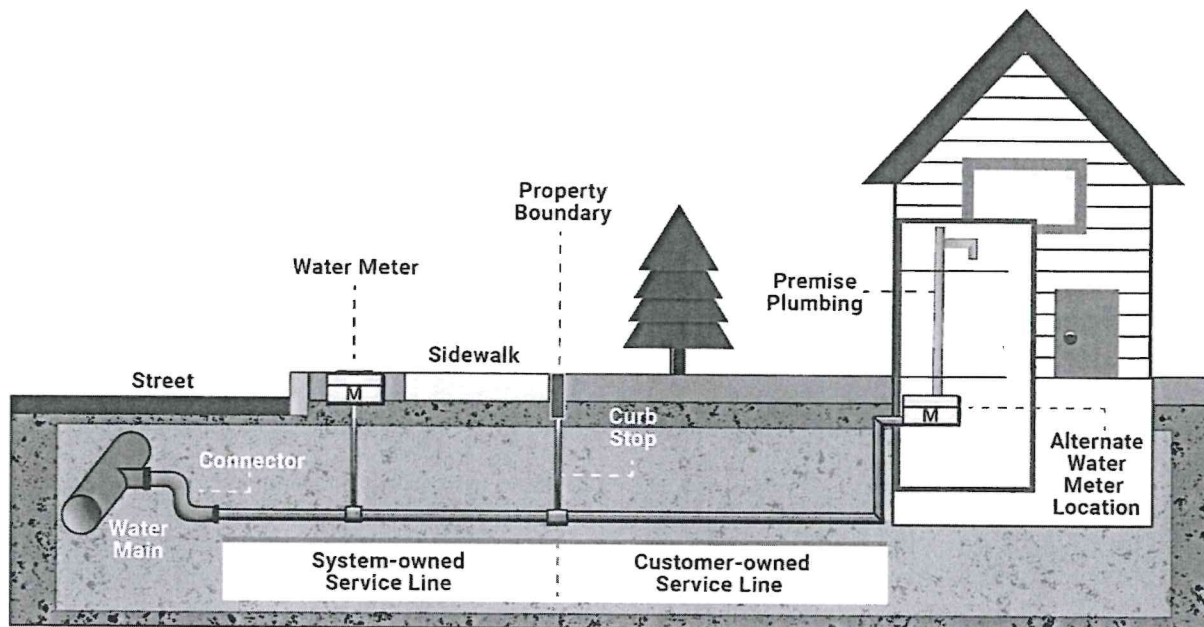


Exhibit 2-2: Example of Service Line Ownership Distinction between the Water System and Customer



While the LCRR requires the inventory to categorize each service line or portions of the service line where ownership is split, a single classification per service line is also needed to support various LCRR requirements, such as lead service line replacement (LSLR), tap sampling, and risk mitigation. Systems should follow these guidelines to comply with the LCRR requirements when classifying the entire service line when ownership is split:

- Service line is lead if either portion is a lead service line (LSL) (40 CFR §141.84(a)(4)(i)).
- Service line is GRR if the downstream portion is galvanized and the upstream portion is unknown or currently non-lead, but the system is unable to demonstrate that it was never previously lead (40 CFR §141.84(a)(4)(ii)).
- Service line is lead status unknown if both portions are unknown, or one portion is non-lead and one portion is unknown (40 CFR §141.84(a)(4)(iv)).
- Service line is non-lead only if both portions meet the definition of non-lead (40 CFR §141.84(a)(4)(ii)).

EPA recognizes that some segments of the system- or customer-owned service lines could be made of more than one material. EPA recommends that systems follow the guidelines above to classify the system-owned or customer-owned portion in these cases. Exhibit 2-3 provides

Chapter 5: Service Line Investigation Methods

This chapter provides a description of the service line investigation methods that water systems have used to verify historical records and gather information when service line material is unknown. These methods are not required under the Lead and Copper Rule Revisions (LCRR), but rather provide examples for systems to consider. The methods included here are:

- Visual inspection of service line material (Section 5.1)
- Water quality sampling (Section 5.2)
- Excavation (Section 5.3)
- Predictive modeling (Section 5.5)
- Emerging methods (Section 5.6)

Section 5.4 provides a comparison of methods from the literature.

Some of these methods require state approval before use for service line classification, such as water quality sampling, predictive modeling, and emerging methods. Water systems should consider the method(s) that are best suited to their particular distribution system and community, considering state approval, cost, labor skill requirements, disruption to consumers, overall time, and accuracy. Water systems should be aware of identification methods provided or required by their state under the LCRR (40 CFR §141.84(a)(3)(iv)). If a water system chooses an investigation method not specified by the state under 40 CFR §141.84(a)(3)(iv), state approval is required (40 CFR §141.84(a)(3)). States may want to consider identifying approved methods that can be used by any system in their state to classify service lines. States could approve different methods for classifying lead, galvanized requiring replacement (GRR), and non-lead. This chapter provides states with information they can use to make their approval decisions. Note that service line investigation methods are evolving; states may wish to revisit approval decisions in the future based on new research or other information.

As noted previously in this guidance, EPA recommends that systems consider including the sources of the material classification (*e.g.*, excavation or visual inspection by customer) in their inventory. In some cases, systems may replace lead service lines (LSLs) when they find them in the field during investigations. EPA recommends systems document where there was an LSL, as recording lead service line replacement (LSLR) activities may be useful for systems to track and demonstrate the LSLR rate achieved.

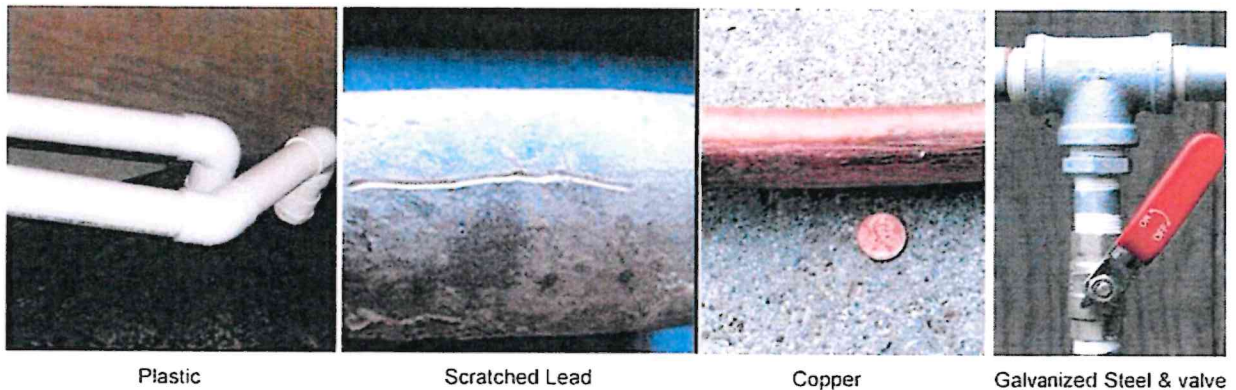
5.1 Visual Inspection of Service Line Material

The material composition of a service line can be identified through visual inspection. Exhibit 5-1 provides a comparison of common service line materials:

- Plastic is a smooth pipe of various colors (*e.g.*, white, blue, black, and green).

- Lead is a soft metal that is a dull, silver-gray color. It is easily scratched with a coin or key, and the scratched areas will be shiny. It is non-magnetic, meaning a magnet will not stick to it. Lead pipe is commonly attached to other pipe with a “wiped” joint.
- Copper is the color of a penny.
- Galvanized is a dull, silver-gray color that is difficult to scratch. It is magnetic, meaning a magnet will stick to it.

Exhibit 5-1: Examples of Commonly Found Pipe Materials



Source: <https://www.epa.gov/ground-water-and-drinking-water/protect-your-tap-quick-check-lead-0>.

Lead can also be distinguished from other materials by a “wiped” joint, which is a rounded ball of lead that connects the lead pipe to other materials. See Exhibit 5-2 for a picture of a wipe joint on an LSL.

Exhibit 5-2: Example of Wiped Lead Joint



Source: <https://www.skokie.org/766/Lead-Water-Line-Information>

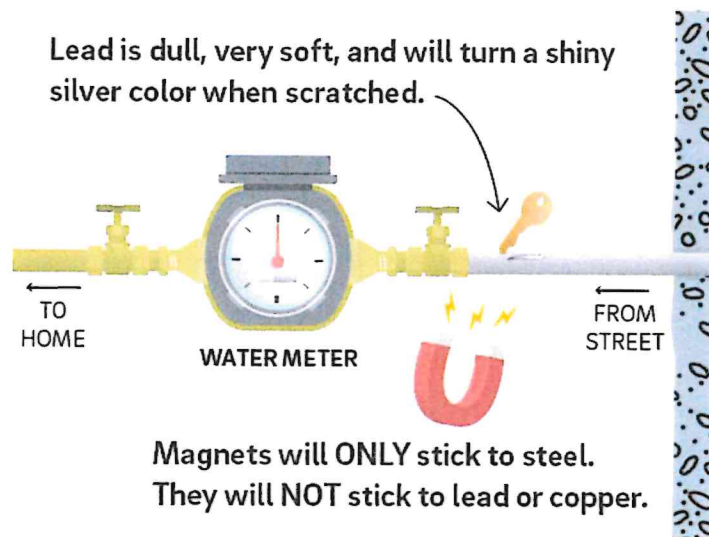
The remainder of this section describes service line materials identification approaches through visual inspection without excavation. See Section 5.3 for a description of excavation techniques.

5.1.1 Visual Inspection of Service Line by Customers

Many utilities have enlisted the public's help to identify the material of the customer-owned portion of the service line. The service line may be visible where it comes into the building, such as in the basement where it connects to the water meter and/or premise plumbing. Exhibit 5-3 shows the possible location of the visible portion of the line connected to the water meter. Note that incoming service lines may have different configurations, which can make it difficult for customers to locate the service line entering the home. DC Water has created a video to assist customers, advising them to locate the meter pit in the yard to estimate where the service line enters the building.¹⁵ Systems may wish to provide guidance on typical configurations to assist customers in finding their water service lines.

¹⁵ <https://www.dwater.com/do-you-have-lead-pipes-let-us-help-you-find-out>.

Exhibit 5-3: Example of Location of Exposed Service Line in Basement



Source: Philadelphia Water System. <https://water.phila.gov/pool/files/how-to-check-your-service-line-for-lead.pdf>. Accessed December 20, 2021. Right edge of image represents basement wall in contact with soil.

After locating the service line, the customer can visually inspect the pipe. A common approach to determine pipe material is a **scratch and magnet test**. If the pipe is a silver metallic color, the customer can carefully scratch the pipe with a key or coin. It is important to not use a sharp object that could puncture the pipe. If the pipe is soft, scratches easily, and reveals a shiny silver color, the pipe is likely lead. The customer can use a magnet to confirm the material since magnets will only react to steel and will not stick to lead (Hensley et al., 2021). Customers can also look for a wiped joint as shown in Exhibit 5-2 that can be an indicator of an LSL. Systems may want to suggest that customers wear gloves when performing a scratch test and cleaning up debris.

In addition to the scratch and magnet test, lead paint test kits can be used to test the pipe for lead (Hensley et al., 2021; LSLR Collaborative, 2021). Surface swab kits approved by EPA for lead paint will change color after coming in contact with a lead surface. A list of approved test kits are available on EPA's website (<https://www.epa.gov/lead/lead-test-kits>). Care should be taken in interpreting results because the kits can react to lead paint if the pipe is painted.

EPA developed the online step-by-step guide “Protect Your Tap: A Quick Check for Lead”¹⁶ to help people identify LSLs in their homes. It also provides tips on actions to reduce lead exposure in drinking water, information on certified laboratories for water testing, and other resources. The guide is for everyone, and EPA has provided Protect Your Tap outreach toolkits for community groups, government and health organizations, and water utilities. The guide is also available in Spanish. To access this information and the online guide, refer to EPA’s website at <https://www.epa.gov/ground-water-and-drinking-water/protect-your-tap-quick-check-lead>.

Examples of instructions for identifying service line materials prepared by the Philadelphia Water Department; Rockford, Illinois; and Newark, New Jersey, are provided in Appendix C. The independent, non-profit media organization National Public Radio (NPR) has also developed an interactive tool available on their website¹⁷ that instructs customers on how to determine if their service line is lead. Other innovative examples of systems that enlist the customer to self-identify their portion of the service line include:

- **Greater Cincinnati Water Works (GCWW), Ohio**, provides instructions for the scratch test on their website¹⁸, along with a fillable form asking for name, email, return phone number, and property address. Customers can select copper, lead, or other from a dropdown menu to specify their service line material. The website asks users to “please upload a picture of your meter setting that we can use to help identify the pipe material.”
- **The City of Grand Rapids, Michigan**, has used free video conferencing software to guide homeowners through the verification process. This approach worked especially well during the COVID pandemic, when customers were reluctant to let others into their homes and could be replicated for harder-to-reach customers who are more comfortable with a video call than letting system personnel enter their homes (USEPA, 2021e).
- **Madison, Wisconsin**, distributed customer surveys to residents in 2000, asking them to perform scratch tests on their exposed portion of service lines in their homes (Bukhari et al., 2020). During that time, the City of Madison held meetings to teach customers how to perform scratch tests. Madison Water Utility still provides instructions on how to



¹⁶ <https://www.epa.gov/ground-water-and-drinking-water/protect-your-tap-quick-check-lead#:~:text=Protect%20Your%20Tap%20Outreach%20Toolkits%20%20%20,Article%20%28Utilities%29%20%28docx%29%20%206%20more%20rows%20>. Accessed December 17, 2021.

¹⁷ <https://apps.npr.org/find-lead-pipes-in-your-home/>. Accessed December 15, 2021.

¹⁸ <https://la.mygcww.org/do-i-have-a-lead-service-line/>. Accessed December 8, 2021.

perform scratch tests on their website¹⁹, along with a number and email to contact if an LSL is discovered.

Water systems can also use community surveys to enlist residences to self-identify service line material (see above for Madison, Wisconsin). Outreach and education can improve the quality of the survey results (Hensley et al., 2021). Systems can also offer financial assistance for customer-side LSLR as an incentive to inspect their service line. The Association of State Drinking Water Administrators (ASDWA) (2022) recommends that systems consider providing incentives for service line identification such as credits on water bills or gift cards.

EPA recommends that systems ask customers to **submit a photograph** of their service line entering the home to the utility to increase confidence in the customer's response and additional visual verification by the water system. Hensley et al. (2021) notes that even with outreach and education, service line material information from residents may be inaccurate and a water system's confidence could be increased with an additional verification step (such as reviewing a customer-submitted photograph of the service line) by the water system staff, a licensed plumber, or other trained personnel. Note that the system's data management structure may need to be revised in order to accept and organize uploaded photos. Partnerships with plumbers and other third parties, such as building inspectors, can facilitate visual inspection and service material identification (see Section 3.5 for recommendations on establishing partnerships).

Note that some water systems elicit customer assistance by requesting access to the customer's home for verification rather than asking the customer to perform visual inspection themselves. For example, the City of Menasha Utilities Electric & Water in Wisconsin sends postcards to residents where the customer-owned portion of the service line material has not been verified. The postcard includes water system contact information to schedule a free service line material inspection by the water system. Those accepting the system's offer receive follow-up information on what the customer can expect during the inspection process, and reminders (see Appendix C for a copy of the postcard and water service inspection information). Inspection by the system or other trained personnel, or asking the customer to submit a photo along with their identification, can increase the degree of confidence the system has in the service line's material classification. Water systems could also determine if existing ordinances already give them access rights to the inside of the home for inspections and/or maintenance, including inspection of the service line material.

¹⁹ <https://www.cityofmadison.com/water/water-quality/lead-service-replacement-program/lead-in-water-what-you-should-know>. Accessed December 20, 2021.