



SARS-CoV-2 wastewater monitoring: Ohio Coronavirus Wastewater Monitoring Network

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US Environmental Protection Agency
Office of Research and Development

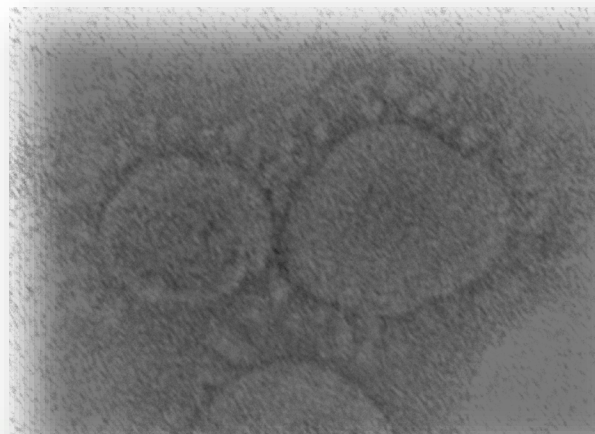
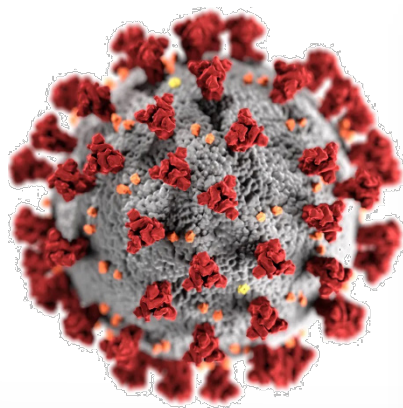


Photo Credit: CDC Public Health Image Library





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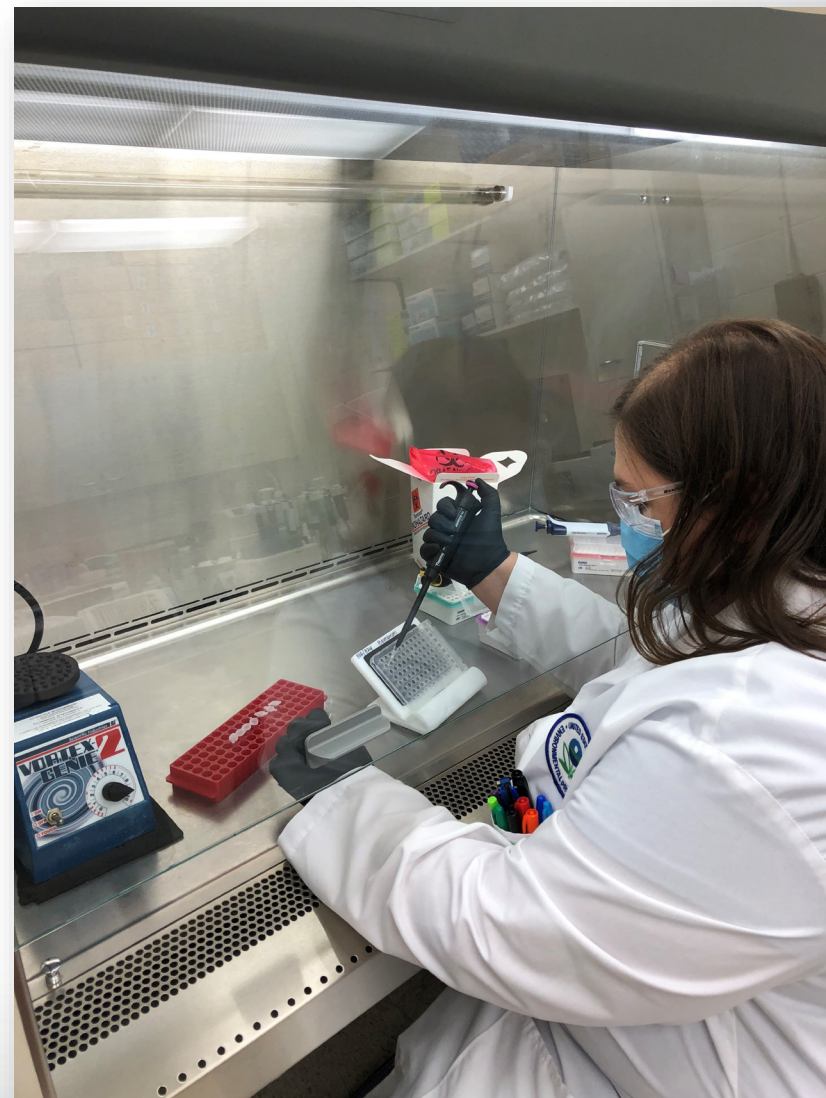
Ohio State University

University of Toledo

Kent State University

University of Akron

- **Ohio Coronavirus Wastewater Monitoring Network**
- **USEPA/ORD analytical method assessment**
- **Temporal trends of SARS-CoV-2 in wastewater**
- **Relating wastewater data to community case rates**
- **Public Health Applications**





OH Coronavirus Wastewater Monitoring Network

- Initiated in May by Gov. DeWine
- Coordinated by Ohio Water Resources Center
- Objectives:
 - Coordinate a network of labs to analyze wastewater for SARS-CoV-2 across Ohio
 - Develop standardized procedures for sampling and analyzing wastewater
 - Manage and share data with state agencies and local communities for public health applications
 - Use data to predict community infection rates

The screenshot shows the Ohio Department of Health's Coronavirus (COVID-19) dashboard. The header includes a language translation option, the Ohio Department of Health logo, and a search bar. A navigation bar lists various COVID-19 resources. The main content area features a breadcrumb trail, a title for the COVID-19 Dashboard, and a menu with options like Overview, Current Trends, and Key Metrics. The 'Wastewater Monitoring Network' option is highlighted. Below this, the title 'Ohio Coronavirus Wastewater Monitoring Network' is followed by a descriptive paragraph. At the bottom, logos for the Ohio Department of Health, Ohio Environmental Protection Agency, and Water Resources Center are displayed.

Language Translation

An Official Site of [Ohio.gov](https://ohio.gov)

Ohio | Department of Health

Coronavirus (COVID-19)

Search

Ohio Public Health Advisory System | Responsible RestartOhio | Testing and Community Health Centers | Families and Individuals | Healthcare Providers and Local Health Districts

COVID-19 / Dashboards / Wastewater Monitoring Network / Ohio Coronavirus Wastewater Monitoring N...

COVID-19 Dashboard

Overview | Current Trends | Key Metrics ▼ | Schools and Children ▼ | Long-Term Care Facilities ▼ | Demographics ▼

Wastewater Monitoring Network | Other Resources ▼

Ohio Coronavirus Wastewater Monitoring Network

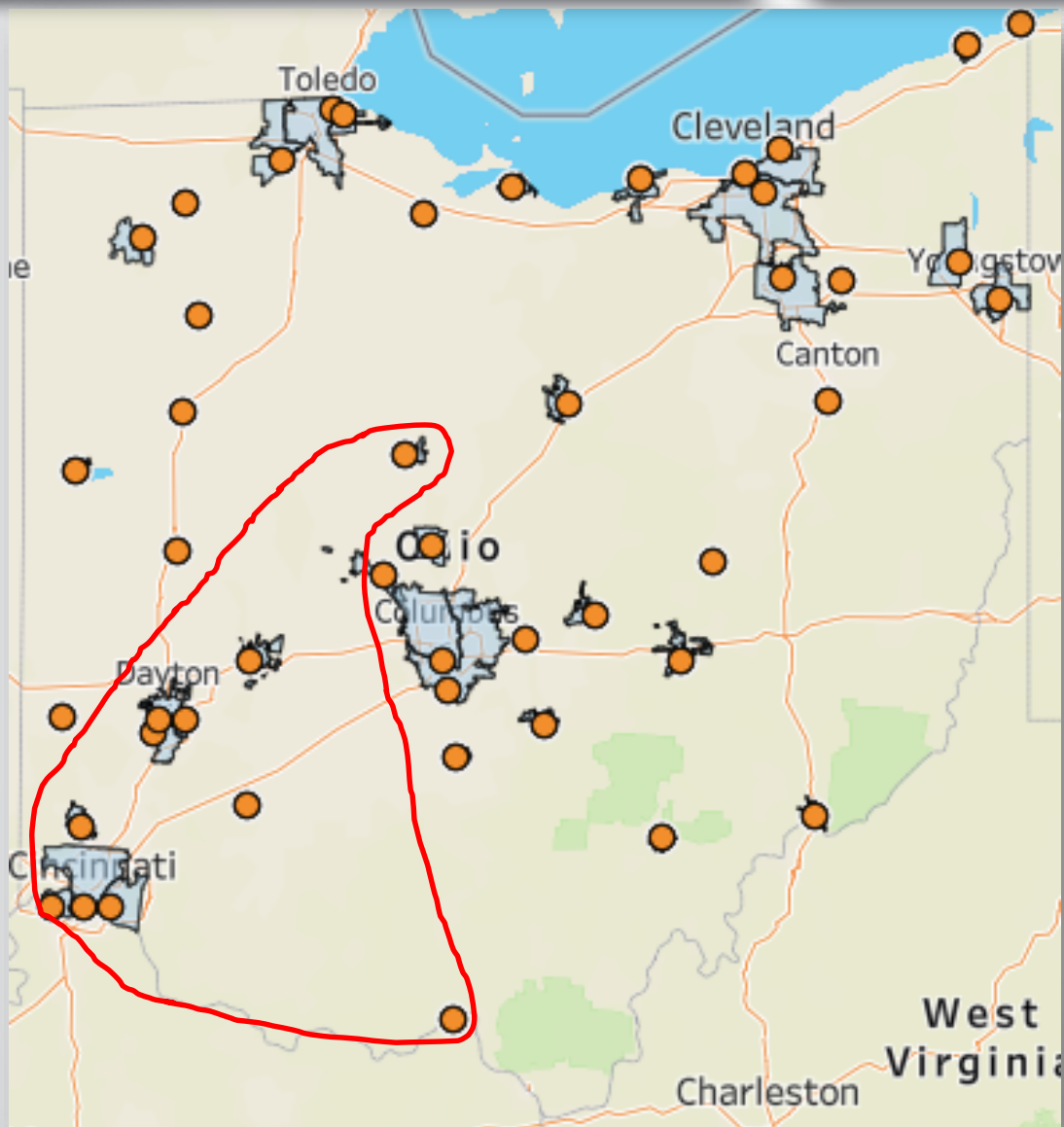
In a new effort to help mitigate the spread of COVID-19, a network across Ohio is studying samples of wastewater to look for the presence of gene copies/fragments of the virus that causes the disease.

Ohio | Department of Health | **Ohio** | Ohio Environmental Protection Agency | **WATER RESOURCES CENTER** | WRC

<https://coronavirus.ohio.gov/wps/portal/gov/covid-19/dashboards/wastewater>



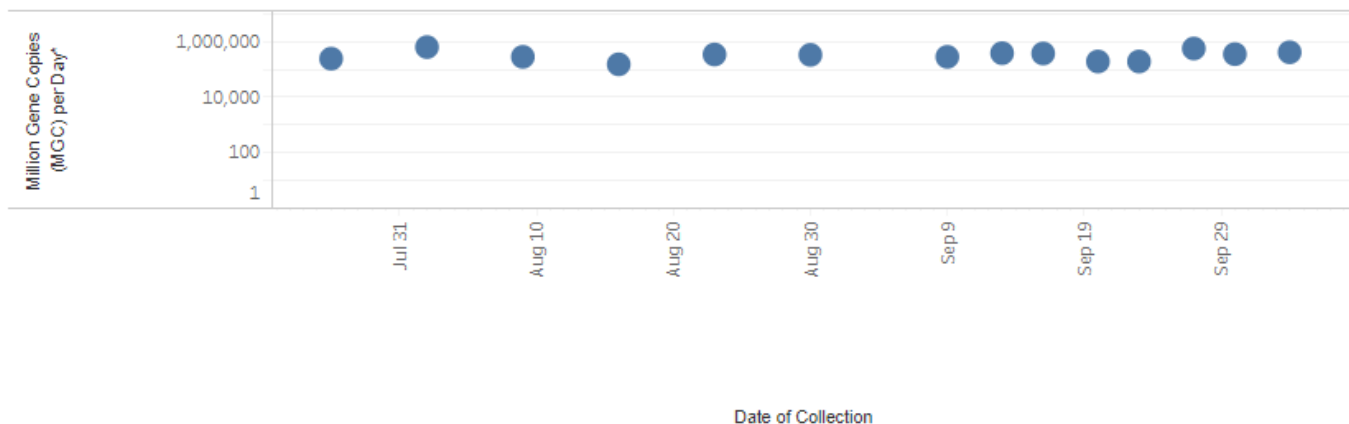
OH Coronavirus Wastewater Monitoring Network



- **46 sites enrolled; target is 70**
- **Sample 2/week**
- **University and commercial labs**
- **ORD-Cincinnati = 10 sites**

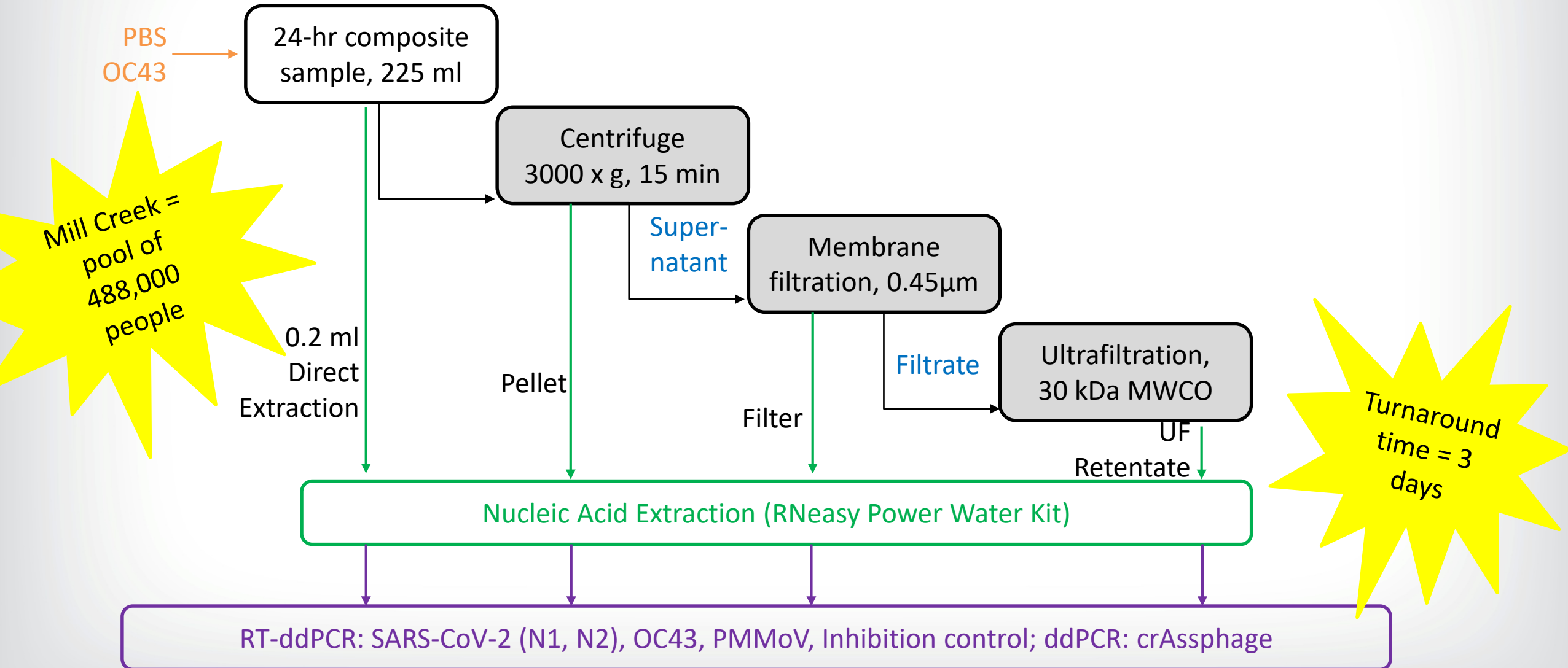
Facility Name = Mill Creek WWTP

Viral Gene Copy Trends



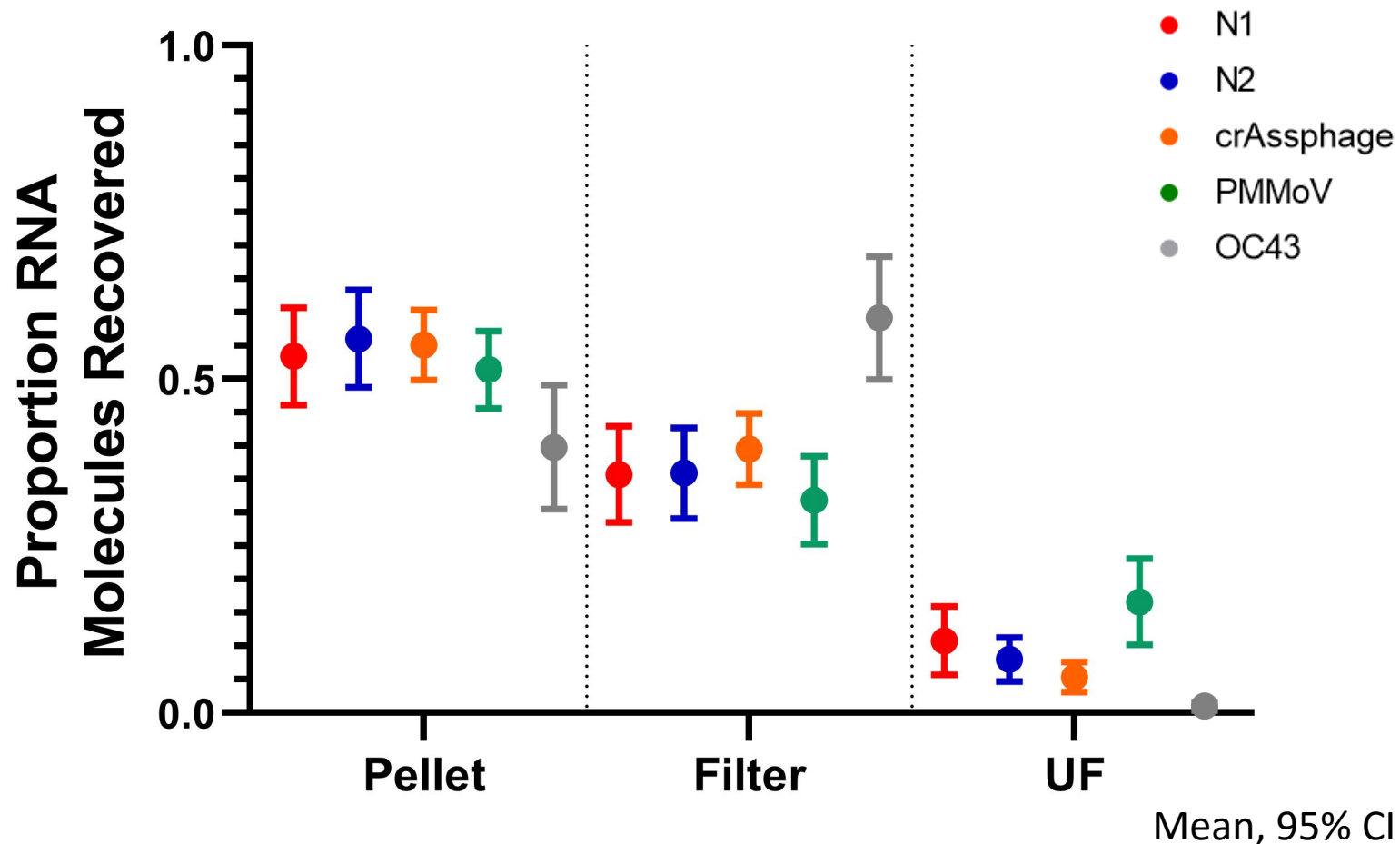


Sample Processing and Analysis



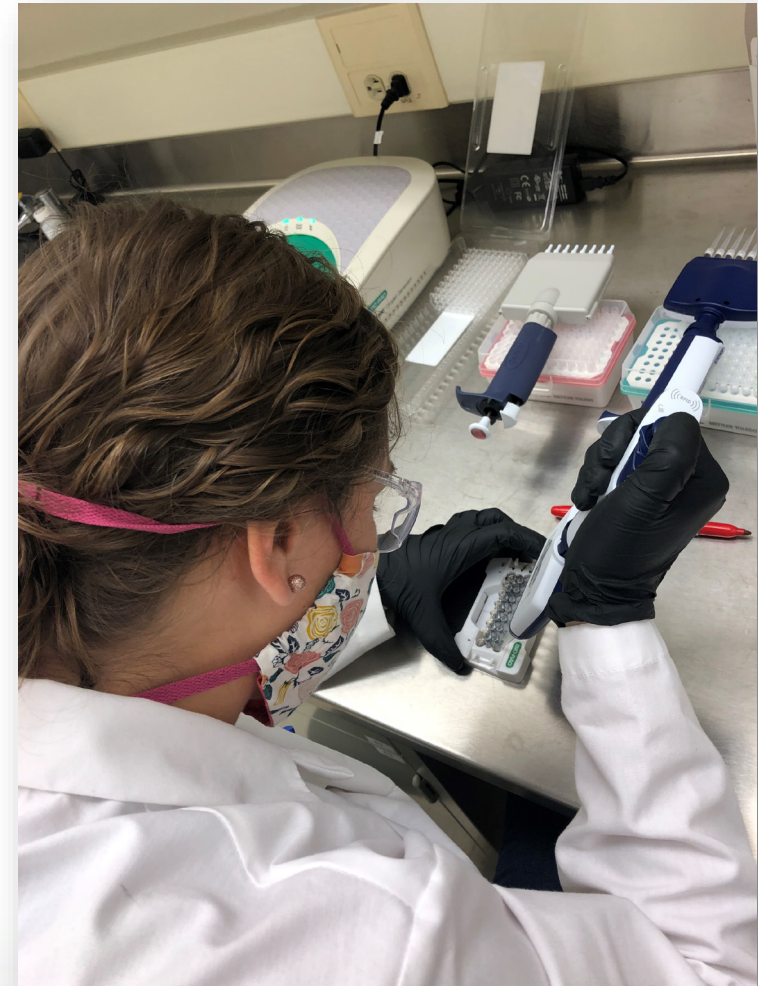


Where are viruses partitioning in samples?



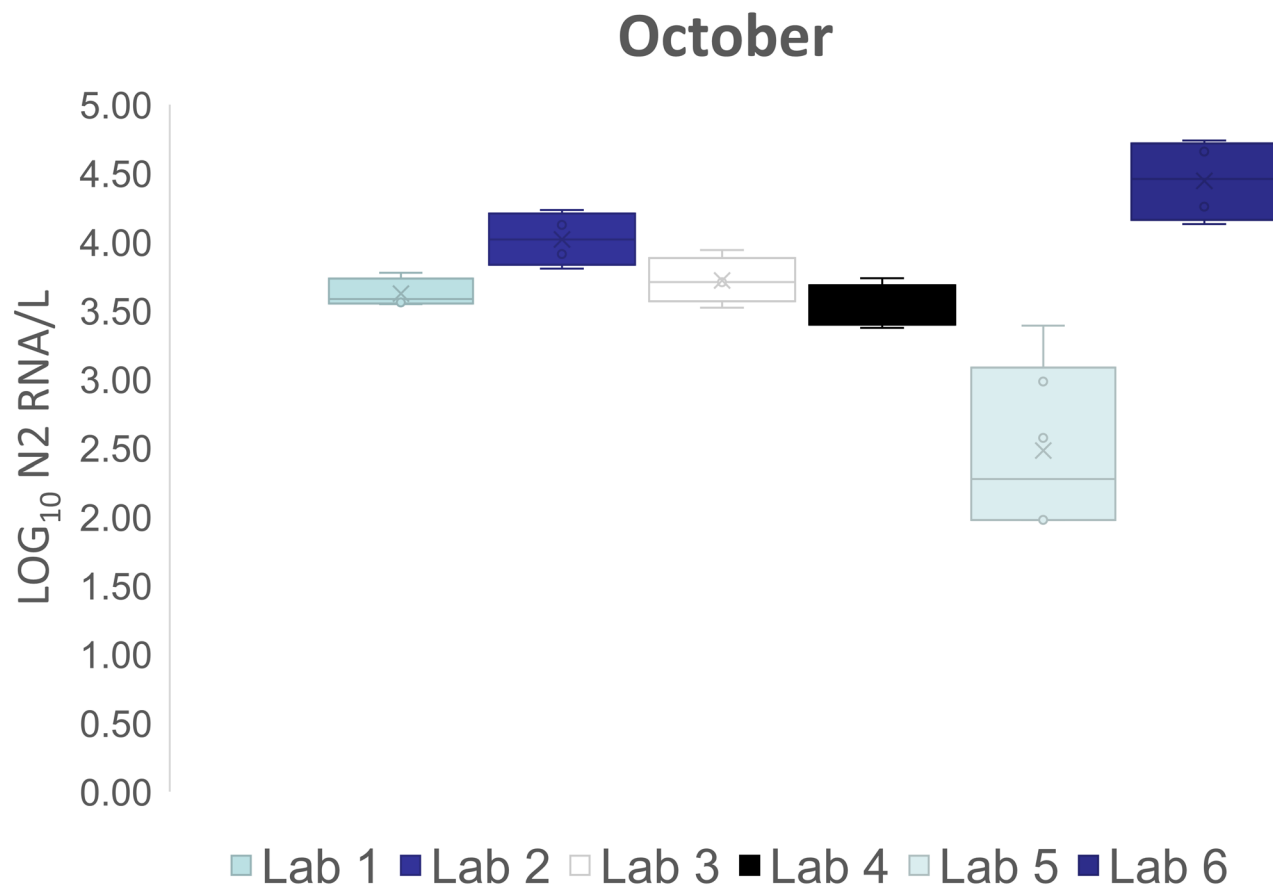
~ 90% measurable virus in pellet and filter fractions

- **Limit of Detection**
 - 655 RNA Molecules/L
- **Recovery Efficiency**
 - Endogenous virus
 - crAssphage 84%
 - Pepper Mild Mottle Virus (PMMoV) 27%
 - Matrix spike
 - Betacoronavirus-I (OC43) 6%
- **RT-ddPCR Inhibition**
 - Minimal (< 20%)



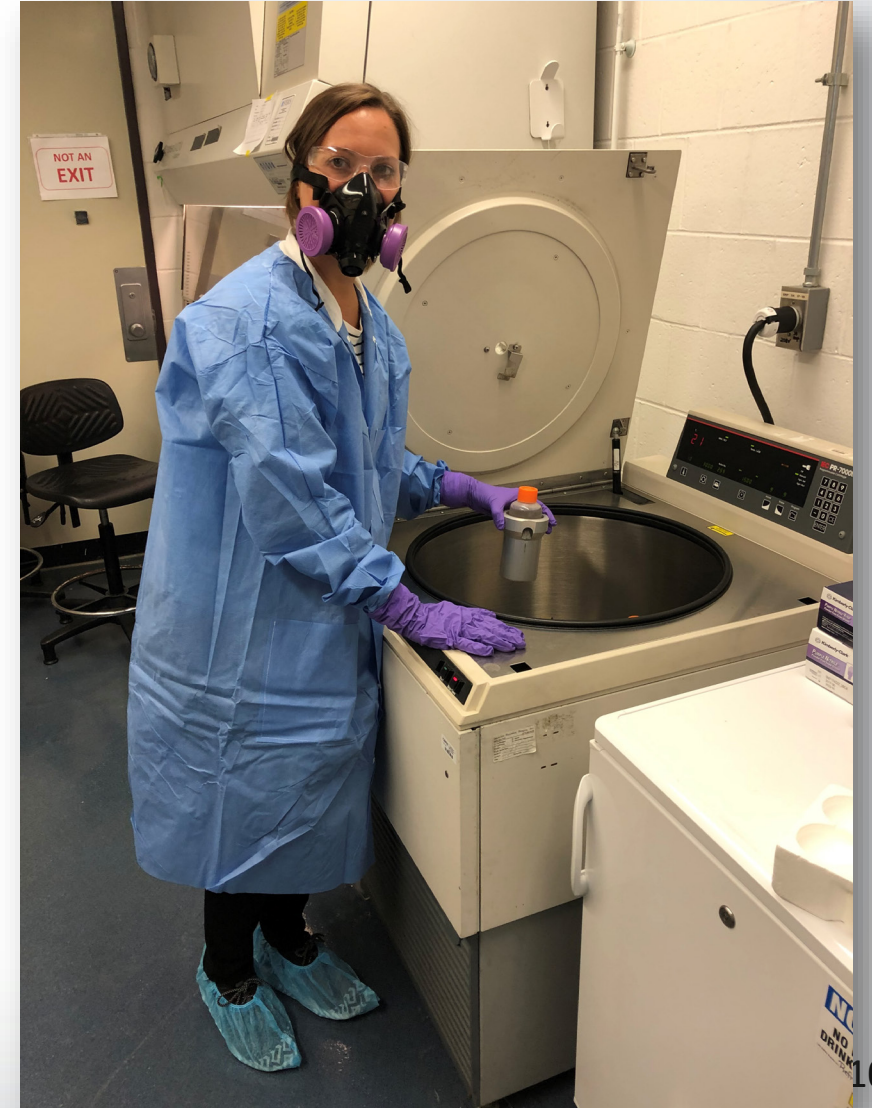
Interlaboratory Comparison

- **Conducted monthly**
- **Sample sent to each lab**
- **Normal protocols performed**
 - 3 different methods
- **Results compared**



Sample Storage Conditions

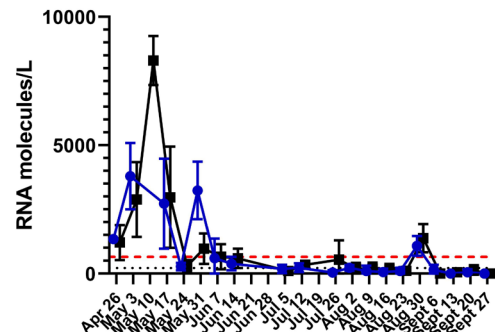
- **Hold time at 4°C**
 - 24- hour composite, overnight shipping
 - No significant difference in SARS-CoV-2 RNA up to 4 days at 4°C
- **Freeze-thaw cycle**
 - Subsample frozen at -70°C, thawed at 37°C
 - Up to 5-fold reduction



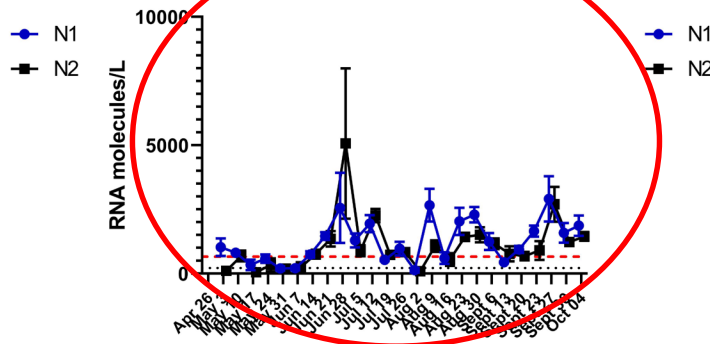


Temporal Trends of SARS-CoV-2 in Sewersheds

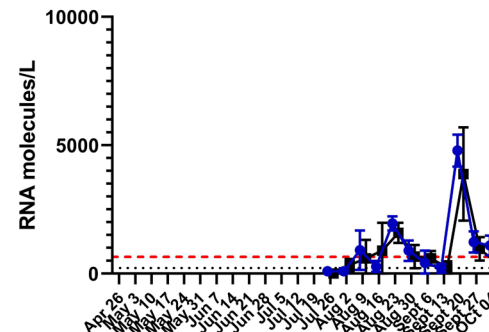
Marion



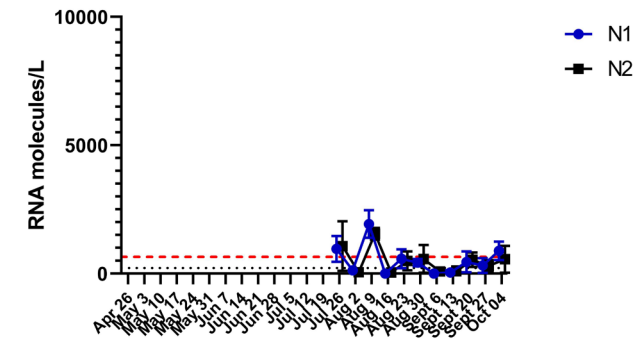
Mill Creek



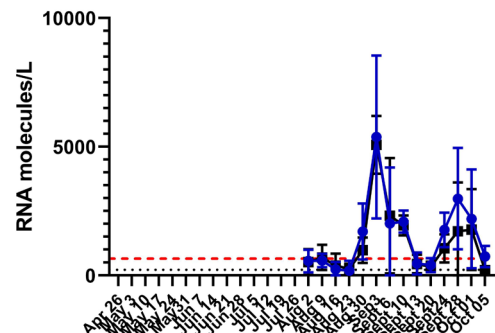
Little Miami



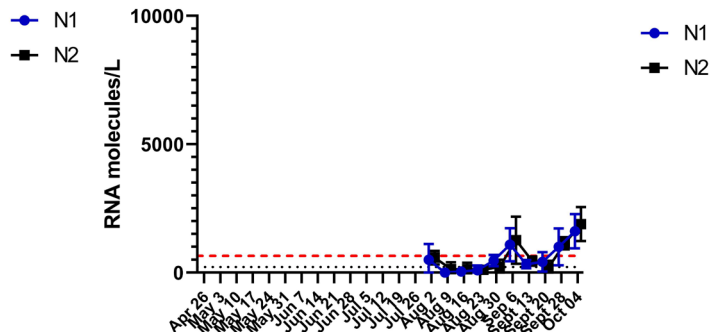
Muddy Creek



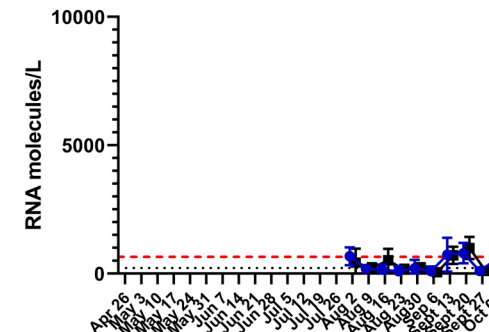
Dayton



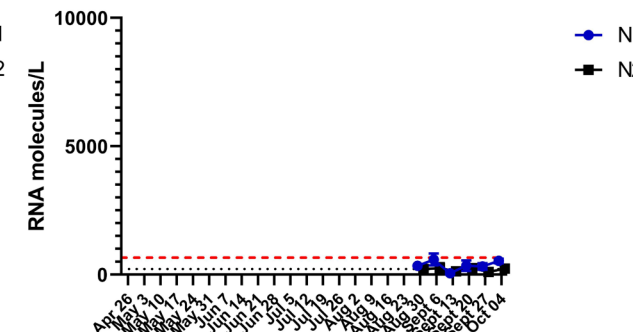
Western Regional



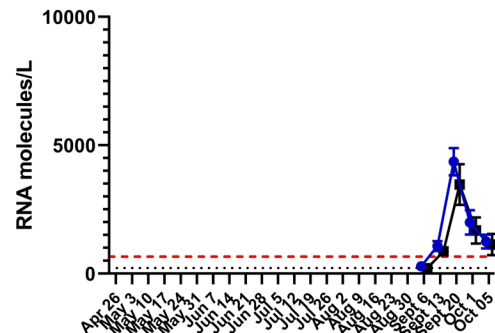
Eastern Regional



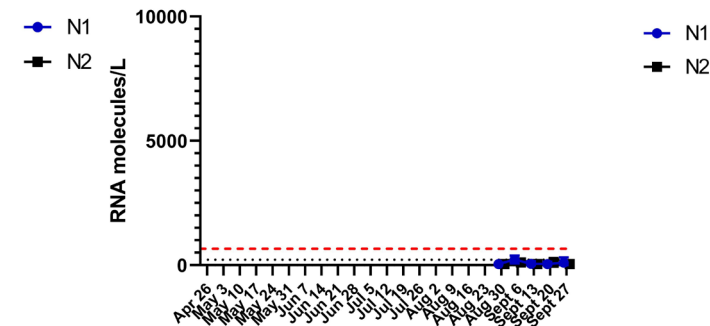
Springfield



Hamilton



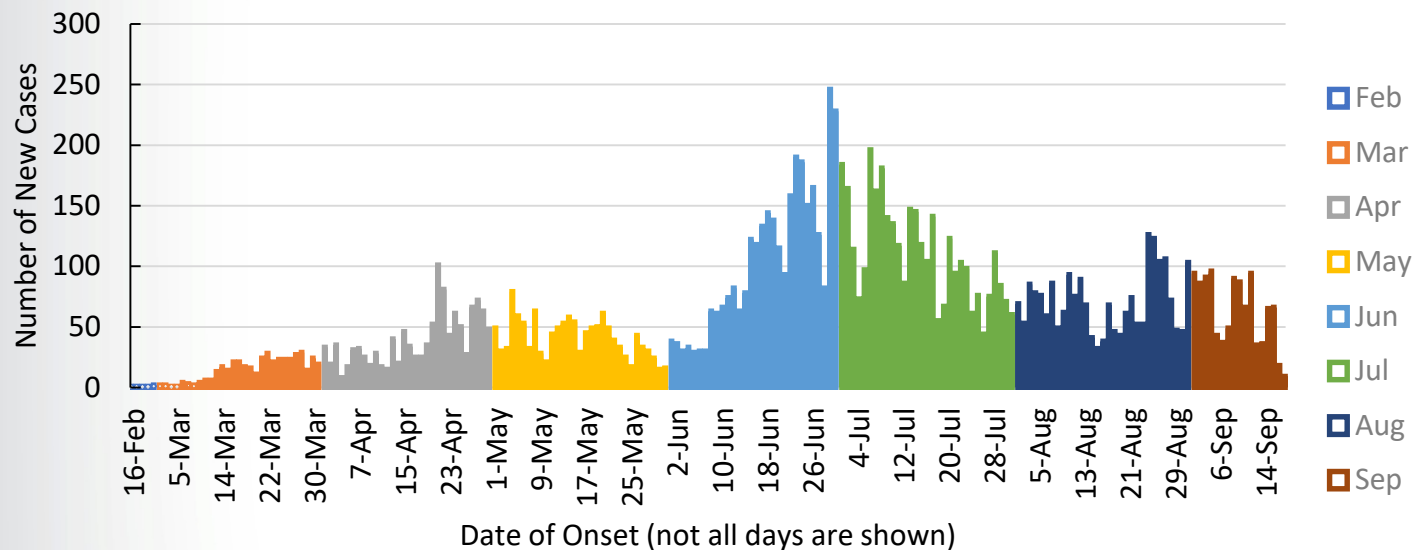
Portsmouth





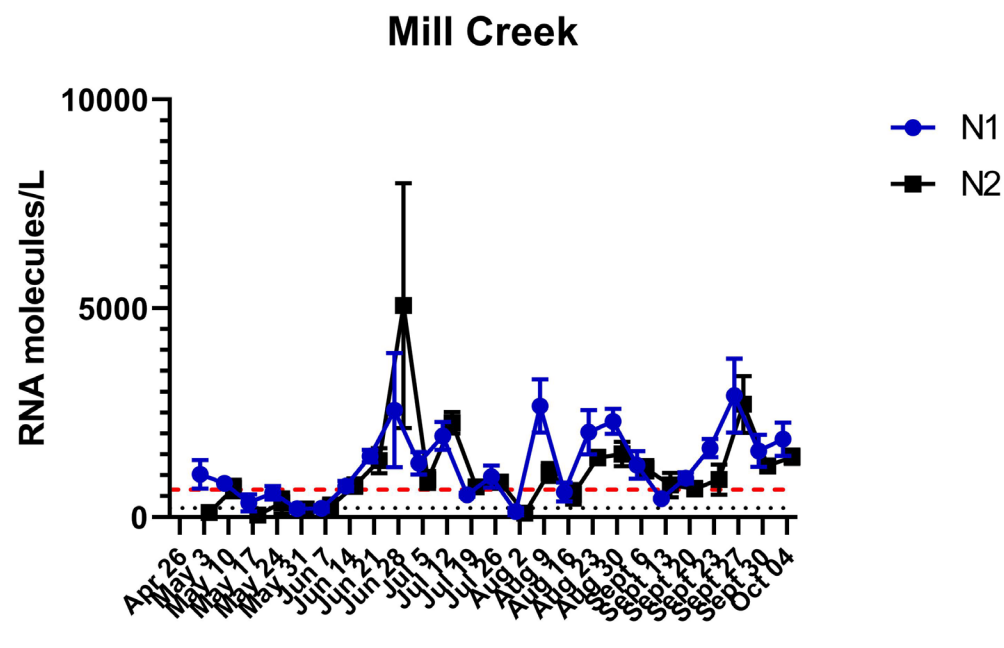
Relating Wastewater Data to New Cases

Hamilton Co. individual test data



data download (Sept 18) from <https://coronavirus.ohio.gov/wps/portal/gov/covid-19/dashboards/overview>

Mill Creek wastewater data
Serves ~80% Hamilton County

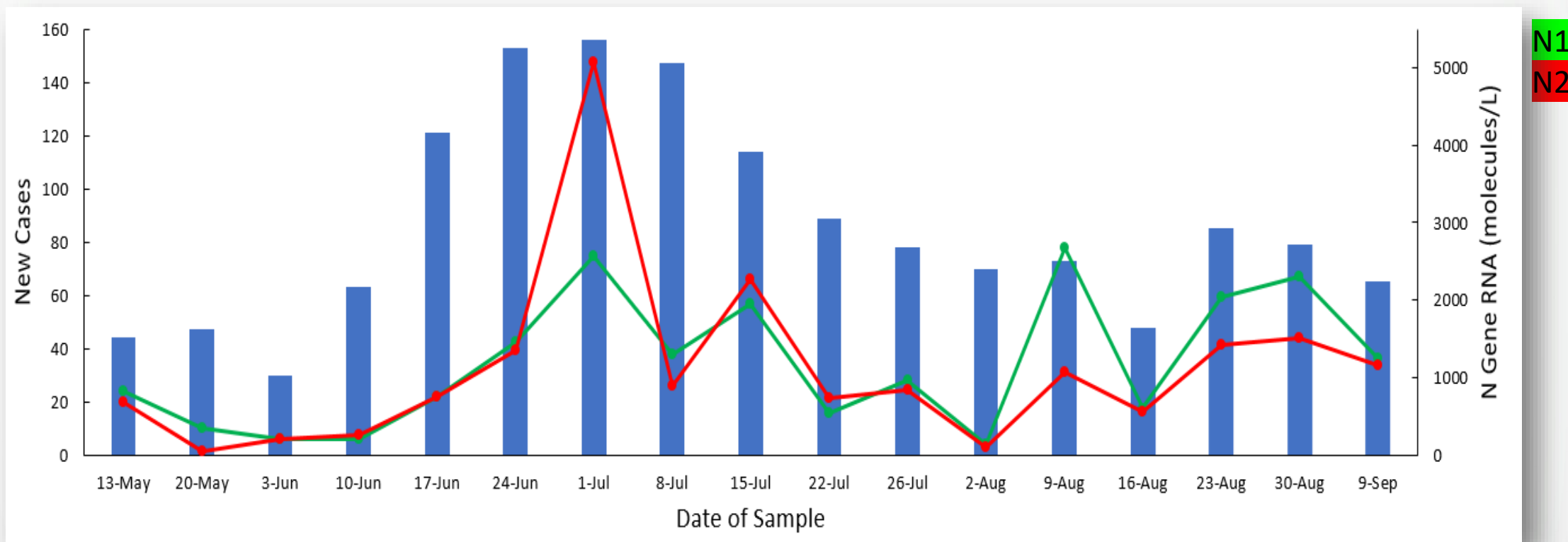


488,000 individuals, 118 MGD

Working with county to obtain sewershed-scale individual test data

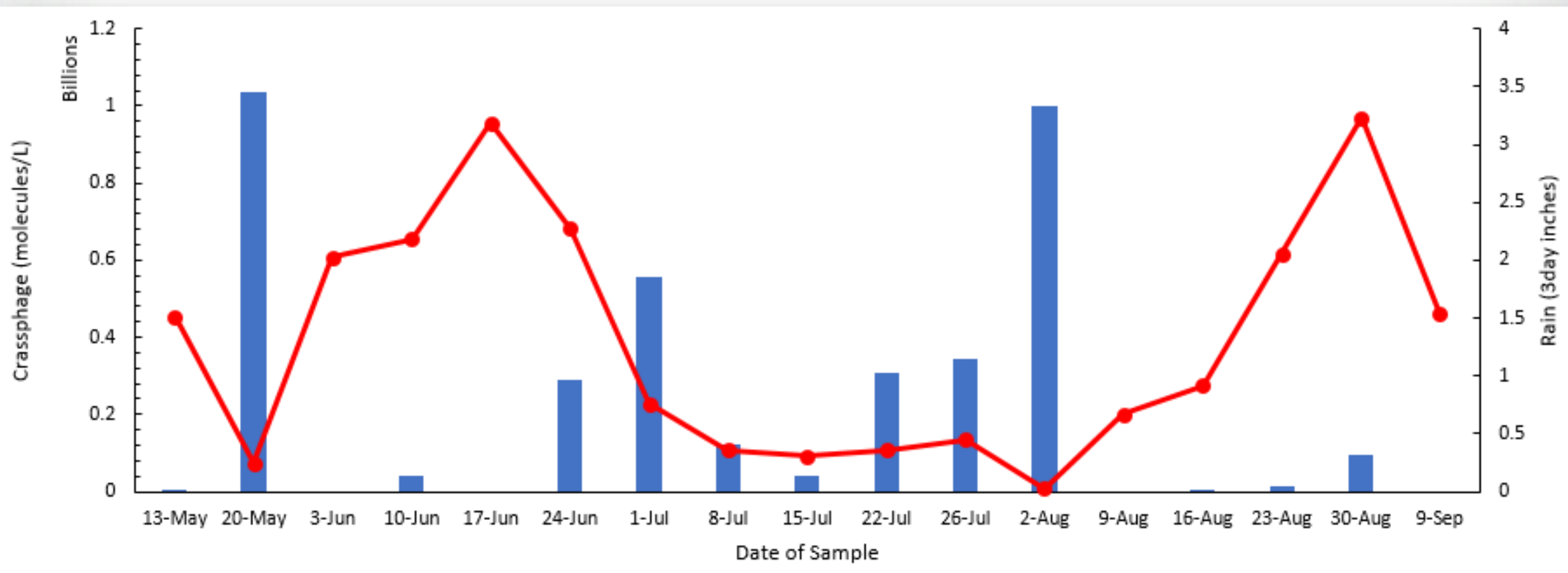


SARS-CoV-2 RNA and New Cases



7-day case averages centered around the sample collection date

Association of Rain and crAssphage





Public Health Applications

- The focus is on trends or significant changes in the number of viral gene copies detected.
- ODH and WRC are monitoring trends
- Currently action is taken when at least 3 samples show a sustained increase of at least 10-fold (1-log_{10})
- State actions when increases are observed:
 - Notify the local health district and utility
 - Provide information on how to interpret the data and link to message toolkit*
 - Notify the state pandemic testing team for linkages to establish pop-up testing sites
 - Provide case data by watershed to local health district (this extraction to be provided soon)



Future Public Health Applications

- **Develop methodologies/predictive models to translate viral loads detected for comparison to health surveillance data or percentage of infection in communities.**
- **Predict or compare results to the prevalence data study for specific communities to better understand factors affecting disease spread.**
- **Determine impacts on disproportionately affected communities (blue-collar, ethnic, race) where risk of infection is greater.**
- **Coordination with data used in the Ohio Public Health Advisory System**

- **Low level of detection, but coincides with observed increases of new cases**
- **Continue to support OH network by monitoring wastewater for SARS-CoV-2 at specified sites**
- **Developing models to account for factors (dilution, recovery efficiency, etc.) influencing virus detection and relationship to new case data**
- **On-going, collaborative evaluation of wastewater monitoring as a public health tool**

