



# PORTLAND WATER BUREAU LEAD AND COPPER RULE

April 21, 2016  
Meeting with OHA and EPA  
Part 1



# Presentation Outline

## Morning Presentation:

- Reasons for Revisiting Portland's LCR Program
- System Overview
- Portland's LCR History
- Lead Hazard Reduction Program
- Questions and Discussion

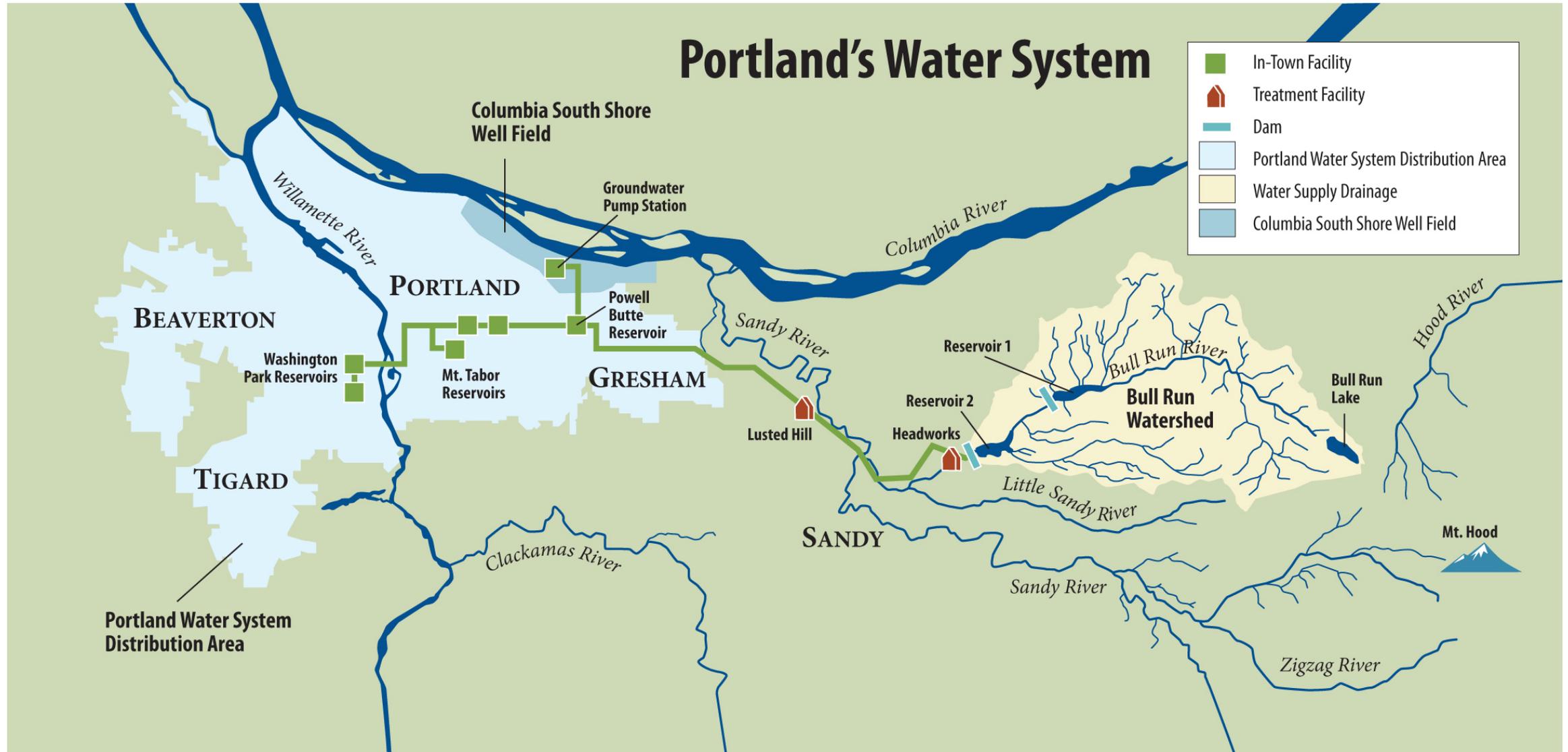
## Afternoon Presentation:

- Corrosion Study
- Next Steps

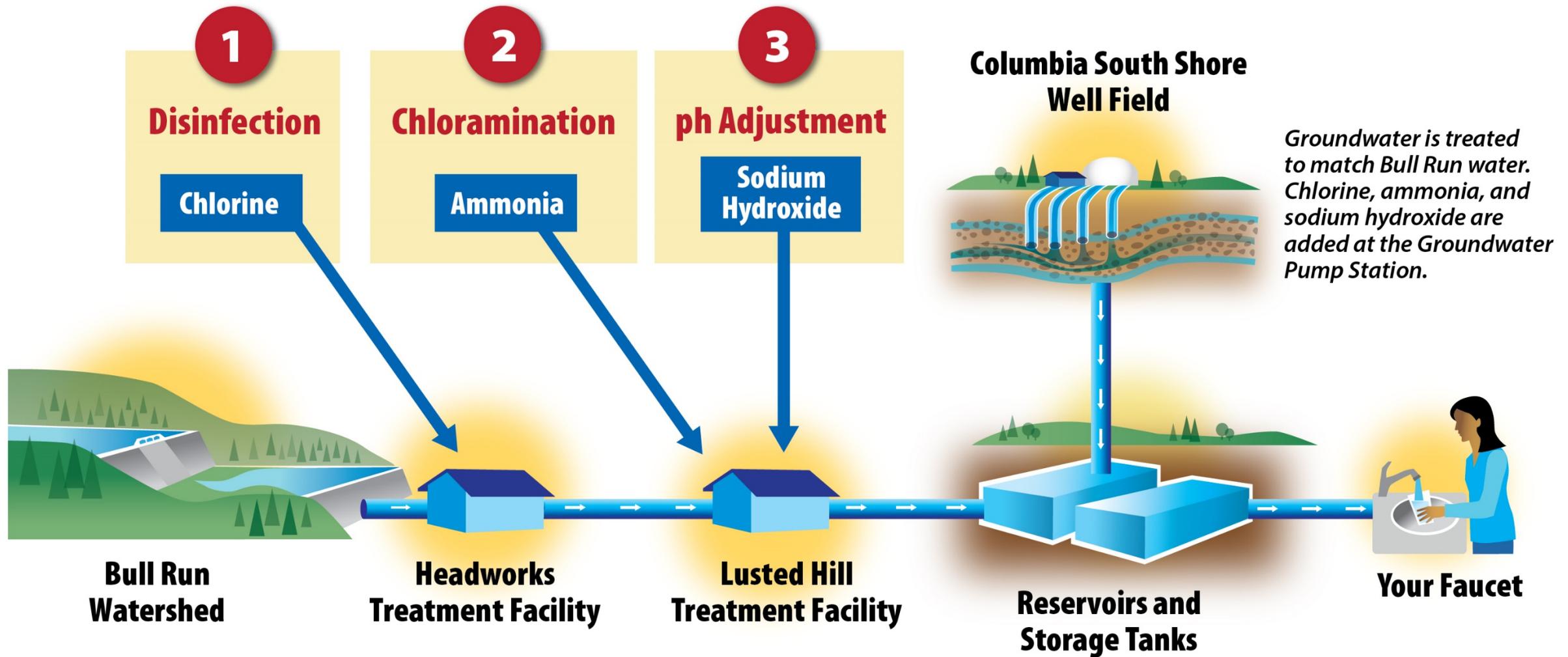
# Reasons for discussing Portland's approach to the LCR

- Open reservoirs coming offline
  - Corrosion treatment enhancements were delayed after receiving treatment variance until Open Reservoir removal is completed.
- LCR Exceedances
  - Fall 2013 PWB (and consecutive systems) exceeded LCR Action Level
  - Since 2014, lead levels have held at 14 ppb.
- Corrosion Study
  - PWB embarked on a distribution system corrosion study in 2014
- Health effects of Lead
  - Lower level of concern (10→5 ug/dL)
  - Better understanding of low level exposures

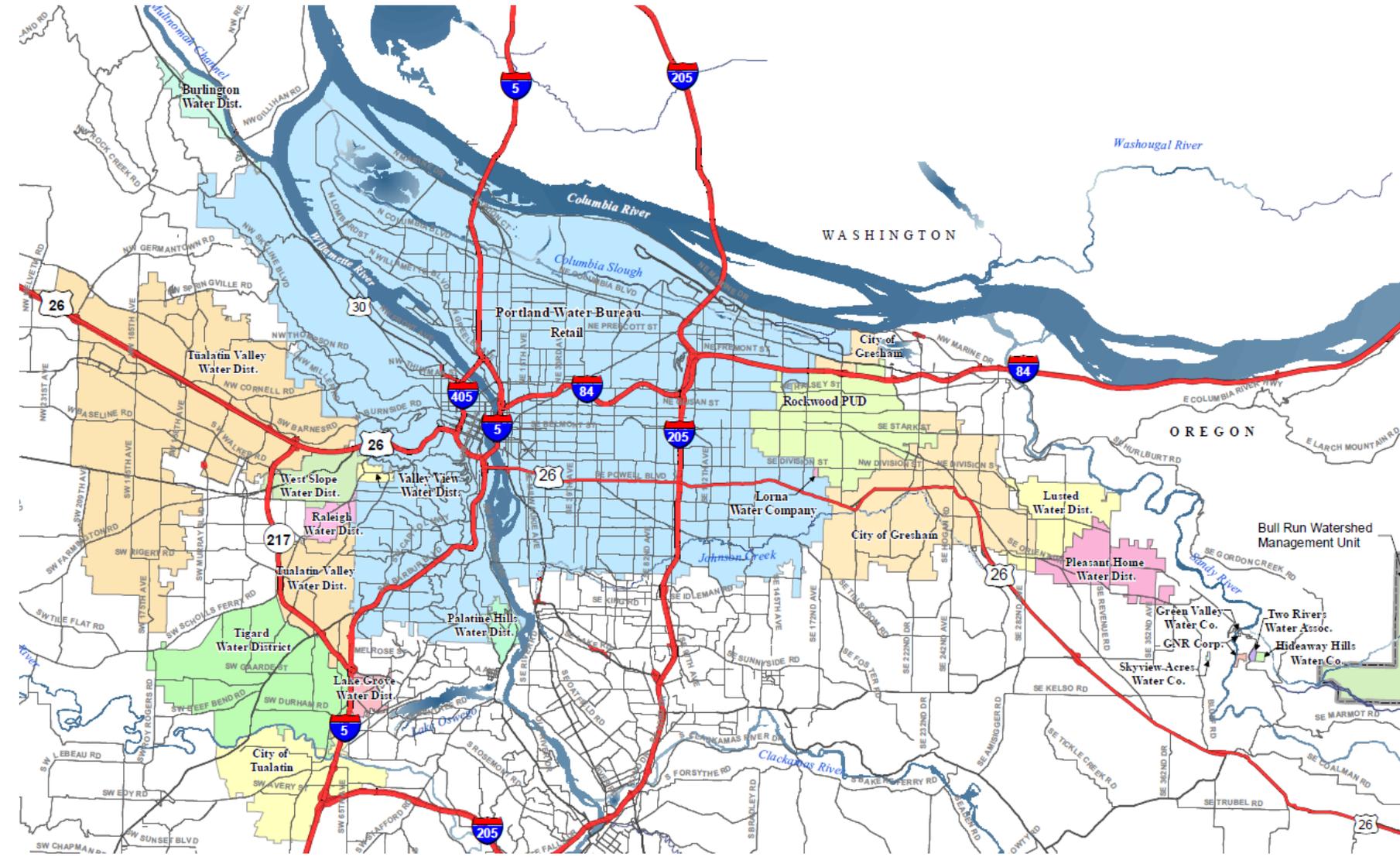
# Service Area and Water Sources



# Supply System Overview



# Service Population & System



## Population

- 958,765 total service
  - 588,365 retail
  - 370,400 wholesale
- 20 wholesale customers

# Sources of Lead in Portland

- Portland never used lead service lines
- Removed all known lead pigtails
- Copper pipes and lead solder - most common in homes plumbed or built from 1970 - 85
- In Portland lead paint is the greatest source of exposure to lead



# Removal of Lead in the Water System

## Lead-based Solder

- Worked with the state of Oregon to ban the use of lead-based solder in water systems in 1985.

## Lead Pigtails

- Completed the removal of all known lead pigtails (>10,000) in the distribution system, 1998. (\$10M)

## Lead-component Meters

- 364 large meters serving schools, hospitals, childcare facilities, community centers, public housing complexes and large apartment building were replaced from 2001-2008.



# Portland's Lead and Copper Rule Timeline

1992: LCR goes into effect

1992: Initial home tap sampling

- Lead = 48 ppb, Copper = 1.5 ppm

1994: Corrosion Control Study

- Optimized Treatment: pH = 9.0-9.5, Alkalinity = 20 mg/L
- 70-85% reduction in lead levels expected

1994: Portland City Council directs the PWB to investigate alternatives to optimal treatment

1997: Portland funds a study to model lead exposure through drinking water

# Conclusions of Lead Exposure through Drinking Water Study

- Drinking water is not the major route of lead exposure in the Portland area.
- Water treatment alone would not sufficiently reduce exposure in homes with significant sources of lead in water.
- Lead-based paint is the most significant source of lead in the Portland area and presents the highest risk.
- Efforts to prevent exposure from lead-based paint could provide significant health benefit to the community.

# Portland's Lead and Copper Rule Timeline

1997: PWB develops a comprehensive approach to corrosion control:  
Lead Hazard Reduction Program

- Water Treatment and Monitoring
- Lead in Water Education and Testing
- Public Education and Community Outreach
- Home Lead Hazard Control Program

1997: The State approves the LHRP as optimized treatment

1997: PWB raises pH from 6.5-7 to 7.5 & implements the state-approved joint monitoring plan

2002: PWB raises pH to 7.8

2002: EPA Technical Advisory Committee (TAC)

- Dr. Michelle Frey, Gregory J. Kirmeyer, Anne Sandvig, Michael Schock, Dr. Vernon Snoeyink, Dr. Rhodes Trussell

# TAC Recommendations

- Confirms pH 9.0, alk 20 as OCCT as a long-term recommendation
- Short-term: Increase pH to 7.8 – 8.0
- Change JMP from consumption based to Tier 1 home based
- Increase monitoring of pH in distribution system
- Investigate nitrification in the distribution system
- Recommended further study of the effect of the open reservoirs, phosphate related issues, analogous systems

# Portland's Lead and Copper Rule Timeline

2005: PWB raises pH to 8.0

2006 & 2013: LCR Tier 1 Home exceedance

2013: Targeted UDF Program

2014: PWB starts Water Quality Corrosion Study

2015: Mt. Tabor disconnected from system

April 2016: PWB meets with OHA and EPA to discuss next steps

# Components of the Lead Hazard Reduction Program (LHRP)

## Water Treatment & Monitoring



pH raised to 8.0

## Lead in Water Education and Testing



Free water testing to all customers in the Bull Run service area

## Public Education and Community Outreach



Raising awareness of all potential sources of lead, focus on highest risks to children

## Home Lead Hazard Control Program



In-home risk assessments, lead hazard reduction measures

# Portland's LHRP: Treatment and Monitoring

Treatment: Sodium Hydroxide pH adjustment to 8.0

Monitoring at Taps – Joint Monitoring Plan with 11 wholesalers

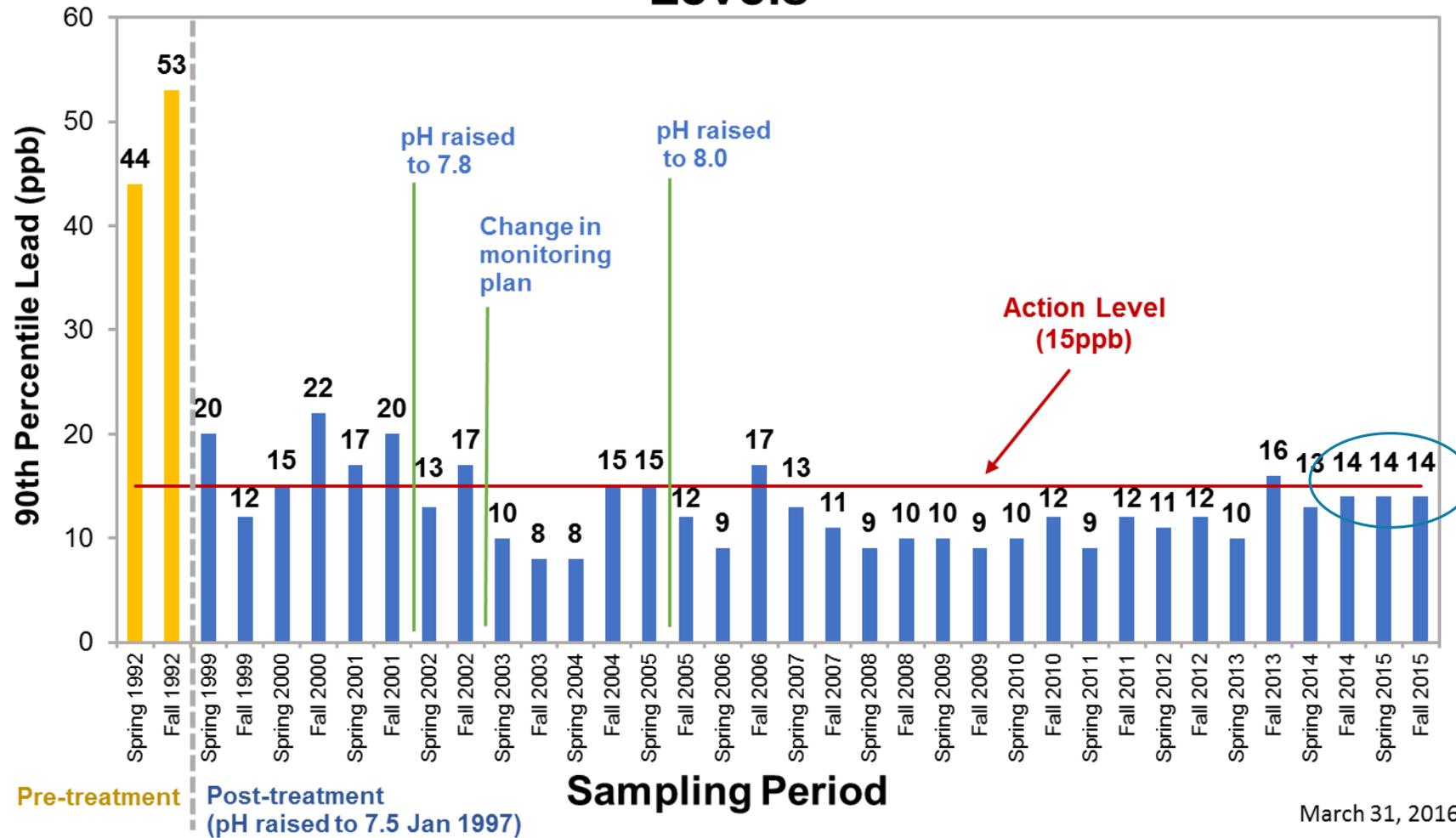
- Every 6 months – minimum 100 “Tier 1” Homes (worst case)

Water Quality Parameter Monitoring

- Daily pH at entry point
- Quarterly pH and alkalinity at 25 sites in Bull Run distribution system
- Collect pH at all TCR sample locations

# Portland's Compliance with the LCR

## Portland Joint Monitoring 90th Percentile Lead Levels



March 31, 2016

# Portland's LHRP: Lead in Water Education & Testing

**A Guide to Lead in Household Plumbing and Your Drinking Water**



**Easy Steps to Reduce Exposure to Lead**

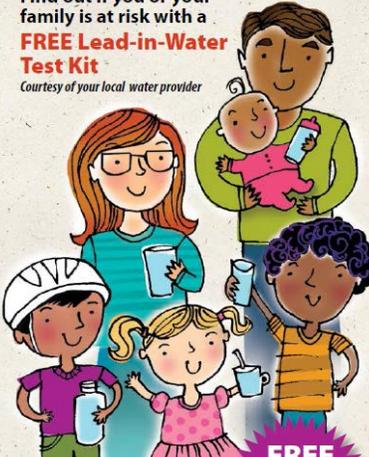


Lead brochure

**Does Your Home Plumbing Contain Lead?**

**If so, your drinking water could have lead in it.**

**Find out if you or your family is at risk with a FREE Lead-in-Water Test Kit**  
*Courtesy of your local water provider*



**FREE LEAD TESTING**  
 DETAILS INSIDE

**Your water provider and local health agencies want to protect your child from lead**

**Prueba de plomo GRATIS - Información en el Interior**  
**БЕСПЛАТНОЕ тестирование воды на предмет содержания свинца - Подробности внутри**  
**Thử chì MIỄN PHÍ - Bản trong có thông tin chi tiết**

LWET mailer

**Reducing Exposure to Lead**

Lead is commonly found in a variety of places throughout our environment. While lead is rarely found in our source waters and there are no known lead service lines in the water system, lead can be found in some homes. In Portland, lead enters drinking water from the corrosion (wearing away) of household plumbing materials containing lead. These materials include lead-based solder used to join copper pipe - commonly used in homes built or plumbed between 1970 and 1985 - and brass components and faucets. Lead in household plumbing can dissolve into drinking water when water sits in those pipes for several hours, such as overnight or after returning from work or school.



**Easy steps to avoid possible exposure to lead from household plumbing**

- **Run your water to flush the lead out.** If the water has not been used for several hours, run each tap for 30 seconds to 2 minutes or until it becomes colder before drinking or cooking. This flushes water which may contain lead from the pipes.
- **Use cold, fresh water for cooking and preparing baby formula.** Do not cook with or drink water from the hot water tap; lead dissolves more easily into hot water. Do not use water from the hot water tap to make baby formula.
- **Do not boil water to remove lead.** Boiling water will not reduce lead.
- **Test your child for lead.** Ask your physician or call the LeadLine to find out how to have your child tested for lead. A blood lead level test is the only way to know if your child is being exposed to lead.
- **Test your water for lead.** Contact the LeadLine at [www.leadline.org](http://www.leadline.org) or 503-988-4000 to find out how to get a FREE lead-in-water test.
- **Consider using a filter.** Check whether it reduces lead - not all filters do. Be sure to maintain and replace a filter device in accordance with the manufacturer's instructions to protect water quality. Contact NSF International at 800-NSF-8010 or [www.nsf.net](http://www.nsf.net) for information on performance standards for water filters.
- **Regularly clean your faucet aerator.** Particles containing lead from solder or household plumbing can become trapped in your faucet aerator. Regular cleaning every few months will remove these particles and reduce your exposure to lead.
- **Consider buying low-lead fixtures.** As of January 2014, all pipes, fittings and fixtures are required to contain less than 0.25% lead. When buying new fixtures, consumers should seek out those with the lowest lead content.

**Protecting Public Health**  
 The Portland Water Bureau's Lead Hazard Reduction program is a comprehensive approach to reduce exposure to lead. Through this program the Portland Water Bureau:

- **Corrosion Control Treatment.** Reduces corrosion of lead in plumbing by increasing the pH of the water. This pH adjustment has reduced lead in tap water by more than half.
- **Lead in Water Testing.** Provides free lead in water testing to everyone, but targets testing the water in households most at-risk from lead in water. These are homes built between 1970 and 1985 with pregnant women or children ages six or younger in the home.
- **Education, Outreach and Testing.** Funds agencies and organizations that provide education, outreach and testing on all sources of lead.
- **Home Lead Hazard Reduction.** Supports the Portland Lead Hazard Control Program to provide grants to minimize lead paint hazards in homes.

**Water Testing**  
 Twice each year the Portland Water Bureau and regional water providers in the Bull Run service area monitor for lead and copper in tap water from a sample group of more than 100 homes. These are homes where the plumbing is known to contain lead solder, and represent a worst-case scenario for lead in water. Samples are collected after the water has been standing in the household plumbing for more than 6 hours. A Lead and Copper Rule exceedance for lead occurs when more than 10 percent of these homes exceed the lead action level of 15 parts per billion. In the most recent round of testing, less than 10 percent of homes exceeded the lead action level.

**LEADLINE**  
 If you are concerned that your home tap water may have lead, contact the LeadLine for a free lead-in-water test kit and to learn ways to reduce your exposure to all sources of lead. **Call the LeadLine at 503-988-4000 or visit [www.leadline.org](http://www.leadline.org).**

- **Free lead-in-water testing**
- **Free childhood blood lead testing**
- **Free lead reduction services**

CCR

The CITY OF PORTLAND Oregon

City Home Government Bureau & Offices of the City of Portland Sign In

**Portland Water Bureau**  
 From forest to faucet, we deliver the best drinking water in the world.  
 GENERAL INFORMATION: 503-823-7404  
 1120 SW Fifth Ave, Suite 800, Portland, OR 97204  
 MORE CONTACT INFO

What We Do Water Quality Reducing Lead Exposure

**Reducing Lead Exposure**



**Sources of Lead**  
 The main source of lead in water in the Portland area is household plumbing. Lead is rarely found in Portland's source waters, and there are no known lead service lines in the distribution system. Lead solder was commonly used in homes built or plumbed with copper pipes before 1985. Lead can also be found in brass plumbing fixtures and components.

When corrosive water stands in plumbing systems that contain lead for several hours or more, the lead may dissolve into drinking water. Water that has been sitting in household pipes that contain lead for several hours, such as in the morning or after returning from work or school, is most likely to contain lead.

**In Portland, the most common source of lead exposure is not from lead in water but from lead-based paint.** Other sources of lead include: household dust, soil, and other household objects such as toys, cosmetics and pottery. For more information on all source of lead, contact the **LeadLine**, 503-988-4000 or [leadline.org](http://leadline.org).

**What You Can Do**  
 Order a free lead-in-water test kit and follow some easy steps to reduce your exposure to lead in water. You can also watch a video PSA from the Multnomah County Health Department about hazards from lead-based paint and dust. Contact the **LeadLine** online, or at 503-988-4000 for more information about lead hazards.

**What the Portland Water Bureau is Doing**  
 The Portland Water Bureau treats the water with sodium hydroxide to raise the pH and reduce the corrosivity of water, provides resources for the reduction of lead exposure from all sources and provides free lead-in-water testing to customers.

**Health Effects of Lead**  
 Lead can cause serious health problems if too much enters your body from drinking water or other sources. It can cause damage to the brain and kidneys, and can interfere with the production of red blood cells that carry oxygen to all parts of your body. The greatest risk of lead exposure is to infants, young children, and pregnant women. Scientists have linked the effects of lead on the brain with lowered IQ in children. Adults with kidney problems and high blood pressure can be affected by low levels of lead more than healthy adults. Lead is stored in the bones, and it can be released later in life. During pregnancy, the child receives lead from the mother's bones, which may affect brain development.

Website

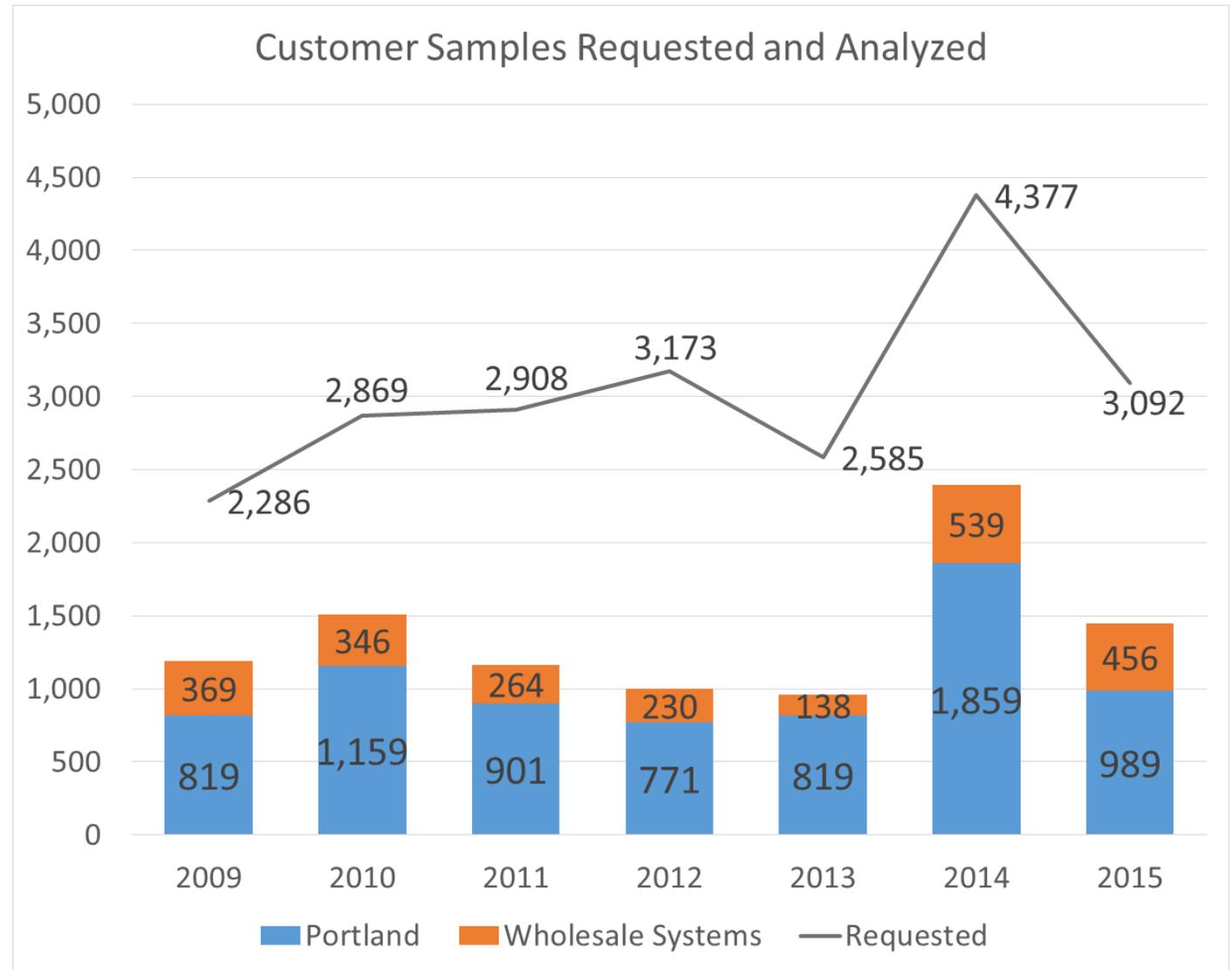
# Portland's LHRP: Lead in Water Education & Testing

## Customer Sampling

2015 90<sup>th</sup> Percentile

Portland: 4.4 ppb

Wholesalers: 9.8 ppb



# Portland's LHRP: Lead in Water Education & Testing

## Customer Sampling

Follow up with customers who have results above 15 ppb:

- Direct contact: phone call
- Easy steps to reduce exposure
- Offer running and faucet and plumbing standing samples

2010-2015 customers who collected a single set of running and standing samples and had a result above the action level in the standing sample (n=67).	
Percent of homes that saw a reduction in the running sample.	100%
Percent of homes that saw an 90% or better reduction in the running sample.	85%
Percent of homes that saw an 80% or better reduction in the running sample.	96%
Percent of homes that went from above the action level to below the action level.	97%
Average percent reduction.	93%

# Portland's LHRP: Public Education and Community Outreach

## **Examples of programs funded by the LHRP:**

LeadLine - centralized resource

Blood Testing

Paint Stabilization in Schools

Lead Poisoning Prevention Workshops

Soil testing for lead contamination

Trainings

Home Investigations

Equipment Lending

Outreach at community events

Playground equipment replacement

# LHRP Community Grant Stats

## Since 2004:

**19,800** tenants have received lead information through Community Alliance of Tenants' Renters' Rights Hotline

**6,816** people have attended a Community Energy Project lead workshop

**14,090** landlords have been reached by Fair Housing Council of Oregon

**996** soil samples have been tested for lead through Growing Gardens

**7,600** new and expecting mothers have received lead information from the International Center for Traditional Childbirth

**40,500** people have called or emailed the LeadLine

**12,625** blood lead level tests

**98** pieces of playground equipment with lead paint were replaced by Portland Parks and Rec

**186** paint stabilization projects have been completed by Portland Public Schools

# Portland Housing Bureau Home Lead Hazard Control Grant Program

Since 2001, LHRP funds have been used as local match to receive 5 HUD grants

Year Awarded	Amount	Units Completed	Number of Kids
2001	\$3,000,000	318	636
2004	\$3,000,000	281	625
2006	\$3,000,000	335	700
2009	\$4,000,000	529	1,000
2013*	\$3,000,000	118	118
TOTAL	\$16,000,000	1,543	3,061

\*As of 3/24/2016

# LHRP Evaluation

Program Design and Evaluation Services (PDES) group will be conducting an evaluation of the LHRP during FY 2016-17.

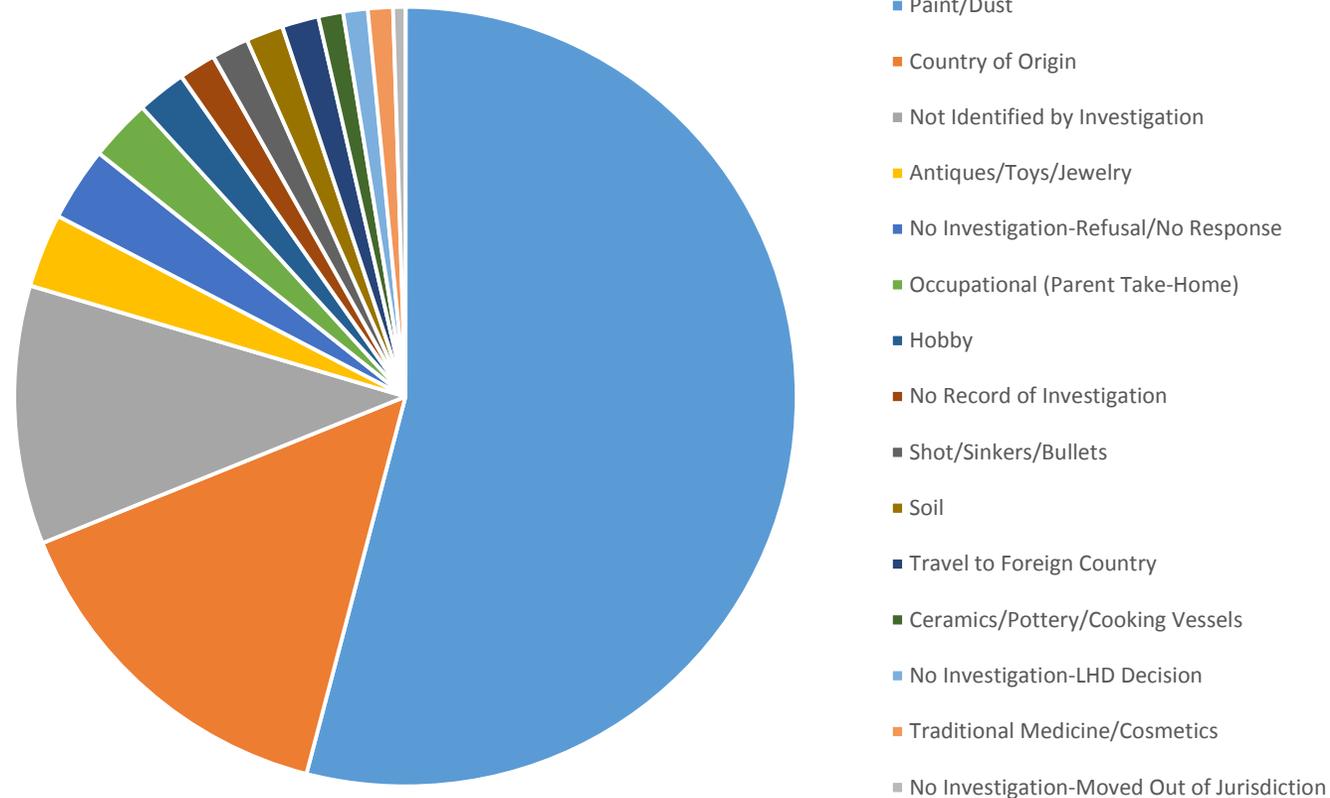
PDES is a partnership between OHA and MCHD

Questions posed by the evaluation:

- Are the LHRP partner organizations raising awareness and knowledge about lead hazard risks in the community?
- Do partner organizations improve knowledge about and use of resources for reducing lead exposure?
- Are the LHRP partner organizations targeting and reaching the most at-risk populations in the Portland community for lead exposure?

PDES will provide a final report to the Water Bureau in Fall 2017.

# Multnomah County Health Department EBLL Investigations (Jan. 2013 – March 2016)



Probable Source	Number
Paint/Dust	106
Country of Origin	29
Not Identified by Investigation	21
Antiques/Toys/Jewelry	6
No Investigation-Refusal/No Response	6
Occupational (Parent Take-Home)	5
Hobby	4
No Record of Investigation	3
Shot/Sinkers/Bullets	3
Soil	3
Travel to Foreign Country	3
Ceramics/Pottery/Cooking Vessels	2
No Investigation-LHD Decision	2
Traditional Medicine/Cosmetics	2
No Investigation-Moved Out of Jurisdiction	1

# Reporting

Data/Report	Reported to	Frequency
Tier 1 Home Monitoring Compliance Reports	OHA	Every 6 months
LHRP Update	EPA and OHA	Twice a year
Customer Results	Customer	As results are received from lab
Customer Results	OHA	Annually
Compliance Results	Posted to website	Updated as needed

# LCR Long-Term Revisions Applied to Portland

Recommendations from LCRWG/NDWAC:

- 1- Replace Lead Service Lines
- 2- Stronger Public Education
- 3- Improve Corrosion Control Treatment
- 4- Modify Monitoring Requirements
- 5- Health-based Home Action Level
- 6- Establish Separate Requirement for Copper

# EPA recommendations

## Website Disclosure

- Lead sampling protocols
- Lead sampling results
- Lead service line inventory information

## Tier 1 Home Sampling

- Pre-stagnation flushing
- Appropriate sample bottles
- Aerator removal

## Customer Notification

- Immediate notification of excessive levels

# Near-term Actions

- Water Quality Corrosion Control Study
- Taking open reservoirs offline
- Continued nitrification control measures
- Continued targeted UDF
- Work with schools and daycares

Questions?



# PORTLAND'S WATER QUALITY CORROSION STUDY

April 21, 2016  
Meeting with OHA and EPA  
Part 2



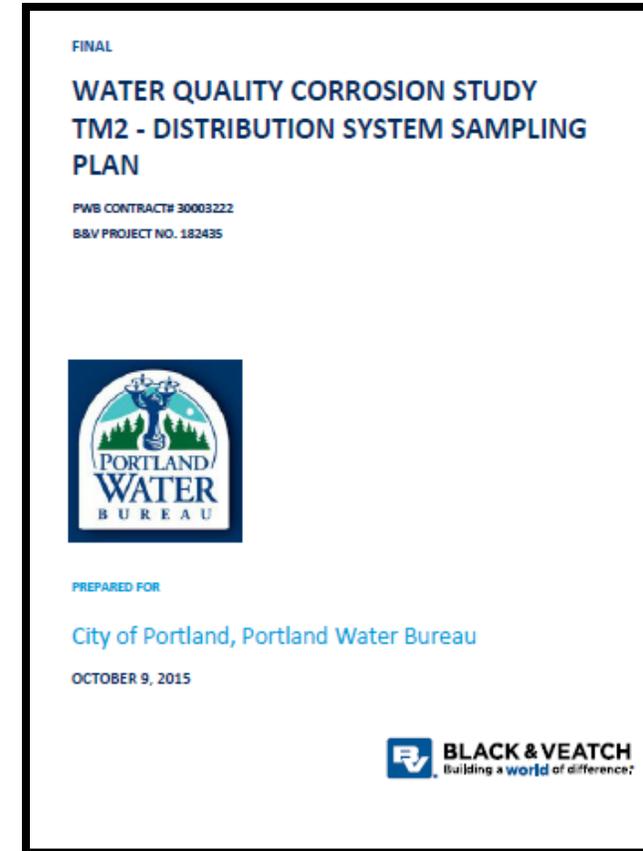
# PRESENTATION OUTLINE

## Corrosion Study

- Background
- Project Objectives
- Study Plan

## Corrosion Control Decision

- Decision
- Treatment Considerations
- Schedule



# WATER QUALITY CORROSION STUDY

## OBJECTIVES

\$240,000 project with B&V

Project objectives include:

- Better understand the causes of lead release in PWB's system
- Identify data gaps and conduct additional sampling required to better understand the role of water quality on lead release
  - *Is uniform corrosion contributing to lead observed in LCR samples?*
  - *Is scale release (caused by hydraulic or physical disturbances) or dissolution (caused by chemical changes) contributing to lead observed in LCR samples?*
  - *What premise plumbing and fixture materials are contributing to lead release for PWB customers?*
  - *Is nitrification or other microbiological activity contributing significantly to lead release?*
  - *What impact does the use of groundwater have on lead release?*
  - *Are operational changes affecting lead release in the distribution system? If so, how?*

# WATER QUALITY CORROSION STUDY OBJECTIVES (CONT.)

Convene a panel of utility, consultant, and academic experts to be a technical advisory committee for this study

- List of TAC panel members:

Dan Giammar (Washington University),  
Rick Sakaji (EBMUD),  
Salmone Freud (NYCDEP),  
Melinda Friedman (Confluence Engineering),  
Mark Knudson (TVWD)

This is not a treatment study

- Any significant changes to treatment would require pilot testing



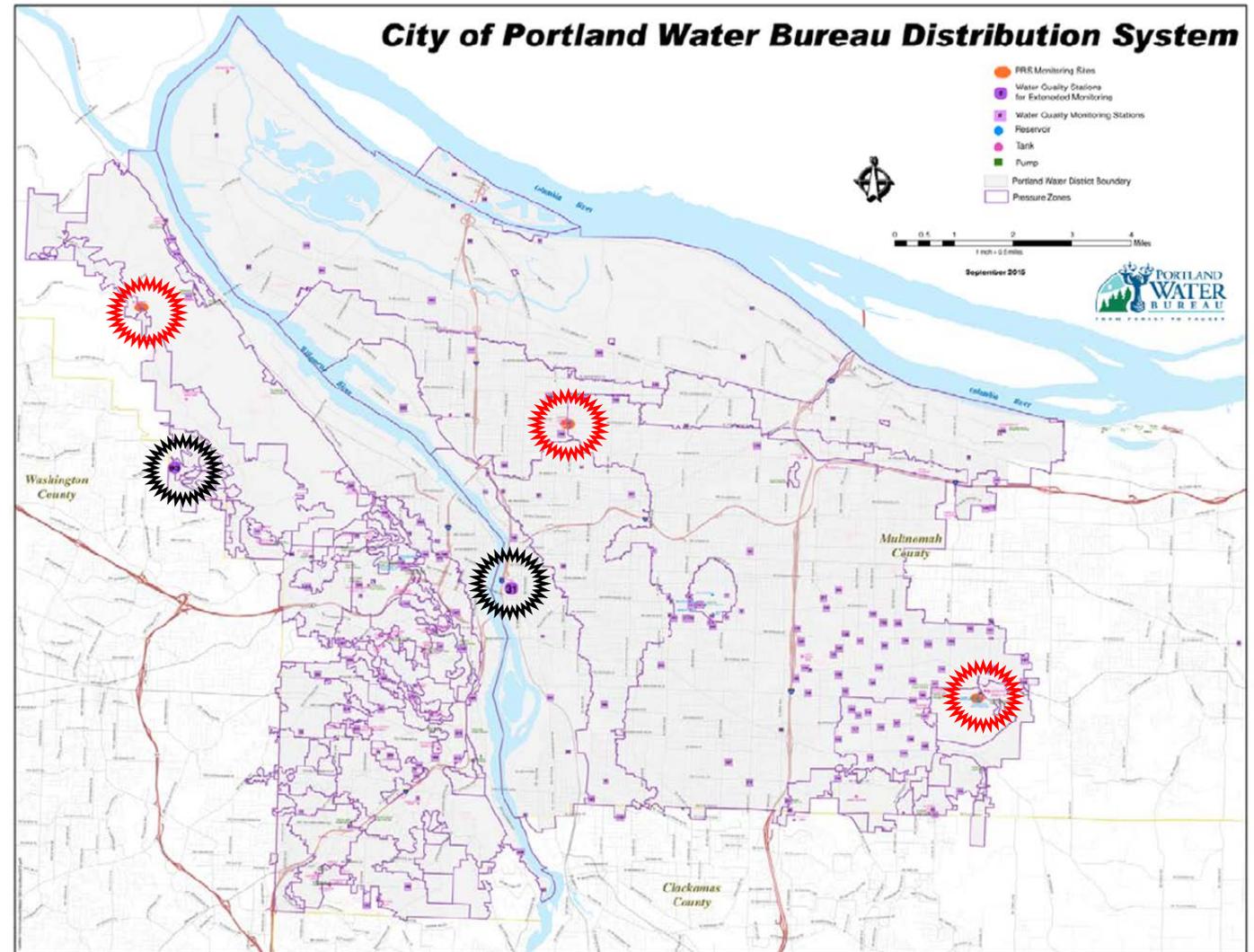
# CORROSION SAMPLING PLAN

Weekly sampling over the course of a year in the distribution system

- 3 Process Research Solution (PRS) Monitoring Stations were installed
- 2 distribution system sites

Follow-up sampling at select LCR and customer homes

- Goal is to sample ~ 50 customer homes as well as several of PWB's Tier 1 homes with elevated lead levels



= PRS Stations



= Distribution system sites

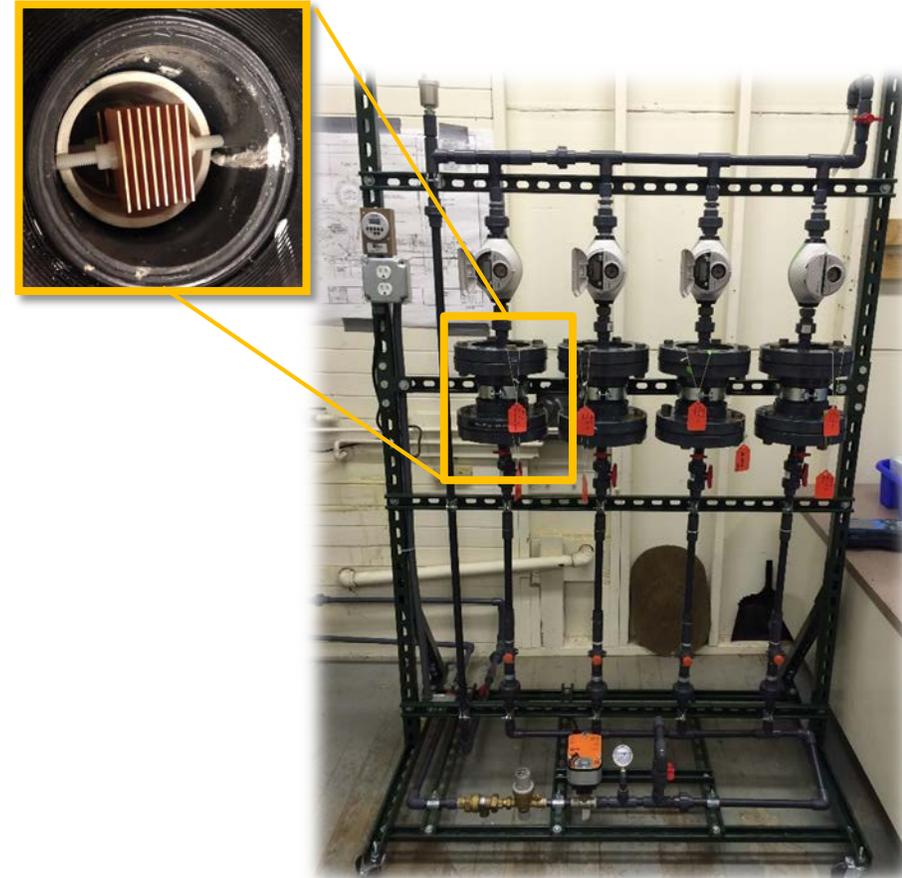
# PRS STATIONS

These stations allow for controlled stagnation cycles to replicate worst case water quality as seen in customer homes

- Previous PRS monitoring station results have tracked well with LCR first draw samples in other systems

Each station includes four stagnation chambers, each containing different metals types

- Copper with Lead Solder
  - Represents material commonly found in Portland Tier 1 homes
- Galvanized Iron
  - Galvanized iron plates represent indoor piping and plumbing fixtures commonly found in Portland homes
- Brass
  - Similar to galvanized iron, brass plates represent indoor piping and plumbing fixtures commonly found in Portland homes
- Lead
  - Even though PWB does not have lead service lines, lead is used in order to magnify the response of lead to the water characteristics



# PARAMETERS MONITORED AS PART OF THE WATER QUALITY CORROSION STUDY

## Field

- pH
- Temperature
- ORP
- Chlorine residual
- Monochloramine
- Free ammonia
- Turbidity
- Conductivity
- ATP

## Lab

- Total and dissolved metals
  - lead, copper, aluminum, arsenic, cadmium, calcium, chromium, cobalt, iron, magnesium, manganese, nickel, zinc
- Total organic carbon
- Dissolved organic carbon
- Total phosphorus
- Alkalinity
- Hardness
- Chloride
- Sulfate
- Nitrate
- Nitrite
- TDS



# WATER QUALITY CORROSION STUDY PROJECT TIMELINE

**May 2014**

Black and Veatch started work on the corrosion study

**June 2015**

Technical Memo 1 Completed

**Nov 2015 – Jan 2017**

Distribution System Sampling

- April 2016: Q1 Report
- July 2016: Q2 Report
- Oct 2016: Q3 Report
- Jan 2017: Q4 Report

**Oct 2014**

Workshop 1 Held at PWB

**Oct 2015**

Technical Memo 2 Completed

**Mid 2017**

Water Quality Report Due

# CORROSION CONTROL DECISION

## KEY DATES

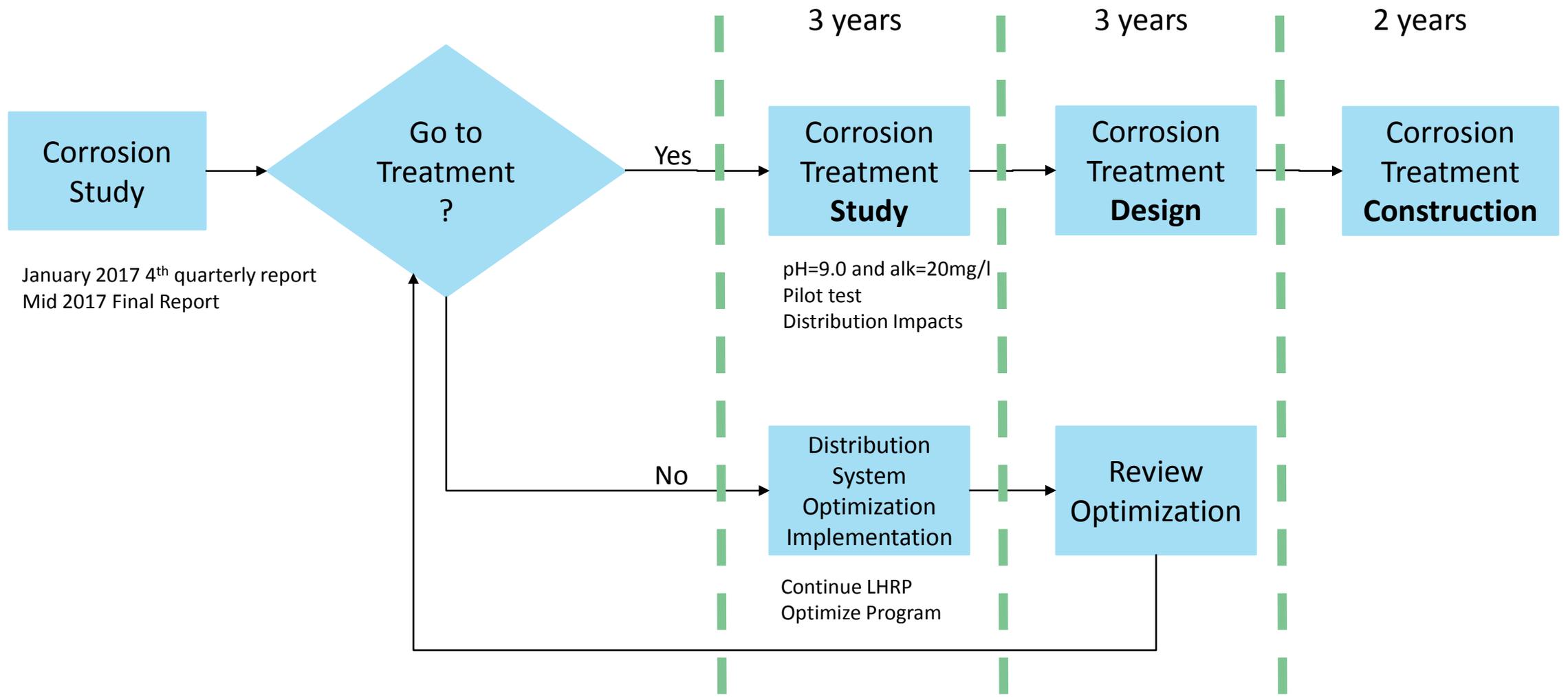
Summer 2016: Washington Park disconnected from system

January 2017: 4<sup>th</sup> quarterly sampling report for corrosion study

Mid 2017: Results from corrosion study

January 1, 2020: Washington Park reservoir online

# CORROSION CONTROL DECISION DECISION TREE



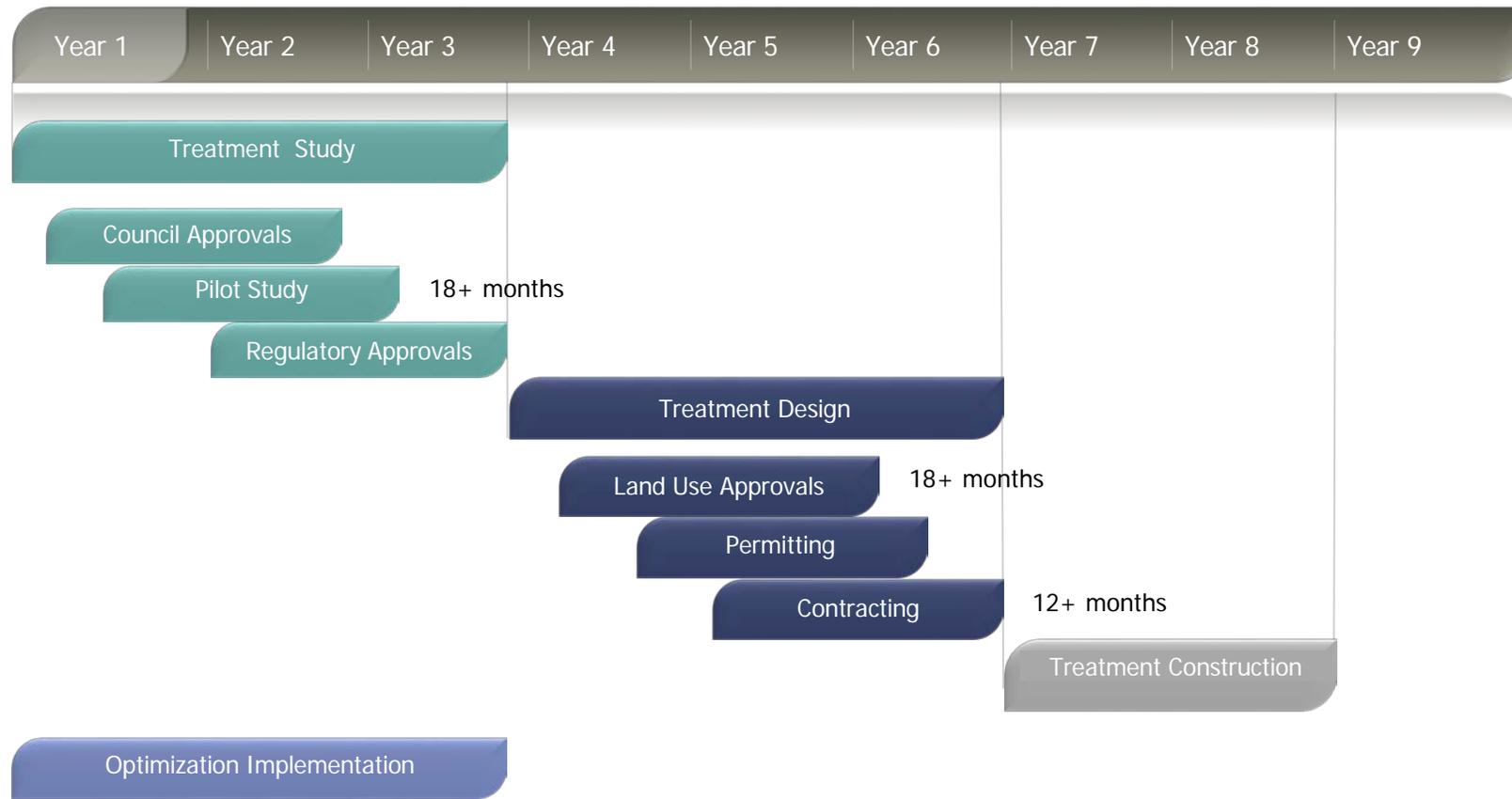
# CORROSION CONTROL DECISION TREATMENT CONSIDERATIONS

- Meet OCCT requirement of LCR
- Reduce corrosiveness of our water
  - Reduces lead and copper
  - Potentially extend useful life of our pipes
- Water should become more stable
  - System pH would be more consistent
  - Potential for greater formation of monochloramines above pH 8
- WQ Impacts – want to avoid unintended consequences
  - Potential red water
  - DBPs – THMs might increase, but HAAs might decrease
  - Aesthetics
  - Unknown

# CORROSION CONTROL DECISION TREATMENT CONSIDERATIONS

- Adding chemicals to Portland's water (Fluoride experience)
- Possible reduction in public health benefit if reduction of other sources of lead exposure is no longer funded
- Discharge issues
- Schedule
  - Next Slide
- Cost
  - Capital: approximately \$15 Million
  - Operational: will be higher (chemicals, staffing, flushing)

# CORROSION CONTROL DECISION SCHEDULE CONSIDERATIONS



# Discussion

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