

First, I want to thank you for your efforts to seek out and convey relevant information on this increasingly important issue. With PFAS and other awarenesses, residents of our county community increasingly want to know what's in the water they are drinking and they, their grand children and their guests are swimming in. While the unwanted changes we are experiencing in lakes get a lot of attention, lakes are just collectors for contaminants that migrate to them from far more concentrated inland sources. They are the canary in the mine where what comes to them in higher concentration via ground water can be more easily accessed for analysis.

qPCR for Detection

As you know water quality stewards in Leelanau are using a variety of sophisticated technologies on lakes to identify disruptive substances and track them to their sources than are currently used in county health practice. In your work-up you are reluctant to assign accuracy to the DNA recognition based detection technology qPCR. Know that the primary use of qPCR technology by lake stewards to date is detection of **connections** between septics, ground water, and shore waters.

For decades inferential measures like total

phosphorous, or coffee, or chloride or e-coli have been tried. Not all septics contain coffee . Road salt and water softener use mask chlorides as a septic connectivity indicator. E-coli responds to waste from a variety of living sources. qPCR can isolate/ differentiate only human intestinally produced bacteria allowing connectivity from septics to unequivocally be established.

How much - dead or alive, doesn't matter for this application.

That said, because of qPCR's ability to precisely isolate, measure, and deliver results in minutes (not 3 days like an e-coli culture) it is becoming the standard for health related testing. Conversion factors from degree of threat thresholds based on prior measurement methods are either in place or under development by the EPA, NPS, and EGLE, for mainstream qPCR deployment.

Privately supported and conducted "discovery" testing verified by sophisticated University laboratory capability has established connectivity between septics in our area shore lines, and wells with concerning numbers of cases identified. The real threat to health and natural ecological systems may not be "dead"

bacteria. It may be highly soluble lake killing nutrients, pharmaceuticals, disruptive chemicals, and persistent pathogens which flow in the septic discharge mix.

Detecting human enteric bacteria as a tracer is the first step in measuring septic conveyed undesirables and the nature of threats they may pose .

The political implication of human enteric bacteria detected in well water though is - what homeowner will be comfortable, having learned of septic influence to their well, with the statement "dead bacteria won't harm you" ? Pathogens that accompany it may not be dead and just bacteria may not be the worst threat to lake ecology or human health.

Septic product transmissibility and pathogen persistence

Dr. Joan Rose uses 90 % persistence in 30 days as conservative one-size-fits-all estimate w/r to pathogens. Mark Borchardt traced noro virus transmission from source to sickened children in an isolated county he studied where both parties treat at the same clinic. He cites connectivity spanning many months and miles. In another rigorous research study on septic influence, peziometers were placed around septics of current design and installation at multiple diameters and depths. The study was conducted over a

350 day period in sandy soils less permeable than ours. With ground water movement less than ours, septic products penetrated ground water 2 feet and its products were conveyed 75 feet during that period. We have the most permeable soils in Michigan. Flow rates of ground water from abrupt slopes like Miller Hill, Alligator Hill, Sugarloaf, Harbor Ridge are well beyond those in which the above research was conducted. Artesian wells and surface tributaries tested with qPCR have shown enteric influences shortly after rain events.

Isolation distances are important to both proper processing and transmissibility. Emerging intense rain events compromise both in a number of ways:

1) High lake levels invade both old precode and post code septics, short circuiting their processing capability and connecting them to ground water and water bodies.

2) Intense rains accumulate and raise ground water levels in areas adjacent to slopes shedding unprecedented quantities of storm water runoff. Clusters of homes with basements and crawl spaces constructed responsibly to code under past conditions are now experiencing flooding. So are their septics.

3) Concerning qPCR positives have been measured

where no structures exist, save for ridge line located structures 1/4 of a mile distant from the point of detection.

Both rapid ground water transmission and intense weather caused abnormally elevated water tables change past isolation situations, thus contaminant transmissibility effecting lake and non lake properties.

These facts speak to the thoughtfulness and priority that need to be attached to the septic issue. With electronic records we can now establish how many structures have pre code installations that could be problematic. With new technologies we can establish how many septic systems may be subject to high water level caused mal function and unwanted transmission. There are early steps toward safety and prevention that can be taken now, Point of Transfer being one. But consider that limiting steps to lake properties may be shortsighted of the above findings. And, in light of technologies that can and will be utilized to accurately characterize unwanted septic product transmission, deployment of Point Of Transfer is to be considered Phase 1 of future options for accelerated and increased safety to be justified by ongoing research.
