Moving the Political Will: Tales from the field

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How safe and secure are our water sources?

Is there a WATER CRISIS BREWING?

How are we solving current problems and challenges?
Critical Infrastructure Sectors

https://www.dhs.gov/critical-infrastructure-sectors

There are 16 critical infrastructure sectors whose assets, systems, and networks, whether physical or virtual, are considered so vital to the United States that their incapacitation or destruction would have a debilitating effect on security, national economic security, national public health or safety, or any combination thereof.
Figure 2 – Evolving Threats to Critical Infrastructure

- Extreme Weather
- Accidents or Technical Failures
- Pandemics
- Acts of Terrorism
- Cyber Threats
Lloyd’s City Risk Index of 301 cities shows natural threats are estimated at $2.43 trillion dollars in risk.
## Infrastructure by the Numbers

### Water
- 1.8 million miles of distribution lines
- 14.5% of Americans rely on their own water sources (wells)
- As of 2016, there are over 150,000 public drinking water systems in the United States—systems that have 15 or more connections or serve more than 25 people
- 3% serve are large and serve 79% of the population
- **$1 trillion needed in the next 25 years for restoration**

### Sanitation
- 1.2 million miles of sewers
- 17% of Americans are served by on-site sanitation (septic tanks)
- Publicly owned wastewater treatment plants serve 189.7 million people and treat 32.1 billion gallons per day
- 15,848 wastewater treatment plants 9,388 facilities provide secondary treatment, 4,428 facilities provide advanced treatment, and 2,032 facilities do not discharge
- **$271 billion to meet current and future demands in the next decade**
FRESH WATER RESOURCES DEGRADATION

Loss of Habitat & Water Supply
Impacts the Health of Animals and Humans

By Todd C. Frankel August 11 2014
Follow @tcfrankel The Washington Post

Algal blooms

Ecosystems

In waters used for drinking, fishing, recreation

Irrigation

A sample glass of Lake Erie water is photographed near the Toledo water intake crib in Lake Erie. (Haraz N. Ghanbari/Associated Press)

Drinking
Risk of Disease Rises With Water Temperatures
By Kari Lydersen Washington Post Staff Writer
Monday, October 20, 2008

- **Communities** with sewers that overflow into local watersheds during heavy rainfall.
- **Outbreaks** of waterborne disease (1948-1994)
- **Outbreaks** of waterborne disease associated with extreme rainfall (1948-1994)

**Giardia**, found in sewage and contaminated streams and lakes, can cause severe gastrointestinal infections.

**Pathogens** (1985-2000)
- Viruses
- Bacteria
- Protozoa
- Flatworms

**Drinking water outbreaks**
- Giardia: 42%
- Cryptosporidium: 10%
- E. coli*: 6%
- Campylobacter: 2%
- Shigella: 2%
- Other: 7%

**Recreational water outbreaks**
- E. coli*: 17%
- Naegleria fowleri: 10%
- Cryptosporidium: 4%
- Giardia: 4%
- Norwalk-like virus: 4%
- Schistosoma: 7%
- Other: 7%
Is Tap Water Safe? Here's How To Tell

As many as 63 million Americans may be consuming dangerous H20.

The public believes the Safe Drinking Water Act protects water at the tap.
ELEVATED LEAD LEVELS FOUND IN BENTON HARBOR, MICH.

10 homes have found lead levels double the federal action level in drinking water.

Elevated lead levels in drinking water have been found in Benton Harbor, Mich. While the city was put under an advisory for its drinking water in October, additional homes have detected lead above the federal action level of 15 ppb.

An additional 27 out of 159 homes tested for lead levels above the federal action level, with 10 of those homes reporting lead more than double the action level.

City officials are still investigating how lead got into the city's drinking water, according to Michigan Health

Bill to require water testing in schools passes committee

US water security falls short

Scientist: PFAS has been contaminating Michigan population years

Homeless People Dying Of Hepatitis A

Disturbing Discoveries In Toronto's Waters Indicate Why E. Coli Levels Are Still So High

The water pollution in the Toronto Harbour is worse than ever,

Hepatitis A Outbreaks Hit Four U.S. States, Killing 41

CDC reports that four states in 2017 (California, Michigan, Utah, and Kentucky) experienced outbreaks of hepatitis A, 1,521 people got sick and 41 died. (All of the deaths occurred in California and Michigan).
Cyanobacteria

The toxin that shut off Toledo’s water
The feds don’t make you test for it.

500 million people impacted from the water shut down

A sample glass of Lake Erie water is photographed near the Toledo water intake crib in Lake Erie. (Haraz N. Ghanbari/Associated Press)

- https://www.epa.gov/nutrient-policy-data/cyanobacteria/cyanotoxins%20
E. Coli casts shadow over public beaches
St. Clair, Sanilac monitor health threat
E coli 0157H7 Outbreak
Linked with Romaine Lettuce contaminated irrigation water: Yuma AZ
Oklahomans have an abundance of water but many communities lack access to dependable water sources due to the distance of supplies, insufficient infrastructure or storage, water quality constraints, and other limiting factors. Increasing water use coupled with growth and development pose water quality challenges throughout the state. A majority of existing water infrastructure has aged beyond its useful life and with stringent water quality requirements, a significant financial burden faces Oklahoma’s water systems.
SOURCES IMPACTING RIVER AND STREAM MILES


- Unknown • 11,344
- Grazing in Riparian or Shoreline Zones • 7,703
- Wildlife Other than Waterfowl • 7,517
- Rangeland Grazing • 7,322
- On-site Treatment Systems (Septic Systems and Similar Decentralized Systems) • 7,298
- Residential Districts • 5,807
- Wastes from Pets • 5,467
SOURCES IMPACTING RIVER AND STREAM MILES


- Highway/Road/Bridge Runoff (Non-construction Related) - 3,982
- Non-Irrigated Crop Production - 3,893
- Impacts from Land Application of Wastes - 3,871
- Municipal Point Source Discharges - 3,574
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Illinois River watershed committee holds first meeting, eyes water quality credit program

By Clifton Adcock | The Frontier  Nov 11, 2019

Federal appeals court judges may dismiss WOTUS lawsuit

Judges Scott Matheson and Gregory Phillips of the 10th US Circuit Court of Appeals have refused to pause a Waters of the US lawsuit involving Oklahoma and business groups. The judges say they "would like to investigate further" and may dismiss the case since the Trump administration is preparing to replace WOTUS.

E&E News (subscription required) (10/8)

11 in Washington, California, Colorado, Kansas, Oklahoma, Texas and Iowa hit by Salmonella Dublin Hamburger

By Bill Marler on November 19, 2019

According to the CDC, since the last update on November 1, 2019, one additional ill person has been reported from Washington. As of November 19, 2019, a total of 11 people infected with the outbreak strain of Salmonella Dublin have been reported from seven states – Washington, California, Colorado, Kansas, Oklahoma, Texas and Iowa.

EPA awards Oklahoma nearly $239K grant to support state's water pollution control program
Waterborne Pathogens from animal fecal waste and human wastewater

**Viruses**  
**Bacteria**  
**Parasites**

THE DISEASES: diarrhea, respiratory illness, liver damage, kidney failure, heart disease, cancer, nervous system disorders; birth defects, death.
Our current compliance bacterial-based fecal indicators are insufficient to address public health, sources and remediation.

**NEED Better Water Diagnostics**

- Fecal coliforms
- \textit{E. coli}
- Enterococci

All bacterial, non-sporeformers
BETTER INFORMATION
MORE SPECIFIC INFORMATION

ADDRESS PATHOGENS SUCH AS VIRUSES,
ADDRESS SOURCE TRACKING
ADDRESS HEALTH RISKS

UNDETAKE COMMUNITY BASED RESEARCH

USE NEW TECHNOLOGY

SUPPORT RISK-BASED
DECISION SCIENCE
US Census 2005
17 million people
250,000 visitors
Per month to the Florida Keys
Septic-tank study

A statewide study of septic-tank permitting is warranted, based on the potential for problems similar to those associated with the pollution of Phillippi Creek in Sarasota County. Septic tanks can be an effective and safe form of sewage treatment — depending on the soil conditions, water tables and installation methods.

But when septic tanks are installed too close together or insufficiently separated from saturated soils and water tables, they can contribute to pollution by nitrates, viruses and organic pathogens that degrade water quality and pose human-health risks.

The conditions that have contributed to the pollution of Phillippi Creek are common throughout Florida. Septic-tank permitting has been improved over the years but it makes sense to regularly review a practice that has significant public health and environmental implications.

Florida should take the necessary precautions to ensure that its problems don’t get worse.
What we learned from viral tracer Studies

1. Both septic tanks and injection wells rapidly contaminated surface water (often in as little as 3 hr).
2. Rates of migration of wastewater ranged from <1 to >150 m/h.
3. These results have shaped future waste disposal policy in the Keys.
What will be done?
1. Septic tanks are being removed.
2. Sewers and wastewater treatment is being built.
3. Advanced treatment is being used to remove nutrients (nitrogen and phosphorous) and disinfection is used to destroy the viruses and bacteria.
4. More attention is being paid to storm waters.
THREATS TO THE GREAT LAKES
Sewage; Combine sewer overflows; Storm water; Non-point source pollution; Invasive species
Algal blooms
Climate change and
Inadequate infrastructure
Sources of *E. coli* and Pathogens

- Septic systems
- Waste water/Sewage treatment
- Animal farming operations
- Combined Sewer Overflow
- Agricultural run-off
- Wildlife
Microbial Source Tracking

• Tools are now available to determine to link specific molecular markers to the source of the fecal pollution

• Health risks
• Remediation
• Prioritization
• Responsibility
Sampling water quality and The Landscape

Baseflow (October 2010)
Spring thaw (March 2011)
Early summer rain (June 2011)

64 River systems

84% Lower Peninsula drainage area

In Stream Conditions:
- River discharge (ADCP and USGS)
- Temperature
- Physical chemistry (pH and specific conductance)

Chemistry and Nutrients:
- Nutrients (N, P, TN, TP, TDN, TDP, SRP)
- Ions (Na, Ca, Mg, Cl, K, NO₃, SO₄, NH₃)
- Dissolved organic carbon
- Alkalinity
- Stable isotopes (δH₂ and δO₁₈)

Algae and Chlorophyll:
- Chlorophyll a
- Epiphytic algae (hard and soft substrate)

Microbes and Pathogen Indicators:
- E.coli
- Bacteroides thetaiotaomicron α-1-6 mannanase (B. thet)
- M2 Bovine marker (Bacteroides)
- Pig2bac (Bacteroides)
Regional Variations of Bovine and Porcine Fecal Pollution as a Function of Landscape, Nutrient, and Hydrological Factors. *J. Environmental Quality* 47 (5): 1024-1032
Recommendations

• Michigan needs a state sanitary code
• Michigan needs to build better data bases
• Michigan needs to understand BMP for non point sources especially manure (tile drains, tillage practices and use of buffers and wetlands as sinks)
Community Decision Making with Community engaged research

Relevant
Timely
Economical
Realistic
Communicated
With consultation & Partners

• Identify the important sources of pollution.
• Pathogen/source tracking monitoring address risk and help to move the political will.
• Tracer studies provide a better way to address the source and the timing of pollution risks.
• Data provide a way to use the community dollars wisely.
How do we solve the water pollution problems and protect water quality?

- Invest in technology
- Invest in assessment
- Improve your knowledge & decision making
THANK YOU FOR YOUR ATTENTION

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