

# MT Guidance for Developing and Maintaining a Service Line Inventory

October 2022

This document provides the requirements and recommendations to public water systems in developing and maintaining a service line (LSL) inventory. The guidance within this document can be used to comply with the requirements under the Lead and Copper Rule Revisions (LCRR) and to submit an initial LSL inventory LSLs by **October 16, 2024**.

EPA published the LCRR in the Federal Register on December 16, 2021 (USEPA, 2021c). It applies to all CWSs and NTNCWSs. The initial inventory requirements of the LCRR specify:

- Information that water systems must include in their service line inventory,
- When water systems must submit their initial inventories to the State,
- Requirements for water systems to make their information publicly accessible and to notify all persons served by the water system at the service connection with a lead, GRR, or lead status unknown service line, and
- Reporting requirements including Customer Notifications and Consumer Confidence Reports.

**Disclaimer:** *Excerpts from this document are from EPA, United States Environmental Protection Agency, Guidance for Developing and Maintaining a Service, Line Inventory, Office of Water (4606M) EPA 816-22-001 August 2022.*

## LCRR Inventory Requirements

The Inventory specifications include the following:

**Material Classification:** Classify each service line or portion of the service line where ownership is split as lead, galvanized requiring replacement, non-lead, or lead status unknown.

**All service lines and ownership:** Prepare an inventory that includes the system- and customer-owned portions of all service lines in the system's distribution system.

**Information to Identify Material:** Use previous materials evaluation, construction and plumbing codes/records, water system records, distribution system inspections and records, information obtained through normal operations, and state- specified information.

This guidance covers the lifecycle updates of the inventory, including inventory creation, material investigations, system reporting, state submittal, public accessibility of service line information, and service line consumer notification.

**Inventory Template and Submittal:** Montana has created a Microsoft Excel template for LSL inventory documentation. Use of this inventory form is mandatory. Information of where to locate Montana's inventory form and submittal information is provided in this document.

# Acronyms

µg/L	Micrograms per liter
ASDWA	Association of State Drinking Water Administrators
AWWA	American Water Works Association
BIL	Bipartisan Infrastructure Law
CBI	Curb Box Inspection
CCR	Consumer Confidence Report
CCTV	Closed-Circuit Television
CFR	Code of Federal Regulations
CMMS	Computerized Maintenance Management System
CWS	Community Water System
DWINSAs	Drinking Water Infrastructure Needs Survey and Assessment
DWSRF	Drinking Water State Revolving Fund
EDF	Environmental Defense Fund
EPA	United States Environmental Protection Agency
FTP	File Transfer Protocol
GIS	Geographic Information System
GPR	Ground Penetrating Radar
GPS	Global Positioning System
GRR	Galvanized Requiring Replacement
IIJA	Infrastructure Investment and Jobs Act
LCR	Lead and Copper Rule
LCRI	Lead and Copper Rule Improvements
LCRR	Lead and Copper Rule Revisions
LSL	Lead Service Line
LSLR	Lead Service Line Replacement
NPR	National Public Radio
NTNCWS	Non-Transient Non-Community Water System

OMB	Office of Management and Budget
ORP	Oxidation-Reduction Potential
PWS	Public Water System
PWSID	Public Water System Identification Number
SDWA	Safe Drinking Water Act
SOP	Standard Operating Procedure
USEPA	United States Environmental Protection Agency
WIIN	Water Infrastructure Improvements for the Nation

## Glossary

Term	Definition <sup>1</sup>
Building Side	Building side - The section of service line from the Curb stop to the building. The building could be a home, commercial building, school, or other structures.
Curb stop	An exterior valve located at or near the property line that is used to turn on and off water service to the building. <sup>2</sup>
Community water system (CWS)	A public water system that serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents (40 CFR §141.2).
Full lead service line replacement	Replacement of a lead service line (as well as galvanized service lines requiring replacement) that results in the entire length of the service line, regardless of service line ownership, meeting the Safe Drinking Water Act (SDWA) Section 1417 definition of lead free <sup>3</sup> applicable at the time of the replacement. See 40 CFR §141.2 for the full regulatory definition.
Galvanized requiring replacement	A galvanized service line that is or was at any time downstream of a lead service line or is currently downstream of a lead status unknown service line. If the water system is unable to demonstrate that the galvanized service line was never downstream of a lead service line, it must presume there was an upstream lead service line (40 CFR §141.84(a)(4)(ii)). An example of a GRR service line is when the customer-owned portion from the meter to the building is galvanized, and the system-owned portion from the water main to the meter was previously lead but has been replaced. The customer-owned portion of the service line would be GRR.
Galvanized service line	Iron or steel piping that has been dipped in zinc to prevent corrosion and rusting (40 CFR §141.2).

Gooseneck, pigtail, or connector	A short section of piping, typically not exceeding two feet, which can be bent and used for connections between rigid service piping. For purposes of this subpart, lead goosenecks, pigtails, and connectors are not considered to be part of the lead service line but may be required to be replaced pursuant to §141.84(c) <sup>4</sup> (40 CFR §141.2).
Lead service line	A portion of pipe that is made of lead, which connects the water main to the building inlet. A lead service line may be owned by the water system, owned by the property owner, or both. For the purposes of this subpart, a galvanized service line is considered a lead service line if it ever was or is currently downstream of any lead service line or service line of unknown material. If the only lead piping serving the home is a lead gooseneck, pigtail, or connector, and it is not a galvanized service line that is considered a lead service line, the service line is not a lead service line (40 CFR §141.2).
Lead status unknown service line	A service line where the material is not known to be lead, galvanized requiring replacement, or a non-lead service line, such as where there is no documented evidence supporting material classification. It is not necessary to physically verify the material composition ( <i>e.g.</i> , copper or plastic) of a service line for its lead status to be identified ( <i>e.g.</i> , records demonstrating the service line was installed after a municipal, state, or federal lead ban <sup>3</sup> ) (40 CFR §141.2).
Non-lead	A service line that is determined through an evidence-based record, method, or technique not to be lead or galvanized requiring replacement (40 CFR § 141.84(a)(4)(iii)). If a system can demonstrate that a galvanized service line was never downstream of an LSL, it may be classified as non-lead. The water system may classify the actual material of the service line (for example, galvanized, plastic, or copper) as an alternative to classifying it as non-lead. The term “non-lead” refers to the service line material only and does not include other potential lead sources present in solder, connectors, and other plumbing materials.
Non-transient non-community water system (NTNCWS)	A public water system that is not a community water system and regularly serves at least 25 of the same persons over 6 months per year (40 CFR §141.2).
Ownership	Terms included “system-owned” (Street Side) and “customer-owned” (Building Side) because they are consistent with the LCRR language. EPA recognizes that states and systems may use other terms to describe ownership status such as “public” and “private” or other terms besides “ownership” to describe the division of responsibility between the water system and the customer.
Service line	The pipe connecting the water main to the interior plumbing in a building. <sup>2</sup> The service line may be owned wholly by the water system or customer, or in some cases, ownership may be split between the water system and the customer.

State	State means the agency of the State or Tribal government that has jurisdiction over public water systems. During any period when a State or Tribal government does not have primary enforcement responsibility pursuant to Section 1413 of the Act, the term “State” means the Regional Administrator, U.S. Environmental Protection Agency (40 CFR §141.2).
Street Side	Street side - The section of service line from the water main to the Curb stop.
Water main	A pipe that conveys water to a connector or customer's service line. In residential areas, it is usually located underground. <sup>2</sup>
Water meter	An instrument, mechanical or electronic, used for recording the quantity of water passing through a particular pipeline or outlet. <sup>2</sup>

**Notes:**

<sup>1</sup> Definitions without a regulatory citation are recommended definitions for use in this guidance document.

<sup>2</sup> Source: Seventh Drinking Water Infrastructure Needs Survey and Assessment: Lead Service Line Inventory for America’s Water Infrastructure Act – State Survey Instruction (USEPA, 2021b).

<sup>3</sup> In 1986, Congress amended the Safe Drinking Water Act (SDWA), prohibiting the use of pipes, solder, or flux that were not “lead free” in public water systems or plumbing in facilities providing water for human consumption. See Appendix D: Summary of Lead Ban Provisions by State. At the time, “lead free” was defined as solder and flux with no more than 0.2 percent lead and pipes with no more than 8 percent. In 2011, Congress passed the Reduction of Lead in Drinking Water Act (RLDWA) that amended Section 1417 of SDWA and updated the definition for “lead free” as a weighted average of not more than 0.25 percent lead calculated across the wetted surfaces of a pipe, pipe fitting, plumbing fitting, and fixture and not containing more than 0.2 percent lead for solder and flux. On September 1, 2020, EPA published the final regulation “Use of Lead-Free Pipes, Fittings, Fixtures, Solder, and Flux for Drinking Water” to make conforming changes to existing regulations based on the RLDWA. <https://www.federalregister.gov/documents/2020/09/01/2020-16869/use-of-lead-free-pipes-fittings- fixtures-solder-and-flux-for-drinking-water>

<sup>4</sup>Section 141.84(c) of the January 15, 2021, Lead and Copper Rule Revisions (LCRR) specifies the operating procedures for replacing lead goosenecks, pigtails, or connectors. The LCRR is under revision and all rule provisions except for the initial inventory requirements may be subject to change.

## Chapter 1: Introduction

Service line inventories are the foundation from which water systems take action to address a significant source of lead in drinking water - lead service lines (LSLs). Establishing an inventory of service line materials and identifying the location of LSLs is a key step in getting them replaced and protecting public health. The purpose of this document is to guide water systems as they develop and maintain service line inventories and to provide states with needed information for oversight and reporting to EPA.

Congress recognized the importance of LSLR when it appropriated supplemental Drinking Water State Revolving Fund (DWSRF) funding as part of the 2021 Bipartisan Infrastructure Law (BIL) (P.L. 117-58). The BIL contains a historic \$15 billion in dedicated funding through the DWSRF for LSL identification and replacement. This funding is being provided to states with no match requirement.

Inventorying service line material permits notification to consumers about potential lead risks affecting them, which can facilitate customer actions to reduce lead in drinking water, including flushing, use of

filters certified to reduce lead, and customer initiated LSLR. Inventories allow water systems to publicly track their progress on LSL identification and replacement, engaging the community and enhancing transparency. Inventories can also help water systems and consumers determine the source of high lead levels in drinking water at a home or building and the possible solutions for reducing exposure. Water systems with inventory information can also proactively mitigate lead exposure caused by disturbances of a lead or galvanized requiring replacement (GRR) service line, for example, during street construction. Inventories can also make LSLR programs more efficient. Even incomplete inventories may create cost-saving opportunities for water systems by better targeting locations served by LSLs, stretching the value of internal or external funding that water systems receive, such as from the BIL. In addition, service line inventories can help inform decisions for other drinking water rules and could inform future needs surveys and potential future costs.. Locating LSLs is the first and critical step to replacing them; however, water systems do not need to complete the entire inventory process before designing and implementing their LSLR programs.

## **Chapter 2: Inventory Materials Classification**

### **Required Service Line Inventory Material Classifications**

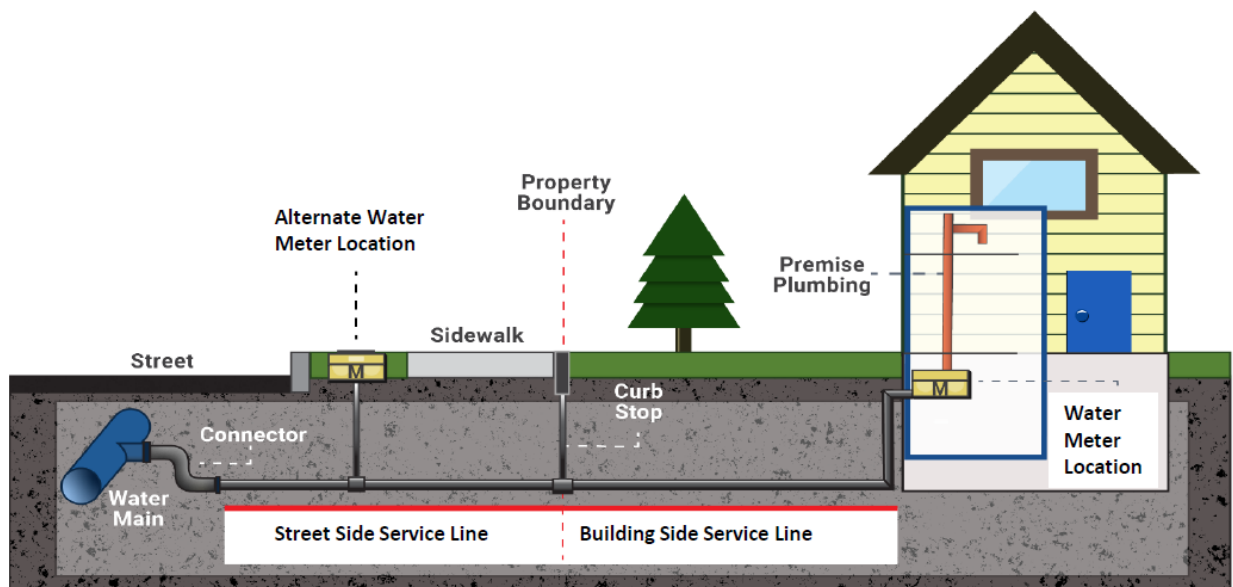
Under the LCRR, the inventory must use one of the following four material classifications to describe the entire service line, including separate material classifications for the Street Side and Building Side portions of each service line where ownership is split:

- Lead
- Galvanized requiring replacement (GRR)
- Non-lead (or the actual material, such as copper or plastic)
- Lead status unknown service lines (or unknown)

The four classifications above will be automatically determined for the system on the inventory template based on the information provided.

Below is a diagram of a possible division in service line ownership (or responsibility) between the customer and water utility in which the street side portion of the service line is from the water main to the curb stop and the building side is from the curb stop to the water meter. For some systems, the delineation may be different, (*e.g.*, the ownership or responsibility distinction is at the water meter or property line). In other instances, the water system may share ownership with customers, or the water system or customer may have sole ownership of the service line. Note that ownership of the property on which the service line is located does not always equate to ownership or responsibility of the service line.

## Example of Service Line Ownership Distinction between the Water System and Customer



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)).

**Classifying Service Line Materials When Ownership is Split According to  
the LCRR 40 CFR §141.84(a)(4)**

<b>Street Side Portion</b>	<b>Building Side Portion</b>	<b>Classification for Entire Service Line</b>
Lead	Lead	Lead
Lead	Galvanized	Lead
Lead	Non-lead	Lead
Lead	Lead Status Unknown	Lead
Non-lead	Lead	Lead
Non-lead and never previously lead	Non-lead, specifically galvanized pipe material	Non-lead
Non-lead	Non-lead, material other than galvanized	Non-lead
Non-lead	Lead Status Unknown	Lead Status Unknown
Non-lead, but was previously lead or system is unable to demonstrate it was not previously Lead	Galvanized	Galvanized Requiring Replacement
Lead Status Unknown	Lead	Lead
Lead Status Unknown	Galvanized	Galvanized Requiring Replacement
Lead Status Unknown	Non-lead	Lead Status Unknown
Lead Status Unknown	Lead Status Unknown	Lead Status Unknown

**Include All Service Lines Regardless of Ownership Status and Intended Use**

All CWSs and NTNCWSs must prepare an inventory of **all service lines** connected to the public water distribution system, regardless of ownership status.

- Some CWSs and NTNCWSs may not have an extensive distribution system, such as those with a direct connection from a well to a single building.
- Systems must report the material from the well to the building inlet for their inventory. Systems must include all service lines, regardless of the actual or intended use. These include, for example, service lines with non-potable applications such as fire suppression or those designated for emergency. These service lines could be repurposed in the future for a potable or non-emergency use.
- Water systems must include in their inventory service lines connected to vacant or abandoned



buildings, even if they are unoccupied and the water service is turned off.

- Sometimes multiple service lines serve the same address (e.g., hospital or apartment building). Water systems should consider adding additional descriptors that would allow each service line to be uniquely identified.
- Water systems are encouraged to check with local laws, ordinances, or contractual provisions that may allow utilities to inspect service lines or water meters that are on the building side.

## Chapter 3: Historical Records Review

The Lead and Copper Rule Revisions (LCRR) specifies the types of historical records that water systems must review to develop their service line inventory. Systems should document the records they reviewed as a best practice. Systems should also consider tracking and including the records used to identify the material of each portion of the service line (e.g., plumbing code or water system record) in your inventory.

### Requirements for Historical Records Review for Initial Inventory

#### Development under the LCRR

Below lists required records systems must use to identify service line materials for the initial inventory under the LCRR. The last column includes how the records can be used to develop the initial inventory.

<b>Type of Historical Records</b>	<b>Regulatory Requirement (citation)</b>	<b>Primary Uses for Inventory Development (Including but not limited to)</b>
Previous Materials Evaluation	Water systems must use the information on lead and galvanized iron or steel that it identified under 40 CFR § 141.42(d) <sup>1</sup> when conducting the inventory of service lines in its distribution system for the initial inventory (40 CFR §141.84(a)(3)).	<ul style="list-style-type: none"> <li>• Reporting construction materials present in their distribution systems.</li> <li>• Identifying LSL material for subset of sites that were used for lead and copper tap monitoring.</li> </ul>
Construction and Plumbing Codes and Records	Systems must review all construction and plumbing codes, permits, and existing records or other documentation which indicates the service line materials used to connect structures to the distribution system to identify service line materials for the initial inventory (40 CFR §141.84(a)(3)(i)).	<ul style="list-style-type: none"> <li>• Identify when LSLs were allowed/specified or banned from use.</li> <li>• Identify service areas most likely to have LSLs by home/building construction date and service line size.</li> <li>• Review construction and plumbing permits for</li> </ul>

		identification of service line (street and/or building side) and plumbing materials.
Water System Records	Systems must review all water system records, including distribution system maps and drawings, historical records on each service connection, meter installation records, historical capital improvement or master plans, and standard operating procedures, to identify service line materials for the initial inventory (40 CFR §141.84(a)(3)(ii)).	<ul style="list-style-type: none"> <li>Identify service line material for street side and building side.</li> </ul>
Distribution System Inspections and Records	Systems must review all inspections and records of the distribution system that indicate material composition of the service connections that connect a structure to the distribution system to identify service line materials for the initial inventory (40 CFR §141.84(a)(3)(iii)).	<ul style="list-style-type: none"> <li>Identify service line material for street and building side portions.</li> <li>Verify construction and water system records.</li> </ul>
Type of Historical Records	Regulatory Requirement (citation)	Primary Uses for Inventory Development (Including but not limited to)
State Requirements	Systems must review any resource, information, or identification method provided or required by the state to assess service line materials, to identify service line materials for the initial inventory (40 CFR §141.84(a)(3)(iv)).	<ul style="list-style-type: none"> <li>Identify service line material for street- and building side portions.</li> </ul>

**Notes:** <sup>1</sup> Under 40 CFR §141.42, water systems were required to identify and report to their state if certain construction materials were present in their distribution system in the early 1980s (USEPA, 1980). Under the 1991 Lead and Copper Rule (USEPA, 1991a), water systems were required to use this evaluation to identify a pool of targeted sampling sites that meet the tiering criteria for lead and copper tap monitoring and was sufficiently large enough to meet the required number of lead and copper tap samples.

## Previous Materials Evaluation

Under the 1991 Lead and Copper Rule (LCR), water systems were required to complete a materials evaluation of their distribution systems to identify a pool of targeted sampling sites that met the sample site requirements and was sufficiently large to meet the required number of lead and copper tap samples. The LCR also required that water systems review:

- All plumbing codes, permits, and records in the files of the building department(s) that document the plumbing materials installed within publicly- and privately-owned structures connected to the distribution system.

- All inspections and records of the distribution system that indicate the material composition of the service connections that connect a structure to the distribution system; and
- All existing water quality information that includes the results of all prior analyses of the system or individual structures connected to the system, indicating locations that may be particularly susceptible to high lead or copper concentrations.

Also, under the LCR, systems subject to lead service line replacement (LSLR) requirements were required to identify the initial number of LSLs in their distribution system, including the portion(s) owned by the system, based on the prior materials evaluations.

For special monitoring for corrosivity characteristics, water systems were required to identify if certain construction materials were present in their distribution system that included:

- Lead from piping, solder, caulking, interior lining of distribution mains, alloys, and home plumbing.
- Copper from piping and alloys, service lines, and home plumbing.
- Galvanized piping, service lines, and home plumbing.
- Ferrous piping materials such as cast iron and steel.

### **Construction and Plumbing Codes and Records**

Systems must review all construction and plumbing codes, permits, and existing records or other documentation that indicate the service line materials used to connect structures to the distribution system. Each of these record types is described below.

#### **Construction and Plumbing Codes**

Municipal construction codes (also known as “building codes”) and plumbing codes may indicate when the use of lead or lead-containing pipes for potable use applications were prohibited by the code. This information, combined with distribution system and building records, can identify structures that were built after lead bans became effective and would not have LSLs.

The 1986 Safe Drinking Water Act (SDWA) amendments prohibited the use of pipe, solder, and flux that were not “lead free” as defined in 1986 - in new installations and repairs.

**(Under Montana rule, lead was banned Dec 31, 1987; therefore, anything constructed on or after January 1<sup>st</sup>, 1988, is considered lead free. Materials should be noted as “Non-Lead – Other” in the inventory unless actual material is known).**

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**Notes:** In 1986, Congress amended the Safe Drinking Water Act (SDWA) to prohibit the use of pipes, solder, or flux that were not “lead free” in the installation or repair of public water systems or plumbing in residential and non-residential facilities providing water for human consumption. At the time, “lead free” was defined as solder and flux with no more than 0.2 percent lead and pipes with no more than 8 percent. This is often referred to as the 1986 SDWA lead ban.

#### **Most Lead Service Lines are Old!**

LSLs were primarily installed from the late 1800s to the 1940s (Hensley et al., 2021). Some communities, however, continued to install them through the 1980s until they were banned at the federal level.

## **Pipe Diameter**

In addition to information on when LSLs were allowed and banned, municipal construction and plumbing codes can also indicate a maximum diameter of LSLs. Most LSLs are **2 inches or less** in diameter and serve primarily single-family homes or small multi-family residences. Larger apartment complexes and commercial and industrial building are typically served by larger diameter service lines. LSLs are almost entirely 2 inches or less in diameter. There are rare reports of installed service lines as large as 3 inches in diameter.

## **Permits**

Water system, local government, or local plumbing codes may require plumbers to obtain permits to install or replace service lines. These permits should include the location and the date of installation or replacement and may include information on service line materials. In addition, there may be an inspection record that accompanies the permit.

If permits do not specify service line material, systems may be able to cross-reference the permit with construction practices at the time of replacement. Systems may be able to find these permits at their municipal building department, code enforcement department, or municipal water system.

Other relevant permits may include those for general renovation or other plumbing-related building activities. Many jurisdictions require permits and inspections when plumbing is modified for remodeling for renovations or additions.

## **Other Existing Records and Documentation**

Systems should also review any local ordinances relevant to LSLs. For example, systems may be aware of an ordinance which prohibits reburial of exposed lead pipe in their community. Water systems could compare the ordinance effective date with records of construction projects subject to the ordinance requirements to determine if service line material can be inferred. Possible locations for construction and plumbing codes include:

- Municipal building permit/code enforcement department
- Agency overseeing state plumbing code
- Local governing body (*e.g.*, city or town council)

- Other possible locations include city archives, which are often in city public libraries. Additionally, online databases have many historical city codes and reports available online.

In addition to construction and plumbing codes and permits, other records may exist that indicate the service line materials used to connect structures to the distribution system. For example, municipal tax records typically contain the date of building construction, which when cross-referenced with construction practice information from other sources, could help identify service line materials. Also, the date of building construction can be compared to water main installation records. A newer tap installation date for an older home could mean the service line was partially replaced on the system side. The reverse could also be true – a newer building construction date compared to tap installation date could indicate a partial service line replacement on the customer side. These records may be found at the municipal tax assessor’s office or the centralized municipal government geographic information system (GIS) office.

Community planning documents and maps may also contain information on the date of construction, which can be useful to identify potential locations of LSLs. These documents may be found at municipal planning departments, regional planning agencies, the public library, or the local historical society. Property appraisal records might include the year a structure was built and when it was modified. County or city council meeting minutes may also contain additional relevant records.

### Water System Records

Water system records are a key source of information and are one of the many sources that systems must review to identify service line materials and develop the initial inventory. Systems can use any relevant water system records they may have to develop their inventory, but at minimum must review the water system records listed below.

<b>Type of Water System Record Required under the LCRR</b>	<b>Relative information</b>	<b>Possible Formats</b>
Distribution system map and drawings	Date of construction of different parts of the distribution system may help inform when and where LSLs were used.	Hard copy maps, digital maps, or web-based map applications
Historical records on each service connection	Detailed information on service line material, location, and size.	Ledgers, cards ( <i>e.g.</i> , tap cards or drill records), or databases
Meter installation records	May contain the service line material. Meter size and/or type can indicate service line size or building usage.	Water system files and records
Historical capital improvement or master plans	Historical installation patterns may help inform when LSLs were used.	Archived report or electronic document

Standard operating procedures	Allowable materials for construction of service lines and for service line repairs.	Specifications and standards used by the water system
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Other possible water system records that could be used to develop the initial inventory include historical water system standard operation procedures (SOPs), water main replacement records, water loss studies, and annual reports.

Historical records on service connection installation may be in the form of tap cards (also called drill records), which are recorded when a service line is tapped into the water main and connected to an individual home or building. They are often handwritten index cards that contain the installation date, pipe diameter, and pipe material.

Historical records of inspections might indicate service line materials. Sources of information include responses to customer complaints, inspections to locate leaks, or inspections to investigate meter issues. Cross connection inspections may also provide information on service line material.

Water systems have opportunities to directly view the service line materials during a variety of maintenance activities.

## Chapter 4 : 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
- Water sampling
- Excavation
- Predictive modeling
- Emerging methods

### Visual Inspection of Service Line

The material composition of a service line can be identified through visual inspection.

Below 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.

## Examples of Commonly Found Pipe Materials



Plastic

Scratched Lead

Copper

Galvanized Steel & valve

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 picture below of a wipe joint on an LSL.

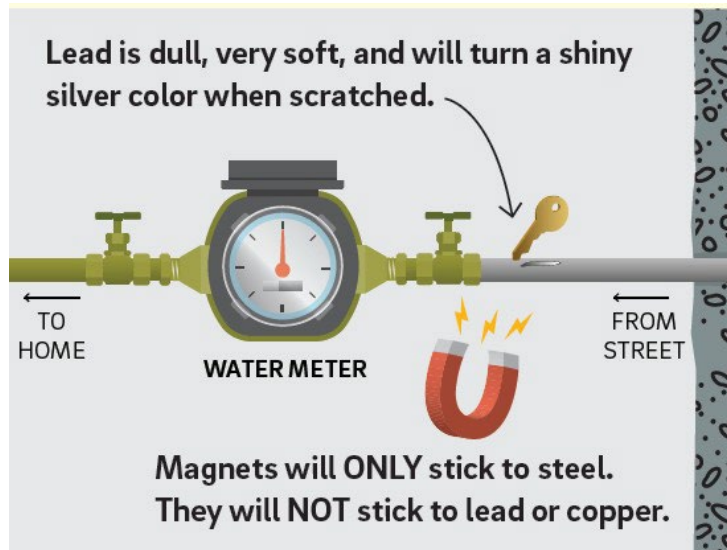
## Example of Wiped Lead Joint



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

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. Note that incoming service lines may have different configurations, which can make it difficult for customers to locate the service line entering the home. See example of exposed service line below.

## Example of Location of Exposed Service Line in Basement



Source: <https://water.phila.gov/pool/files/how-to-check-your-service-line-for-lead.pdf>. 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 (shown below) 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.

Water systems can also use community surveys to enlist residences to self-identify service line material. Systems can elicit customer assistance by requesting access to the customer's home for verification rather than asking the customer to perform visual inspection themselves or consider sending postcards to residents where the customer-owned portion of the service line material has not been verified. The postcard would provide information to schedule a free service line material inspection by the water system. The system could ask the customer to submit a photo along with their identification to 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.

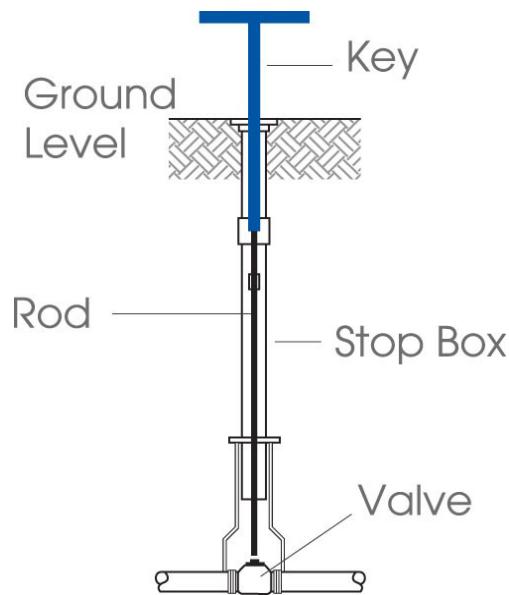
## CCTV Inspection by the Water System



Closed-circuit television (CCTV) cameras have been used by water utilities to visually inspect service line material. External inspections involve inserting the CCTV camera into the curb box to view the outside of the pipe on either side of the shutoff valve. Shown below an example schematic of a curb or stop box with a telescoping pipe from Des Moines Water Works.

### Example Stop Box Schematic from Des Moines Water Works, Iowa

A small diameter CCTV camera can be inserted into the curb box to visually inspect the exterior of the service line connected at each side of the valve. A bulb-shaped “wiped joint” connection to the curb stop indicates an LSL.



Source: Des Moines Water Works, IA ([https://www.dmww.com/water\\_service/service\\_lines/index.php](https://www.dmww.com/water_service/service_lines/index.php))

### Example Lead Pipe at a Curb Stop



Source: LSLR Collaborative, 2021 from Philadelphia Water Department, PA

## Examples CCTV Camera Pictures for LSL, non-LSL, and Unable to Determine



Lead Service Line



Non-Lead Service Line



Unable to Determine

Pittsburgh, PA (Bolenbaugh 2018 AWWA ACE)

Source: Baribeau, 2021

After shutting off water service and disconnecting the water meter located inside the curb box, systems can use high-resolution cameras equipped with a flexible, fiber optic scope and a light source to inspect the internal service line material from inside the pipe. However, the drawbacks are that the method is ineffective when the line is coated with corrosion scale and the method itself can cause disturbance to the pipe (Bukhari et al., 2020; Hensley et al., 2021).

Hensley et al. (2021) recommend measures be taken to reduce scale disturbances and lead release when using this method. For example, the LSLR Collaborative has guidance on alerting customers to potential disturbances of LSLs.<sup>1</sup> The LSLR Collaborative also has guidance on actions customers can take to reduce lead exposure after a replacement or disturbance.<sup>2</sup>

<sup>1</sup> <https://www.lslr-collaborative.org/disturbing-lead-service-lines.html>.

<sup>2</sup> <https://www.lslr-collaborative.org/techniques-to-control-lead-exposure-from-lsl-replacement.html>.

### Water Quality Sampling (Non-Compliance Sampling)

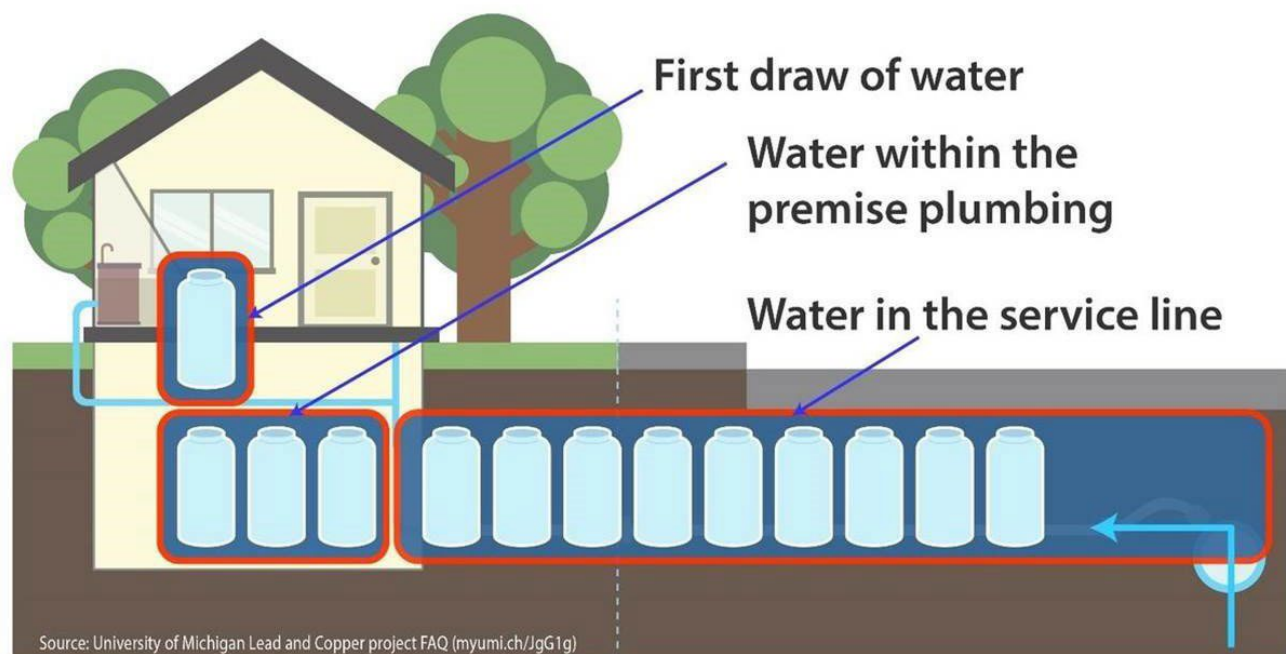
Water quality sampling protocols have been used by water systems to detect the presence of LSLs. The system's routine compliance sampling results cannot be used to determine the presence or lack of presence of lead service lines. Three allowed sampling protocols are described in Hensley et al. (2021), each with varying degrees of cost, complexity, accuracy, and customer cooperation required:

- **Targeted service line sampling** involves flushing out the volume of water in the premise plumbing and collecting and analyzing a sample from the service line. The volume of water from the tap to the service line can be estimated based on pipe diameters and lengths. Cartier et al., 2012 (as cited in Hensley et al., 2021) found that based on typical premise plumbing volumes in Montreal, Quebec, a lead concentration threshold of 3 micrograms per liter ( $\mu\text{g/L}$ ) in the second liter after 15 minutes of stagnation was indicative of an LSL.
- **Flushed sampling** involves collecting a sample from the customer's tap after a set flushing time. For example, flushing for five minutes could result in a sufficient difference in lead levels to distinguish LSL

sites from non-LSL sites (Cartier et al., 2012; Deshommes et al., 2016). This method is simple and can be done as an initial screening.

- **Sequential sampling** uses series of consecutive samples (typically 500 mL to 1 L) collected from an interior tap after a stagnation period (typically 6 hours or more). The number of samples needed depends on the length and diameter of the plumbing from the tap through the length of the premise plumbing and service line, but it is commonly between 8 and 15 liters (Hensley et al., 2021). See below for an example of sequential sampling. Although sequential sampling can be a sensitive tool for identifying LSLs, it is relatively invasive to the resident and more complex than other water quality sampling methods (Schock et al., 2021; Hensley et al., 2021)

### Example of Sequential Sampling



**Note:** The number of bottles for each part of the plumbing system and service line is site-specific.

Water quality sampling is an appropriate screen for the presence of LSLs since low and non-detect lead levels may not reliably detect the absence of LSLs (Hensley et al., 2021). The key to using water quality sampling for identifying LSLs is establishing a **community-specific threshold** above an indicator for the possible presence of an LSL. DEQ must issue prior approval to sampling plan for water quality sampling program.

Examples of water systems using water sampling protocols and thresholds to screen for LSLs include:

- **Denver Water** (Denver, CO), which uses pH adjustment for corrosion control, uses a subset of three samples to assess if a location has an LSL: a first draw, a second draw after a 30-second flush, and a third draw after another 30-second flush. If the average lead concentration is 5  $\mu\text{g}/\text{L}$  or greater, they consider it an LSL (Denver Water, 2019, cited in Hensley et al., 2021).
- **DC Water** (Washington, DC), which uses orthophosphate for corrosion control, conducts sequential sampling and uses a screening value of 5  $\mu\text{g}$  total lead mass in ten 1-liter sequential samples (Schmelling, 2019, cited in Hensley et al., 2021; Bukhari et al., 2020).

- **Three Canadian utilities** (Montreal, Quebec; Guelph, Ontario; and Ottawa, Ontario) use either targeted service line sampling or flushed sampling protocols and thresholds of 1 to 5 µg/L to screen for LSLs (Schock et al., 2021).

A study by Schock et al. (2021) investigated the reliability of using the flushed sampling protocol and the sequential sampling protocol at two communities with varying levels of corrosion control. They were able to establish community-specific threshold levels to identify LSL sites based on the maximum flushed sample lead concentration and the weighted average sequential profile lead concentration. The authors recommend a four-step sampling approach for identifying LSLs as follows:

- Establish baseline threshold lead concentrations for fully flushed and sequential samples from homes that have never had LSLs.
- Collect fully flushed and sequential samples from homes with LSLs.
- Collect fully flushed samples from homes with unknown service line materials suspected to be lead (*i.e.*, unknown, likely lead).
- Collect sequential samples from the same homes in step 3 if fully flushed samples do not clearly indicate the presence of an LSL.

Researchers found this combination of sampling to be robust in predicting the presence of LSLs under different corrosion control and household plumbing scenarios (Schock et al., 2021).

## Excavation

If a service line is not accessible for visual inspection, the water system may need to excavate soil, and potentially remove portions of the road, sidewalk, or other obstacles to determine service line materials. Excavation methods require different levels of disturbance, time investment, and cost as well as coordination with the property owner.

Mechanical excavation is typically done at the curb box or shutoff valve. A full trench can be dug, exposing the entire length of the service line. Digging a full trench can have a higher accuracy but comes with risks of more likely to result in disturbance or damage to the yard, service lines, and nearby infrastructure. Disturbances to LSLs can cause elevated lead levels in drinking water (Del Toral et al., 2013).



**Example of a Mechanical Excavation**

Source: Duffy and Pickering, 2021

## Vacuum Excavation

Vacuum excavation<sup>22</sup> involves using a water jet or compressed air to loosen soil, which is vacuumed up resulting in a small hole to access the service line. This method is faster, less intrusive, less likely to disrupt or damage the service line or other buried utilities, and cheaper than mechanical excavation





### Example of Vacuum Excavation

Source: Hensley et al., 2021

Excavation can be done at the curb box to access sections of the customer-owned and system-owned portions of the service line and might be within the water system's authority to conduct without customer approval. Due to the size of the inspection hole, there is a risk of missing an LSL segment in a service line, such as when a service line is partially replaced (Kuhl, 2018, as cited in Hensley et al., 2019; Bukhari et al., 2020). This can be mitigated by conducting vacuum excavation at multiple points along the service line or by combining vacuum excavation with another identification method, such as visual inspection where the service line enters a building. If an LSL or GRR is disturbed during the excavation, it is recommended to alert the customer that such disturbance can potentially cause temporarily elevated lead levels in drinking water and providing them with information about how to reduce lead levels, such as flushing.

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<sup>22</sup> This technique is also referred to as "hydro-excavation" when water is used instead of air (Bukhari et al., 2020).

### Predictive Modeling

Predictive models look for patterns in a dataset to develop rules or algorithms. Geostatistical models use attributes from known locations to make inferences about areas of unknown condition. Examples of model inputs may include water system or community data, such as the distribution of known materials, along with other factors, such as building age and location. These models are typically built using an initial dataset and can be continually "trained" or improved as more data are added (Muylywyk, 2020).

Geostatistical models have been used by water systems to estimate the probability that a service line is lead, prioritizing areas for service line investigations and expediting LSLR (Abernathy et al., 2018; Muylywyk, 2020; Bukhari et al., 2020; Hensley et al., 2021). These models can be enhanced by incorporating machine learning algorithms in which the model improves itself as new data are added. Information on sensitive subpopulations and socioeconomic factors can be added as layers to enhance planning and prioritization of LSLR (Muylywyk, 2020).

The literature provides successful examples of geostatistical and machine learning modeling in Flint, Michigan, and Denver, Colorado (Abernathy et al., 2018; Muylywyk 2020; Walker 2020). Detroit, Michigan, is also using these models to inform their service line investigation and LSLR programs.<sup>23</sup> A key factor in the success of predictive modeling is the use of representative data. Using a representative set of known data on service line material is important in maximizing accuracy and reliability and minimizing bias.

For more information and examples of how predictive modeling has been used in Flint, Michigan, and Denver, Colorado, systems, and states can refer to the 2020 ASDWA webinar, “Predictive Tools for Lead Service Line Inventories” (ASDWA, 2020).

**Disclaimer:** *Montana’s policy is still being developed regarding predictive modeling. Please contact DEQ prior approval to implementing steps to modeling.*

## Chapter 5 : Developing and Updating the Inventory

This chapter provides recommendations for classifying service line materials, submitting the initial inventory, and inventory updates. It includes requirements and recommendations specific to systems with no LSLs and provides guidance related to inventory changes from an unknown status.

### Developing an LSL Inventory

- Guidance on completing lead service line inventory form is provided on our website, as well as the,
- Montana LSL inventory Microsoft Excel templates, are found at:

#### [Link to DEQ Website Lead and Copper Page LSL Inventory](#)

- This template is the only file type Montana is accepting.

### Submitting the Initial Inventory to the State

The state has prepared the required inventory template for systems to submit.

- **Email completed Montana LSL inventory Microsoft Excel templates to:**

[leadandcopper@mt.gov](mailto:leadandcopper@mt.gov)

Systems with all non-lead service lines must still submit an initial inventory to their state by **October 16, 2024**. The inventory should have all service lines categorized as non-lead or a non-lead subclassification (*e.g.*, copper or plastic) and zero service lines categorized as lead, GRR, or unknown.

### Recommended Documentation for Systems with all Non-Lead Service Lines

Scenario	Basis of Determination <sup>1</sup>	Recommended Documentation <sup>2</sup>
	Municipal codes and construction dates ( <i>e.g.</i> , all service lines were installed after lead was banned)	Relevant municipal code language and dates and references/web links to materials that are available online.  Dates when service lines were constructed, and a list of service line materials used instead of lead.  Confirmation that no LSLs have ever been found in the system.

Never had LSLs	Detailed historical records on service line material, location, and size indicating that all service lines are a material other than lead (e.g., copper or PVC)	<p>Description of historical records including format of the records and condition.</p> <p>Specific standard operating procedures (SOPs) or policies regarding LSL installation.</p> <p>Description of how the system verified the accuracy of historical records including the method(s) and number of verified service lines records compared to the total.</p> <p>Confirmation that no LSLs have ever been found in the system.</p>
	Field investigations	<p>Description of methods including how the system inspected the material of the system-owned and customer-owned portion, if applicable.</p> <p>The number of service lines that were investigated using each method.</p> <p>Confirmation that no LSLs have ever been found in the system.</p>
Replaced all LSLs and GRR	Detailed historical records of non-lead lines and records showing when each LSL and GRR service line was replaced	<p>Description of historical records documenting non-lead service line material along with description of how the system verified the accuracy of non-lead records.</p> <p>Specific SOPs or policies regarding LSL installation.</p> <p>Detailed list of where and when each LSL and GRR was replaced.</p>

**Notes:**

<sup>1</sup> Basis of determination for systems that have all non-lead service lines can be a combination of the information shown. Systems should include all relevant documentation for all their bases of determination.

<sup>2</sup> Should include records for both the system-owned and customer-owned portions where ownership is split.

## **Discovery of LSLs or GRRs after submission of initial inventory with no LSLs, GRRs, or Unknowns – Updated LSL Inventory**

Water systems will improve and update their inventory over time, decreasing the number of unknowns and confirming service line material classifications. Even when systems' inventory and LSLR efforts have progressed such that all service lines have been classified as non-lead, it is possible that an LSL or GRR may subsequently be found. If systems discover an LSL, they must notify the state within 30 days. The system must prepare and submit an updated inventory within **30 days** after completing updated inventory. A new updated inventory is required. The updated inventory file name should indicate that it is updated for example, save as, Date Service Updated Line Inventory\_MT000XXXX.

**Submit Microsoft Excel inventory to [leadandcopper@mt.gov](mailto:leadandcopper@mt.gov).** Please retain the file type as Microsoft Excel other file types will not be accepted.

## **Notification of Known, Unknown, or Potential Service Line Containing Lead**

Water systems with LSL, GRR, or lead status unknown services lines must provide notification to people served by these lines within **30 days** after completing the initial inventory. For new customers, the notice must be provided at the time-of-service initiation. The notification must be repeated annually until the entire service line is no longer a lead, GRR, or lead status unknown service line. Delivery must be by mail or another state-approved method. Example notification templates will be developed by the state at a later date and made available for systems to use.

All notifications must include the following:

- (1) A statement that the service line material is lead, GRR, or lead status unknown
- (2) Information on the health effects of lead. Details on required health effects language.
- (3) Steps to minimize exposure in drinking water

Additional content is required based on service line material classification as follows for:

- **Confirmed LSLs**, the notification must also include information about opportunities to replace the LSL, any available financing programs, and statement that the system must replace its portion if the property owners notify the system that they are replacing their portion.
- **GRR**, the notification must also include information about opportunities for service line replacement.
- **Lead status unknown**, the notification must also include a statement that the service line is unknown but may be lead and information about opportunities to verify the material of the service line.

Water systems must demonstrate that they delivered the notification and provide a copy of the notification and information materials to their states annually by July 1 for the previous calendar year.



## Chapter 6: Public Accessibility

Under the Lead and Copper Rule Revisions (LCRR), community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) must make a portion of their inventory publicly available. This chapter describes those requirements and provides recommendations for implementation of the public accessibility requirement. In addition to the public accessibility requirements, the LCRR also requires all systems to inform all persons served by the service connection with a lead service line (LSL), galvanized requiring replacement (GRR), or unknown service line of their service line material within 30 days following completion of the initial inventory.

### Required under the LCRR

Under the LCRR, systems are **required** to provide the public with a location identifier, such as a street address, block, intersection, or landmark, associated with each service line classified as lead or GRR. Water systems that have demonstrated they have no lead, GRR, or lead status unknown service lines in their inventory (*i.e.*, have only non-lead service lines regardless of ownership) may, in lieu of publishing their inventory, provide a **written statement** that there are no LSLs along with a **general description** of the sources specified in the regulations used to make that determination.

Water systems serving more than 50,000 people must provide their inventory online.

CWSs must indicate in their CCR how to access service line inventory information. Non-lead CWSs must also include a statement they have no LSLs in their CCR.

Within 30 days of completion of the initial inventory, systems must notify persons served by lead, GRR, and lead status unknown lines.

### How to Make the Data Publicly Available

Water systems must make the inventory publicly accessible, including a location identifier for each LSL and GRR. The LCRR requires water systems that serve more than 50,000 people to provide their inventory online.

Water systems serving 50,000 or fewer people are not required to post their inventories online if they are publicly accessible in some fashion. This may include availability by mail or in-person at the water system's office.

### Consumer Confidence Report Inventory Requirements

The LCRR requires CWSs to include in their annual CCR a statement that they have prepared a service line inventory and instructions on how to access the inventory. Systems with no lead, GRR, or lead status unknown service lines can instead provide a statement that they have no LSLs or GRRs with the description of methods used to make that determination

## **LCRR Notification Requirements:**

### **Public Accessibility and Consumer Confidence Report**

**Public Accessibility:** Make the inventory publicly available and include a locational identifier for LSLs and galvanized requiring replacement. Water systems serving more than 50,000 people must provide inventories online.

### **Consumer Confidence Report (applies to CWSs only):**

**CWSs with LSLs:** Indicate how the public can access the service line inventory information.

**CWSs with only non-lead service lines:** Provide a statement there are no LSLs and how to access the service line inventory (or a statement in lieu of the publicly accessible inventory with a description of methods used to make this determination).

### **Service Line Consumer Notification**

Provide notification to persons served by the water system at the service connection with an LSL, GRR, or lead status unknown service line. If the water system serves communities with a large proportion of non-English speaking consumers, as determined by the state, public education materials must be in appropriate languages or contain a telephone number or address where persons served may contact the water system to obtain a translated copy of the materials or to request assistance in the appropriate language.

**Timing:** Notification within 30 days after completing of initial inventory and repeated annually until only non-lead remains. For new customers, water systems must also provide this notice at the time-of-service initiation.

**Content:** Statement about service line material, lead health effects, and steps to minimize lead exposure in drinking water. If:

- Confirmed LSL must include opportunities to replace the LSL, any available financing programs, and statement that the system must replace its portion if property owners notify the system they are replacing their portion.
- GRR, must also include opportunities for service line replacement.
- Lead status unknown, must also include opportunities to verify the material of the service line.

**Delivery:** Email to: [leadandcopper@mt.gov](mailto:leadandcopper@mt.gov).

**Reporting to state:** Demonstrate that the water system delivered the notification and provide a copy of the notification and information materials to states annually by July 1 for the previous calendar year.

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## Inventory Templates and Submittal Information

- **Montana LSL inventory Microsoft Excel templates can be found on:**  
[Link to DEQ Website Lead and Copper Page LSL Inventory](#)
- **Submit - Completed Montana LSL inventory Microsoft Excel templates to Email:**  
[leadandcopper@mt.gov](mailto:leadandcopper@mt.gov)

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