

# Wastewater Infrastructure & Operations for an Enduring Public Health Partnership

Wastewater Monitoring for Early Detection of COVID-19 Infected Populations

**Beverley Stinson, PhD, PE**  
DHS/NIST Workshop  
June 14, 2021

# Presentation Overview

- 1 Introduction
- 2 Brief History of Sewer Systems and Public Health
- 3 Sewer System Basic Infrastructure Design
- 4 Early Indication of SARS-CoV-2 Presence
- 3 Sampling and Testing Logistics and Methods
- 4 Brief Case Study: Israel
- 5 Case Study: Commonwealth of Kentucky Department of Corrections
- 6 Case Study: Bergen County, NJ Utility Authority Study
- 7 Summary and Acknowledgements

# Engineering in Partnership with Public Health

## Brief History

### Before the Eighteenth Century

- Plague; Cholera; Smallpox
- Some thought to be caused by poor moral and spiritual condition
- Mediate through prayer and piety
- Control through isolation and quarantine

### Nineteenth Century: The Great Sanitary Awakening

- Protecting public health became a social responsibility
- Identified “filth” as one of causes and transmission of infectious diseases
- Increased urbanization caused unsanitary conditions in working class areas
- *General Report on the Sanitary Conditions* published
  - Identified foul air from decomposing waste as cause
  - Necessary to build drainage network to remove sewage and waste

### First Sewer Systems in the US – 1850s

- Chicago and Brooklyn
- Helped control outbreak of diseases such as Cholera and Typhoid
- Began public health partnership



“To prevent the hardship of this last year from happening again, pandemic preparedness must be taken as seriously as we take the threat of war.”

– GATES FOUNDATION

# Engineering in Partnership with Public Health

## Sewer System Basics

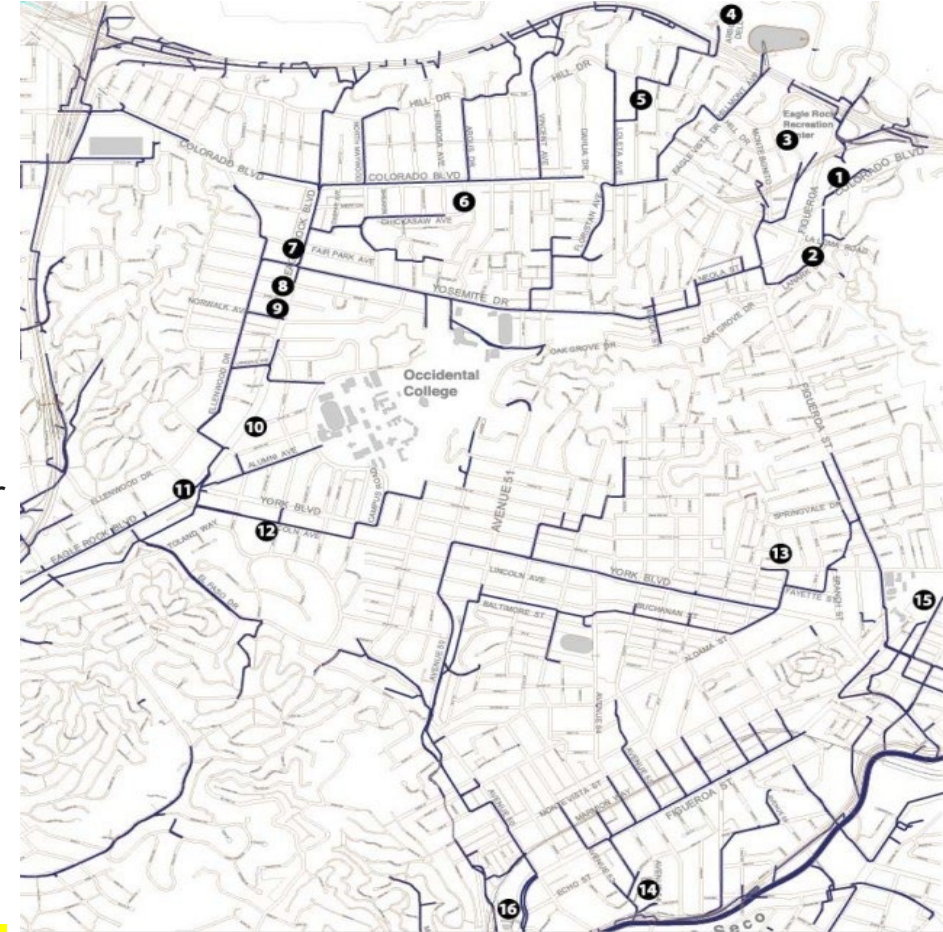
**Main Function of Sanitary Sewer System** - Protect water supply and Public Health

### Sewer Systems Consist of:

- Underground pipes, manholes and pumping stations to convey sewage flow to wastewater treatment plants
- Piping network is designed with drainage areas from cities and neighborhoods to campuses, buildings and homes.
- Designed like a transportation system with streets/roads (small lateral sewer pipes) going to super-highways (trunk sewers and interceptors) to final destination (wastewater treatment plant)

### Existing infrastructure and 21<sup>st</sup> Century Surveillance

- Conducive to sampling individual areas and in the aggregate
- Data in wastewater can be harvested for warning of today's threats – pandemics, opioids, biological etc.
- No need for large capital expenditures – the infrastructure is in place
- **Sampling methods in sewer system and frequencies should be standardized**
- **Daily sampling for SPDES and NPDES permits is standard**



# Engineering in Partnership with Public Health

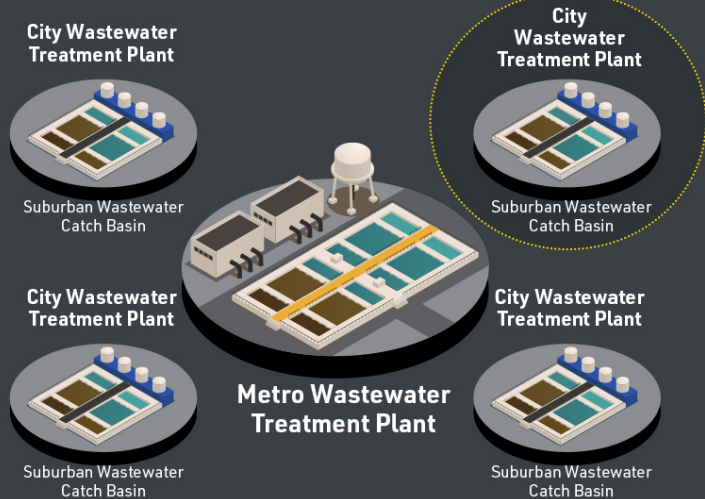
A phased approach allows for early detection at specific locations.

## ▶ NATIONAL/STATE



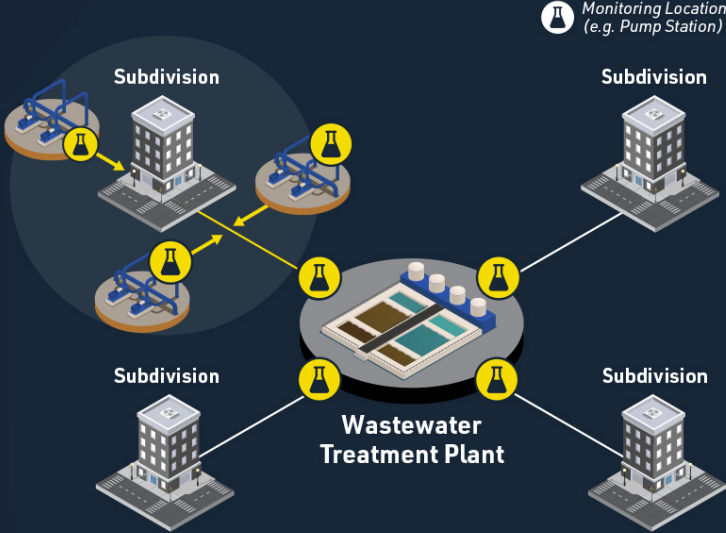
A phased approach can accelerate wastewater testing to promote confidence in reopening and provide up to 2 weeks of advance notification of virus reemergence.

## ▶ METROPOLITAN AREA



Monitoring at multiple WWTPs in small, medium and large metropolitan and suburban areas allows for localized identification of infection.

## ▶ CITY DISTRICT



Sampling in sequentially smaller subsections of the sewage collection system can help to identify local infection hotspots.

# Engineering in Partnership with Public Health

## Wastewater Monitoring is Currently the Only Leading Indicator in the Toolbox

### Early warning can inform strategies that help:

- Contain the virus.
- Limit the spread.
- Protect the most vulnerable.
- Avoid large-scale shutdowns.
- Verify efficacy of vaccination programs.
- Identify generic variants.

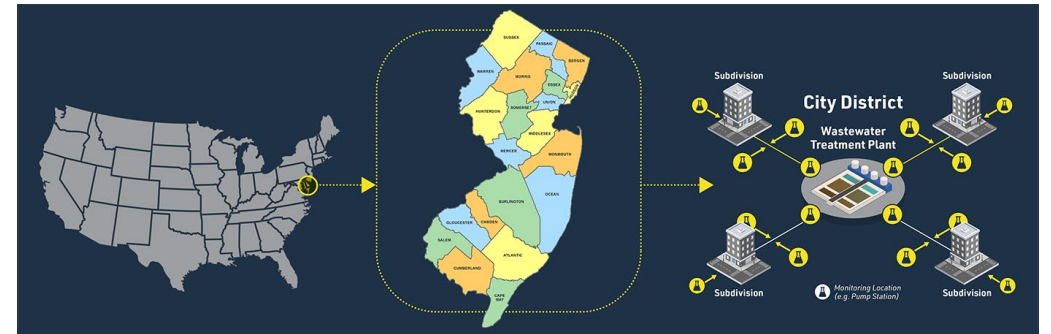


# Engineering in Partnership with Public Health

## Sampling and Testing Logistics and Methods: 4 Key Steps

1

Identify Sampling Locations, Install Composite Samplers – Grab samples acceptable at WWTPs



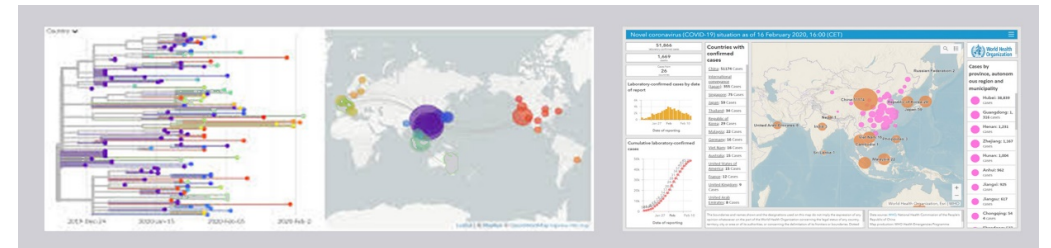
2

Preserve and Ship Samples to Equipped Laboratories for SARS-CoV-2 RNA analysis



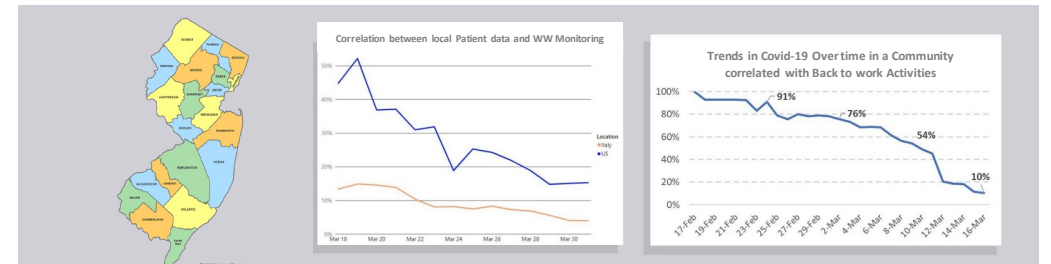
3

Analysis – CDC Test Methods, RT-qPCR, Normalization of Results, Statistical Analysis



4

Reports – Heat Maps and Trending Graphs



# Engineering in Partnership with Public Health

## How a sewer system was leveraged to warn of Infectious Disease – Israeli Case Study

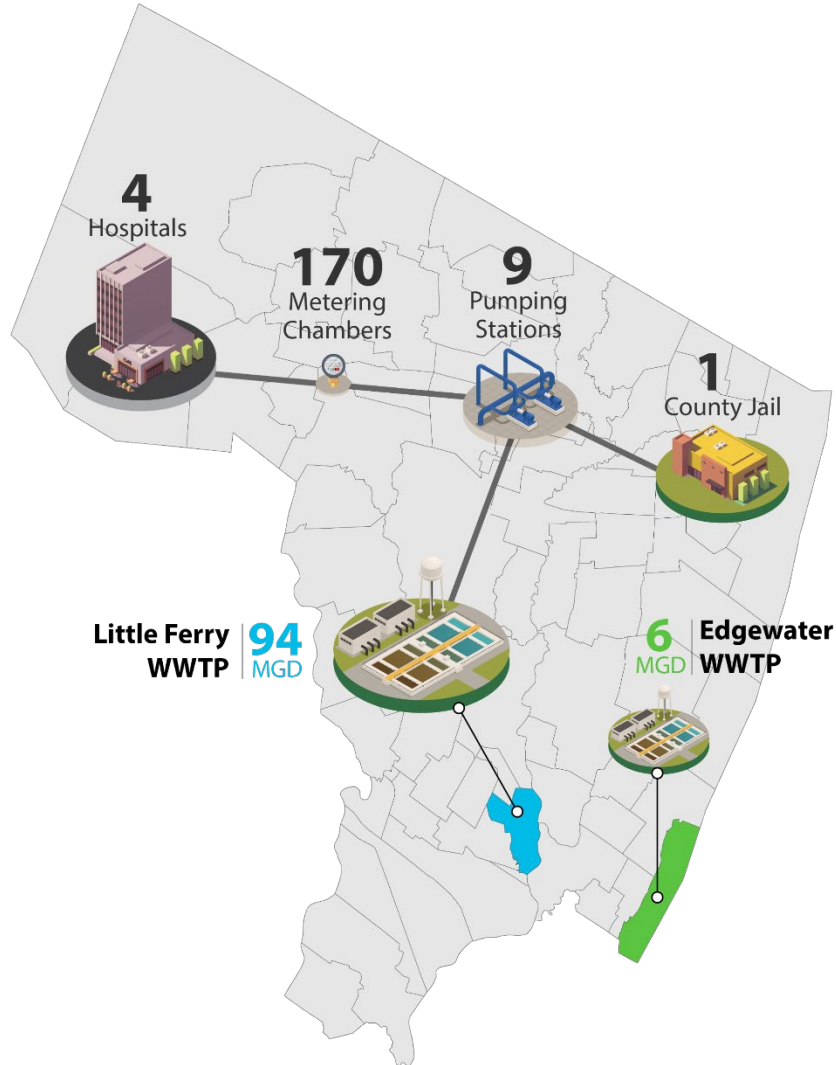
- Israel realized polio was being transmitted actively in 2013.
- A sewage surveillance system – set up in 1989 by the Israeli Ministry of Health to detect poliovirus – sounded the alarm. Health officials worked quickly to vaccinate the public.
- To track polio in human waste in Israel, samples are automatically collected from sewage trunk lines and treatment plants approximately weekly.
- Positive sewage samples during the 2013 outbreak came from the Negrev region.
- Based on molecular characteristics of the virus isolated from the sewage, the virus originated in Pakistan, then traveled into the region, diverging into Egypt, Israel, and Syria.
- Policy decisions were enacted to mitigate the spread of the virus.



Human circulation creates pathways for potential spreading of the virus.



# Bergen County WW Surveillance Program



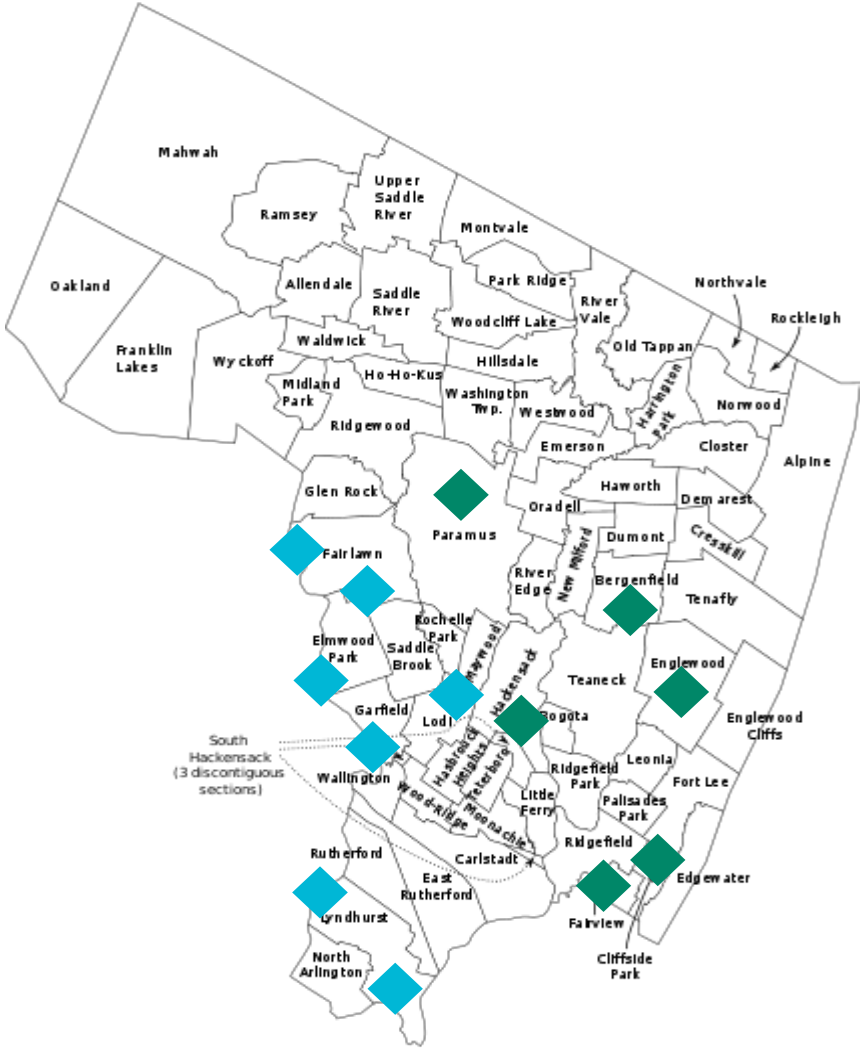
## BCUA Sewer Shed

- Populations Served at Little Ferry WPCF – 580,000
- 47 Townships
- Mixed Residential (suburban/urban), Industrial, Commercial
- Existing wastewater system
  - 2 WWTPs
  - 9 pumping stations
  - 170 metering chambers

## Program Highlights

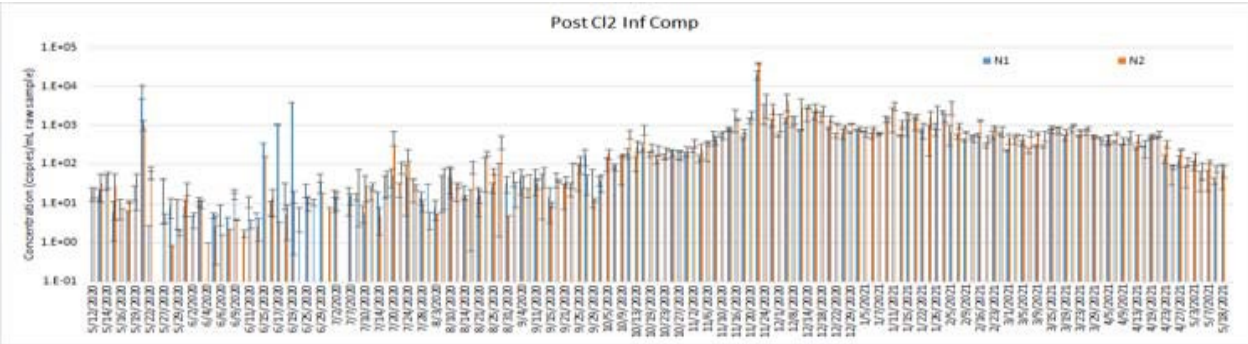
- Period – May 12,2020 to Present
- Total Population “Pool Tested” – 800,000
- Over 1,200 samples analyzed using RT-qPCR
  - Little Ferry WPCF Influent Pre-Chlorination & Post Chlorination
  - Points throughout the Little Ferry WPCP – Liquid & Solids
  - County Jail
  - Hospital
  - 14 individual Towns/areas

# Bergen County WW Surveillance Program

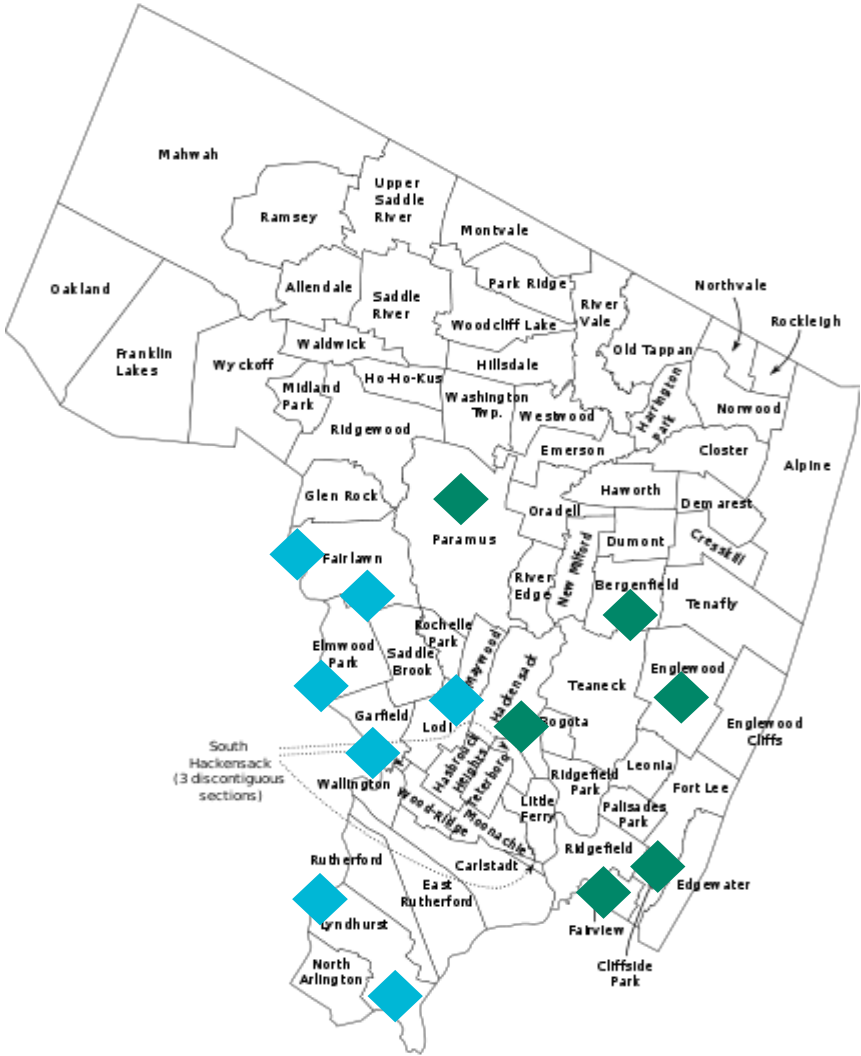


## Program Methods

- Received split of standard composite samples taken SPDES compliance at Little Ferry WPCP (580,000 people “pool tested”)
- **Composite samplers** installed in existing metering chambers, pump stations and manholes in the sewer collection system (Additional 200,000 people)
- Sampling frequency: 2 times per week per site
- RT-qPCR Testing in laboratory
- Results analyzed for concentrations & trends, correlated to actual reported cases
- Report weekly to Bergen County



# Bergen County WW Surveillance Program

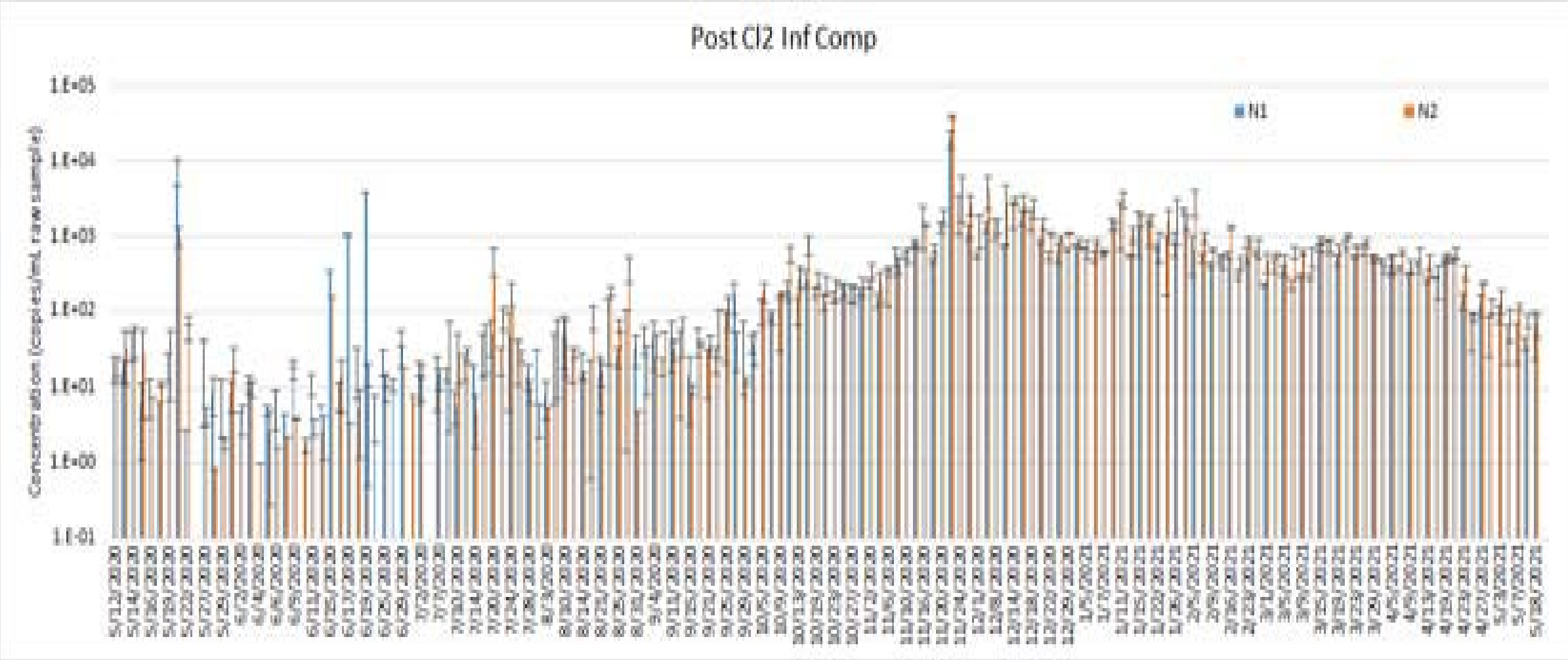


## Lessons Learned

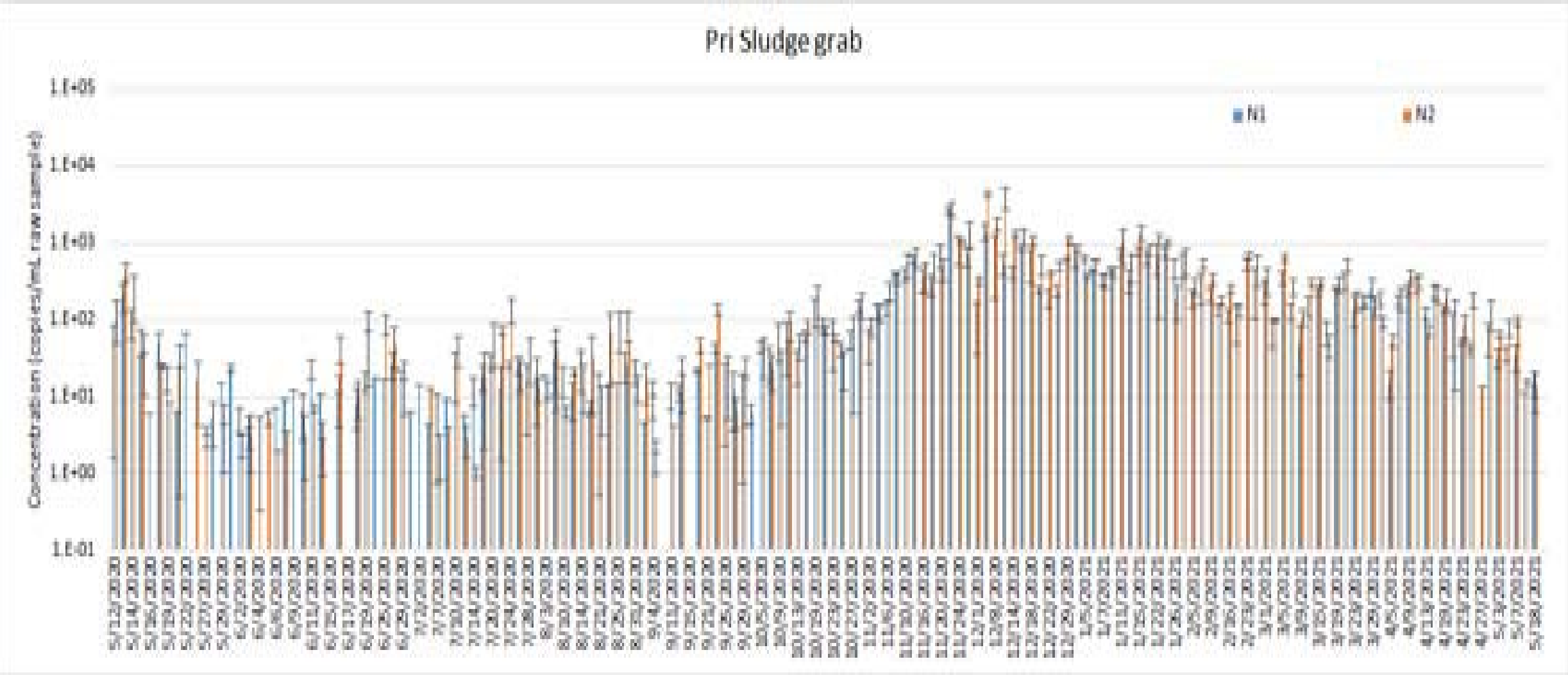
- Existing wastewater infrastructure is well designed to facilitate wastewater surveillance for large and small populations
- NPDES and SPDES permits require sampling and testing at all plants - only addition splits of those samples are required
- 24- hour composite samplers are preferred for both treatment plants and collection system points – However grab samples at large well mixed flows in a large can be used.
- Pre-chlorination does not impact the data significantly
- Some degradation of RNA throughout the wastewater treatment process
- Suggested sampling regiment
  - Minimum 1 time per week per site
  - Increase to 2 or 3 times per week as concentrations and reported cases increase

***By using existing wastewater infrastructure, weekly pool testing is done for “pennies per person”***

# Bergen County WW Surveillance Program



# Bergen County WW Surveillance Program



# Sampling in Wastewater Collection System and Individual Facilities

**Sampler Placement and Other Site Details**

Bell County Forestry Camp Sampling Location.jpg

Bell County Forestry Camp  
360 Correctional Drive Pineville, KY 40977  
Wallace Evans  
Mobile - (606) 521-2727  
wallace.evans@ky.gov  
Additional contact Doug Brown

Check-in Building  
Entrance Road  
Sampling Manhole  
Pump Station pumps flow up the hill for wastewater treatment  
Sampling Manhole Sample downstream of "T"

Bell County Forestry Camp, Minimum Security, Pineville, KY 300 Inmates on Jan 29, 2021

Wastewater flows by gravity to the sample location. We are at the sampling point is a pump station that pumps all waste

---

**Sample Delivery & Chain of Custody**

Delivered to Lab	Delivered to UPS	Total Lab Kits	Total Lab Kits
0	1	25	1
Pending Receipt	In Transit	Received By Lab	Lost By Shipper

Sample Delivery Status

- Chain of Custody not complete  
Eastern Team CoC # 3003050  
Wk 3 - Day 3 - 1/29/2021, 7:41 PM  
Tracking # TZE1428E417968854
- Chain of Custody received by lab  
Central Team CoC # 3003040  
Wk 3 - Day 3 - 1/29/2021, 5:43 PM  
Tracking #
- Chain of Custody received by lab  
Western Team CoC # 3003050  
Wk 3 - Day 3 - 1/29/2021, 3:46 PM  
Tracking #
- Chain of Custody received by lab  
Eastern Team CoC # 3002050  
Wk 3 - Day 2 - 1/28/2021, 9:50 AM  
Tracking # TZE1428E158607771
- Chain of Custody received by lab  
Central Team CoC # 3002040  
Wk 3 - Day 2 - 1/27/2021, 10:44 PM  
Tracking #
- Chain of Custody received by lab  
Western Team CoC # 3003050  
Wk 3 - Day 2 - 1/27/2021, 3:31 PM  
Tracking #

Eastern - Chain of Custody not complete  
Chain of Custody # 3003050  
Received by  
Wk 3 / Day 3 - 1/29/2021, 7:41 PM

CoCPhoto-20210130-002412.jpg

## Lessons Learned

- Daily tailgate safety meetings including weather hazards
- PPE. Steel toe boots, Tyvek coveralls, Nitrile or equivalent gloves, face mask, safety glasses and face shield for splash protection.
- Rigorous decontamination using bleach solution for equipment and hand /face washing for crews
- Two person teams at all times for Safety.
- Develop automated sample chain of Custody

## Wastewater Surveillance Provides Public Health Information to Bergen County

“By testing the wastewater entering the Bergen County Utilities Authority’s (BCUA’s) collection system for COVID-19, public health experts and local officials have access to important data for managing resources in response to the pandemic” The BCUA remains committed to our partnership with the County of Bergen, AECOM and Columbia University and looks forward to continuing this important public health initiative to help spot new trends in concentration data.”

- **Robert Laux, Executive Director of the Bergen County Utilities Authority**



### BERGEN COUNTY WASTEWATER TESTS INDICATE STEADY DECREASE IN COVID-19 COMMUNITY SPREAD

June 10, 2021, 12:30 pm | in

#### BERGEN COUNTY WASTEWATER TESTS INDICATE STEADY DECREASE IN COVID-19 COMMUNITY SPREAD

*COVID-19 concentration samples show decrease since April 2021*

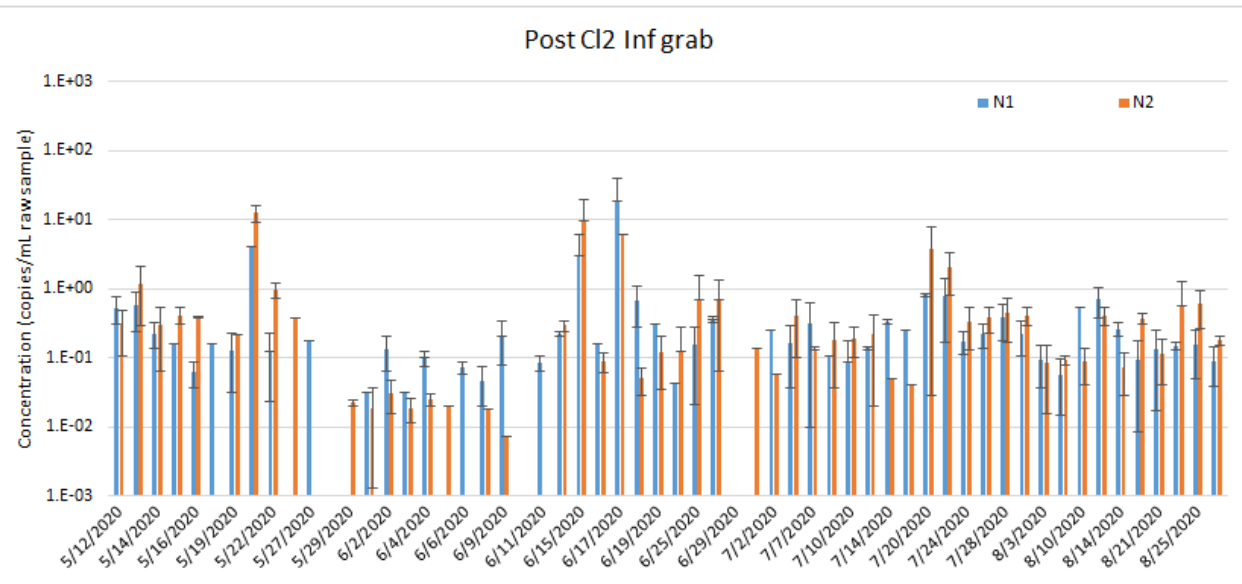
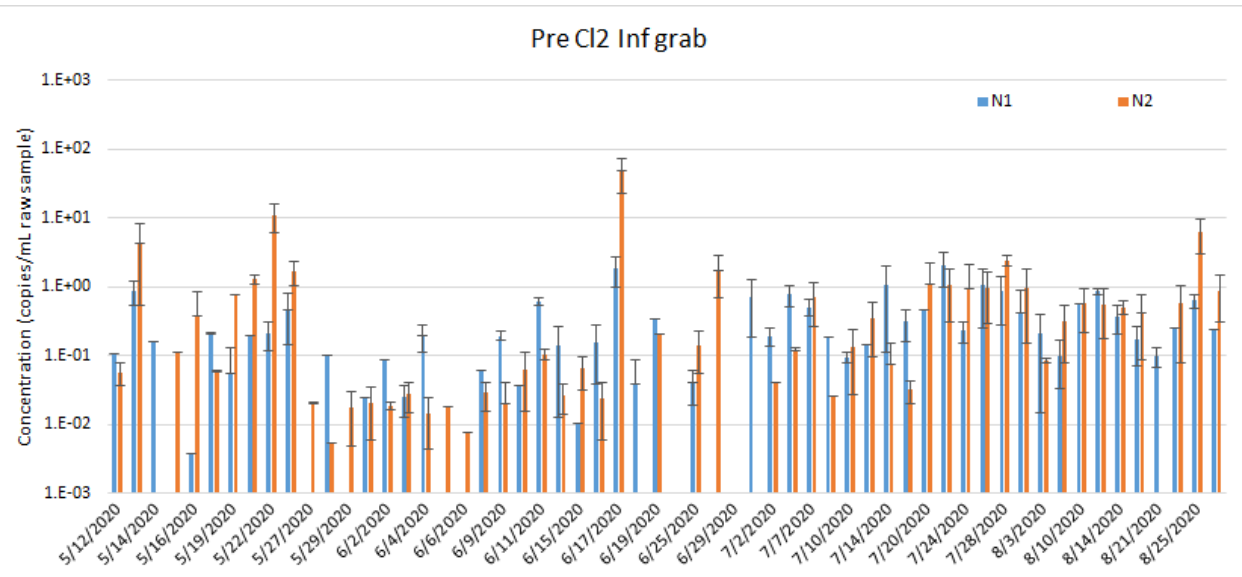
**(HACKENSACK, NJ)** – Bergen County’s ongoing Wastewater Testing program indicates that concentration levels of COVID-19 have demonstrated a steady decrease since April 2021.

According to a May 25 report from project partner, AECOM, “concentrations in the composite samples have shown a downward trend in SARS-CoV-2.” The report went on to specify that during the most recent collection period (May 15 to May 21), all municipalities serviced by the BCUA were reporting less than 500 copies/ml, with the exception of five outliers that either maintained the same level of magnitude or had a slight uptick.

The wastewater concentration data shows a correlation with several reports indicating a general decrease in positive COVID-19 cases in Bergen County. The month of May saw 1,116 total positive COVID-19 cases in Bergen County, down significantly from the 7,210 recorded in March. As of May 25, the most recent positivity score for New Jersey’s northeast region, which includes Bergen, Essex, and Hudson Counties was 1.99. That is down from 10.81 in late March.

# Impact of chlorination

There was no systematic impact of influent chlorination in the concentrations of SARS-CoV-2 copies in most of the influent wastewater grab samples.



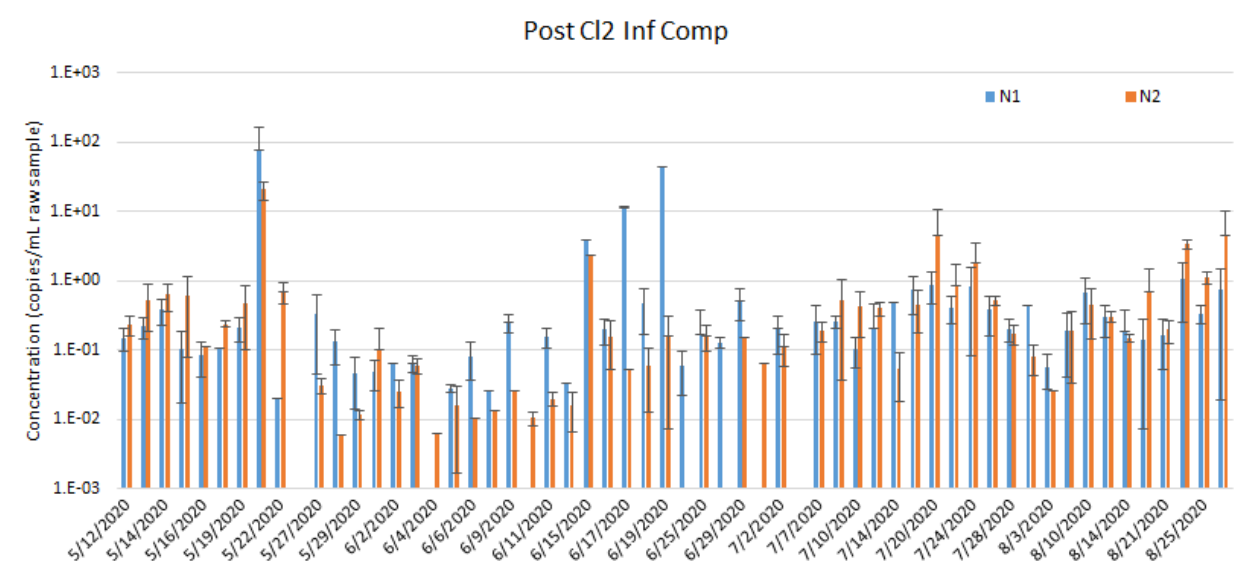
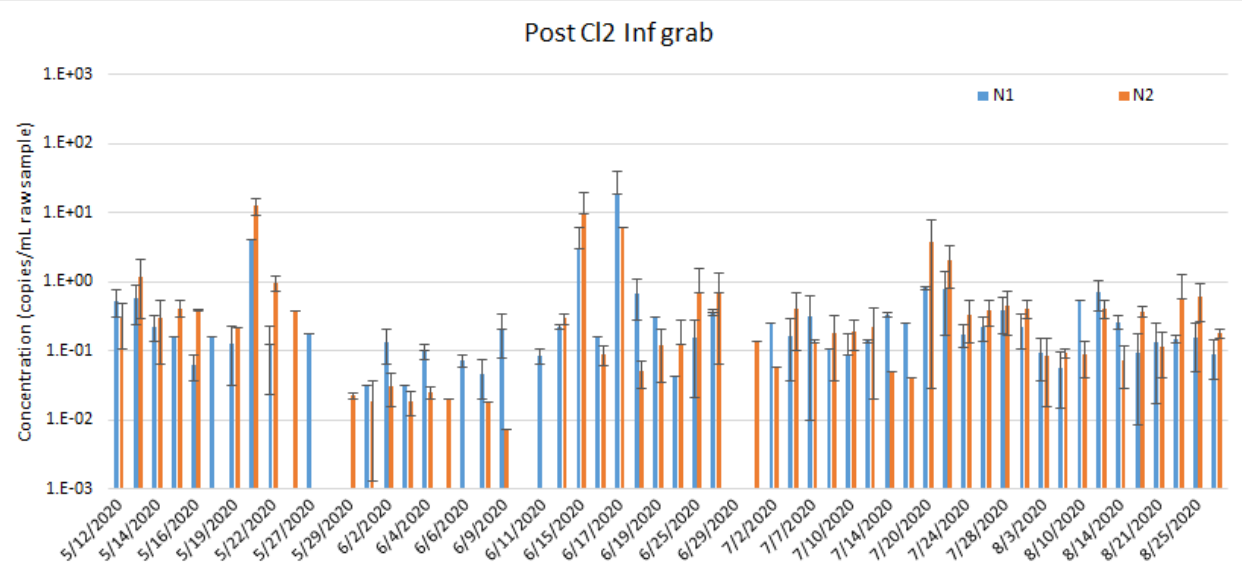
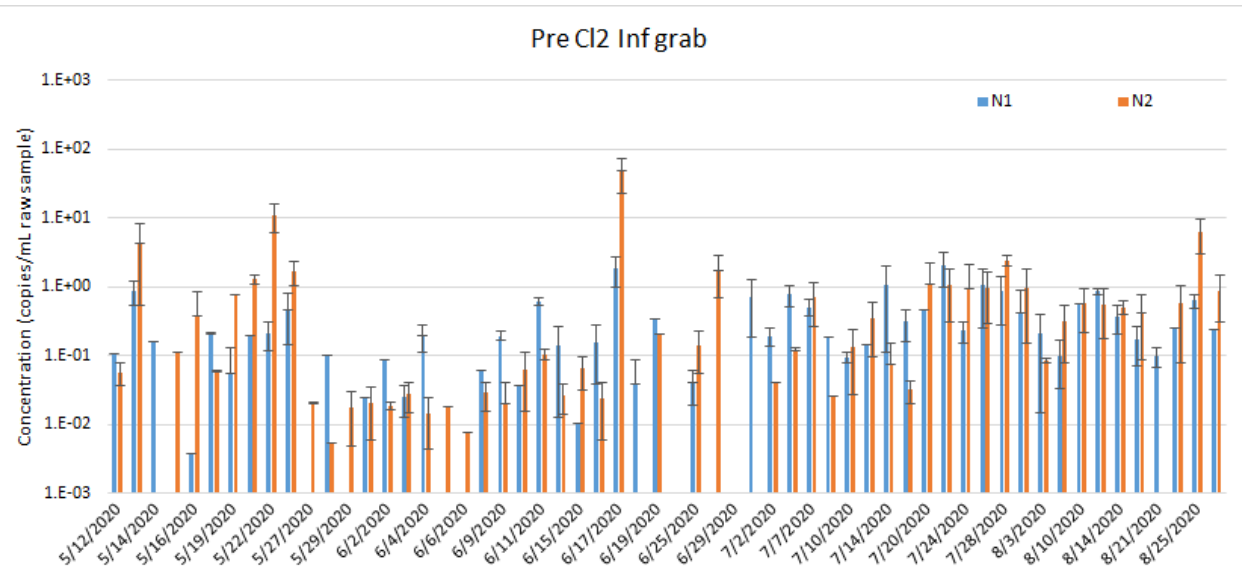


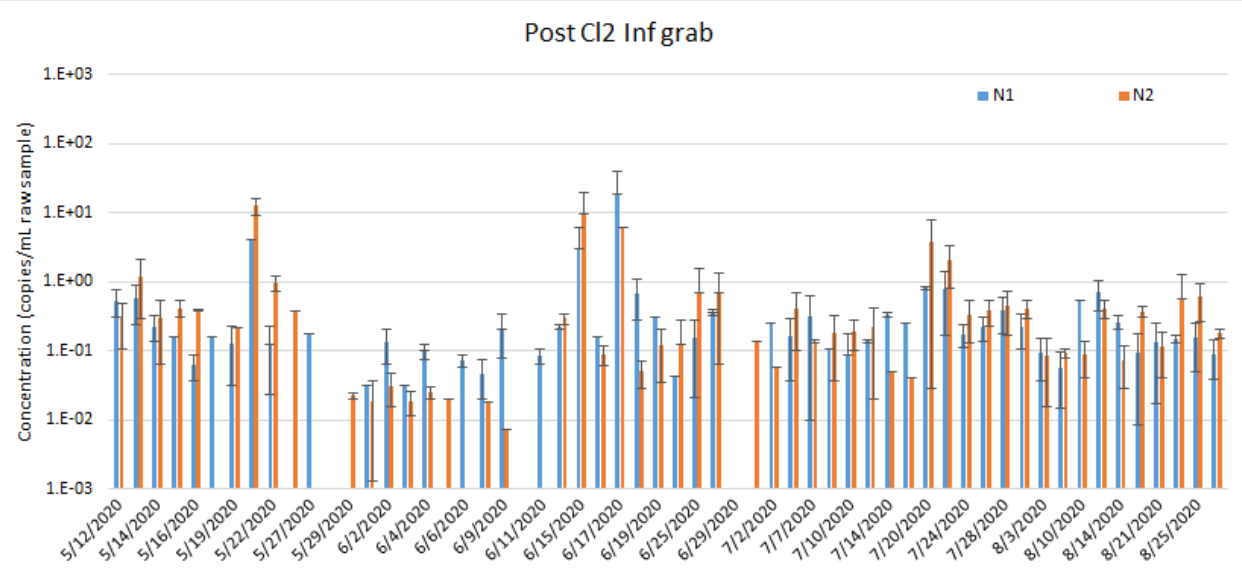
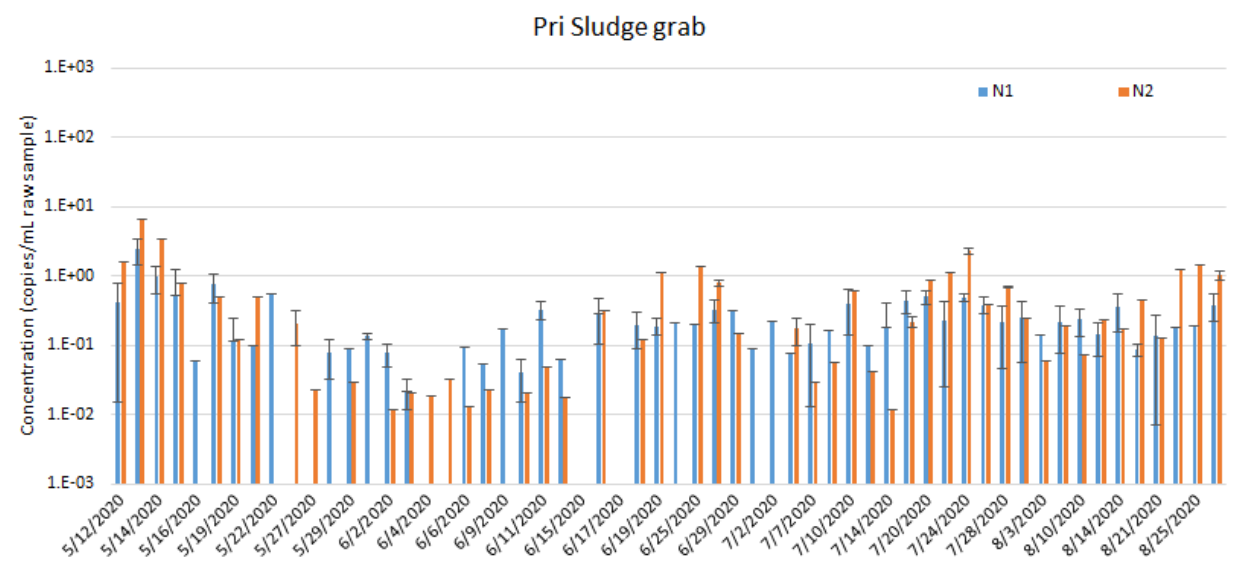
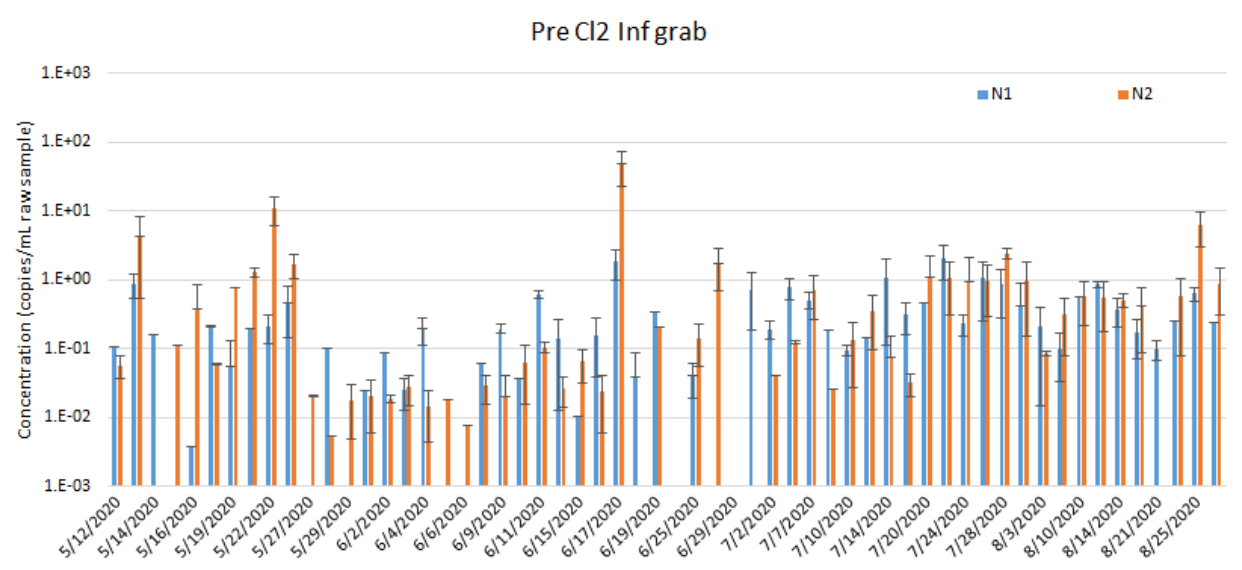


Some differences were observed in the results from grab and composite samples.

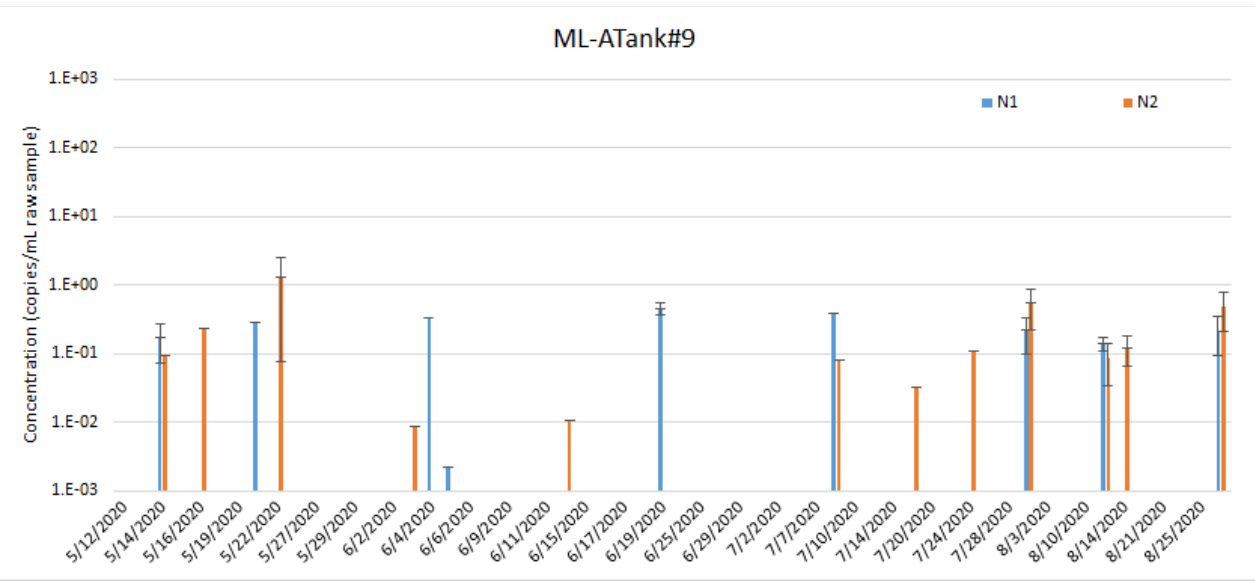
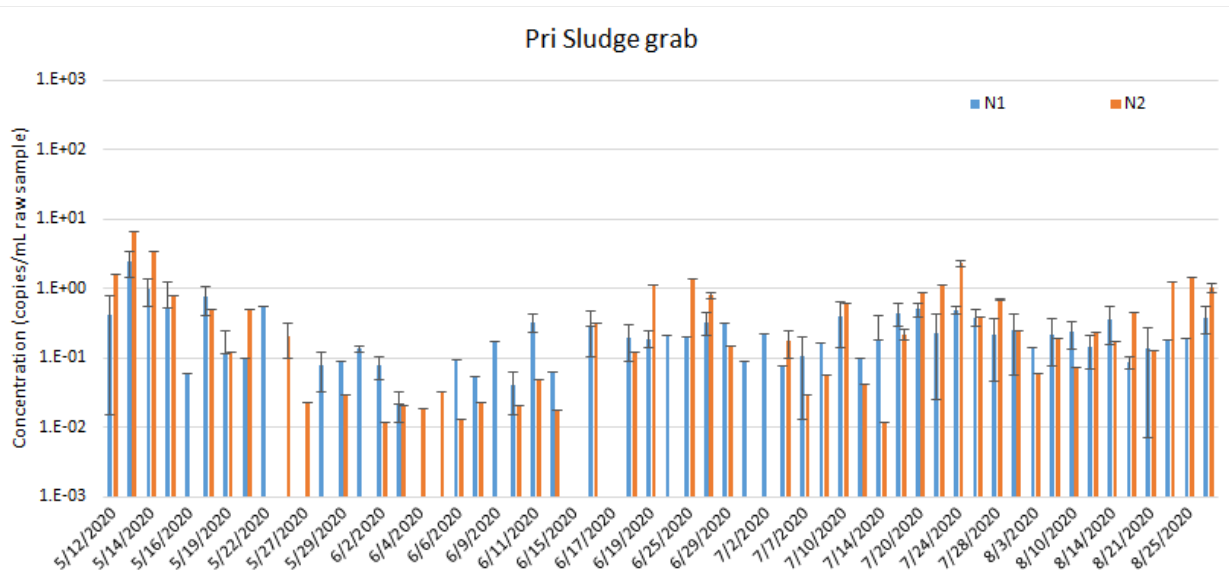
Given the expected variability in influent wastewater flow and composition, it might be beneficial to obtain composite samples where feasible

Strong parallel trends were observed in the Post-Cl2 grab and composite samples





- In general, comparable or lower virus concentrations were observed in the primary sludge samples compared to the raw sewage influent samples (normalized to sample volume)
- Partitioning of the virus between the aqueous and solids phases needs to be quantified



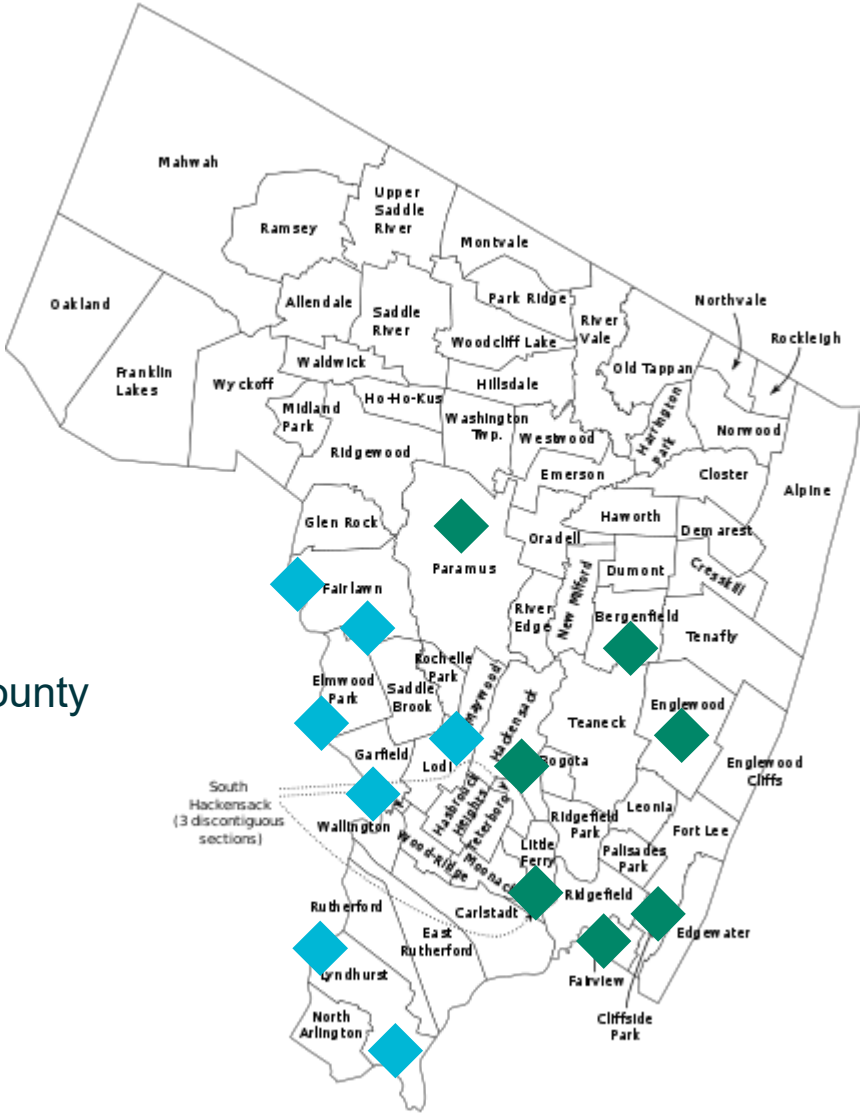
Some degree of variability observed in the results from the mixed-liquor grab samples.

In general, the SARS-CoV-2 concentrations in ML were less frequently detected and visually lower than in primary sludge.

- The impact of virus-solids association needs further investigation
- Fate in the solids streams needs to be determined
- Impact of solids on (differential) assay efficiency and sample pre-treatment needs to be considered

# BCUA Phase 2 Expansion – Sampling Locations

BCUA Sampling Locations	PVSC Sampling Locations
Cliffside Park	Fair Lawn #1
Englewood	Fair Lawn #2
Fairview	Lodi
Paramus	Lyndhurst #1
Hackensack	Lyndhurst #2
Bergenfield	Garfield
Little Ferry WPCF - Post CI Infl.	Elmwood Park



 BCUA  
 PVSC

# RAPID: Viral Structure Function – Activity in the Engineered Wastewater Cycle

## Kartik Chandran, CBET - 2026599



**Program:** 1440/Environmental Engineering Program, COVID-19 Research

**Technical Goals:** 1.) To develop a science-based understanding of the link between **SARS-CoV-2 presence in wastewater streams** and the **health of the contributing communities**. 2.) To determine the **fate of SARS-CoV-2 and other viruses** in engineered **wastewater treatment plants**.



**Wastewater sampling conducted at:**



**Sewage treatment plants and sewersheds**

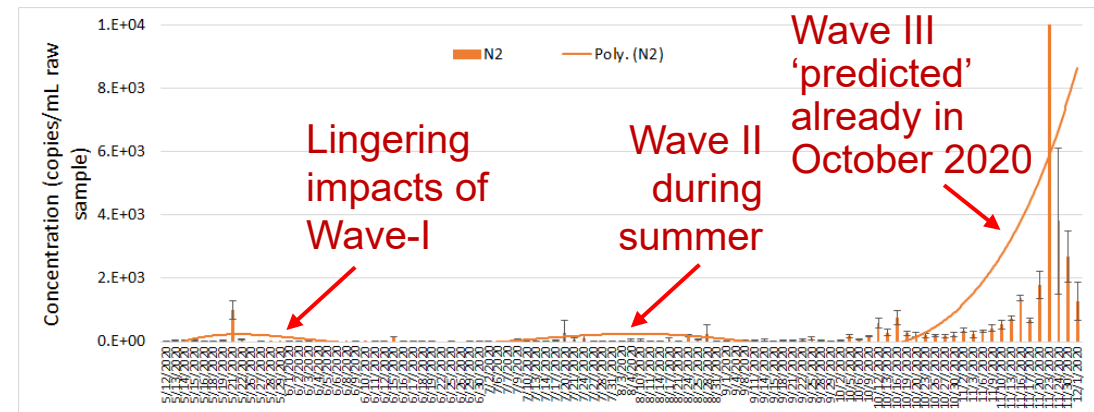


**University residential buildings**



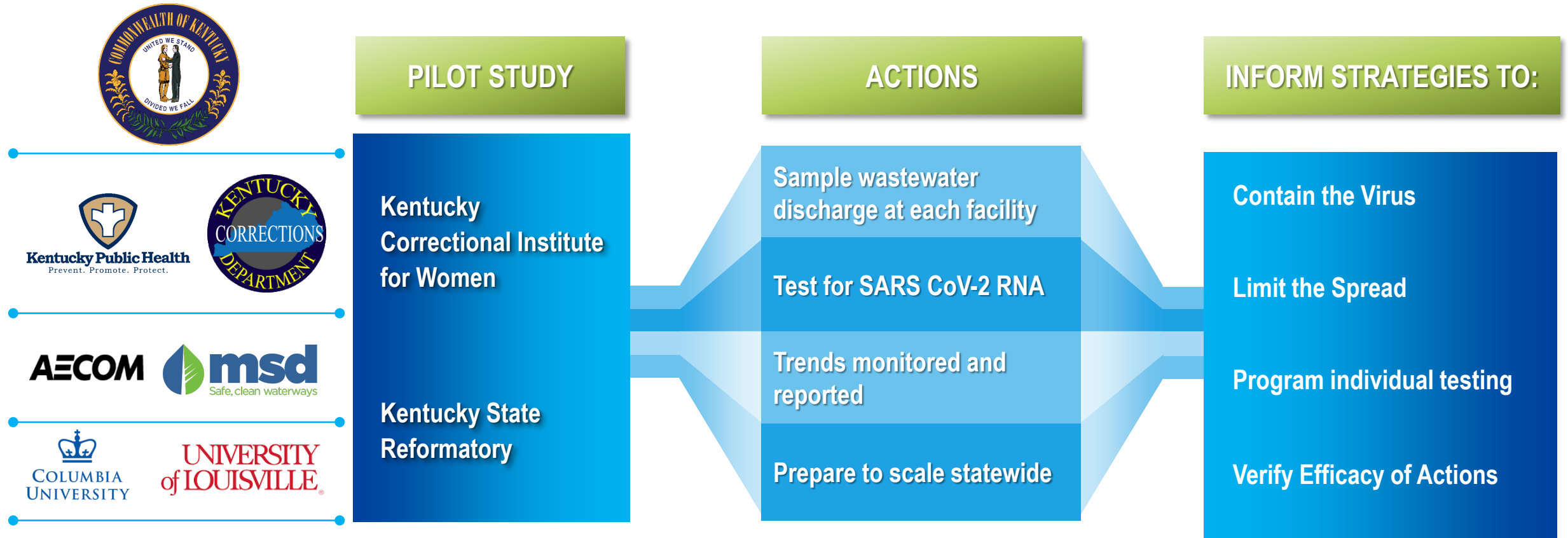
**Healthcare and incarceration facilities**

- Trends in wastewater SARS-CoV-2 concentrations precede trends in clinical Covid-19 positive cases by up to two weeks.
  - **Results of long-term monitoring in Bergen County, NJ** →
- Wastewater testing can provide an indication of overall community infection.
- By extension, wastewater testing can also track the efficacy of vaccination efforts.



# A public private partnership to help protect Kentucky correctional facility inmates and staff from COVID-19

Testing wastewater discharge can provide a leading indicator of COVID-19 presence and trends



# Kentucky Correctional Facility WW Sampling Program

## Expanded Program Setup

### Pilot Program

- Sampling commenced at KSR & KCIW on August 31, 2020
- Sampling concluded on November 23, 2020

### Expanded Program

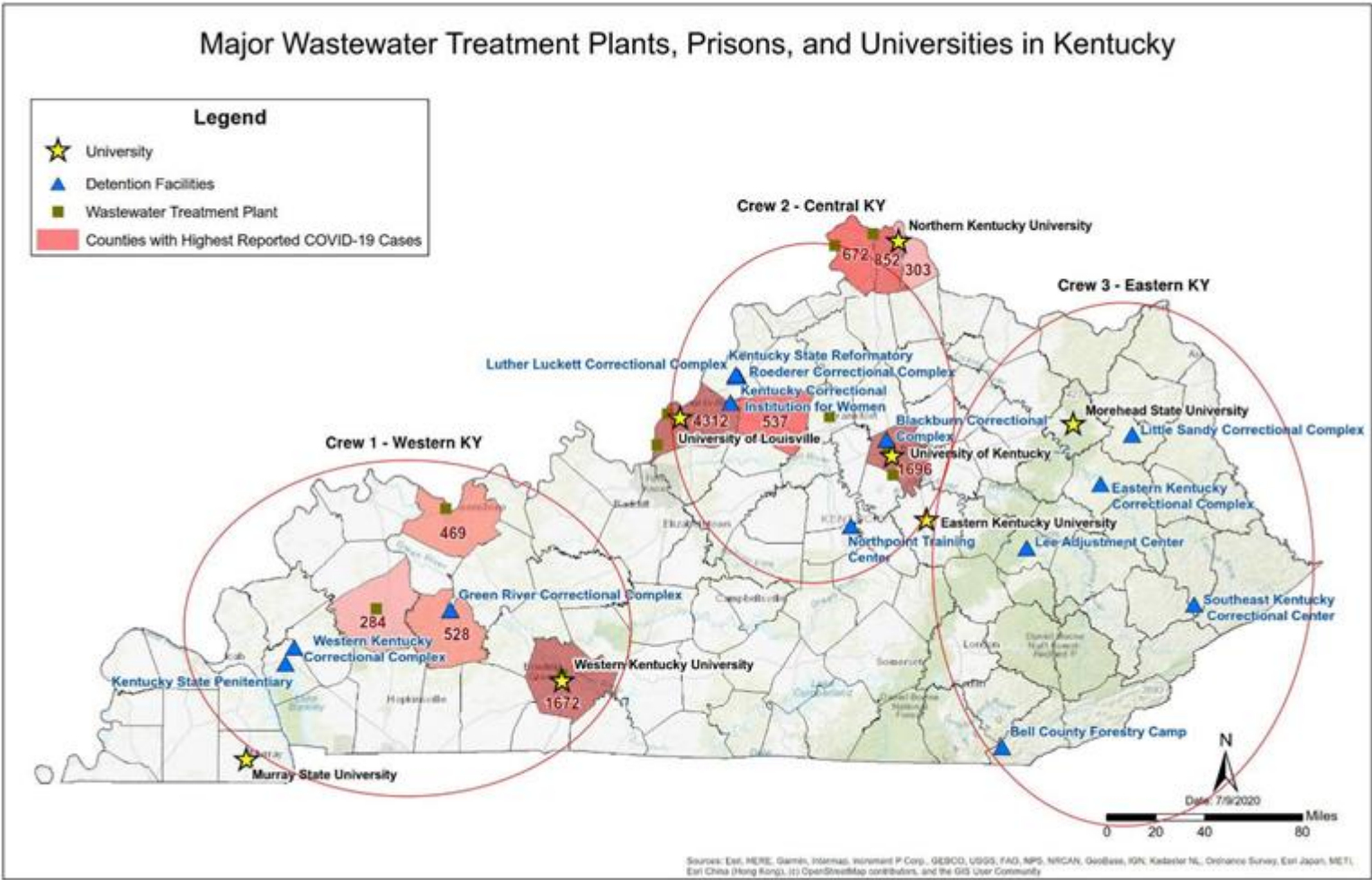
- Conducted initial site visits with site contacts in December 2020
- Teledyne ISCO Glacier samplers installed at all 14 correctional facilities in January

### Crews Deployed

Samples obtained starting the week of January 11<sup>th</sup>



# COVID-19 RNA Concentrations at 14 Facilities



**Sample collection and processing is ongoing and is expected to continue through 2021**

**Three two-person crews**

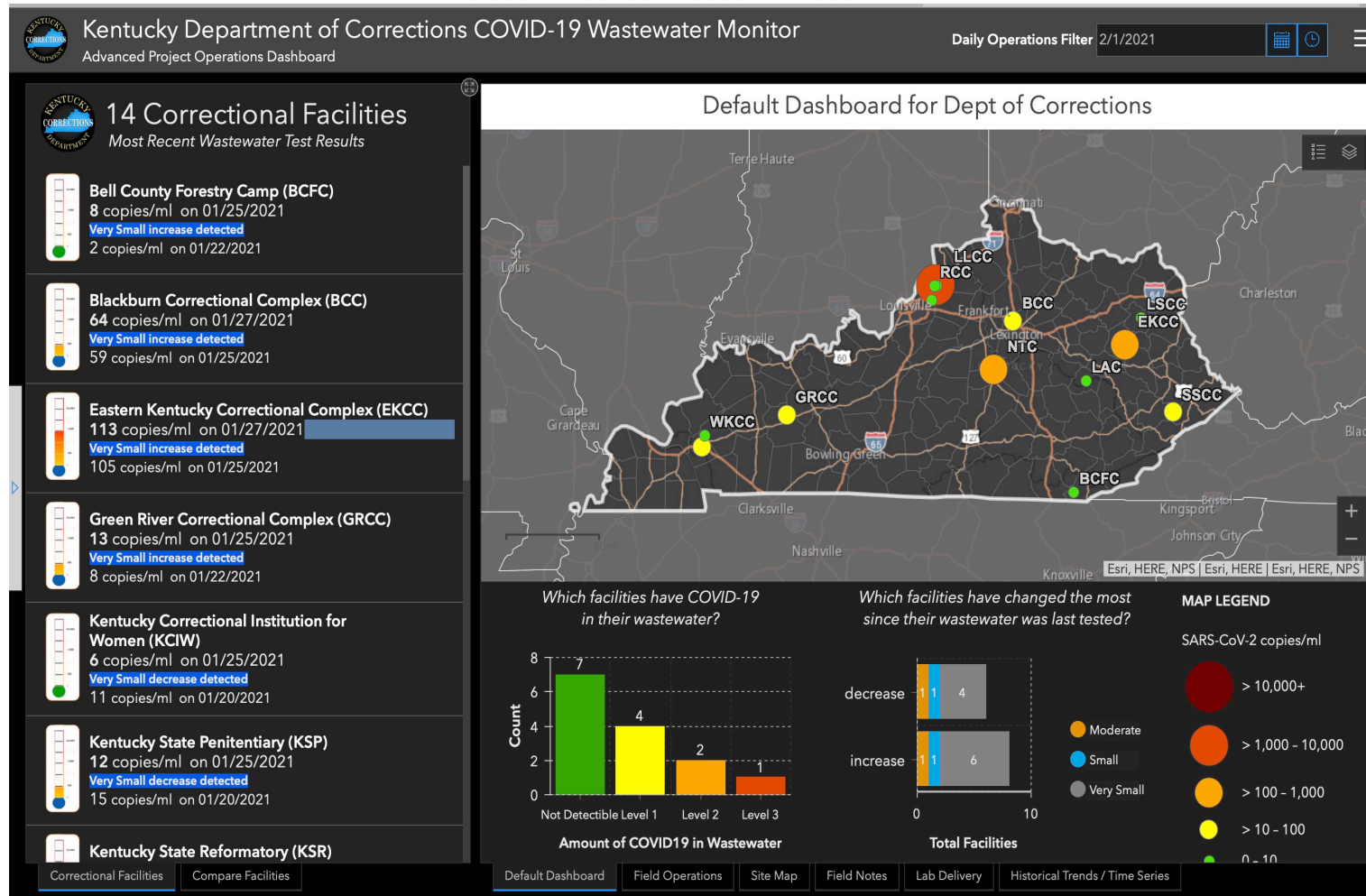
- Western Area
- Central Area
- Eastern Area

**Samples collected three (3x) per week for 52 weeks**



# Commonwealth of Kentucky Correctional Facilities Program

## Custom Dashboard Provides Real Time Information Immediately



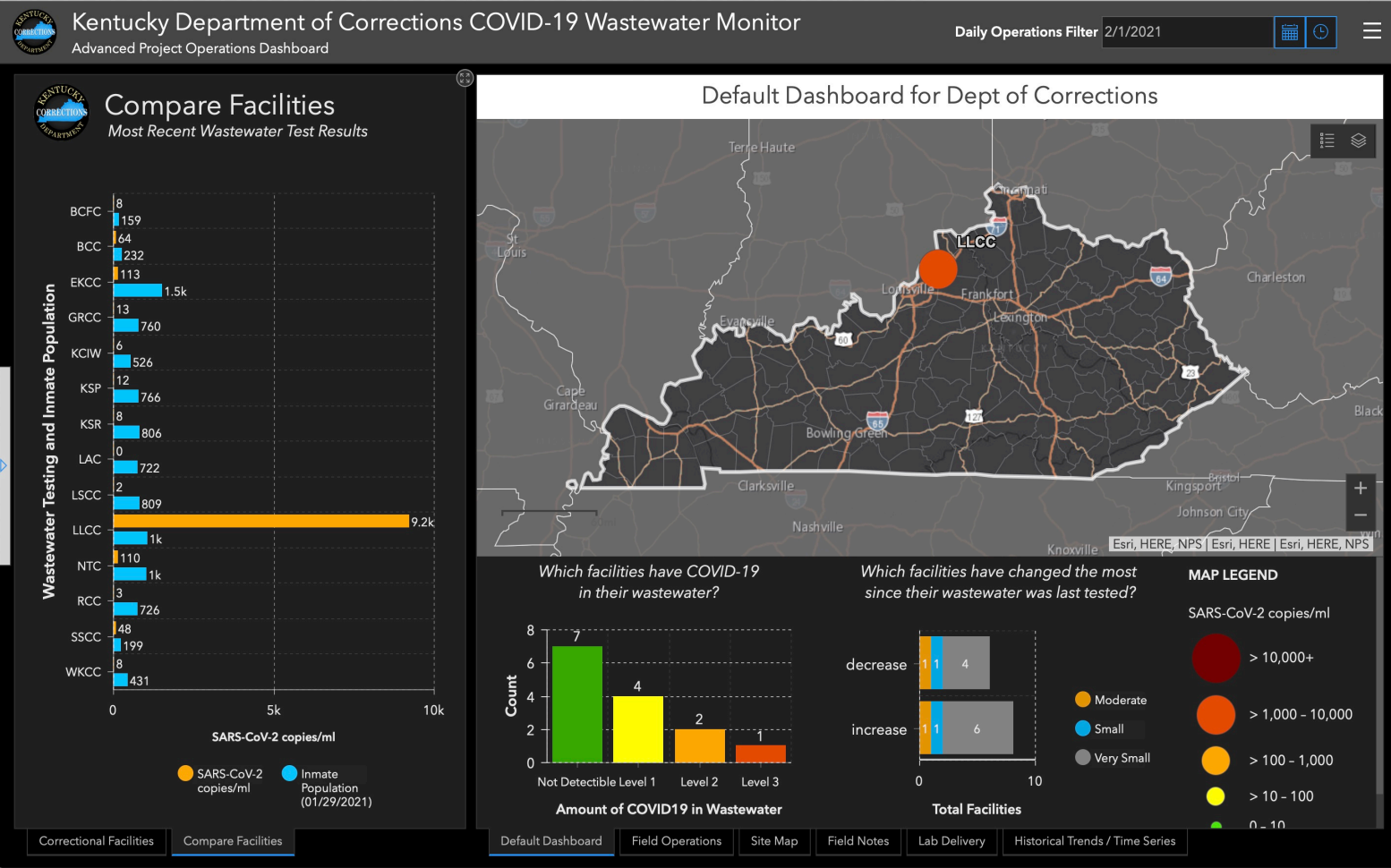
### Heat Map Identifies Facilities with Elevated Levels

- Total Number of Facilities with Level Indication – Green, Yellow, Red
- Data Trending of Facilities - Number Increasing or Decreasing
- One Click to Specific Facility Data throughout the Sample Chain of Custody and Test Results

### Secure Login for Department of Corrections and Public Health Commissioners, and each Warden

# Commonwealth of Kentucky Correctional Facilities Program

## Custom Dashboard Provides Real Time Information at a Glance



- Facility Comparison for Macro Information of Entire System

# Commonwealth of Kentucky Correctional Facilities Program

## Specific Facility Dashboard – Wastewater Sample Chain of Custody Information

Kentucky Department of Corrections COVID-19 Wastewater Monitor  
Advanced Project Operations Dashboard

Daily Operations Filter: 2/1/2021

### 14 Correctional Facilities

Most Recent Wastewater Test Results

- Bell County Forestry Camp (BCFC)**  
8 copies/ml on 01/25/2021  
Very Small increase detected  
2 copies/ml on 01/22/2021
- Blackburn Correctional Complex (BCC)**  
64 copies/ml on 01/27/2021  
Very Small increase detected  
59 copies/ml on 01/25/2021
- Eastern Kentucky Correctional Complex (EKCC)**  
113 copies/ml on 01/27/2021  
Very Small increase detected  
105 copies/ml on 01/25/2021
- Green River Correctional Complex (GRCC)**  
13 copies/ml on 01/25/2021  
Very Small increase detected  
8 copies/ml on 01/22/2021
- Kentucky Correctional Institution for Women (KCIW)**  
6 copies/ml on 01/25/2021  
Very Small decrease detected  
11 copies/ml on 01/20/2021
- Kentucky State Penitentiary (KSP)**  
12 copies/ml on 01/25/2021  
Very Small decrease detected  
15 copies/ml on 01/20/2021
- Kentucky State Reformatory (KSR)**  
8 copies/ml on 01/22/2021

### Current Status of Field Teams

Use the **Daily Operations Filter** in the top right corner to view previous sampling timelines by date.

WESTERN FIELD TEAM	CENTRAL FIELD TEAM	EASTERN FIELD TEAM
% Complete	% Complete	% Complete
33.3%	83.3%	0%

**Green River Correctional Complex**  
Completed 2/1/2021, 9:46 AM  
Day 1 / Wk 4

**Kentucky Correctional Institution for Women**  
Completed 2/1/2021, 8:21 AM  
Day 1 / Wk 4

**Roederer Correctional Complex**  
Completed 2/1/2021, 9:47 AM  
Day 1 / Wk 4

**Blackburn Correctional Complex**  
Completed 2/1/2021, 9:48 AM  
Day 1 / Wk 4

**Kentucky State Reformatory**  
Completed 2/1/2021, 10:09 AM  
Day 1 / Wk 4

**Luther Luckett Correctional Complex**  
Completed 2/1/2021, 10:37 AM  
Day 1 / Wk 4

No Wastewater Samples Collected Today

Last update: a few seconds ago

Navigation: Correctional Facilities | Compare Facilities | Default Dashboard | Field Operations | Site Map | Field Notes | Lab Delivery | Historical Trends / Time Series

Kentucky Department of Corrections COVID-19 Wastewater Monitor  
Advanced Project Operations Dashboard

Daily Operations Filter: 2/1/2021

### 14 Correctional Facilities

Most Recent Wastewater Test Results

- Bell County Forestry Camp (BCFC)**  
8 copies/ml on 01/25/2021  
Very Small increase detected  
2 copies/ml on 01/22/2021
- Blackburn Correctional Complex (BCC)**  
64 copies/ml on 01/27/2021  
Very Small increase detected  
59 copies/ml on 01/25/2021
- Eastern Kentucky Correctional Complex (EKCC)**  
113 copies/ml on 01/27/2021  
Very Small increase detected  
105 copies/ml on 01/25/2021
- Green River Correctional Complex (GRCC)**  
13 copies/ml on 01/25/2021  
Very Small increase detected  
8 copies/ml on 01/22/2021
- Kentucky Correctional Institution for Women (KCIW)**  
6 copies/ml on 01/25/2021  
Very Small decrease detected  
11 copies/ml on 01/20/2021
- Kentucky State Penitentiary (KSP)**  
12 copies/ml on 01/25/2021  
Very Small decrease detected  
15 copies/ml on 01/20/2021
- Kentucky State Reformatory (KSR)**

### Sampler Placement and Other Site Details

Click a facility in the list to the left to view its site map.

Bell County Forestry Camp Sampling Location.jpg

**Bell County Forestry Camp**  
560 Correctional Drive Pineville, KY 40977  
Wallace Evans  
Mobile - (606) 521-2727  
wallace.evans@ky.gov  
Additional contact Doug Brown

**Bell County Forestry Camp, Minimum Security, Pineville, KY 300 Inmates on Jan 29, 2021**

Wastewater flows by gravity to the sample location. We are unaware of any pumped flow or trash grinding/removal. Directly downstream of the sampling point is a pump station that pumps all wastewater up the hill for wastewater treatment.

Navigation: Correctional Facilities | Compare Facilities | Default Dashboard | Field Operations | Site Map | Field Notes | Lab Delivery | Historical Trends / Time Series

# Commonwealth of Kentucky Correctional Facilities Program

## Specific Facility Dashboard – Wastewater Sample Chain of Custody Information

Kentucky Department of Corrections COVID-19 Wastewater Monitor  
Advanced Project Operations Dashboard

Daily Operations Filter 2/1/2021


**14 Correctional Facilities**  
Most Recent Wastewater Test Results

- Bell County Forestry Camp (BCFC)**  
8 copies/ml on 01/25/2021  
Very Small increase detected  
2 copies/ml on 01/22/2021
- Blackburn Correctional Complex (BCC)**  
64 copies/ml on 01/27/2021  
Very Small increase detected  
59 copies/ml on 01/25/2021
- Eastern Kentucky Correctional Complex (EKCC)**  
113 copies/ml on 01/27/2021  
Very Small increase detected  
105 copies/ml on 01/25/2021
- Green River Correctional Complex (GRCC)**  
13 copies/ml on 01/25/2021  
Very Small increase detected  
8 copies/ml on 01/22/2021
- Kentucky Correctional Institution for Women (KCIW)**  
6 copies/ml on 01/25/2021  
Very Small decrease detected  
11 copies/ml on 01/20/2021
- Kentucky State Penitentiary (KSP)**  
12 copies/ml on 01/25/2021  
Very Small decrease detected  
15 copies/ml on 01/20/2021
- Kentucky State Reformatory (KSR)**

**Field Notes and Pictures of Samples**  
Click a facility in the list to the left view its field notes

1/29/2021, 10:45 AM - BCFC (Wk 3/Day 3)

Sample\_site\_image-20210129-130719.jpg



**BCFC Wk 3 / Day 3 - Eastern Area**  
Bell County Forestry Camp  
Composite Sample on 1/29/2021, 10:45 AM  
#3003040123  
Light brown, 65/96 samples collected, clear weather, some sediment  
\*\*location inaccurate could not load app at site\*\* (Corby Smith)

**BCFC Wk 3 / Day 2 - Central Area**  
Bell County Forestry Camp  
Composite Sample on 1/27/2021, 10:45 AM  
#30020400107  
Light brown/foggy, half jug, some sediment, clear weather, \*location not accurate, could not load app at site\* (Corby Smith)

**BCFC Wk 3 / Day 1 - Eastern Area**  
Bell County Forestry Camp  
Composite Sample on 1/25/2021, 11:30 AM  
#30010400091  
Half jug (56/96), light brown tint, some sediment, rainy weather. (Corby Smith)

**BCFC Wk 2 / Day 3 - Eastern Area**  
Bell County Forestry Camp  
Composite Sample on 1/22/2021, 6:15 PM  
#20030400081  
Light brown color, full jug, clear weather \*location not accurate could not load app at site\* (Corby Smith)

**BCFC Wk 2 / Day 1 - Eastern Area**  
Bell County Forestry Camp  
Composite Sample on 1/19/2021, 5:45 PM  
#20010500046  
(Danielle Doering)

**BCFC Wk 1 / Day 3 - Eastern Area**  
Bell County Forestry Camp  
Composite Sample on 1/15/2021, 10:25 AM  
#10030500030  
(Kendall Stone)

**BCFC Wk 1 / Day 2 - Eastern Area**

Kentucky Department of Corrections COVID-19 Wastewater Monitor  
Advanced Project Operations Dashboard

Daily Operations Filter 2/1/2021

**14 Correctional Facilities**  
Most Recent Wastewater Test Results

- Bell County Forestry Camp (BCFC)**  
8 copies/ml on 01/25/2021  
Very Small increase detected  
2 copies/ml on 01/22/2021
- Blackburn Correctional Complex (BCC)**  
64 copies/ml on 01/27/2021  
Very Small increase detected  
59 copies/ml on 01/25/2021
- Eastern Kentucky Correctional Complex (EKCC)**  
113 copies/ml on 01/27/2021  
Very Small increase detected  
105 copies/ml on 01/25/2021
- Green River Correctional Complex (GRCC)**  
13 copies/ml on 01/25/2021  
Very Small increase detected  
8 copies/ml on 01/22/2021
- Kentucky Correctional Institution for Women (KCIW)**  
6 copies/ml on 01/25/2021  
Very Small decrease detected  
11 copies/ml on 01/20/2021
- Kentucky State Penitentiary (KSP)**  
12 copies/ml on 01/25/2021  
Very Small decrease detected  
15 copies/ml on 01/20/2021
- Kentucky State Reformatory (KSR)**

**Sample Delivery & Chain of Custody**

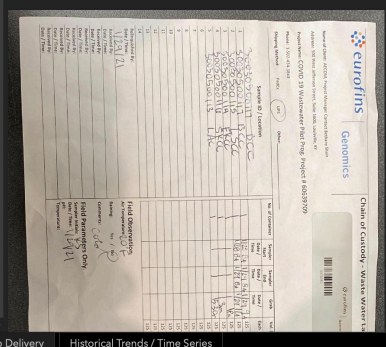
Delivered to Lab <b>0</b> Pending Receipt	Delivered to UPS <b>1</b> In Transit	Total Lab Kits <b>25</b> Received By Lab	Total Lab Kits <b>1</b> Lost By Shipper
-------------------------------------------------	--------------------------------------------	------------------------------------------------	-----------------------------------------------

**Sample Delivery Status**

- Chain of Custody not complete**  
Eastern Team CoC # 3003050  
Wk 3 - Day 3 - 1/29/2021, 7:41 PM  
Tracking # 1ZE1428E4179088554
- Chain of Custody received by lab**  
Central Team CoC # 3003040  
Wk 3 - Day 3 - 1/29/2021, 5:43 PM  
Tracking #
- Chain of Custody received by lab**  
Western Team CoC # 3003060  
Wk 3 - Day 3 - 1/29/2021, 3:46 PM  
Tracking #
- Chain of Custody received by lab**  
Eastern Team CoC # 3002050  
Wk 3 - Day 2 - 1/28/2021, 9:50 AM  
Tracking # 1ZE1428E1580607771
- Chain of Custody received by lab**  
Central Team CoC # 3002040  
Wk 3 - Day 2 - 1/27/2021, 10:44 PM  
Tracking #
- Chain of Custody received by lab**  
Western Team CoC # 3002060  
Wk 3 - Day 2 - 1/27/2021, 3:31 PM  
Tracking #

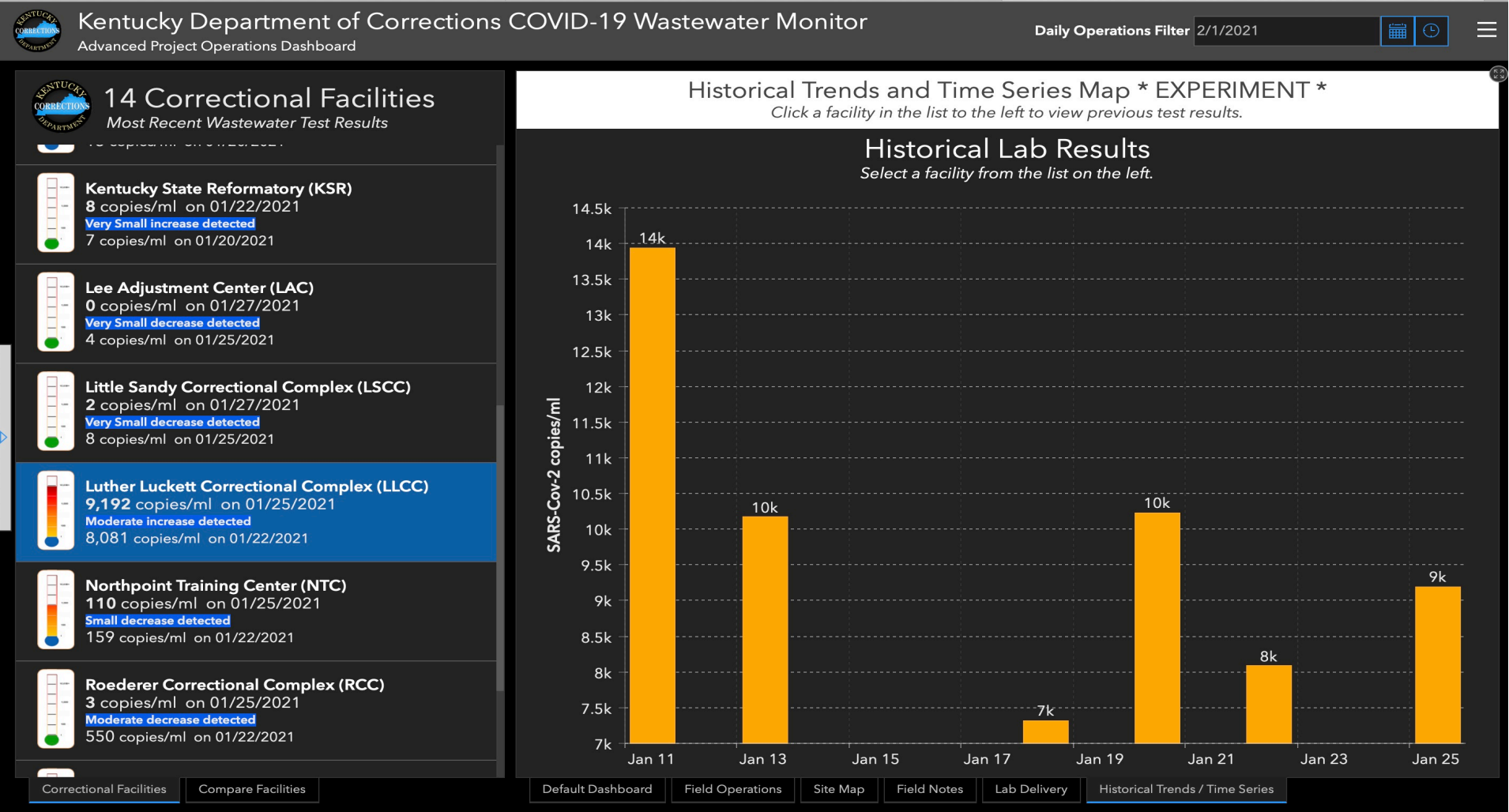
**Eastern - Chain of Custody not complete**  
Chain of Custody # 3003050  
Received by  
Wk 3 / Day 3 1/29/2021, 7:41 PM

CoCPhoto-20210130-002412.jpg



# Commonwealth of Kentucky Correctional Facilities Program

## Specific Facility Dashboard – Concentration of SARS-CoV-2 RNA at Specific Facilities



## Key Findings and Ongoing Work



- Viral dynamics in wastewater capture the multiple Covid-19 waves.
- Very cost effective and fast compared to individual clinical testing.
- Wastewater virus trends lead clinical data by approximately one week and as much as approximately two weeks.
  - Can provide valuable time for actions to protect human health (testing, quarantine, other measures).
  - Very good correlation between viral RNA protein concentration in wastewater and number of infected individuals in the sewer shed of the community.
- Provide a measure of health for the overall community in advance of clinical testing.
- Determines and verifies efficacy of vaccination programs.
- Monitoring expanding to other sites with complementary analysis.
- Genetic sequencing to detect variants underway.

# Acknowledgments

- Bergen County Utilities Authority
- Commonwealth of Kentucky
- GHI
- Columbia University
- National Science Foundation
- ALS Global Laboratories
- Eurofins Laboratories

Beverley Stinson, PhD  
[Beverley.Stinson@aecom.com](mailto:Beverley.Stinson@aecom.com)

Paul Storella, PE  
[Paul.Storella@aecom.com](mailto:Paul.Storella@aecom.com)



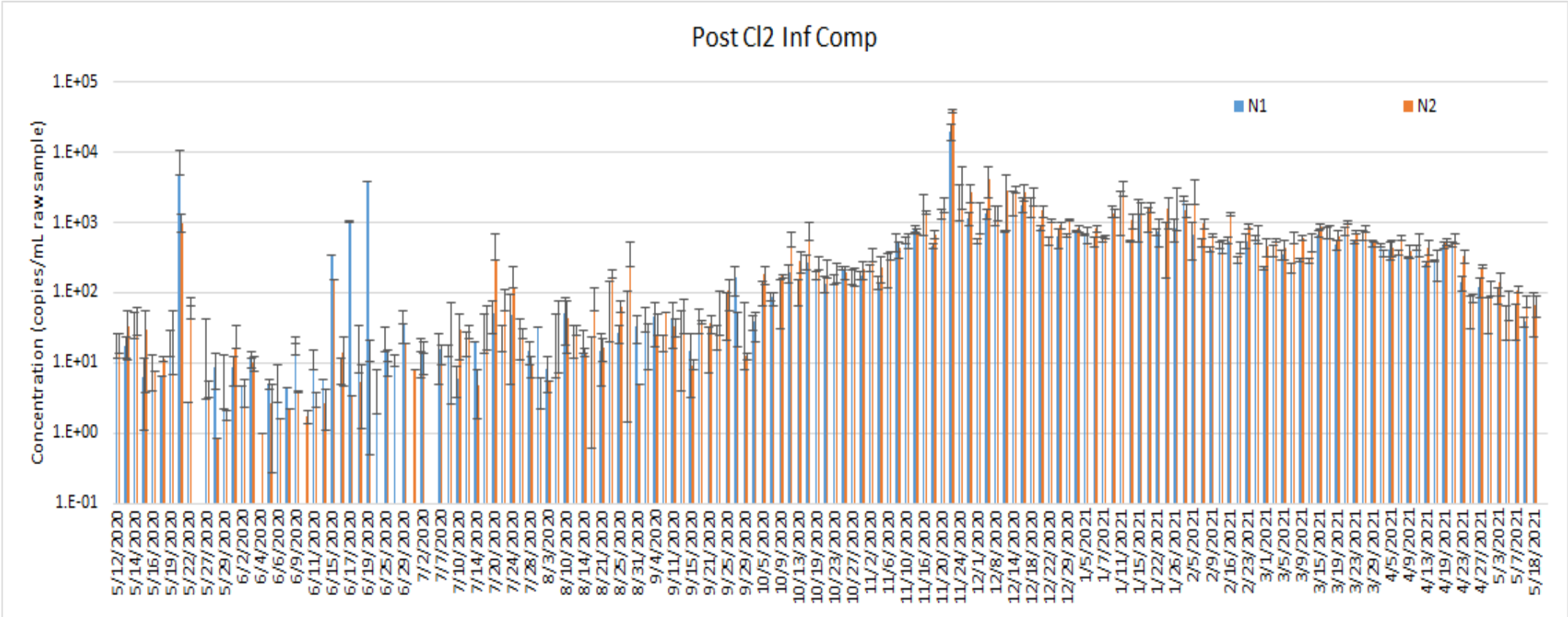
# Thank you.

Beverley Stinson, PhD  
[Beverley.Stinson@aecom.com](mailto:Beverley.Stinson@aecom.com)

Paul Storella, PE  
[Paul.Storella@aecom.com](mailto:Paul.Storella@aecom.com)



# BCUA Phase 1 Results – Little Ferry WPCF



**At Little Ferry - Wastewater SARS-CoV-2 concentrations have in general decreased following a peak during Fall-Winter 2020. However, concentrations are still higher than in Spring 2020**

# Results Summary

Grab and composite samples from locations at the selected towns were collected and tested at ALS Global Laboratories in Houston TX. It needs to be noted that the grab samples provide an instantaneous reading of concentrations and cannot be used for correlation to the composite samples taken at Little Ferry.

During the periods below, elevated concentrations (copies/mL) in the samples were noted at the following locations:

Location	Copies/mL (samples detected/total samples)								
	3/8-3/12*	3/15-3/19*	3/22-3/26*	4/5-4/9*	4/12-4/16*	4/19-4/23*	4/26-4/30*	5/3-5/7*	5/10-5/14*
Cliffside Park	3,000 (1/2)	6,000 (1/2)	500 (1/1)	900 (1/1)**	900 (1/2)**	2,000 (1/2)**	1,000 (2/2)**	1,000 (1/2)**	200 (1/2)**
Elmwood Park	1,500 (1/2)	3,000 (1/2)	700 (1/1)	500 (1/1)	1,000 (1/2)**	2,000 (1/1)**	900 (1/2)**	500 (1/2)**	200 (2/2)**
Fairview	3,000 (1/2)	256,000 (1/2)	500 (1/1)	<500 (1/1)**	2,000 (1/2)**	8,000 (1/2)**	2,000 (1/2)**	100 (1/2)**	500 (1/2)**
Lodi	<20 (2/2)	14,000 (1/2)	1,000 (1/1)	600 (1/1)**	2,000 (1/3)**	3,000 (1/1)**	1,000 (1/2)**	2,000 (1/2)**	60 (1/2)**
Garfield	4,000 (1/2)	12,000 (1/2)	<500 (1/1)	500 (1/1)	4,000 (1/2)**	1,000 (1/1)**	400 (1/2)**	600 (1/2)**	100 (2/2)**
Lyndhurst	4,000 (1/4)	6,000 (1/4)	10,000 (1/2)	#1: 1,000 (1/1) #2: <500 (1/1)**	#1: 24,000 (1/2) #2: 1,000 (1/3)**	#1: NA #2: 700 (1/1)**	#1: 1,000 (1/2) #2: 500 (1/2)**	#1: 5,000 (1/2) #2: 300 (1/2)**	#1: 400 (1/2) #2: 70 (1/2)**
Englewood	2,000 (1/2)	3,000 (1/2)	700 (1/1)	NA	<500 (1/1)**	1,000 (1/1)**	300 (1/2)**	<20 (2/2)**	80 (1/2)**
Bergenfield	2,000 (1/2)	3,000 (1/2)	<500 (1/1)	1,000 (1/1)	600 (1/1)**	1,000 (1/2)**	500 (1/2)**	200 (2/2)**	300 (1/2)**
Hackensack	2,000 (1/2)	4,000 (1/2)	<500 (1/1)	2,000 (1/1)	<500 (1/1)**	1,000 (1/2)**	400 (1/2)**	100 (1/2)**	100 (1/2)**
Paramus	2,000 (1/2)	2,000 (1/2)	<300 (1/1)	100 (1/1)	700 (1/1)**	1,000 (1/2)**	200 (1/2)**	300 (1/2)**	100 (1/2)**
Fairlawn	<700 (4/4)	<800 (4/4)	<300 (1/1)	2,000 (1/2)**	3,000 (2/6)**	2,000 (2/4)**	500 (1/4)**	400 (1/4)**	80 (1/4)**
Little Ferry WPCF	NA	NA	NA	NA	NA	NA	NA	NA	200 (1/1)**

\*Note that these dates represent date that samples were received by lab

\*\*Composite sample results