# WASTEWATER SURVEILLANCE PROGRAM

**Resilient Environment Department**

**October 2022**

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## Executive Summary

In response to the increase in infectious disease outbreaks within the US, government agencies have sought tools to enhance the early detection of viruses to minimize spread. One such tool, wastewater surveillance, has proven to be effective in detecting the presence and spread of viruses. While clinical data remains the gold standard for disease surveillance and tracking, availability is limited by reporting bias and the inability to track asymptomatic disease carriers. Wastewater surveillance, however, allows the detection of disease agents regardless of disease symptom severity as the disease agents are excreted in the urine and feces of infected individuals and wastewater is relatively easy to collect from different cross sections of the population. Therefore, wastewater surveillance can offer a cost-effective mechanism relative to individual testing to provide insights into community health independent of biases associated with case-reporting. For SARS-CoV-2 and other disease-causing agents, an aggregate wastewater-monitoring system at the level of a wastewater treatment plant can help identify or confirm clusters of infection.

It should be noted that the CDC is still working to create sampling methods and testing standards specific to the SARS-CoV-2 pathogen and currently does not have guidance available regarding sampling methodology standardization for other disease-causing agents. This means the identification of specific viruses of concern to Broward County would require the services of epidemiologists and/or contracted services for developing testing protocols. The specifics of these protocols would also need to be tailored to whether the county: a) wants to test to confirm the absence of those pathogens; and/or b) wants to create an unbiased estimate of transmission at the community level. In addition, the lack of standardization for non-SARS-CoV-2 pathogens may make it difficult to compare data collected in Broward County with data collected in other locations until such guidance is developed by the CDC and implemented on a consistent basis around the country.

This report will explore the feasibility and limitations of wastewater surveillance, the capabilities in place to analyze for existing pathogens and emerging pathogens of concerns, the feasibility for Broward County to perform wastewater surveillance, and the cost associated with sample collection and analysis. Based on the findings within this report, recommended options include, but are not limited to, the following:

1. Fully outsource a comprehensive program by hiring a consultant to institute and manage a wastewater surveillance program in Broward County. Estimated cost between $1.5 - $2.2 million annually.
2. Fully outsource a limited wastewater surveillance program by hiring a consultant to implement a piloted wastewater surveillance program at a county-owned facility (WWS). Estimated cost between $400,000 and $600,000 annually.
3. Fully outsource a limited program by hiring a consultant to work with the Florida Wastewater Surveillance Program specific to SARS-CoV-2. (county-wide or WWS). Estimated cost between $315,000 - $374,000 annually.
4. Await development of guidance and standard sampling protocols from the CDC as part of the National Wastewater Surveillance System.

Implementation will require engaging and constructing a framework with collaborating government agencies. *Success hinges on a public health entity's participation, as any data we might acquire would need their cooperation for analysis and implementation of any appropriate protective measures*. In addition, municipalities and wastewater treatment providers would need to cooperate regarding site access, sample

collection, sample frequency, parameters for analysis, and data use/sharing. There will also be a need to consider privacy concerns, the potential risk of stigmatization, and societal perceptions regarding wastewater surveillance.

## *NATIONAL WASTEWATER SURVEILLANCE SYSTEM

In response to the COVID-19 pandemic, CDC launched the National Wastewater Surveillance System (NWSS) in September 2020. CDC developed NWSS to coordinate and build the nation's capacity to track the presence of SARS-CoV-2, the virus that causes COVID-19, in wastewater samples collected across the country.

CDC's NWSS works with health departments to track SARS-CoV-2 levels in wastewater so communities can act quickly to prevent the spread of COVID-19. NWSS is transforming independent local efforts into a robust, sustainable national surveillance system.

### How wastewater surveillance works

People infected with SARS-CoV-2 can shed viral RNA (genetic material from the virus) in their feces, and this RNA can be detected in community wastewater. Wastewater, also referred to as sewage, includes water from household or building use (such as toilets, showers, and sinks) that can contain human fecal waste, as well as water from non-household sources (such as rain and industrial use).

Wastewater from a sewer shed (the community area served by a wastewater collection system) is collected as it flows into a treatment plant.

The samples are sent to environmental or public health laboratories for SARS-CoV-2 testing.

Health departments submit testing data to CDC through the online NWSS Data Collation and Integration for Public Health Event Response (DCIPHER) portal.

The NWSS DCIPHER system analyzes the data and reports results to the health department for use in their COVID-19 response. The results are available to the public through CDC's COVID Data Tracker.

### Is wastewater surveillance right for my community?

Wastewater surveillance for the virus that causes COVID-19 is a developing field. Health departments setting up a wastewater surveillance system to detect infectious germs should consider the following issues to make sure they are gathering data that are useful for a public health response:

- Wastewater testing over time can provide trend data that can complement other surveillance data to inform public health decision making. However, at this time, it is not possible to reliably and accurately predict the number of infected individuals in a community based on wastewater testing.
- Community-level wastewater surveillance at a treatment plant will not capture homes on a septic system.
- Community-level wastewater surveillance at a treatment plant also will not capture communities or facilities served by decentralized systems, such as prisons, universities, or hospitals, that treat their waste.

- Low levels of infection in a community may not be captured by wastewater surveillance. The lower limits of detection (i.e., the smallest number of people shedding the virus in stool that can still be detected by current testing methods) for wastewater surveillance are not yet known. More data on fecal shedding by infected individuals over the course of disease are needed to better understand the limits of detection.
- Some wastewater treatment plants may not be appropriate as surveillance sites given their operations logistics (for example, if wastewater is pre-treated before it reaches the plant).

## How do I become engaged in NWSS?

Using wastewater surveillance for public health action requires a multidisciplinary approach. Communities interested in conducting wastewater surveillance for COVID-19 should identify the necessary local partners for sample collection, testing, and public health action.

Local partners should include:

- State, local, tribal, and territorial health departments—COVID-19 epidemiologists and environmental health specialists.
- Wastewater treatment plants—managers and workers.
- Laboratories—public health, environmental, academic, and/or private. (Note: CDC is not currently accepting wastewater samples for testing.)
- NWSS participation is expected to grow as health departments and public health laboratories develop their capacity to coordinate wastewater surveillance, including epidemiology, data analytics, and laboratory support. Learn more [PDF – 1 page] about building wastewater surveillance with NWSS.

**The information in this section comes directly from the Center for Disease Control and Prevention's (CDC) website. www.cdc.gov/healthywater/surveillance/wastewater-surveillance/wastewater-surveillance.html*

# WASTEWATER SURVEILLANCE PROGRAM MODELS

## New York State Department of Health contract with Syracuse University

In March of 2020, New York State began analyzing wastewater for SAR-CoV-2. Participating wastewater treatment plants provided wastewater samples. Lab analysis was conducted at contracted laboratories and data was provided back to the county to guide response to the coronavirus pandemic. In August of 2020, New York State Department of Environmental Conservation funded $500,000 for a pilot program with Syracuse University to test the feasibility of wastewater surveillance to monitor COVID-19. Testing was done in selected counties for six weeks and data was used to inform the state program. Currently the team involved in the program includes experts in microbiology, chemistry, epidemiology, statistical modeling, and information sciences and includes scientists from the state health department and the U.S. Centers for Disease Control and Prevention.

County staff contacted Syracuse University to gain more details on the current operations and funding. Funding came through the CDC's Expanding Laboratory for Emerging Pathogens program. They were contracted to scale the entire program including building dashboards and modeling of data to inform New York Department of Health for potential policy making consideration. The initial budget following the pilot was $900,000 for sampling once weekly and lab costs for processing of samples from the treatment plants, plus an additional $200,000 for a post-doctoral staff and another staff position to build the program. Their current budget for the expanded SARS-CoV-2 program is $5.9 million, which now includes the entire state, over 200 sampling plants with a 1-to-2-week sampling frequency. Beyond the SARS-CoV-2 program they are piloting programs for Monkeypox, influenza A, hepatitis A, Norovirus, RSV, and antimicrobial resistance testing and currently scaling a statewide program for Polio sampling at an estimated cost of $1.5 million per year. The Polio pilot includes all of the 200 sampling plants with varying frequencies of testing.

## Florida Wastewater Surveillance Program

The Florida Department of Health (FDOH) is currently in the process of developing a Florida Wastewater Surveillance Program (FWSP), through the Division of Disease Control and Health Protection. At this time, the focus is sampling and testing for SARS-CoV-2, only. The program is led by an Epidemiologist and has an approximate start date of the end of 2022.

The program model consists of several components, including sample collection, analyses, and data sharing. FWSP anticipates paying for sampling kits, testing, and shipping costs. The sampling kits will be mailed through the Department of Health to participating wastewater treatment plants (WWTP). Participating WWTPs will collect samples twice a week and mail samples to FDOH Bureau of Public Health Labs where samples will then be analyzed for SARS-CoV-2. FWSP will upload data into the DCIPHER National Wastewater Surveillance System portal (referenced above), which is then published publicly by the CDC. FWSP staff will generate a weekly report with data across all participating sites and disseminate this information to the respective County Health Departments and utility partners for internal use.

## Individual Wastewater Surveillance in Florida

In addition to the state-wide program model being developed, the FWSP also has a model for Individual wastewater surveillance. This model is based on individual agencies paying for sampling kits, testing, and shipping costs with private labs to deliver the testing protocol. Under this model, the individual agency is responsible for obtaining and submitting the private lab data to the FWSP staff once a week for entry into the DCIPHER database. Data publishing and distribution is managed as described above.

## Altamonte Springs, Florida Wastewater Surveillance Program

Altamonte Springs is a suburban city in Seminole County, Florida, with a population of 46,231 according to the 2020 Census.

The City provides wastewater treatment services to all residents at one central treatment facility, a Regional Water Reclamation Facility. In addition, the City provides wastewater treatment services to six entities located outside the City through agreements. The City's wastewater collection consists of 73,100 lineal feet of 6-inch through 48-inch diameter gravity sewer and 74 pump stations pump the wastewater through 136,220 lineal feet of four-inch through 30-inch diameter force main to the City's 12.5 MGD wastewater treatment plant.

Altamonte Springs initiated wastewater surveillance in September of 2020 at their central treatment facility at the direction of their City Manager and Utilities Director. The primary focus was identification of SARS-CoV-2 in the initial protocol. The utility contracted with an external laboratory, GT Molecular in Fort Collins, Colorado for sample analysis, while the Utility Director developed the protocol for sample collection. The protocol includes the staff collection of one (1) - 24-hour composite sample (Sunday/Monday) and one (1) – 24-hour composite sample (Wednesday/Thursday) to capture pre- and post-weekend activities. Samples are shipped via FedEx to the analytic laboratory prelabeled boxes provided by the laboratory, with a 24-hour turnaround time. The City Manager receives results from the laboratory on Wednesday and Saturday. Data for SARS-CoV-2 are uploaded to the CDC's National Wastewater Surveillance Dashboard and DCIPHER database. The City Manager disseminates results in weekly reports to CDC, FDOH, Elected Officials, area hospitals and National Institute of Health (NIH).

Due to the success and support of the surveillance program, Altamonte Springs officials have expanded the program to include testing for Monkeypox, Influenza A & B and they will be participating in beta testing for Polio virus.

Altamonte Springs spends approximately $10,000 per month for sample analysis.

## Private Laboratory Testing and Analysis Example

GT Molecular Laboratory (Contracted Laboratory for Altamonte Springs)

GT Molecular is based out of Fort Collins, Colorado. Their team has experience in molecular genetics, assay technology development and clinical medicine. The company started in 2018 developing ultra-sensitive technology to fight cancer. They have since expanded these technologies in the development of assays to detect SARS-CoV-2 (single and multi-variant), hMPXV (Human Monkeypox Virus), Influenza A & B, and will start beta testing their assay for Polio in the next couple of weeks.

GT Molecular was just awarded a bid from CDC to develop assay technology for thirty (30) different pathogens and they receive grant funding from NIH.

GT Molecular assays demonstrate a limit of detection 3000 copies of viral RNA per liter of media.

GT Molecular can field some epidemiology calls relating to results with current staff (3 PhD and 1 molecular biologist).

GT Molecular currently provides analytical support to six (6) customers in Florida. In addition, they provide analytical support to one hundred (100) customers nationwide. GT molecular has the capabilities to upload data directly in to the DCIPHER database or can send results to the agency to upload.

## CONSIDERATIONS

Based on the research completed to date, the following are topics for consideration when designing a wastewater surveillance program:

- What are the specific viruses of concern to Broward County? Does the county want to test to confirm the absence of those pathogens and/or create an unbiased estimate of transmission at the community level?
- Currently, the CDC is working to create sampling methods and testing standards specific for the SARS-CoV-2 pathogen. At this time, they only have guidance available for sampling regime planning for the SARS-CoV-2 pathogen.
- Most programs either include or have some level of communication with their respective Department of Health.
- All programs include Epidemiologists or contracted services for sampling, testing and analyzing sample data.
- Most models provide sample collection directly at the wastewater treatment plants.
- A Request for Information (RFI) should include the following components to ensure the selection of a properly qualified vendor and the delivery of a robust program, should the County wish to outsource services for a wastewater surveillance program:
    - Required expertise in Epidemiology
    - Provide recommendation for which pathogens to test for in wastewater
    - Research and advise regarding best sampling methods to use and necessary frequency of testing for the pathogens selected.
    - Coordinate with municipalities on their desire for participation.
    - Organize and manage field work for sampling.
    - Source a lab for each pathogen recommended for sampling
    - Organize and manage the process of sample transfer to the designated laboratory
    - Obtain results and consult with appropriate CDC and State Department of Health staff.
    - Recommend next steps after consulting with CDC and provide to Broward County for Board consideration.
    - Have staff available to answer questions from Broward County, partners or the public.

# POTENTIAL PARTNERSHIPS

## Municipal Partner Communication

County staff contacted the 9 municipal Wastewater Treatment Plants that partnered with the County for Covid-19 sampling and analyses of influent domestic wastewater. Staff asked those cities if they would be willing to participate in another wastewater surveillance program outside of what was initiated for Covid-19 if the County wished to pursue a program. The results are included in the table below.

| Survey Results | Count | Percentage |
|---|---|---|
| Yes | 2 | 22.22% |
| Need More Information Before Deciding | 3 | 33.33% |
| Not Interested | 2 | 22.22% |
| Unsure | 2 | 22.22% |

The models researched for this review consistently performed sample collection at the wastewater treatment plant. For a full county-wide program, municipal participation is needed.

## Florida Department of Health in Broward

The Florida Department of Health (DOH) in Broward was contacted in this review. Currently, DOH in Broward is just learning about the state program and recommends working directly with the state's Florida Wastewater Surveillance Program.

## Florida Department of Health

In the course of this research, County staff contacted the newly formed Florida Wastewater Surveillance Program (FWSP) staff to learn more about the state's effort. FWSP confirmed local DOH participation is not a requisite to participation, but support for individual programs is at the sole cost of the entity conducting the individual program.

## Center for Disease Control and Prevention

Staff asked the CDC for more information regarding the national program and collaborations with local governments. The CDC advised if a county/local government were interested in wastewater surveillance, they should first connect with their State Department of Health; the State may already be involved in building up wastewater surveillance programs and might be able to give more specific information. If the state were not working with the National Wastewater Surveillance System (NWSS) already, the NWSS could work directly with the local/county health department. The CDC's desire was for the State coordinator to be aware of efforts in wastewater surveillance at local levels, with data typically first sent to the State and *then* to CDC.

# RECOMMENDATIONS FOR CONSIDERATION

## Option 1. Full Outsourcing of a Comprehensive Wastewater Surveillance Program (estimated cost between $1.5 and $2.2 million annually)

This option includes full outsourcing of a county-wide program for comprehensive wastewater surveillance. This would allow the County to scale the program as desired and obtain the necessary expertise and resources to conduct a consistent and sustained monitoring effort inclusive of data analyses and reporting. *Success hinges on a public health entity's participation, as any data we might acquire would need their cooperation for analysis and implementation of any appropriate protective measures*.

The base level costs of a wastewater surveillance program are a function of the number of locations sampled, sample frequency, the variant and laboratory costs associated with testing/analysis. There are other administrative and overhead costs as well. While conducting research staff received varied estimates from other programs of $250 per sample for sample processing for SARS-CoV-2 to $500 for SARS-CoV-2 and Monkeypox testing, epidemiology support, shipping, and analysis. Specific information from a known laboratory, (GT Molecular), indicates single variant testing of SARS-CoV-2 is $295 per sample (includes shipping container, collection tube, and FEDEX label). For multiple variant testing of SARS-CoV-2 cost per sample is $695. For testing of hMPXV (Human Monkeypox Virus), cost per sample is $295, and for Polio cost per sample is estimated between $200 - $295.

Utilizing the County's procurement process, a Request for Information (RFI), could be advanced to determine the exact costs for full program outsourcing. The vendor would be required to provide costs to manage all aspects of the program, including coordination with the Florida Department of Health and the CDC, hiring of epidemiologist or virologist to interpret data; coordination of sample collection and analysis; pursuit of state and federal funding to support wastewater surveillance efforts, and municipal outreach for program expansion, as warranted.

## Option 2. Limited Launch at the County's Wastewater Services Facilities with Program Outsourcing (estimated cost between $400,000 and $600,000 annually)

This option recommends the hiring of a consultant as a program administrator to develop a scalable program for piloted implementation with the County's WWS and potential expansion with municipal wastewater service providers. In this model, the consultant would be responsible for developing the recommended protocol for sample collection; identifying laboratories credentialed in the analyses for pathogens selected by the Board; providing state and federal coordination; seeking state and federal funding to support wastewater surveillance efforts; hiring of epidemiologist or virologist to interpret data; and providing municipal outreach for program expansion, as warranted. *Success hinges on a public health entity's participation, as any data we might acquire would need their cooperation for analysis and implementation of any appropriate protective measures*.

It is recommended that the ultimate protocol for sample collection be developed by the consultant in conjunction with utility management, including effective sample collection. Officials with Altamonte Springs

provided several recommendations based on their program experience including an initial launch limited to the County's facility before expanding efforts to municipal facilities, as well as contracting with a private laboratory that has experience in ultra-sensitive analyses and low-level detection limits; these laboratories typically have greater capacity to expand analyses in a quicker timeframe than most public laboratories.

### Option 3. Limited SARS-CoV-2 Program with Florida Wastewater Surveillance Program (estimated costs between $315,000 and $374,000 annually)

This option includes the hiring of a consultant to coordinate a SARS-CoV-2 program limited to the upcoming focus of the Florida Wastewater Surveillance Program and would defer on additional viral testing until a broader suite of methodologies and protocols for consistent sampling and reporting are established at the state and/or federal levels. *Success hinges on a public health entity's participation, as any data we might acquire would need their cooperation for analysis and implementation of any appropriate protective measures*.

### Option 4. Monitor development of guidance and standard sampling protocols from the CDC as part of the expansion of the National Wastewater Surveillance System.

This option defers the development of a Broward County led wastewater surveillance program until further development of a standardized surveillance approach by national and state public health agencies pertaining to testing parameters, methods, and data analysis.

Per the CDC, wastewater surveillance for viruses is a developing field and at this time it is not possible to reliably and accurately predict the number of infected individuals in a community based on wastewater testing. In addition, low levels of infection in a community may not be captured by wastewater surveillance as the lower limits of detection (i.e., the smallest number of people shedding the virus in stool that can still be detected by current testing methods) are not yet known. More data on fecal shedding by infected individuals over the course of disease are needed to better understand the limits of detection.

The CDC will continue to expand the NWSS to better understand and respond to infectious disease threats and the NWSS will be establishing Wastewater Surveillance Centers of Excellence to support the continued development of wastewater surveillance for public health. The CDC considers public health laboratories across the nation to be critical to public health infrastructure and is committed to assisting them in developing innovative technologies to help prepare communities to detect and track disease outbreaks now and in the future.

According to the US Government Accountability Office (GAO), some scientists contend that the U.S. could benefit from a standardized approach to wastewater surveillance and the current lack of a standardized approach complicates efforts to aggregate, interpret, and compare data across sites and develop large-scale public health interventions. The GAO has identified the following Policy Context and Questions:

- What steps might help to standardize wastewater surveillance programs in the U.S.?

- What can be done to promote cost-benefit analyses of widespread wastewater surveillance for public health threats?
- If costs and benefits are favorable, what policies would best facilitate the use of wastewater surveillance data while protecting individual privacy?
- How can wastewater surveillance data be used as a public health resource for policymaking?

## Concluding Remarks

Implementation of options 1 through 3 above would require engaging and constructing a framework with collaborating government agencies. *Success hinges on a public health entity's participation, as any data we might acquire would need their cooperation for analysis and implementation of any appropriate protective measures*. Staff looks forward to engaging with the Board and obtaining Board direction on next steps.