

AGENDA

Denver Board of Water Commissioners

Denver Water Administration Building
1600 West 12th Avenue
Denver, CO
Board Room, Third Floor

Wednesday, April 11, 2018 9:00 a.m.

I. INTRODUCTORY BUSINESS

A. Call to Order and Determination of Quorum

B. Public Comment and Communications

At this point in the agenda, the Board may allow members of the public to address the Board on any item of interest within the jurisdiction of the Board, and not on the agenda for action. Speakers wishing to address a specific Action Item will be invited to address the Board when the item is being considered. Three minutes are allowed for each person unless the President determines otherwise.

1. Distributor Communications
2. Citizen Advisory Committee Communications

C. Ceremonies, Awards and Introductions

D. Legislative Update

II. ACTION ITEMS

A. Consent Items

Items listed below are considered routine and may be enacted by one motion and vote. If any Board member desires discussion beyond explanatory questions, or corrections to the Minutes, the President may order that item to be considered in a separate motion and vote.

Minutes from March 9, 2018 – Executive

1. Minutes from March 14, 2018 – Open and Executive
2. Minutes from March 28, 2018 – Open and Executive
3. Revisions to Operating Rules Regarding Service Lines
4. Ratification of Construction Contract Change Orders and Amendments and Professional Services Agreement Amendments

B. Individual Approval Items

1. Replace Conduit No. 16 West Segment - Contract No. 503037	Jim Light	10 minutes
2. Cherry Creek Galleries – Surplus Property Declaration	Amy Turney	5 minutes
3. Resolution Authorizing Negotiations for the Acquisition of Property for the Gross Reservoir Expansion Project	Amy Turney	5 minutes
4. Foothills Treatment Plant Process/Mechanical Project	Ryan Walsh	10 minutes
5. Declaration of Drought Watch	Nathan Elder	10 minutes

III. POLICY MATTERS

A. Lead Reduction Program Update	Steve Price	10 minutes
B. Capital Planning Process	Bob Mahoney	60 minutes

IV. EXECUTIVE UPDATE

- A. CEO Update**
- B. CFO Update**
- C. Operations Update**

V. BRIEFING PAPERS & REPORTS

- A. Briefing Paper**
 - 1. Legislative Update
 - 2. Lead Reduction Program Update
- B. Report**

DENVER BOARD OF WATER COMMISSIONERS

Meeting Date: April 11, 2018

Board Item: II-A-3

Revisions to Operating Rules Regarding Service Lines

Action by Consent

Individual Action

Summary:

On July 13, 2016, the Board revised Operating Rule 9.04.3, concerning the replacement of services lines, to formalize an arrangement with the City Building Department under which Denver Water reviews certain building permit applications to determine if upgrades or replacements to service lines would be necessary. Rule 9.04.3.b was also revised regarding redevelopment and replacement of lead service lines. In its review of permit applications, Denver Water would determine “[i]f the date of the original tap installation indicates that the service line might contain lead, if so, the rule requires, a water quality test, if “lead is detected by the test, all non-copper components of the service line must be replaced from the main to the first copper or brass fitting within the structure.”

Since 2016, the workload required to perform the water quality test has been greater than anticipated, and can result in delays. In addition, Denver Water has confirmed through research of historical records and its experience in the field, that the use of non-copper service lines was discontinued in 1950. If the tap was installed or the structure was constructed in 1950 or earlier, the property is very likely to have a non-copper service line.

As a result of this new information, Operating Rule 9.04.3.b should be revised to require replacement based on the 1950 date, without the need for a water quality test. The revised rule would provide that “[i]f the year of the original tap installation or year that the structure located at the premises was constructed is 1950 or earlier, and there are no records or other information that indicate that the service line has been replaced since 1950, all non-copper components of the service line must be replaced from the main to the first copper or brass fitting within the structure.”

Recommendation:

It is recommended that the Board approve the above described revisions to Operating Rule 9.04.3.b.

Approvals:

Respectfully submitted,



Patricia Wells
Office of General Counsel

DocuSigned by:


DEDE0A34E77B484
James S. Lochhead
CEO/Manager

DocuSigned by:



D06201CC9B9440B...
Mike King
Chief of External Affairs

DENVER BOARD OF WATER COMMISSIONERS

Meeting Date: April 11, 2018

Board Item: II-A-4

Ratification of Construction Contract Change Orders and Amendments and Professional Services Agreement Amendments

Action by Consent

Action

Summary:

The attached are Construction Contracts Change Orders and Amendments and Professional Services Agreement Amendments for Board ratification for February 2018 through March 2018.

Recommendation:

It is recommended that the Board ratify these Construction Contract Change Orders and Amendments and Professional Services Agreement Amendments.

Approvals:

DocuSigned by:

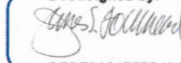


FB8A49375BFB418

Robert J. Mahoney
Chief Engineering Officer

Respectfully submitted,

DocuSigned by:



DEDEC0348778481

James S. Lochhead
CEO/Manager

This list of Change Orders and Amendments is required per the September 13, 2017 resolution which raised the CEO's signing authority to \$750,000. These requirements may be modified by a future Board resolution.

Denver Water aspires to be the best water utility in the nation.
Integrity :: Vision :: Passion :: Excellence :: Respect



DENVER BOARD OF WATER COMMISSIONERS

Meeting Date: April 11, 2018

Board Item: II-B-1

Replace Conduit No. 16 West Segment Contract 503037

Action by Consent

Individual Action

Summary:

The Replace Conduit No. 16 West Segment Project is an 8.5-mile-long, 66-inch diameter treated water pipeline that will replace the existing 42-inch Conduit No. 16 pipeline. The existing conduit currently conveys raw water from Ralston Reservoir to the Moffat Water Treatment Plant and was installed in 1937. The conduit is currently undersized to be able to deliver projected future demands, and has required repairs for joint leaks in the past several years. The replacement of Conduit No. 16 will deliver treated water from the future Northwater Treatment Plant at Ralston Reservoir to the Moffat Facility. The entire project will be delivered in four bid packages (Tunnels Installations, West, Central, and East Segments) with a total project budget of \$86,372,367. The Tunnels Installations package is currently under construction, and the West Segment is scheduled to start construction in June 2018.

The general project scope for the Conduit No. 16 West Segment consists of the following:

- Selection of the 66-inch diameter bid alternate over the 84-inch diameter base bid, for a West Segment project savings of approximately \$1,600,000 (additional savings will be realized on Central and East Segments)
- Approximately 9,330 feet of 66-inch diameter steel pipeline from the east side of State Highway 93 to Denver Water's Van Bibber Facility located on West 60th Avenue in Arvada, Colorado
- One 66-inch diameter butterfly valve vault
- Cathodic protection, appurtenances, demolition, traffic control, dewatering, restoration, and abandonment of portions of the existing 42-inch reinforced concrete pipe
- Electrical and mechanical components will be added to five valve vaults as part of the Central Segment Bid Package

Budget Information:

The work begins in 2018 and will be completed in 2019. The 2018 Capital Improvement Plan for the Replace Conduit No. 16 West Segment Project Business Unit includes \$5,000,000 which will cover the estimated 2018 expenditures, and \$2,300,000 will be budgeted for the 2019 Capital Improvement Budget. The total project cost for installing 66-inch pipelines on the West, Central, and East Segments of Conduit No. 16 is estimated at \$70,000,000 for construction and \$6,600,000 for design.

Selection of Business Partner:

Denver Water solicited bids from five General Contractors listed on the Prequalified Contractor List under the Civil Pipelines discipline. The contract was structured for Contractors to provide bids for an 84-inch diameter pipeline with an alternative bid option for 66-inch diameter pipeline. This Contract was a restricted bid process using Invitation to Bids on the QuestCDN platform. On March 22, 2018, bids were received from five General Contractors. Garney Companies, Inc. was selected based on the lowest cost bid for both alternates. The 66-inch bid alternate was selected with a contract value of \$7,285,938.

S/MWBE Information:

The Minority and Women Business Enterprise (MWBE) goal established for this construction project was 8% participation. Garney Companies, Inc. achieved 10.77% participation.

*Denver Water aspires to be the best water utility in the nation.
Integrity :: Vision :: Passion :: Excellence :: Respect*




3

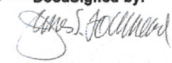
Recommendation:

It is recommended that the Board approve Contract 503037 - Replace Conduit No. 16 West Segment Project with Garney Companies, Inc. for the contract period April 11, 2018 to June 14, 2019 in the amount of \$7,285,938, and authorize a \$350,000 Owner-directed contingency to address unknown issues during construction.

Approvals:

DocuSigned by:

FB8A4B97E6F6416...
Robert J. Mahoney
Chief Engineering Officer

Respectfully submitted,

DocuSigned by:

DEDE0A34B77B484...
James S. Lochhead
CEO/Manager

FOY Usha Sharma

Angela Bricmont
Chief Finance Officer

DENVER BOARD OF WATER COMMISSIONERS

Meeting Date: April 11, 2018

Board Item: II-B-2

Cherry Creek Galleries – Surplus Property Declaration

Action by Consent

Individual Action

Summary:

Denver Water owns 34.6 acres of property at approximately Cherry Creek Drive South and East Iliff Ave. It was acquired in 1886 to be utilized as a well field. The wells have been decommissioned over time with only one well, Well O, still operable. Well O is connected to raw water Conduit No. 5 and located on the northeastern portion of the property. The Cherry Creek Channel bisects a portion of the western boundary of the property and generally consists of a 30-foot wide channel and associated banks. Currently, the active channel is experiencing severe downcutting, specifically on Denver Water's property, leaving a 10- to 20-foot deep eroded/incised channel with vertical banks.

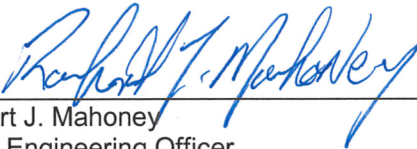
Since 2015, Denver Water has been a project sponsor of the Urban Drainage and Flood Control District (UDFCD) Cherry Creek Corridor Improvement project, contributing \$280,000 for bank stabilization and multiple drop structure installations within our property boundaries (Contract Number 16353A/501219). The UDFCD project spans between the City and County of Denver on the downstream side and Arapahoe County on the upstream side extending from East Iliff Avenue to South Quebec Street. The original project scope of work expanded with additional project funding to develop a comprehensive drainageway to maintain flood conveyance and grade control, improve aquatic, wetland, and riparian habitat, and restore ecologic function.

As the project design evolved, Denver Water staff determined that 26 acres of the current property is not needed from an operations perspective due to its location in the floodplain and distance to existing wells. Additionally, this same area has posed maintenance concerns due to being frequently trespassed on by local recreationalist and those wishing to establish unauthorized camping areas. Denver Parks and Arapahoe County agreed the area adjacent to the creek could serve a greater public good with the land being used for an expanded stream bed and public open space maintained and patrolled by the counties. In exchange for the conveyances, Denver Water will retain 8.4 acres of land and will rezone the property with project funding and support from Denver Community Planning and Development to an Industrial Zone designation. This zoning will allow Denver Water to utilize the remaining property for the continued operation of Well O and a variety of potential uses including material storage, decentralization station for remote crews, and various construction staging for projects in the area.

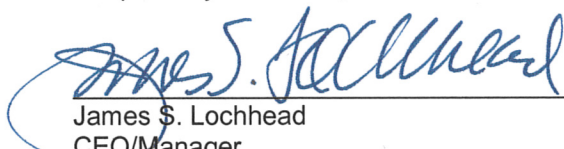
Recommendation:


It is recommended that the Board declare 26 acres of Cherry Creek Galleries as surplus to convey to the City and County of Denver and Arapahoe County as it is no longer needed for waterworks purposes.

Approvals:


Robert J. Mahoney
Chief Engineering Officer

Respectfully submitted,


James S. Lochhead
CEO/Manager


Patricia Wells
General Counsel

DENVER BOARD OF WATER COMMISSIONERS

Meeting Date: April 11, 2018

Board Item: II-B-3

Resolution Authorizing Negotiations for the Acquisition of Property for the Gross Reservoir Expansion Project

Action by Consent

Individual Action

Summary:

The Board plans to construct the Gross Reservoir Expansion (GRE) Project as part of its long-term, multi-pronged water supply approach (including conservation, recycled water, and responsible sourcing of new supply). The GRE will raise Gross Dam by 131 feet to provide an additional 77,000 acre-feet of storage capacity in Gross Reservoir. Expanding storage at Gross Reservoir is crucial in providing a secure water future for Denver Water customers.

The Board's staff determined that the expanded reservoir will inundate private and National Forest Service (NFS) land outside the existing Federal Energy Regulatory Commission (FERC) boundary for Gross Dam. NFS lands will be acquired using the FERC amendment process, but private lands need to be acquired using eminent domain.

As the construction stage of the project approaches, the Board's staff determined that it is time to begin the formal process of acquiring the private land. The party that owns the land has been in discussions with the Board's staff for several years as the permitting process has moved forward and are aware the Board will soon begin the process to acquire the property.

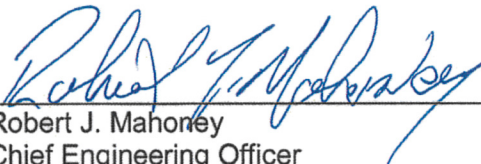
Estimated purchase amount has been included in the 2018 Budget for the GRE Project and the purchase and sale agreement will be brought to the Board by separate action.

Recommendation

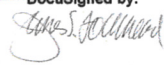
Estimated purchase amount has been included in the 2018 Budget for the GRE Project and the purchase and sale agreement will be brought to the Board by separate action.

Approvals:


Respectfully submitted,



Robert J. Mahoney
Chief Engineering Officer

DocuSigned by:

DEDE0A34B77B484

James S. Lochhead
CEO/Manager



Patricia Wells
General Counsel

DENVER BOARD OF WATER COMMISSIONERS

Meeting Date: April 11, 2018

Board Item: II-B-4

Foothills Treatment Plant Process/Mechanical Project

Action by Consent

Individual Action

Summary:

The Foothills Treatment Plant Process/Mechanical Project includes a new phosphoric acid feed system and improvements to the sodium hydroxide feed system to comply with drinking water regulations, specifically the Lead and Copper Rule. The Project also includes replacing large-diameter butterfly valves for the flocculation, sedimentation, and filter processes; a new reservoir overflow valve; reservoir access hatch improvements; pipe lining and coating system repairs; sludge storage actuator and pipe replacement; service water pipe replacement; a battery backup for rapid mix valves; a compressed air system for chemical offloading; and concrete crack repair.

The Colorado Department of Public Health and Environment (CDPHE), the state's drinking water quality regulatory agency, did not accept Denver Water's recommended approach of pH and alkalinity adjustment for the control of lead corrosion. Instead, they designated phosphate addition to the water system for the control of lead corrosion in a letter dated March 20, 2018 with the requirement for implementation at all three drinking water plants (Foothills, Marston, and Moffat) by March 20, 2020. The work at Foothills must be completed during a tight timeframe from late-October 2018 through mid-April 2019. The recent CDPHE designation coupled with the need to complete work during low demand months while the treatment plant is offline results in a constrained design and construction schedule.

The project team has selected a Construction Manager at Risk (CMAR) method to deliver the project, because it provides the advantages of one responsible party for construction phasing and minimizes the risk of extending the project into the higher demand period of mid- to late-spring. The initial award is for Design-Assist services, and later, a CMAR Agreement will be executed for construction-phase services. Because of the constrained schedule, it is recommended that the Board approve the total project cost of \$10,000,000 for the Foothills Treatment Plant Process/Mechanical Project. The following contracts are included in this Board Item:

- Consultant (Contract 503012) – Amendment No. 1 with Brown and Caldwell
- Vendor (Contract 10205) – Owner-Procured Valves with Henry Pratt Company, for Foothills Treatment Plant only
- Contractor (Contract 503318) – Design-Phase Services with MWH Constructors, Inc.

Future construction contracts will be negotiated and executed with reporting of progress back to the Board.

Budget Information:

Because of the new CDPHE regulatory requirements, the revised estimated project cost for the Foothills Treatment Plant Process/Mechanical Project is shown in Exhibit A. The 2018 Capital Improvement Plan budget for this project is \$3,480,000 which does not provide sufficient budget for the Foothills Treatment Plant Process/Mechanical Project's revised scope. Expenditures of \$5,650,000 anticipated in 2018 result in a project budget variance of \$2,170,000. (Associated Business Unit Numbers: 2009612274, 2009612302, 2009612303, 2009612252, and 1009610084.)

Selection of Business Partners:

Consultant (Contract 503012) - Brown and Caldwell was selected for the original agreement through a quality based selection process which included four proposers. Amendment No. 1 is for Final Design and Services During Construction at the Foothills Treatment Plant. Future design and construction phase services for the Moffat and Marston Treatment Plants will be added via addendum at a later time.

Vendor (Contract 10205) - Denver Water issued an Invitation for Bid to the public on the Rocky Mountain E-Purchasing System (BidNet), on Denver Water's website, through notifications to the SBE and MWBE community, and via direct solicitation to four valve manufacturers. Denver Water received three bids on March 22,

2018; the Bid Tab is attached as Exhibit B. Henry Pratt Company was selected based on best value and their ability to meet the required delivery schedule.

Contractor (Contract 503318) - On February 14, 2018, a Request for Proposals for Design-Assist services was electronically distributed to Garney Construction, Mortenson Construction, and MWH Constructors, Inc. All three firms attended the mandatory pre-proposal conference held on February 22, 2018. On March 8, 2018 Denver Water received three proposals from the pre-qualified firms. Denver Water evaluated the Design-Assist proposals and references, and then conducted team interviews and one-on-one management team meetings to discuss the project structure and delivery options, key project personnel, and rate and fee structures. Denver Water determined that MWH Constructors, Inc. provides the best team and has a competitive rate and fee structure, both of which maximize Denver Water's ability to return value to the project and minimize project schedule and budget risks. Denver Water will later execute a CMAR Agreement for construction-phase services.

S/MWBE Information:

Consultant - The Minority and Women Business Enterprise (MWBE) goal established for design and services during construction was 5% participation. Brown and Caldwell achieved 11.9% participation.

Vendor - Due to the specialized nature of the work, no MWBE goal was established for the valve procurement portion of the project.


Contractor - MWH Constructors has committed to allocating 4% of their budget to MWBE Subcontractors for this initial phase of the project. Further MWBE participation will be required during project construction phase.

Recommendation:

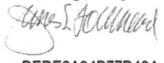
It is recommended the Board approve a total project budget of \$10,000,000 for the Foothills Treatment Plant Process/Mechanical Project for project elements listed in Exhibit A. This includes a project budget variance of \$2,170,000. The recommended approval includes the following items:

- Final Design and Services During Construction Amendment No. 1 to Contract 503012 with Brown and Caldwell is for an extension of the contract period through June 2019. The original amount of the preliminary design agreement was \$431,304, Amendment No. 1 adds an additional \$500,177 bringing the amount not to exceed to \$931,481.
- Contract 10205 with Henry Pratt Company for the contract period of April 11, 2018 to May 31, 2019 for a total contract amount not to exceed \$1,133,936.
- Contract 503318 with MWH Constructors, Inc. for the contract period April 11, 2018 to December 31, 2018 for a total contract amount not to exceed \$146,768.
- Owner Project Contingency Fund not to exceed \$348,846.
- Future construction contracts listed in Exhibit A.

Approvals:

DocuSigned by:

F88A4B37E8F0410...
Robert J. Mahoney
Chief Engineering Officer

Respectfully submitted,

DocuSigned by:

DEDE0A34B77B484...
James S. Lochhead
CEO/Manager

FOR

Angela Bricmont
Chief Finance Officer

DENVER BOARD OF WATER COMMISSIONERS

Meeting Date: April 11, 2018

Board Item: II-B-5

Declaration of Drought Watch

Action by Consent

Individual Action

Summary:

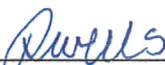
Storage in Denver Water's reservoirs is currently at 88% of full, which is higher than the historic median for storage at this time of year. However, lower than average snowpack, coupled with predictions of significantly lower than average streamflow and dry weather indicate that the reservoirs may not fill this year. In addition, as we head into the summer and through to 2019, dry and hot conditions may occur.

Given the potential for drought conditions later this year or next, the Denver Water Drought Response Committee recommends that the Board declare a Drought Watch. Drought Watch involves increased communication and outreach to customers and stakeholders, and encouraging customers to continue to use water efficiently. Although Denver Water's fixed-amount contracts for nonpotable water would allow the Board to reduce deliveries by 10% during a Drought Watch, the Committee recommends that the Board approve a continuation of deliveries with no reduction at this time. The Committee also recommends the Board continue to closely monitor reservoir supplies, water use patterns, weather conditions, streamflow and river administration in order to take further action as necessary to preserve the reliability and quality of our water supply.

Recommendation:

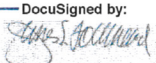
It is recommended that the Board adopt the attached resolution to declare a Drought Watch, directing staff to increase communication and outreach to customers and stakeholders; encouraging customers to continue to use water efficiently; and continuing deliveries of water under fixed-amount contracts with no reduction.

Approvals:



Patricia Wells
General Counsel

Respectfully submitted,

DocuSigned by:


0EBE0A34B77B484...
James S. Lochhead
CEO/Manager

DocuSigned by:


D6A2A2A6E3864DE...
Angela Bricmont
Chief Finance Officer

DENVER BOARD OF WATER COMMISSIONERS

Meeting Date: April 11, 2018

Board Item: V-A-1

Briefing Paper for Legislative Update

Strategic Plan Alignment

Lenses: Customer Centric Industry Leader Long-Term View

GOAL: Play a key role in issues important to our success by advocating the interests of Denver Water in legislative and regulatory matters, specifically by proactively lobbying the Colorado General Assembly.

Summary

As of April 11, there will be 29 days left in the Legislative Session. We continue to press forward on the reclaimed water bills. There is no news on either the TENORM bill or the CO 811 One-Call bill. We were following the "right to rest ACT" and, as expected, it was postponed indefinitely.

HB18-1069 Reclaimed Water Use for Toilet Flushing AND HB18-1053 Reclaimed Water Use For Edible Crops – These two bills have both passed the Senate Committee on Agriculture, Natural Resources, & Energy and will next be heard in Senate Appropriations due their small fiscal note. We are pleased with the forward progress on these bills. **Position: SUPPORT**

HB18-1008 Mussel-free Colorado Act – This bill is on the calendar for Second Reading in the Senate. We are lobbying the Senate at the request of the Department of Natural Resources to ensure there are enough votes for it to pass. It has run into a little bit of opposition from some members of the Senate. This bill establishes a \$25 in-state and \$50 out-of-state annual boat fee to help pay for DNR's aquatic nuisance species inspection program which is extremely important to Denver Water in protecting our facilities from invasive mussels. **Position: SUPPORT**

Background

See attached "Report on 2018 Legislation"

Budget

N/A

Alternatives

N/A

Approach

See attached "Report on 2018 Legislation"

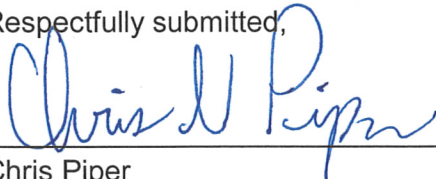
Owner(s)

Chris Piper, Government Relations, External Affairs

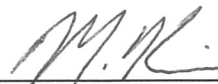
Attachments

Report on 2018 Legislation

Respectfully submitted,



Chris Piper
Manager of Government Relations



Mike King
Chief of External Affairs

DENVER BOARD OF WATER COMMISSIONERS

Meeting Date: April 11, 2018

Board Item: V-A-2

Briefing Paper for Lead Reduction Program

Strategic Plan Alignment

This program is part of Denver Water's commitment to provide our customers high-quality water at their taps, and aligns with the Strategic Plan priorities to earn the support and trust of our customers; responsibly implement progressive solutions; and preserve the health of our community.

Denver Water continues to optimize corrosion control, remove lead service lines, and provide outreach and education to our customers. By initiating this program, Denver Water has already been acknowledged as one of the leading water agencies in the nation on this issue. Our long-term view is to reach a point when all lead service lines have been removed and we have optimized our corrosion control strategy.

Lenses: Customer Centric Industry Leader Long-Term View

Summary

Denver Water serves high-quality water to 1.4 million people in the city of Denver and the surrounding suburbs. Since 1918, we have expertly planned, developed and operated a complex system that provides clean, safe, great-tasting water. We take our water quality seriously. In 2017 we collected more than 35,000 samples and conducted more than 68,000 tests to ensure our water is as clean and safe as possible. Denver Water safeguards our mountain water supplies, and the water is carefully treated before it reaches our customer taps.

Current crises involving lead in drinking water in Flint, Michigan, and other cities across the United States and Canada have highlighted the dangers of lead in drinking water and elevated the issue to one of national importance. For many years Denver Water has taken a proactive approach to lead corrosion control treatment and has adapted our response to lead in drinking water as science and regulations have evolved. Since 1992, Denver Water has tested water inside homes within its distribution system considered at risk for lead and copper contamination, per Environmental Protection Agency (EPA) standards. Denver Water's source water, water leaving the treatment plants, and water in the distribution system have no detectable lead and have trace levels of copper.

This briefing paper is a summary of our current Denver Water Lead Reduction Program and lists enhancements to the program that staff is recommending for Board consideration. Additional background information on lead issues, program components, national and local risk events and lead policy changes start on page 7 of the report.

Summary and Recommendations for Denver Water's Lead Reduction Program

Existing Lead Reduction Program

In response to the data, practices at other major water utilities, the changing regulatory environment and the national spotlight on the lead issue, Denver Water developed a comprehensive lead service line reduction program, coupled with a continued strategy to mitigate the potential health effects of lead service lines and plumbing. The program's goal is to limit exposure of our customers to lead in drinking water from service lines and plumbing.

There are four components in Denver Water's current approach to lead reduction:

- A. Optimize Corrosion Control Treatment
- B. Remove Lead Service Lines
- C. Customer Outreach and Education
- D. Research

A. Optimize Corrosion Control Treatment

Like all water utilities subject to the EPA's Lead and Copper Rule (LCR), Denver Water has a process to minimize corrosion of metals, which can leach into water and cause health issues. Denver Water's current corrosion control process is through treated water, which deposits minerals that coat the pipe with a scale that protects it from the release of metals into the water supply. Denver Water completed an optimal corrosion control treatment study starting in 2015 and lasting through most of 2017. We also developed an opinion of probable costs (OPCs) for both capital and operation and maintenance (O&M) expenses for implementation of treatment. For more information on corrosion control treatment, refer to page 12 in the report.

B. Removal of Lead Service Lines

1. Lead Service Line Encounters

- i. When Denver Water encounters a lead service line during Denver Water construction activities we perform a full service line replacement (from main to inside the home) at our cost.
- ii. In January 2018, Denver Water entered into an interagency, cost-sharing agreement with the City and County of Denver to coordinate removing lead service lines when they are encountered on city projects. Denver Water is preparing to engage with Xcel Energy on discussions regarding a similar agreement.
- iii. Encourage customers with lead service lines to participate in the lead service line Replacement Program.
 - a. Loan Program with Denver Urban Renewal Authority (DURA):
As a part of Denver Water's lead reduction efforts, Denver Water and the Denver Urban Renewal Authority (DURA) have partnered to pilot a project that involves the use of Denver Water funds by DURA for the purpose of providing low-cost financing options to eligible participants to replace lead water service lines. DURA is tasked with establishing and administering a Revolving Loan Fund to provide no- or low-interest loans to participants. In 2017, Denver Water entered into a contract with DURA, providing \$200,000 (which includes 20% administrative fees) to start up the program. Since the

providers to advise us on ways to better reach and inform people with low-incomes about the hazards of consuming lead in household drinking water.

- D. Research: The following are examples where Denver Water participated in and advanced research on lead service lines and lead in drinking water.
1. Drexel University – This research-focused group has a patent for a trenchless technology that can determine the service line materials uses. They team with American Water in New Jersey for this work. Denver Water provided several harvested lead service lines for this research.
 2. Colorado School of Mines Collaboration – Capstone Program. Seniors at Mines are continuing research on a non-destructive method for locating non-copper service lines.
 3. Water Research Foundation – Use of existing technology for locating unexploded ordinance (e.g. land mines) is being tested to determine service line material from the ground surface without excavation. This research is being led by HDR Engineering.

Recommendations to Enhance the Lead Reduction Program

Denver Water should maintain existing elements of the program to further reduce the risk of lead in drinking water to our customers. We recommend the Board review the following elements with staff to continue further developing the program:

- A. Optimize Corrosion Control Treatment.
Implement the corrosion control treatment technique designated by the Colorado Department of Public Health and the Environment (CDPHE) to reduce the corrosiveness of Denver Water's treated water to reduce the mobilization of lead from service lines and interior plumbing. On March 20, 2018, CDPHE sent a letter designating orthophosphate as the optimal corrosion control treatment. Denver Water is required to implement this by March 2020. To do this, Denver Water will need additional sodium hydroxide storage and metering capacity is needed as well as new phosphoric acid feed systems at the Foothills, Marston, and Moffat Treatment Plants.
- B. Removal of Lead Service Lines
1. Lead Service Line Encounters
 - i. Denver Water is proposing to extend the DURA pilot program through 2018, adding an additional \$300,000 and implementing new marketing and communication strategies to help increase customer participation.
 - ii. Other policy considerations for replacing lead service lines are to:
 - 1) Incorporate areas where we expect to encounter lead service lines into the main replacement project prioritization process, to further reduce the number of lead service lines. The Board should consider whether it's funding or financing policy might be different for high priority facilities such as schools, day cares, health care facilities or other facilities.
 - 2) Consider additional funding options for lead service line replacement: Provide customers with more alternatives to finance lead service line replacements. If the Board considers a funding or financing program options could include:
 - o Denver Water financing through rates, bonds or a surcharge.
 - o Denver Water financing provided through its customers' water bills.

- A program providing the opportunity to homeowners on Denver Water's priority list to contract with a certified plumber to replace the remaining lead service line in coordination with Denver Water at a shared cost.
 - Denver Water rebates to customers to help finance the cost of replacing lead service lines.
 - 2. Lead Service Line Discovery:
 - i. Develop a list of homes and other facilities with lead service lines that are prioritized for replacement based on risk of exposure. Through customer sampling results and Denver Water's inventory, develop a list of customers who have lead service lines and who are known to have the greatest risk of exposure to lead based on customer sampling data.
 - ii. Develop a prioritization process for retroactive replacement of known partial lead service line replacement. Before 2016, Denver Water's previous policy was to replace the portion of the service line from the main to the meter. Full service line replacements were done only when a customer had an inside set meter. We should consider whether we need to determine an approach to the remaining portion of the lead service lines at the over 10,000 homes where we have records that we performed this work as part of our lead reduction goal. We do not know whether these 10,000 homes are at risk for higher lead levels, but we should begin to develop better information. Like every aspect of lead service line removal, we will need policies for whether and how to pay or finance the retroactive removal of partial lead service lines. Options for Board consideration include the following:
 - a. For customers affected by a construction project prior to 2016 who received a partial lead service line replacement, and whose water quality test shows lead present in the drinking water, Denver Water could do one or more of the following:
 - 1) Pay for the line removal.
 - 2) Provide financing or incentive programs.
 - 3) Develop a multi-faceted financing and/or incentive strategy to accelerate the removal of lead service lines.
 - 3. Expand our coordination efforts with other governments and utilities:
 - i. Denver Water construction activity is not the only activity that impacts and has the potential to disturb lead service lines. Denver Water can coordinate with other utilities performing work in streets to ensure that property owners are protected.
 - ii. Denver Water is reaching out to Xcel to discuss better coordination with Xcel on their projects in the street that may impact lead service lines.
 - 4. Regulatory and Legislative Efforts
 - i. This could include changes to Denver Water's Operating Rules; city ordinance changes to building codes or street occupation permits; or state legislation. Examples of ordinance or legislative changes might include lead line disclosure upon transfer or sale of property or lead service line removal as a condition of any new construction or landscaping.
- C. Customer Education and Protection
- 1. Test all child-care facilities and at-home child-care centers in our service area.
 - 2. Expand the current customer outreach and incentive/assistance programs to encourage customers to replace lead service lines, focusing on children and disadvantaged communities. Lead is a community issue, and Denver Water has made significant progress in public outreach, education and communication for customers who have lead service lines that we encounter during Denver Water construction activities. We want to

ensure that all residents, regardless of income, ethnicity, language spoken, education and renter/homeowner status receive the information and resources they need to protect themselves and make informed decisions about their drinking water.

- D. Participate in and advance additional research on lead service lines and lead in drinking water.
 - 1. Study effects of Denver Water construction activities on lead service lines
 - 2. Continue to study additional corrosion treatment strategies such as uni-directional flushing of water mains, which has been demonstrated to lower lead levels at customer taps.

Supplemental Report on Denver Water's Lead Program

Lead Service Lines within Denver Water's Service Area

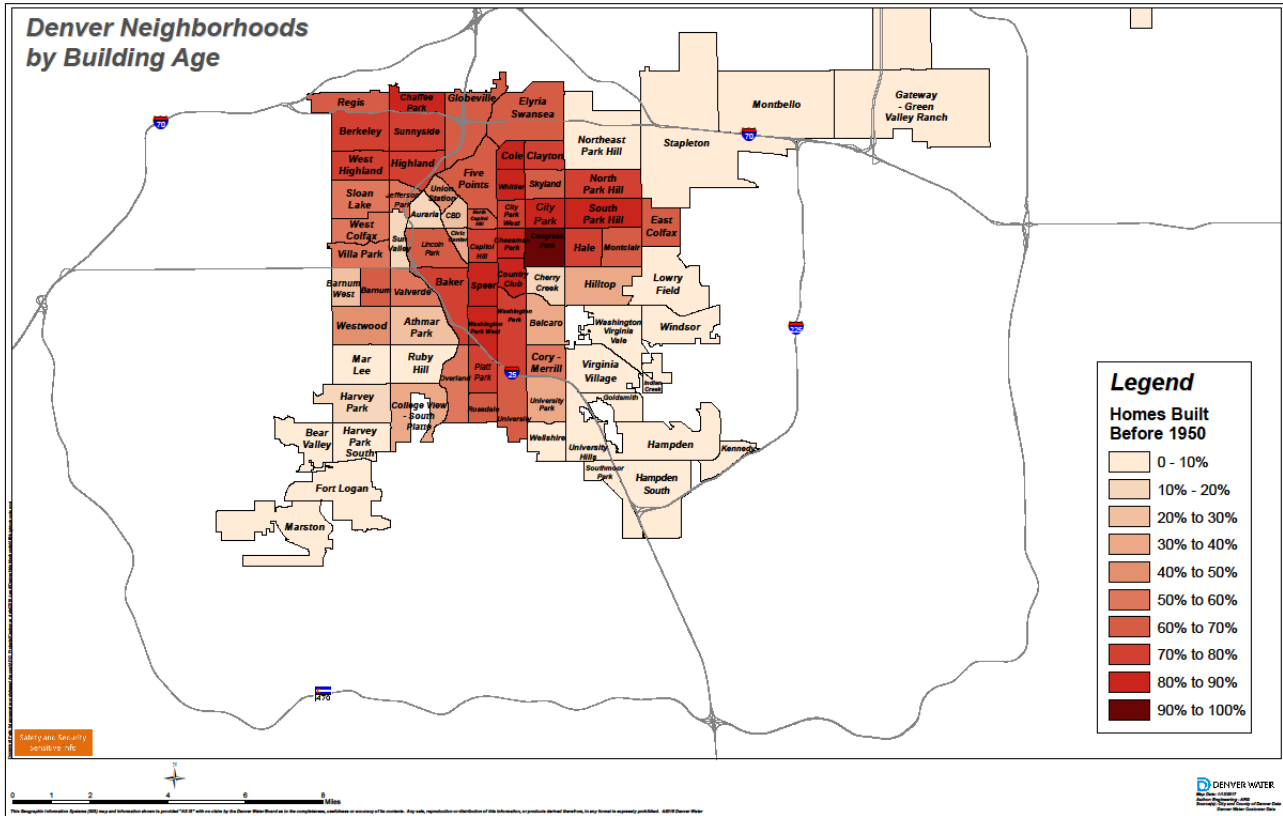
Lead was used as the primary service line material in the 1800s and well into the 1900s in the United States. The material was inexpensive, durable and flexible when compared to other materials available at the time. Some research has shown that more than 70% of the homes built prior to 1900 had a lead service line. While there was health research showing that lead in drinking water could be the cause of lead poisoning well before then, it wasn't until the 1920s that many cities began stopping the use of lead for service lines. Lead was used for service line and plumbing material until 1986, when it was banned nationally.¹

As the Denver metro area developed, service lines were installed by home builders and developers. They were not installed by Denver Water, and are owned by the customer. As a result, Denver Water does not have a record of the materials that were used for these service lines. Some of the suburban areas that Denver Water serves also have lead service lines. Our Distributors in Wheat Ridge, Edgewater and Littleton have reported that lead service lines are present in their service areas.

Based on the number of homes in our service area and our observations during street work in certain neighborhoods, we estimate that there may be as many as 58,000 lead service lines still in our service area. Like many water utilities that did not install the service lines, our confidence in that estimate is low. While we do not have a list of homes we believe have lead service lines, we have developed an inventory of properties in Denver where we have encountered lead service lines during our work. Based on our most current information regarding known lead service lines in the Denver area, the use of lead service lines in the Denver area sharply decreased after 1950, when the Board adopted a rule that allowed the use of copper as an alternative to lead. Denver Water has been able to locate records of over 10,000 properties where we have replaced the lead service line either partially or in full, and 91% of these properties were built before 1950. However, Denver Water's Engineering Standards did not eliminate lead as an acceptable material for service lines until 1971. Lead service lines are encountered most commonly at single family homes with a ½-inch up to ¾-inch diameter, although we have found them at buildings served by up to 3-inch diameter service lines.

EPA recently provided a guidance document to state regulatory agencies that specifically called on water providers to have an inventory of where lead service lines are located and to provide that information on the water provider's website. The National Drinking Water Advisory Council (NDWAC) recommendations also reference the importance of an inventory. Considering this, Denver Water is actively working to complete an inventory. Doing so will require the use of GIS, a thorough research of our records, providing ways for field crews to enter information from the field when working with customers, and a public education campaign to get customers to help us identify lead service lines in their homes and report them.

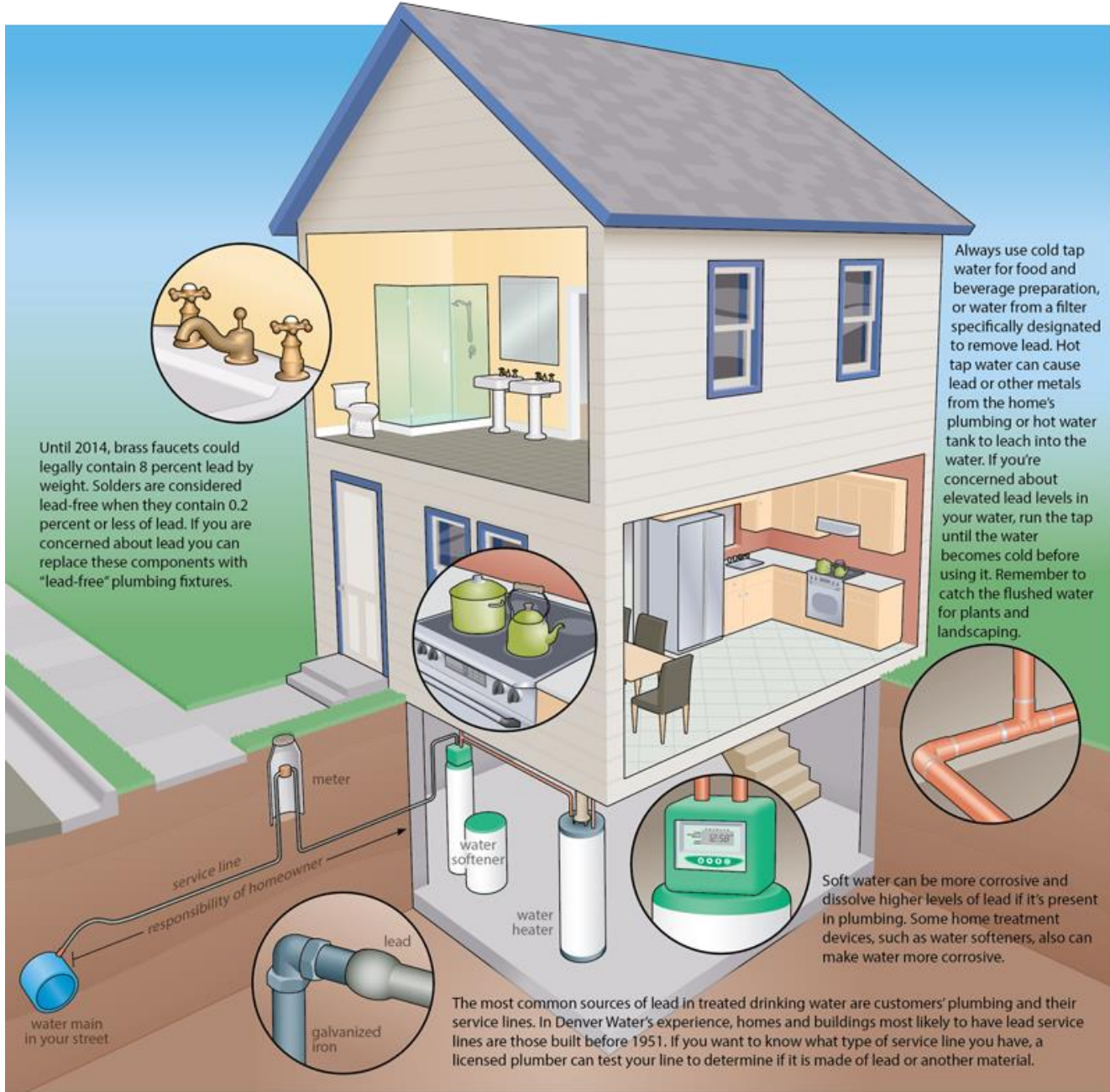
¹ An overview of the history of lead water pipes and the lead industry can be found in the American Journal of Public Health article: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2509614/>



Additional sources of lead in plumbing

There are two additional sources of lead in household plumbing:

- Copper pipes connected with solder made of lead, which was common before 1987. Solder can be used anywhere in the house, from fixtures to service lines.
- Brass faucets and faucet parts, such as fittings and valves. Fixtures installed before 2014 are likely to contain some brass, even if they have a chrome finish.



Sources of lead in plumbing (denverwater.org/your-water/water-quality/lead/reduce-your-risk)

Lead and Copper Rule Sampling/Testing

Denver Water has a long history of meeting or surpassing state and federal drinking water standards, including the LCR, except for one exceedance of the LCR action level in 2012 as discussed in this paper. Lead is not present in water when it leaves our treatment plants or travels through our system's water mains. Rather, lead originates primarily from lead service lines, as well as lead solder in plumbing and fixtures.

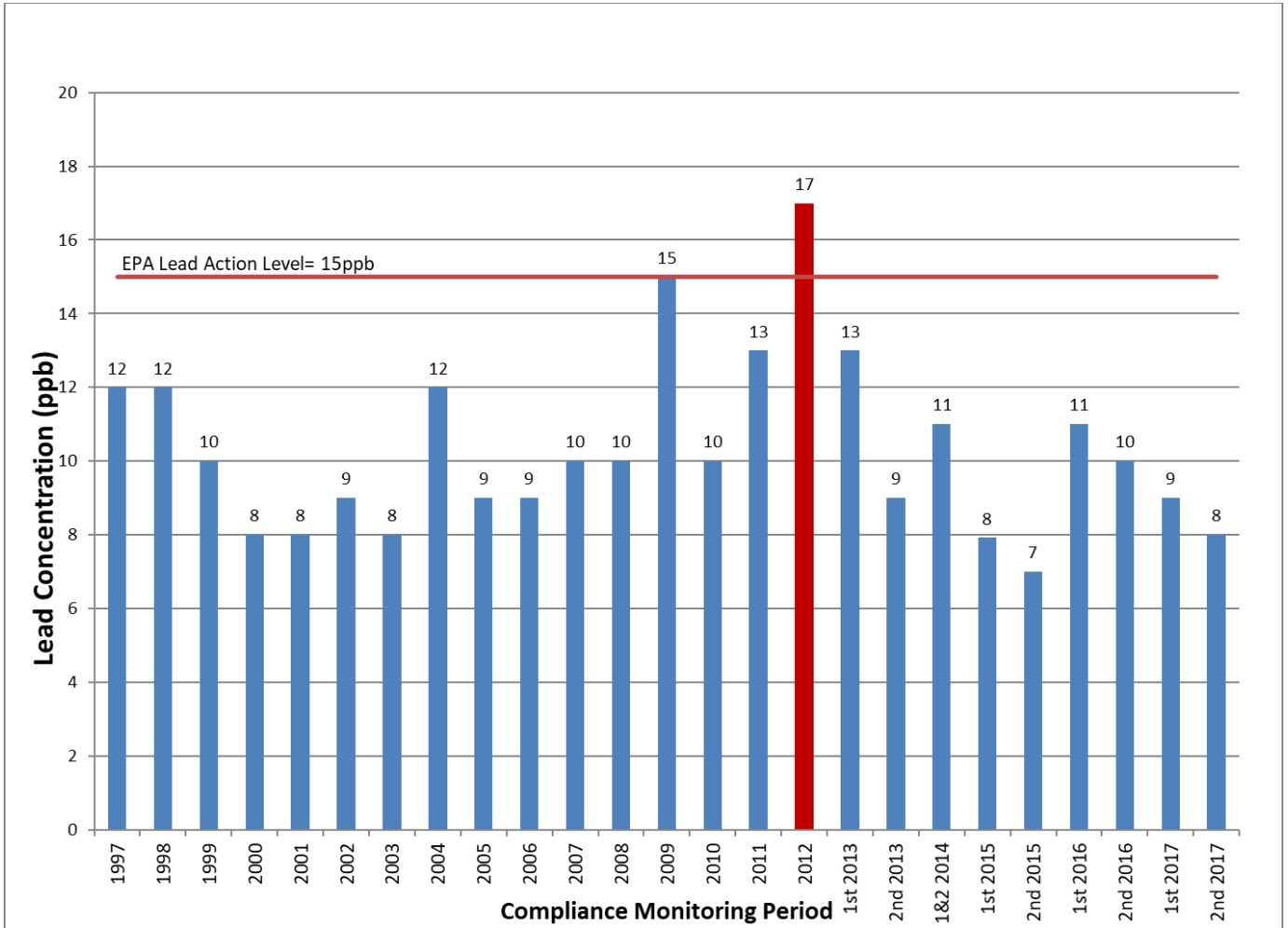
Denver Water conducts monitoring in a representative sample of homes twice a year as required by CDPHE under the LCR. Per the LCR, Denver Water collects a minimum of 100 water quality samples from these homes every six months. Each sample must be collected from a specific site—single family homes with lead service lines or single-family homes built between 1982 and 1988, the last years that lead solder was in use.

Unlike all our other water quality sampling, LCR sampling is not done by Denver Water employees, but rather by the homeowner or resident. EPA has specific protocols for sampling in the LCR. If these protocols are not specifically followed by the homeowner, the results of the sampling could be inaccurate, including the possibility of “false positives” above the 15 parts per billion (ppb) LCR action level. Therefore, Denver Water works carefully with each homeowner to ensure accurate samples. We provide the occupants responsible for taking the samples with standard instructions that ask for a first-draw sample from a cold-water tap after the tap has been off for at least six hours. We reach out to each homeowner before, during and after the sampling to ensure they are fully aware they have a lead service line, and understand the sampling process and the test results. Typically, homeowners collect the sample first thing in the morning and then leave the sample for Denver Water to pick up and test. We attempt to keep homeowners in our sampling pool long-term so that we can detect any trends in the sampling data. Homeowners receive a \$50 credit on their water bill for each sample they provide.

When a water sample at a home that is in Denver Water’s LCR survey tests at or higher than the 15 ppb LCR action level, we immediately inform the homeowner of the test result. Depending on the situation, and to ensure the homeowner followed the proper sampling protocol, we may seek to resample the site. If the home continues to exceed the 15 ppb, we will replace the entire service line at no cost to the customer. That customer is then removed from the LCR survey and no longer submits water quality samples.

In 2012, the sample results exceeded the LCR action level for lead during the period June 1, 2012, through August 30, 2012. Sampling results from homes indicated a monitoring value of 17 ppb for the 90th percentile (meaning the concentrations were above 15 ppb in more than 10% of the homes tested). This exceedance prompted a public education requirement and follow-up action. Prior to, and after, this period, Denver Water’s testing has shown that the homes tested with known lead and copper service lines and plumbing have been below the LCR action level. Denver Water has always been well under the specific action level for copper, which is 1.3 parts per million (or milligrams [mg] per liter).

Compliance with Lead and Copper Rule Regulations



Per the LCR, when a utility exceeds the action level, it must do more frequent testing and evaluate its corrosion control treatment. Prior to 2012, Denver Water tested once per year. After the sampling exceeded the LCR action level in 2012, we implemented a twice-per-year testing schedule, and remain on that frequency currently.

Overview of Denver Water's Lead Reduction Program

Optimal Corrosion Control Treatment (OCCT)

Like all water utilities subject to the EPA's LCR, Denver Water has a process to minimize corrosion. Corrosion control occurs when water deposits minerals that coat the pipe with a scale that protects it from the release of metals. Denver Water operates its corrosion control today based on our previously approved 1994 study that concluded our best treatment was to maintain a pH of our treated water above 7.5 standard units and to maintain finished alkalinity of at least 15 mg/L as calcium carbonate.

While Denver Water has high-quality water sources, we have three treatment plants and we serve an interconnected distribution system from two different sources. Water quality at our Marston and Foothills treatment plants on the south end of our system is similar. The water at our Moffat treatment plant has a lower alkalinity and salinity (or "total dissolved solids"). All of the water we treat is optimized for corrosion. If we were to introduce a new water source, we would test that water and adjust our treatment as necessary to minimize corrosion before that new water source is introduced into our system.

We have been working closely with CDPHE over the last few years to optimize Denver Water's corrosion control treatment. We began these efforts after the sample results exceeded the LCR action level in 2012. CDPHE approved a 2013 study that recommended next steps for research. We provide CDPHE with regular updates on our corrosion control treatment efforts, which include a study of lead service lines removed from our service area. Denver Water completed an optimal corrosion control treatment study starting 2015 and lasting through most of 2017. The study included a pilot test using harvested lead service lines (LSLs) from Denver Water's distribution system. Three potential corrosion control treatments (orthophosphate, increased pH, and silicates) were tested to determine their effectiveness at reducing lead levels in tap water. Two pilots were operated, one at the Marston Treatment Plant (TP) and one at the Moffat TP, to test source water from the South Platte/Dillon system (higher alkalinity and hardness) and the Moffat Tunnel System (lower alkalinity and hardness). Orthophosphate was added using phosphoric acid, pH was increased to 8.8 with sodium hydroxide, and silicates were added using sodium silicate. Sodium silicate was discontinued midway through pilot testing because it was noticeably ineffective at reducing lead release from the LSLs. Therefore, this study focused on the orthophosphate and pH adjustment results.



Denver Water's ongoing Corrosion Control Study

Based on the positive pilot results for pH adjustment, the ability to implement earlier, ability to increase focus on LSL removal, and the current and future disadvantages associated with orthophosphate, Denver Water recommended moving forward with pH adjustment as an optimal corrosion control treatment (OCCT). Adjusting pH is an OCCT solution that protects public health and the environment, and represents a more sustainable, total watershed approach when compared to orthophosphate.

Despite our recommendation, the CDPHE found that the results of our OCCT study warrant the implementation of orthophosphate. CDPHE's conclusion is based in part on the plain language of the LCR, which defines optimal corrosion control as "corrosion control treatment that minimizes the lead and copper concentrations at consumers' taps while ensuring that the treatment does not cause the water system to violate any provision of the Colorado Primary Drinking Water Regulations." On March 20, 2018, CDPHE sent a letter designating orthophosphate as the optimal corrosion control treatment. Denver Water will have to implement this by March 2020. Prior to this change, we will do outreach to sensitive customers for whom water chemistry changes may be an issue and to Distributors, some of whom may need to perform sampling within their service areas.

The capital costs to implement orthophosphate are estimated to range from \$7M-\$9M. In order to meet the March 2020 deadline, Denver Water must begin construction at Foothills treatment plant this summer.

Lead Service Line Replacement

The goal of this facet of the program is to eliminate lead service lines in the most cost-effective manner, using a data driven approach. This is a difficult goal to accomplish given that Denver Water has only a general idea where lead service lines may be located. To accomplish this goal, Denver Water targets the removal of lead service lines: (1) when encountered in the field; (2) through an active lead service line identification and removal program; and (3) through an intergovernmental approach focused on the development of enforceable rules and ordinances to facilitate the removal of lead service lines and plumbing.

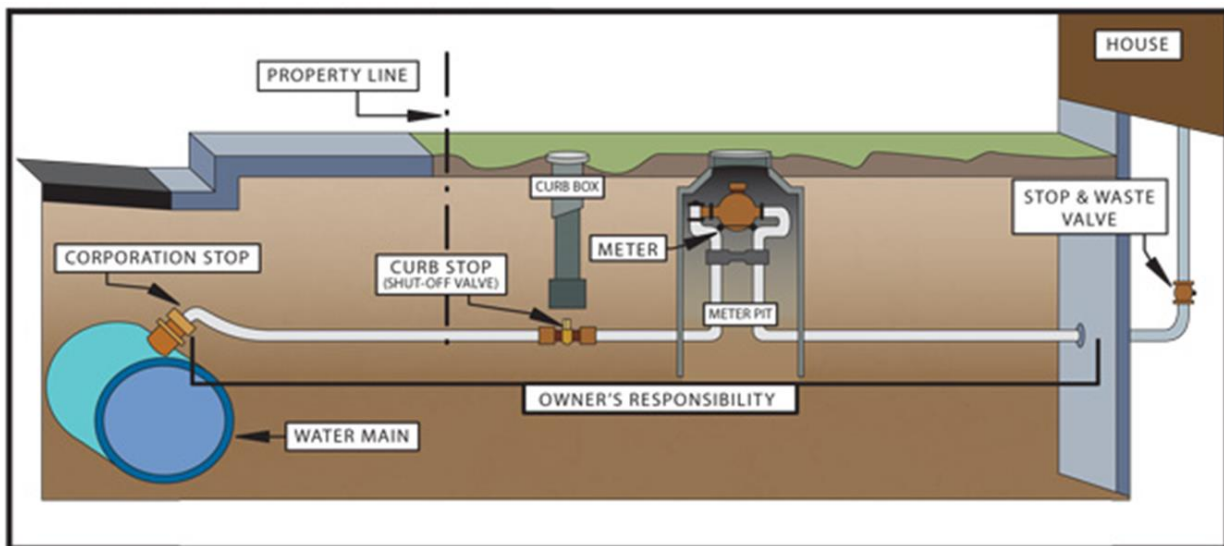


Diagram of a service line

During water main projects, Denver Water evaluates the section of a customer's service line that runs from the water main to the water meter. Because our work at the main involves cutting the line, which has been determined to potentially elevate lead levels in the water at the home, we adopted an Operating Rule requiring replacement of the line "to a point where it can be removed without cutting the

line.” In practice this has meant replacing the portion of the line from the main to the meter, which we have done at no cost to the property owner. Where the meter is located inside a home, the entire line has been replaced and the meter has been moved outside the home.

Recent research in other parts of the country has shown that replacing only a portion of a lead service line, can in fact increase the amount of lead in drinking water at the tap. In light of this concern, Denver Water adopted a policy in 2016 that when we encounter any lead service line during the course of our work, we replace the line in full from the main into the house. In the case of leaks, if a service line has a leak between the main and meter, we replace that portion of the line with copper and strongly encourage the customer to replace the remaining portion (meter to house). If a service line has a leak between the meter and house, the customer is responsible for replacing that portion. Once their portion is replaced, we replace the remaining section (main to meter). In both circumstances, the customer will receive information about our DURA program and a water quality test.

Lead levels can potentially remain elevated for a few months due to pipes being disturbed during construction or service line replacement. If these impacts result from our work, Denver Water provides the customer with water filters to use for drinking and cooking as well as information on flushing the household plumbing system to help protect residents from the risk of lead exposure. Providing National Sanitation Foundation (NSF) certified pitcher filters certified to remove lead to customers who have a lead service line replacement performed by Denver Water is an additional precaution to manage the risk of elevated lead levels at the tap that can occur temporarily after a service line replacement.

Four months after the service line is replaced, the customer will receive a letter offering another water quality test to ensure that the lead levels have gone down.

Working with Customers during Denver Water Construction Project

Currently, Denver Water focuses customer communication on specific situations in which we encounter a lead service line during a main replacement project, a main break or a service line leak. As discussed above, although Denver Water doesn't know which specific properties have lead service lines, we have a good idea of the areas of Denver and a few surrounding suburbs that are more likely to have homes with lead service lines. When we are doing work on mains in these areas, we notify customers in advance of the potential that they have a lead service line and that we will replace the line if we encounter it. We also provide them direct information about how to protect themselves from water quality risks due to lead exposure. These customers receive multiple notifications and specific instructions to flush water from the taps inside their homes, as well as advice on replacing lead service lines, regularly flushing with cold water and considering the use of water filters.

We provide all information to the customer in writing, because we want our customers to receive consistent information in a format that they can review and consider. Customers impacted by these projects can also find this information online. All materials have a phone number to reach a Denver Water employee who can answer questions, and the material is also translated into Spanish.

Denver Water also provides general information about lead in water to all our customers. Our annual water quality report (EPA's official term for this is the Consumer Confidence Report) is made available on our website and is announced to all customers in their water bills. The Consumer Confidence Report contains information on our LCR testing results based on samples gathered at customers' taps. In addition, there is a broad range of information about lead and lead service lines on Denver Water's website. We have also placed messages in our customer newsletters about lead.

The following are guidelines we provide customers to reduce their risk of exposure to lead:

When water has not been used for several hours, run the cold-water tap for a couple of minutes. Customers can conserve water by catching the flushed tap water for household uses such as watering plants or cleaning.

- Use cold water for drinking, cooking and preparing baby formula. Hot water dissolves lead faster and is likely to contain higher levels of lead, if present.
- Identify and replace plumbing fixtures containing lead.
- Use only lead-certified contractors, and insist they install lead-free solder and lead-free fixtures.
- A water filter specifically designed to remove lead in drinking water can be used. The water filter should be independently certified by NSF International to remove lead.
- Follow the instructions Denver Water gives customers after certain projects in their neighborhoods. These instructions are useful for anyone who wants to help reduce the amount of lead-containing particles and sediment that may have entered a home during construction work.

Depending on site conditions and other factors, a full service line replacement performed by Denver Water crews costs approximately \$6,000-7,000. A partial service line replacement is approximately 30% less. However, as discussed above, partial replacements are no longer recommended. Denver Water will analyze alternative methods of replacement to minimize costs, including different construction techniques and use of contractors to perform the work.

Service Line Leaks

Denver Water is called out on approximately 450 service line leaks annually on average. Over 80% of these leaks occur on service lines that are either all or partially lead. As a courtesy to customers, Denver Water replaces the portion of the service line from the water main in the street to the inlet side of the meter. The customer is responsible for replacing the remaining portion of the line from the outlet side of the meter into the home.

Denver Water identifies customers eligible to participate and refers them to DURA. Homeowners of either single family residences or duplexes within Denver Water's Total Service Area are currently eligible to participate in the DURA loan program when a leak occurs between the structure and meter. DURA verifies eligibility and manages the loan for the homeowner. DURA solicits contractor bids and oversees the lead service line replacements. Under the DURA program, the customer may have their entire service line replaced. Denver Water will replace the service line from the main to the meter, and DURA's contractor will replace the service line from the meter to the structure served. Since 2017, of customers with leaks between the meter and the structure served, 8% of customers eligible to participate in the DURA program took advantage.

In addition to the DURA program, if a customer hires their own contractor at the customer's cost to repair a leak between the meter and the structure served, Denver Water will partner with the customer by replacing the remaining portion of the service line from the main to the meter. This also ensures a full replacement. About 10% of customer elect this option to replace.

Elective Full Replacement

Homeowners of single family residences or duplexes who have lead service lines are also eligible for the DURA loan program even if the service line isn't leaking.

Number of Non-copper Service Lines Replaced

The following table shows the number of non-copper service lines replaced under the various facets of Denver Water's lead response program.

Data for Service Line Replacements		
Replacement Type	2016	2017
Construction (Pipe Replacement, Pipe Rehabilitation, & City Projects)	545	227*
Leaks/Harvest – Full Replacement	427	206
Leaks – Partial Replacement	0	209
Redevelopment (scrape offs, major home construction)	413	540
DURA Pilot Program	NA	18
Total Full Replacements	1,385	991
Remaining Partial Replacements	0	209
Total:	1,385	1,200

* Only 227 lead services were replaced on main replacement projects, because our main replacement program doesn't specifically target areas with lead service lines. The 2018 replacement program will replace an estimated 500 lead services.

Customer Education and Protection

The goal of the community protection element of a lead service line replacement program is to engage the community to enhance protection from exposure to lead in water.

Lead is a community issue, and Denver Water has made significant progress in public outreach, education and communication for customers that have a lead service line that we encounter during Denver Water construction activities. We want to ensure that all residents, regardless of income, ethnicity, language spoken, education and renter/homeowner status receive the information and resources they need to protect themselves and make informed decisions about their drinking water.

Here are some of the tactics Denver Water currently uses for outreach and education:

Web	<ul style="list-style-type: none">• Information on lead in drinking water and how Denver Water is regulated• Request a water quality test for lead• Graphics explaining how lead enters drinking water through household plumbing• Explanation of Denver Water's Lead Reduction Program
Notices	<ul style="list-style-type: none">• Easy to understand construction notices that are also translated into Spanish• Explanations of water quality testing and service line testing• Advance notice of construction activity and regular communication throughout the project• Provide a pitcher filter and easy to understand flushing instructions
Stakeholder Outreach	<ul style="list-style-type: none">• Partnering with government and public health agencies to reach selected audiences• Neighborhood outreach and presentations• Outreach to retailers for filters and plumbers for lead plumbing awareness

Research

Through research and studies, Denver Water can advance the evolving science of lead in drinking water to benefit Denver Water customers and the water industry. Water utilities know more now than they did when the Lead and Copper Rule began in 1991, but more research is needed. Denver Water should continue to seek out opportunities to participate in research with partnering agencies such as Water Research Foundation, and within our own utility, to find the best ways to protect our customers and to grow the body of knowledge in our industry.

Additional Information and Resources

Blood Lead Levels in Denver's Children

Denver's Department of Environmental Health (DEH) publishes data relating to blood lead levels in children in our service area. We agree with DEH that there is nothing in the data that would indicate that the source of blood lead levels is drinking water, rather DEH says the most likely source is lead paint.

In 2012, the Centers for Disease Control updated its recommendations on children's blood lead levels and shifted its focus to primary prevention of lead exposure while emphasizing there is no safe blood lead level in children. The CDC now uses a reference level of 5 micrograms per deciliter to identify children with blood lead levels that are much higher than most other children's levels.

If a child age 6 or younger is tested for lead, and the results are above the reference level, the physician reports this to CDPHE, which relays the information to DEH. DEH then can arrange for an environmental assessment at the child's home. In partnership with Denver Water, DEH currently will conduct a water quality test in an older home, and will discuss with parents or guardians the possibility of lead service lines or plumbing in the home.

Sources and health effects of lead in drinking water

Lead is a naturally occurring element found in small amounts throughout the environment. Exposure to lead through inhalation or ingestion can cause serious health effects, especially for young children and developing fetuses because it interferes with brain and nervous system development. The Centers for Disease Control (CDC) has determined that no safe blood lead level in children has been identified. Even low levels of lead in blood have been shown to affect IQ, ability to pay attention, and academic achievement. Because lead exposure often occurs with no obvious symptoms, it frequently goes unrecognized, and effects of lead exposure cannot be corrected. While lead in tap water is rarely the single cause of lead poisoning, it can increase a person's total lead exposure.

Lead was used for many years in paints, plumbing and other products found in and around homes including cosmetics, plastics and ceramics. The dangers of lead have been recognized for many years and its use in consumer products manufactured in the United States today has been essentially eliminated. But because of these uses, lead persists in our environment as a risk until it is abated or removed. Because of lead's persistence, children living in older homes are generally more at risk from lead poisoning than those in newer residences.

Of all lead sources, paint and dust are considered to be the primary routes of exposure. There have been programs aimed at eliminating exposure to these sources through testing and abatement of identified properties. These programs, administered through the Colorado Department of Health and Environment and county health agencies, may take advantage of grants, loans, and property owner and landlord education programs.

Although not considered by the CDC to be a primary lead source, lead in drinking water is a risk. Lead isn't present in the mountain streams and reservoirs that supply our water, and it isn't found in water when it leaves our treatment plants or travels through our system's water mains. However, lead exists in household plumbing in the form of: lead service lines; solder on copper lines; and as a component of brass fixtures that are often used as faucets.

All water is corrosive, as water is a universal solvent—it dissolves more substances than any other liquid. Lead that is exposed to water can leach dissolved lead and also release particulate lead. Water utilities have a treatment process to minimize this corrosion, by allowing the water to deposit minerals that can coat lead service lines and plumbing with a scale that protects them from the release of lead. This is done by managing the finished water by controlling pH, alkalinity and other elements such as dissolved solids that could react and reduce the protective scale on lead pipes. However, even when corrosion control is optimized, lead can be present at the tap. Moreover, disturbance of lead plumbing through cutting or some types of construction work can cause particles of scale to dislodge from the pipe, resulting in elevated lead levels until the scaling is restored. Faucet aerators may catch some of

that particulate lead, not allowing it to completely flush from the system and increase the lead level in the water.

Galvanized plumbing can also be a source of lead. Galvanized iron pipes are steel pipes that are covered with a protective layer of zinc. Galvanized plumbing was installed in many homes that were built before the 1960s. We know now that over the years the zinc has corroded and created a rough surface within the pipe walls. This corrosion creates a place for particulate lead originating from a lead service line or lead containing plumbing fixtures to adhere. Hence, in homes with galvanized interior plumbing, lead can still be an issue even though a lead service line has been removed because lead that has lodged in the galvanized pipe may continue to precipitate into the water. Lead is not an issue for homes with galvanized plumbing where the service line did not consist of lead in the past.

Overview of regulations controlling lead in drinking water

In recognition of the concern lead poses in drinking water, the EPA published the LCR in 1991. These requirements were also adopted by the Colorado Department of Public Health and Environment (CDPHE). The regulation recognizes that the sources of lead in drinking water are household plumbing and service lines owned in most cases by the property owner—not in the treated drinking water delivered to the customer. In fact, the maximum contaminant level goal for lead in drinking water is zero parts per billion (ppb). The focus of the LCR has been on requiring water utilities to utilize corrosion control techniques to minimize lead leaching into the water at the tap.

The LCR requires water utilities to determine the best way to adjust water chemistry to control corrosion by monitoring treatment performance. To do this, the LCR requires public water systems serving more than 3,300 people to regularly test a sample of high-risk homes for lead at the tap. High risk homes are those with lead service lines and that have lead containing solder built between 1983 and 1988. A water utility is considered to have an effective corrosion control program if the 90th percentile of this monitoring is below the 15 ppb “action level” that the LCR established. To reiterate – 15 ppb is a regulatory standard related to the effectiveness of a utility’s corrosion control program, not a determination that less than 15 ppb in water is safe to drink.

If more than 10% of homes tested have lead concentrations higher than the EPA “action level” of 15 ppb, individual water utilities are required to notify area residents via the news media and direct mail; increase the frequency of water quality sampling from high-risk homes; and evaluate their corrosion control treatment. If the utility cannot control corrosion effectively it must replace any lead service lines it owns over a period of time.

There are other regulations that have been enacted concerning lead in drinking water. The Lead Contamination Control Act of 1988 focused specifically on reducing drinking water lead exposure in schools by forcing recalls on water fountains and water coolers containing lead lined water tanks. The law also assisted schools in identifying and eliminating sources of lead within the schools’ plumbing. The EPA also has issued guidance to assist schools and daycares to examine sources of lead in plumbing, called *3T’s for Reducing Lead in Drinking Water in Schools*. This is a voluntary program, separate from the requirements of the LCR.

In 2014, revisions to the Safe Drinking Water Act made it illegal to install any pipe, or plumbing fitting or fixture (such as brass fixtures), any solder, or any flux, during the installation or repair of a public water system or customer's drinking water plumbing unless it meets the following definition of "lead-free": not containing more than 0.2% lead when used with respect to solder and flux; and not more than a weighted average of 0.25% lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures. Prior to 2014 these materials could contain up to 8% lead.

The LCR has been revised since it was first promulgated, although the revisions have been minor. In 2014 – before the national press surrounding the water quality crisis in Flint – the EPA announced that it would be revising the LCR, and that the revisions would not likely be minor in scope. Specifically, discussions regarding the anticipated revisions have signaled a shift in emphasis from corrosion control to removing lead lines. EPA has long acknowledged that sources of lead still exist in water systems and that they are not typically being removed. With continuing national press covering the issue, and with Congress engaged in hearings and several proposed pieces of legislation, urgency over these revisions has accelerated. It is currently unknown when a revised LCR is likely to be proposed, the EPA is currently consulting with state and local government officials and reviewing the [draft revision white paper](#) issued in October 2016.

Lead in drinking water is a national issue. When the LCR was instituted in 1991, the EPA estimated there were 10.2 million lead service lines nationwide. Analysis published by the American Water Works Association in 2016 estimates that 6.1 million lead service lines remain in U.S. communities.² This suggests progress in lead service line removal over the past two decades, but indicates an estimated \$30 billion challenge remains.

Key takeaways from the study include:

- Approximately 7% of homes nationally have a lead service line, which means up to 22 million people in the U.S. are served by lead lines.
- The number of remaining lead service lines could be as high as 7.1 million and as low as 5.5 million.
- Approximately 11,200 community water systems currently have at least some lead service lines within their service areas.
- Regionally, the largest concentration of remaining lead service lines is in the Midwest, estimated at 3.4 million.

The EPA engaged its National Drinking Water Advisory Council (NDWAC) to advise the agency on how to modify the LCR and recommend additional measures it could take to remove sources of lead from plumbing systems. The 15-member NDWAC advises the EPA on matters related to drinking water. It includes members of the general public, state and local agencies, and advocacy groups

² The study, titled National Survey of Lead Service Line Occurrence, is available at: <http://www.awwa.org/publications/journal-awwa/abstract/articleid/57880483.aspx>

concerned with safe drinking water and public health. The NDWAC finished two years of work on the issue in late 2015, making recommendations that are significant in scope.³

Among the NDWAC's key recommendations are that water utilities:

1. Locate and replace all lead service lines completely, sharing responsibility for that replacement with customers;
2. Conduct additional monitoring and analysis of water quality parameters in order to better manage corrosion control;
3. Expand on current educational outreach to alert customers, particularly customers with lead service lines, to the risks posed by lead and steps they can take to reduce those risks; and
4. Analyze customer water quality samples for lead upon request.

A summary of the regulatory chronology is provided in the table below:

Rule and Year adopted	Major content	Denver Water compliance
EPA LCR (1991)	Control lead and copper from drinking water at the customers' tap. Establishes a testing protocol and 15 ppb action level for lead.	Sample results exceeded the action level in 2012, but Denver Water has been within the action level all other years
Lead Contamination Control Act (1988)	Aimed at schools, recalls water fountains containing lead lined water tanks.	No action from Denver Water was needed.
3Ts Guidance (not a rule)	Voluntary guidance to assist schools and daycares examine sources of lead in drinking water.	No action from Denver Water was needed.
Reduction of Lead in Drinking Water Act (2014)	Reduction in lead content in plumbing materials from 8% to 0.2%	Denver Water has always been in compliance.
NDWAC Recommendations (not a regulation)	Recognized there is no safe level of lead. Emphasizes removing lead service lines and recommends a robust public education and outreach program	This is not a requirement, however, as summarized in this paper, Denver Water is working to implement many of the recommendations in its Lead Reduction Program.

Summary of recent events that highlight risk

In the aftermath of the water quality crisis in Flint, Michigan, water utilities across the nation are being asked questions about lead and drinking water that are creating a national dialogue on the issue.

Flint, Michigan

³ The recommendations and complete report can be found at this link: <https://www.epa.gov/sites/production/files/2016-01/documents/ndwacrecommtoadmin121515.pdf>

The story of Flint is a story of failed government. After suffering through decades of economic decline, in 2011 the state declared the city in a state of local government fiscal emergency and appointed an emergency manager. The Flint water system had been underfunded for decades. In 2014, Flint's water source was changed from being a wholesale customer of Detroit's Lake Huron source to the Flint River. The change occurred as a money-saving effort and was fast-tracked through state regulatory approvals. During the change, the utility did not perform corrosion control treatment, which led to Flint's 100,000 residents potentially being exposed to dangerous levels of lead in their drinking water, which led to incredible health issues such as decreased fertility and a Legionnaires' disease outbreak. State agencies involved repeatedly denied there was a serious problem, leaving the city with contaminated water for many months until a local pediatrician reported the growing number of children with high blood levels. Flint's water source was the Flint River from April 2014 to October 2015, when it reconnected to the Detroit system.

Six officials were charged with involuntary manslaughter tied to the Legionnaires' disease outbreak, according to the [Chicago Tribune](#). Dr. Eden Wells, Michigan's chief medical executive, was the 15th person to be criminally charged in the water crisis, according to [the Detroit Free Press](#).

In addition to involuntary manslaughter, city and state officials were charged with acts such as tampering with evidence, misconduct in office and willful neglect. In January 2017 the Michigan State Department of Environmental Quality has said that the lead levels in the city's water tested below the federal limit. But the infrastructure problems left in the wake of the lead leaching are not solved for Flint residents, many of whom still have lead or galvanize service lines.

Recent Federal Legislative Activities

The following legislation was recently enacted by Congress:

- H.R. 1625 is the recently enacted omnibus spending bill signed into law on March 23, 2018. The bill included the following funding:
 - \$20,000,000 in grants for lead testing in school and child care program drinking water authorized in section 2107 of the Water Infrastructure Improvements for the Nation Act (Public Law 114-322);
 - \$10,000,000 shall be for grants for reducing lead in drinking water authorized in section 2105 of the Water Infrastructure Improvements for the Nation Act (Public Law 114-322).
- In 2016, Congress passed legislation to provide \$120 million in funding for Flint, including funding for debt forgiveness and funding for low-interest loans to improve Flint's water infrastructure. In addition, the legislation provided \$100 million in grants for any state where an emergency declaration has been issued for lead in drinking water, which at the time was limited to Michigan.

There are currently several bills pending in the 115th Congress related to lead, although movement on the bills is unlikely:

- H.R.4907 is currently pending in the House of Representatives. This bill would amend the Safe Drinking Water Act to require the Administrator of the Environmental Protection Agency to establish a grant program to assist eligible entities in carrying out programs to replace lead service lines for schools and solder that is not lead free used in the plumbing for schools, and for other purposes. The bill is currently in committee.
- H.R. 4908 is currently pending in the House. The bill would amend the Safe Drinking Water Act to provide assistance to schools to replace drinking water fountains that may contain lead.
- H.R.1068 is a House bill currently pending in committee. The bill would amend several provisions in the Safe Drinking Water Act. With regard to lead, it would establish a grant program

for reducing lead in drinking water in schools, provide guidance for testing and removing lead from schools, and broaden the definition of lead service line.

- H.R. 1974 and S. 2000 are House and Senate Bills that would amend the Safe Drinking Water Act to require the EPA to revise the national primary drinking water regulations for lead and copper. The bills direct EPA to adopt a rule that would require:
 - public water systems to meet certain reporting requirements;
 - the EPA to develop a sampling protocol and develop instructions for compliance with the protocol;
 - the EPA, or the state exercising primary enforcement responsibility, to require on-site investigations for determining the source of lead when the concentration of lead or copper contamination exceeds specified levels;
 - public water systems to meet certain notification and reporting requirements when lead or copper concentration limits are exceeded;
 - the systems to develop and publish an inventory of the material composition of the service lines at residential and nonresidential facilities;
 - the systems to collect and publish information about the ownership of those service lines;
 - the systems, when replacing lead service lines, to entirely replace the lines instead of partially replacing them; and
 - the EPA must also revise the rule to lower the allowable level of lead in drinking water.

EPA Actions

On February 29, 2016, the EPA sent a memo and guidance to all state regulatory agencies, including the CDPHE, which covered a variety of topics including clarification on recommended tap sampling procedures for the LCR.⁴

Of particular note in this guidance is the encouragement from EPA that state regulatory agencies:

“Work with public water systems – with a priority on large systems – to increase transparency in implementation of the LCR by posting on their public website and/or on your agency’s website.

- *The materials inventory that systems were required to complete under the LCR, including the locations of lead service lines and lead plumbing in the systems, and*
- *LCR compliance sampling results collected by the system, as well as jurisdiction for invalidation of LCR samples.”*

In addition, on October 13, 2016, EPA issued guidance on implementation of the LCR related to sample site selection and triennial monitoring primarily related to Tier 1 sample site selection.⁵

State Actions

In Colorado, the General Assembly adopted H.B. 17-1306, the Test Lead in Public Schools’ Drinking Water Act. Adopted in 2017, HB 17-1306 directs CDPHE to establish a grant program to test for lead in

⁴ A link to that guidance is here: <http://www.awwa.org/Portals/0/files/resources/water/USEPALetter.pdf>

⁵ A link to the guidance can be accessed here: https://www.epa.gov/sites/production/files/2016-10/documents/lcr_sample_site_selection_and_triennial_monitoring_wsg200.pdf
https://www.epa.gov/sites/production/files/2016-10/documents/lcr_sample_site_selection_and_triennial_monitoring_wsg200.pdf

public schools' drinking water. The bill also appropriated \$431,803 and 1.3 FTE to CDPHE for the implementation of the act.

Related to the fallout from Flint, the State of Michigan announced on April 14, 2016 that it is proposing lowering the action level for lead to 10 ppb by 2020, requiring the removal of all lead service lines within 10 years, and requiring water utilities to test lead levels in schools and daycares. Advocates are touting this as a model for state regulatory agencies and for the EPA.

There have been several other cities with lead issues in the aftermath of Flint. Schools in Newark, New Jersey, Portland, Oregon and even in Colorado have found high levels of lead. Ohio EPA has [adopted new requirements for the LCR](#) with stricter monitoring and reporting. Pittsburgh [repeatedly exceeded the action level](#) since 2016, requiring them to not only treat their water with orthophosphate but to replace 7% of their lead service lines annually until all are replaced.

Since 2016, several cities and water utilities have implemented public outreach and education programs as well as developed lead service line replacement programs:

List of Lead Service Line Replacement Programs in other cities in the U.S.

1. Philadelphia: Offers a 5-year, 0% interest loan.
<http://www.phila.gov/water/educationoutreach/customerassistance/Pages/HelpLoan.aspx>
2. Cincinnati: Goal is to replace all lead service lines in 15 years. Offers a cost-share program.
https://www.cincinnati-oh.gov/water/assets/File/Lead/2017_Fall_H2Oconnection_Final.pdf
3. D.C. Water: shared pay on public/private side
<https://www.dcwater.com/voluntary-replacements>
4. Louisville: Service line protection plan
<http://www.louisvillewater.com/leadservices>
5. Boston: Credit/Incentive program
http://www.bwsc.org/SERVICES/Programs/Lead_Brochure.PDF
6. Pueblo Water: \$1 monthly service charge, which covers service line repair/replacement up to meter.
https://www.pueblowater.org/images/RulesRegs_section7.pdf
7. Lansing: Replaced last lead line in Dec. 2016
<https://www.detroitnews.com/story/news/local/michigan/2016/12/14/lansing-lead-service-line/95435604/>
8. Milwaukee: Offers 10-year financing options and cost-share for multi-units.
http://city.milwaukee.gov/ImageLibrary/Groups/WaterWorks/Lead-Service-Lines/LSLReplacementProgram_1801011.pdf
9. Madison: Replaced lead pipes in 2001 through credit program
<https://www.cityofmadison.com/water/water-quality/water-quality-testing/lead-copper-in-water>
10. Pittsburgh- Exceeded the LCR Action Level in 2017, and must have an active replacement program
<http://www.post-gazette.com/local/2018/01/26/Lead-pipe-replacement-policy/stories/201801260178>
<http://www.pgh2o.com/replacing-your-lead-serviceline>
11. NYC: Service Line Insurance (supplied by Am Water)
http://www.nyc.gov/html/dep/html/service_line_protection/index.shtml
12. Green Bay, WI: 97% of lead service lines already removed, the remaining with happen over the course of construction activities.
<http://gbwater.org/water-quality/general-lead-information/>

Budget N/A

Alternatives N/A


Approach Denver Water continues to be an industry leader in our lead reduction efforts. Our staff will remain dedicated to finding more efficient methods for lead service line removal and more effective methods for outreach and education. We are committed to provide the Board with updates on our efforts will seek out guidance on policy and budgetary decisions throughout the coming year.

Owner(s) Steve Price Engineering
Alexis Woodrow External Affairs


Attachments

- Letter from CDPHE designating OCCT
- AWWA's formal LCR comments

Respectfully submitted,

DocuSigned by:

06D400A6A1A7431

Steve Price
Engineering Manager

DocuSigned by:

54550730AA00CA2

Alexis Woodrow
Community Relations Specialist

DocuSigned by:

FDB8A4B37EBF6416

Robert J. Mahoney
Chief Engineering Officer

DocuSigned by:

D06201CC9584465

Mike King
Chief External Affairs Officer

DocuSigned by:

2F3F07C4B395420

Thomas J. Roode
Chief Operations Maintenance Officer