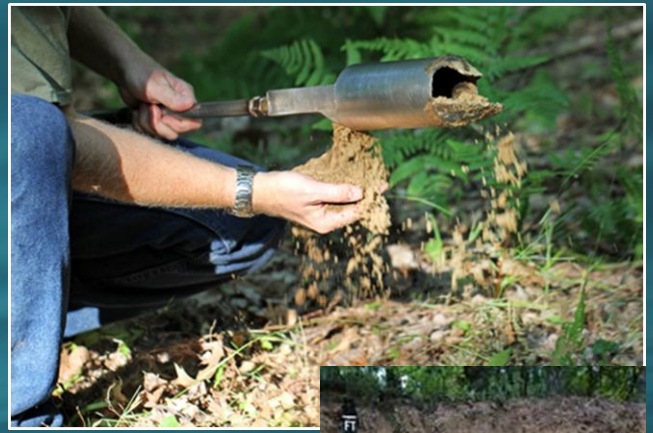
Construction and Maintenance of Septic Systems

Wastewater (Septic) Systems

- Designed to treat domestic sewage and discharge effluent to the environment through a sewage treatment and disposal system (STDS)
- Treatment occurs through a combination of physical, biological and chemical processes
- Objective: separate solids, liquids and fats, oils and greases and remove harmful fecal contamination (ie. bacteria, pathogens and limiting nutrients).
- Decentralized systems are necessary in many rural areas not provided with municipal sewer or community systems.
- Disposal vs. Treatment
- Oversight and Maintenance
- Management Programs

Wastewater Systems – Local Regulations

- Michigan has 45 Health Departments with separate sanitary codes for single and two-family uses.
- All have requirements for the oversight of wastewater systems within their counties or districts
- Important elements of wastewater programs require that:
  - A septic system is properly sited
  - The system is properly designed
  - The system is installed correctly
  - *Assure proper maintenance*
- Approval criteria include acceptable soils, separation from groundwater and isolation from surface water, drinking water wells etc.
- Design includes proper sizing for soil and groundwater properties and proposed use (ie. number of bedrooms, seating capacity, etc.)
- Installation requires a final inspection by LHDs to assure compliance with permitted design parameters



Other Wastewater Regulations Administered by LPH:

- Michigan Criteria for Subsurface Disposal (1994)
- The Condominium Act and Administrative Rules, Land Division Act and Septage Regulations

Basic Septic System Components

Septic Tank: The septic tank is a buried, water-tight container usually made of concrete, fiberglass, or polyethylene. Its job is to hold the wastewater long enough to allow solids to settle down to the bottom forming sludge, while the oil and grease floats to the top as scum.

Compartments and a T-shaped outlet prevent the sludge and scum from leaving the tank and traveling into the drainfield area.

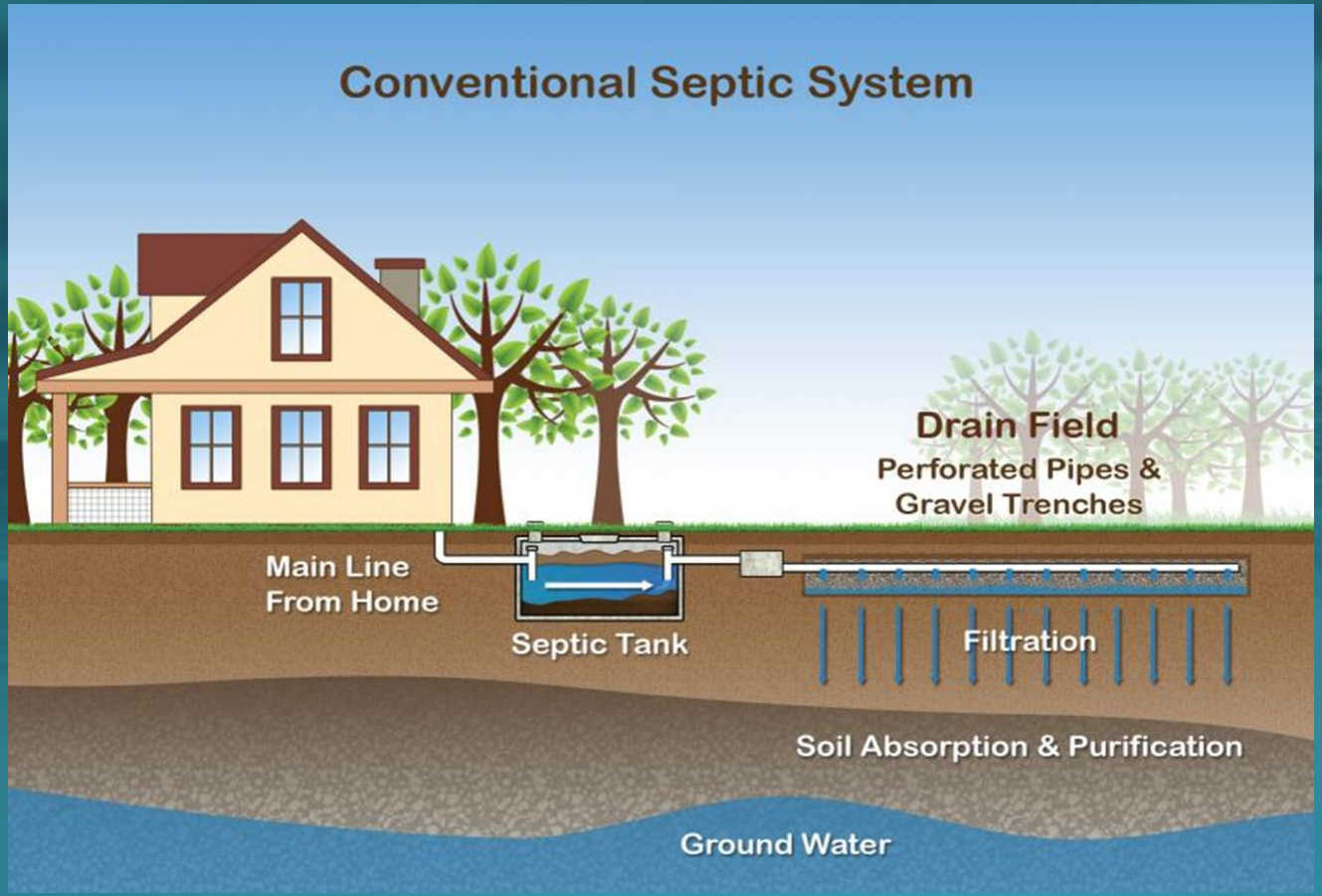
The liquid wastewater (effluent) then exits the tank is then conveyed to the drainfield for treatment and disposal.

Soil Absorption System (ie. drainfield): The drainfield is a shallow, covered, excavation made in unsaturated soil. Pretreated wastewater is discharged through piping, or other means, onto porous surfaces that allow wastewater to filter though the soil. The soil accepts, treats, and disperses wastewater as it percolates through the soil, ultimately discharging to groundwater.

If the drainfield is overloaded with too much liquid, it can flood, causing sewage to flow to the ground surface or create backups in toilets and sinks.

Finally, the wastewater percolates into the soil, naturally removing harmful coliform bacteria, viruses and nutrients. Coliform bacteria is a group of bacteria predominantly inhabiting the intestines of humans or other warm-blooded animals. It is an indicator of human fecal contamination.

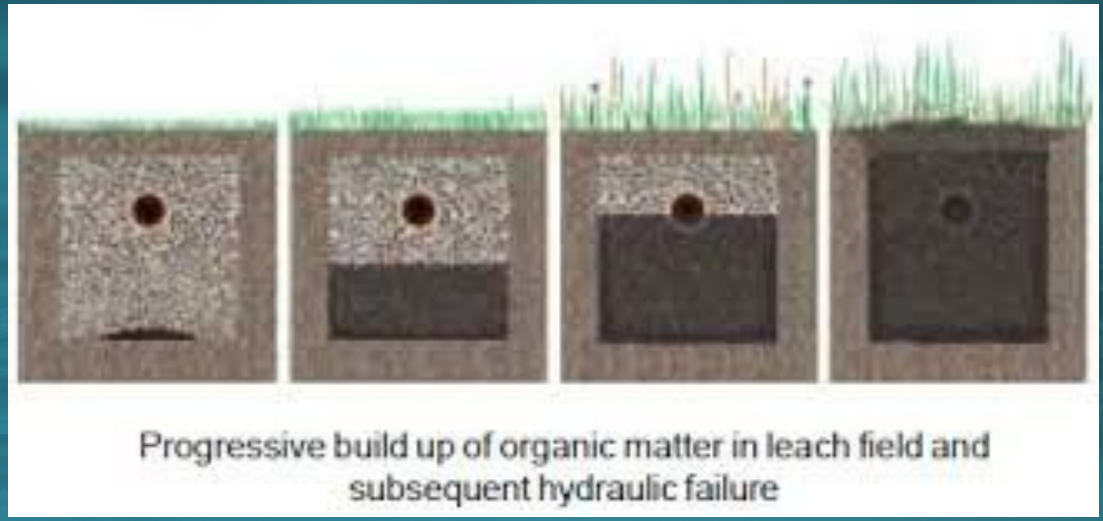
Typical Wastewater System Design



Uniform Distribution and Biomat Development

Biomat Development and Benefits

- Consist of Anaerobic bacteria that accumulate at the soil interfase below the drainfield
- When wastewater from your tank washes through the biomat, the anaerobic bacteria consume some of the excess nutrients and disease-causing organisms
- A healthy biomat will promote uniform distribution of effluent across the entire drainfield area

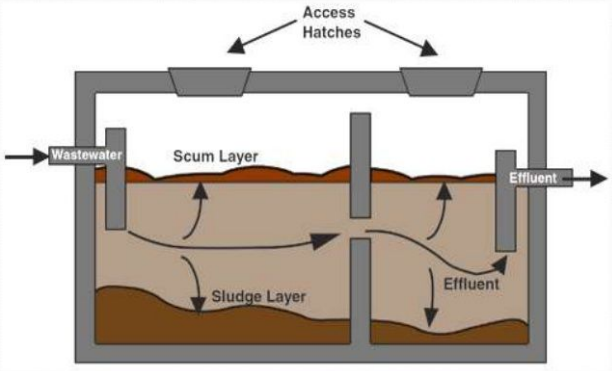


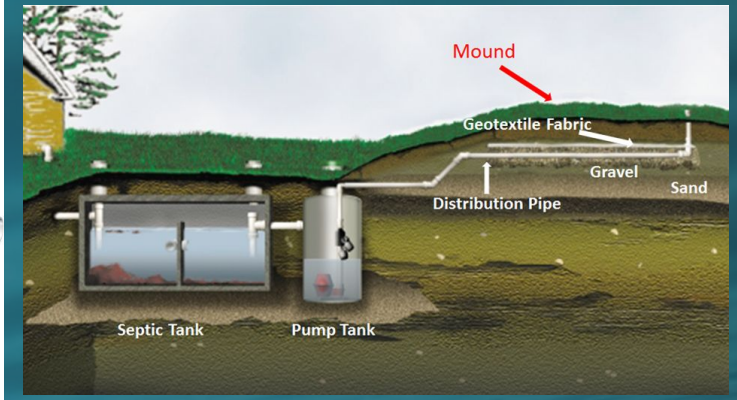
Progressive build up of organic matter in leach field and subsequent hydraulic failure

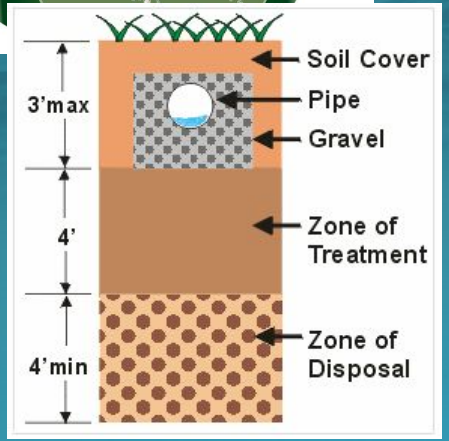
Wastewater System Designs

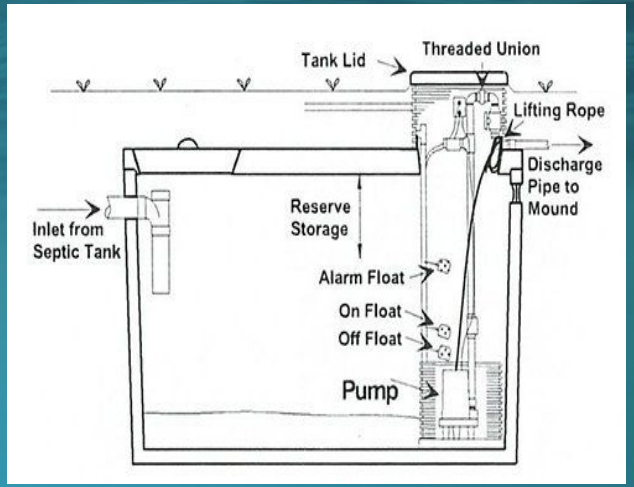
- Conventional System
  - Installed at or below the natural grade
  - Primary treatment - Septic Tank
  - Secondary treatment - Soil Absorption System.
- Mound Systems
  - Installed on fill material above natural grade
  - Primary treatment – Septic Tank
  - Secondary Treatment – Low Pressure Distribution System
- Advanced Treatment Systems (ATS)
  - Installed on fill material above natural grade
  - Primary treatment – Septic Tank
  - Secondary Treatment – Advanced Treatment Unit
  - Tertiary Treatment – Low Pressure Distribution System
- Off-Site Systems
  - Installed on land through an easement
  - Drainfield can be any of the above

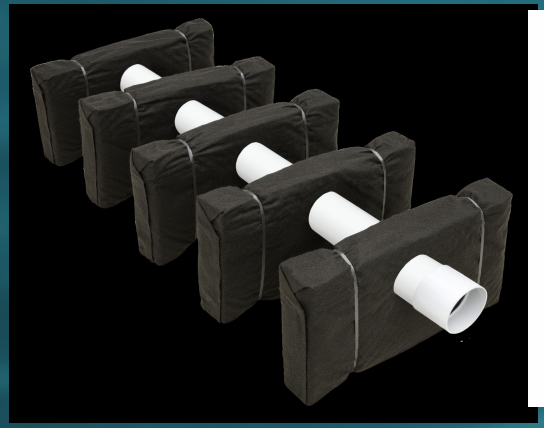
View Cross Section of Tank

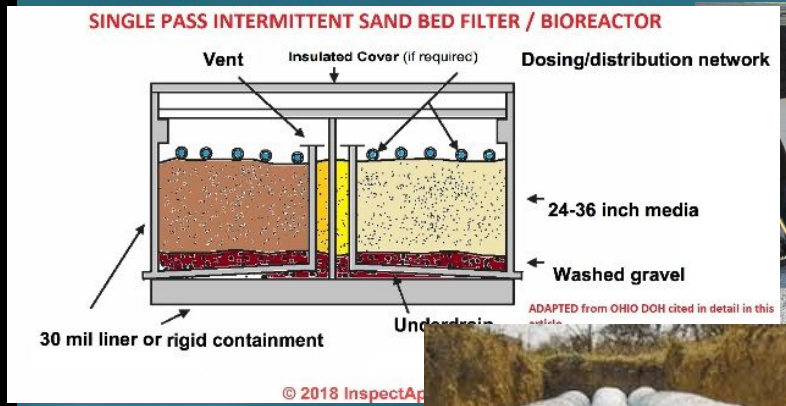


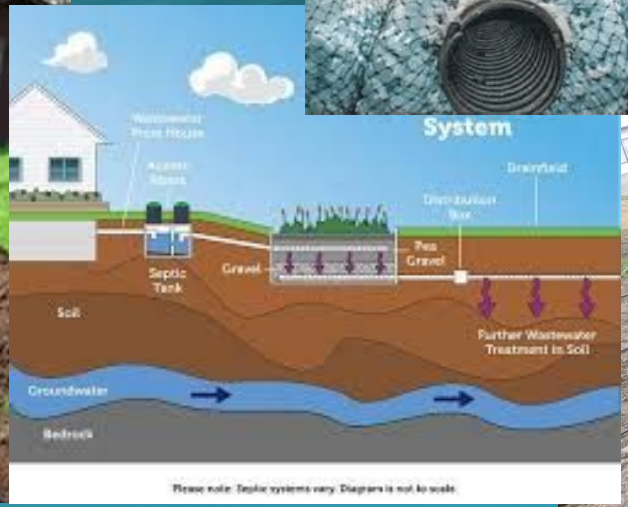









SINGLE PASS INTERMITTENT SAND BED FILTER / BIOREACTOR
Vent
Insulated Cover (if required)
Dosing/distribution network
24-36 inch media
Washed gravel
ADAPTED from OHIO DOH cited in detail in this
30 mil liner or rigid containment
© 2018 InspectAp


System
Septic Tank
Gravel
Soil
Further Wastewater Treatment in Soil
Groundwater
Bedrock

Wastewater Treatment

Bacteriological Indicators	Septic Tank Effluent (mg/l)	After 24" of soil
Total Coliform (TC)	10^6 - 10^8	ND
Fecal Coliform (FC)	10^8 - 10^{10}	ND

Analyte	Septic Tank Effluent (mg/l)	ATS Treatment Average	Percent Reduction
Biological Oxygen Demand (BOD)	155 – 286	6.25	96 - 98%
Total Suspended Solids (TSS)	155 – 300	9.75	93.7 - 97%
Total Inorganic Nitrogen (TIN)	26 - 75	12.14	53.3 – 83.8%

Oversight and Maintenance of Wastewater Systems

Self Initiated: Most commonly pumping septic tanks

- response to a problem
- some will maintain routinely
- some will never maintain

Enforcement: LHDs required to investigate complaints

- LHD staff observations
- complaints from the public
- referrals by other regulatory agencies

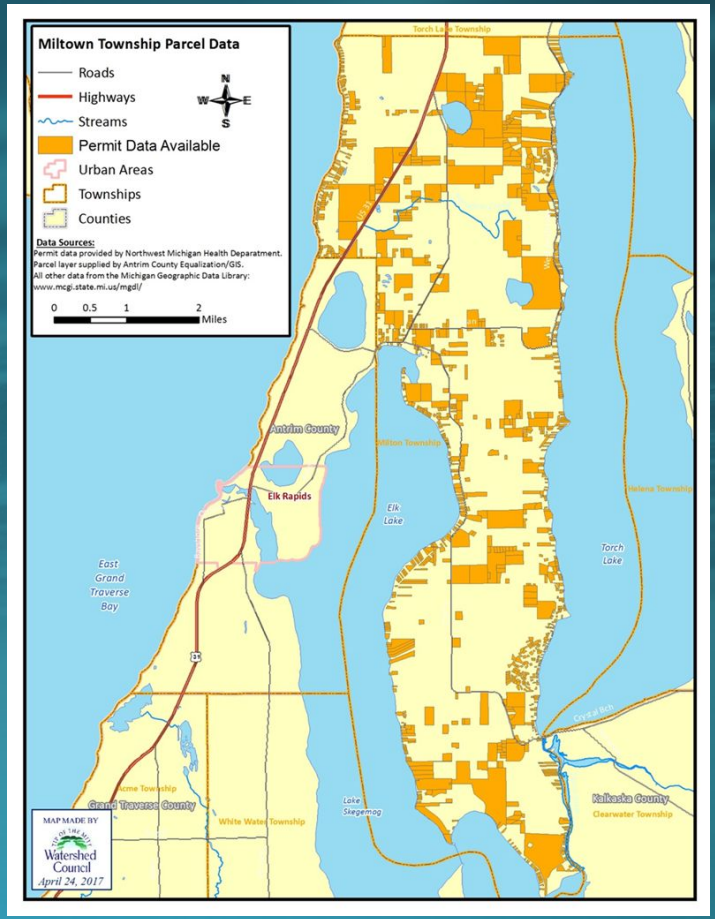
Mandatory Maintenance Programs: Requirement for routine maintenance through-

- contracts
- agreements
- operation permits etc.

Wastewater Management Programs

Management Programs and Emerging Issues

- Time of Transfer / Point of Sale
- Mandatory Pumping
- Mandatory Inspection
- Management Districts
- Operation Permits
- Seasonal Rentals
- Statewide Code



Thank You!

10:30 – 11:15 a.m.

FLOW

Risks to Human Health & the Environment

Dr. Mark Borchardt, Microbiologist/Researcher
USDA Agriculture Research Service, Marshfield, WI

When It Hits the Fan: Private Onsite Wastewater System Risks to Groundwater and Health

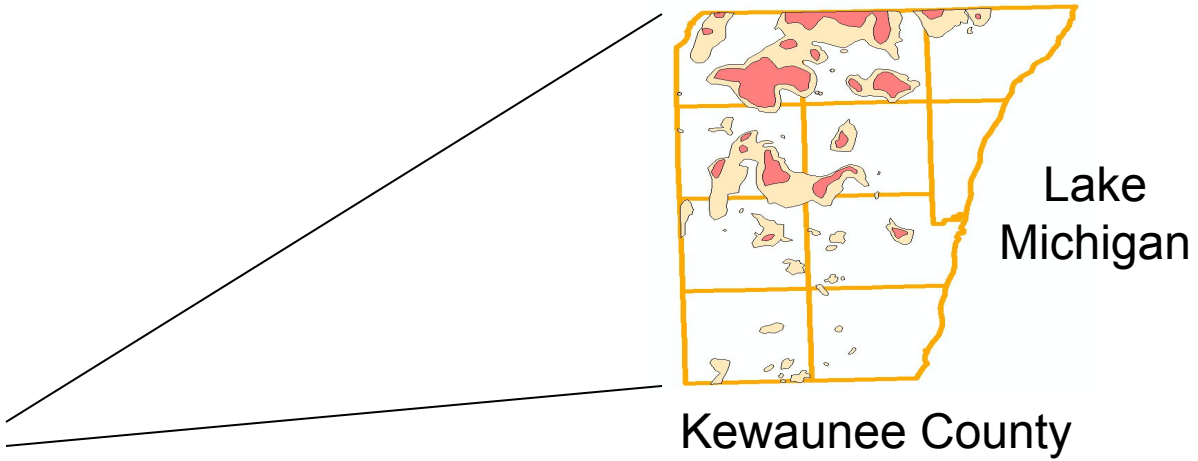
Mark Borchardt, Ph.D.

Laboratory for Infectious Disease and the Environment
USDA-Agricultural Research Service
USGS Upper Midwest Water Science Center

Key Point #1

The density of septic system drainfields is related to private well contamination in northeastern Wisconsin

Study Location – Kewaunee County, Wisconsin

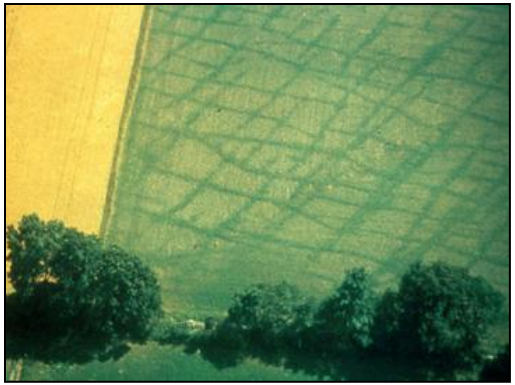


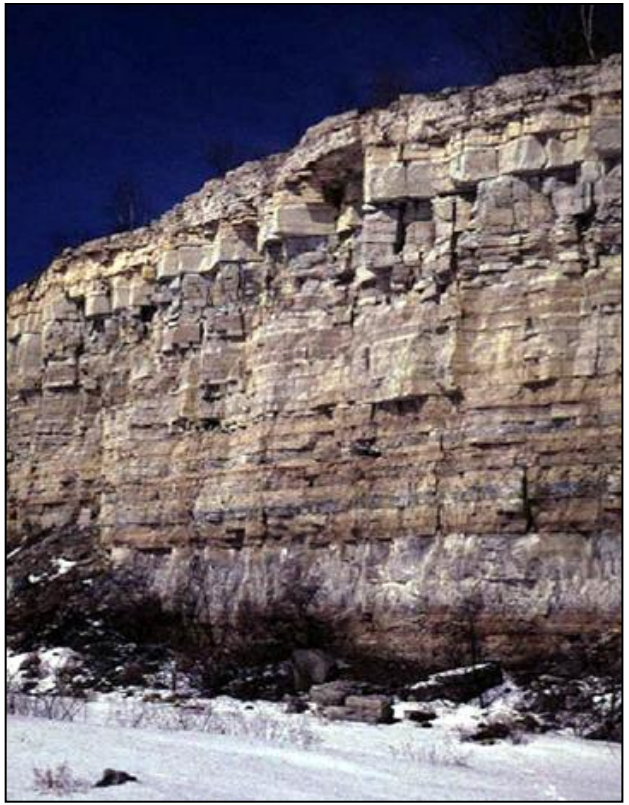
Brown Water Events in Northeast Wisconsin

- Groundwater recharge, especially spring snow melt, can generate brown water events
- Several outbreaks associated with these events e.g., EHEC, *Campylobacter jejuni*
- This well is code compliant, 123 ft deep, cased to 63 ft

Photos courtesy of Chuck Wagner

Silurian Dolomite Aquifer





Photos courtesy of Ken Bradbury and Maureen Muldoon

Silurian Dolomite Aquifer Characteristics

- Dense and ubiquitous fracture network
  - little surface runoff
  - water easily infiltrates to subsurface
- Recharge
  - exceedingly rapid
  - carries surface contaminants to the water table
- Flow within the aquifer occurs primarily along bedding plane fractures
  - Little to no attenuation of contaminants within the aquifer
- Flow rates vary from 10's to 100's of ft/day

Kewaunee County Cattle

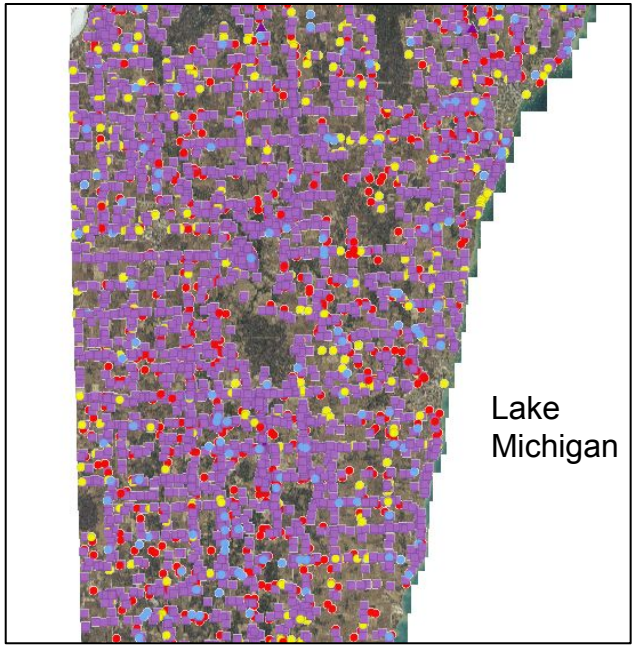
- All cattle & calves in 2016 = 97,000
- Milk cows in 2013 = 45,500
- Milk cow herds in 2016 = 167
- Concentrated Animal Feeding Operations (CAFOs) 15 dairy, one beef
- Approximately 700 million gallons cattle manure per year

Kewaunee County Septic Systems

- 4822 septic systems in the county
- 540 holding tanks, 155 abandoned

Personal comm. Lee Luft, Kewaunee County Supervisor, March 7, 2017

Legend
Purple = replaced or inspected
Red = not inspected
Yellow = holding tank
Blue = abandoned system



Kewaunee County septic systems

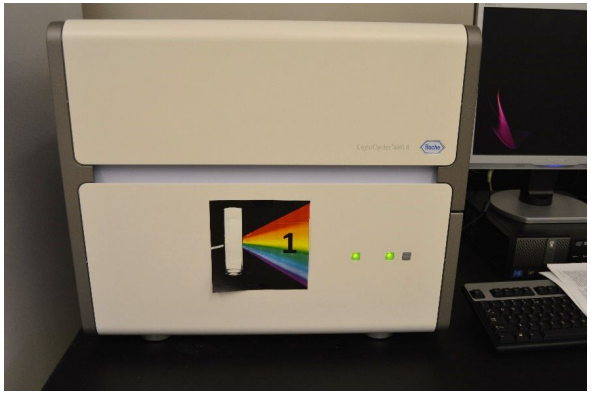
Approximately 200 million gallons septic effluent per year released to the subsurface

Research Objectives

1. ~~Estimate county-wide contamination rate for nitrate and indicator bacteria~~
2. Determine source of fecal contamination using viruses and fecal markers
3. Identify risk factors for private well contamination using statistical models

Study Sampling and Analyses

- Collected 138 samples from 131 household wells in Kewaunee County
- Pump ~800 L through hemodialysis filters
- qPCR for microbial genetic targets
  - Human-specific microbes
  - Bovine-specific microbes
  - Non-specific microbes (pathogens of both people and cattle)



Microbes: Identifying the Fecal Source

(n = 138 samples from 131 wells) (red font indicates pathogenic)

Host	Microorganism	Wells
Human-specific	Adenovirus A	1
	Bacteroidales-like Hum M2	7
	Human *Bacteroides*	27
	Cryptosporidium hominis	1
	Rotavirus A (G1 P[8])	7
	Any human microbe	**33**

Not detected: [human-specific] adenovirus B & C, D, F, enterovirus, human polyomavirus, norovirus GI & GII [bovine-specific] coronavirus, bovine diarrheal virus 1 & 2

Risk Factors Investigated

Land Use –

Agricultural

Septic Systems

All septic types

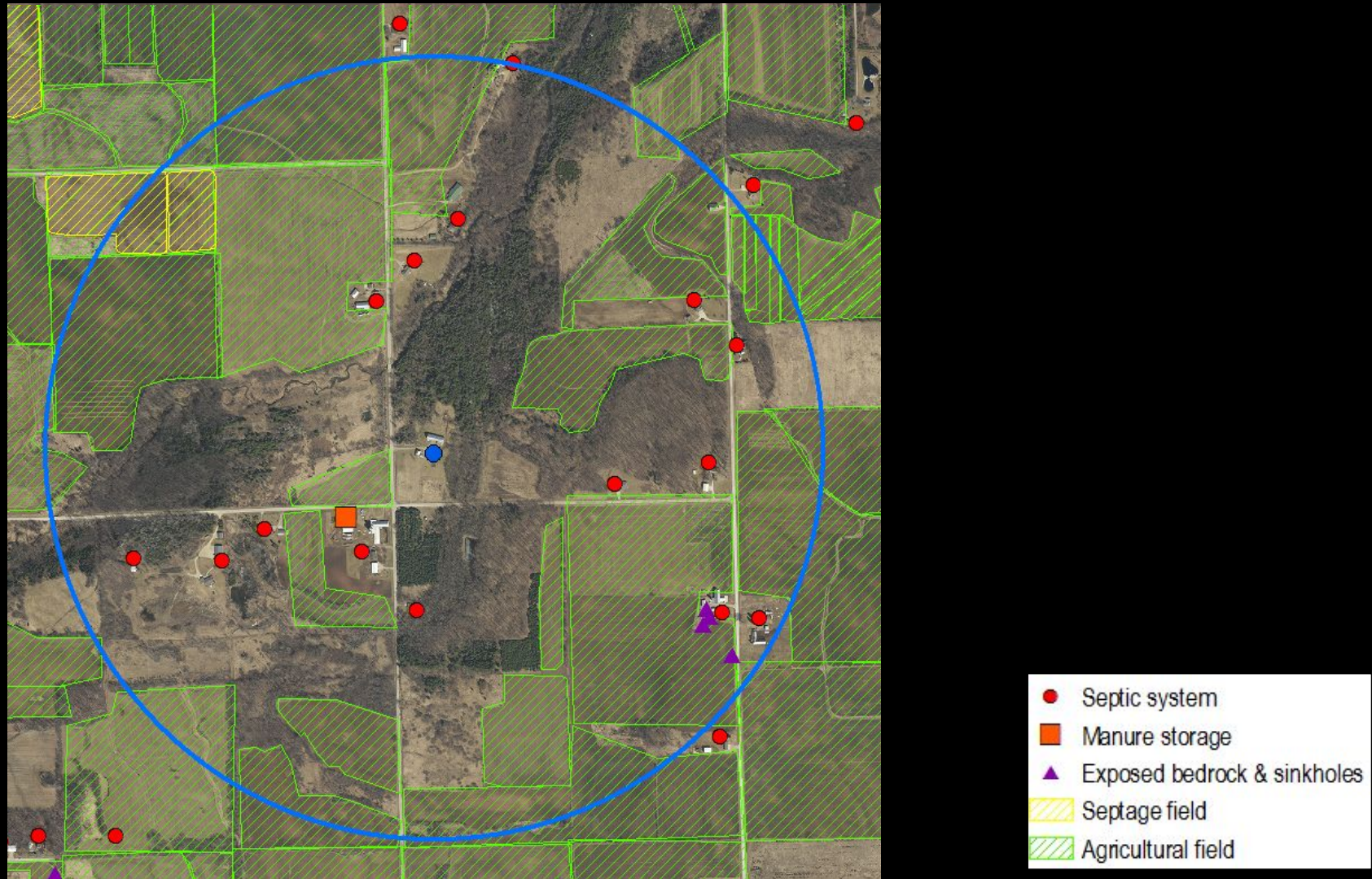
Drain fields

Bedrock Features –

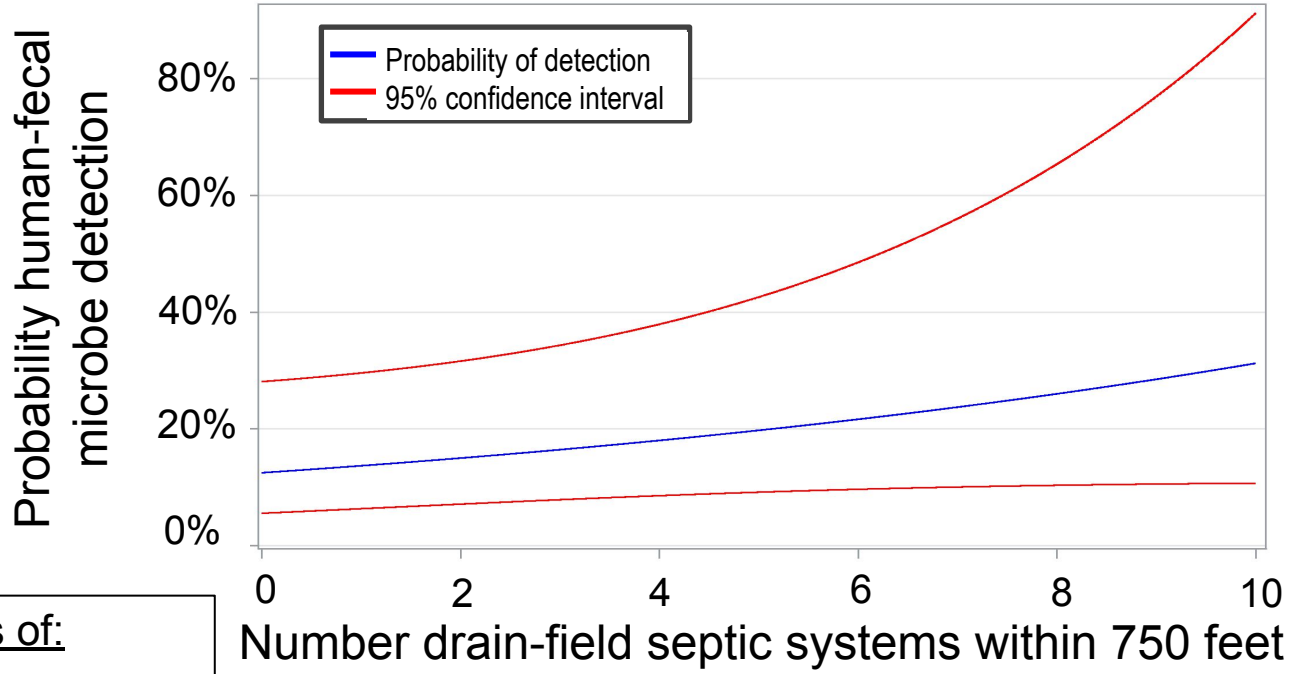
Precipitation –

Groundwater Recharge –

Depth to Bedrock


Septic system
Manure storage
Exposed bedrock & sinkholes
Septage field
Agricultural field

More septic systems around a well means greater risk for contamination by human fecal microbes



Model accounts for the effects of:

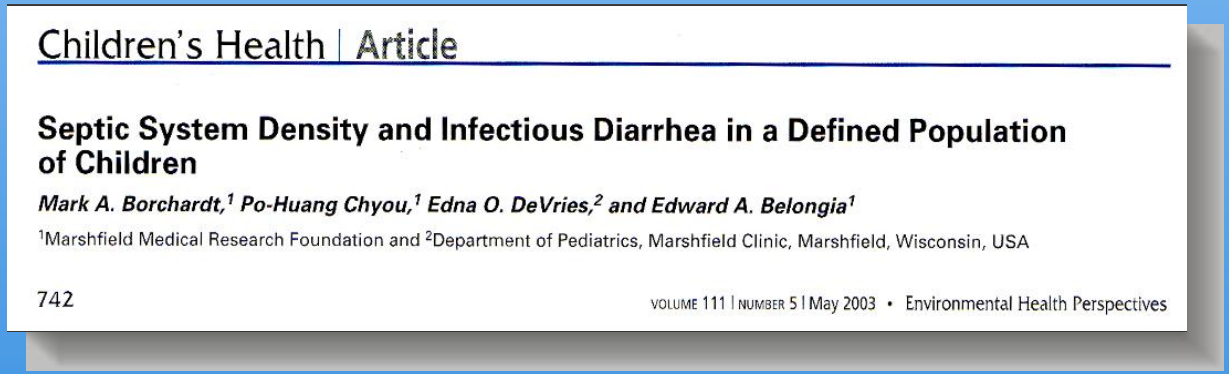
Rainfall total previous 2 days

Depth to groundwater previous 14 days

Depth to bedrock

Key Point #2

The density of septic holding tanks in central Wisconsin is related to sporadic infectious diarrhea in children



Children's Health | Article

Septic System Density and Infectious Diarrhea in a Defined Population of Children

Mark A. Borchardt,[1] Po-Huang Chyou,[1] Edna O. DeVries,[2] and Edward A. Belongia[1]

[1]Marshfield Medical Research Foundation and [2]Department of Pediatrics, Marshfield Clinic, Marshfield, Wisconsin, USA

Environmental Health Perspectives, 2003, 111:742-748

Holding Tank Capacity and Pumping Status Wood County 1991 - 1994

	1991	1992	1993	1994[1]
Holding tank capacity	3,062,170	3,342,633	3,727,991	4,144,855
Expected gallons to be pumped	30,621,700	33,426,330	37,279,910	41,448,550
Reported gallons pumped	7,283,380	10,337,916	11,685,550	11,064,340
Gallons unaccounted for	23,338,320	23,088,414	25,594,360	30,384,210

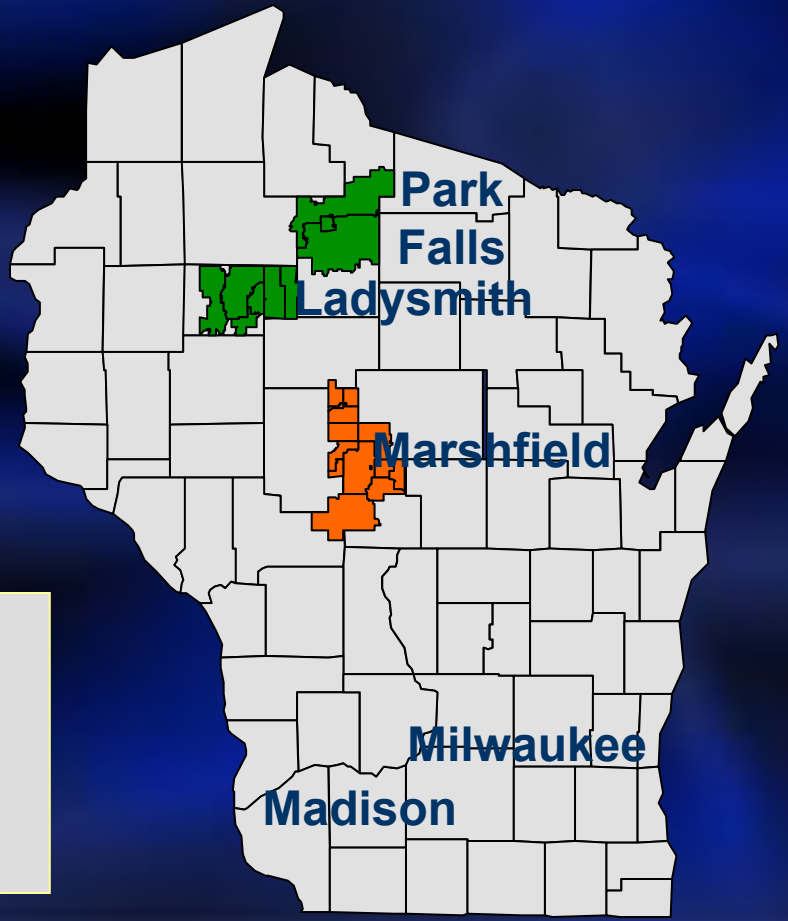
[1] Except for "gallons unaccounted for," 1994 figures are for January through June. Note: 1994 "reported gallons pumped" are projected, based on first half pumping reports.

SOURCE: Wood County Planning & Zoning Office, September, 1994

Study Design

- Case-control epidemiological study
- Cases (sick children) enrolled when seeking medical care at Marshfield Clinic, Feb 1997 to Sept 1998
- Controls (healthy children) randomly selected from MESA, frequency matched (2:1) by age and gender
- Structured telephone interview, 68 questions on risk factors
- Stool specimens analyzed for cause of diarrhea

The Marshfield Epidemiologic Study Area (MESA)



Case Definition and Exclusions

A case was defined as a child 1 to 18 years old with acute diarrhea (≥ 3 loose stools/day).

Exclusion criteria:

- Chronic diarrhea
- Immunosuppression
- Antibiotic use within 48 hours before diarrhea

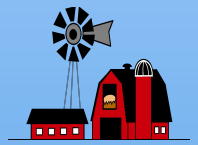
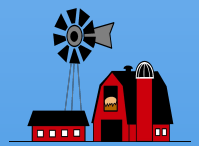
Behavioral, dietary, and lifestyle risk factors investigated

- Person to person transmission
- Travel
- Dietary history
- Pets
- Farm activities
- Recreational water activities
- Drinking water source

Septic System Data Abstraction

- Location of rural cases and controls determined by county parcel identifier
- Section neighbors determined by county property tax records
- Parcels with septic systems identified by improved value >$10,000
- Septic system type and age from county sanitary permits
- Excluded closed and replaced septic systems
- Cases and controls with municipal sewer assigned septic system density = 0
- Septic system densities determined by section, 1/4 section, 1/4 1/4 section

Characterization of Case and Control Subjects

					Mean Age
Cases 153	86 56%	67 44%	66 43%	87 57%	4.4
					
Controls 274	153 56%	121 44%	115 42%	159 58%	5.4

Number of Septic Systems per Section (640 acres) Where Cases and Controls Resided

Type	Mean	Range
All septic systems	14	1 - 56
Holding tanks	6	0 - 50
Drainfields	8	1 - 25
Drainfields less than 20 years old	1	0 - 5
Drainfields more than 20 years old	7	0 - 25

Septic System Type and Density Related to Diarrhea Etiology (★Significant)

Septic Type	Area (acres)	Cause of Diarrhea			
		Viral	Bacterial	Protozoan	Unknown
All septic systems	640	★	-	-	-
	160	★	★	-	-
	40	★	★	-	★
Holding tanks	640	★	-	-	-
	160	★	-	-	-
	40	★	★	-	-
Drainfields	640	-	-	-	-
	160	★	★	-	-
	40	★	-	-	★

Independent Risk Factors For Viral Diarrhea (n=18)

Risk Factor	Adjusted Odds Ratio	95% CI	P-value
Holding tanks/sec	1.08	1.02 - 1.15	0.008
Age	0.66	0.47 - 0.92	0.015
Household member with diarrhea previous 4 weeks	5.04	1.70 - 14.95	0.004

Independent Risk Factors For Bacterial Diarrhea (n=20)

Risk Factor	Adjusted Odds Ratio	95% CI	P-value
Holding tanks / 1/4 1/4 section	1.22	1.02 – 1.46	0.026
Child inside calf hutch or pen	12.74	4.67 – 34.72	<0.001

Fraction of Diarrhea Attributable to Holding Tanks

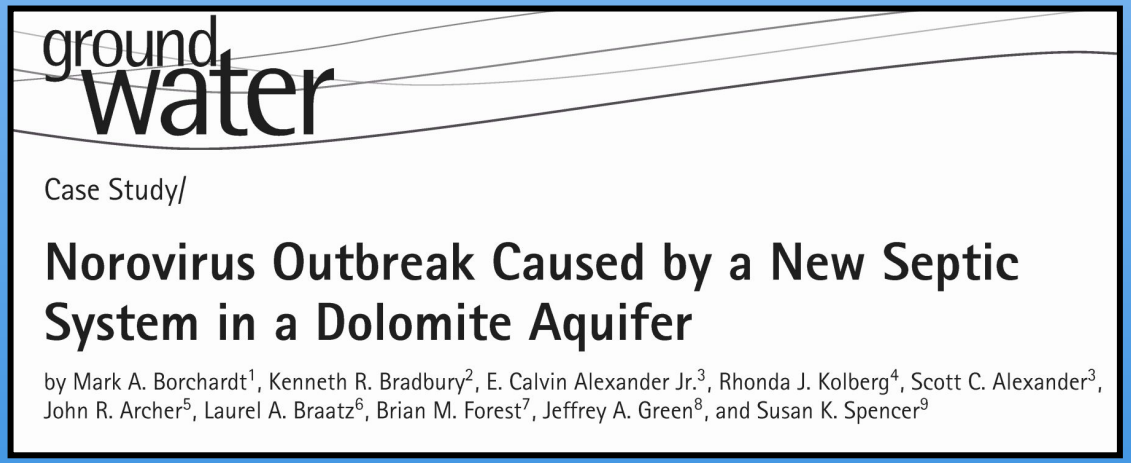
Etiology	Risk Factor	Percent Cases Exposed	Attributable Fraction	95% Confidence Interval
Viral	Number of holding tanks in same 640 acre section	28%	20%	2% - 42%
Bacterial	Number of holding tanks in same 40 acre / 1/4 1/4 section	35%	19%	0% - 39%

Association between holding tank density and infectious diarrhea: Is it plausible?

- Holding tanks constitute 1/3 of all septic systems in study area
- 40% of holding tanks have some illegal discharge to surface
- In Wood County, year 2000, 40 millions gallons of holding tank wastes were unaccountable
- 19% of conventional drain fields were constructed before 1970 and are assumed failing
- Pathogenic bacteria and viruses can be transported long distances and survive for months in the environment

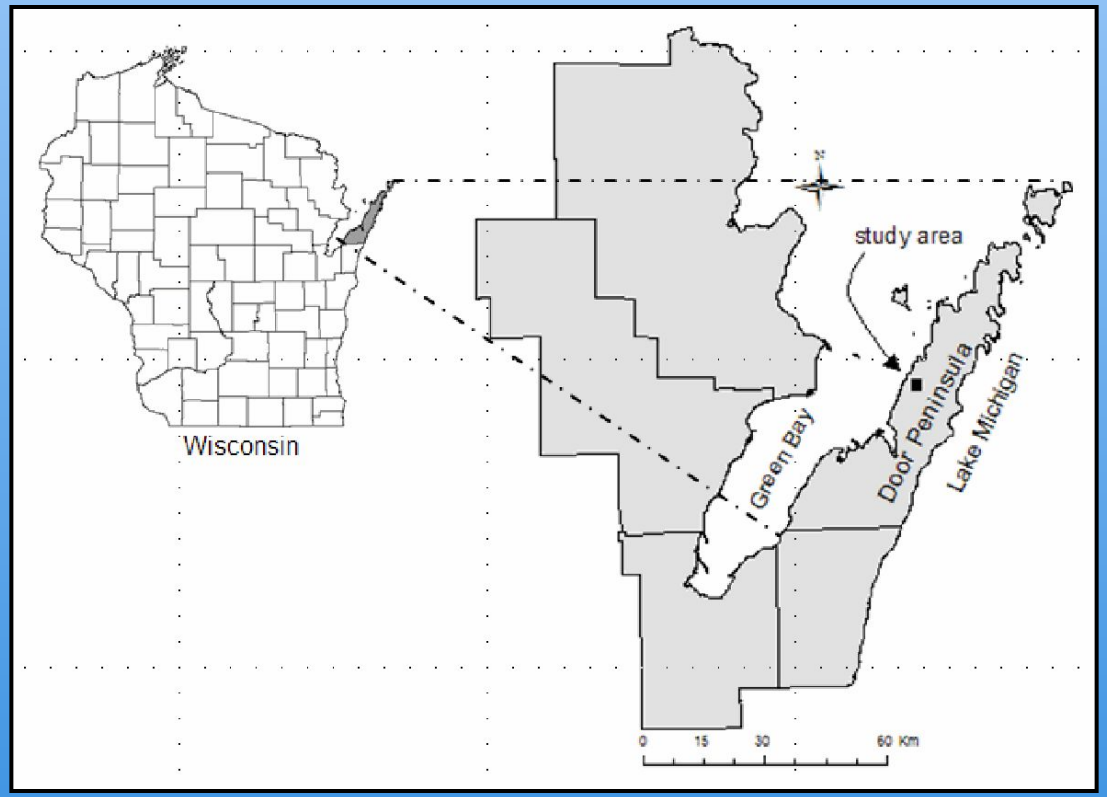
Key Point #3

Septic systems located in vulnerable hydrogeological settings can result in disease outbreaks



Ground Water, 2011, 49:85-97

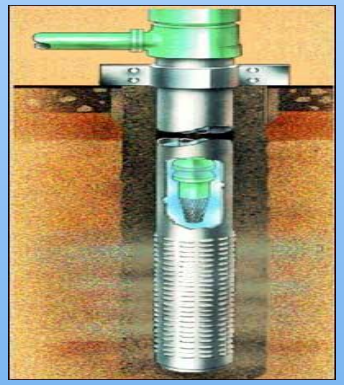
Study Site


Wisconsin
study area
Green Bay
Door Peninsula
Lake Michigan
0
15
30
60 Km

Outbreak Background

- In early June, 2007, 229 patrons and employees of a new restaurant in Door County were affected by severe acute gastrointestinal illness, 6 people hospitalized
- New well and conventional drain-field septic system, both conforming to State code
- Hydrogeologic setting: shallow soil over densely fractured dolomite
- Epidemiologic case-control analysis indicated the restaurant's well water was associated with illness

Norovirus Transmission Cycle



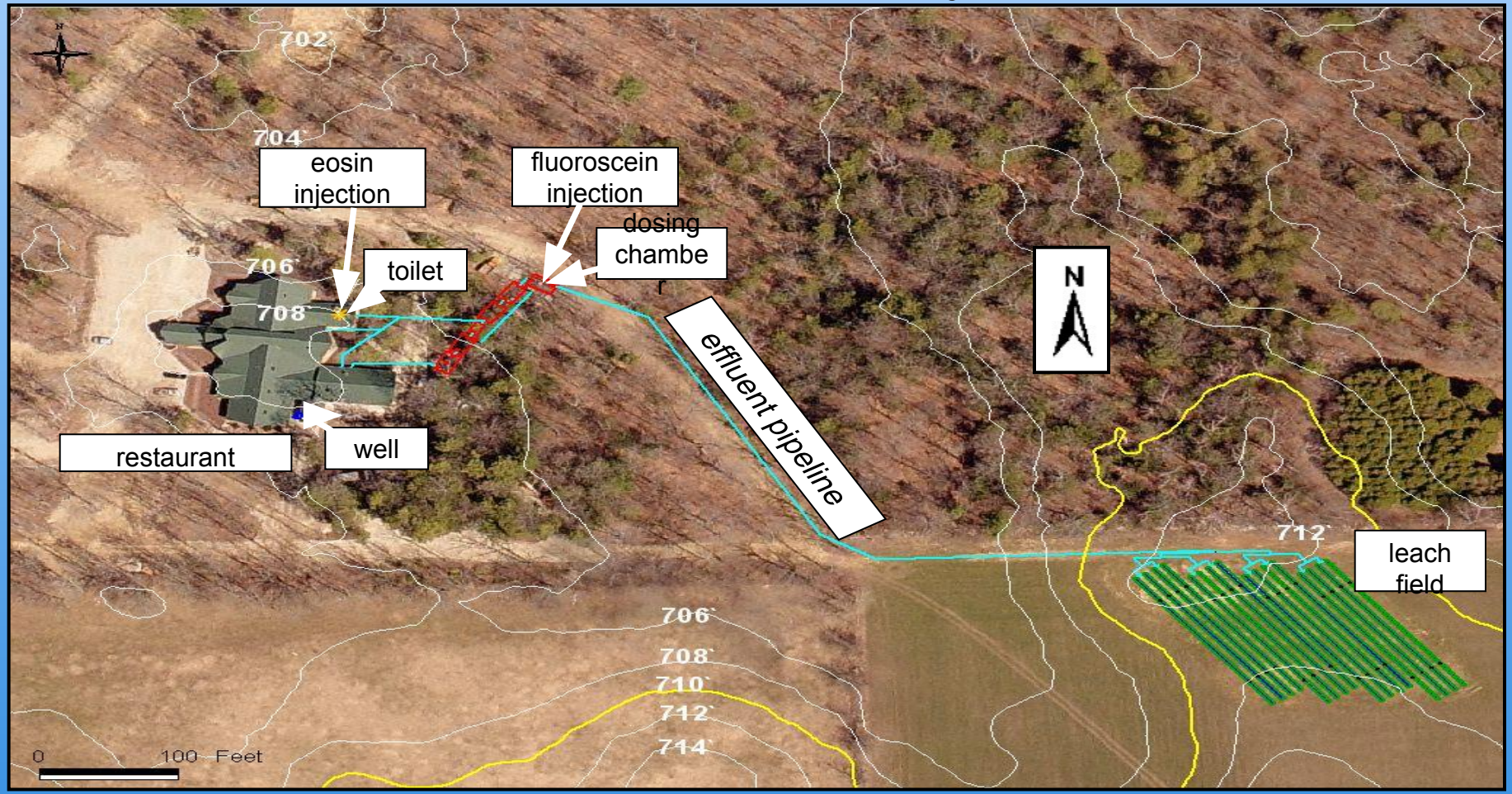
Tap water from well:
50 genomic copies/L

Norovirus isolates from 3 sources had identical 327 bp polymerase gene sequences

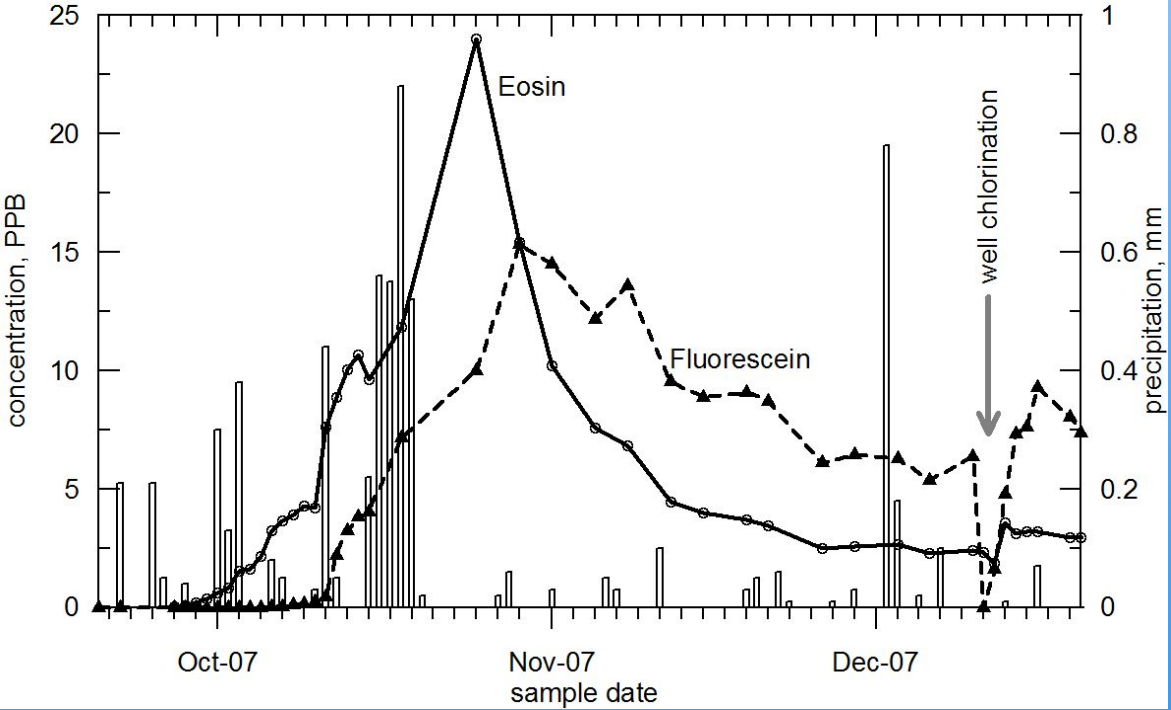
Restaurant patrons: $10^4 - 10^8$ gc /gm stool

Septic tank: 79,600 genomic copies/L

Restaurant - As Built Septic System and Well



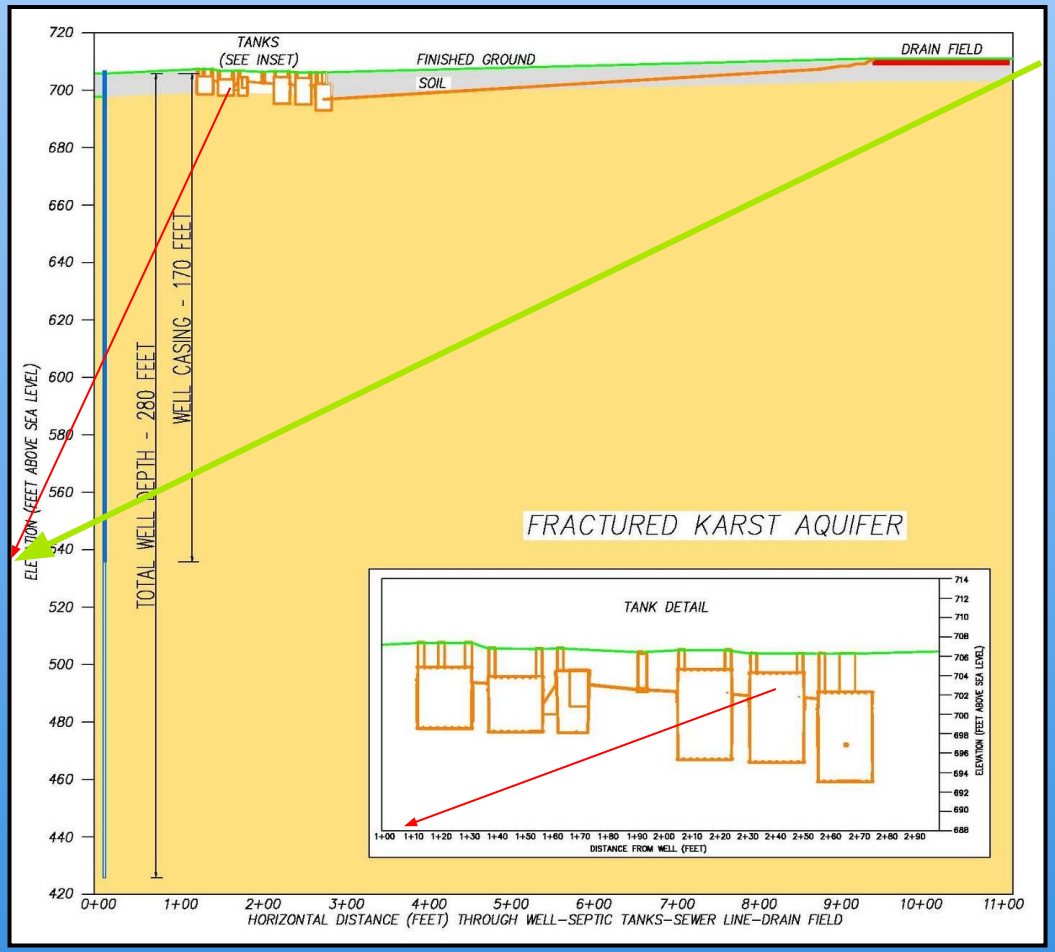
Tracer concentrations in the restaurant supply well

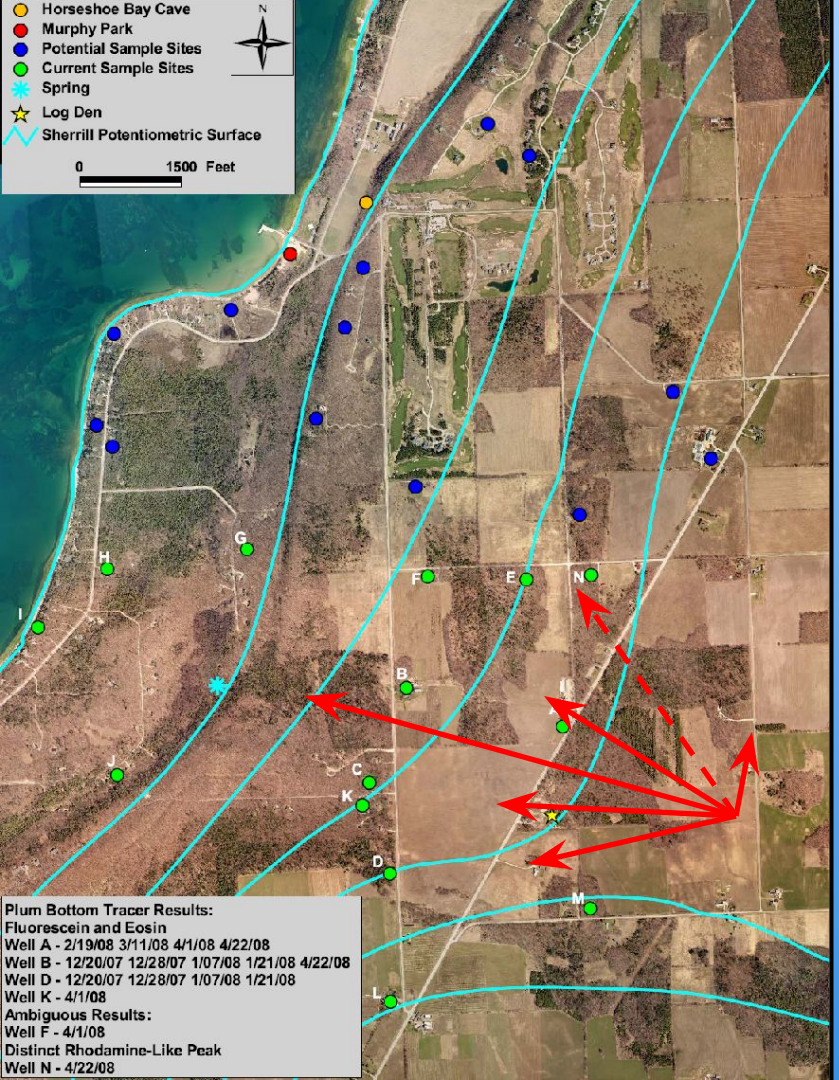


Forensic Investigation

Torn Boot Leak

Restaurant Cross Section





Regional Scale Movement of Dye from the Restaurant

Tracer velocities to offsite wells B and D are in the range of 7 to 8 m/d.

The Research Team

Maureen Muldoon, Ph.D. UW-Oshkosh Department of Geology

Sue Spencer USDA-Agricultural Research Service

Randall Hunt, Ph.D., Joel Stokdyk, Aaron Firnstahl & Dave Owens USGS Upper Midwest Water Science Center

Davina Bonness Kewaunee County Land and Water Conservation

Burney Kieke Marshfield Clinic Research Foundation

USDA United States Department of Agriculture

L·I·D·E LABORATORY FOR INFECTIOUS DISEASE AND THE ENVIRONMENT

USGS science for a changing world


Thank you!
© Mason Reid

11:25 – 11:45 a.m.

FLOW

Responding to Old & Failing Septic Systems in Mid-Michigan

Jon Beard, Senior Consultant,
Public Sector Consultants

Failing Septic Systems in Mid-Michigan: An Unseen Threat to Public Health

Jon Beard

November 6, 2019

About Public Sector Consultants

PUBLIC SECTOR CONSULTANTS

Background

- Failing septic systems are identified as a source of pollution throughout Michigan
- Information is often unavailable about the extent of the problem
- PSC has been hired by clients to
  - Understand the scope of the problem in their community
  - Work with community partners to develop solutions

Septic Systems in Michigan

1.3M+

There are more than 1.3 million septic systems in Michigan

50%

Approximately 50 percent of new builds rely on septic systems

1

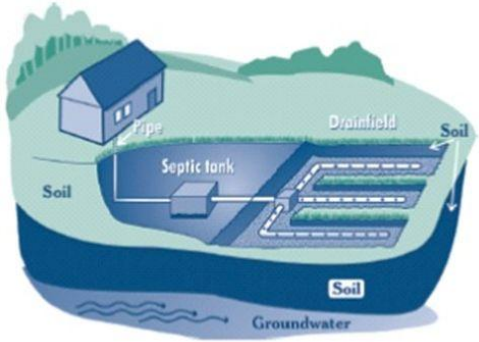
Michigan is the only state without a comprehensive statewide septic ordinance

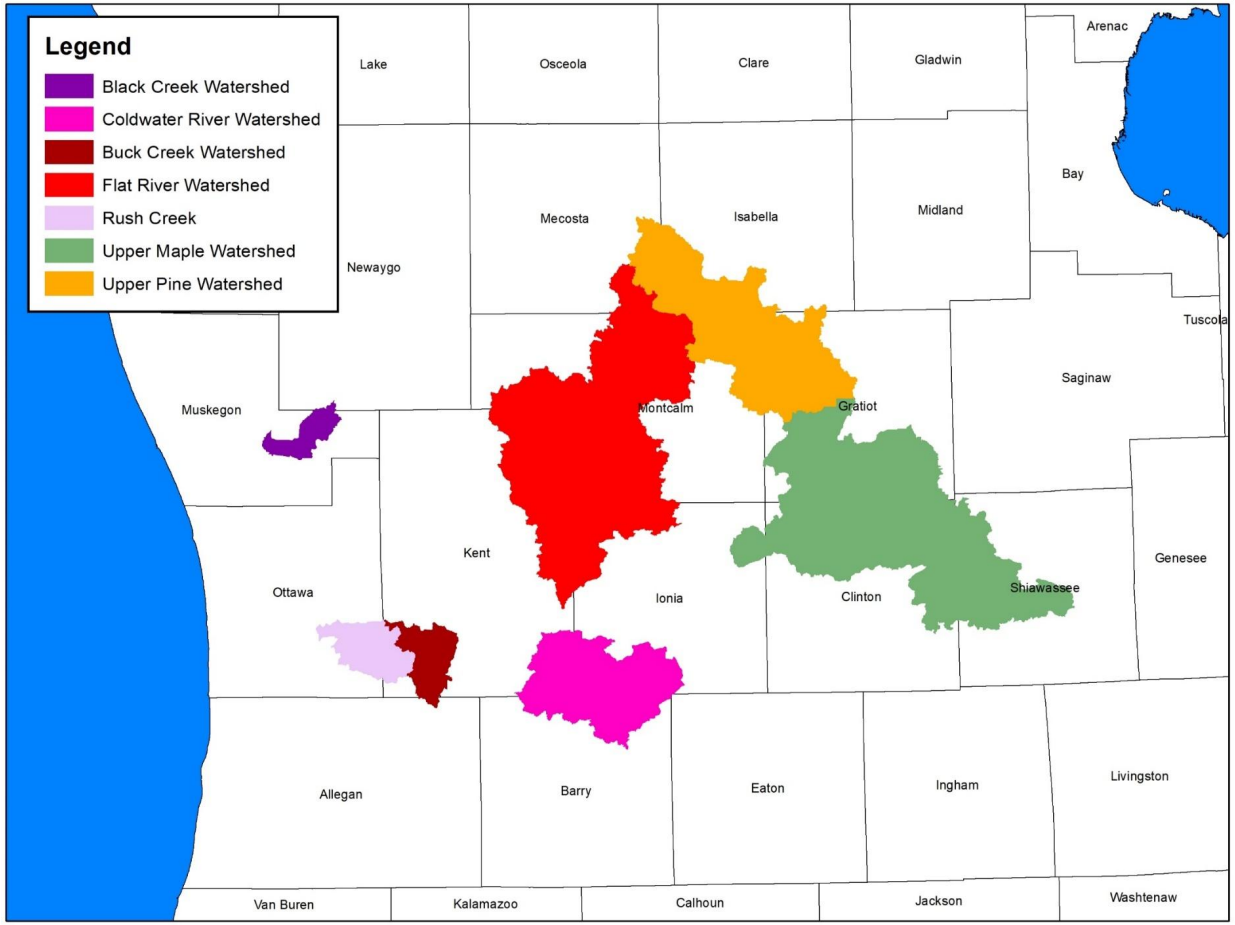
20–30 YRS

The normal lifespan of a septic system is 20–30 years

Septic Management in Mid-Michigan

- Clinton, Gratiot, and Montcalm Conservation Districts leading watershed management
- Suspected there was a problem with bacteria in the river and streams
- Thought failing septic systems were part of the problem




Legend
Black Creek Watershed
Coldwater River Watershed
Buck Creek Watershed
Flat River Watershed
Rush Creek
Upper Maple Watershed
Upper Pine Watershed
Lake
Osceola
Clare
Gladwin
Arenac
Bay
Midland
Isabella
Mecosta
Newaygo
Tuscola
Saginaw
Muskegon
Montcalm
Gratiot
Kent
Ottawa
Ionia
Clinton
Shiawassee
Genesee
Allegan
Barry
Eaton
Ingham
Livingston
Van Buren
Kalamazoo
Calhoun
Jackson
Washtenaw

What Did Partners Do in Response?

- Started a dialogue with the local health department
- Conducted rigorous scientific analysis
  - Sampling demonstrated very high E. coli levels
  - Completed source tracking to determine the causes
    - Canine tracking
    - DNA analysis
  - Confirmed that human sewage was the prominent source
- Engaged the community
  - Conducted a survey of residents
  - Convened community leaders to review the findings and discuss potential solutions

Water Quality Sampling in Mid-Michigan

Upper Maple River Watershed

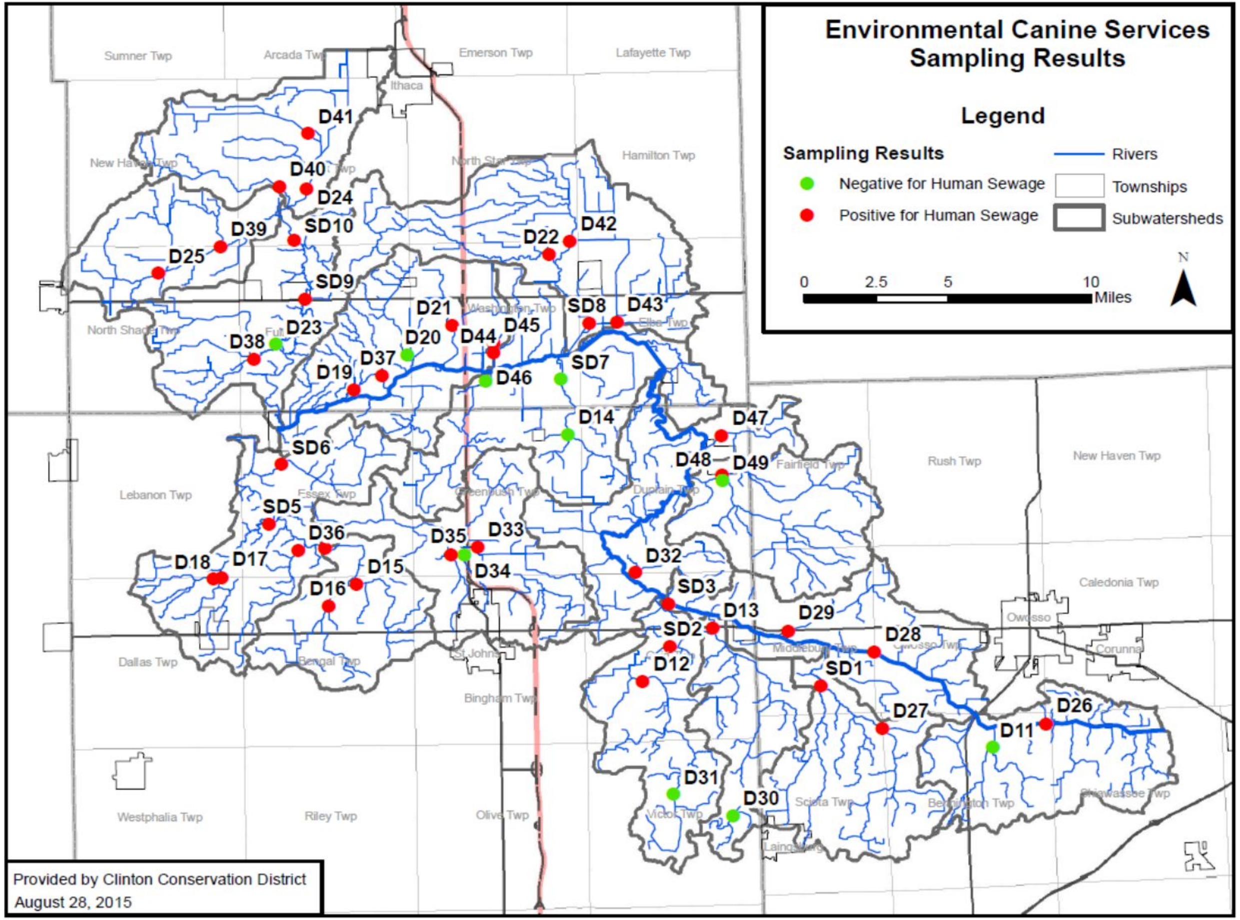
100%
of sites sampled exceeded E. *coli* standards at some point

80%
of sites identified by dogs as having human sewage

100%
of sites contained human DNA analysis

73%
of samples showed human DNA was the dominant marker

36%
of samples showed human DNA was the only marker



Environmental Canine Services
Sampling Results
Legend
Sampling Results
Negative for Human Sewage
Positive for Human Sewage
Rivers
Townships
Subwatersheds
0 2.5 5 10 Miles
N
Sumner Twp
Arcada Twp
Emerson Twp
Lafayette Twp
Ithaca
Hamilton Twp
New Haven Twp
North Shade Twp
Lebanon Twp
Essex Twp
Greenbush Twp
Duplain Twp
Fairfield Twp
Rush Twp
Caledonia Twp
Owosso
Corunna
Dallas Twp
Bengal Twp
St Johns
Bingham Twp
Middlebury Twp
Westphalia Twp
Riley Twp
Olive Twp
Victor Twp
Sciota Twp
Bennington Twp
Shiawassee Twp
D41 D40 D24 D39 SD10 D25 SD9 D22 D42 D21 SD8 D43 D45 D23 D38 D20 D44 D37 SD7 D19 D46 D14 D47 SD6 D48 D49 SD5 D36 D35 D33 D18 D17 D15 D34 D32 D16 SD3 D13 D29 SD2 D28 D12 SD1 D27 D26 D11 D31 D30
Provided by Clinton Conservation District
August 28, 2015

PSC

Survey of Residents with a Septic System

26 YRS
is the average length of residency

30%
did not know they had one

28 YRS
is the average age of a septic system

25%
do not pump or maintain system regularly

15%
are aware of the normal lifespan of a septic system

Community Advisory Group Recommendations

- Improve information management
- Increase community awareness
- Develop financial support mechanisms
- Evaluate alternative policy options

Improving Information Management

- Health department received a grant to develop a new information technology platform to manage environmental services
- Digitizing historic septic records
- Enables partners to identify system location, age, and condition
- Serves as the basis for focused outreach

Time-of-sale Ordinances:

Septic systems are inspected during a property transaction.

Pros	Cons
• Inspections occur when money is changing hands • Piggybacks on inspections that frequently occur during a transaction	• Not all homes sell frequently • Intrafamily transfers are not included • Some have concerns about delaying/complicating a sale • No mechanism to ensure continued function after the sale • Unpredictable frequency • Arguably less equitable because only some properties included

Discharge Permit:

Properties receive a permit to discharge water from their septic system. Inspections are conducted periodically.

Pros	Cons
• Public health concerns addressed more quickly and consistently • Ensures function after installation • More predictable workload • Arguably more equitable because all properties are equally affected	• Larger administrative footprint than alternatives • Some property owners resistant to government intrusion onto private property • Added costs for residents to complete inspections • Financing not readily available to assist residents in need

What Was the Result?

- Committee recommended the discharge permit approach
- Health department developed ordinance language and sought approval from the Clinton, Gratiot, and Montcalm county commissions
- Ultimately unsuccessful in updating the septic code
- Counties have agreed to fund a new staff position to support septic management activities

Lessons Learned

- A little data goes a long way
- Data-driven strategies are more effective
- Work with the community to develop solutions together
- Find financing solutions
- Robust information management can support outreach and education

How Many Septic Systems Are Failing in Kalkaska County?

10%

Nationally, the Environmental Protection Agency estimates 10 percent of systems are failing

25%+

In Michigan, communities with inspection programs find 25+ percent of systems are failing

1.1K–2.7K

Estimated failing systems in Kalkaska County

How Much Pollution Is Generated from Failing Systems in Kalkaska County?

Cover 0.77 to 1.9 acres

in a foot of sewage every day

Fill 139 to 347 Olympic

swimming pools every year

Cover 0.44 to 1.1 miles

in a foot of sewage every year

Cover the Village of Kalkaska

in 1.7 to 4.2 inches of sewage every year


PSC
PUBLIC SECTOR
CONSULTANTS
PUBLIC SECTOR CONSULTANTS
PUBLICSECTORCONSULTANTS.COM
@PSCMICHIGAN

Panel: Local Efforts to Control Risks

Eric Johnston, Benzie-Leelanau District Health Department

Seth Phillips, Manistee Lake Association & Kalkaska County Drain Commissioner

Grenetta Thomassey, Tip of the Mitt Watershed Council

Matt Allen, Onsite Service Supervisor, Ottawa County Department of Public Health

Toni Morrison, Real Estate One, Elk Rapids

12:30 – 1:45 p.m.

FLOW

LUNCH – with Two Presentations

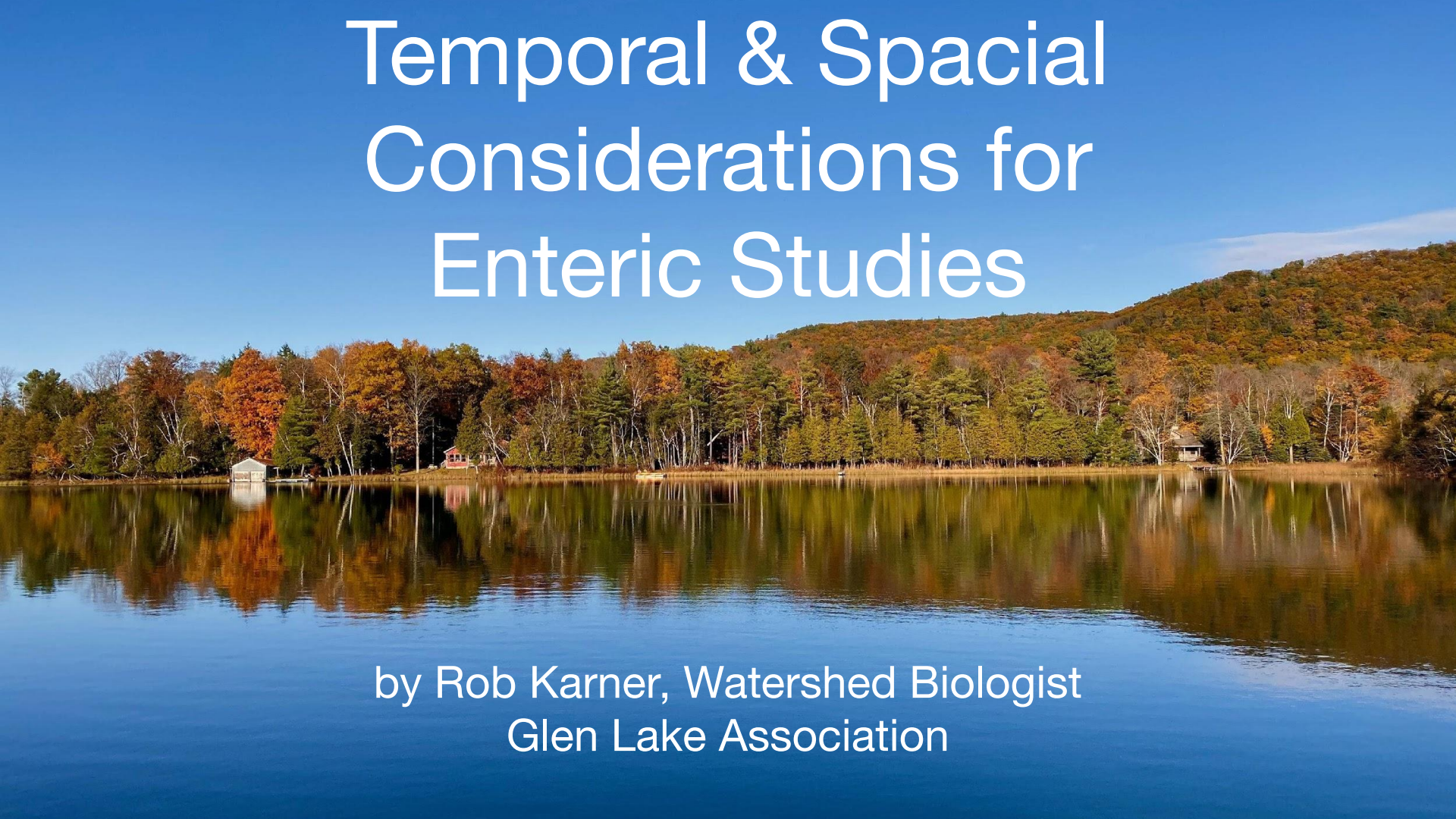
Enteric Bacteria, Source Tracking & Emerging Techniques

Rob Karner, Watershed Biologist, Glen Lakes Association

Kawkawlin River Watershed Septic System Mapping & Outreach Program

Joel Kwiatkowski, Env. Health Mng., Bay County Health Department

Temporal & Spacial Considerations for Enteric Studies



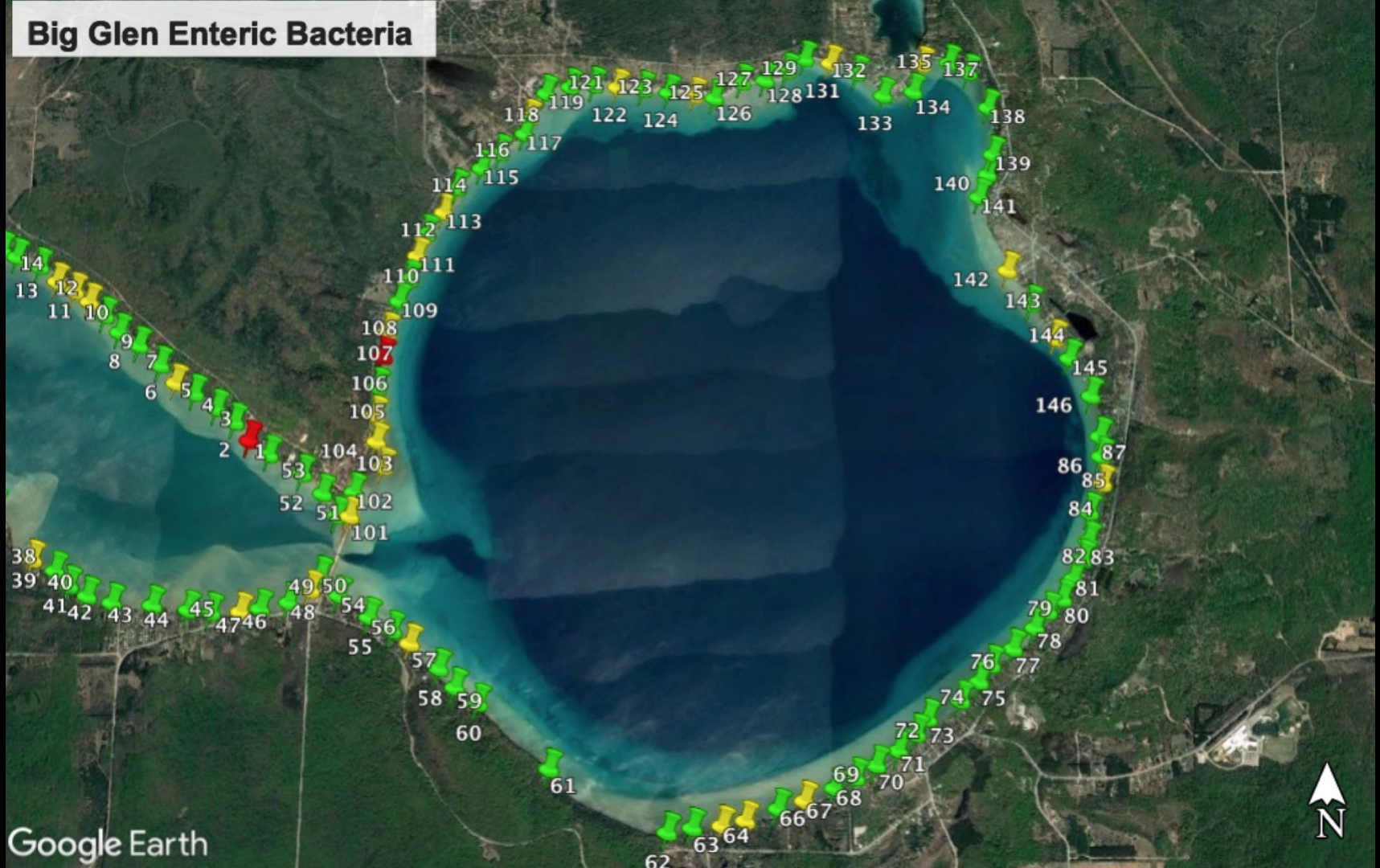
by Rob Karner, Watershed Biologist
Glen Lake Association

Three Basic Considerations

- Temporal - based on time-sensitive factors
- Spacial - based on location(s) that are logical to sample first
- Financial - How to raise funds

Temporal Factors

- Mid-summer when septic systems are fully charged
- Peak season for short-term rentals
- Before and after rain events (rainfall above 1.5 inches in a short window of time)
- Establish a baseline for entire shoreline


Big Glen Enteric Bacteria
Google Earth
N

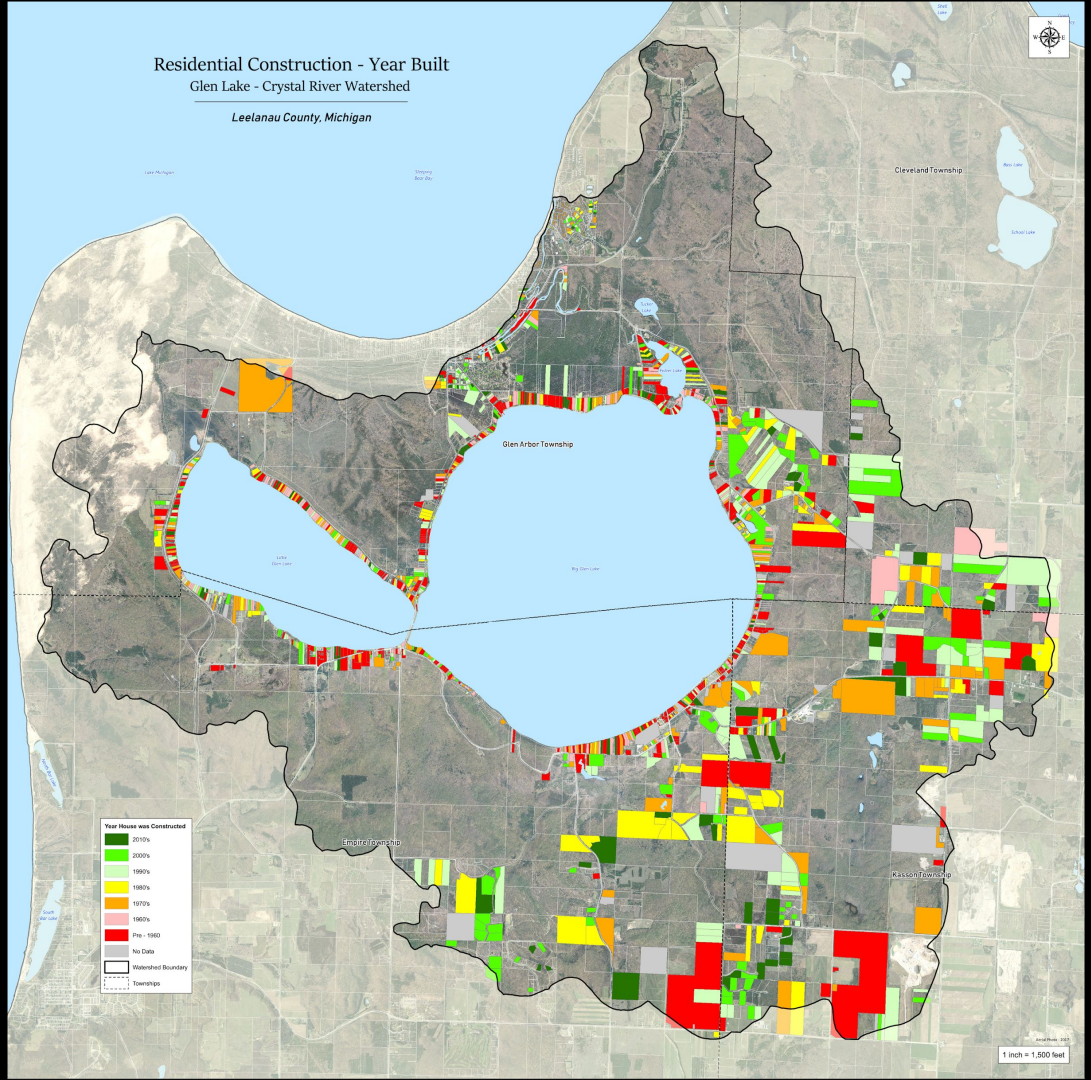
Spacial Factors

- Age of septic system mapped out by parcel
- Topography - steep slopes vs. flat
- Density of housing
- Storm water discharge

Residential Construction - Year Built

Glen Lake - Crystal River Watershed

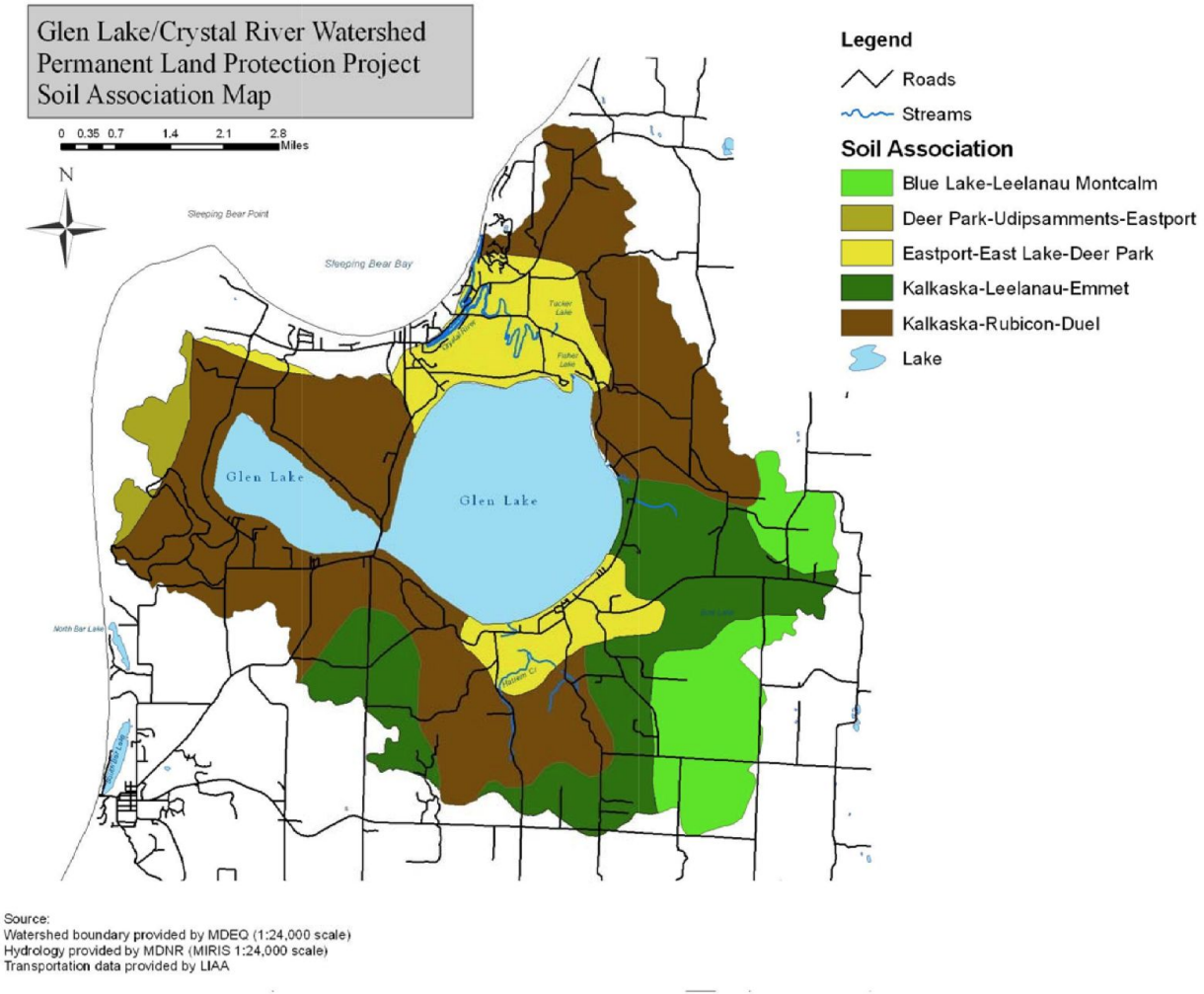
Leelanau County, Michigan



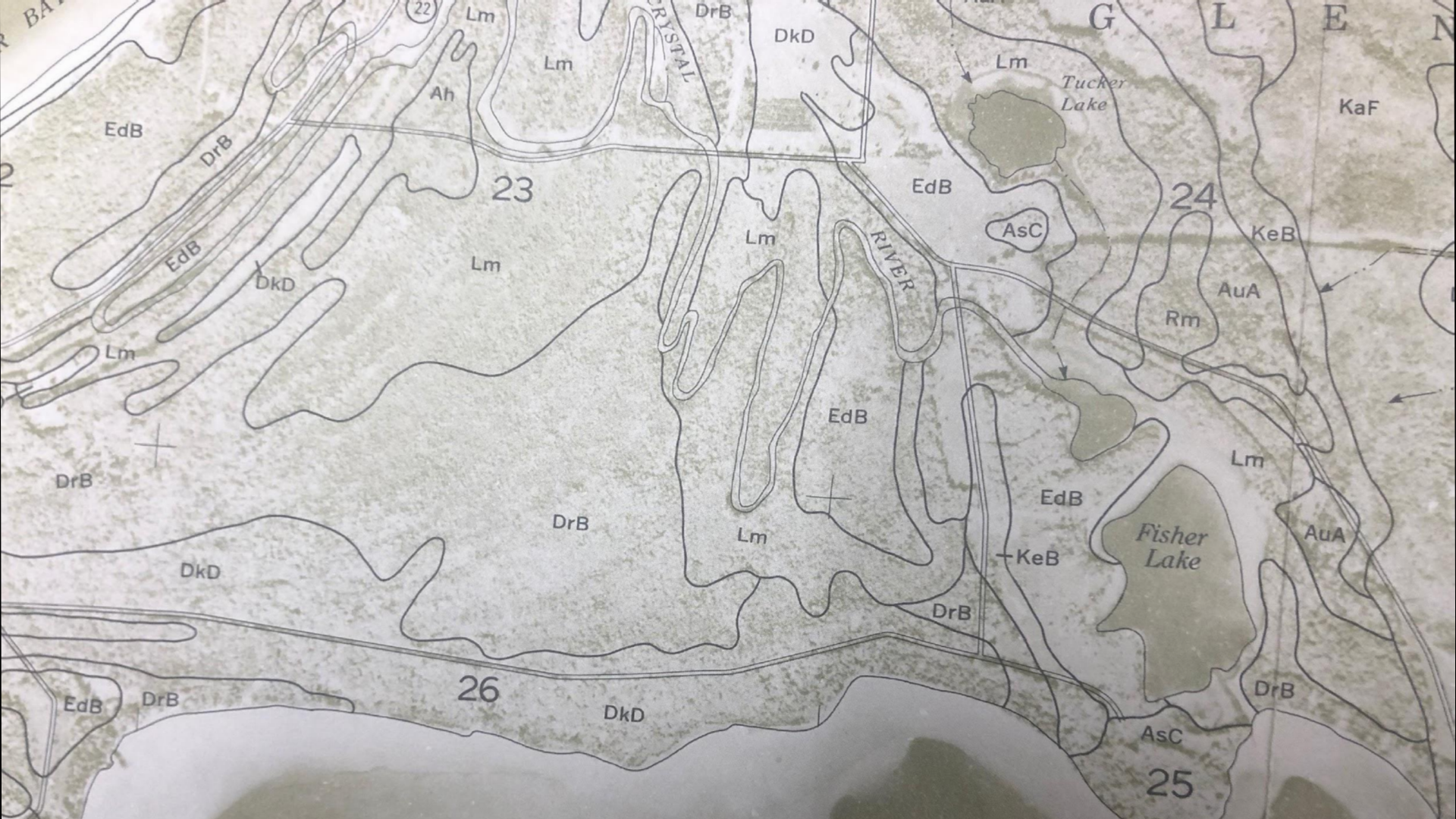
Spacial Factors

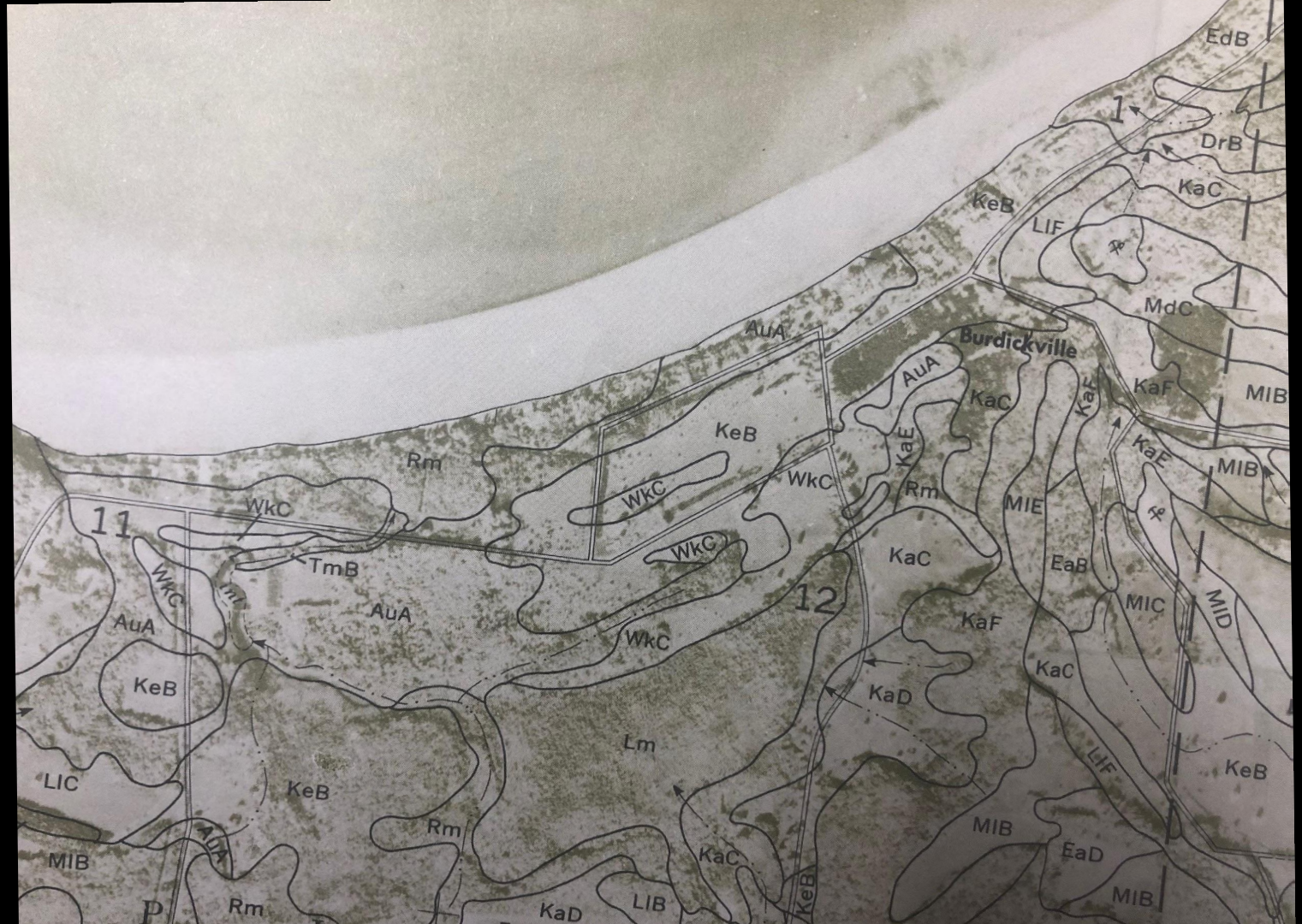
- Cladophora colonies
- Community septic systems
- Inlets
- Groundwater flow - direction and volume

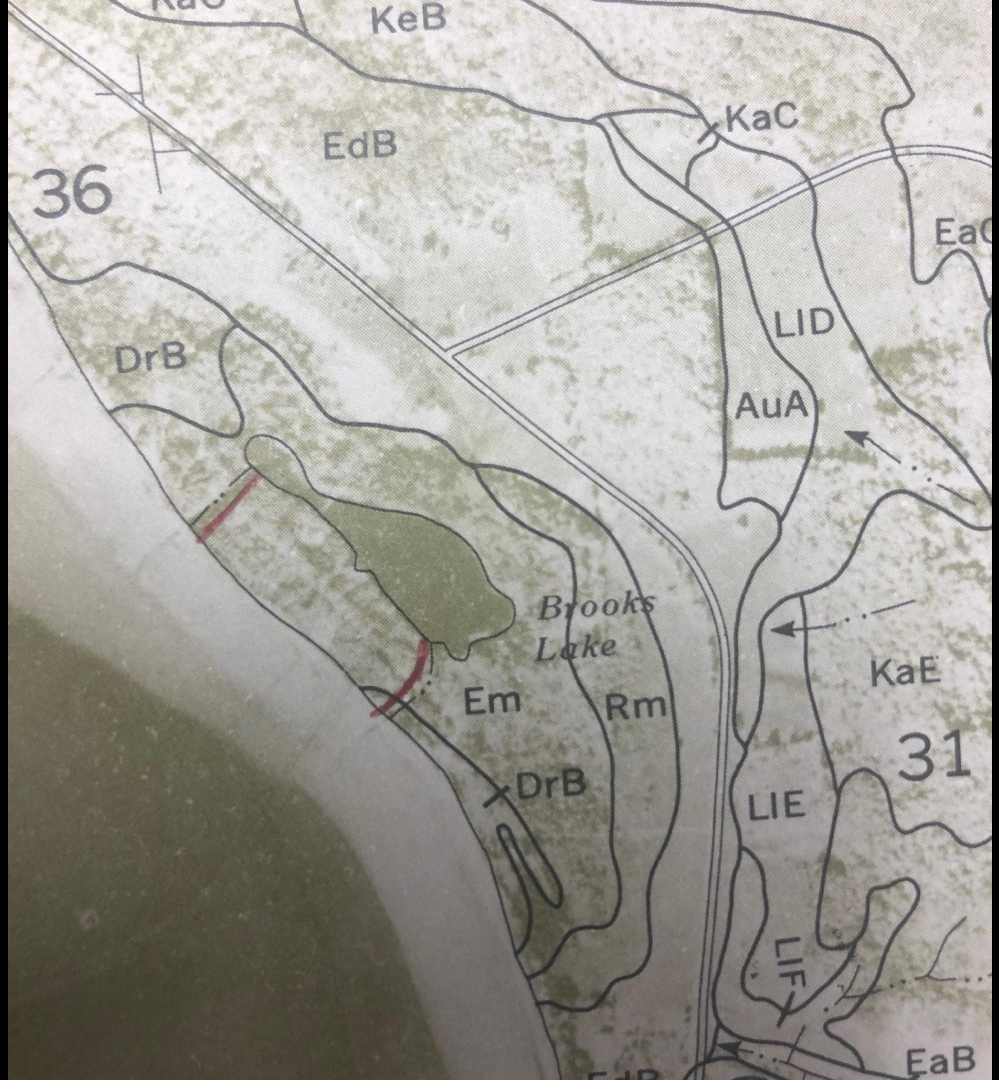
Glen Lake/Crystal River Watershed Permanent Land Protection Project Soil Association Map



Source:
Watershed boundary provided by MDEQ (1:24,000 scale)
Hydrology provided by MDNR (MIRIS 1:24,000 scale)
Transportation data provided by LIAA


22
Lm
DrB
DkD
Lm
Ah
CRYSTAL
Lm
Tucker Lake
KaF
EdB
DrB
23
EdB
DkD
Lm
EdB
24
AsC
KeB
Lm
RIVER
AuA
Rm
Lm
EdB
DrB
Lm
EdB
DrB
Fisher Lake
AuA
DkD
KeB
DrB
26
EdB
DrB
DkD
DrB
AsC
25


EdB
1
DrB
KaC
KeB
LIF
MdC
Burdickville
AuA
KaC
KaF
MIB
KeB
Rm
WkC
WkC
WkC
KaE
KaF
MIB
11
WkC
Rm
MIE
TmB
WkC
KaC
EaB
12
AuA
AuA
MIC
MID
WkC
KaF
KeB
KaC
KaD
Lm
LIC
KeB
LIF
KeB
Rm
MIB
EaD
AuA
MIB
Rm
KaC
KaD
LIB
KeB


KeB
KaC
EdB
36
EaC
LID
DrB
AuA
Brooks
Lake
KaE
Em
Rm
31
DrB
LIE
LIF
EaB


L43
L43
L42
L42
L41
L41
L40
L40
Brooks Lake Inlets
L39
L39
Brooks Lake
Lime 3
Lime 3
L38
L38


Hatlem
Creek

Drain Pipe Map


Storm Water at Road Ends

Financial Factors

- Endowment Fund
- Watershed Protection Fund
- Operating Budget
- Stewardship via Discovery Boat


GLEN LAKE
ASSOCIATION
Discovery
Boat


Thank You!

12:30 – 1:45 p.m.

FLOW

LUNCH – with Two Presentations

Enteric Bacteria, Source Tracking & Emerging Techniques

Rob Karner, Watershed Biologist, Glen Lakes Association

Kawkawlin River Watershed Septic System Mapping & Outreach Program

Joel Kwiatkowski, Env. Health Mng., Bay County Health Department

Panel – Public Policy Options

Eric Johnston, Benzie-Leelanau District Health Department

Sean McBrearty, Clean Water Action

Leslie Sickterman, Planning Director, Long Lake Township

George Bailey, Chair, Gratiot County Commission

Rick Stein, Re/Max Bayshore Real Estate

3:00 – 3:45 p.m.

Panel – Where Do We Go from Here

Jon Beard, Senior Consultant, Public Sector Consultants

Tom Zimnicki, Michigan Environmental Council

Christine Crissman, Executive Director, Watershed Center Grand Traverse Bay

Daniel R. Thorell, Environmental Health Director, Grand Traverse County Health Department

Liz Kirkwood, Executive Director, FLOW

3:45 – 4:00 p.m.

Closing Remarks

Dave Dempsey, Senior Advisor, FLOW

FLOW
FOR LOVE OF WATER

“We forget that the water cycle and the life cycle are one.”

- Jacques Cousteau