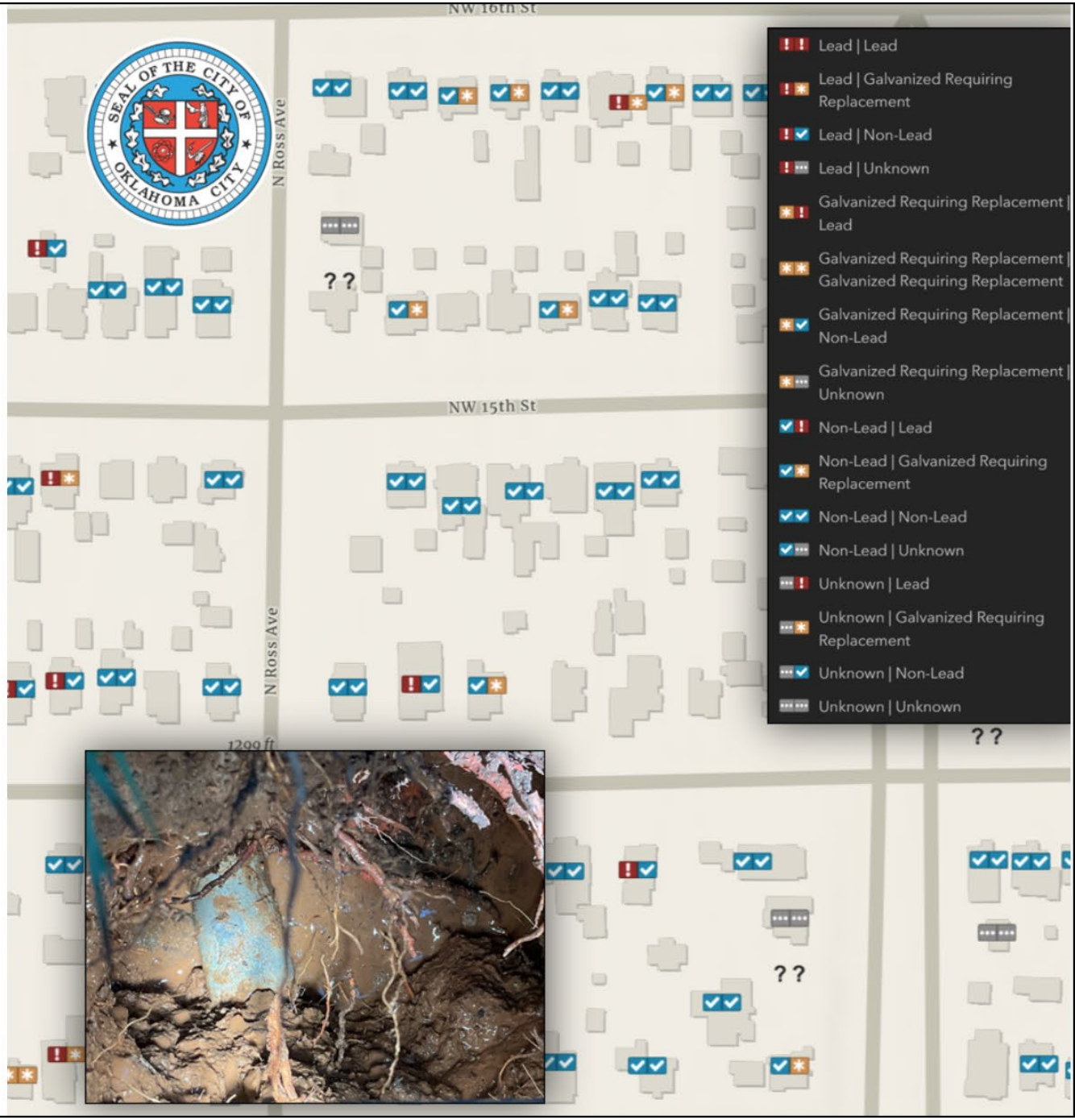
The Hunt for Lead

Utilizing Web GIS to Identify Lead Service Lines in the City of Oklahoma City

Hayden Harrison | **Systems Analyst II**

September 25, 2023

Note from author: thank you for your interest in this presentation! The original presentation was given via StoryMap. This PowerPoint was created for sharing purposes. For additional information, you can reach the author at hayden.Harrison@okc.gov



Introduction

The Problem with Lead

Lead can have adverse affects on almost every organ and system in your body and can accumulate over time.

- Young children and infants are particularly vulnerable.

Exposure to lead (even in low levels) has been linked to:

- damaged nervous systems
- learning disabilities
- various physical impairments such as hearing loss and slowed growth
- Cardiovascular effects including increased blood pressure and hypertension

> "The science is clear--there is no safe level of exposure to lead" -- EPA Administrator Michael S. Regan

How Lead Gets into Drinking Water

Lead can enter drinking water when plumbing infrastructure is made of lead.

Typical locations containing lead:

- Faucets
- Galvanized pipe
- Copper pipe with lead solder
- Lead goose necks
- Lead service lines

Lead service lines are most likely to be found in older cities and homes built before 1986.

Source

Revised Lead and Copper Rule

The first Safe Drinking Water Act (SDWA) was originally passed in 1974 and was amended in 1986 to "prohibit the use of any pipe...that is not "lead free"" .

The Revised Lead and Copper Rule of 2021 provides, "greater and more effective protection of public heath by reducing exposure to lead and copper in drinking water." (40 CFR Parts 141 and 142)

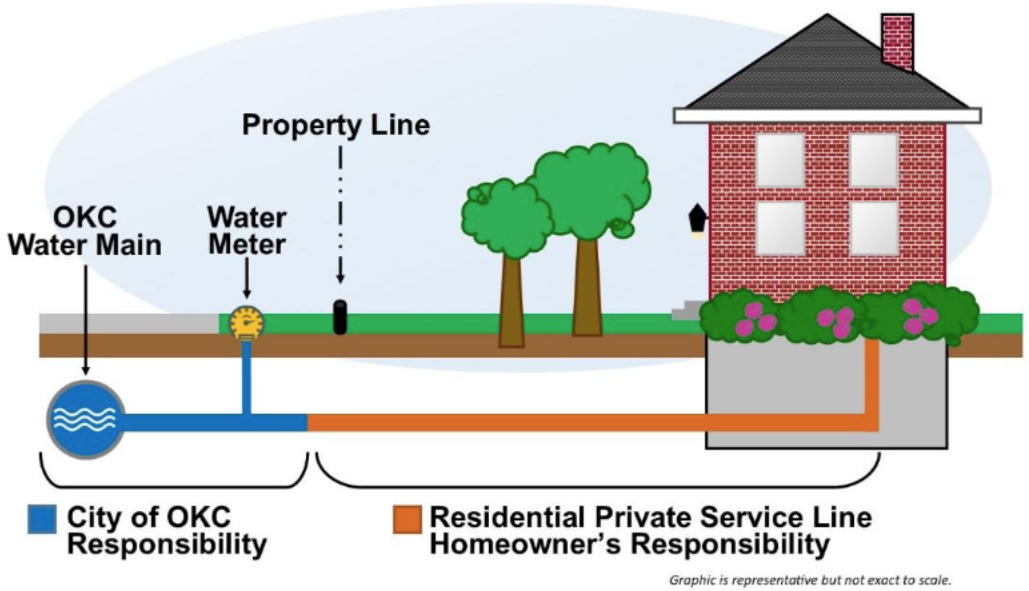
Requirements for Oklahoma City

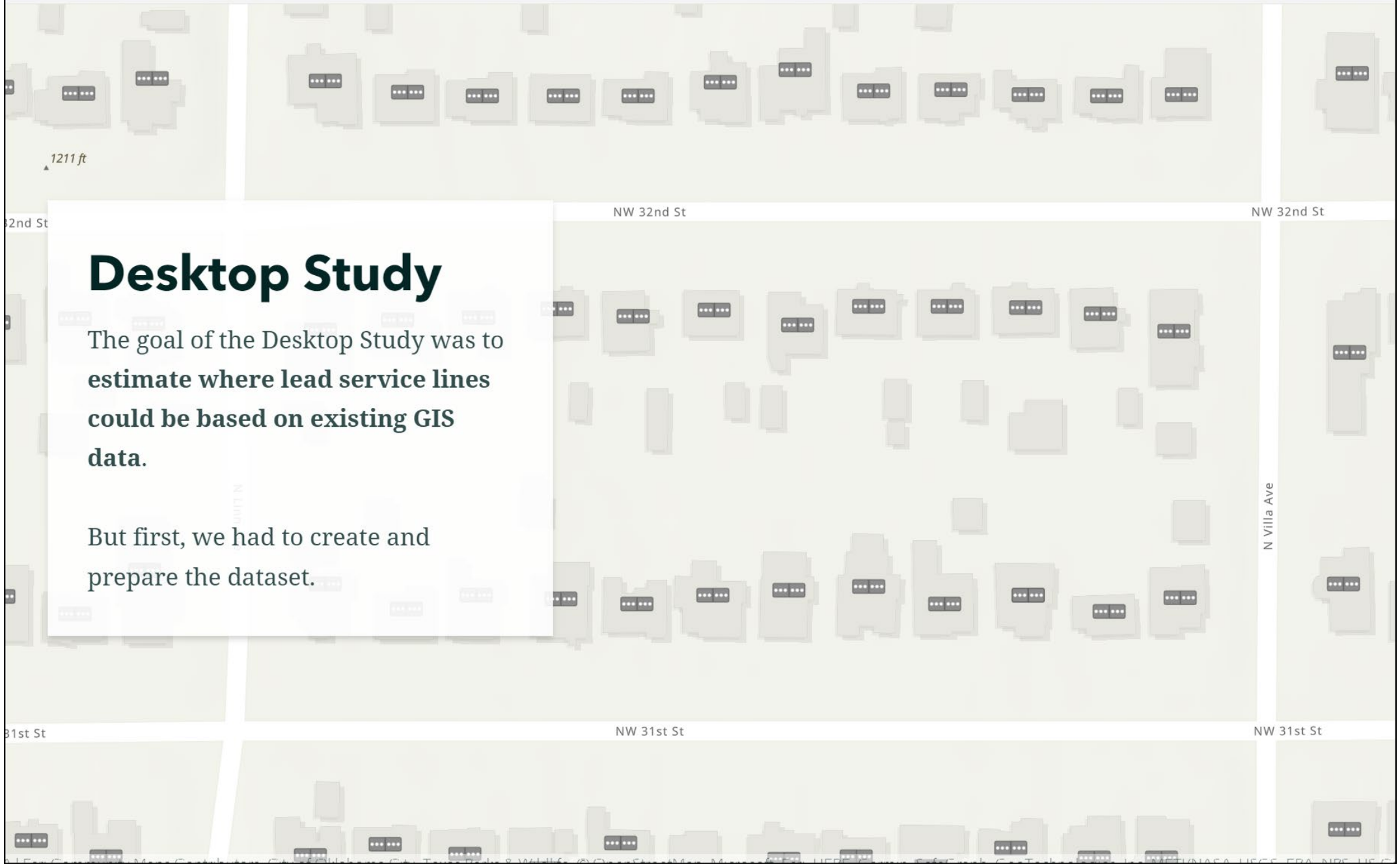
By October 16, 2024, we must:

- Have an active database of all service lines for both customer and utility side
- Inventory must be publicly accessible online (EPA requires publishing online for systems serving over 50,000 customers)
- Must notify all customers with lead, galvanized, or unknown service lines on an annual basis

The City must continue to verify service lines until all service lines have been verified.

The City must also develop a Service Line Replacement Plan.





Desktop Study

The goal of the Desktop Study was to **estimate where lead service lines could be based on existing GIS data**.

But first, we had to create and prepare the dataset.

Address
Full address of point

Supplement
Supplemental address information (building number)

GISID
Identifier used in City's address database

Premise Number
SAP Premise number

Meter Size
Size of meter at address

Meter Number
Meter Number in SAP

Premise Type
SAP categorical type of account

Installation
Sap installation number

X
X coordinate of point

Device Location
SAP unique identifier

Installation Type
Installation type in SAP

Y
Y coordinate of point

Data Preparation

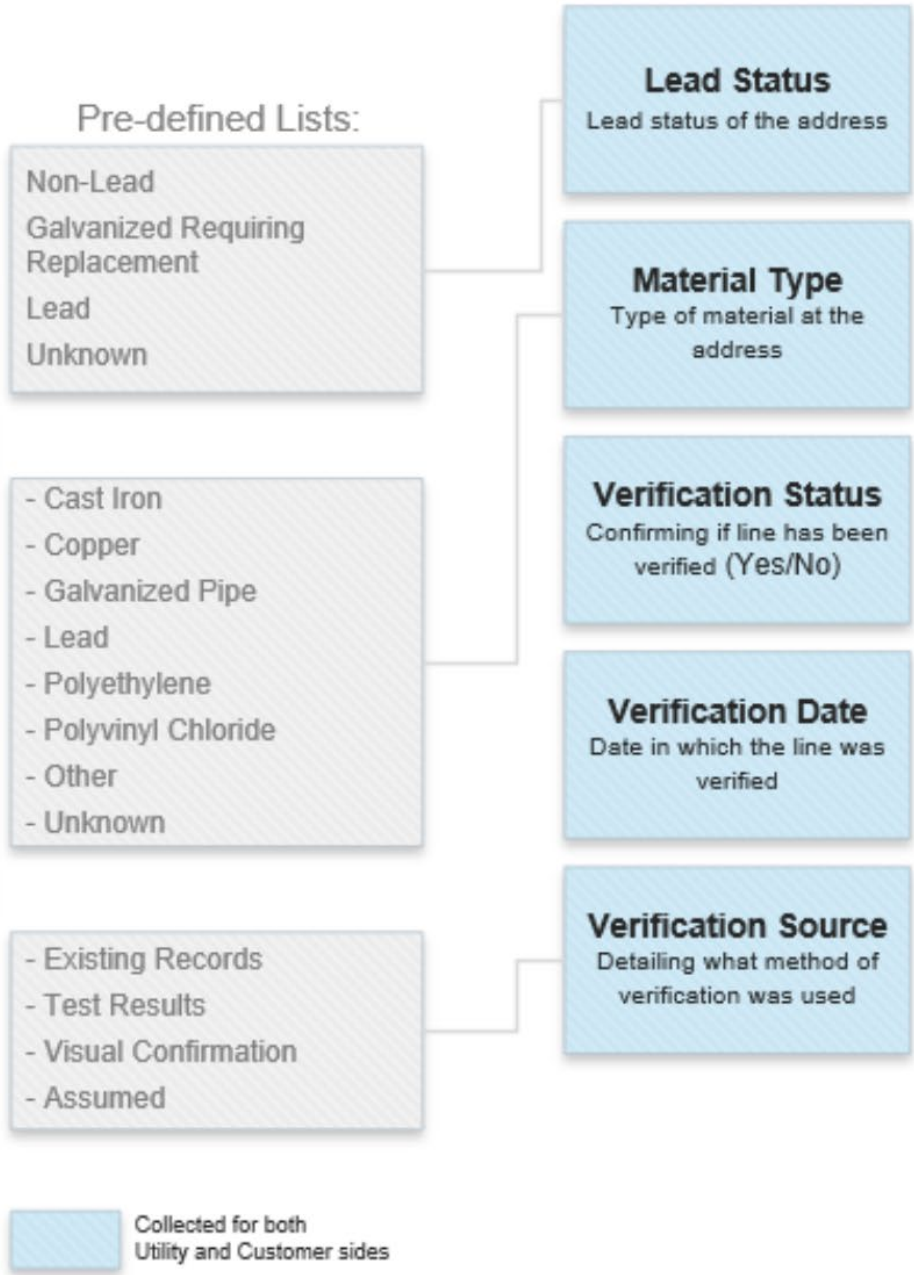
Step 1: Export all accounts with water service out of SAP billing system.

Step 2: Create feature class with fields required by SAP billing system.

Data Preparation

Step 3: Add ESRI Lead Service Line Solution fields.

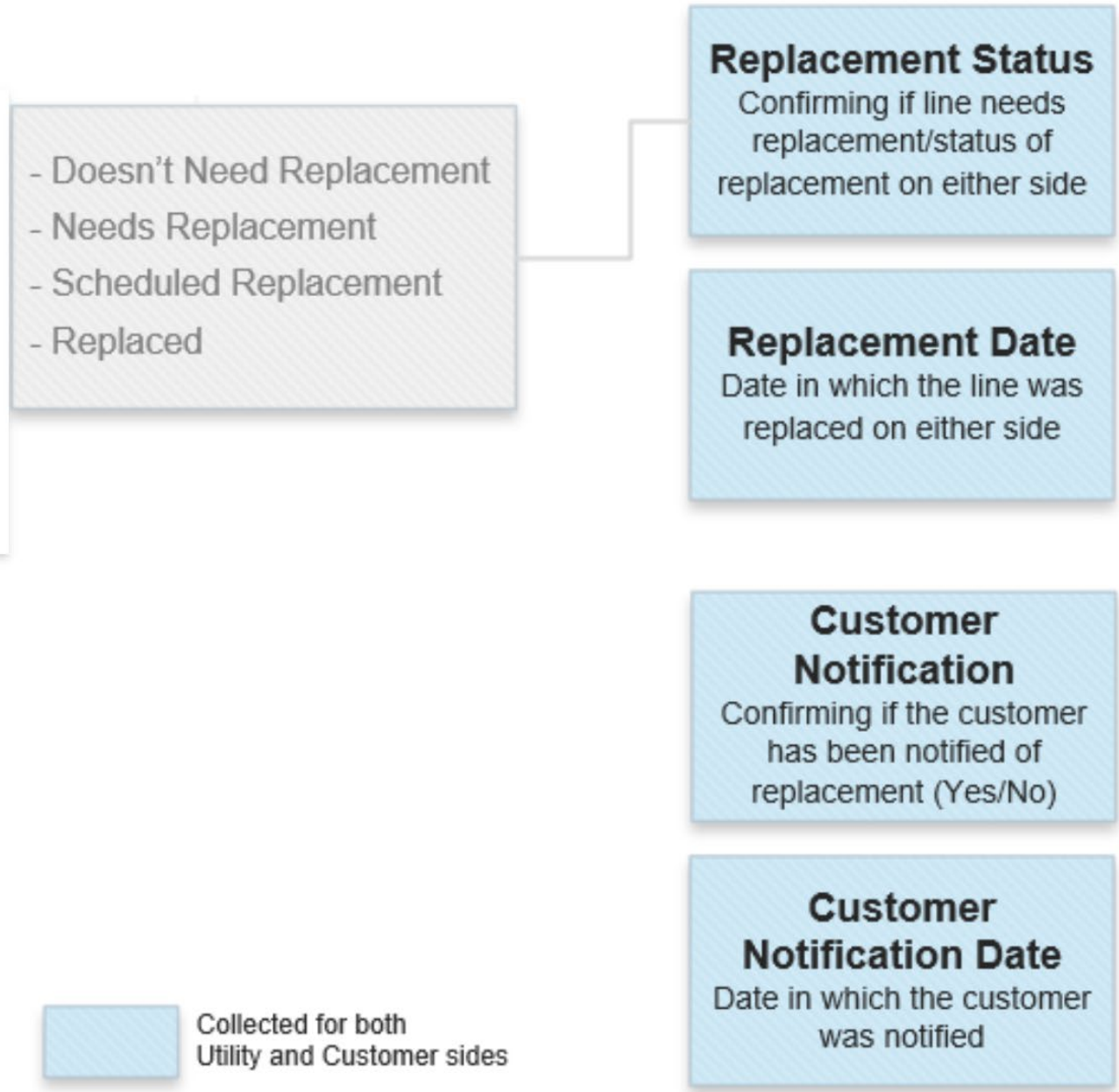
- Lead status
  - Material Type
  - Verification Status, Source, and Date

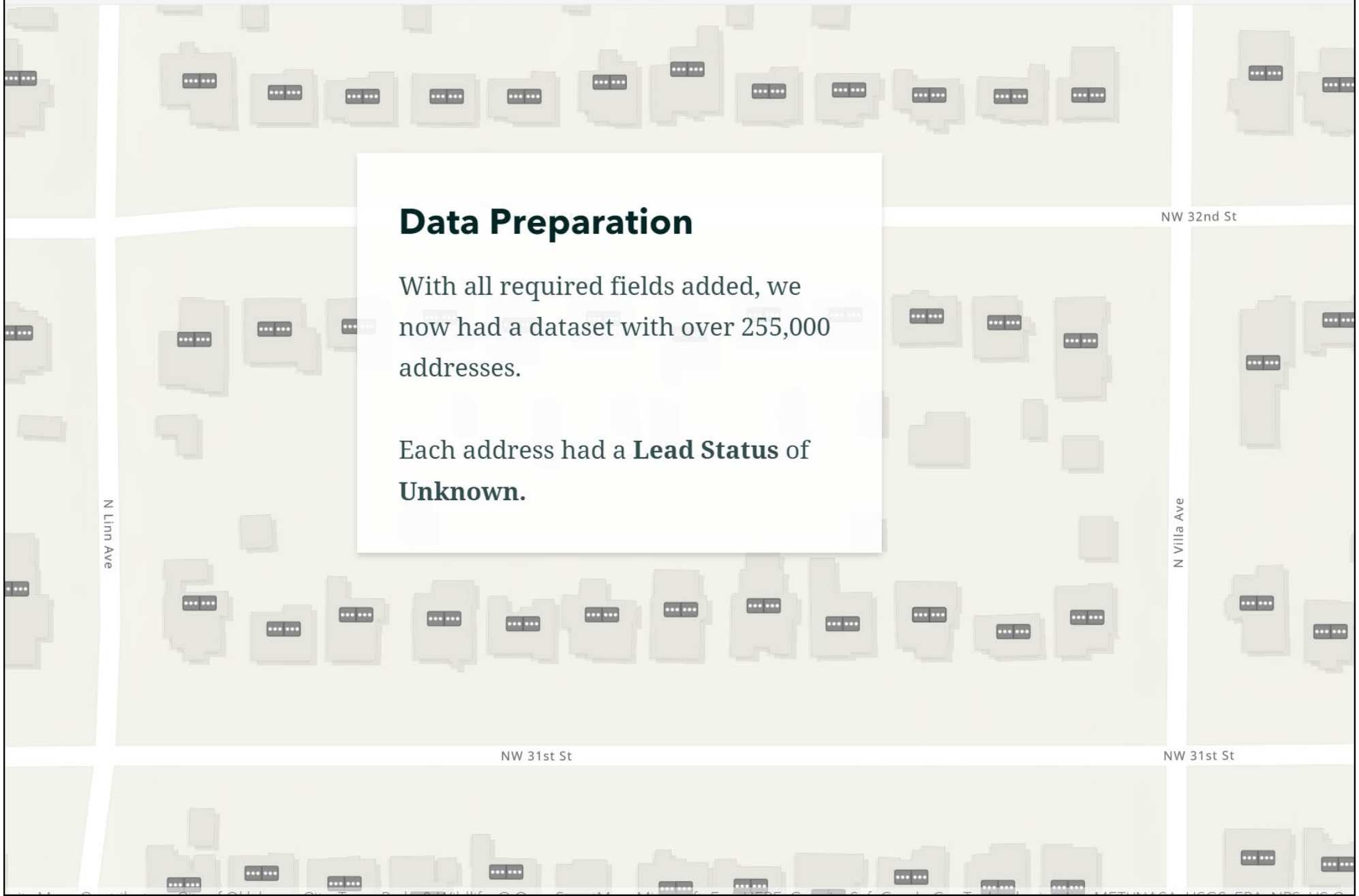


Data Preparation

Step 3: Add ESRI Lead Service Line Solution fields.

- Replacement Status, Date
- Customer Notification, Date

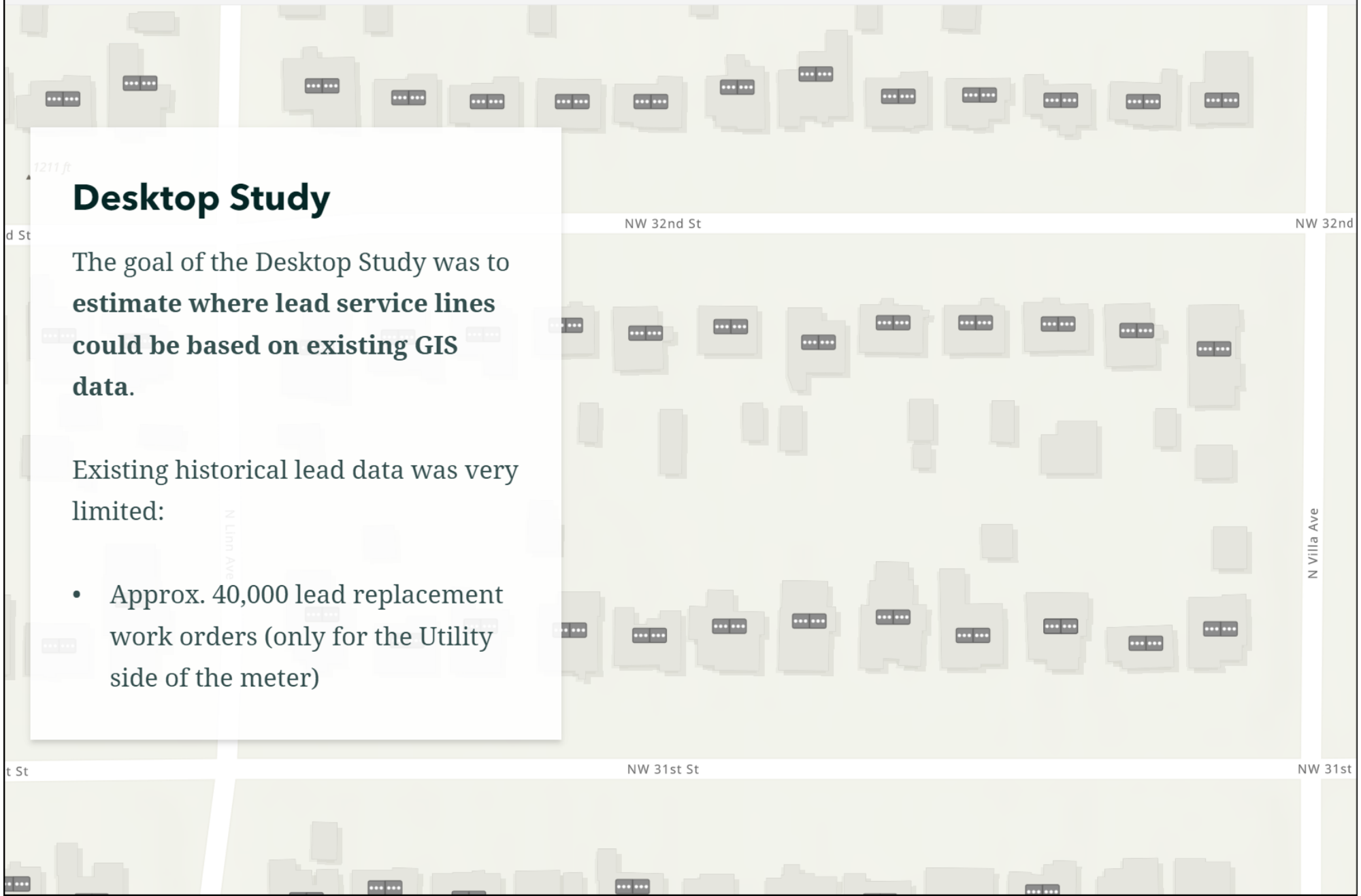




Data Preparation

With all required fields added, we now had a dataset with over 255,000 addresses.

Each address had a **Lead Status** of **Unknown.**

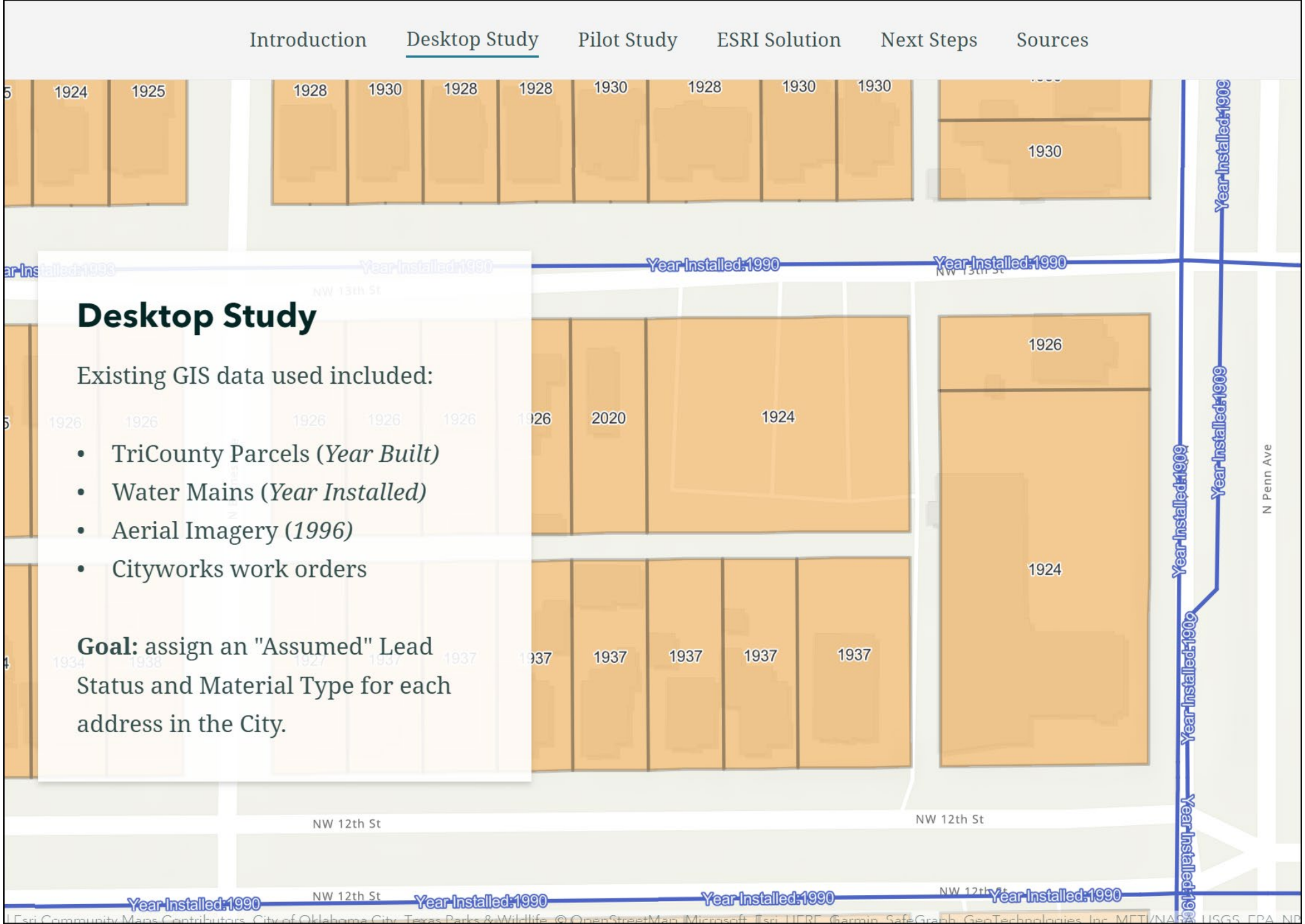


Desktop Study

The goal of the Desktop Study was to **estimate where lead service lines could be based on existing GIS data**.

Existing historical lead data was very limited:

- Approx. 40,000 lead replacement work orders (only for the Utility side of the meter)



Desktop Study

Existing GIS data used included:

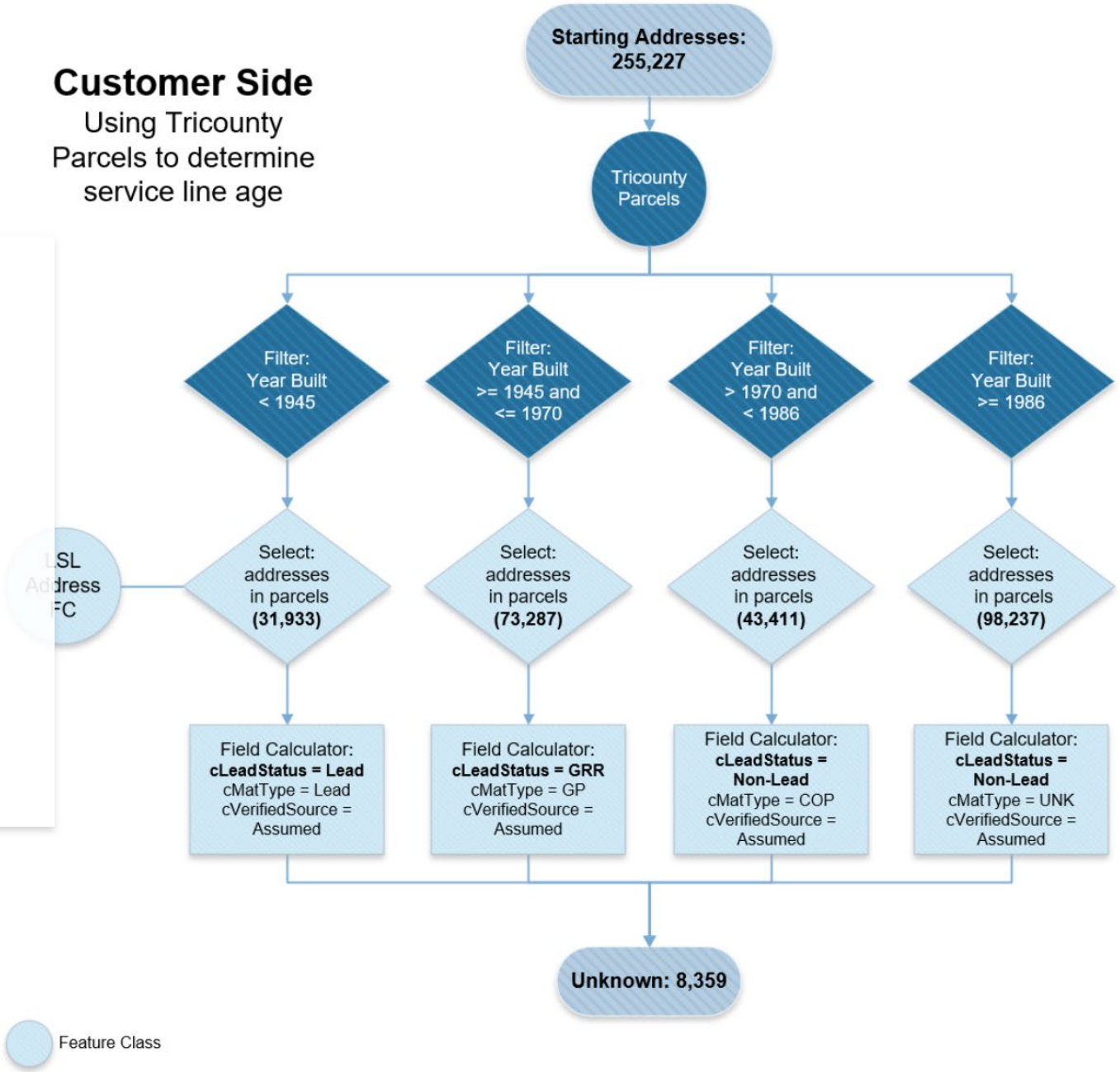
- TriCounty Parcels (*Year Built)*
- Water Mains (*Year Installed)*
- Aerial Imagery (*1996)*
- Cityworks work orders

Goal: assign an "Assumed" Lead Status and Material Type for each address in the City.

Estimating Lead on Customer Side

We started with a series of spatial joins using the TriCounty Parcel layer.

Leadership estimated what service lines *could* be based on the year the house was built.

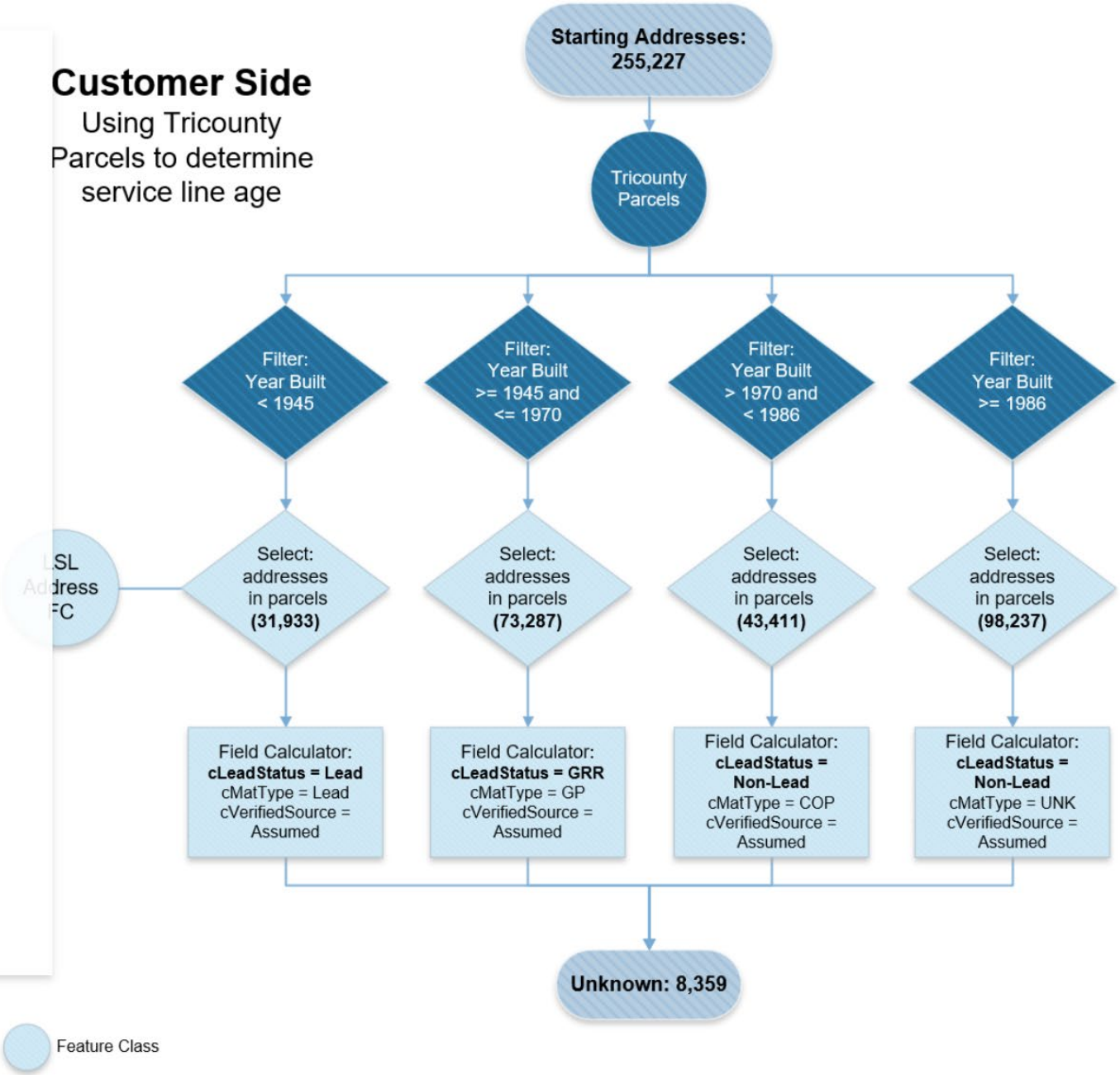


Example: if an address was within a parcel built before 1945, it was assigned the following:

- Lead Status = Lead
- Material Type = Lead
- Verification Source = Assumed

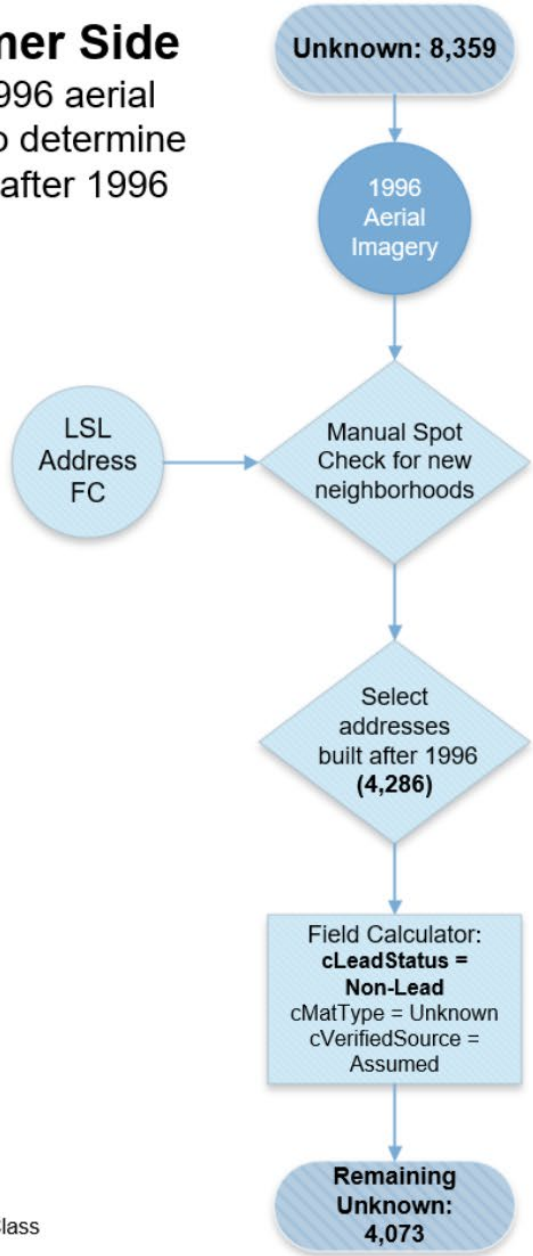
Using this logic, we were able to determine an **Assumed Lead Status** of 248,868 addresses.

This left 8,359 addresses left to determine.

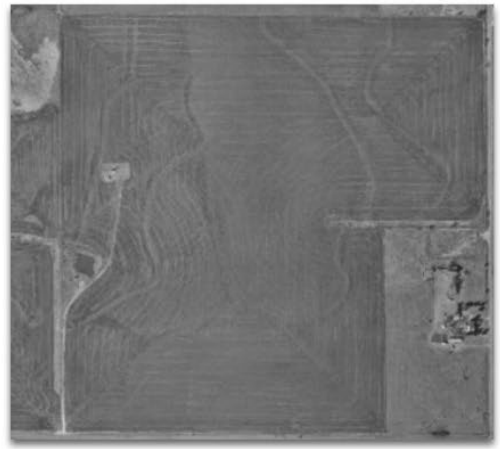


Customer Side

Using 1996 aerial imagery to determine lots built after 1996



1996



2020

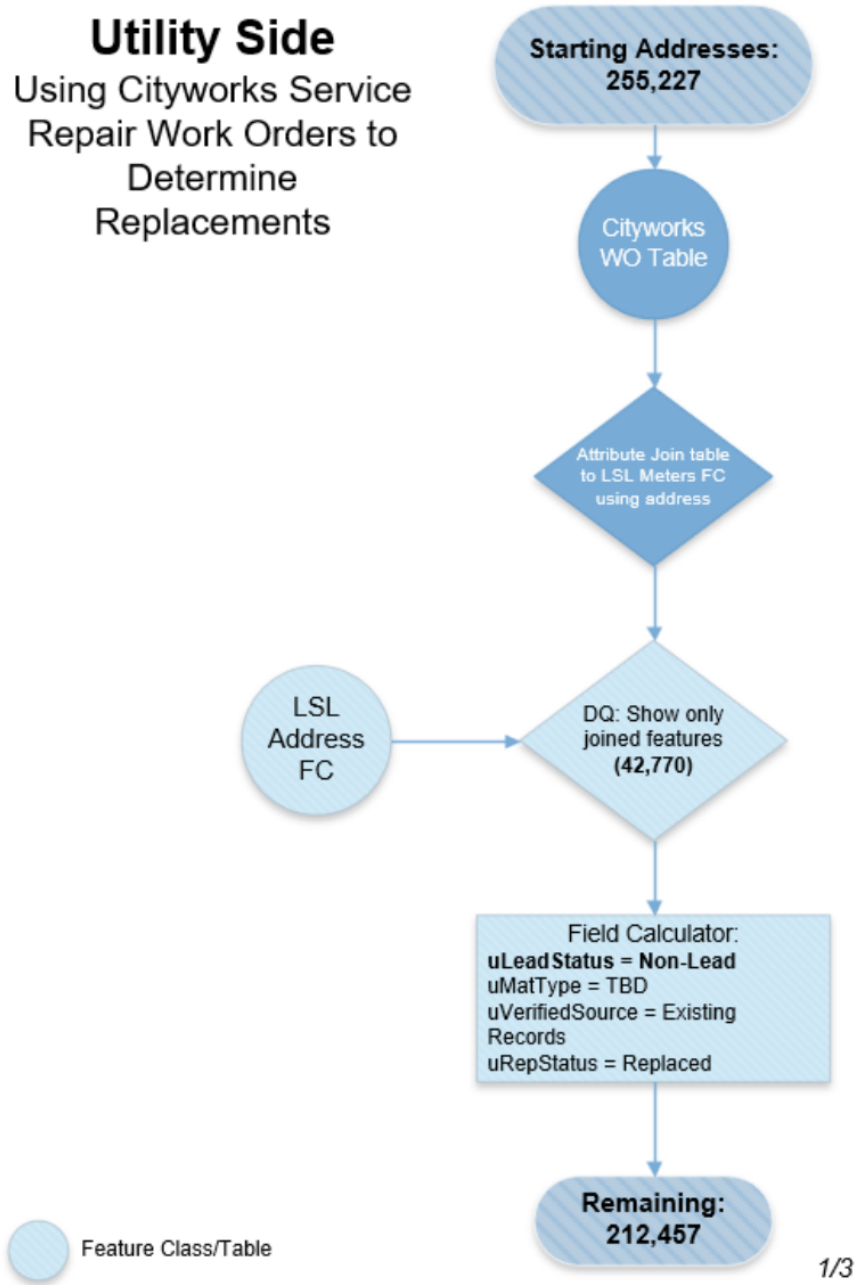
Estimating Lead on the Customer Side

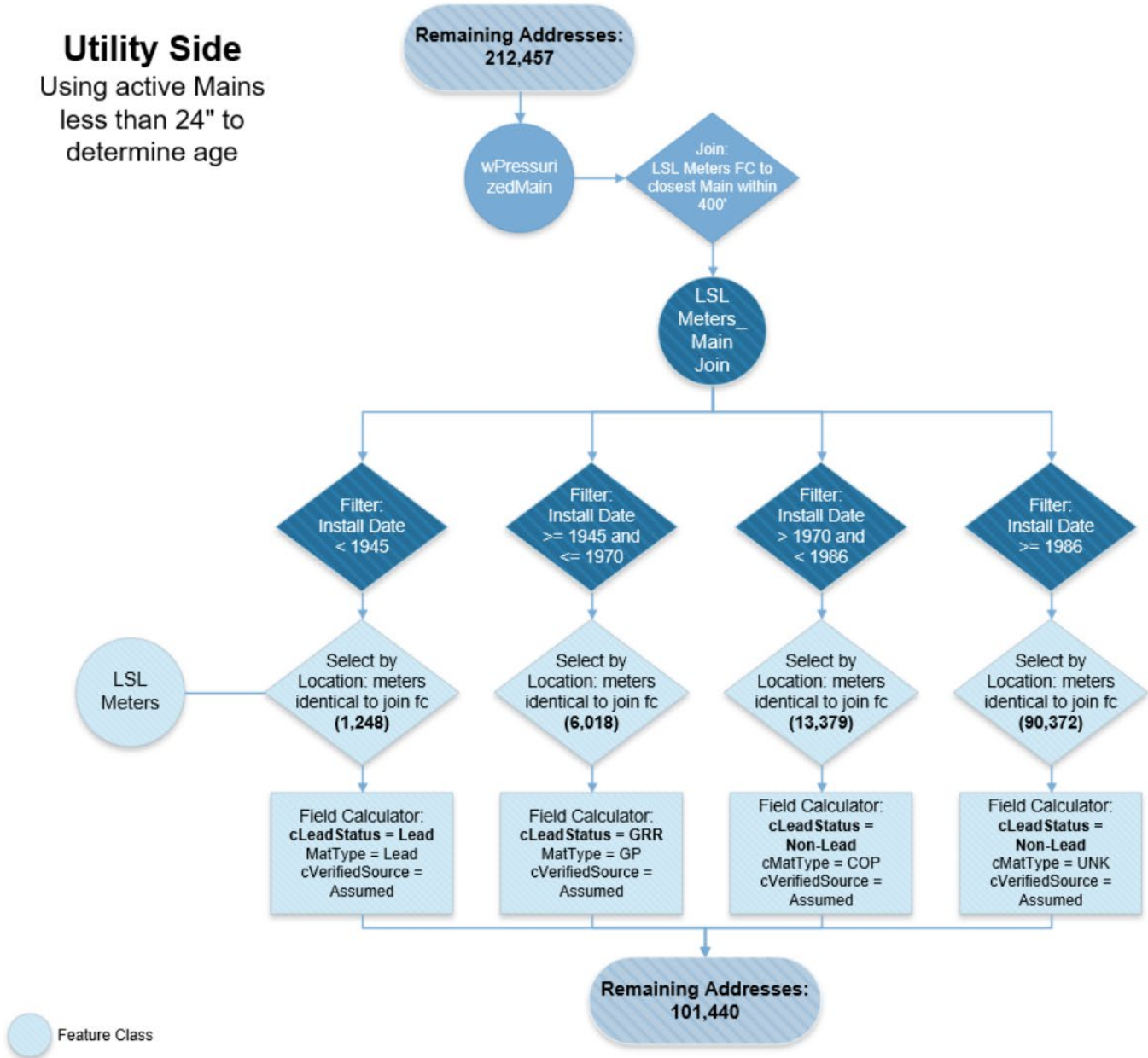
We were then able to use aerial imagery from 1996 to estimate an additional 4,286

This left 4,073 addresses with a lead status of Unknown.

Estimating Lead on the Utility Side

- Using work orders from Cityworks, we were able to confirm the lead status of 42,770 addresses (on the Utility Side).
  - This left 212,457 addresses left to estimate on the utility side.





Estimating Lead on the Utility Side

We then did a proximity analysis to estimate lead status.

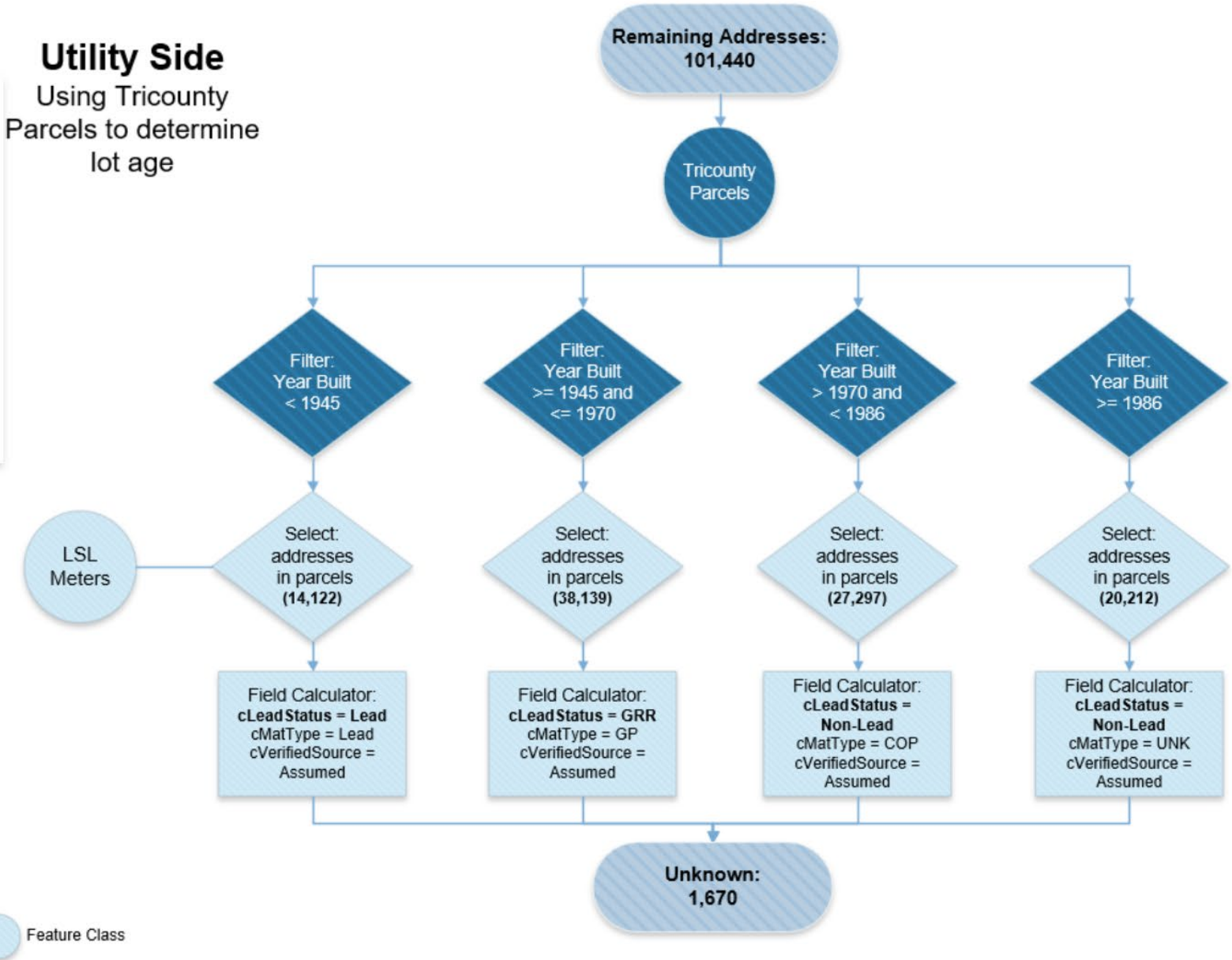
Addresses that were within 400' of an active water main <=24" were assigned the Install Date of that main line.

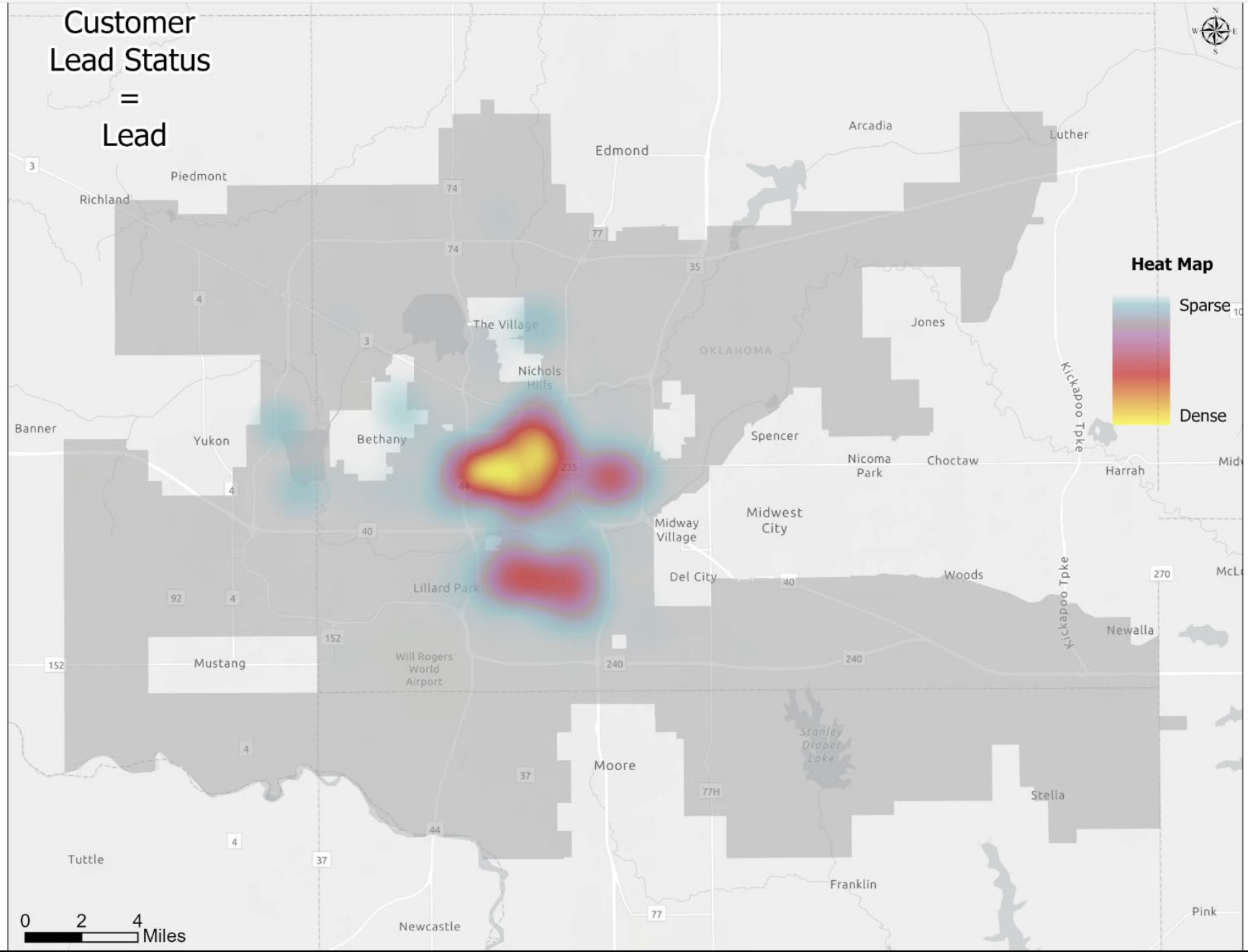
Example: Addresses within 400' of an active water main with an install date of before 1945 were assigned the following:

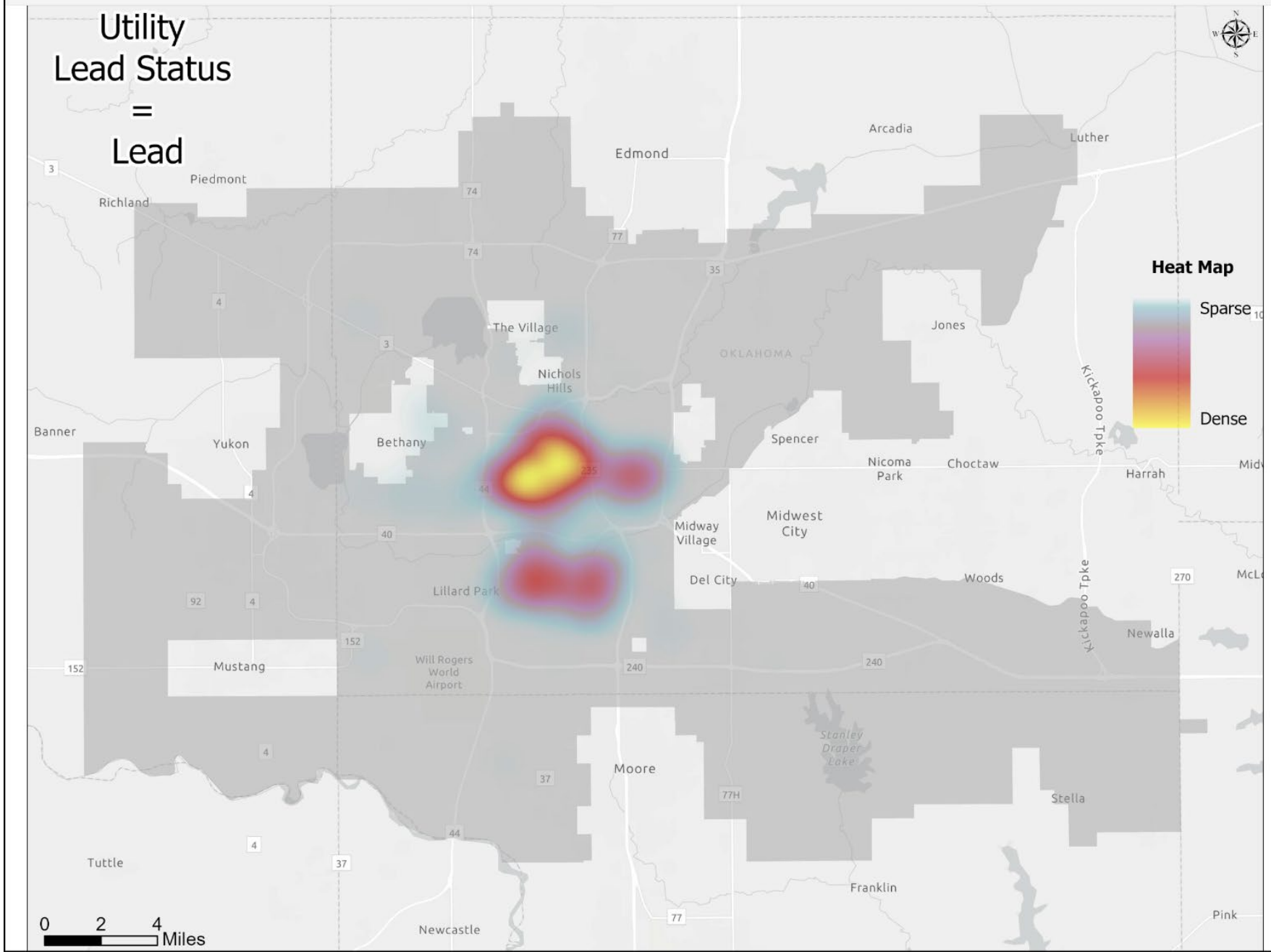
- Lead Status: Lead
- Material Type: Lead
- Verified Source: Assumed

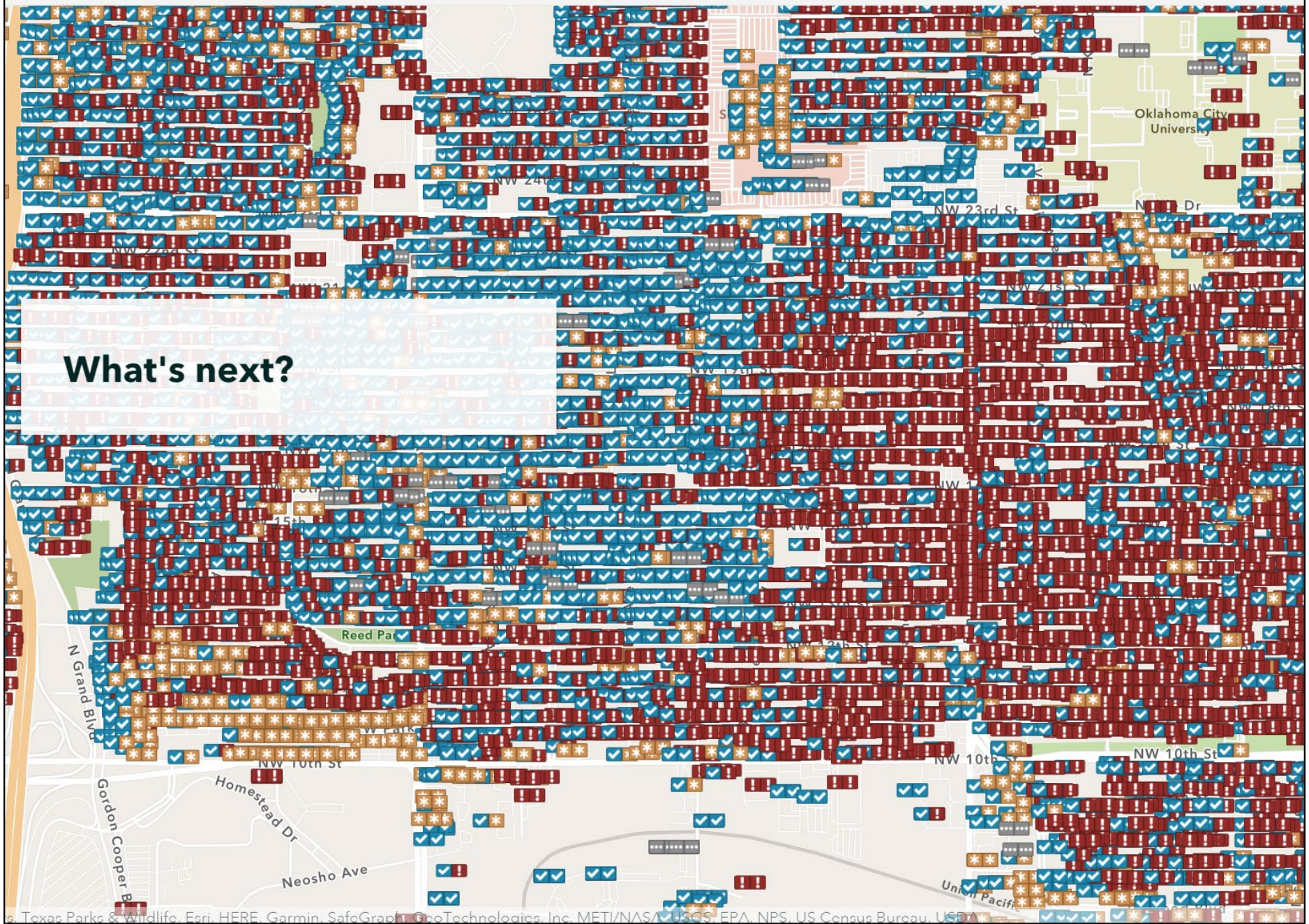
Lastly, we used the TriCounty Parcel layer to assume the remaining addresses.

This left 1,670 addresses with an assumed status of "Unknown".




Customer
Lead Status
=
Lead
Heat Map
Sparse
Dense
Edmond
Arcadia
Luther
Piedmont
Richland
The Village
Nichols Hills
OKLAHOMA
Jones
Banner
Yukon
Bethany
Spencer
Nicoma Park
Choctaw
Harrah
Midwest City
Midway Village
Del City
Lillard Park
Woods
Newalla
Mustang
Will Rogers World Airport
Moore
Stanley Draper Lake
Stella
Tuttle
Franklin
Newcastle
Pink
Kickapoo Tpke
0 2 4 Miles


Utility
Lead Status
=
Lead
Heat Map
Sparse
Dense
Edmond
Arcadia
Luther
Piedmont
Richland
The Village
Nichols Hills
OKLAHOMA
Jones
Banner
Yukon
Bethany
Spencer
Nicoma Park
Choctaw
Harrah
Midwest City
Midway Village
Del City
Lillard Park
Woods
Newalla
Mustang
Will Rogers World Airport
Moore
Stella
Tuttle
Franklin
Newcastle
Pink
Kickapoo Tpke
0 2 4 Miles


What's next?
Oklahoma City University
NW 23rd St
NW 10th St
Reed Park
N Grand Blvd
Gordon Cooper Blvd
Homestead Dr
Neosho Ave
Union Pacific
Texas Parks & Wildlife, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

Pilot Study

We started planning for a pilot study to verify assumed lead service lines.

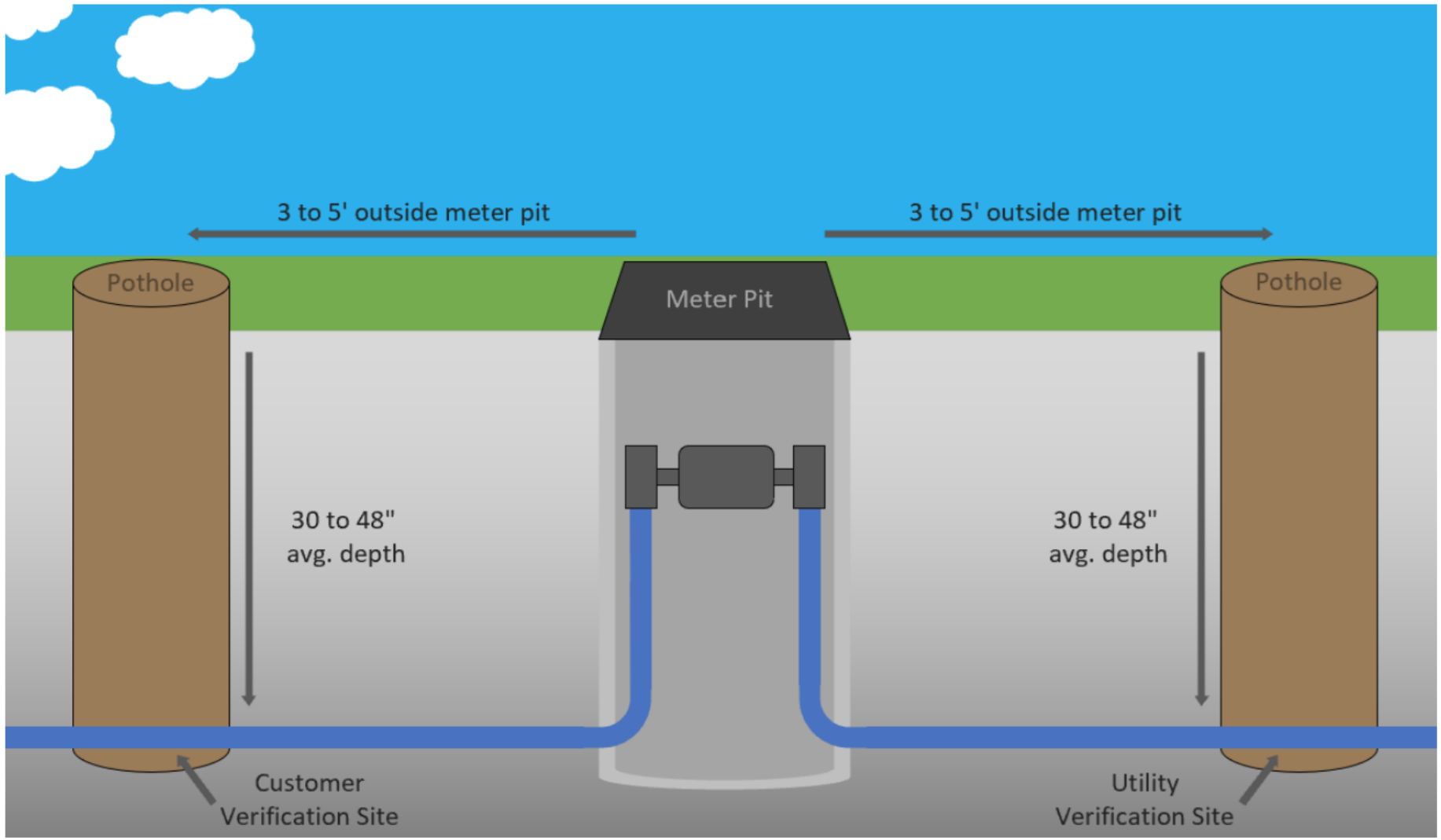
In 2023, OCWUT acquired a loan of **2.25 million** through the Drinking Water State Revolving Fund from OWRB.

This funding would allow us to verify 4,250 addresses (8,500 potholes total).

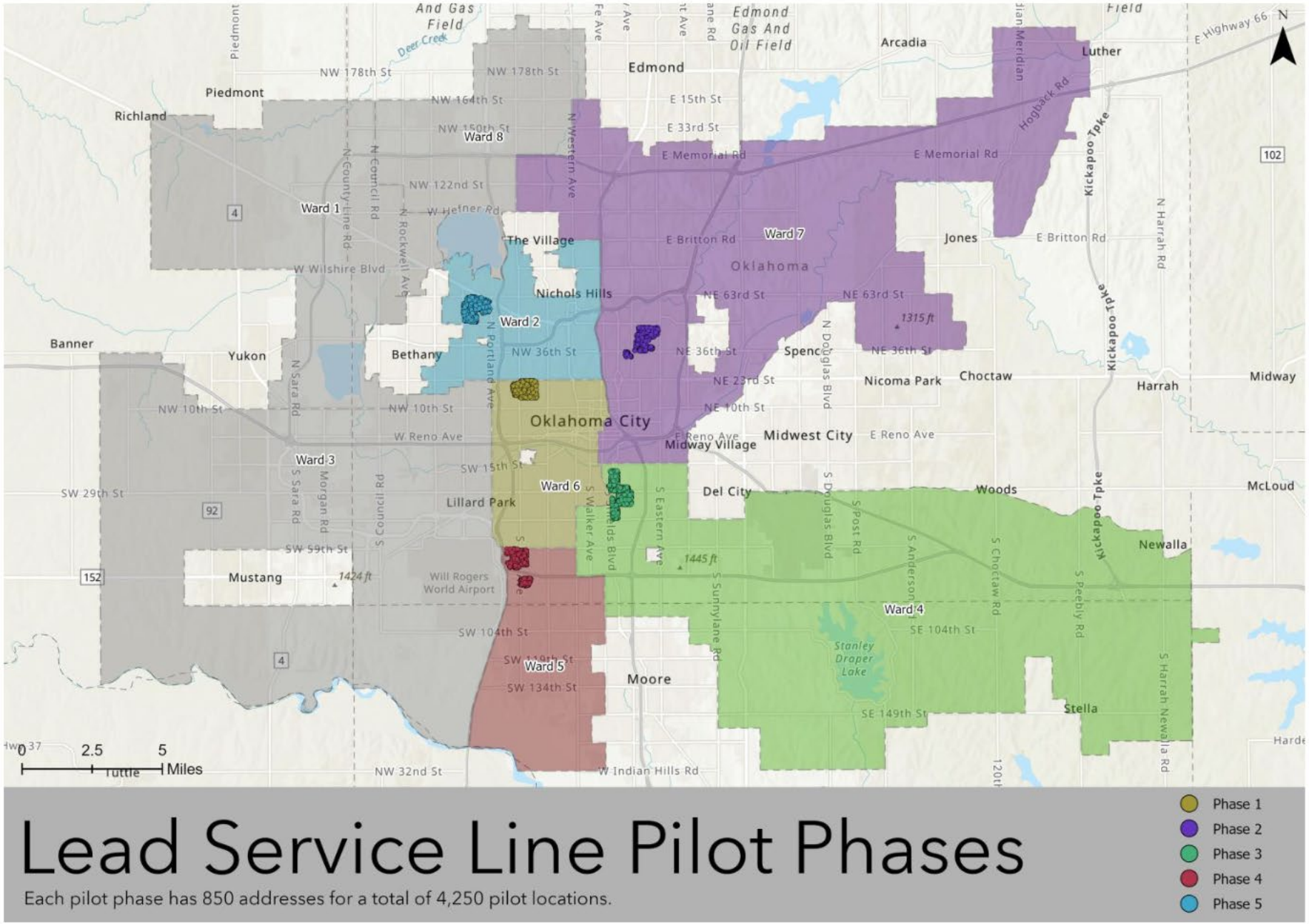
Through an RFP process, OCWUT hired Cimarron Construction Company to verify lead service lines across the city.

Cimarron was to verify lines for both the customer and utility side via potholing.

Signage developed detailing funding sources.

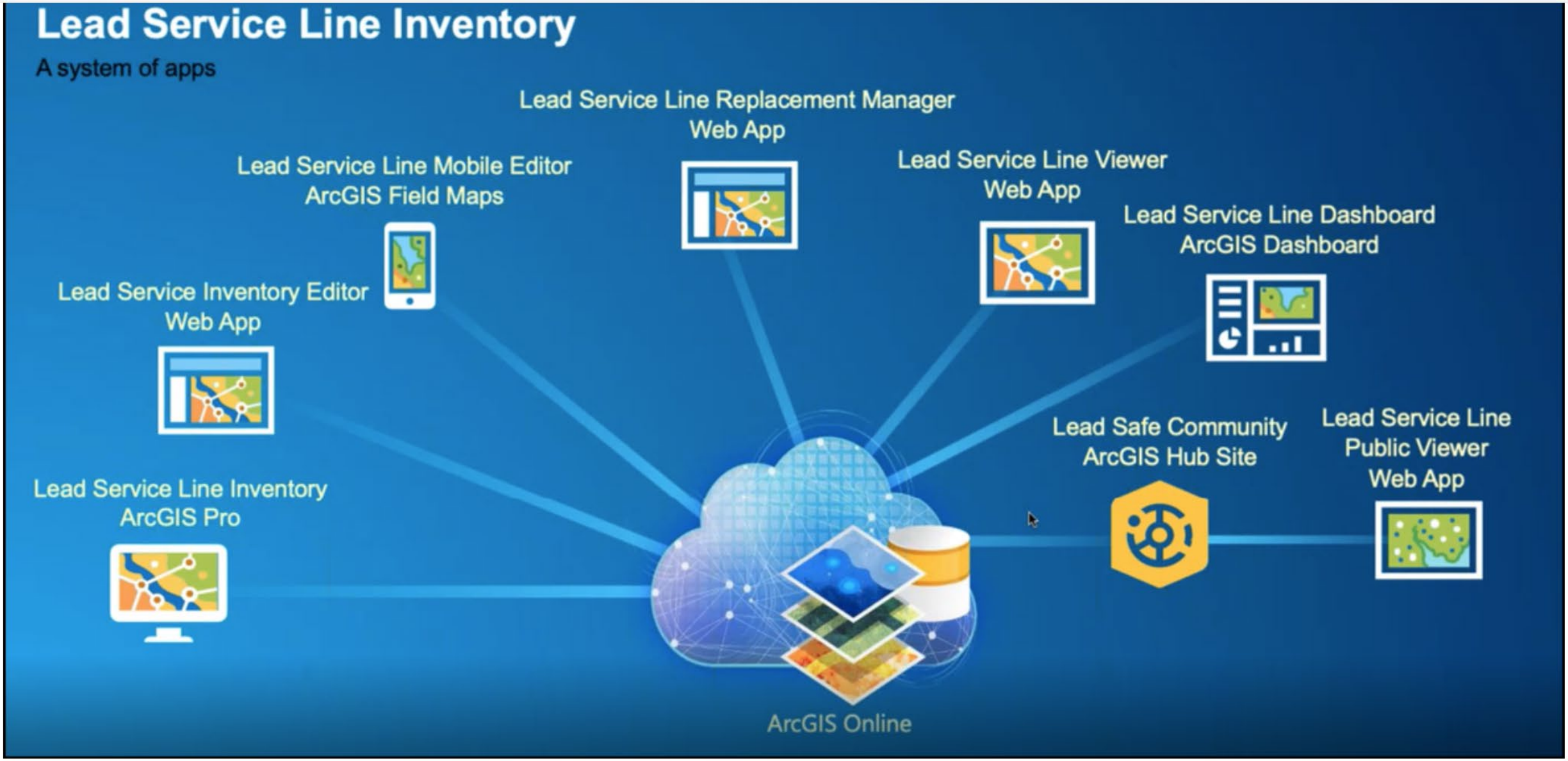


A diagram showing potholing locations outside of meter tile.



Pilot phases across the City

With pilot funding acquired, how were we going to verify?



Suite of maps and apps deployed

Staff worked with ESRI to:

- Develop custom symbology

- Deploy out of box maps and apps to our Enterprise Portal

Custom symbology developed for LSL solution

Field Maps Mobile Solution

Used by contractor in pilot

Lead Service Line Viewer

Used for viewing LSL data in office

Lead Service Line Editor

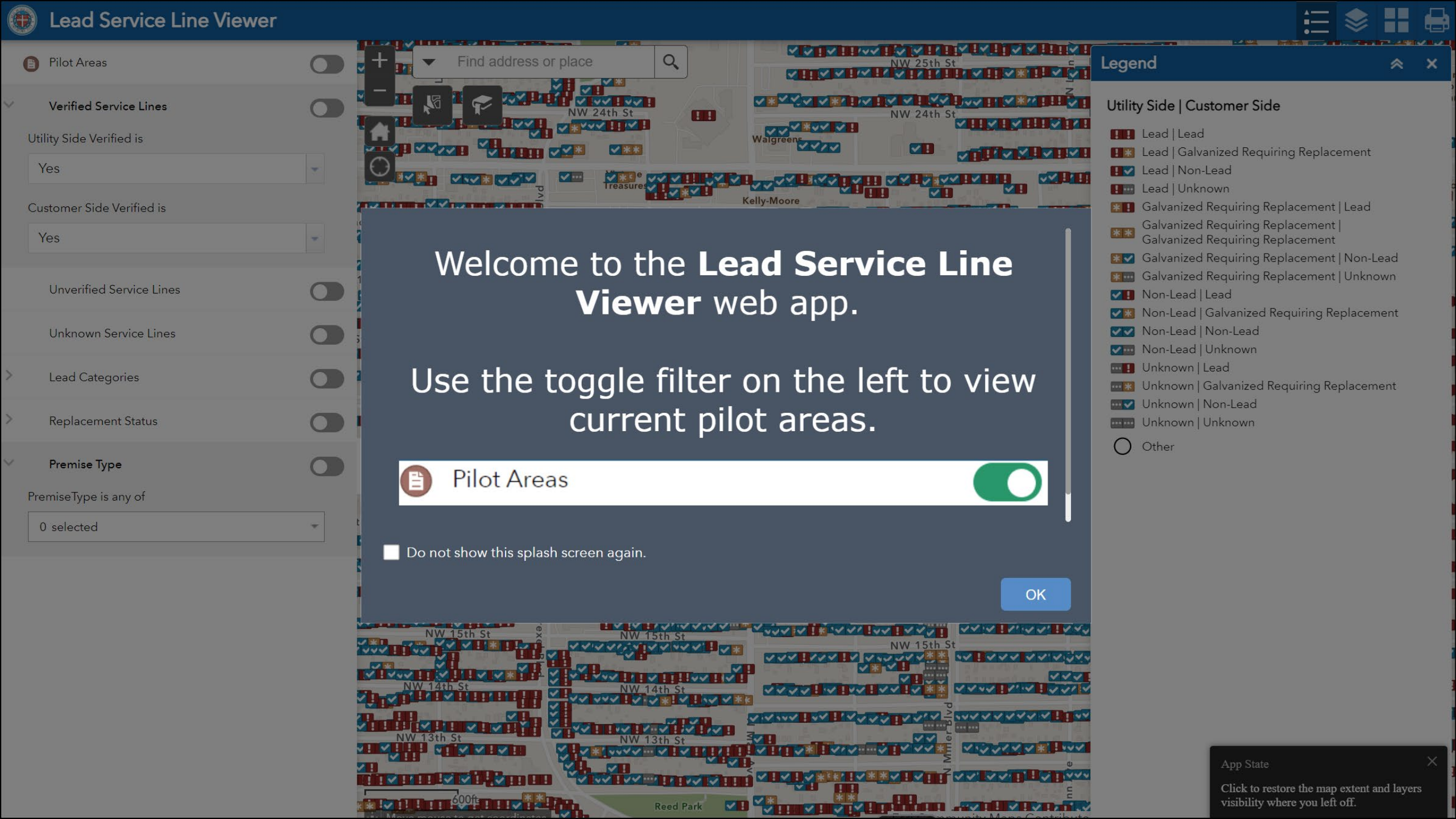
Used for editing LSL data in office

Lead Service Line Replacement Manager

Used for monitoring replacement status of verified addresses

Lead Service Line Pilot Dashboard

Used for monitoring current status of pilot

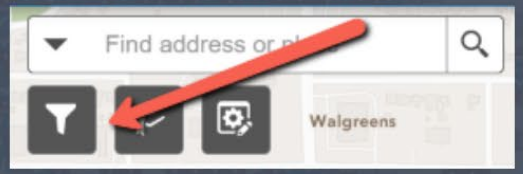

Lead Service Line Viewer
Pilot Areas
Verified Service Lines
Utility Side Verified is
Yes
Customer Side Verified is
Yes
Unverified Service Lines
Unknown Service Lines
Lead Categories
Replacement Status
Premise Type
PremiseType is any of
0 selected
Find address or place
NW 25th St
NW 24th St
Walgreens
Kelly-Moore
Welcome to the Lead Service Line Viewer web app.
Use the toggle filter on the left to view current pilot areas.
Pilot Areas
Do not show this splash screen again.
OK
NW 15th St
NW 14th St
NW 13th St
N Miller Blvd
Reed Park
600ft
Legend
Utility Side | Customer Side
Lead | Lead
Lead | Galvanized Requiring Replacement
Lead | Non-Lead
Lead | Unknown
Galvanized Requiring Replacement | Lead
Galvanized Requiring Replacement | Galvanized Requiring Replacement
Galvanized Requiring Replacement | Non-Lead
Galvanized Requiring Replacement | Unknown
Non-Lead | Lead
Non-Lead | Galvanized Requiring Replacement
Non-Lead | Non-Lead
Non-Lead | Unknown
Unknown | Lead
Unknown | Galvanized Requiring Replacement
Unknown | Non-Lead
Unknown | Unknown
Other
App State
Click to restore the map extent and layers visibility where you left off.

Lead Service Line Editor

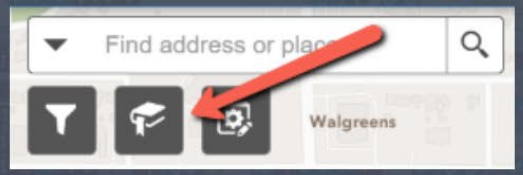
Select an existing feature in the map to edit its attributes.

Welcome to the Lead Service Line Editor map

To filter by Pilot Phases, click the Filter icon



To zoom to a specific Pilot Phase, click the Bookmark icon



☐ Do not show this splash screen again.

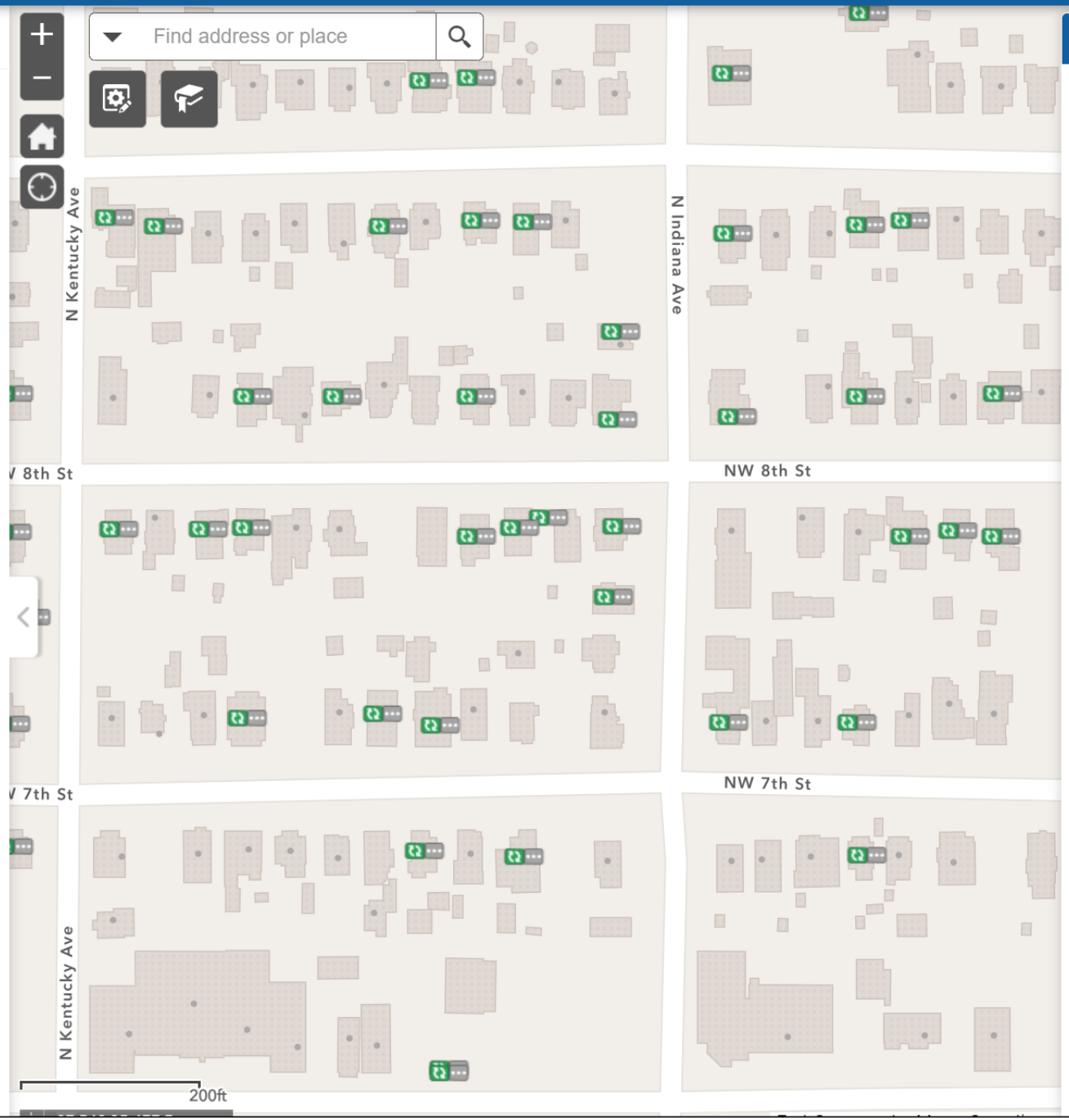
OK

App State

Click to restore the map extent and layers visibility where you left off.

Lead Service Line Replacement Manager

Pilot Phase Filter



Legend

Replacement Status

- Does Not Need Replacement | Does Not Need Replacement
- Does Not Need Replacement | Needs Replacement
- Does Not Need Replacement | Scheduled Replacement
- Does Not Need Replacement | Replaced
- Does Not Need Replacement | Unknown
- Needs Replacement | Does Not Need Replacement
- Needs Replacement | Needs Replacement
- Needs Replacement | Scheduled Replacement
- Needs Replacement | Replaced
- Needs Replacement | Unknown
- Scheduled Replacement | Does Not Need Replacement
- Scheduled Replacement | Needs Replacement
- Scheduled Replacement | Scheduled Replacement
- Scheduled Replacement | Replaced
- Scheduled Replacement | Unknown
- Replaced | Does Not Need Replacement
- Replaced | Needs Replacement
- Replaced | Scheduled Replacement
- Replaced | Replaced
- Replaced | Unknown
- Unknown | Does Not Need Replacement
- Unknown | Needs Replacement
- Unknown | Scheduled Replacement
- Unknown | Replaced
- Unknown | Unknown

- Other

App State

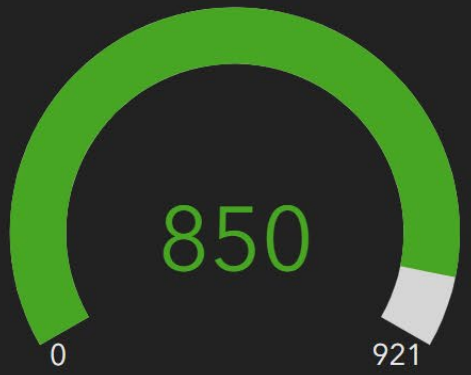
Click to restore the map extent and layers visibility where you left off.

Lead Service Line Pilot Study

Pilot Area: 1 | 2 | 3 | 4 | 5 | None

Last Edit Date
No date selected

Total Pilot Addresses Verified

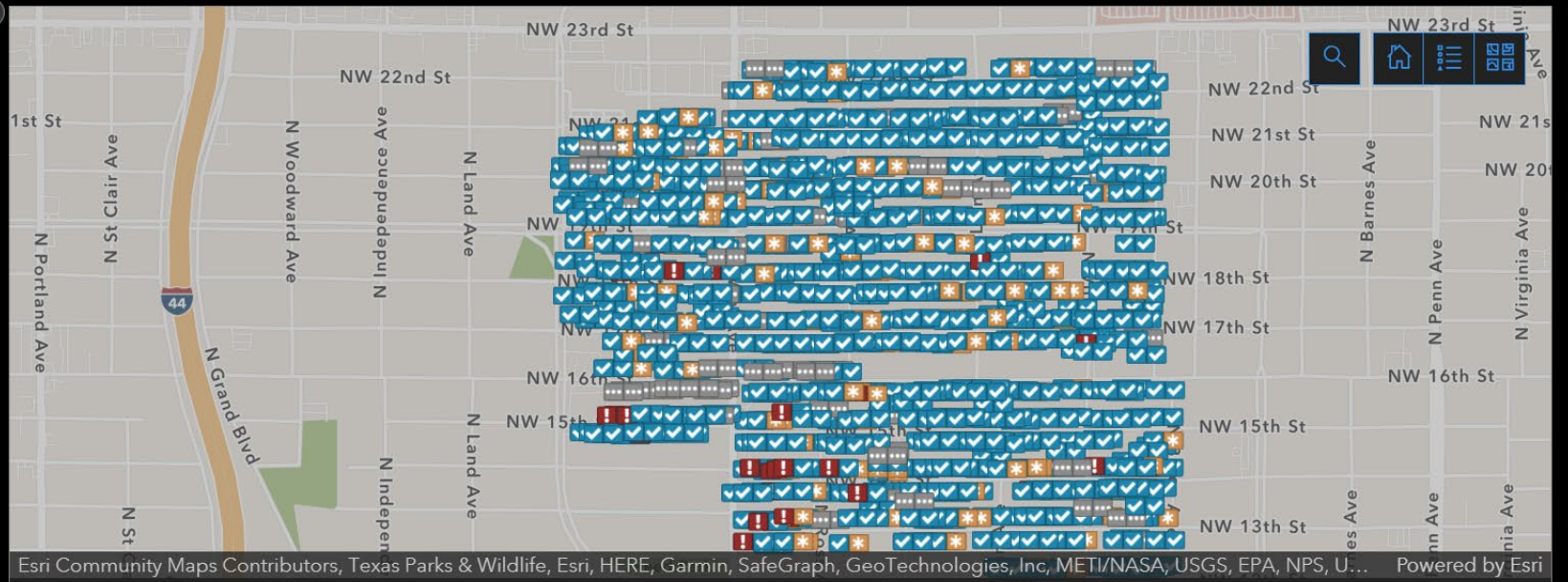


Addresses that have been verified through this pilot.

Unknown Service Lines

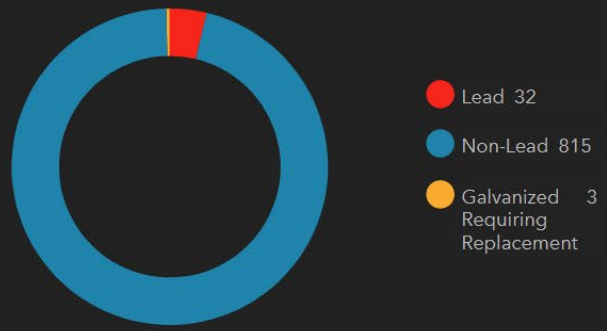
71

Adresses that could not be verified due to environmental constraints.



Click the house icon in the top right to view current pilot phase.

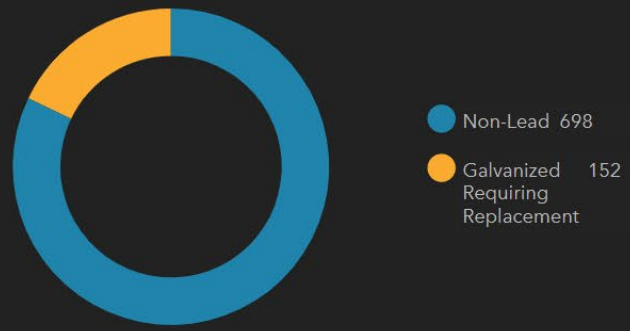
Utility Side Lead Status (Verified)



Click a section of the pie chart to see specific addresses.

Lead Status | Material Type

Customer Side Lead Status (Verified)



Click a section of the pie chart to see specific addresses.

Lead Status | Material Type

Verified Address List

- 2836 NW 18TH ST
- 2759 NW 19TH ST
- 2645 NW 14TH ST
- 2721 NW 19TH ST
- 2517 NW 22ND ST
- 2533 NW 18TH ST
- 2527 NW 18TH ST
- 2744 NW 19TH ST
- 2558 NW 19TH ST
- 2409 NW 18TH ST
- 2833 NW 21ST ST
- 2721 NW 20TH ST
- 2816 NW 20TH ST
- 2805 NW 15TH ST
- 2809 NW 15TH ST
- 2558 NW 19TH ST
- 2800 NW 20TH ST
- 2552 NW 22ND ST
- 2844 NW 14TH ST

Verified Addresses

921

Lead-Safe Community (DRAFT)

Taking action to reduce risk and keep our community safe

The City of Oklahoma City's Utility Department is working to identify lead service lines. The below numbers reflect how many addresses have been verified, confirmed, or replaced.

Lead Service Lines by the Numbers

Service Lines Verified

Service Lines with Confirmed Lead

Next Steps

Continue to verify service lines throughout the City

- Started Phase 2 out of 5 at the end of August

Complete the Lead Safe Community Hub

- Must be publicly available by October 16, 2024

Launch the Water Service Line Material Survey

- Would allow residents to submit records of service line replacement to supplement data.
  - Will be linked on the Lead Safe Community Hub

Questions?

Photo of contractor doing potholing at address

Hayden Harrison | Systems Analyst II

Sources

General Information about Lead in Drinking Water	Link
NATIONAL PRIMARY DRINKING WATER REGULATIONS	Link
Safe Drinking Water Act	Link
Understanding the SDWA	Link
Safe Water Drinking Act: A summary of the Act and its Major Requirements	Link