



# The value of wastewater surveillance to support COVID-19 response in a community with large-scale asymptomatic testing

Hannah Safford

UC Davis Department of Civil & Environmental Engineering  
hrsafford@ucdavis.edu

## Wastewater-based epidemiology (WBE): A quick intro

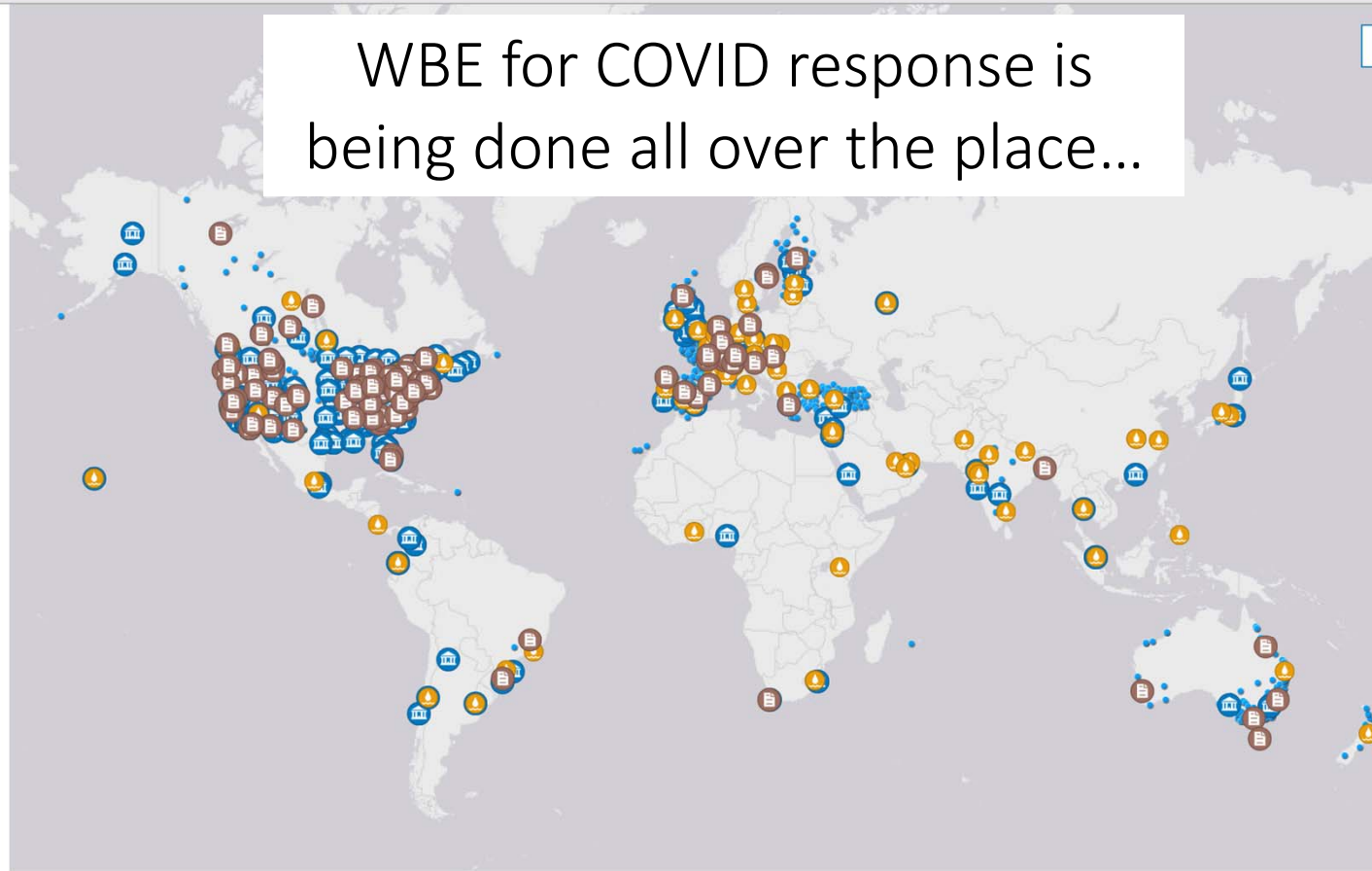
- Analysis of chemical or biological markers in wastewater to provide health-relevant information.



## Wastewater-based epidemiology (WBE): Advantages for pandemic response

- Cost-effective. Low-resource way to gather info on large numbers of individuals.
- Unbiased. Provides data on entire populations rather than the subset who come in for testing.
- Early-warning system. Fecal shedding of virus precedes symptom onset.

WBE for COVID response is being done all over the place...



Dashboards

 **88**

*Last update: a few seconds ago*

Universities

 **263**

*Last update: a few seconds ago*

Countries

 **55**

*Last update: a few seconds ago*

Sites

 **2,302**

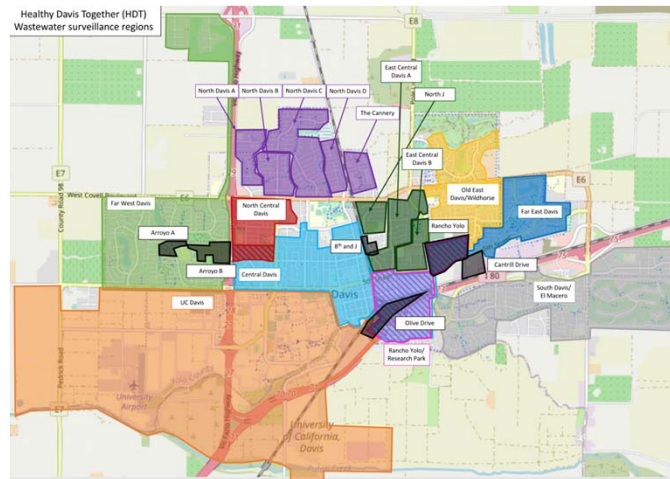
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## ...so what additional value is WBE in Davis providing?



Demonstrating additional value of WBE when asymptomatic testing is at saturation

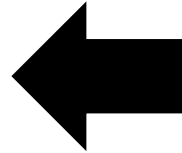


Achieving unmatched level of spatial granularity in sewershed sampling



Using algorithmic approach for sophisticated imputation of missing data

# **Asymptomatic clinical testing**



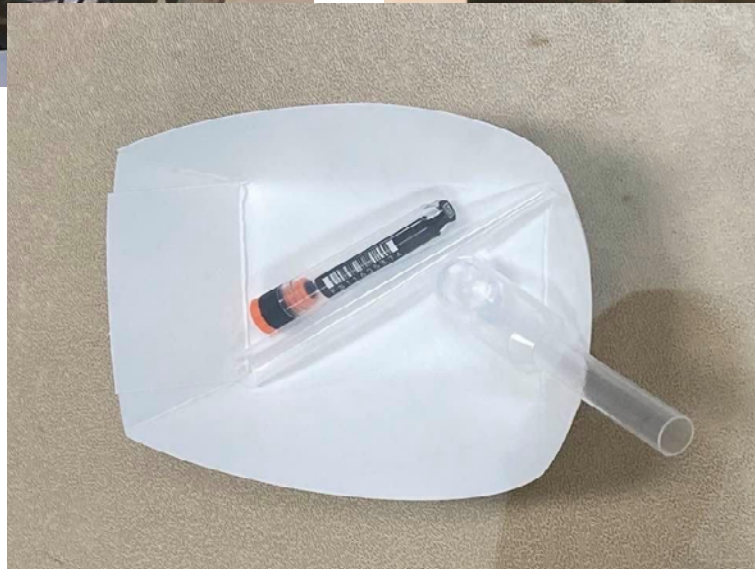
Partnership between UC Davis  
and the City of Davis

*The New York Times*

### ***A California University Tries to Shield an Entire City From Coronavirus***

The University of California, Davis, is providing free testing, masks and quarantine housing to tens of thousands of people who live nearby.

Cited by *The New York Times* as  
“...the most ambitious program  
of its type in the country”





## Healthy Davis Together clinical testing

- Offering free asymptomatic tests to all Davis workers, residents, and household members since November 2020.
- 21 testing sites, including six stationary sites, two mobile testing vans, and 13 K–12 school testing sites.
- Huge, multi-pronged outreach program

# Healthy Davis Together clinical testing: outreach

Billboards/banners



**Got tested?  
Get rewarded!**

To keep our community safe and healthy, District (DJUSD) students and staff are encouraged to get tested. Take advantage of this free opportunity.

Cash and prize incentives

**Enter to win prizes!**

Every time you take a COVID-19 test at your school or at a Healthy Davis Together site, you can enter to win prizes! Just fill out a raffle ticket at the raffle table after you take your test and you could win a grand prize valued at \$500. Other prizes will be up for grabs, too! All DJUSD students are eligible.



Bilingual social media

Hazte la prueba. Vacúnate.



HEALTHY DAVIS TOGETHER

FREE COVID-19 TESTING

**Get tested**

TV ads

## Healthy Davis Together clinical testing

- Number of Davis residents who reported receiving at least one COVID test rose from 30% to 73% from Sept. 2020–March 2021.
  - For comparison: ThermoFisher survey conducted in Jan. 2021 found that 2/3 of Americans had never received a COVID test.
- Takeaway: HDT represents a setting in which clinical testing is about as good as it can get.

## **Even the best clinical-testing program falls short in some ways**

- 73% is good, but it's not everyone.
- Only a subset of the 73% are consistent testers.



## Data from May 2021

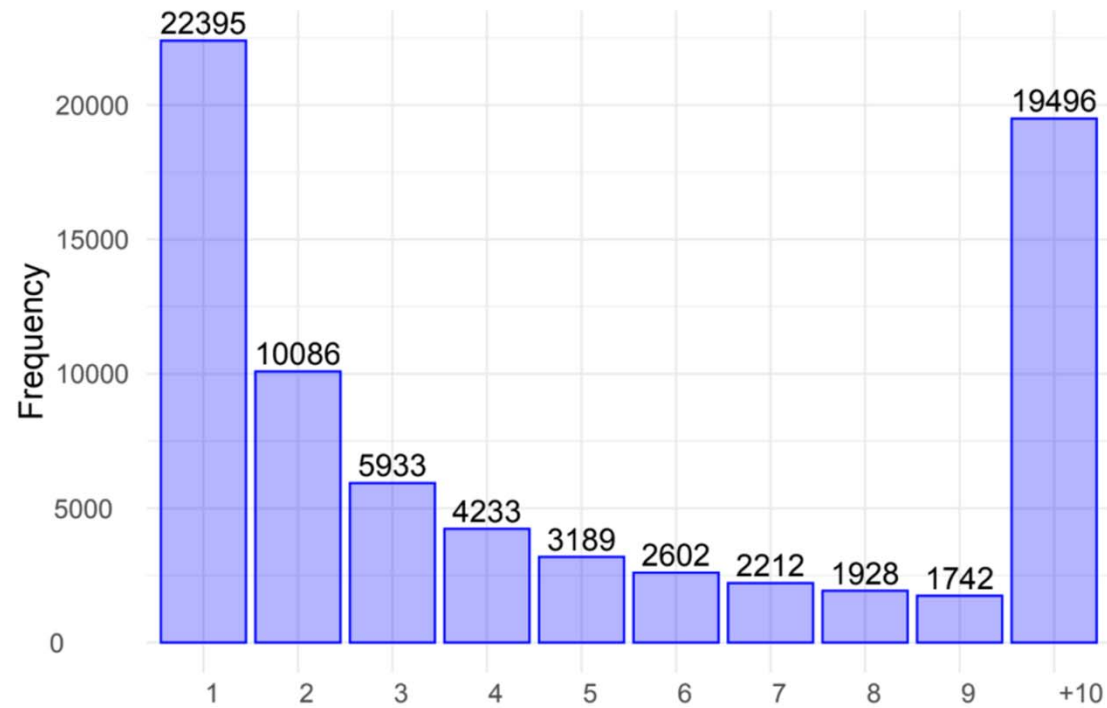


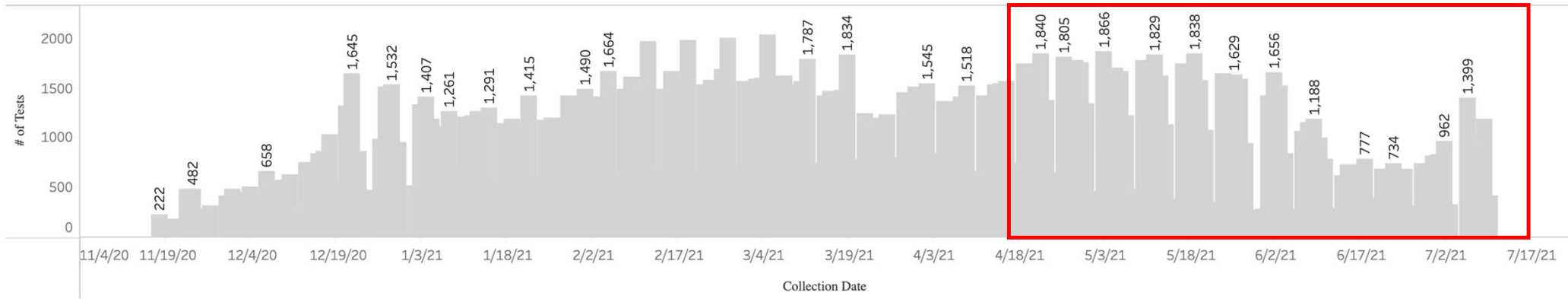
Figure 5: Histogram of the number of tests taken by a user.

**Summary Statistics:** Minimum= 1, Median = 3 , Mean = 7.45 , Maximum = 114.

## **Even the best clinical-testing program falls short in some ways**

- 73% is good, but it's not everyone.
  - Only a subset of the 73% are consistent testers.
  - Higher-risk populations may account for a greater share of under- or never-testers.
- Testing fatigue sets in eventually

Total Number of Tests



## Even the best clinical-testing program falls short in some ways

- 73% is great, but it's not everyone.
  - Only a subset of the 73% are consistent testers.
  - Higher-risk populations may account for a greater share of under- or never-testers.
- Testing fatigue sets in eventually
- Expensive and resource-intensive to continue for the long haul
- Takeaway: Wastewater surveillance can help fill in the gaps.



# Wastewater surveillance



**At first: 1 sample/week; 2 days for results**



Ultrafiltration + manual handling

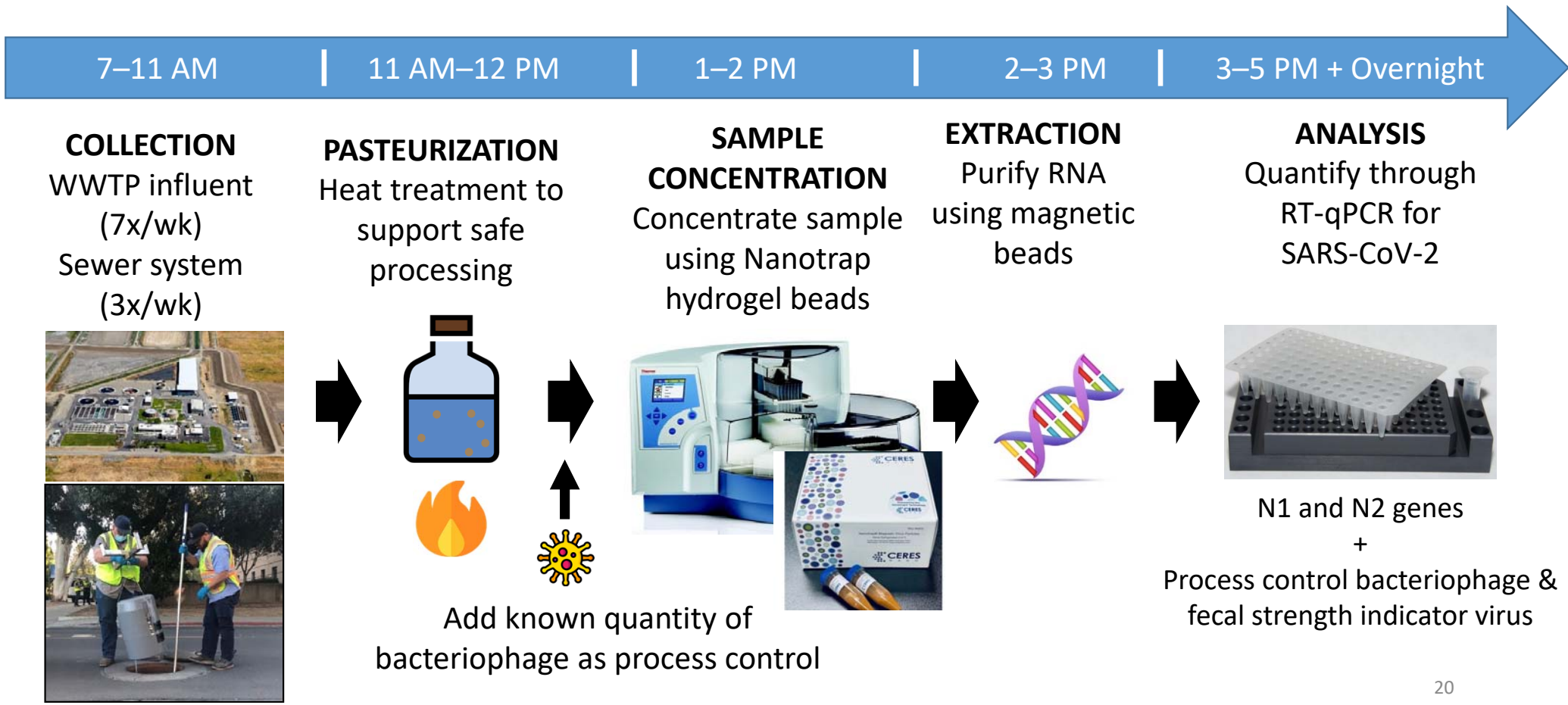
**Now: >100 samples/ week; <24 hours for results**



Nanotrap hydrogel beads + robotic handling

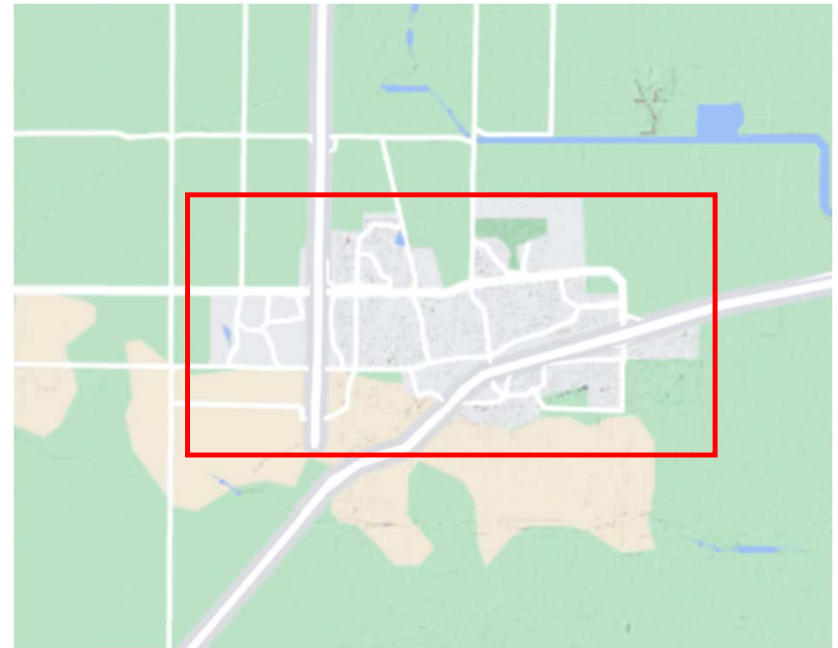


# Pipeline for overnight turnaround



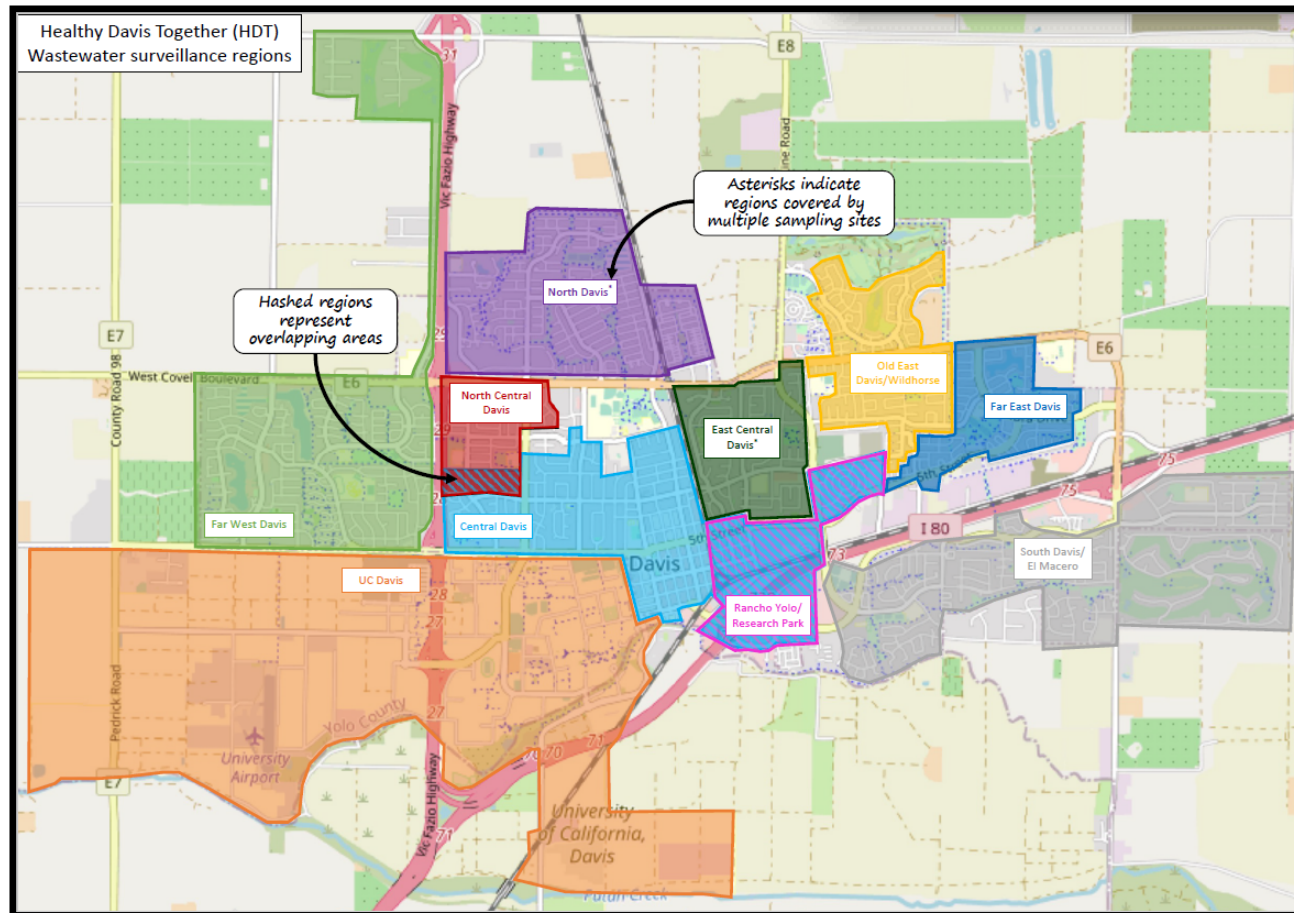
## Monitoring at multiple scales

WWTP → Whole city  
(7x/wk)



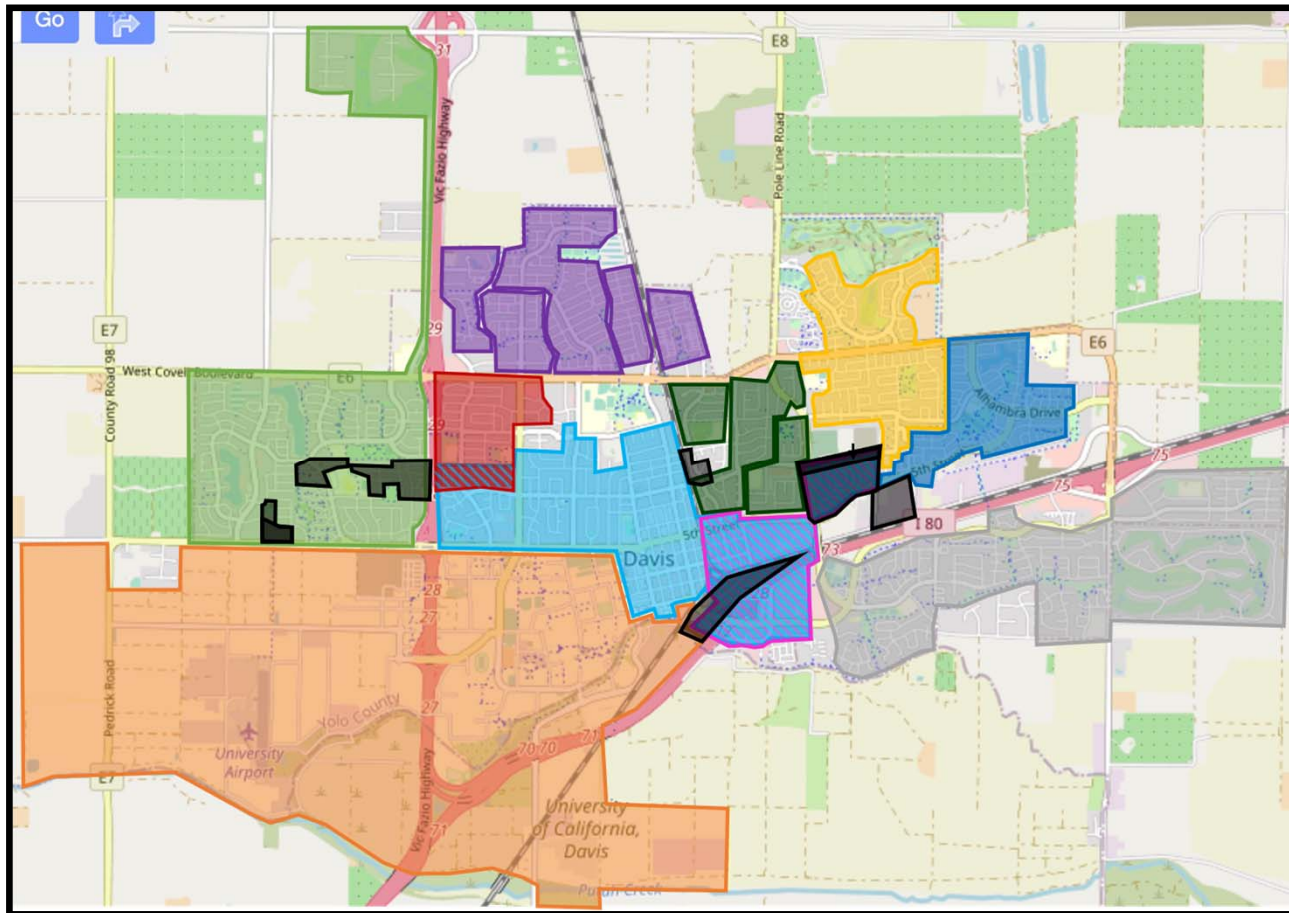
# Monitoring at multiple scales

## Sub-city regional (3x/wk)



# Monitoring at multiple scales

Neighborhood / building complex (3x/wk)

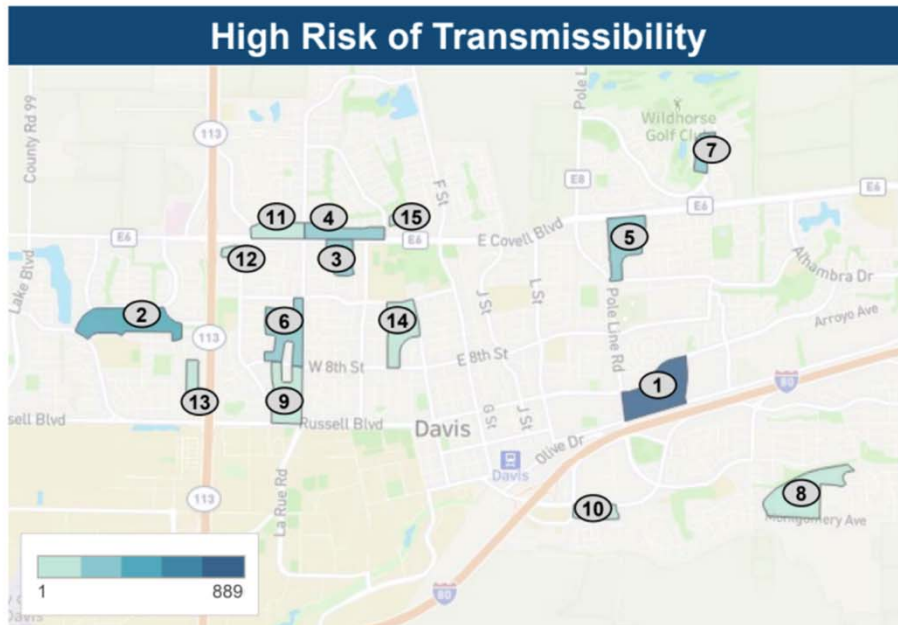




# Deloitte PredictRisk tool

## HIGH RISK OF TRANSMISSIBILITY

Each census block shown below registered high levels of residents meeting at least one of the four transmissibility risk criteria; containing the virus in these areas will be crucial for containment

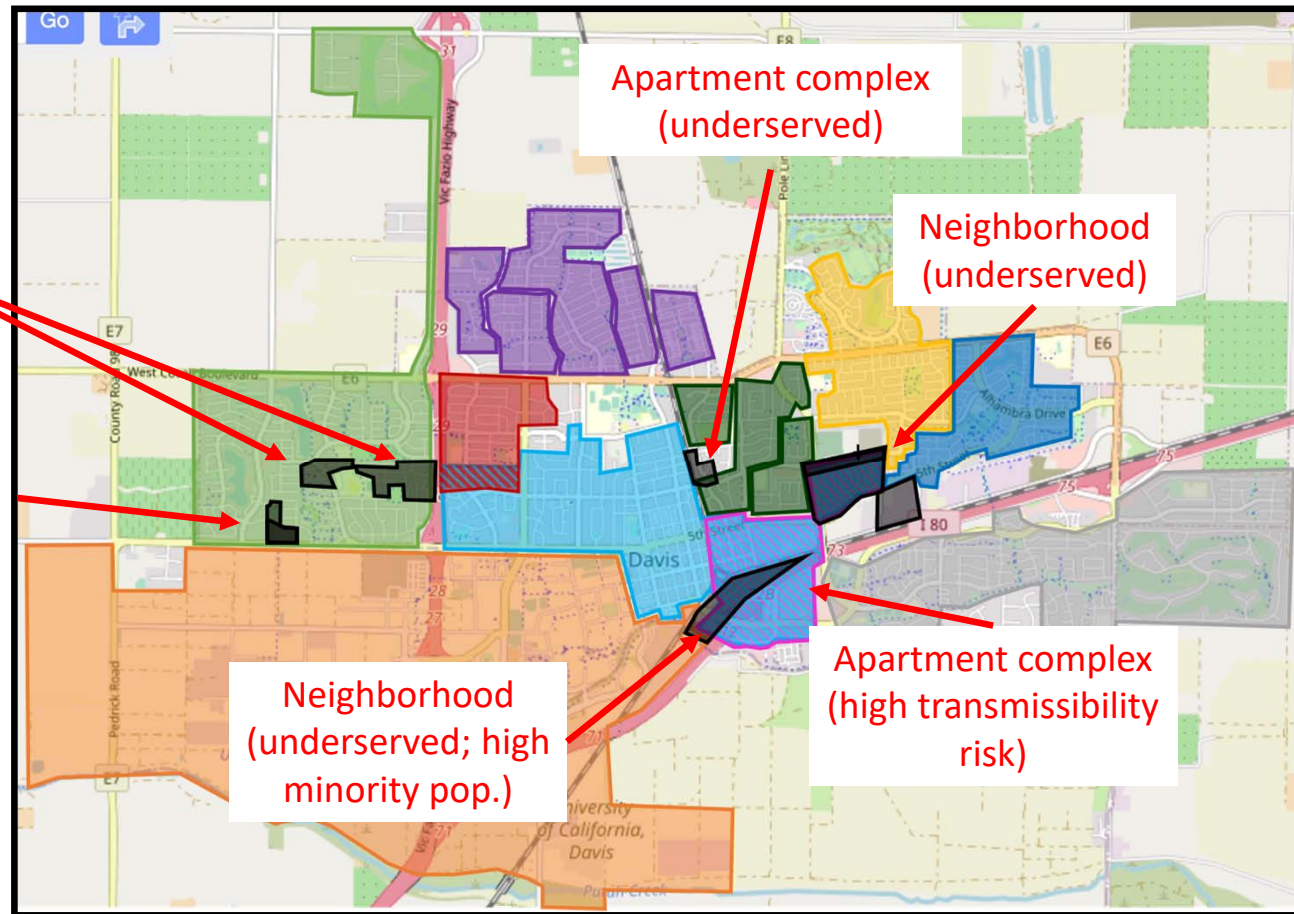


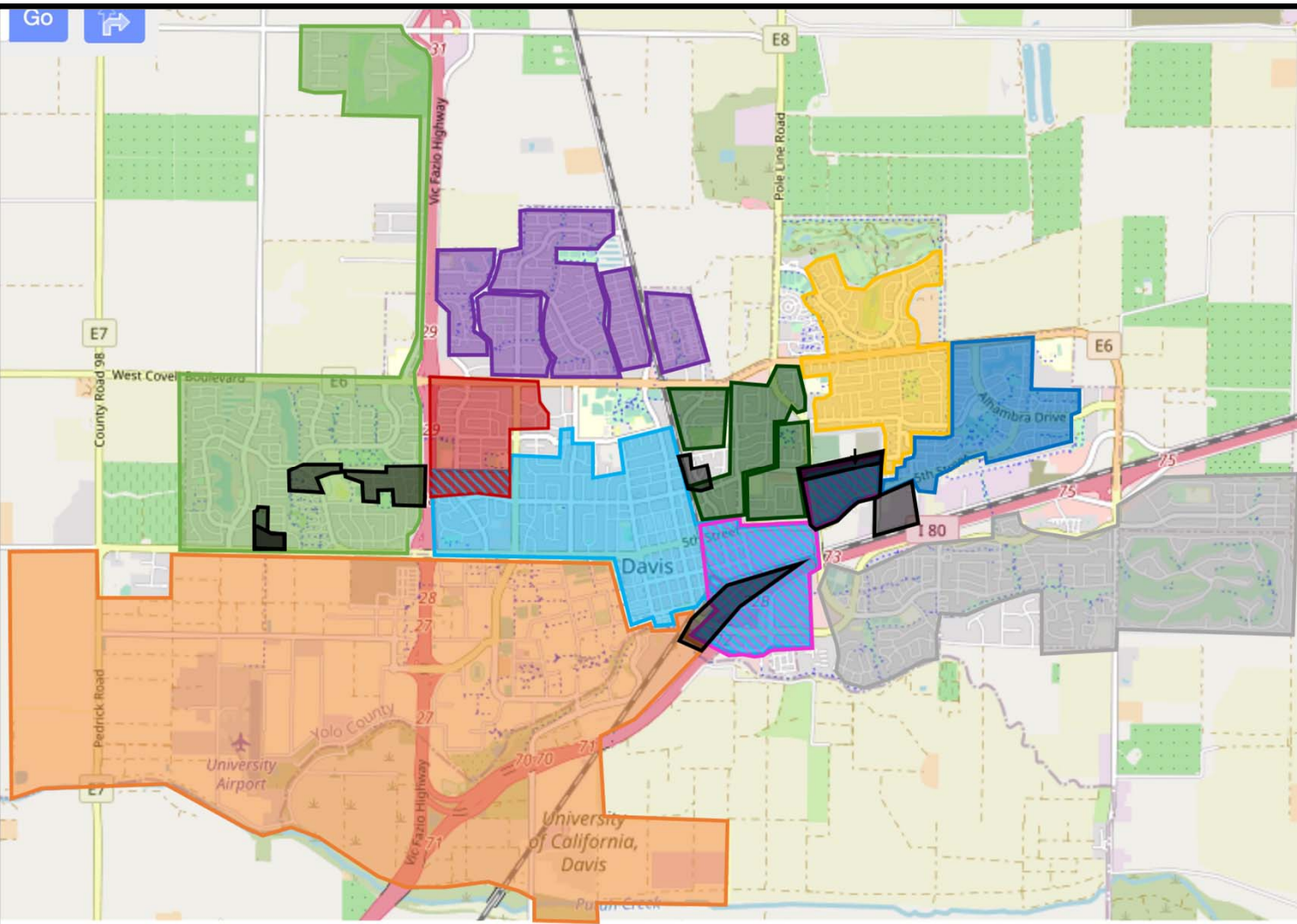
Top 15			
#	GeoID	Neighborhood	PredictRisk Pop.
1	061130106064014	U Apartments, Carlton Plaza	889
2	061130105122000	Arroyo Park South	166
3	061130107041001	W. Covell Blvd & Redwood Ln (Central Davis)	158
4	061130105091007	W. Covell Blvd & Anderson Rd (Covell Park)	122
5	061130106062012	E. Covell Blvd & Birch Ln SE (Birch Ln Elementary)	110
6	061130107032008	Anderson Rd & Villanova Dr SW (Redwood Park)	96
7	061130105053020	Moore Blvd & Bromard St NW (Wildhorse)	89
8	061130106073025	Montgomery Ave & Oakside Dr (Old Willowbank)	76
9	061130107034000	Russell Blvd & Anderson Rd NW (Central Davis)	70
10	061130106082011	Richards Blvd & Research Park Dr SE (Olive Drive)	70
11	061130105103005	W. Covell Blvd & Anderson Rd (Covell Park)	67
12	061130107031003	Drake Dr & Sycamore Ln (Sycamore Park)	63
13	061130105121008	Arthur St & Burr St SE (Westwood Park)	62
14	061130107011004	W 14th St & B St SW (St. James Catholic Church)	60
15	061130105092011	Bella Casa St. (Covell Park)	57

The current wastewater sampling efforts at Rancho Yolo could be extended to high transmissibility areas near **Carlton Plaza (U Apartments), Arroyo Park, and W Covell Blvd (Anderson Place Apts, Hanover Place Apts)** to monitor potential COVID-19 outbreaks

# Monitoring at multiple scales

Neighborhood / building complex (3x/wk)





Takeaway: 23  
sewershed sites +  
WWTP (for  
population of ~65k)  
= unmatched level  
of spatial  
granularity

## **Education and outreach**





Testing ▾

Public data dashboard =  
transparency and education

# Neighborhood Wastewater Data

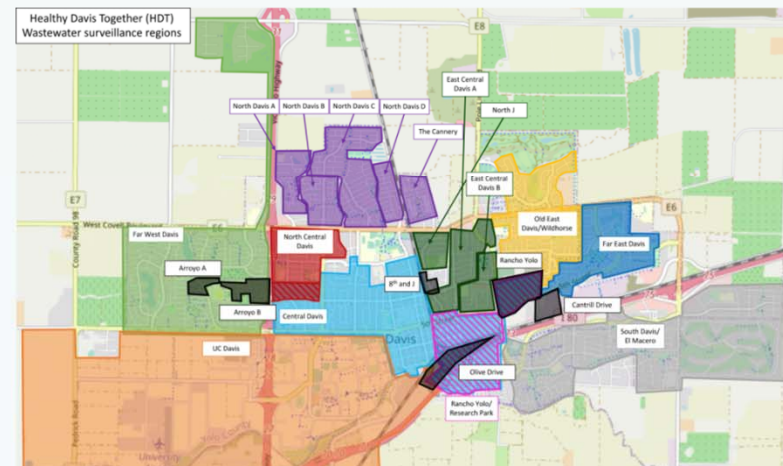
About Wastewater Testing

View the Testing Data

How to Stay Safe

Environmental monitoring of wastewater (regularly testing sewage) is another tool Healthy Davis Together is using to learn about COVID-19 and prevent its spread in our community.

The virus that causes COVID-19 (SARS-CoV-2) is found in the excrement (feces) of individuals who have COVID-19, including asymptomatic and pre-symptomatic individuals. This means that wastewater testing can be used as an early-warning detection system for the virus in a regional area (e neighborhood).



[HealthyDavisTogether.org/Wastewater-Testing](https://HealthyDavisTogether.org/Wastewater-Testing)

# Davis Regional Testing Graphs

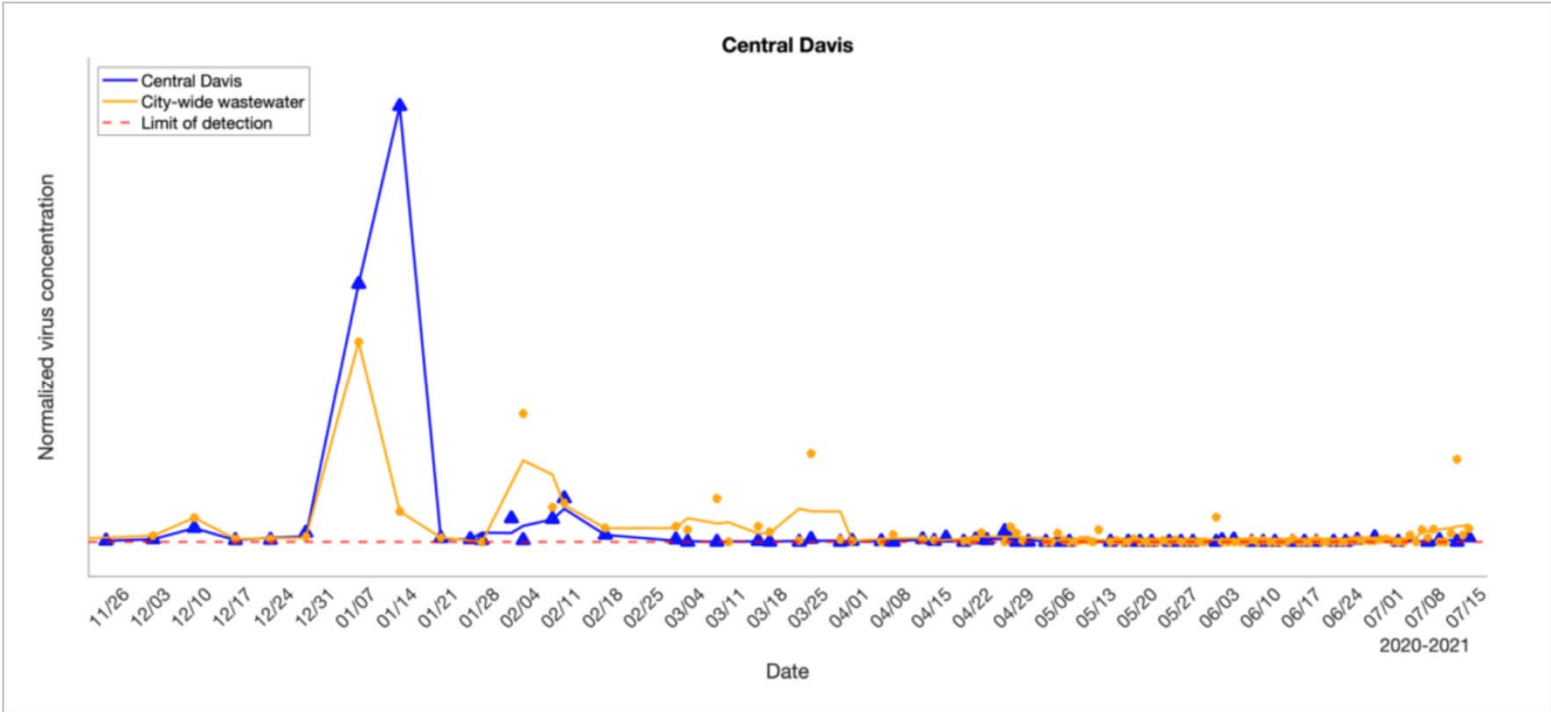
## Wastewater sampling week of July 12

Select a Region **Central Davis** ▾

View **Recent Results** **All Results**

The wastewater data indicate that levels of COVID-19 for **Central Davis** are **staying about the same**, while the City levels are **going up**. Healthy Davis Together encourages everyone to remain vigilant and follow guidance to prevent the spread of COVID-19 and all its variants.

[DOWNLOAD CHARTS](#)





# Davis Regional Testing Graphs

## Wastewater sampling week of July 12

Select a Region

Central Davis ▾

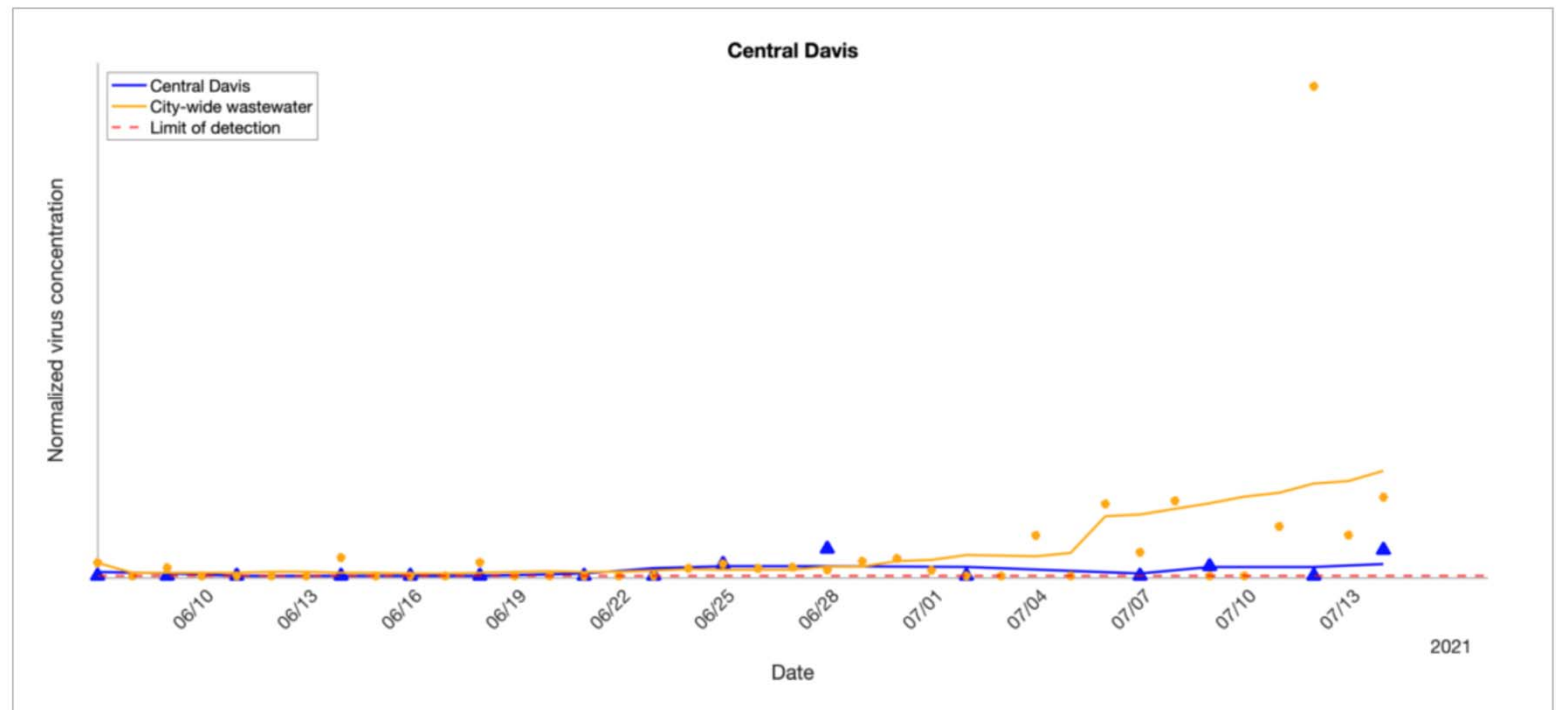
View

Recent Results

All Results

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[DOWNLOAD CHARTS](#)



# Davis Regional Testing Graphs

## Wastewater sampling week of July 12

← Data updated weekly

Select a Region

Central Davis ▾

View

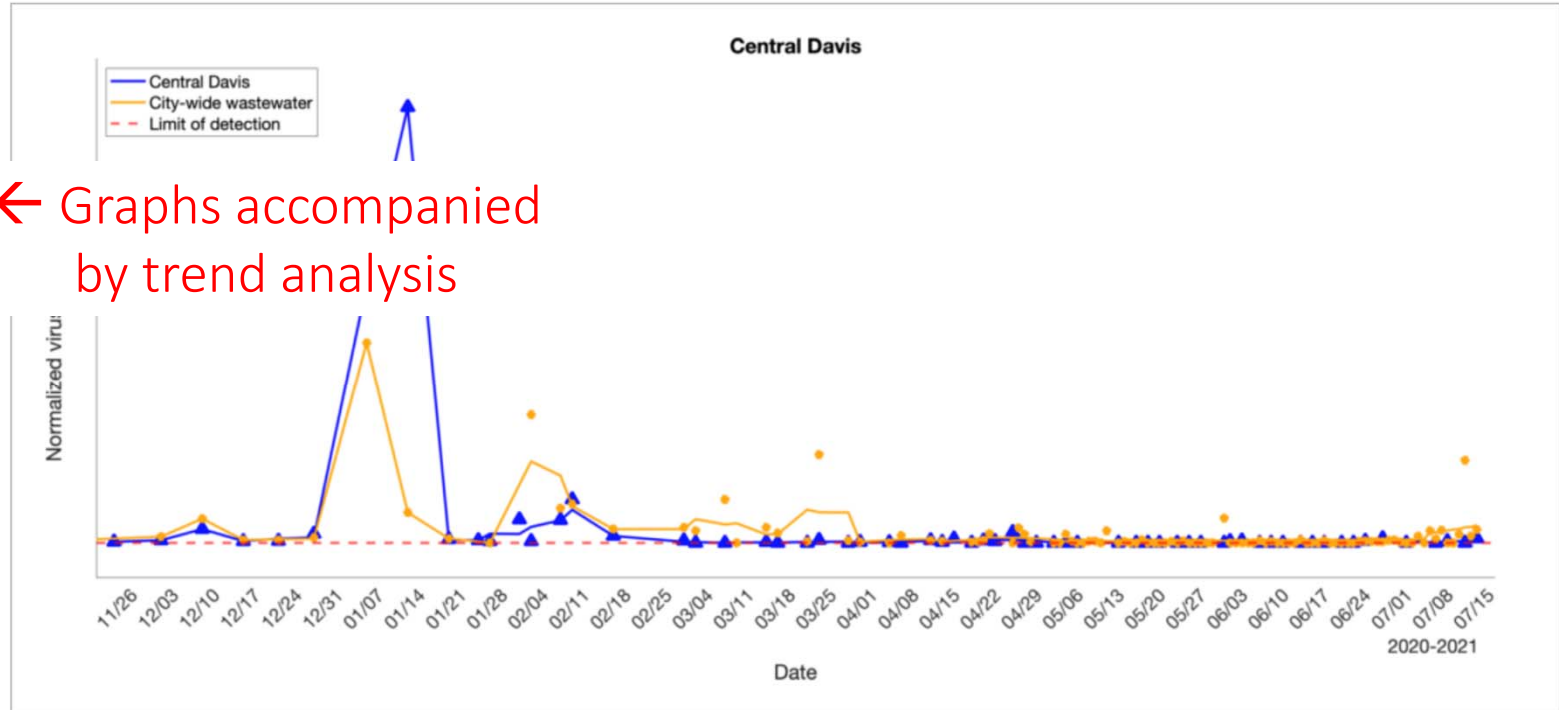
Recent Results

All Results

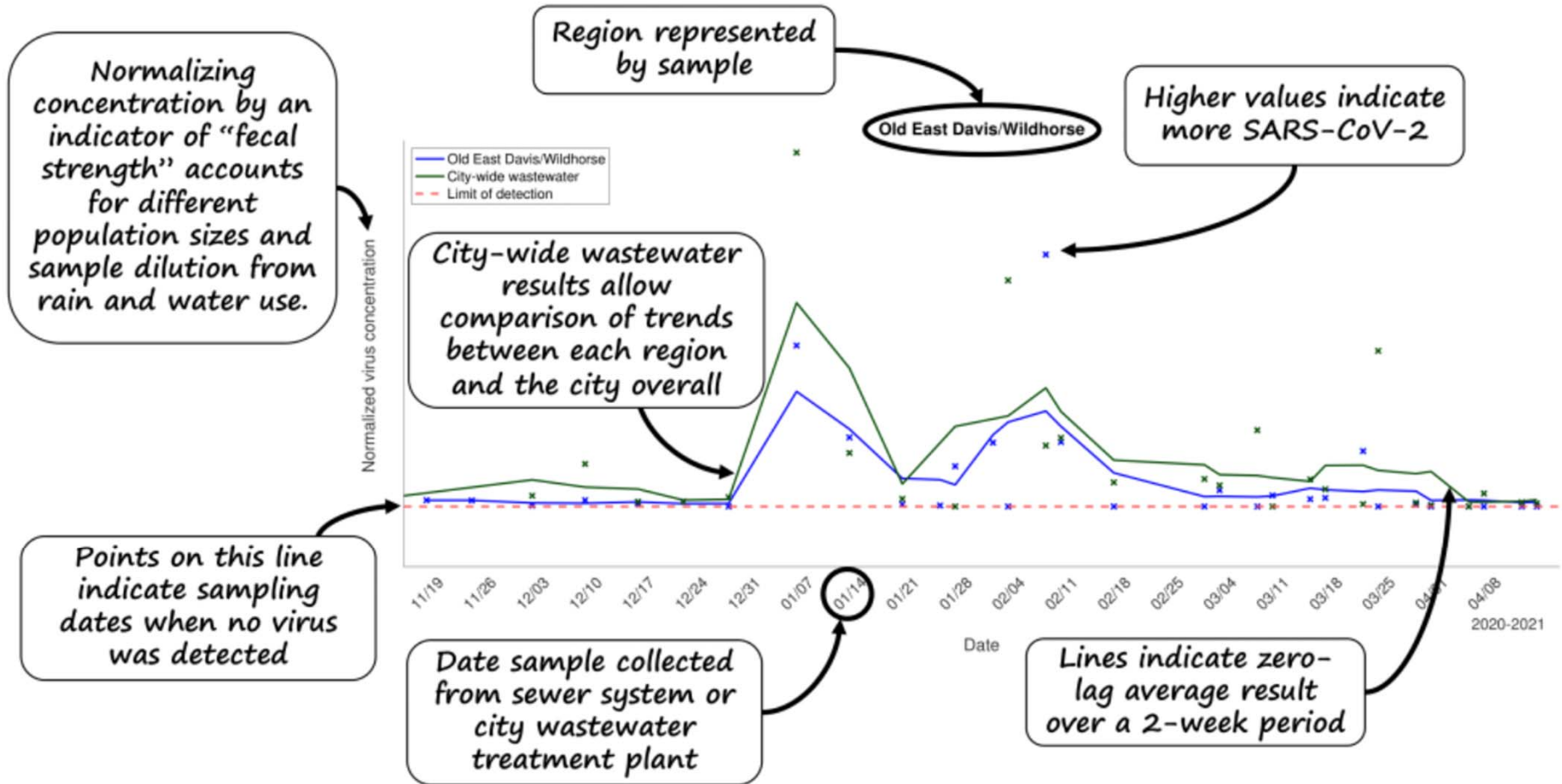
The wastewater data indicate that levels of COVID-19 for **Central Davis** are **staying about the same**, while the City levels are **going up**. Healthy Davis Together encourages everyone to remain vigilant and follow guidance to prevent the spread of COVID-19 and all its variants.

[DOWNLOAD CHARTS](#)

← Graphs accompanied by trend analysis



# Explainer infographic



## **Informing decision-making and action**

# Davis Regional Testing Graphs

## Wastewater sampling week of July 12

Select a Region

North Central 

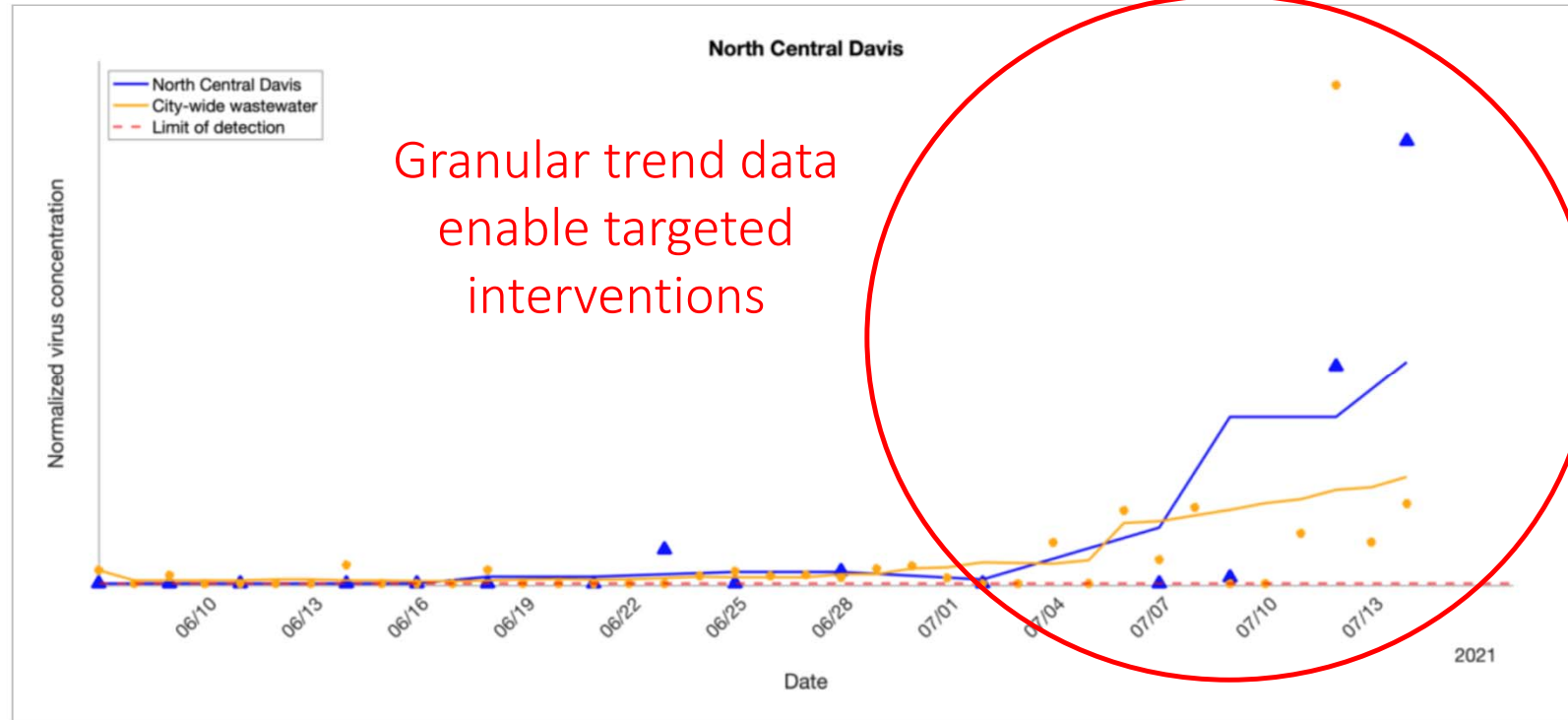
View

Recent Results

All Results

The wastewater data indicate that levels of COVID-19 in **North Central Davis** and the City overall are **going up**. Healthy Davis Together encourages everyone to remain vigilant and follow guidance to prevent the spread of COVID-19 and all its variants.

[DOWNLOAD CHARTS](#)



## Our sewage can tell us a lot about COVID-19.

Healthy Davis Together, a joint project between UC Davis and the City of Davis, collects and tests wastewater (sewage) from across the city three times a week to track the presence of SARS-CoV-2 (the virus that causes COVID-19) in our community.

As vaccinations increase and COVID-19 rates decline in Davis, regularly testing wastewater is a non-invasive way to identify trends and take action to protect our community's health. *No samples or data are collected from individual households. Drinking water in the City and your area remains completely safe.*

### Recent sampling has detected SARS-CoV-2 in wastewater from this neighborhood.

This is a sign that new COVID-19 infections may be present. It's important to keep taking steps to prevent the spread.

### Protect yourself and your family:



Follow local guidance on masking and gathering.



Get tested if you have COVID-19 symptoms or may have been exposed, even if you are vaccinated.



Keep getting tested in you are not yet vaccinated for COVID-19.



Get vaccinated if you are 12 years or older.

Healthy Davis Together offers free saliva-based COVID-19 testing to community members at six locations. Walk-ins welcome or make an appointment at [HealthyDavisTogether.org/testing](https://HealthyDavisTogether.org/testing)

#### Mondavi Center

523 Mrak Hall Drive  
Every day: 8 am–5 pm

#### Davis Senior High School

315 West 14th Street  
M–F: 8 am–4:15 pm

#### Emerson Junior High

2121 Calaveras Avenue  
M–F: 7 am–2:15 pm

#### Marguerite Montgomery Elementary School

1441 Danbury Street  
M–F: 10:30 am–6:30 pm

#### Harper Junior High

4000 East Covell Blvd  
M–F: 8:30 am–4:15 pm

#### Davis Community Clinic

For more information about Healthy Davis Together and to view the latest visit [HealthyDavisTogether.org](https://HealthyDavisTogether.org)

**Let's stay healthy together.**

## El alcantarillado nos puede dar mucha información sobre el COVID-19

Healthy Davis Together, un proyecto conjunto de UC Davis y la Ciudad de Davis, recoge y analiza muestras de aguas residuales de toda la ciudad tres veces por semana para detectar la presencia de SARS-CoV-2 (el virus que causa COVID-19) en nuestra comunidad.

A medida que la tasa de vacunación aumenta y los casos de COVID-19 disminuyen, el análisis periódico de las aguas residuales es una manera no invasiva de identificar tendencias y tomar medidas para proteger la salud de nuestra comunidad. No recogemos muestras ni datos de hogares individuales. El agua potable de la ciudad y de tu área sigue siendo totalmente segura.

### Se ha detectado SARS-CoV-2 en muestras de aguas residuales recogidas recientemente de este vecindario.

Esto indica que podría haber nuevas infecciones de COVID-19. Es importante seguir tomando medidas para prevenir la propagación.

### Cúidate a ti y a tu familia:



Sigue las recomendaciones locales sobre el uso de la mascarilla y las reuniones.



Hazte la prueba si tienes síntomas del COVID-19 o si crees haber estado expuesto (aunque ya te hayas vacunado).



Sigue haciéndote la prueba si aún no te vacunaste contra el COVID-19.



Vacúnate si tienes 12 años o más.

Healthy Davis Together ofrece pruebas de saliva del COVID-19 gratuitas a todos los miembros de la comunidad en seis centros distintos. Puedes venir con o sin cita. Para hacer una cita, visita [HealthyDavisTogether.org/pruebas](https://HealthyDavisTogether.org/pruebas)

#### Mondavi Center

523 Mrak Hall Drive  
Cada día: 8 am–5 pm

#### Davis Senior High School

315 West 14th Street  
L–V: 8 am–4:15 pm

#### Emerson Junior High

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L–V: 7 am–2:15 pm

#### Marguerite Montgomery

1441 Danbury Street  
M–F: 10:30 am–6:30 pm

#### Harper Junior High

4000 East Covell Blvd  
L–V: 8:30 am–4:15 pm

#### Davis Community Clinic

2051 John Jones Road  
L–J: consulta el horario en el sitio web

Para más información sobre Healthy Davis Together y para consultar los datos más recientes sobre [HealthyDavisTogether.org/pruebas](https://HealthyDavisTogether.org/pruebas)

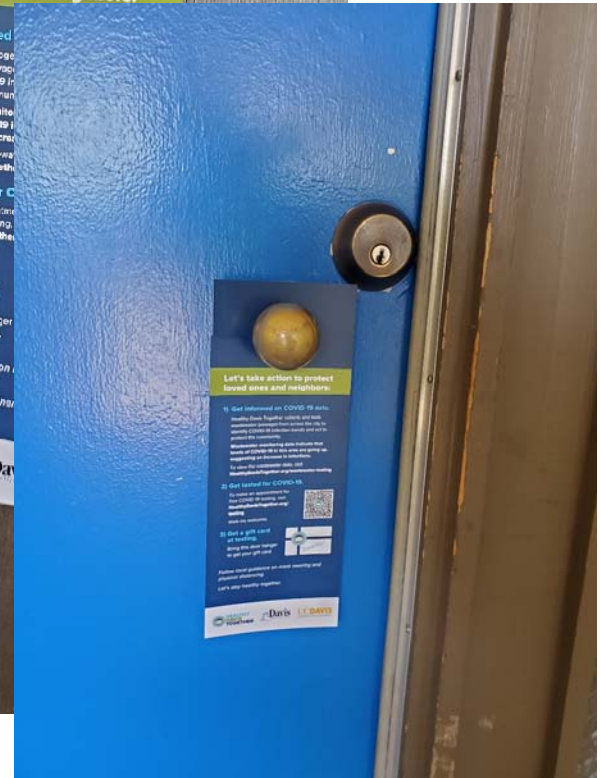
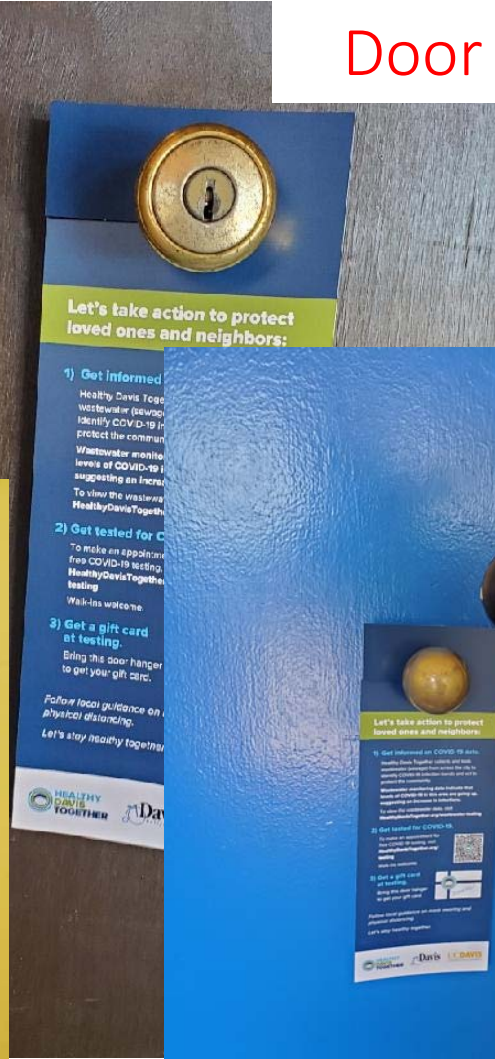
**todos.**



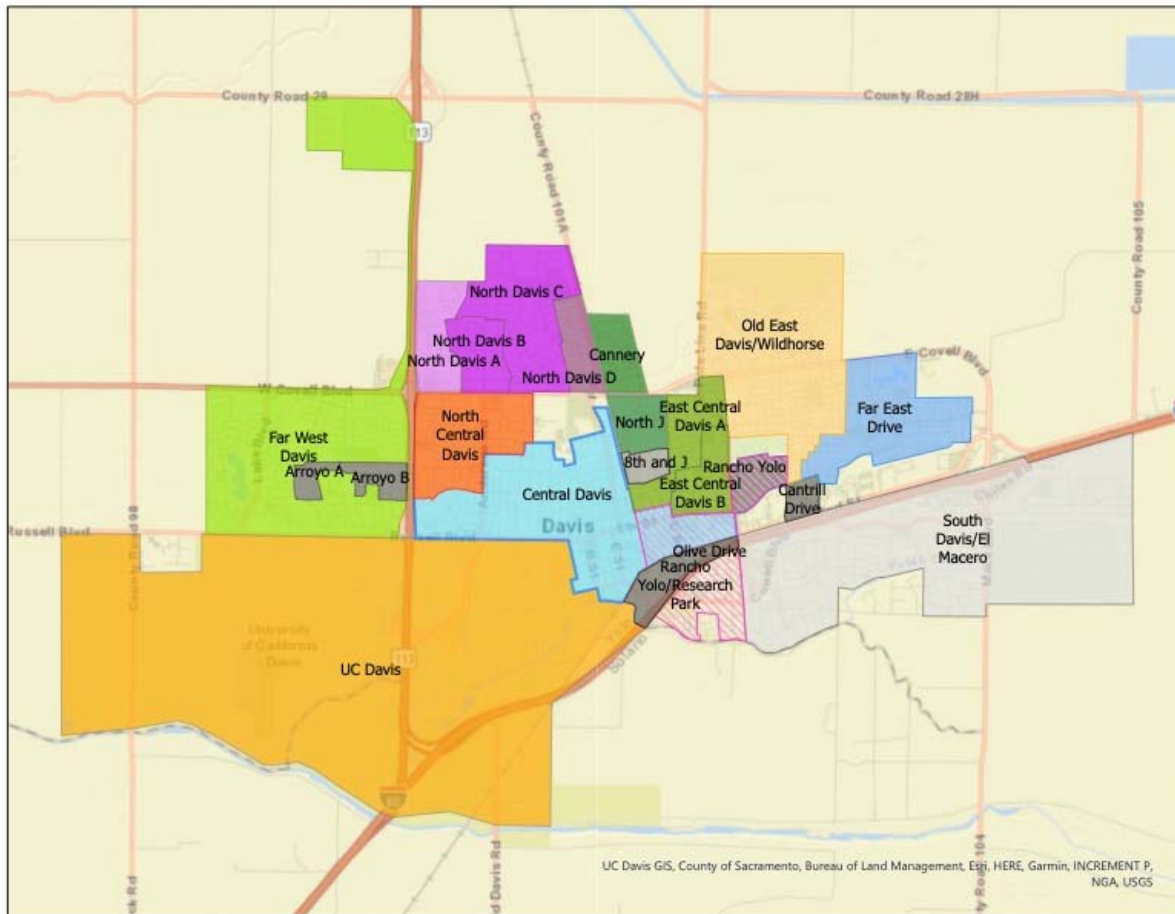
Bilingual fliers (e.g., for distribution in apartment lobbies)



# Door hangers



## Geotargeted text and email alerts



*Healthy Davis Together tests wastewater to provide early indication of the presence of COVID-19 in our community. Increased levels of the virus that causes COVID-19 were recently detected in wastewater samples from your area (East Central Davis). This suggests new infections may be present. Drinking water in the City and your area remains completely safe. Please help us in reducing the spread of COVID-19 by getting free testing and following other public health behavior guidance. More information is available at [HealthyDavisTogether.org](https://HealthyDavisTogether.org).*

## Looking to the future

- HDT wastewater surveillance will continue until at least June 2022
- Exploring expansion to neighboring communities in Yolo and the broader Central Valley
- Potential to refocus wastewater surveillance on other public-health priorities (e.g., flu)
- Digging into the data:
  - Assessing sub-city relationships between clinical and WW data
  - Developing algorithmic approach for imputing missing data



# Acknowledgements

- UC Davis Campus Utilities, Facilities, & Safety Services
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