



ENVIRONMENTAL POLICY  
**INNOVATION**  
CENTER



**WATER  
DATA  
PRIZE**

## **TAP INTO INNOVATION TO REPLACE LEAD PIPES**

Results & recommendations  
for water utilities and regulators  
from the 2021 Water Data Prize



## WHAT TOOLS & TEMPLATES WILL HELP ME QUICKLY AND EFFICIENTLY REMOVE ALL TOXIC LEAD PIPES?

Replacing 100 percent of lead pipes in this country is possible, but it will take a collaborative and multilayered approach.

At EPIC, we are working to ensure lead pipes become a thing of the past over the next five to ten years. To do this, water utilities need to identify where the lines are located in their communities, design a plan to replace them, line up the necessary funding, put in place cost efficiencies to ensure the money goes further, focus on the vulnerable residents most at risk, and help communicate effectively to their customers throughout all of this. Funding is key to replacement, but so is addressing all of these various components of an effective lead service line replacement program. We launched the 2021 Water Data Prize to spur innovation around tools, templates, and resources that can help get the job done.

We hope that the ideas from the prize submissions and outlined in this report will help get us one step closer to replacing all of the nation's lead pipes... faster, efficiently, and equitably.



*"One thing about public works projects - we always feel like they have to be drawn out over a 20 to 30-year period. Efficiency and effectiveness was demonstrated in the lead service line replacement program in Newark, NJ. We need to continue to show that these public works projects can actually get done."*

*- Kareem Adeem, Director of Water and Sewer Utilities, Newark, NJ*

# 2021 WATER DATA PRIZE

There are an estimated 10 million lead pipes in this country, largely installed a century or more ago. With new federal regulations in place on lead in drinking water, EPIC launched the 2021 Water Data Prize to spur innovation around replacing lead pipes faster, efficiently, and equitably. Below are the final winners, who went above and beyond to come up with innovative solutions to the age-old problem of toxic lead pipes.

## WINNERS

### OVERALL




### INVENTORY


**120Water™**

### WILDCARD


*In collaboration with:*


### MAPPING



### EQUITY



Smart infrastructure. Strong communities.



### COMMUNICATIONS





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## KEY TAKEAWAYS

- **The best lead service line replacement programs require an integrated approach - from data and technology to equity and communications.** The prize categories reflect that interconnectedness - and the winners and submissions we saw do, too. For example, a well-devised map that shows where lead lines are will also help better communicate the problem to customers. A focus on equity may require a full lead inventory to understand where the most vulnerable populations are in relation to a community's pipes. And so on. The best solutions to lead service line replacement, therefore, are integrated ones.
- **Keeping solutions simple - and accessible - goes a long way.** Water utilities are big on water problems and low on resources to solve those problems. Solutions that are easy to access and adopt - even on a shoe-string budget and with limited resources and investment needed - are more likely to be useful to water utilities over the long run.
- **Building public trust in water, while not a prize category, is a big winner anyway.** EPIC's Water Data Prize was founded on the premise that more Americans should trust the water coming from their kitchen taps. We therefore appreciate the submissions that will help further this goal by partnering and co-designing projects with the community, pushing information out proactively to the public, being straightforward and clear in communications and visual tools like maps, and ensuring transparency with the public at all stages.





# EQUITY

Toxic lead pipes are the main source of lead in drinking water, contributing to the broader problem of lead poisoning around the country, especially in our most vulnerable populations, and affecting up to half of American children.

While replacing pipes will largely eliminate the problem of lead in drinking water, water utilities still need to think about creating equitable solutions and programs that address the needs of the most vulnerable and at risk people in their communities and do not cause unnecessary hardship.

Implementing programs that conduct partial replacements and putting the onus on homeowners to pay some of the replacement costs are both practices that can lead to inequitable replacement across a municipality, at times along racial and economic lines. Subtle practices, like prioritizing residents who are more likely to respond to written notices or overlooking the fact that many communities have a high number of renters who are not receiving those notices are also practices that can lead to an uneven and unequal replacement in communities, benefitting some over others. Without an intentional focus on equity, local governments and utilities can inadvertently cause distrust and exclude residents who are most at risk.

EPIC included equity as a category in our 2021 Water Data Prize because we want to put this issue at the front and center of every lead service line replacement program in the country. Without this focus, we believe that water utilities will be missing the mark.



## Q: What tools or resources support more equitable lead water pipe identification or replacement programs?

Placing **equity** at the center of lead service line replacement will build trust with the public and ensure no one is left behind.

### Best Practices:

- **Mapping.** Maps - when coupled with sound analytics - can identify or highlight equity considerations, and help visualize complex data sets.
- **Build Trust.** Tools and engagement strategies done in partnership with community-based organizations can help to build trust with residents and improve program design and implementation.
- **Center User Experience.** Design is important insofar as it facilitates usability of tools, and it must be done in regular consultation with users.
- **Use Community Generated Data.** Supporting community-generated data can help to improve understanding and inform lead replacement programs, while also building trust.
- **Clearly Define Equity.** When defining equity, consider factors like tax and property parcel data, service history, demographics, and other household level data - also EPA's environmental justice tenets and equity index tools.

*"Having this data for a whole state could be extremely useful for systems, policy makers, advocates, and customers/water consumers. It could be especially helpful for targeting systems, and areas within systems, where replacement and funding to achieve that should be targeted."*

**- Water Data Prize Judge**

*"I was also happy to see that equity was addressed with more than amazing GIS or mapping technology and that real human interaction and face-to-face meetings were included as part of understanding what the communities actually needed and to keep them informed. This is an important piece that I think is always forgotten. We need both the tech and the humanity piece."*

**- Water Data Prize Judge**

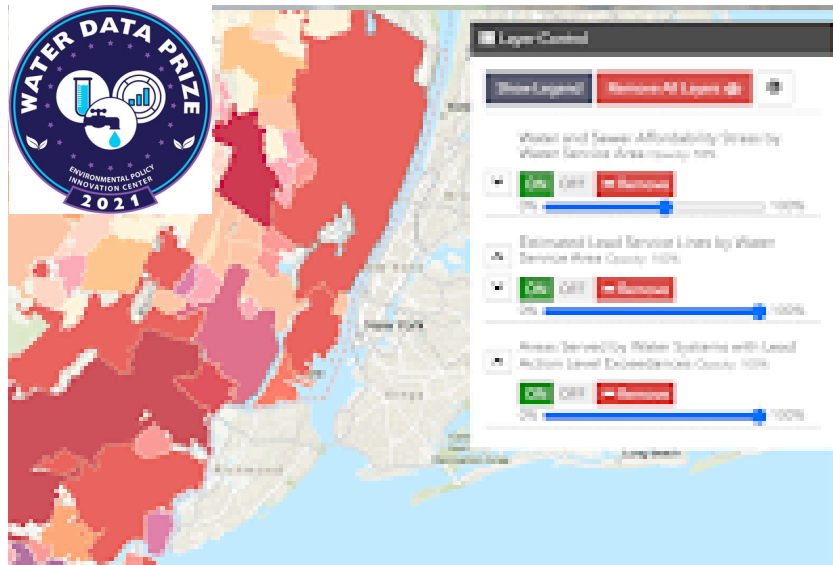


# Q: What tools or resources support more equitable lead water pipe identification or replacement programs?

Below are some illustrative examples of best practices on equity from the 2021 Water Data Prize.

## Converging Impacts

New Jersey Future and Jersey WaterWorks used mapping to highlight the convergence of affordability stress, lead levels, and estimated lead service lines. This can help inform lead replacement programs and ensure that funding is equitably allocated.



My lead service line was **REPLACED FOR FREE!**

**NEWARK'S LEAD SERVICE LINE REPLACEMENT PROGRAM**

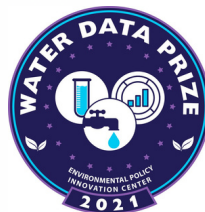
To sign up or for more information, visit: [newarklead serviceline.com](http://newarklead serviceline.com)

YOUR CITY AT WORK

MAYOR RAS J. BARAKA

**CITY OF NEWARK**  
Mayor Ras J. Baraka

**ATTENTION CERTIFIED !!!  
MINORITY (MBE) AND WOMEN (WBE)  
CONSTRUCTION CONTRACTORS**



LEARN MORE ABOUT LEAD SERVICE REPLACEMENT LINE CONTRACT AND SUPPLY OPPORTUNITIES!  
CONTRACT & SUPPLY OPPORTUNITIES AVAILABLE: SUPPLIERS, TRUCKING, PAVING ETC.....

## Trust

CDM Smith and the City of Newark worked with nonprofit organizations to engage residents where they live, work, and play - ultimately building trust and leading to greater enrollment in lead replacement programs. The program created multiple benefits, including workforce development. Approximately 70% of funding supported community residents.



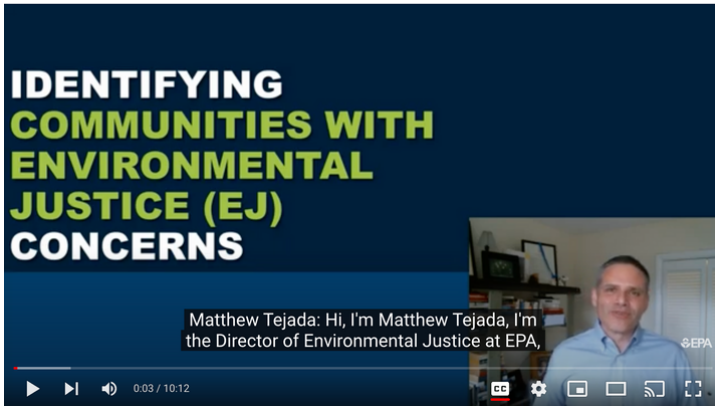


## Q: What tools or resources support more equitable lead water pipe identification or replacement programs?

Below are some illustrative examples of best practices on **equity** from the 2021 Water Data Prize.

### Community-Generated Data

TruePani developed a tool to help residents inspect and report water service lines, a community inventory database. The tool has a simple user interface, translated into different languages, and can be customized to fit a specific utility. Utilities receive this crowd-sourced data via API or CSV export. The publicly available version of this utility-specific tool is available for you to check out!



### Define Equity

Buffalo Water performed a comprehensive environmental justice analysis using tenets developed by EPA.



### Account for Historical Injustice

MIT used a story map to examine the relationship between housing segregation and lead pipes.



# COMMUNICATIONS

The water crisis in Flint, Michigan shed a national spotlight on the threat of lead-contaminated water, but in addition, led to a national crisis of public trust in our drinking water. Nearly 60 million Americans have stopped trusting their drinking water, a third of them since the Flint crisis, and many have resorted to drinking bottled and filtered water in recent years. This has happened even in places where there are no lead pipes, simply because crises elsewhere have destroyed people's trust in tap water.

Communicating effectively and proactively about lead in drinking water is therefore critical - and is not just a matter of public health. When water utilities get communications wrong, it's hard (but not impossible) to recover public trust. Getting the communications right out of the gate and communicating often - openly and honestly - is key.

With new communications required as part of the newly enacted federal regulations, EPIC knew that we needed to lift up innovative communication strategies around lead in drinking water. The submissions from the 2021 Water Data Prize on communications show us how critical this piece is - but also how clear and proactive communications can make a difference.



## Q: What are ways to give water consumers useful, actionable information about lead in drinking water?

Clear, effective **communications** is vital to ensuring transparency and building trust with the community.

### Best Practices:

- **Focus on community understanding, not utility marketing.** Beautiful design is nice, but only if it enables community understanding and action.
- **Consider multiple communications channels.** Local newspapers, radio, television, personal calls, social media, presentations - these channels can collectively help reach different community members.
- **Innovate with mandated water quality reports, but don't rely on them.** While regulations about water quality reporting can feel restrictive, there are ways to make them more engaging to readers. See results from [2020 Water Data Prize](#). However, utilities will need to go beyond annual reports to effectively reach customers.
- **Be clear about the health impacts of lead.** Make information about health impacts prominent and use accessible language.
- **Avoid jargon.** Use accessible, simple language and avoid acronyms and highly scientific terms. For example, use lead water "pipe" rather than "lateral."

*"I appreciate the prioritization of the most relevant, actionable data as well as health impacts to various populations and homeowner education... Together with the option to request an inspection, this makes for a very engaging process."*

**- Water Data Prize Judge**

*"Enhanced outreach to schools and childcare facilities could be a communications strategy that leads to better awareness and participation."*

**- Water Data Prize Judge**

*Inclusion was critical for the success of our program, as it was key to achieving our goal... Given the goal of 100 percent replacement, we engaged to ensure no one was missed in our efforts.*

**- Water Data Prize Entry**



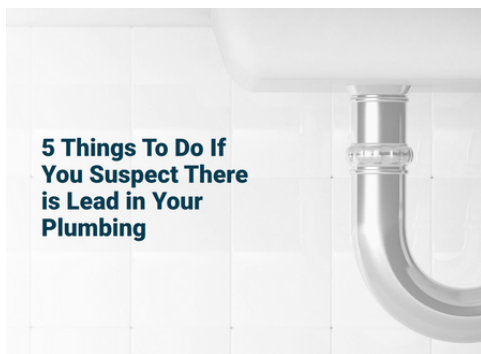
# Q: What are ways to give water consumers useful, actionable information about lead in drinking water?

Below are some illustrative examples of best practices on **communications** from the 2021 Water Data Prize.



## Action-Oriented

**Raftelis** developed a simple website - intended to be part of a broader engagement strategy - that provides customers with information about lead, but also steps that individuals can take to identify and address lead in drinking water.



## Pipes Inside Your Home or Business

The easiest way to check if your home has lead pipes is to check the most accessible pipes, such as the ones in your basement, crawl space, or in cabinets beneath sinks. When you find them, check for the following characteristics:









Get a magnet and see if it sticks. If it does, it's iron (and therefore lead-free, but remember that soldering performed before 1988 may have used lead-based solder). If the magnet doesn't stick it may be lead or copper.



Unpainted lead pipes are dull grey and have rounded swollen joints where they join other pipes.

Exposure to lead can lead to severe and permanent damage to the body. Children and people who are pregnant are most at risk even to low levels of lead.

					
<b>Cardiovascular System</b>	<b>Body</b>	<b>Brain</b>	<b>Kidneys</b>	<b>Digestive System</b>	<b>Nervous System</b>
<ul style="list-style-type: none"> <li>• high blood pressure</li> <li>• anemia</li> </ul>	<ul style="list-style-type: none"> <li>• fatigue</li> <li>• joint pain</li> <li>• muscle pain</li> <li>• decreased bone and muscle growth in children</li> </ul>	<ul style="list-style-type: none"> <li>• memory loss</li> <li>• headaches</li> <li>• behavior problems</li> <li>• hearing loss</li> <li>• irritability</li> </ul>	<ul style="list-style-type: none"> <li>• abnormal function and damage</li> </ul>	<ul style="list-style-type: none"> <li>• constipation</li> <li>• nausea</li> <li>• poor appetite</li> </ul>	<ul style="list-style-type: none"> <li>• numbness and pain</li> <li>• damage</li> </ul>

## Health Impacts

**Map Nerd Consulting** used simple language and visuals to communicate the health impacts of lead.





## Q: What are ways to give water consumers useful, actionable information about lead in drinking water?

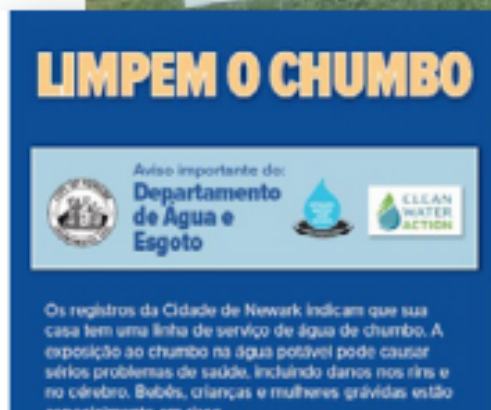
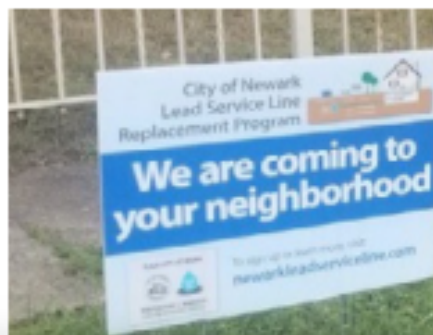
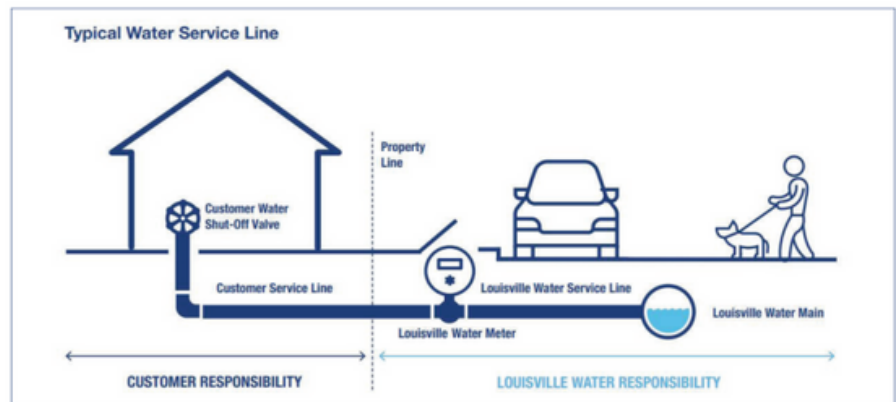
Below are some illustrative examples of best practices on **communications** from the 2021 Water Data Prize.

### Water Quality Reports

**Louisville Water Company** included useful information and graphics about lead in its annual water quality report.

#### LOUISVILLE WATER WILL HELP WITH REPLACEMENT

Because replacing a service line can be expensive, Louisville Water will pay 50 percent of the cost, up to \$1,500. If customers can't afford this program and they meet eligibility requirements, Louisville Water Foundation's grant program may pay the remaining replacement cost. Visit [LouisvilleWater.com/Lead-Awareness](https://LouisvilleWater.com/Lead-Awareness) for more information on this program, how to apply, and frequently asked questions.



### Multiple Channels

**CDM Smith and the City of Newark** used multiple communications channels (and multiple languages) to reach residents, including social media, print, and radio. This multi-pronged approach was an effective way to engage the community in planning and regular updates.





# INVENTORY

There are 11,000 communities in the country with lead pipes, but many of these communities still do not know where these pipes are. The extent and location of this vast problem is therefore still not quite known. Fortunately, the federal Lead and Copper Rule Revisions enacted at the end of 2021 have started the clock on when all water systems across the country will be required to submit an inventory of their lead service lines - by October 2024. Some states, like New Jersey, have moved forward with state laws that require an even faster timetable for submitting inventories.

Time is ticking, not only for this inventory requirement of the federal regulations, but also on the available funding through the bipartisan infrastructure law for lead service line replacement to states over the next five years. Water systems with inventories in place will have more time to access this funding through the State Revolving Fund (SRF) program.

Having an inventory will make it easier for a community to put a price tag on replacement, and ultimately identify the most adequate funding strategy from all available grants and loans. Having an inventory will also make it easier for water utilities to plan an equitable approach to replacement, and conduct more efficient block-by-block replacements.

Knowing the number and location of lead lines in a community is a basic first step to addressing the problem - and ultimately, replacing toxic lead pipes.



## Q: What tools or data help utilities quickly determine the location of lead pipes?

Knowing how many and where lead pipes are through **inventories** will significantly help communities understand and tackle the problem.

### Best Practices:

- **Be Clear About the Accuracy of Predictive Models.** Data has the capacity to mislead, misrepresent, or harm communities.
- **Technical Capacity Varies.** Not all utilities have IT departments or experience working with open source tools. Finding ways to simplify use is essential.
- **Consider Different Users.** There can be multiple users of tools - utility staff, customers, and even regulators. Clearly defining the users and working with those users to develop a tool will help ensure its success.

*"The submission had a high 'Wowza factor'... the explanation suggests a user-friendly and locally-tailored approach."*

**- Water Data Prize Judge**

*"I really appreciated the attention to affordability and equity. More utilities should be cross-referencing analyses of affordability and lead burden, and measuring effectiveness of affordability programs in a transparent way."*

**- Water Data Prize Judge**



## Q: What tools or data help utilities quickly determine the location of lead pipes?

Below are some illustrative examples of best practices on inventories from the 2021 Water Data Prize.

### Predictive Models



120Water evaluated the strength of its predictive model using a range of evaluation metrics. These models then informed sampling and verification strategies.

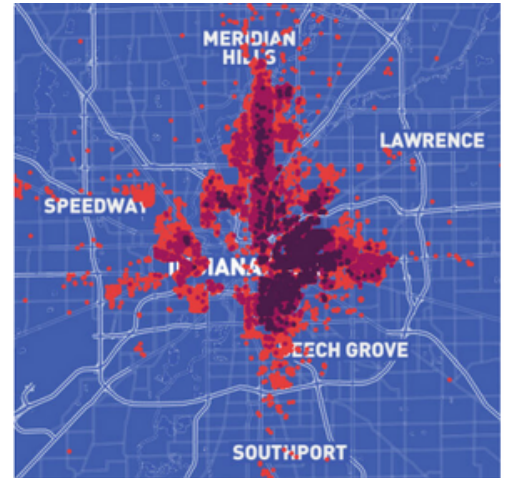
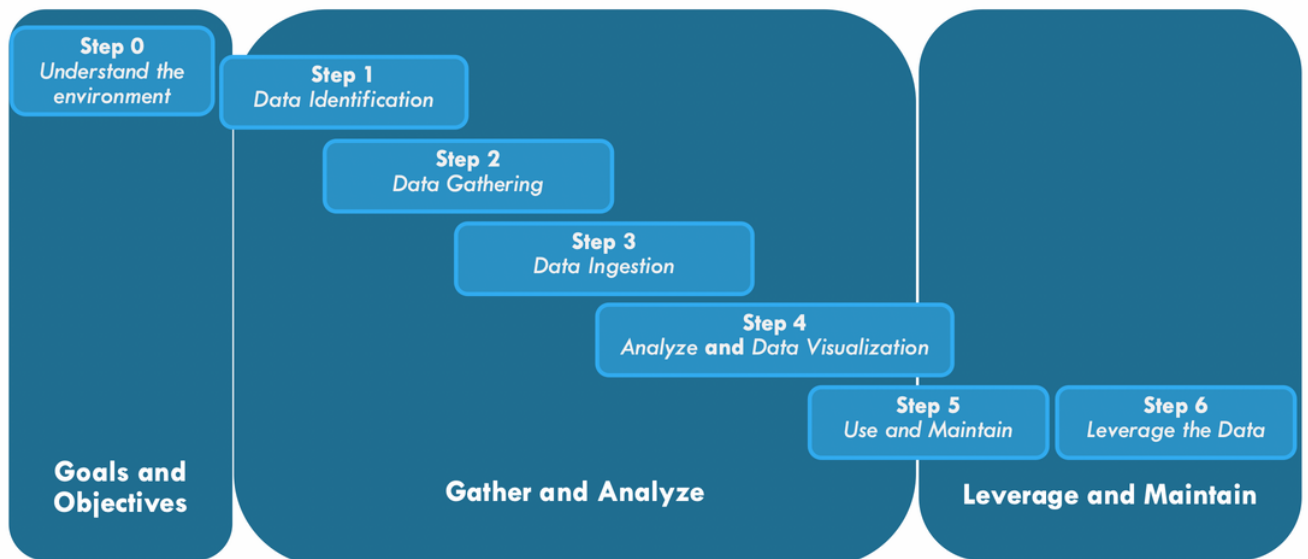


Figure 5. Distribution of predicted positive LSL locations in Indianapolis



### Center for Neighborhood Technology in collaboration with BlueConduit and IBM

used predictive modeling mechanisms to access lead pipes faster with a lower margin of error. It would normally take a utility longer to create an inventory.



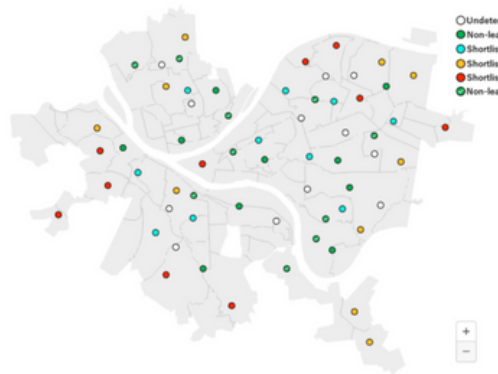
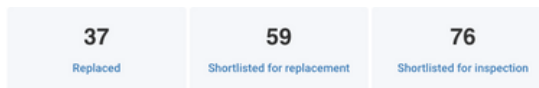
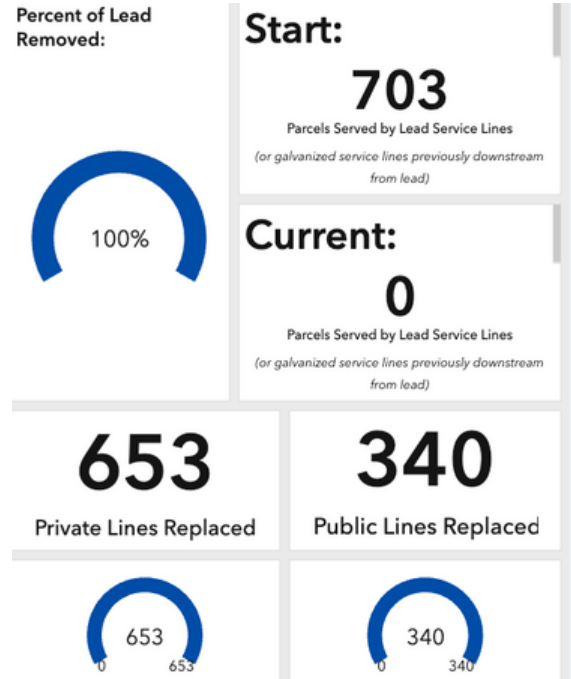


## Q: What tools or data help utilities quickly determine the location of lead pipes?

Below are some illustrative examples of best practices on inventories from the 2021 Water Data Prize.

### Public versus Private Lead Lines

**Stoughton Utilities** developed an online dashboard that clearly tracks public versus private lead service lines. This ensures transparency in the process of tracking lead service lines over time, and gives customers a clearer picture of the problem.



WaterSuite



### User-Defined Tools

**Ketos** created a customer-facing website, designed with utility customers and operators in mind. In response to requests from communities, Ketos also created a mobile tool to bring testing to communities and increase the amount of data available.

This complements a tool that **WaterSuite** developed to help share data with regulators.

These tools and others like them show a great deal of promise because they clearly articulate their core user needs and perspectives.



# MAPPING

Mapping is key to all other aspects of a lead service line replacement program - putting an inventory in a format that people understand and can visualize, helping to create a visual tool that speaks to and communicates effectively with residents, and identifying the most vulnerable neighborhoods and populations in relation to lead pipes.

There are integral aspects of a map design that make some more accessible and informative for more residents, while others less so. While it is important to demonstrate where confirmed lead service lines are located, it is just as important to display where unconfirmed lead pipes and confirmed non-lead pipes are, where replacements have already occurred, and if there is a distinction in the material on the private/homeowner side versus the public/utility side of a lead service line.

Ideally, this information should be hosted in one, easily accessible public interface with updated information as well as links to other resources, such as public health. Symbology and color schemes should emphasize this information rather than hinder it and make it clear for all to understand.





## Q: How can maps make it easy for the public to understand and interact with lead pipe data?

**Maps** can identify or highlight vital information that is accessible and clear for all residents of a community.

### Best Practices:

- **Avoid mapping pitfalls.** Many lead maps fail to explain missing or unknown data, differentiate between public and private service lines, let customers look up homes, or offer a course of action.
- **Design maps to enhance engagement and accessibility.** For example, all information should be provided within a website, as external links can reduce engagement. Be mindful of the limited mapping expertise residents may have and make use of modern practices to increase accessibility.
- **Integrate mapping with other communications tools.** Mapping was a key feature of many communication submissions. There are also ways to use mapping to customize communications materials.
- **While helpful, in-house GIS staff are not always necessary to meet your mapping or inventory goals.** There are great, affordable resources and organizations that you can leverage to bolster your lead-free water programs.

*"I appreciated the clear introduction and links to the mapping tool and community-facing website, which helped illustrate the strengths of their tool and won them high marks from me."*

**- Water Data Prize Judge**

*"I appreciate that the authors identified problems/gaps in the standard GIS approach to mapping and how their interventions make for a better product for the end user."*

**- Water Data Prize Judge**

*"Story maps were super engaging and accessible - an innovative approach to presenting this information, plus visual appeal for strong Wowza points."*

**- Water Data Prize Judge**

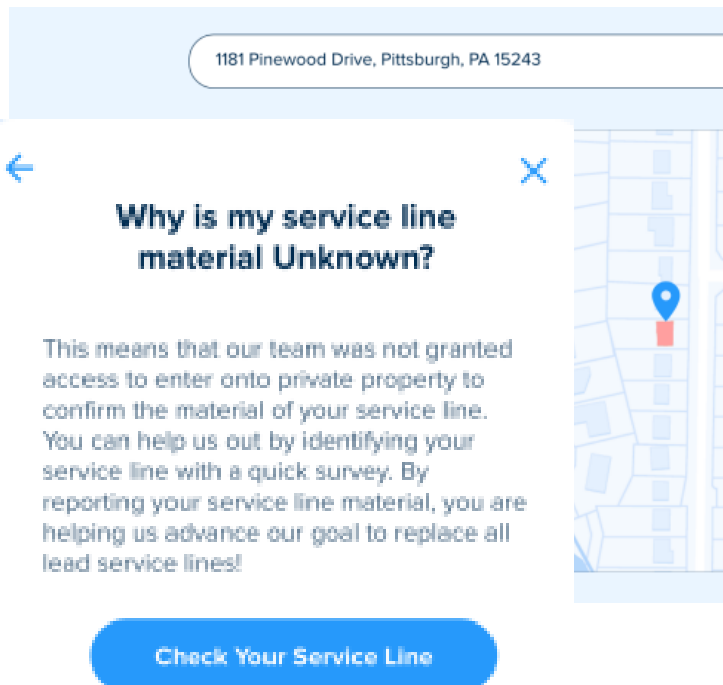


# Q: How can maps make it easy for the public to understand and interact with lead pipe data?

Below are some illustrative examples of best practices on **mapping** from the 2021 Water Data Prize.

## Include Context & Compel Action

**KETOS** developed a mapping solution for utilities to visualize their lead service line inventory at different geographic scales in three simple steps without requiring specialized skillsets. This has the benefit of helping communities address lead concerns with accuracy and avoid the expense of replacing the entire system.



**TruePani** clearly identified challenges with existing maps, and addressed those challenges to help customers understand what a service line is and view data for their home. They also provided an explanation for missing data and provided a course of action.

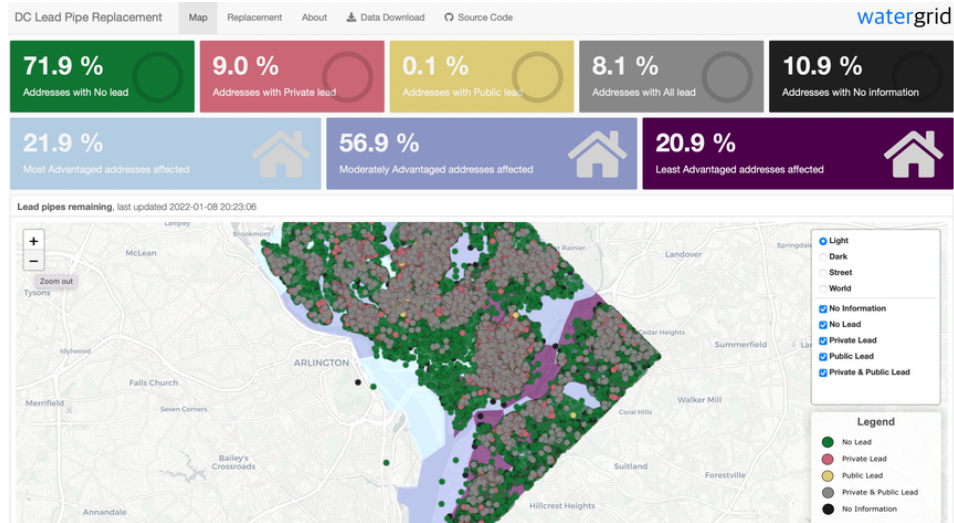


# Q: How can maps make it easy for the public to understand and interact with lead pipe data?

Below are some illustrative examples of best practices on mapping from the 2021 Water Data Prize.

## Free Mapping Tools

**Water Data Lab** provided a free open source template with the color schemes, legends and information already set up for utilities to plug in their information.



## Integrate Maps & Communications

**SimpleLab** in collaboration with **BlueConduit** developed a map-based system that allows utilities to customize correspondence and other outreach materials to different residents.

### Select residents for sampling kits.

Placeholder text goes here with explanations.

Service Line Data | Last updated on Dec 4, 2021 11:24PM UTC

Map View | List View

Layers

- Est. SL Material
- SL Install Year
- Year Built
- Neighborhood
- Est. Med. Household Income (\$, 2019)
- Est. Black Population (\$, 2019)
- Est. SL Material
- Known Lead
- High Likelihood of Lead
- Medium Likelihood of Lead
- Low Likelihood of Lead
- Known Non-Lead
- Unknown

Requests | Sampling sites

4 requests selected

<input type="checkbox"/>	Address	Opt-In ID	Language
<input checked="" type="checkbox"/>	1178 West Fork Street	G20114	English
<input type="checkbox"/>	1191 West Fork Street	G20017	English

# ACKNOWLEDGMENTS

## WINNING TEAMS

*Congratulations to the winning teams and all entries for the creativity, dedication, and ingenuity.*

### CDM SMITH AND THE CITY OF NEWARK

Sandra Kutzing  
 Brian Kearney  
 Tiffany Stewart  
 Mark Zito  
 Brian Farrelly  
 Shoshanna Page  
 Kareem Adeem

### 120WATER

Megan Glover  
 Logan Hendrickson  
 Tom Bruns  
 Antony Rhine

### KETOS

JMeena Sankaran  
 Ganesh Hegde  
 Kedar Dabhadkar  
 Steve Shaffer

### JERSEY WATER WORKS AND NEW JERSEY FUTURE

Jyoti Venketraman  
 Andrew Tabas  
 Kimberley Irby  
 Jersey WaterCheck Data Advisory Committee  
 and Water Risk and Equity Subcommittee

### RAFTELIS

Samantha Villegas  
 Jeff Bronowski  
 Matt Wittern

### CENTER FOR NEIGHBORHOOD TECHNOLOGY

Anna Wolf  
 Peter Haas  
 Paul Esling  
 Ian Robinson, BlueConduit  
 Eric Schwartz, BlueConduit  
 Laura Gilligan, IBM  
 Liz Mitchell, IBM  
 Sue Hallen, IBM

## TAP INTO INNOVATION

Released May 2022.

Suggested citation:  
Maureen Cunningham et al.  
2022.  
“Results and Recommendations  
from the 2021 Water Data  
Prize” Environmental Policy  
Innovation Center, Washington  
D.C.

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Jessica Mahr.

The Environmental Policy Innovation Center (EPIC) is a nonprofit start-up based in Washington, DC focused on building policies that deliver spectacular improvement in the speed and scale of conservation and environmental progress.

EPIC is committed to finding and highlighting the best approaches to scaling up positive results quickly. Our program areas include water infrastructure and financing, endangered species, environmental markets and restoration, and the use of data and technology in producing conservation outcomes.

Our water work focuses on four areas of water infrastructure and financing that are critical to health, equity, and the environment: eliminating disparities across water systems and expanding access for communities to federal dollars; increasing investment in green infrastructure, especially in disadvantaged communities; developing policies, innovative strategies, and hands-on capacity building for faster, more efficient, and more equitable lead service line replacement; and rapid response and policy analysis on a number of health equity issues such as affordability and public trust. We work to establish strong collaborative networks and creative policy solutions centered on community needs.

EPIC believes that replacing lead pipes is a solvable problem, and that no one should be drinking lead-contaminated water. Our goal is therefore to find ways to speed up lead pipe replacement and eliminate this problem over the next five to ten years.

*Support for the Water Data Prize was provided by the Robert Wood Johnson Foundation and The Bezos Earth Fund. The views expressed here do not necessarily reflect the views of the funders.*



# ACKNOWLEDGMENTS

## JUDGES

*Thank you to the experts who reviewed and scored entries to the 2021 Water Data Prize.*

**Albert Cho:** Chief Strategy & Digital Officer, Xylem Inc.

**Lynn Thorp:** National Campaigns Director, Clean Water Action

**Alan Roberson:** Executive Director, Association of State Drinking Water Administrators

**Tiffani Ashley Bell:** Founder & Executive, The Human Utility

**Stephanie Corso:** CEO and Co-Founder, Rogue Water

**Anna-Lisa Castle:** Policy Director, Alliance for the Great Lakes

**Jeff Allenby:** Director of Geospatial Technology, Center for Geospatial Solutions

**Jonathan Cuppett:** Research Program Manager, Water Research Foundation

**Amen Ra Mashariki:** Principal Scientist & the Head of AI Cities, NVIDIA

**Monica Lewis-Patrick:** President & CEO, We the People of Detroit

**Alicia Smith:** Co-Founder & Director, The Junction Coalition

**Chris Sosnowski:** CEO, WaterClick

**Jalonne White-Newsome:** CEO & Founder, EGE<sup>2</sup>