MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

One Health

Water Quality Testing with *E. coli*

Dr. Shannon Briggs

briggss4@michigan.gov

State of Michigan

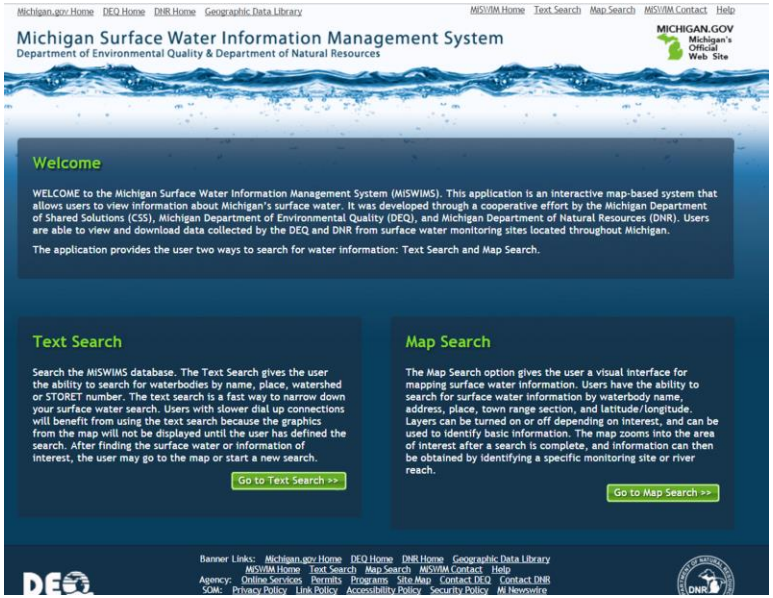
11,000 inland lakes
77,000 river miles
1,200 public beaches
4 Great Lakes
3,288 miles of coast
5.5 million acres of wetlands

Escherichia coli (E. coli)

- Fecal Indicator Bacteria (FIB)
- Michigan Water Quality Standards rely on *E. coli* measured with culture-based methods
- Daily Geometric Mean of 300 *E. coli* per 100 ml based on minimum of 3 samples
- 30-day Geometric Mean of 130 *E. coli* per 100 ml based on minimum of 5 sampling events within 30 day period (each event has 3 samples)

Where can I find E. coli data?

- MiSWIM, the Michigan Surface Water Information Management System, is a mapping and text interface that allows you to look for existing *E. coli* data near you.
- BeachGuard is another mapping and text search interface designed to share beach closing and *E. coli* information collected by local health departments. BeachGuard also contains some *E. coli* results collected from rivers.
- Your local health department is also a good source for information. Use the "Contact your local Health Department" map on Michigan Department of Community Health website (http://www.michigan.gov/mdhhs/0,5885,7-339--96747--,00.html)



Water Quality and Pollution Control in Michigan Sections 303(d), 305(b), and 314 Integrated Report

Get the latest updates - subscribe to receive TMDLs and Integrated Reporting (Clean Water Act Sections: 303d, 305b, and 314) emails.

The Clean Water Act (CWA) requires Michigan to prepare a biennial report on the quality of its water resources as the principal means of conveying water quality protection/monitoring information to the United States Environmental Protection Agency (USEPA) and the United States Congress. The Integrated Report satisfies the listing requirements of Section 303(d) and the reporting requirements of Section 305(b) and 314 of the CWA. The Section 303(d) list includes Michigan water bodies that are not attaining one or more designated use and require the establishment of Total Maximum Daily Loads (TMDLs) to meet and maintain Water Quality Standards. Approval of the 2016 303(d) list was received from the USEPA on February 3, 2017.

- Download the complete and final 2016 Report

Appendix A1 - 8 and 12 Digit Hydrologic Unit Code (HUC) Basins for the Lower Peninsula

Appendix A2 - 8 and 12 Digit Hydrologic Unit Code (HUC) Basins for the Upper Peninsula

Appendix B1 - Comprehensive list of assessment unit designated use support (HUCs 04010302 - 04050007)

Appendix B2 - Comprehensive list of assessment unit designated use support (HUCs 04060101 - 07070001)

Appendix C - List of assessment units not supporting designated uses and are scheduled for a TMDL (Category 5)

Appendix D1 - 303(d) list modifications - delistings

Appendix D2 - 303(d) list modifications - new listings

Appendix E - Public Comment and Response

Appendix F - TMDL Vision

- Download the complete and final 2014 Report

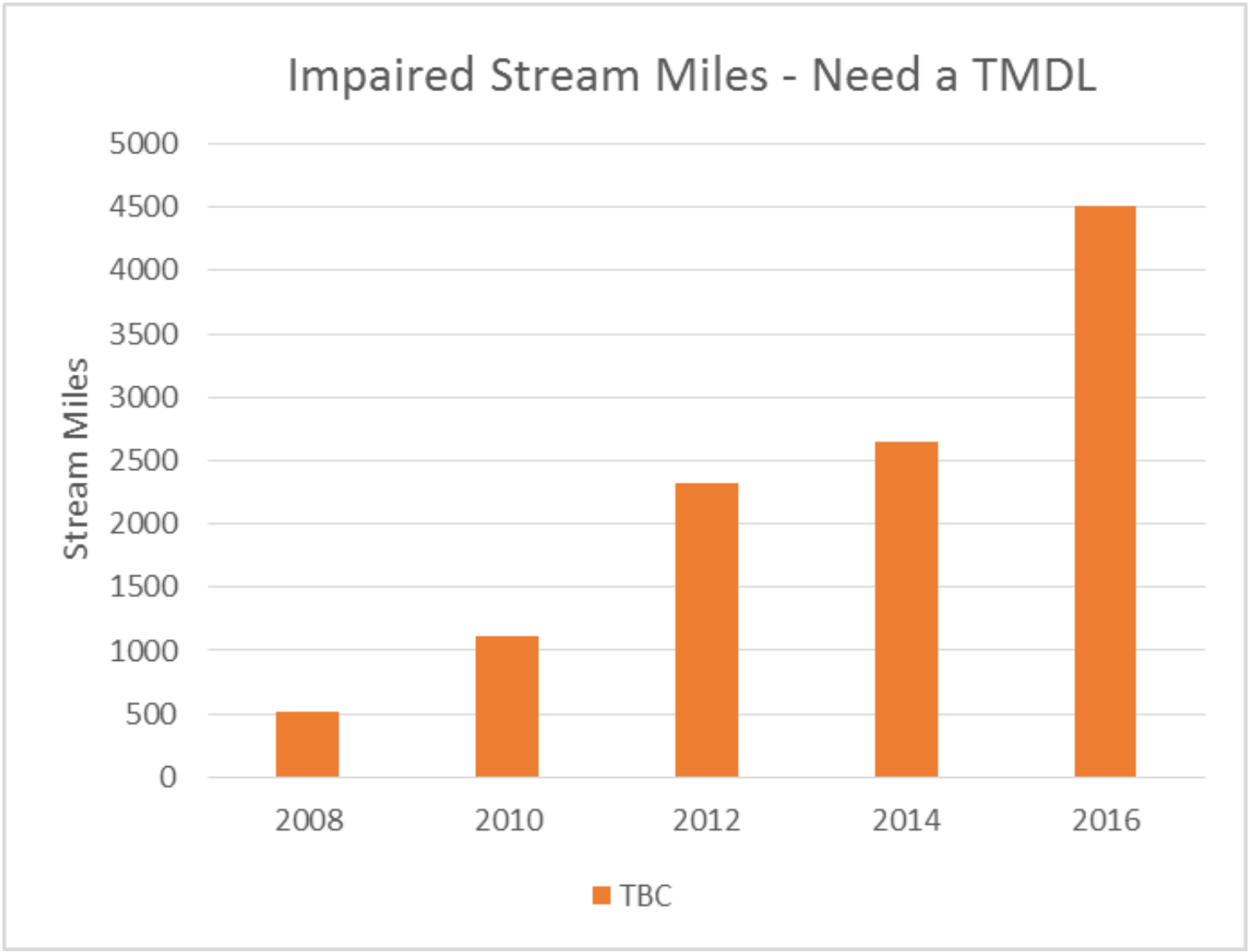
Appendix A1 - 8 and 12 Digit Hydrologic Unit Code (HUC) Basins for the Lower Peninsula

Appendix A2 - 8 and 12 Digit Hydrologic Unit Code (HUC) Basins for the Upper Peninsula

Appendix B1 - Comprehensive list of assessment unit designated use support (HUCs 04010302 - 04050007)

Related Content

- Holland Harbor Draft 401 Certification
- Muskegon Harbor Draft 401 Certification
- St Joseph Harbor Draft 401 Certification
- Application for Water Quality Certification
- Michigan's Statewide *E. coli* Total Maximum Daily Load
- EPA Approved Total Maximum Daily Loads (TMDLs)
- Statewide Mercury and PCB TMDL Information
- DEQ Water Quality Monitoring Reports
- Fish Contaminant Monitoring Program
- Total Maximum Daily Loads (TMDLs)
- Monitoring Request Form
- Whole Effluent Toxicity Regulation In Michigan


Impaired Stream Miles - Need a TMDL
Stream Miles
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
2008
2010
2012
2014
2016
TBC

Monitored public beaches exceeding the daily geometric mean of 300 *E. coli* per 100 ml.

Year	2012	2013	2014	2015	2016	2017	10-Year Average
Number of Beaches with Exceedances	114	98	76	98	80	72	92.8
Percent of Beaches with Exceedances	27	24	23	25	19	18	22.6
Number of Samples Exceeding WQS	224	162	129	212	188	133	188.9
Percent of Samples Exceeding WQS	4	3	4	5	4	3	3.8

WATER

- Great Lakes
- Drinking Water
- Lakes & Streams
  - Aquatic Nuisance Control
  - Water Quality Monitoring
  - Lakes & Streams Protection
  - Marinas
  - Related Links
- Wetlands
- MiWaters
- Permits
- Wastewater
- Water Management

DEQ / WATER / LAKES & STREAMS / WATER QUALITY MONITORING

Michigan's Statewide *E. coli* Total Maximum Daily Load

Contact: Molly Rippke 517-284-5547

Get the latest updates - subscribe to receive TMDLs and Integrated Reporting (Clean Water Act Sections: 303d, 305b, and 314) emails.

When the water quality standard is exceeded, the Federal Clean Water Act requires Michigan to address pollution issues with either a Total Maximum Daily Load (TMDL) or by fixing the problem through other means. For some issues, a remedy is already in progress to reduce pollution. This is not the case for *E. coli*. This TMDL will provide a framework for restoration of water quality.

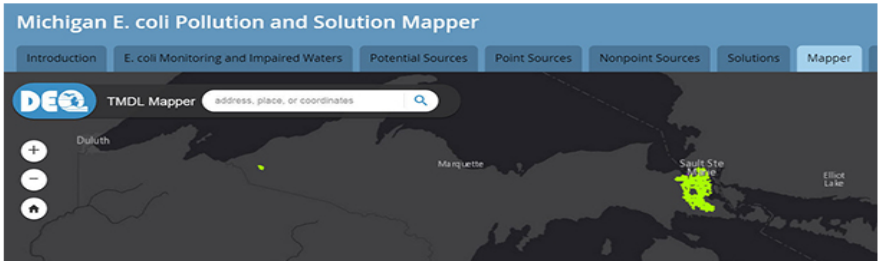
Routine testing has shown *E. coli* levels in many areas are above the standard. These levels increase the risk of illness upon contact or incidental ingestion of the water. Given the extent of this problem, and the multitude of potential sources, a statewide approach will be more effective and more efficient at addressing this issue. To learn more, please visit the *E. coli* in Surface Waters website or view the *E. coli* in Surface Waters webinar.

Public Outreach for the Draft Statewide *E. coli* TMDL

As part of efforts to inform and educate, the draft Statewide *E. coli* TMDL is now available for public discussion.

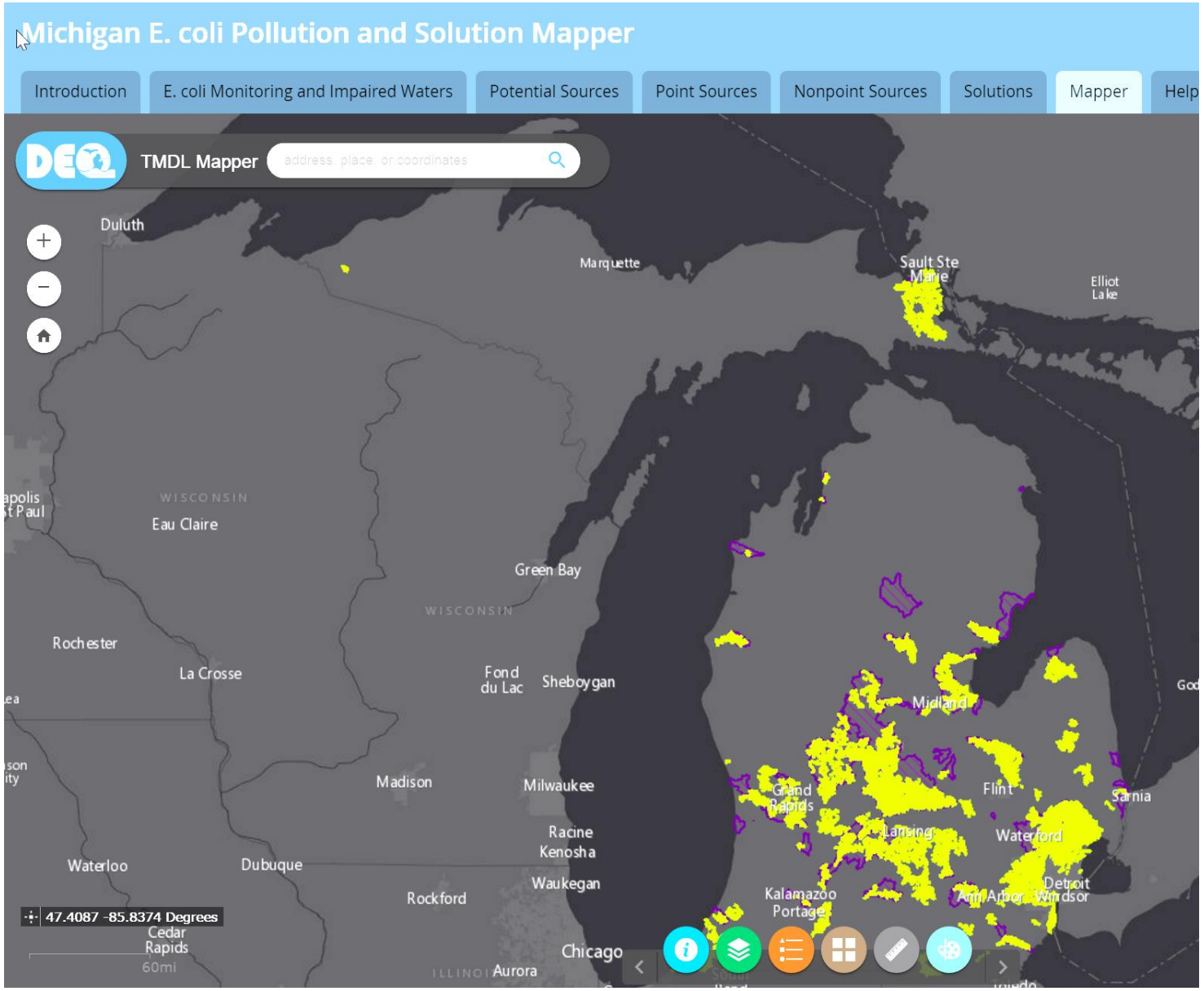
Long term solutions to bacterial problems can only be accomplished through a collaborative approach. In addition to its work on effective National Pollutant Discharge Elimination System (NPDES) permit requirements and corrective actions on illegal sources, the MDEQ is looking for assistance from landowners, local health departments, conservation districts, other state and local agencies, and environmental groups to focus voluntary improvements in areas where nonpoint sources are a problem.

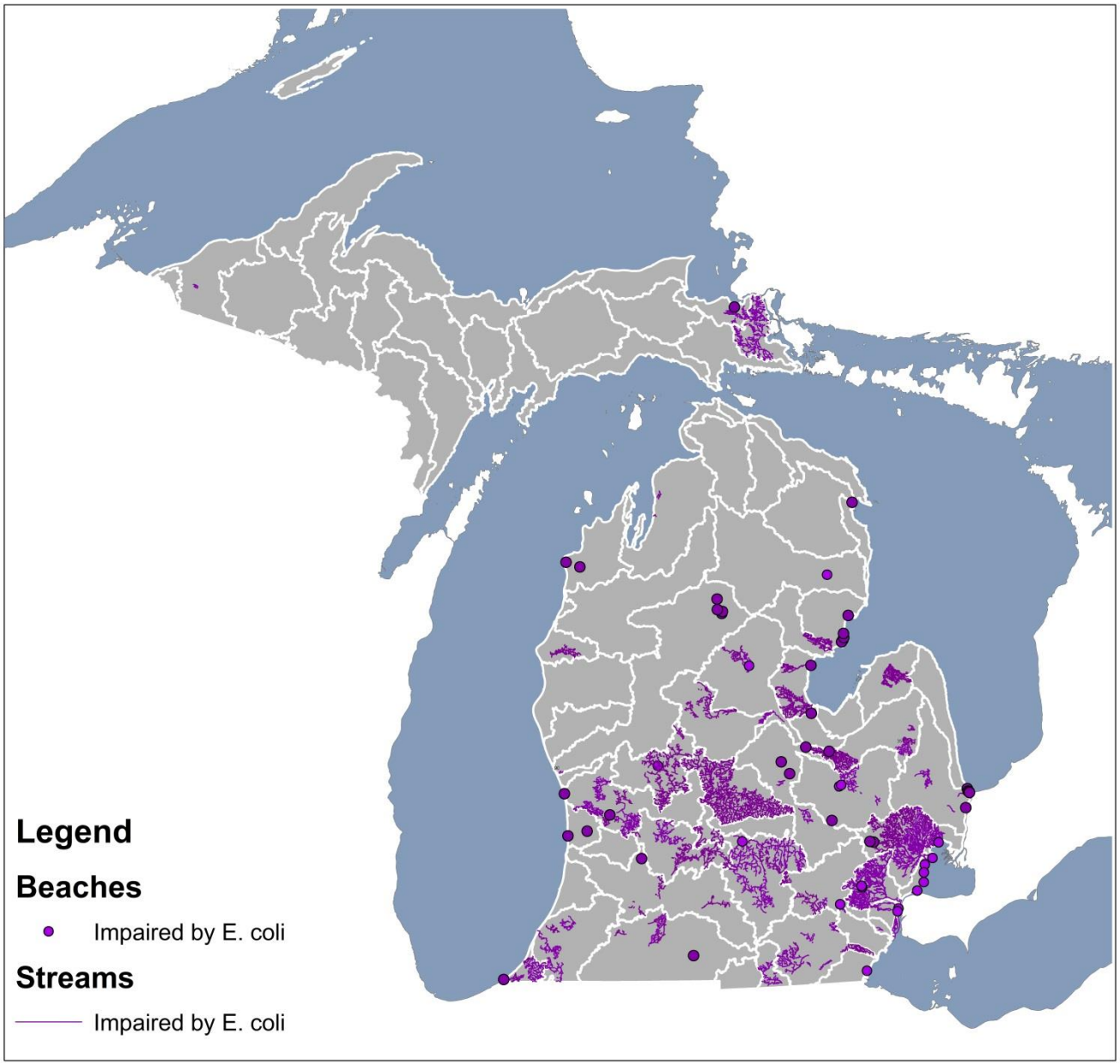
A new statewide, interactive mapping tool is available to assist in identifying impacted areas as well as provide resources for getting involved in efforts to reduce the *E. coli* levels. The purpose is to empower local communities to protect our waters.



- Map Help Document
- *E. coli* Success Stories

Educational presentations from MDEQ staff are also available. If your group is interested in a


Michigan E. coli Pollution and Solution Mapper
Introduction
E. coli Monitoring and Impaired Waters
Potential Sources
Point Sources
Nonpoint Sources
Solutions
Mapper
Help
TMDL Mapper
address, place, or coordinates
Duluth
Marquette
Sault Ste Marie
Elliot Lake
WISCONSIN
Eau Claire
Green Bay
WISCONSIN
Rochester
La Crosse
Fond du Lac
Sheboygan
Midland
Madison
Milwaukee
Grand Rapids
Flint
Sarnia
Racine
Kenosha
Lansing
Waterford
Waterloo
Dubuque
Waukegan
Detroit
Windsor
Ann Arbor
Kalamazoo
Portage
Rockford
47.4087 -85.8374 Degrees
Cedar Rapids
60mi
Chicago
Aurora


Legend
Beaches
Impaired by E. coli
Streams
Impaired by E. coli

Culture Based Methods require incubation time (18 hours)

Membrane Filtration

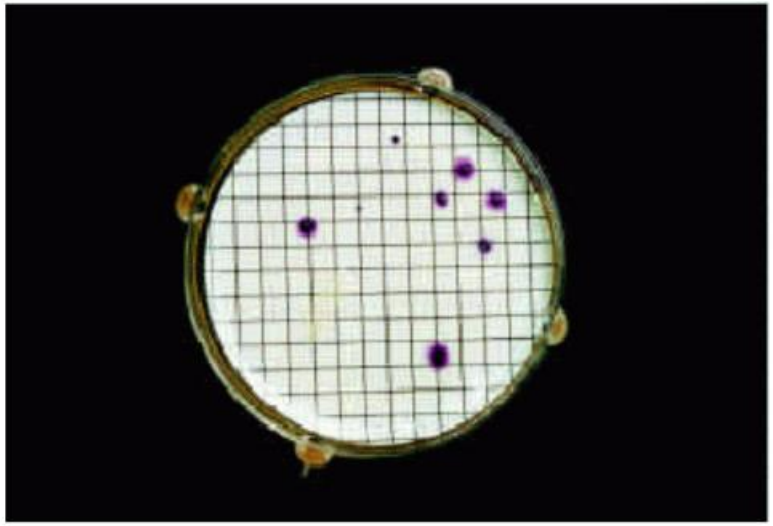
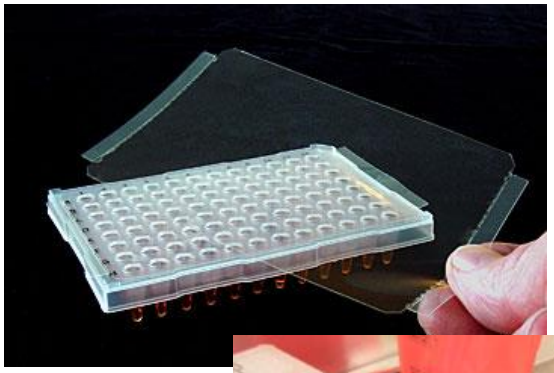
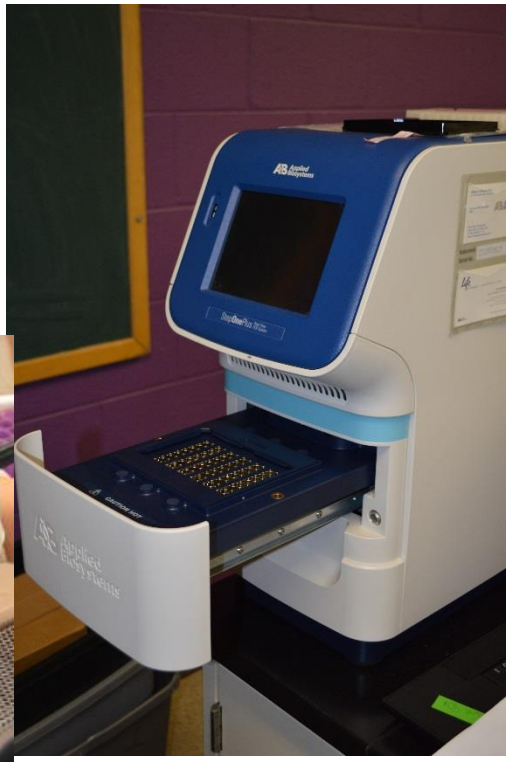


Photo 1. *E. coli* colonies on modified mTEC agar are red to magenta.

IDEXX Colilert® Quanti-Tray®

Quantitative Polymerase Chain Reaction (qPCR) measure DNA in 2-4 hours





Remember QPCR is *not* Measuring the Same Thing as a Culture…

- QPCR differs from traditional culture-based assays in that it measures all DNA:

- Culture assays only measure cells possessing the ability to grow on the selective media you are using

Multi-Lab Validation Study for draft Method C (qPCR method for *E. coli*)

Determined that labs and method produced consistent results

Results evaluated By USEPA, DEQ, and Michigan State University

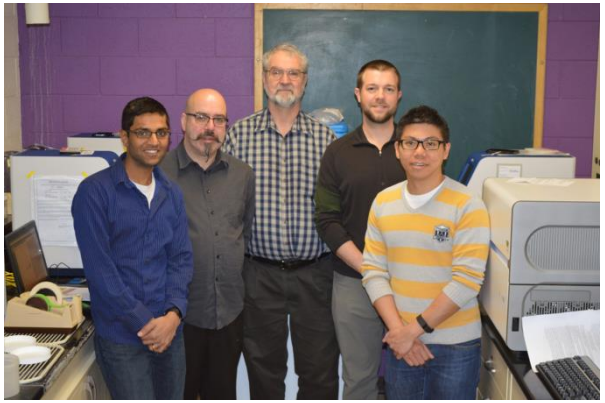
Our Network of Michigan qPCR Labs

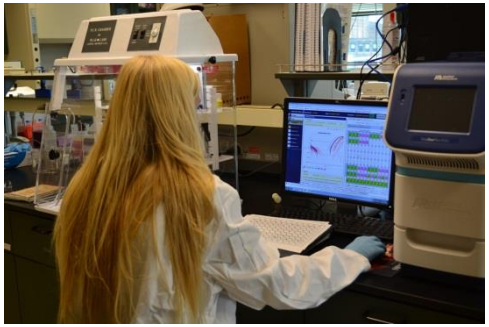
Marquette Area Wastewater Treatment Plant
Lake Superior State University
Northwest Michigan Regional Lab
NPS- Sleeping Bear Dunes
Central Michigan Health District
Ferris State University
Saginaw County Dept of Public Health
Saginaw Valley State University
Grand Valley State University
Hope College
Kalamazoo County Health & Community Services
Michigan State University
USGS- Lansing
Oakland County Health Department
Oakland University

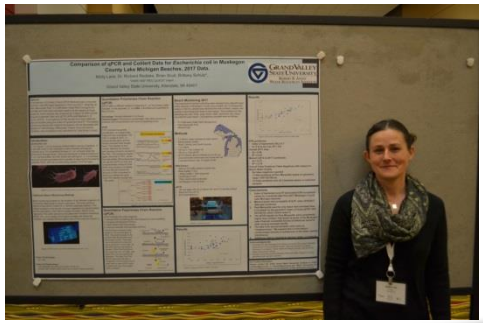
GRAND VALLEY STATE UNIVERSITY

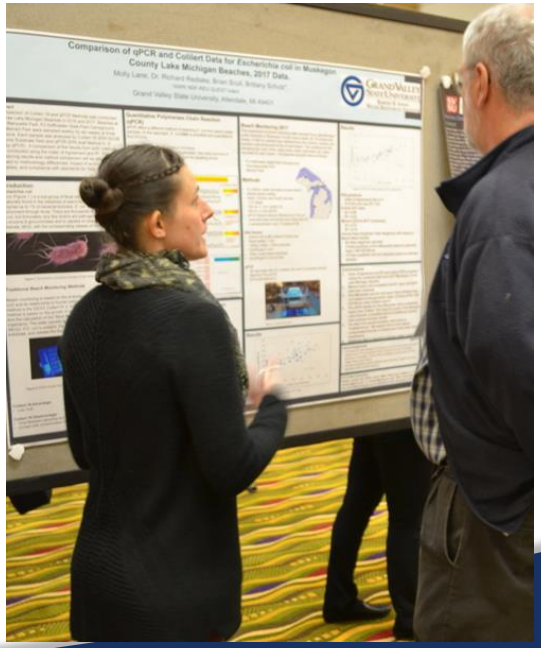
ROBERT B. ANNIS WATER RESOURCES INSTITUTE

Public Health
Prevent. Promote. Protect.
Muskegon County









Michigan Department of Environmental Quality

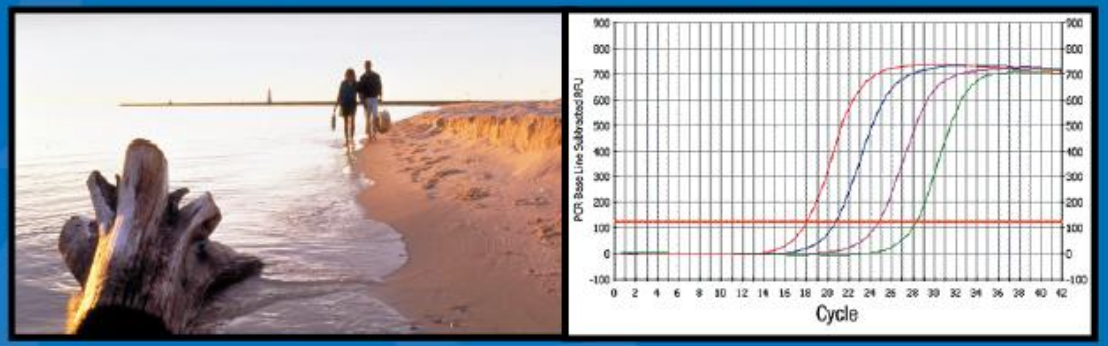
qPCR Monitoring Plan for *E. coli*

1. Local health departments collect water samples in 2016 and 2017
2. Compare new draft Method C results to 2 approved methods
    1. Colilert (culture based method for *E. coli*)
    2. Method 1609.1 (qPCR method for enterococci)
3. Now reviewing results to determine equivalent qPCR value
4. Propose qPCR value for *E. coli* monitoring in 2018

EPA
United States
Environmental Protection
Agency

Fecal Waste Contaminates our Waterways:
Molecular technologies offer new solutions

Orin C. Shanks

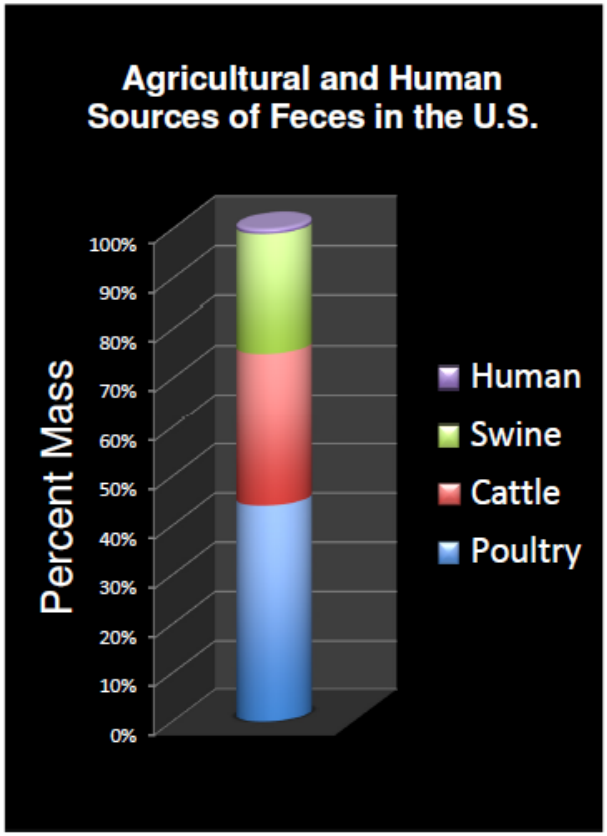


Office of Research and Development
National Risk Management Research Laboratory, Water Supply and Water Resources Division

December 17, 2014

Fecal Pollution is a Nationwide Problem

- Estimated $1x10^9$ tons of fecal material produced in U.S. each year
  - Human (0.01%)
  - Poultry
  - Cattle
  - Swine
  - Contributions from other agricultural animals and wildlife not included
- Fecal pollution source information can improve water quality management



RL Kellogg, CH Lander, DC Moffitt, N Gollehon - NRCS and ERS GSA Publ. No. NPS00-0579. Washington, DC: USDA, 2000

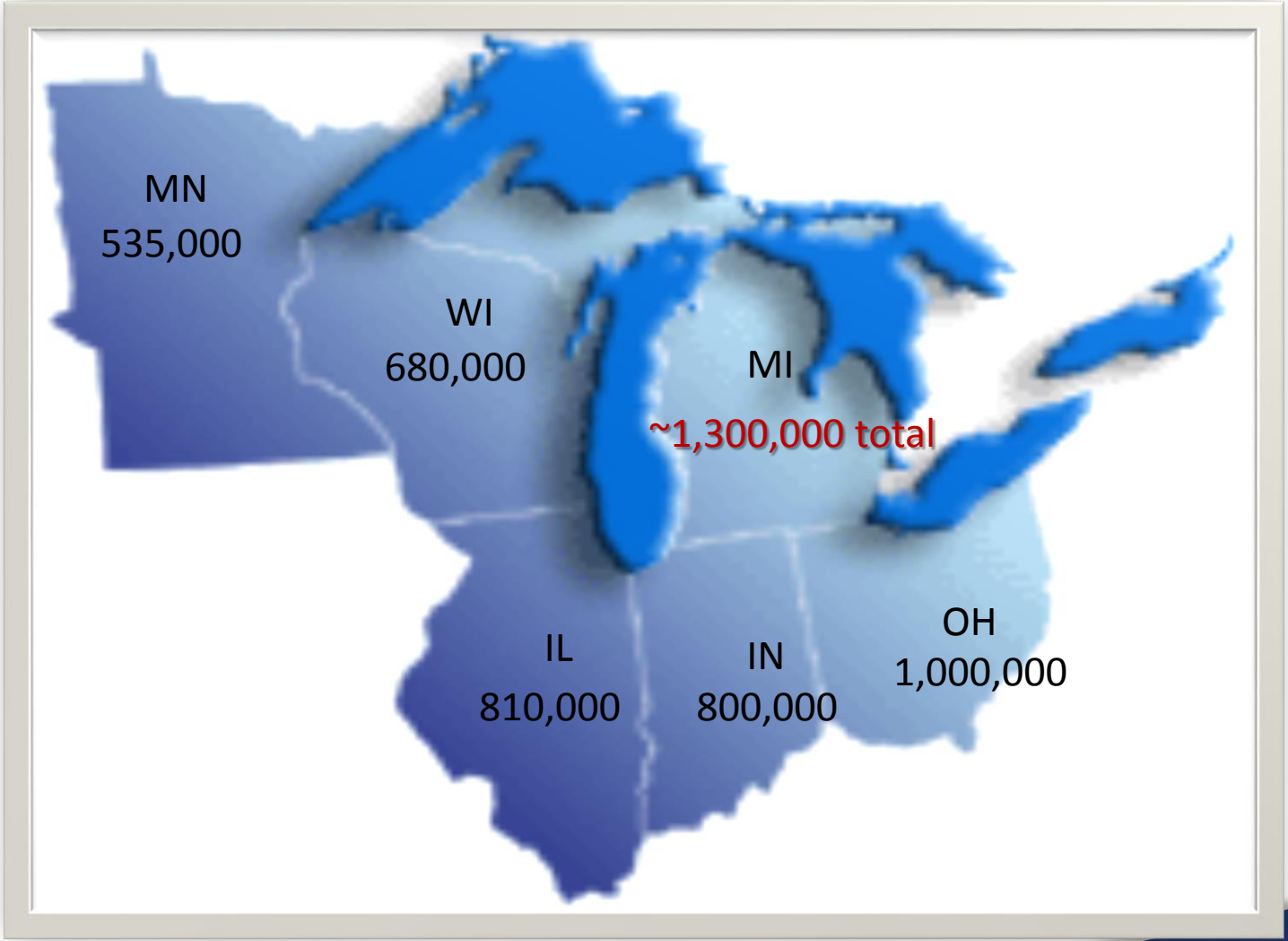
Next Steps for qPCR methods

1. DNA based identification of fecal source
2. 11 genetic markers
3. Train qPCR labs with source tracking markers
4. Conduct source tracking during beach closures
5. Conduct source tracking on impaired waters

Identify and Correct Sources

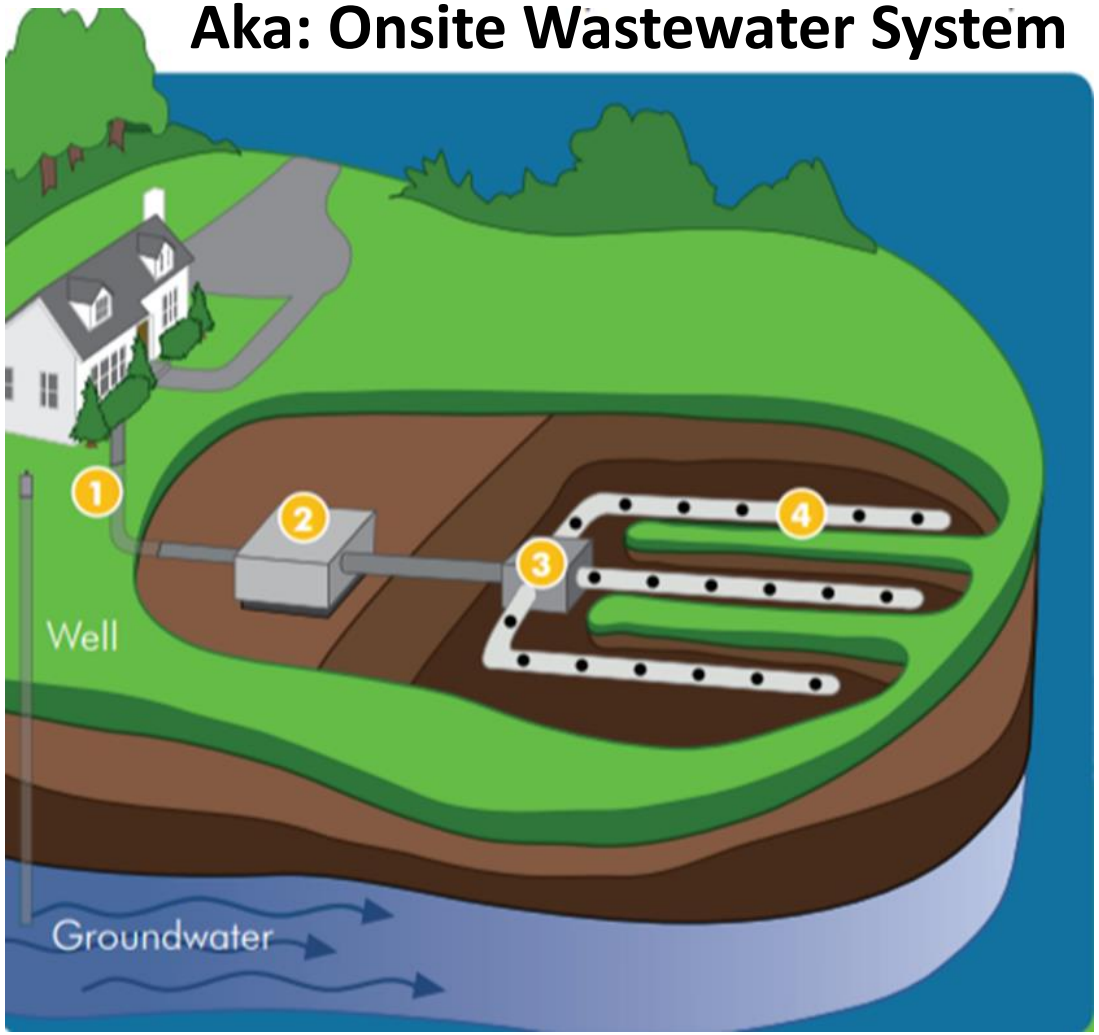
Potential Sources of Pollution

Number of Onsite Wastewater Systems



What is a Septic System?

Aka: Onsite Wastewater System

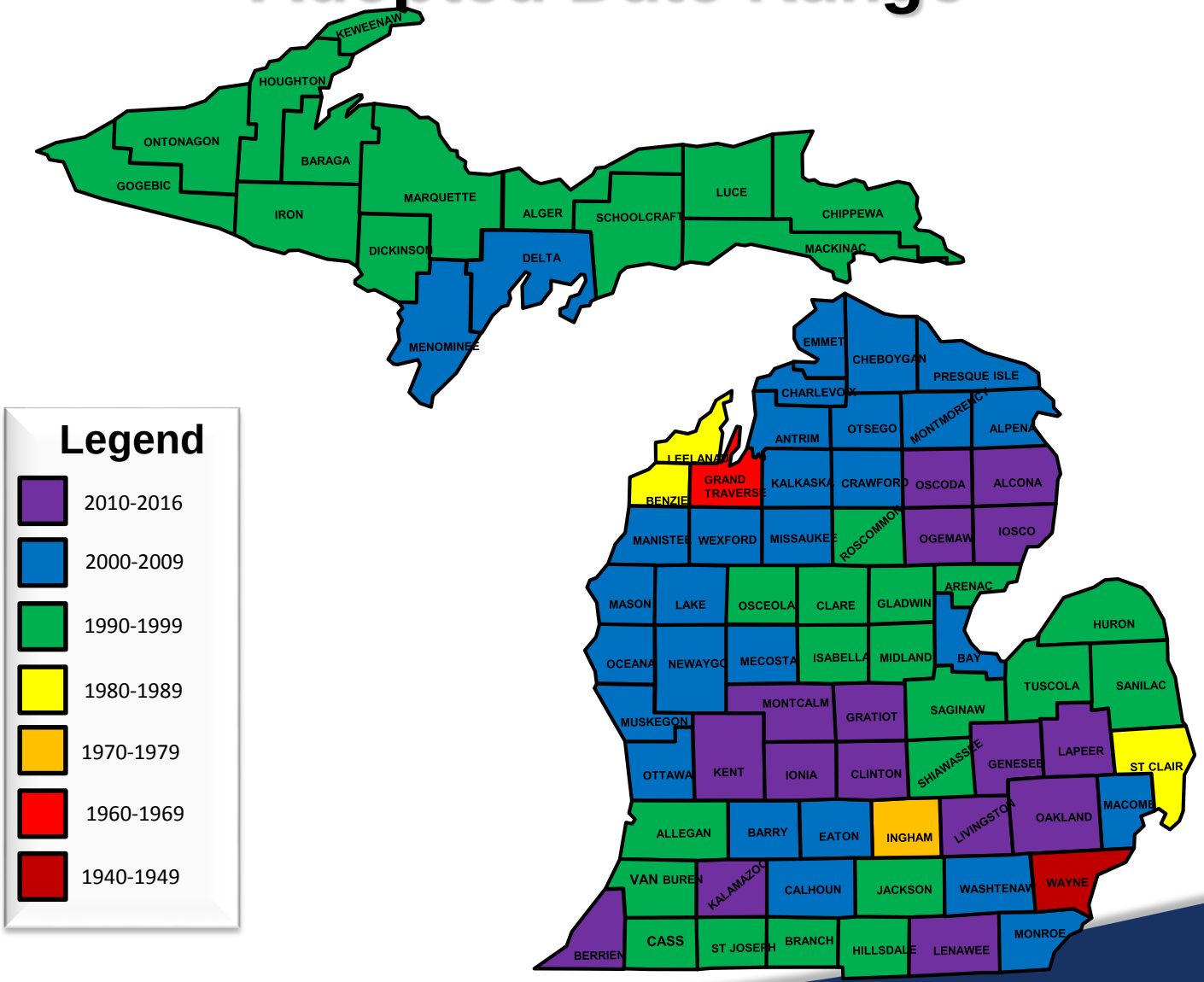


Environmental Health Regulations

The state of Michigan is unique that we do not have a state wide Sanitary Code for single and two family residential systems or equivalent sized commercial systems.

Each county/district LHD has adopted regulations to help implement the Onsite Wastewater Program.

County Sanitary Regulations/Code Adopted Date Range



Legend

- 2010-2016
- 2000-2009
- 1990-1999
- 1980-1989
- 1970-1979
- 1960-1969
- 1940-1949

MICHIGAN STATE UNIVERSITY

JOURNALISTS | MSU ON TV | PERSPECTIVES | WEBCAMS | SPA

Arts | Business | Environment | Life | Health | Science & Technology | Sports

ENVIRONMENT + HEALTH + SCIENCE & TECHNOLOGY

Published: Aug. 3, 2015

SEPTIC TANKS AREN'T KEEPING POO OUT OF RIVERS AND LAKES

Bridge

News and ar

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Quality of life

Michigan rivers polluted by human, animal waste more than double previous estimates

22 January 2014

Bridge

News and analysis from The Center for Michigan

Joan Rose

Articles

Waste in the water – why Michigan needs a state septic code

November 13, 2017 | Joan Rose

Roughly half of Michigan's rivers and streams exceed safety standards for E. coli bacteria, yet we are the only state ...iform septic code.

Human fecal matter in Michigan's great rivers, and what to do about it

Posted on: Thursday, October 29th, 2015 at 12:16 pm

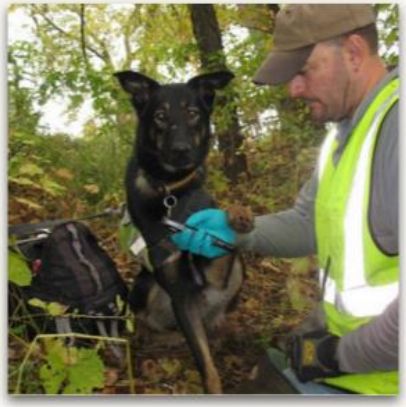
WMEAC

West Michigan Environmental Action Council

The MSU team tested 64 river systems in Michigan's Lower Peninsula and found that 100 percent of the rivers were contaminated by human fecal matter, and that household septic tanks were a major source.

Environmental Canine Services

Karen and Logan



Scott and Sable

Aryn and Crush

Stephanie and Kona

Dan and Abbey

Laura and Kenna

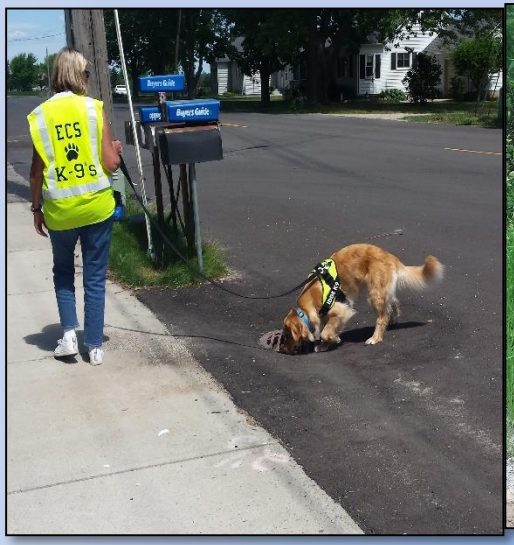
Using sewage detection dogs to help improve water quality

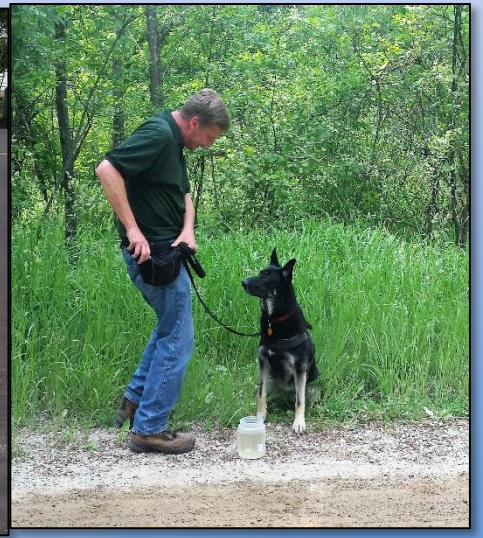
K9 Sable at Grand Traverse Bay

- *Beaches and shorelines*
- *Stormwater systems*
- *Urban & rural areas*
- *Sample scenting – on site or shipped*
- *Large & small MS4s – screening & source tracking*

Environmental Canine Services (ECS)

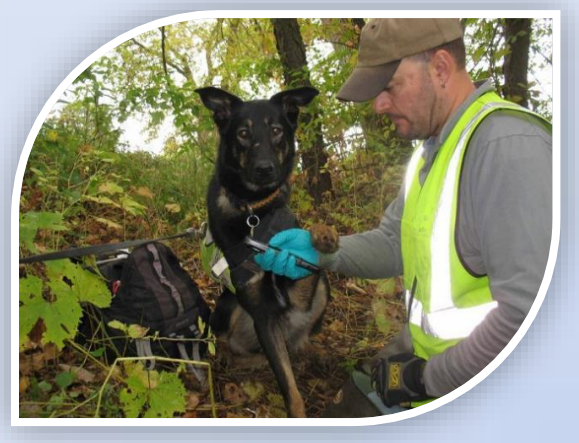
Detecting and source tracking human pathogen pollution from failing septic systems, leaking sewer lines, & Illicit pipe connections





Michigan Teams: K9 Kenna and K9 Abbey

A COMPLEMENTARY TOOL



Benefits of Sewage Detection Dogs

Human specific
Indication of human source pathogens only

Immediate results
Presence/absence of sewage in seconds

High # Site Investigations/Day
Due to immediate responses at each site

Rapid source tracking
Source location or narrow bracketing in minutes, hours, or days, not months or years

+ Collaboration

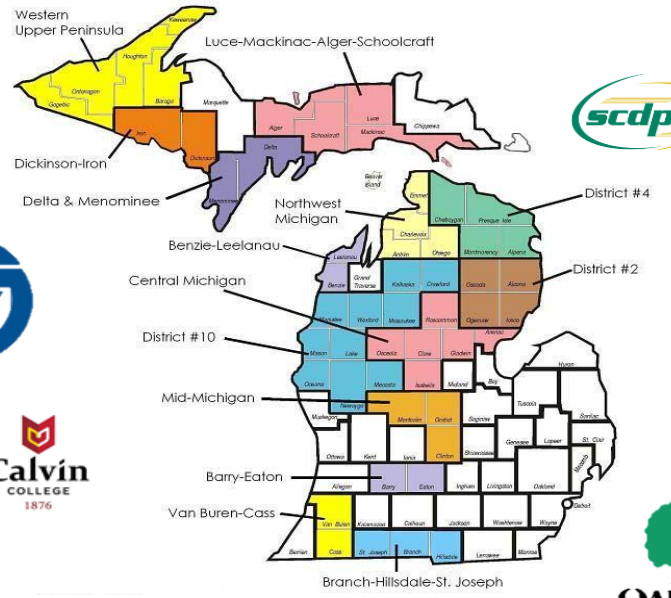
Clients, Labs, State & Federal Agencies, Environmental Professionals, Researchers, Local Communities

- *Historical data and current information review*
- *Developing investigation strategies*
- *Lab results from tandem sampling paired with K9 results*
- *Funding opportunities*
- *Quality control oversight*
- *Problem solving*
- *Local knowledge*

=

More efficient, accurate, cost effective results!

Connecting with Partners



Connecting with Partners

Great Lakes Beach Association

beachnet@great-lakes.net

October, 2018

MSU hosted qPCR list serv

MIQPCR@LIST.MSU.EDU

Questions