Lake Charlevoix Septic Study

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Acknowledgements

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Additional thanks goes to Central Michigan University and the Health Department of Northwest Michigan for analyzing project samples and for aquatic nutrient expertise.

CHARLEVOIX COUNTY COMMUNITY FOUNDATION

Giving Back. Moving Forward.

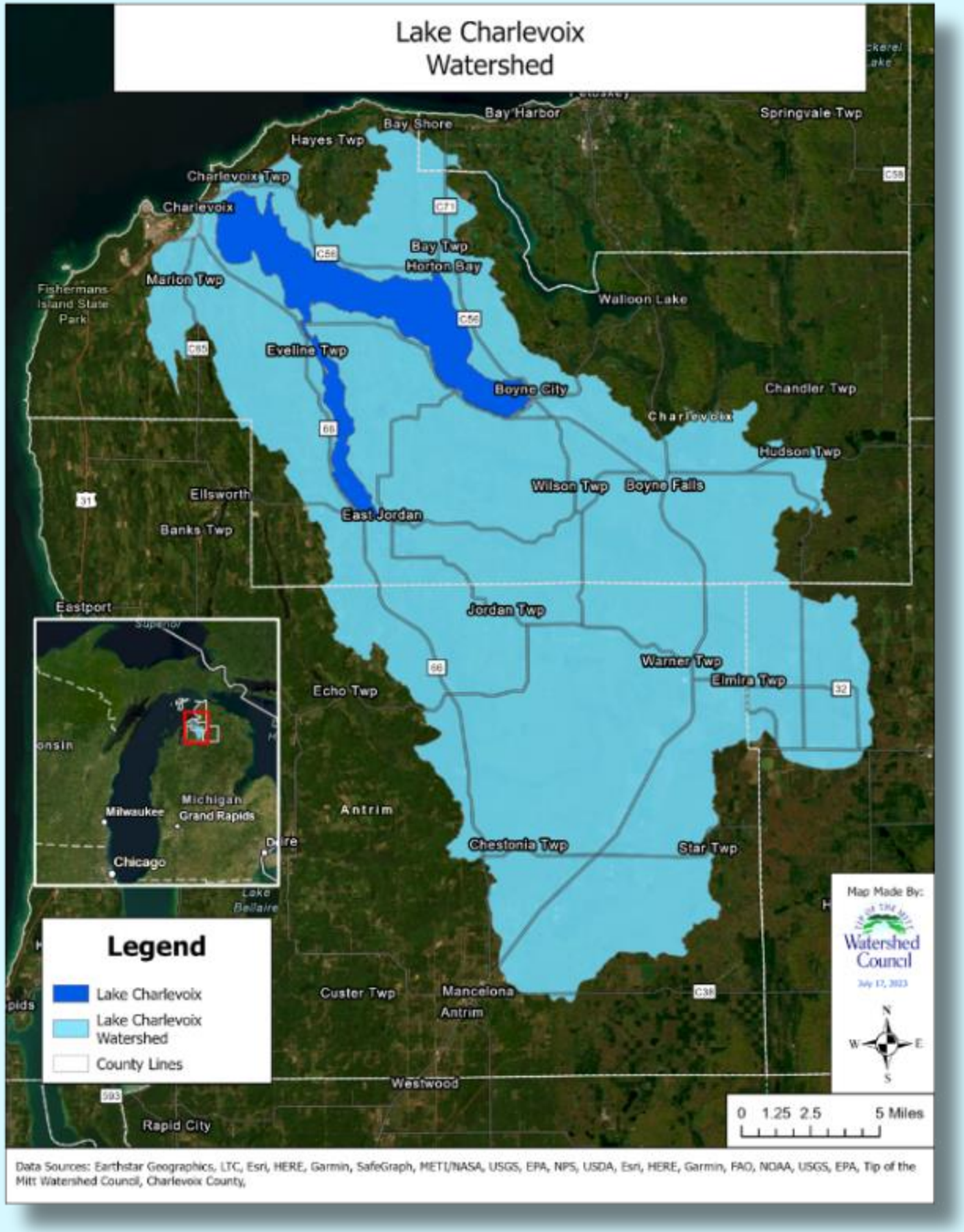
Lake Charlevoix LCA Association

HEALTH DEPARTMENT of Northwest Michigan

CMU CENTRAL MICHIGAN UNIVERSITY

Study Area

- Surface area of **17,200** acres and a shoreline length of **60 miles**
- **Third largest** inland lake in Michigan
- Watershed collects from **214,400 acres** in Northern Michigan
- Land cover is predominantly (over 50%) **forest**
- Deepest area of Lake Charlevoix reaches **122 feet**



Methodology: Septic Survey

- 500 letters announcing septic survey sent to Lake Charlevoix property owners (using Lake Association mailing list)
- 15% response rate received
- Topics included:
    - Shoreline structure
    - Erosion
    - Aquatic plants
    - Filamentous algae
    - Septic tank pumping/age/composition

Methodology: Field Data

- **Priority parcels** identified based on the following:
    - Cladophora
    - Health department priority areas
    - Local knowledge
        - Not representative of total in-lake conditions

- 984 priority parcels identified, 431 surveyed for conductivity (44%)

- Probe measured **basic aquatic parameters** (temp, DO, pH, depth)

- **Conductivity > ~300 uS/cm** triggered collection of nutrients

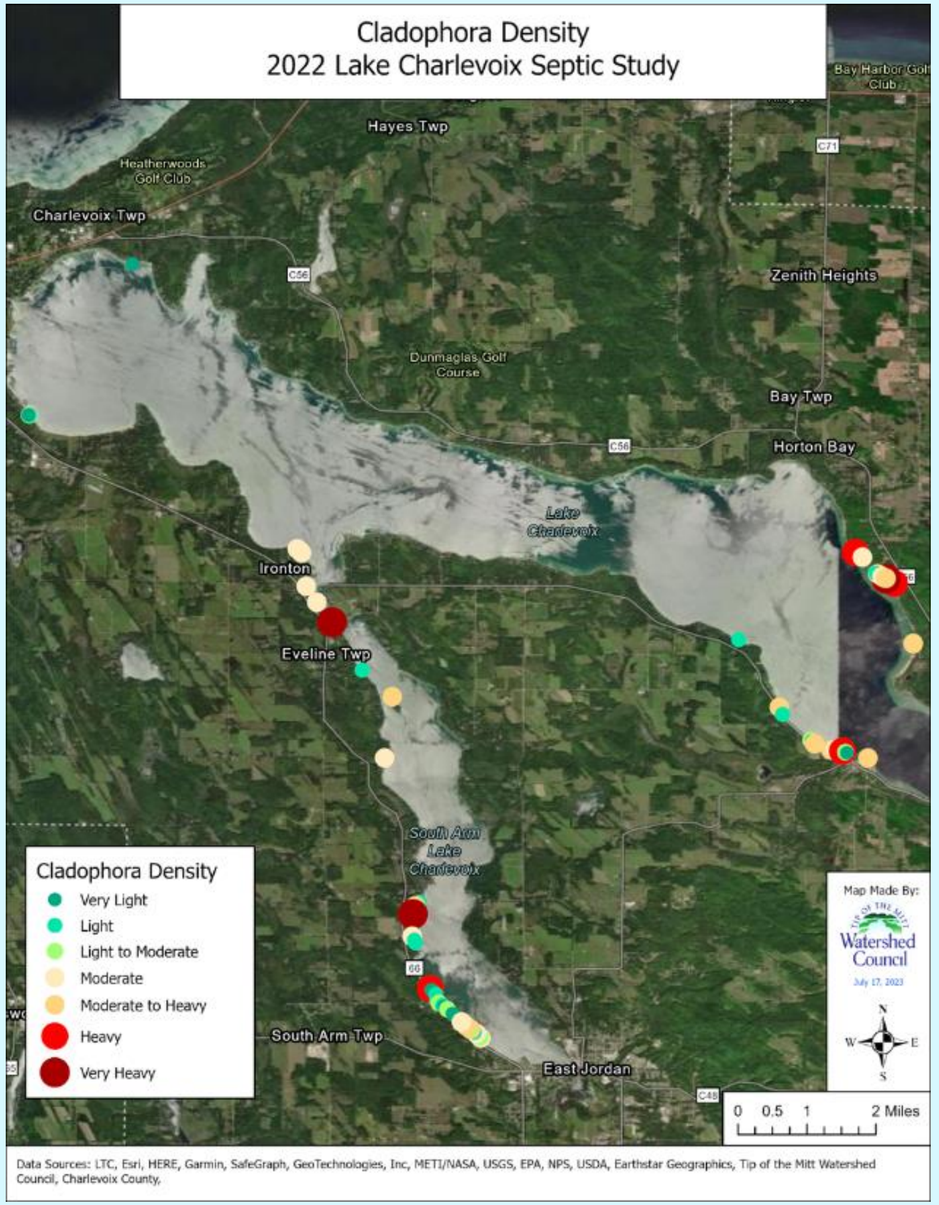
Methodology: Field Data

- On-Site Sampling Collection:
  - Soil Conductivity
  - Surface Water Conductivity
  - Groundwater Conductivity
  - Surface Water Nutrients and E. coli
  - Groundwater Nutrients and E. coli

qPCR analysis not completed for E. coli samples

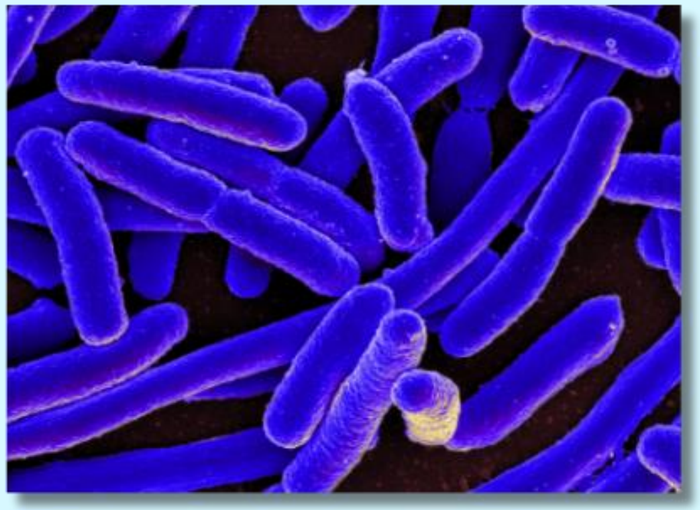
Results: Cladophora

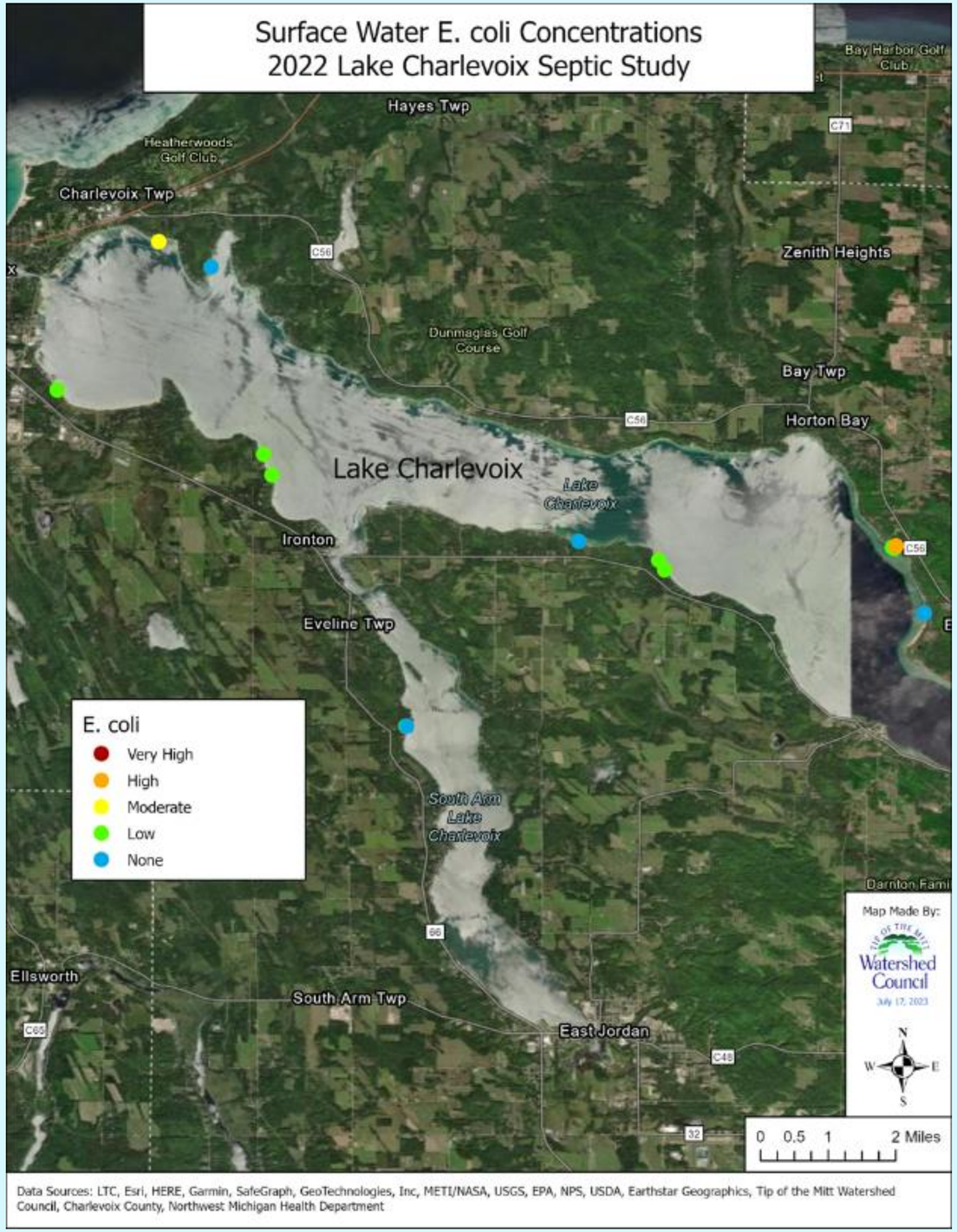
- 76.3% of parcels surveyed showed no signs of Cladophora growth



Results: Surface Water E. coli

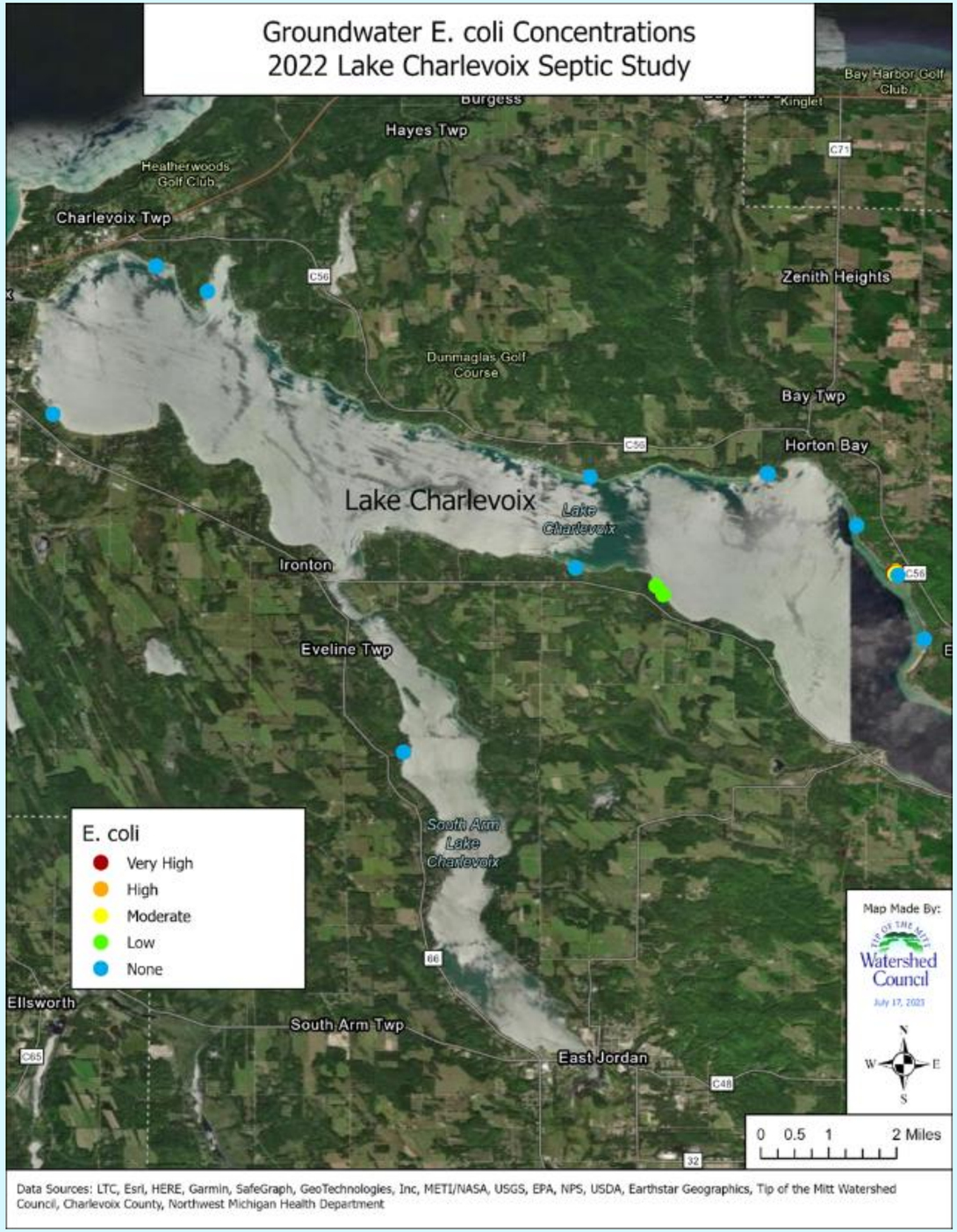
- 73.3% of parcels surveyed for E. coli were recorded as having bacteria present





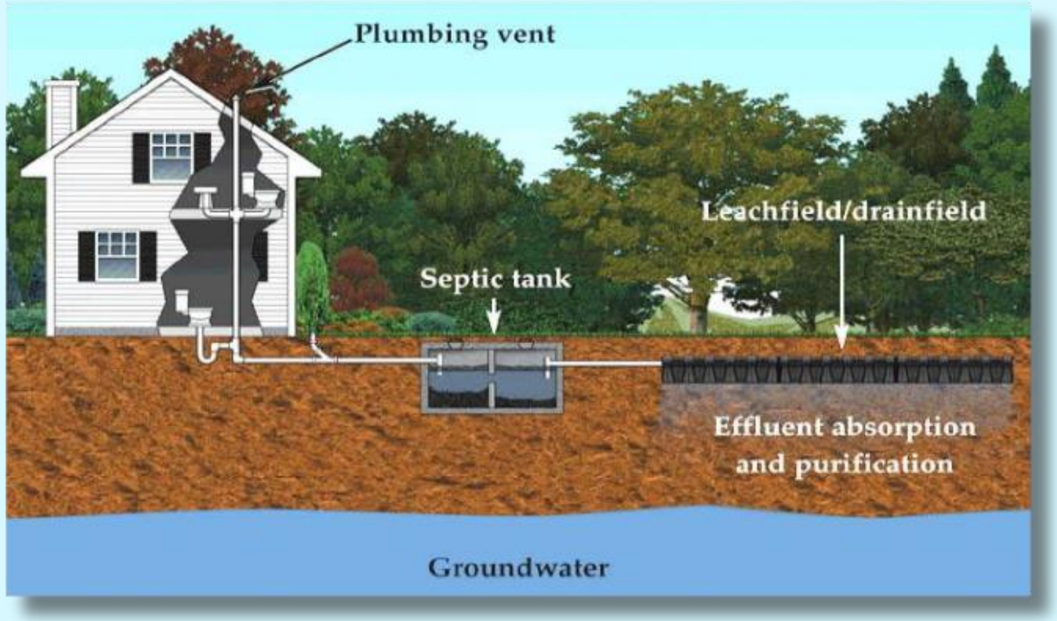
Results: Groundwater E. coli

- 61.1% of parcels did not have E. coli present
- 11.2% of parcels had ‘high’ or ‘very high’ levels of E. coli



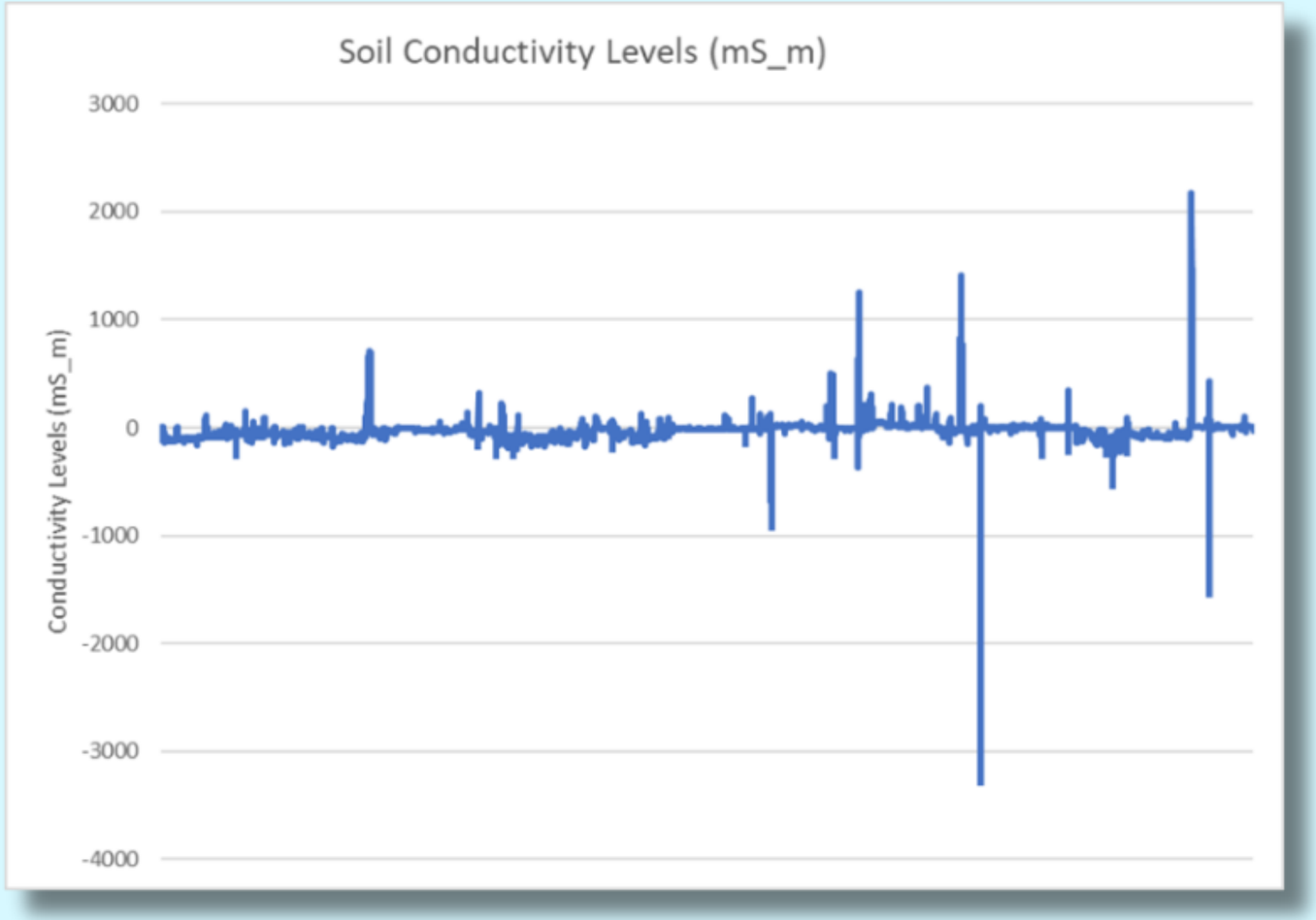
Results: Nutrients

- Nutrients sampled **= Total Phosphorus (TP) and Total Nitrogen (TN)**
  - **Nitrogen** = all samples were ABOVE the recommended threshold
  - **Phosphorus** = 76% of samples were BELOW the recommended threshold
  - Many samples with elevated TN and TP concentrations were from **groundwater samples**



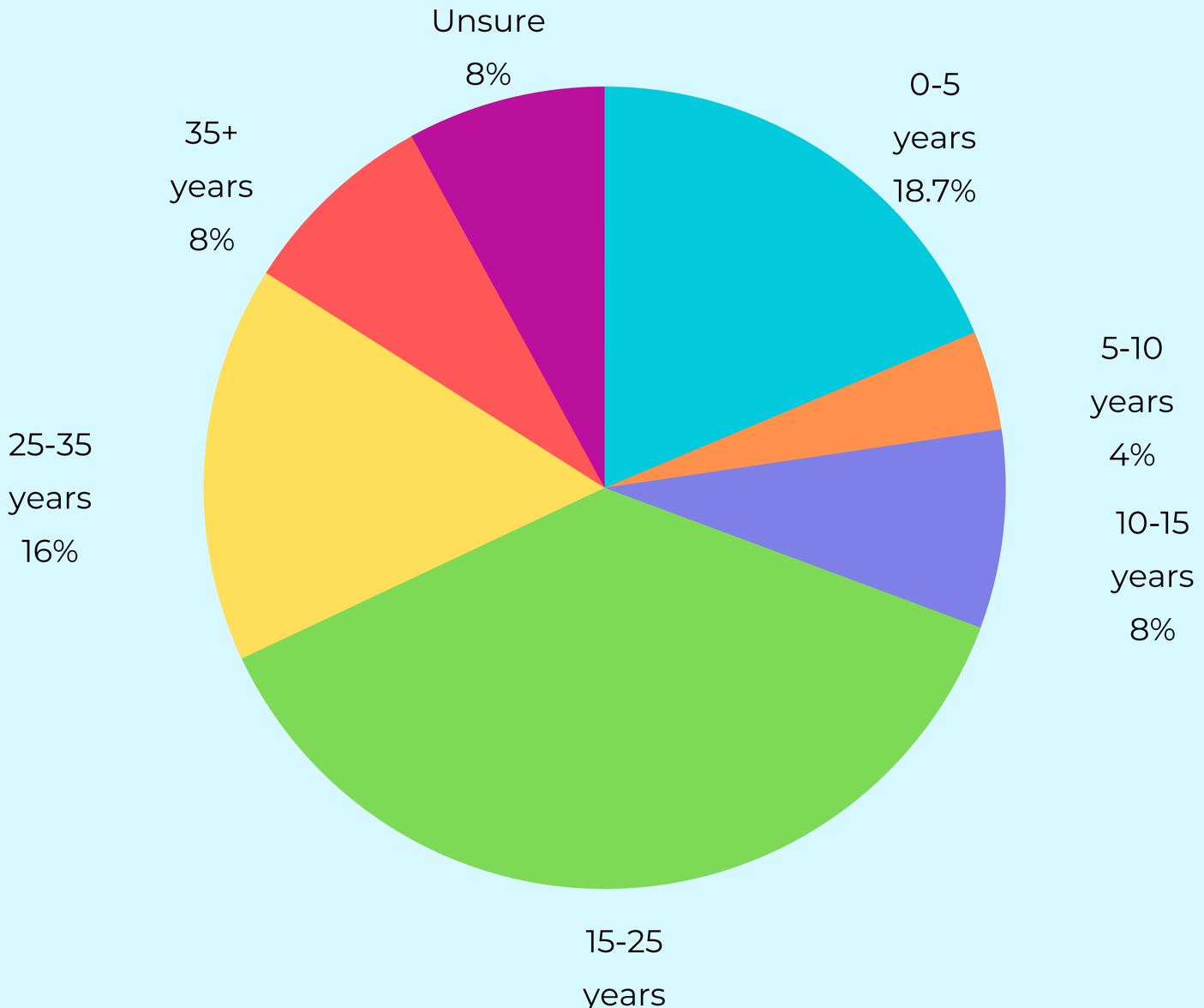
Results: Soil Conductivity

- Wide range of conductivity values
- Ranging from around **-3300 ms_m to almost 2200 mS_m** (milliSiemens/meter)



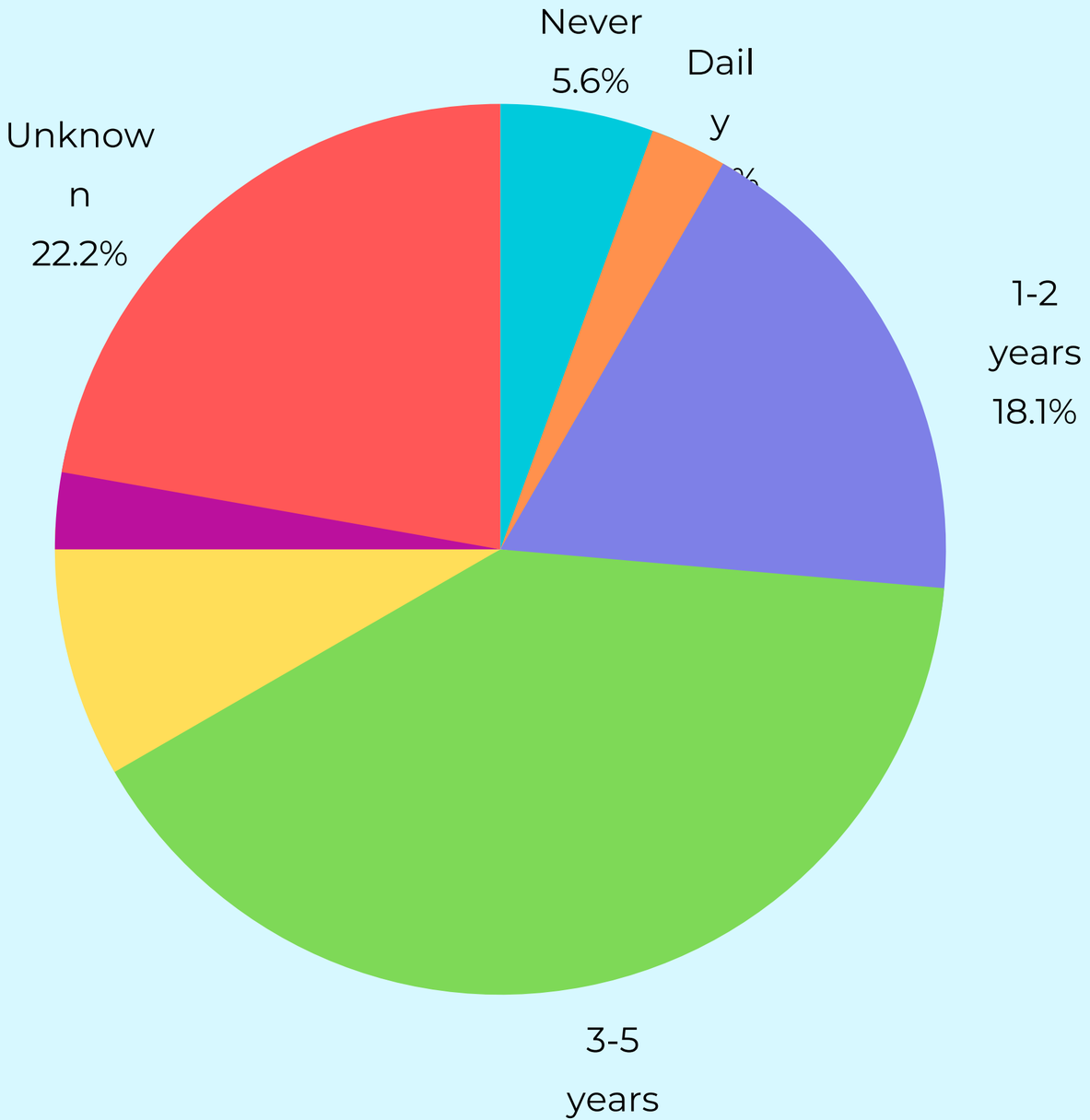
Results: Septic Survey

- Septic systems range from 0-5 years old (37%) all the way to 35+ years old (8%)
- Many systems had issues, such as **root infiltration, replacement part needed, pumping needed**



Results: Septic Survey

- **40% of property owners** pumped their septic tanks within the recommended number of years (3-5)
- BUT, pump times ranged from never pumped (6%) to every 10+ years (3%)
- Over 1/5 of property owners (22%) had **no knowledge of how often their septic tank was pumped**



Discussion: Septic Survey

While many homeowners are practicing proper septic maintenance, there is a large portion of homeowners failing to follow recommendations

- Costly to the owner
- Plethora of environmental issues
    - Groundwater contamination
    - Human pathogen exposure
    - Nutrient influx to ecosystems
- Drainfields
    - Pollutant contribution
    - No livestock, cars, plant roots

Discussion: Cladophora

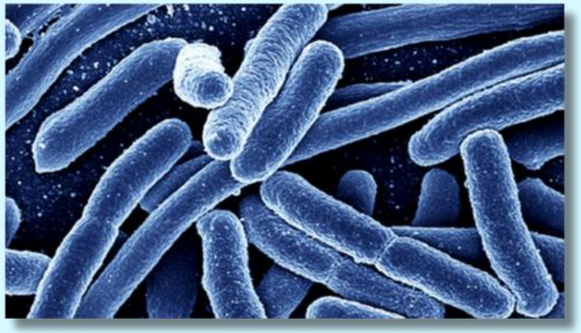
- **Decline in general growth** when compared to 2018 shoreline survey
    - Could be due to results of survey and subsequent septic care
    - Doesn’t necessarily mean no septic contamination occurring

Discussion: E. coli

- 73.3% **of surface water samples had fecal contamination**

- Septic effluent can contain significant amounts of E. coli

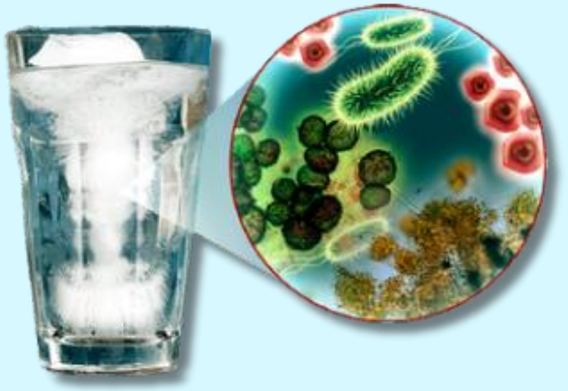
    - Can **contaminate waterbodies** if the tank/drainfield soil is not treating wastewater properly
    - Growth of bacteria within tanks with **warmer temperatures**



BUT….!

- Only **2 samples were above the EPA recommended maximum** →

    - If septic malfunction was occurring, then it was likely only at a few select properties on Lake Charlevoix



Discussion: Total Nitrogen

- At parcels sampled, Lake Charlevoix is [illegible] in the form of **nitrogen-heavy waters**
- Conventional septic systems are **not effective in removing all nitrogen species from wastewater**
    - Cultural eutrophication and decreased water quality
        - Unsafe drinking water
        - Threats to human health and aquatic ecosystem stability

Discussion: Soil Conductivity

- **Wide range** of soil conductivity values
  - Septic leachate absorbed into surrounding soils
  - Hydraulic conductivity impacting drainfield ability to treat septic effluent
  - Varying ecological conditions impacting chloride levels

What Can We Definitively Conclude?

- Improper care of septic tank systems is occurring in a portion of Lake Charlevoix properties
- Many of these properties experience problems with their septic systems due to improper maintenance
- Nutrient pollution and fecal contamination are occurring in select parcels, BUT…

Septic malfunction cannot be determined without further data collection and on-site inspection from a professional!

What Are The Next Steps?

- **Education/outreach** to homeowners and prospective buyers regarding i**nspections** and proper maintenance
- Identify properties with **no/outdated permits** through MDHHS
- **Long-term septic monitoring** program to track WQ changes
- Adopt local ordinances/promote adoption of a **statewide septic code**
- Identify potential property owners that may need funding for **system replacement**

Additional sampling and qPCR analysis for 18 properties with E. coli above 100 cfu/100 mL

Potential sampling of 553 remaining priority properties for nutrients, bacteria, or other parameters

Questions?

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