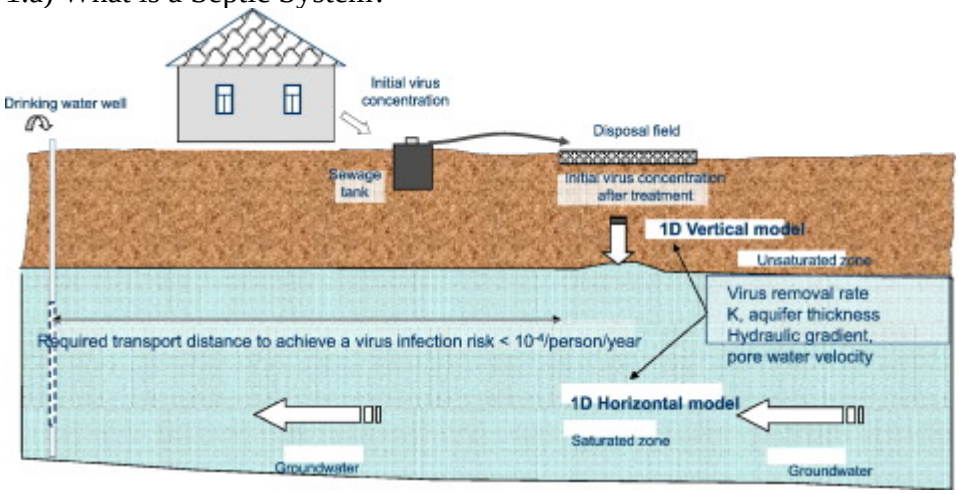
Proposed Agenda for Septic Workshop

1. What is a septic system, what will it do and won't do, and how to maintain.
    a) Design
    b) Remove contaminates and pathogens
    c) Won't remove most chemicals or toxins
    d) Maintenance
2. What is the Health Departmant tasked to do.
    a) Enforce State Law
    b) Pass and enforce local laws
3. When and how do septic **public** health problems actually occur (as documented).
    a) When are pathogens **not** removed.
        i. Isolation distances
        ii. State vs Local Regulations
4. Possible regulation options.
    a) No Action.
    b) Water Testing
        i. Cultures
        ii. qPCR
    c) Time of Sale Inspection.
    d) Mandatory Pumping.
    e) Mandatory Inspection.
    f) Mandatory Reporting
    g) Overlay District.
5. Proposed Action

1.a) What is a Septic System?



Septic systems are underground wastewater treatment structures, commonly used in rural areas without centralized sewer systems. They use a combination of nature and proven technology to treat wastewater from household plumbing produced by bathrooms, kitchen drains, and laundry.

A typical septic system consists of a septic tank and a drainfield, or soil absorption field. The sizes of the septic tank and drain field are based upon the size of the potential amount of wastewater from the house.

The septic tank digests organic matter and separates floatable matter (e.g., oils and grease) and solids from the wastewater. Soil-based systems discharge the liquid (known as effluent) from the septic tank into a series of perforated pipes buried in a leach field, chambers, or other special units designed to slowly release the effluent into the soil.

Alternative systems use pumps or gravity to help septic tank effluent trickle through sand, organic matter (e.g., peat and sawdust), constructed wetlands, or other media to remove or neutralize pollutants like disease-causing pathogens, nitrogen, phosphorus, and other contaminants. Some alternative systems are designed to evaporate wastewater or disinfect it before it is discharged to the soil.

https://www.epa.gov/septic/how-your-septic-system-works

1.b) Contaminates and Pathogen Removal

While some filtering and bacterial breakdown occurs within the septic tank, the final treatment of the septic tank effluent occurs within the drain field. The drain field must be properly designed in order to effectively remove contaminates and pathogens. This design is primarily determined by size (determined by expected wastewater volume), separation from unsaturated soils (typically 2-4 ft), and the permeability of the area soil (determined by site testing).

"3.2.1 Wastewater Treatment and Disposal by Soil

The soil is capable of treating organic materials, inorganic substances, and pathogens in wastewater by acting as a filter, exchanger, adsorber, and a surface on which many chemical and biochemical processes may occur. The combination of these processes acting on the wastewater as it passes through the soil produces a water of acceptable quality for discharge into the groundwater under the proper conditions. Physical entrapment of particulate matter in the wastewater may be responsible for much of the treatment provided by soil. This process performs best when the soil is unsaturated. If saturated soil conditions prevail, the wastewater flows through the larger pores and receives minimal treatment. However, if the soil is kept unsaturated by restricting the wastewater flow into the soil, filtration is enhanced because the wastewater is forced to flow through the smaller pores of the soil.

Because most soil particles and organic matter are negatively charged, they attract and hold positively charged wastewater components and repel those of like charge. The total charge on the surfaces of the soil system is called the cation exchange capacity, and is a good measure of the soil's ability to retain wastewater components. **The charged sites in the soil are able to sorb bacteria, viruses, ammonium, nitrogen, and phosphorus, the principal wastewater constituents of concern.** The retention of bacteria and viruses allows time for their die-off or destruction by other processes, such as predation by other soil micro organisms (1)(2). Ammonium ions can be adsorbed onto clay particles. Where anaerobic conditions prevail, the ammonium ions may be retained on the particles. If oxygen is present, bacteria can quickly nitrify the ammonium to nitrate which is soluble and is easily leached to the groundwater. Phosphorus, on the other hand, is quickly chemisorbed onto mineral surfaces of the soil, and as the concentration of phosphorus increases with time, precipitates may form with the iron, aluminum, or calcium naturally present in most soils. Therefore, the movement of phosphorus through most soils is very slow (1)(2).

Numerous studies have shown that 2 ft to 4 ft (0.6 to 1.2 m) of unsaturated soil is sufficient to remove bacteria and viruses to acceptable levels and nearly all phosphorus (1)(2). The needed depth is determined by the permeability of the soil. Soils with rapid permeabilities may require greater unsaturated depths below the infi1trative surface than soi1s with slow permeabi1itiers."

Design Manual: Onsite Wastewater Treatment and Disposal Systems, EPA 625/1-80-012
https://www.epa.gov/sites/production/files/2015-06/documents/septic_1980_osdm_all.pdf

1.c) Won't Remove Most Chemicals or Toxins

Don't put any types of chemicals or medications down any drain or toilet. Only wash water (sinks, baths, showers, washing machines), toilet paper (septic tank compatible - **no wipes**) and human waste should go into a septic tank. Most chemicals and medications are not filtered or broken down by a septic system, and end up in the groundwater. **Septic systems are not trash cans.**

"Your septic system is not a trash can. An easy rule of thumb: Do not flush anything besides human waste and toilet paper. Never flush:

- Cooking grease or oil
- Non-flushable wipes, such as baby wipes or other wet wipes
- Photographic solutions
- Feminine hygiene products
- Condoms
- Dental floss
- Diapers
- Cigarette butts
- Coffee grounds
- Cat litter
- Paper towels
- Pharmaceuticals
- Household chemicals like gasoline, oil, pesticides, antifreeze, and paint or paint thinners

Think at the sink!

Your septic system contains a collection of living organisms that digest and treat household waste. Pouring toxins down your drain can kill these organisms and harm your septic system. Whether you are at the kitchen sink, bathtub, or utility sink:

- Avoid chemical drain openers for a clogged drain. Instead, use boiling water or a drain snake.
- Never pour cooking oil or grease down the drain.
- Never pour oil-based paints, solvents, or large volumes of toxic cleaners down the drain. Even latex paint waste should be minimized.
- Eliminate or limit the use of a garbage disposal. This will significantly reduce the amount of fats, grease, and solids that enter your septic tank and ultimately clog its drainfield."

https://www.epa.gov/septic/how-care-your-septic-system

1. d) Maintenance

A septic system requires maintenance, including pumping the septic tank to remove scum and settled solids (preventing them from entering the drain field and plugging it up), and helping to keep the drain field clear and efficient.

“Inspect and Pump Frequently

The average household septic system should be inspected at least every three years by a septic service professional. Household septic tanks are typically pumped every three to five years. Alternative systems with electrical float switches, pumps, or mechanical components should be inspected more often, generally once a year. A service contract is important since alternative systems have mechanized parts.

Four major factors influence the frequency of septic pumping:

- Household size
- Total wastewater generated
- Volume of solids in wastewater
- Septic tank size

Maintain Your Drainfield

Your drainfield—a component of your septic system that removes contaminants from the liquid that emerges from your septic tank—is an important part of your septic system. Here are a few things you should do to maintain it:

- **Parking:** Never park or drive on your drainfield.
- **Planting:** Plant trees the appropriate distance from your drainfield to keep roots from growing into your septic system. A septic service professional can advise you of the proper distance, depending on your septic tank and landscape.
- **Placing:** Keep roof drains, sump pumps, and other rainwater drainage systems away from your drainfield area. Excess water slows down or stops the wastewater treatment process.”

https://www.epa.gov/septic/how-care-your-septic-system

2. a) What is the Health Dept. Tasked to do?

The Health Department is required to both control existing health hazards and prevent future ones. This includes taking action to prevent foreseeable significant risks or diseases. Michigan law provides the authorization to take required actions, with County Board of Commissioner approval for local regulations.

The Benzie Leelanau District Health Department (BLDHD) is authorized under the Public Health Code, **Act 368 of 1978.**

Sec. 2433.(1) A local health department **shall** continually and diligently endeavor to prevent disease, prolong life, and promote the public health through organized programs, including prevention and control of environmental health hazards; prevention and control of diseases; prevention and control of health problems of particularly vulnerable population groups; development of health care facilities and health services delivery systems; and regulation of health care facilities and health services delivery systems to the extent provided by law (bold emphasis added).

Sec. 2441.A local health department may adopt regulations necessary or appropriate to implement or carry out the duties or functions vested by law in the local health department. The regulations shall be approved or disapproved by the local governing entity. The regulations shall become effective 45 days after approval by the local health department's governing entity or at a time specified by the local health department's governing entity. The regulations shall be at least as stringent as the standard established by state law applicable to the same or similar subject matter. Regulations of a local health department supersede inconsistent or conflicting local ordinances.

Sec. 2442.Before adoption of a regulation the local health department shall give notice of a public hearing and offer any person an opportunity to present data, views, and arguments. The notice shall be given not less than 10 days before the public hearing and not less than 20 days before adoption of the regulation. The notice shall include the time and place of the public hearing and a statement of the terms or substance of the proposed regulation or a description of the subjects and issues involved and the proposed effective date of the regulation. The notice shall be published in a manner calculated to give notice to persons likely to be affected by the proposed regulation. Methods which may be employed, depending on the circumstances, include publication of the notice in a newspaper of general circulation in the jurisdiction, or when appropriate, in a trade, industry, governmental, or professional publication.

Sec. 2444.(1) A local governing entity, or in case of a district the district board of health, may fix and require the payment of fees for services authorized or required to be performed by the local health department. The local governing entity or district board may revoke, increase, or amend the fees. The fees charged shall not be more than the reasonable cost of performing the service.

Sec. 2446. To assure compliance with laws enforced by a local health department, the local health department may inspect, investigate, or authorize an inspection or investigation to be made of, any matter, thing, premise, place, person, record, vehicle, incident, or event. Sections 2241 to 2247 apply to an inspection or investigation made under this section.

Sec. 2451.1) Upon a determination that an imminent danger to the health or lives of individuals exists in the area served by the local health department, the local health officer immediately shall inform the individuals affected by the imminent danger and issue an order which shall be delivered to a person authorized to avoid, correct, or remove the imminent danger or be posted at or near the

imminent danger. The order shall incorporate the findings of the local health department and require immediate action necessary to avoid, correct, or remove the imminent danger. The order may specify action to be taken or prohibit the presence of individuals in locations or under conditions where the imminent danger exists, except individuals whose presence is necessary to avoid, correct, or remove the imminent danger.

(2) Upon the failure of a person to comply promptly with an order issued under this section, the local health department may petition a circuit or district court having jurisdiction to restrain a condition or practice which the local health officer determines causes the imminent danger or to require action to avoid, correct, or remove the imminent danger.

(3) As used in this section:
(a) "Imminent danger" means a condition or practice which could reasonably be expected to cause death, disease, or serious physical harm immediately or before the imminence of the danger can be eliminated through enforcement procedures otherwise provided.
(b) "Person" means a person as defined in section 1106 or a governmental entity.

Sec. 2455.1) A local health department or the department may issue an order to avoid, correct, or remove, at the owner's expense, a building or condition which violates health laws or which the local health officer or director reasonably believes to be a nuisance, unsanitary condition, or cause of illness.

(2) If the owner or occupant does not comply with the order, the local health department or department may cause the violation, nuisance, unsanitary condition, or cause of illness to be removed and may seek a warrant for this purpose. The owner of the premises shall pay the expenses incurred.

(3) If the owner of the premises refuses on demand to pay expenses incurred, the sums paid shall be assessed against the property and shall be collected and treated in the same manner as taxes assessed under the general laws of this state. An occupant or other person who caused or permitted the violation, nuisance, unsanitary condition, or cause of illness to exist is liable to the owner of the premises for the amount paid by the owner or assessed against the property which amount shall be recoverable in an action.

(4) A court, upon a finding that a violation or nuisance may be injurious to the public health, may order the removal, abatement, or destruction of the violation or nuisance at the expense of the defendant, under the direction of the local health department where the violation or nuisance is found. The form of the warrant to the sheriff or other law enforcement officer may be varied accordingly.

(5) This section does not affect powers otherwise granted to local governments

Sec. 2461.(1) In the manner prescribed in sections 2441 and 2442 a local governing entity may adopt a schedule of monetary civil penalties of not more than $1,000.00 for each violation or day that the violation continues which may be assessed for a specified violation of this code or a rule promulgated, regulation adopted, or order issued which the local health department has the authority and duty to enforce.

(2) If a local health department representative believes that a person has violated this code or a rule promulgated, regulation adopted, or order issued under this code which the local health department has the authority and duty to enforce, the representative may issue a citation at that time or not later

than 90 days after discovery of the alleged violation. The citation shall be written and shall state with particularity the nature of the violation, including reference to the section, rule, order, or regulation alleged to have been violated, the civil penalty established for the violation, if any, and the right to appeal the citation pursuant to section 2462. The citation shall be delivered or sent by registered mail to the alleged violator.

Sec. 2462.1) Not later than 20 days after receipt of the citation, the alleged violator may petition the local health department for an administrative hearing which shall be held within 30 days after the receipt of the petition. After the administrative hearing, the local health officer may affirm, dismiss, or modify the citation. The decision of the local health officer shall be final, unless within 60 days of the decision the appropriate local governing entity or committee thereof, or in the case of a district department, the district board of health or committee thereof, grants review of the citation. After the review, the local governing entity, board of health, or committee thereof may affirm, dismiss, or modify the citation.

(2) A person aggrieved by a decision of a local health officer, local governing entity, or board of health under this section may petition the circuit court of the county in which the principal office of the local health department is located for review. The petition shall be filed not later than 60 days following receipt of the final decision.

(3) A civil penalty becomes final if a petition for an administrative hearing or review is not received within the time specified in this section. A civil penalty imposed under this part is payable to the appropriate local health department for deposit with the general funds of the local governing entity, or in case of a district, the funds shall be divided according to the formula used to divide other district funds. A civil penalty may be recovered in a civil action brought in the county in which the violation occurred or the defendant resides.

3. When and how do public health problems with Septic Systems occur (as documented)?

There are few recent documented examples (even at the national level) of septic systems causing health problems. The impetus for septic system (and larger sewage systems) regulation is really grounded in history. There are many historical examples of epidemics caused by poor sanitation (such as typhoid, cholera,polio,hepatitis), and it is generally accepted that the advent and implementation of modern sanitation and drinking water standards has saved more lives than any other medical advance in modern times (including antibiotics, medical doctor training, and hospital improvements - combined. In many respects, Public Health officials are victims of their own success in that they have been very successful in preventing diseases caused by poor sanitation, so there are few negative examples to reference. They are, however, the true unsung heroes in preventing disease. All modern disease cases associated with drinking water contamination (including problems from septic system contamination) are required to be reported to both the State Health Department as well as the CDC at the federal level (Surveillance for Waterborne Disease Outbreaks Associated with Drinking Water). Review of these reports reveal that the most common water-borne disease (and all deaths) is Legionarres Disease (not caused by septic systems). The most common water-borne illness isn’t even a disease - it’s swimmer’s itch (also not caused by septic systems). There was only one modern case found in the CDC records (non-Michigan) for a septic system contamination of a nearby well causing illness (due to improper drain field construction in a limestone formation resulting in rapid transport of contaminated effluent). There were several historical Michigan cases from 1945 (two), 1947, 1952, and 1959. Only the 1959 case resulted in any confirmed illnesses (89 cases of infectious hepatitis in Posen, Pres Isle County caused by improper drain field construction in limestone formations). While there has most probably been multiple cases of gastrointestinal

illnesses that are undocumented, the documented cases of septic systems causing illness are rare.All of the modern documented cases were the result of improper drain field construction in areas where there were inadequate separation from geology that enabled rapid transport of contaminated effluent.This occurs in two primary instances:

A. Drain fields improperly constructed directly (without a layer of slow-permeability soils) in limestone formations, and

B. Drain fields improperly constructed with an inadequate layer of slow-permeability soils over or in water saturated soils (below the water table).

While we do not have any shallow limestone formations in the Leelanau area (so it is extremely unlikely that there are any drain fields under instance 1.), there is the very real risk of drain fields in instance 2.

Septic system design utilizes the use of isolation distances to insure that there is adequate time for pathogens to be filtered and neutralized in a drain field before the remaining effluent passes through to groundwater. As documented in the previously cited EPA reports, pathogens are filtered and neutralized within a roughly 4 feet depth of a proper drain field bed. Said another way, while water does travel large distances underground, **PATHOGENS DO NOT** from a properly designed and installed septic system. The Michigan Criteria for Subsurface Sewage Disposal Onsite lists several isolation distances for septic systems. Local regulations may exceed the state requirements and, in the case of Leelanau County, do in the following standards:

Section 2.450 SUB-SURFACE DISPOSAL SYSTEM
The bottom of the disposal system shall not be over 42 inches below the
finished grade (no maximum below finish grade in State regulations). This primarily applies to mound systems.
Section 2.458 PERMIT DENIAL A permit to install an on-site sewage disposal system may be denied for any of the following reasons: b. Where the known high ground water table is encountered within four feet of the natural ground surface. (See exception in 2.458 [G.] for existing systems only) (2 feet in State regulations). This primarily applies to mound systems.

4. Local Regulation Options

A. No Action: As the actual documented instances of Leelanau County septic systems causing illness in the modern era is rare, there is an argument that any additional regulation is unnecessary. If the only requirement were to act to address any existing problems, then this action would be appropriate. But with the requirement to **prevent** disease also being paramount, the question becomes whether additional requirements at the county level are a reasonable action.

B. Additional Testing to determine if local action is required: There are two basic water testing methodologies that could be used to determine if there are water contamination problems, and where they occur.

i) Culturing of contaminates or indicators: this has been the historical methodology. Either actual pathogens (such as ecoli) or indicator bacteria (such as bfragilis or btheta) are sampled from water sources and attempted to be cultured to determine if they are prevalent in the sample and in what concentrations. This has been determined to be the most accurate

methodology and most closely linked to actual pathogens, but suffers from lack of human specificity (that the contamination comes from human sources) and high cost/time.

ii) Quantitative Polymerase Chain Reaction (qPCR) of indicator bacteria: this has been the focus of more recent methodology, as it is much cheaper, faster, and can be more specific to human contamination, but has not been as closely linked to actual pathogens and levels of actual contamination.

qPCR Problems: While there are many new studies and research papers focused on using qPCR to identify contamination in water sources, there are also many documented problems with using this new methodology. These problems primarily result from the fact that qPCR measures DNA markers of indicator bacteria, which means that the bacteria cells must be dead and the DNA separated from the rest of the cell in order for their DNA to be available to be found - as opposed to culturing living cells indicative of the potential to cause live pathogen transfer.

1. **Cultivated B theta compares favorably with actual pathogens as a indicator of fecal pollution, while molecular measurements of B theta do not.**

GLOBAL WATER PATHOGEN PROJECT ***PART FOUR. MANAGEMENT OF RISK FROM EXCRETA AND WASTEWATER*** ***PERSISTENCE OF PATHOGENS IN SEWAGE AND OTHER WATER TYPES***

Heather Murphy *Temple University* , Philadelphia, United States

See Tables 2 and 5, taking note of cultivated B theta vs molecular measurements as indicated by the footnotes.

2. Molecular testing for various *Bacteroides* DNA markers were strongly found in not only raw human waste, raw sewage, and raw septage, but also in septic effluent, secondary sewage effluent, and final treated sewage effluent, in multiple studies in multiple locations (45 published studies). **DNA markers are found even after proper sewage or septic treatment - and are therefore not indicative of a "failed" system.**

Current Status of Marker Genes of Bacteroides and Related Taxa for Identifying Sewage Pollution in Environmental Waters

Warish Ahmed, Bridie Hughes and Valerie J. Harwood

See tables S1 - S10 in the Suplementary Materials, pages S1-S4

3. "Thus currently qPCR can be used a tool to monitor loading and physical removal or dilution but cannot be used to address viability."

Escherichia coli, enterococci, and Bacteroides thetaiotaomicron qPCR signals through wastewater and septage treatment

Sangeetha Srinivasan, Asli Aslan, Irene Xagoraraki, Evangelyn Alocilj, Joan B. Rose , 2011

See Page 10, paragraph 3. "One key limitation of qPCR methods is the inability to differentiate between live and dead cells and we found signifificant difference between qPCR and cultivable levels of E. coli and enterococci following disinfection (chlorination)."**Note Joan B Rose as contributing author.**

4. Problems with the MSU Study of Michigan Rivers: Linking fecal bacteria in rivers to landscape, geochemical, and hydrologic factors and sources at the basin scale

Marc P. Verhougstraetea, Sherry L. Martin , Anthony D. Kendall , David W. Hyndman , and Joan B. Rose. **Note Joan B Rose as contributing author.**

A. The Study included missleading statements. "Nine rivers (14% of sites) exceeded the US Environmental Protection Agency (USEPA) suggested *E. coli* criterion for safe contact." (pg 2, Study).

The EPA requires states to set the actual Recreational Water Quality Criteria (RWQC) - which may be the EPA suggestion, or the EPA suggestion modified to reflect site-specific conditions and be scientifically defensible. Michigan did modify the EPA suggested criteria, and the EPA approved the actual RWQC set by Michigan at 300 *E coli*/100 ml 30 day Geometric Mean for May 1 - October 31 Total Body Contact, and 1000 E coli/100 ml Partial Body Contact all year. Under the actual RWQC, ALL of the tested rivers in the Study met the actual safety standard.

> B. "A Michigan Health Department reported a 26% on-site wastewater failure rate during time of sale or transfer inspections that discharged an estimated 65,000 gallons of untreated fecal waste each year to nearby water bodies." (pg 3, Study).

The actual Barry/Eaton District Health Department (BEDHD) report, however, does not mention any such 65,000 gallons, nor does the report use the term "untreated fecal waste". Both statements were derived by the MSU Study"s authors. Both the Study and the BEDHD report confuse the terms "sewage", "septage" and "septic tank effluent". Sewage is the wastewater and excrement that flows from a house. Septage is the combined contents of a septic tank. Septic tank effluent is the partially treated, mostly solid-free output from a septic tank which is sent to a distributed treatment system (drain field, drywell, etc) for final treatment and return to the natural environment. The BEDHD report showed an overall 26% of the sites having a "sewage" failure condition, but this % actually included all sewage, septage, and distributed treatment system failures. The BEDHD report did not break down the failures by type of waste being discharged, therefore it can not be determined how much was untreated or partially treated waste. The MSU Study author's misquoted the BEDHD, and perpetuated the confusion of of terms.

> C. "The ratio of average annual WWTP effluent to measured baseflow was calculated using annual averages of WWTP discharge and field measurements: thus values greater than 100% were possible - and any watersheds exceeding 100% were removed from calculations." (Supporting Information pg 1).

The quoted language in the supplemental material is not correct, as admitted by the lead author.

> D. Various other studies have shown sediment allows enteric bacteria to survive for months in an aquatic environment, and that sediment can act as a reservoir for later bacteriological contamination (*Indicator Bacterial Survival in System Sediments - Brett Sherer, et al).*

The last ten years of Combined Sewer Overflow & Sanitary Sewer Overflow Reports by the MI DEQ show an average overflow of 31.9 **billion** gallons per year of untreated or partially treated sewage discharge statewide. Despite this massive loading of bacteria by WWTPs, and the retention of bacteria in sediment acting as a sink or bank for recontamination, the MSU Study's authors admit that this reservoir action was not taken into account.

> E. "Effects of wastewater treatment plant (WWTP) effluent on microbial water quality were examined using multiple approaches (see Supporting Information for details), and it was ultimately determined that WWTP were not a driving factor of microbial water quality in the studied watersheds. Future analysis of the seasonal efficacy of WWTP could improve the understanding of wastewater impact on water quality by quantifying effluent discharge contributions in key urban areas."

Unfortunately, the Study's authors either didn't know or chose to ignore that WWTPs are already required to report to the MDEQ all known leaks and overflows. As stated in item D. above, the last ten years of these reports show an average of 31.9 **billion** gallons per year of untreated or only partially treated sewage discharged to the environment statewide. In the the BEDHD 10 year Report referenced in the MSU Study, the statewide discharge from septic systems with operational problems is **estimated** at 11.3 billion gallons per year -- compared with the **documented** 31.9 billion gallons per year of WWTP overflow (this is just the documented amounts, with the unreported leaks and discharges from leaky sewer pipes (exfiltration) has been estimated at between 11% and 25% of total sewage volume [https://www.mswmag.com/online_exclusives/2019/04/sewer-exfiltration-the-leaking-enemy_sc_00125], so

the actual WWTP environmental impact is no doubt even higher). Based on the documented WWTP overflow amounts, the Study conclusion that WWTPs were not a driving factor of microbial water quality, based solely on statistical analysis, is highly questionable.

F. "Previous studies from Michigan demonstrated that B. theta concentrations in untreated sewage averaged 7.2 log10 CE/100 mL and were reduced by 3.1 logs through secondary treatment before discharge (66)". *Supporting Information*, at the end of the third paragraph

This citation (66) is shown in the footnotes as refering to "66. Hamilton SK, Bruesewitz DA, Horst GP, Weed DB, Sarnelle O (2009) Biogenic calcite–phosphorus precipitation as a negative feedback to lake eutrophication. Can J Fish Aquat Sci 66(2):343–350." Unfortunately, this reference has nothing to do with Btheta or sewage. This was an error in the footnotes.

Overall, I was personally disappointed in the robustness and completeness of the MSU Study.

C. Time of Sale (TOS) Inspection Ordinance: This option has been used in other counties, and is currently in use by some townships in the County. This option requires inspection of properties when they are sold. Problems identified are as follows:

i) Only properties sold are inspected. It takes a long time (if ever) to inspect all suspected problem properties.

ii) It is expensive. All properties being sold are inspected, even those at low risk of being a public health risk.

iii) It delays sales. It takes time to schedule, complete, and document inspections.

iv) It undermines confidence in government. Because of it's questionable cost benefit, even some locations that have used it have canceled participation.

D . Mandatory Pumping: This option sets a schedule in which all properties with septics must be pumped. This requires pumping when it may not be needed, and therefore is an expensive one-size-fits-all approach that is a hard sell to homeowners.

E. Mandatory Inspections: This option requires properties to be inspected on a set interval. Problems include inspecting properties at low risk of a public health risk, thereby increasing costs overall for all homeowners.

F. Mandatory Reporting of Maintenance: This option requires reporting of any maintenance on septic systems, such as pumping or inspections, but doesn't require them to be done.

G. Overlay Districts: This is an area restricting option, which only requires one of the above options to be implemented within a specified area, rather than a whole governmental unit (such as is used in zoning).

5 . Proposed Option: This is my personal recommendation: While there is no documented health problems with septic systems in Leelanau County, the prevention of potential problems is a valid public health concern. But because there is no documented septic problems, it is reasonable to limit any action only to those septic systems where the risk of a public health problem is highest. Based on where those rare septic contamination problems HAVE occurred, this would be areas with the likelihood of rapid transfer of pathogens into the environment -- which in Leelanau means saturated soils (below the water table). I would propose a combination of some of the above sections of item 5. I would propose requiring mandatory reporting of all septic maintenance by licensed providers (repairs, pumping and inspections) to the Health Dept. This would provide valuable data for public

health consideration, including any potential problems noted by the maintenance provider, at a very small cost to the Health Dept. and maintenance providers. I would also require mandatory inspection of properties on a schedule of every 5-7 years, but only those properties whose home is located within a specified distance of a lake or stream (100 feet?). These could be identified by GIS review of properties to identify those within the specified distance of a lake or stream, and then having the mandatory inspection performed and reported to the Health Dept. by the same providers currently authorized under the TOS ordinances. This limits the inspections to only those most a risk of causing a public health problem. The homeowners would be required to pay for these inspections. Because any problem systems identified would require usually expensive repairs, I would revise the current Leelanau County Environmental Health Regulations to have the mound system requirements be no more strict than the state requirements. This would allow mound systems to be built anywhere there is at least 2 feet of existing soil above the water table, and allow enough proper fill to insure a 4 foot vertical isolation distance above the water table. I would also specifically allow both composting and incinerating systems (which discharge NOTHING into the home's ground water), in addition to any Alternative Systems approved by the Health Department. Both of these options would provide cheaper options to homeowners facing expensive repairs to deficient systems found by the new regulations. While I realize that this proposal would not satisfy everyone, it does move us in the right direction. I would suggest that this proposal be implemented as a pilot program, with a review annually for a two year period. I freely admit to stealing many of these ideas from the Tip Of The Mitt Watershed Council
(https://www.watershedcouncil.org/uploads/7/2/5/1/7251350/the_septic_question_report-final-web2_5.pdf). I look forward to a open discussion of this proposal. I apologize for the length of this document. Tony Ansorge