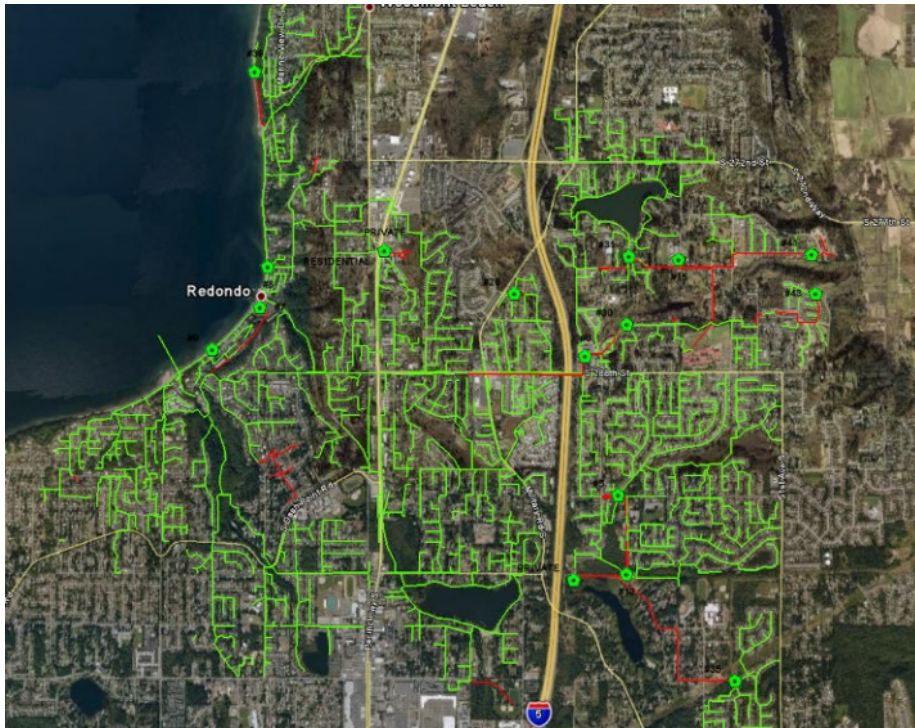


CIPP Lining for Infiltration Reduction and Asset Renewal

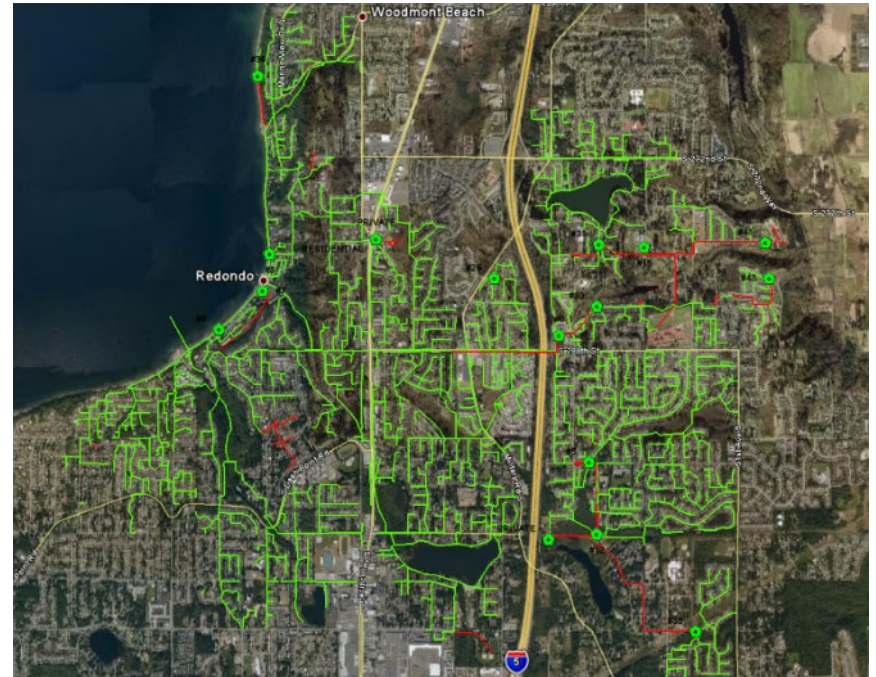


October 3, 2019



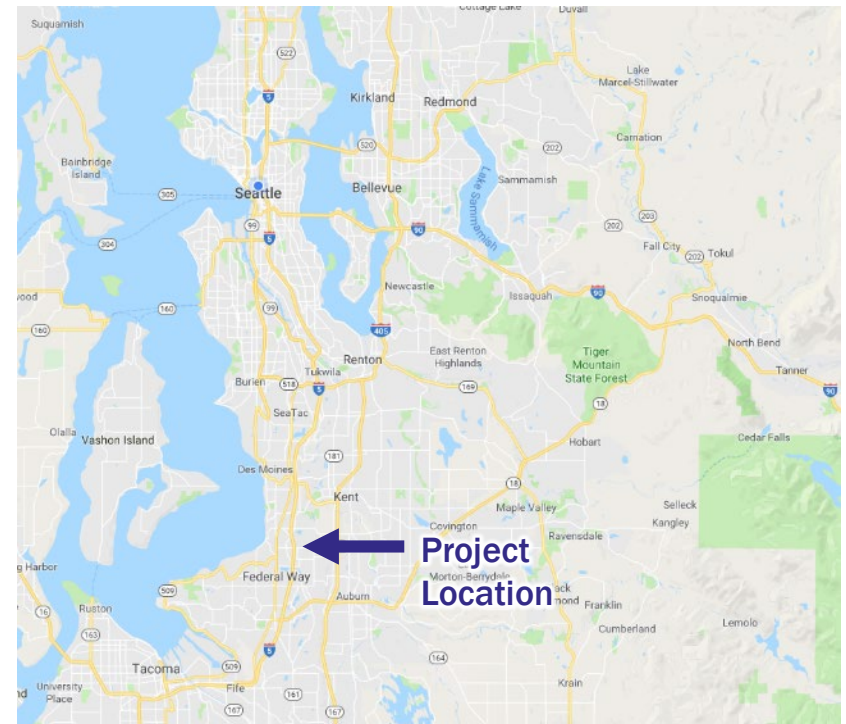
Agenda

- Location and Issues
- Planning and Decisions
- Public Outreach Process
- Project Bidding
- Construction
- Final Construction Statistics and Cost
- Post Construction Monitoring
- Thoughts on Private Property



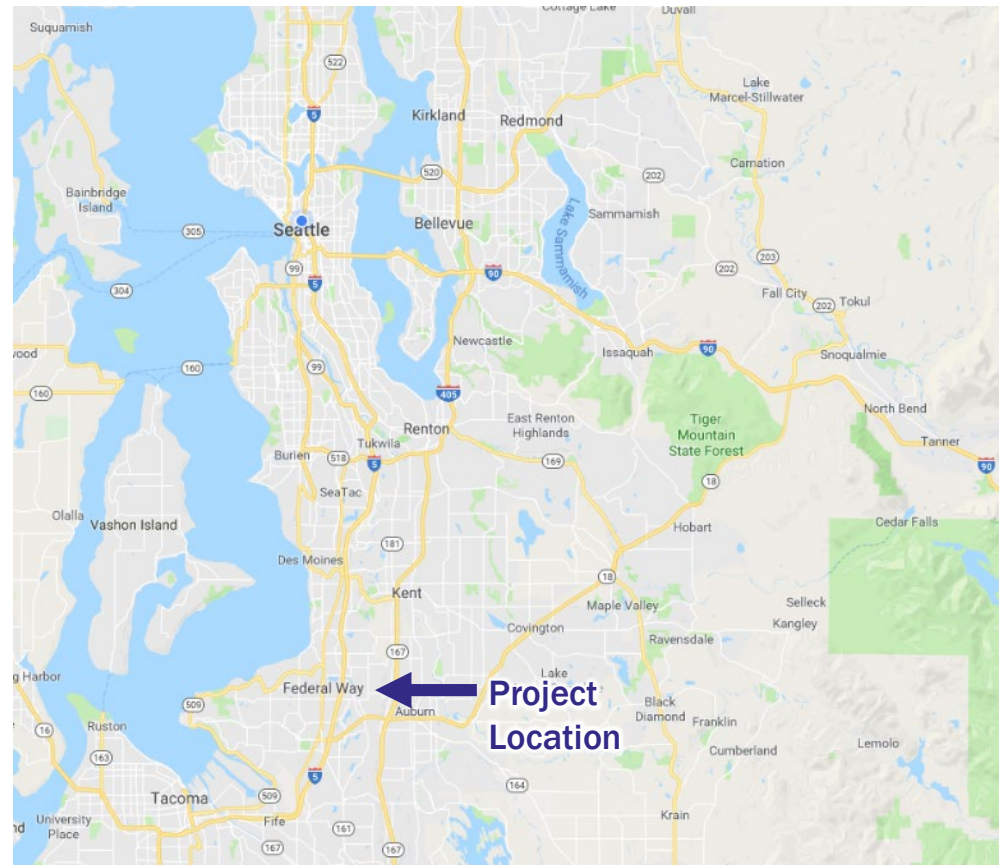
Project Location and Issues

- Lakehaven Water and Sewer District (LWSD)
 - 2 WWTPS
 - Redondo WWTP
 - Lakota WWTP
 - 32 pump stations
 - 312 miles of separated sewer pipes



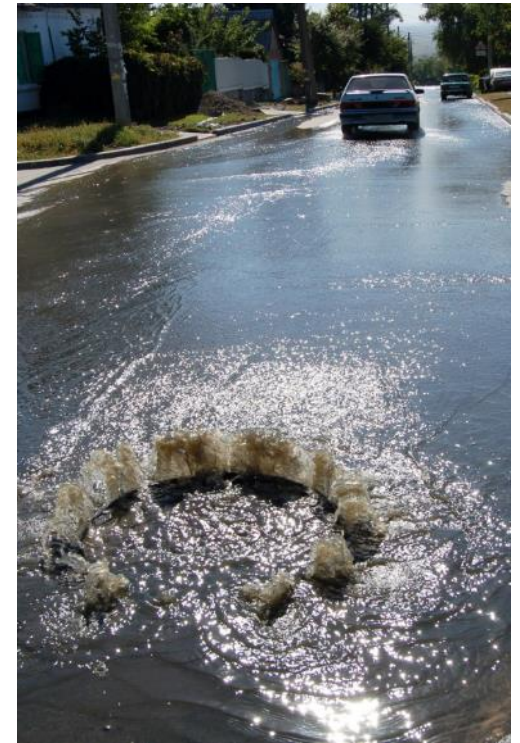
Project Location and Issues

- Lakehaven Water and Sewer District (LWSD)
 - 2 WWTPS
 - Redondo WWTP
 - Lakota WWTP
 - 32 pump stations
 - 312 miles of separated sewer pipes
 - Aging infrastructure leading to increased treatment and O&M costs



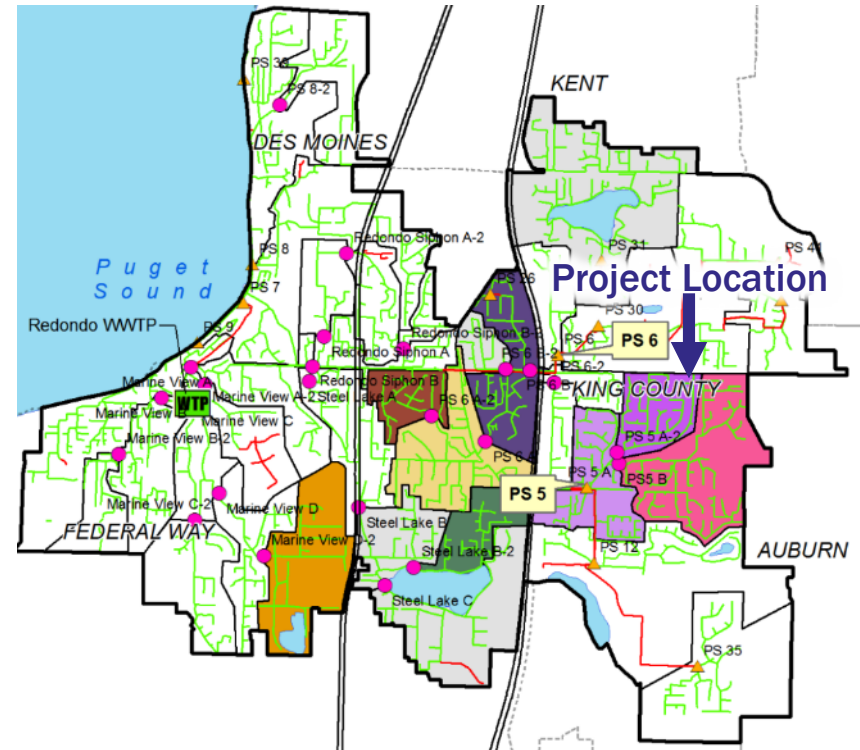
Why is I/I an Issue?

- Increases peak flows >14 fold
- Risk of sanitary sewer overflows (SSOs) and basement backups
- “Steals” system, treatment, and outfall capacity
- Increases operational costs
- Dilutes/coolers sewage <200 mg/l
 - 85% removal rule lowers effluent limits
- Element of NPDES permit
- Problem increases as system ages



Development of a Program

- BC developed I/I program goals and identified project location
- Completed 2 years of flow monitoring
- Developed a prioritization method to meet identified goals

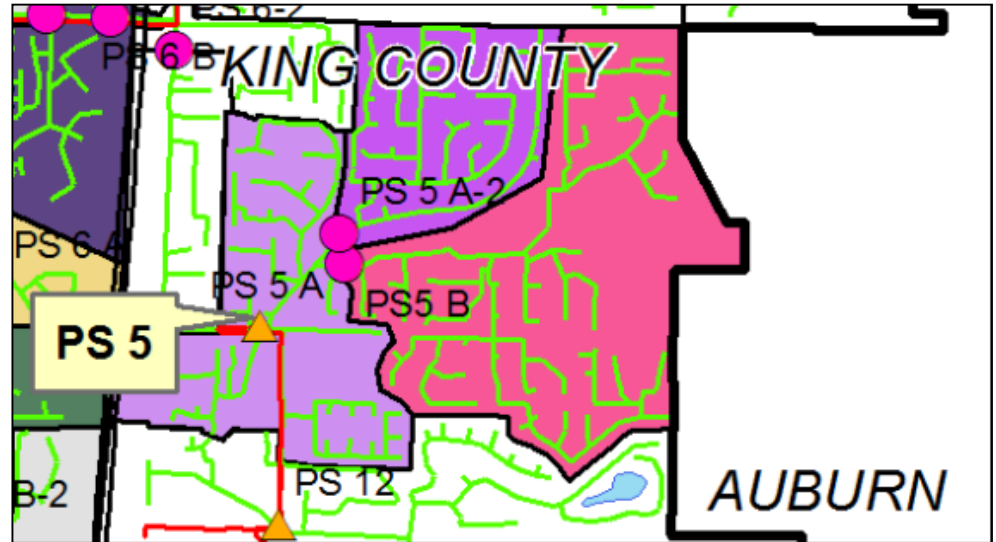


Program Goals

1. Meet hydraulic capacity of Redondo WWTP
2. Reduce flows to protect against SSOs
3. Reduce flows to EPA and WA Ecology I/I guidance
 - <120 gpcd wet season dry weather flow rate
 - <275 gpcd peak wet weather flow rate
 - Pump Station Capacity
4. Meet industry target goals
 - <1,500 gpad within drainage basins

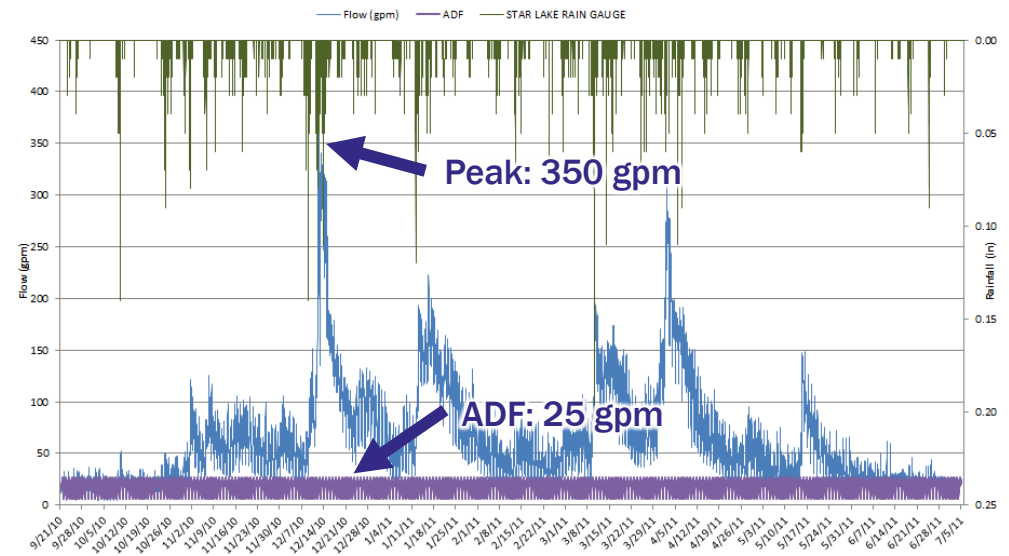
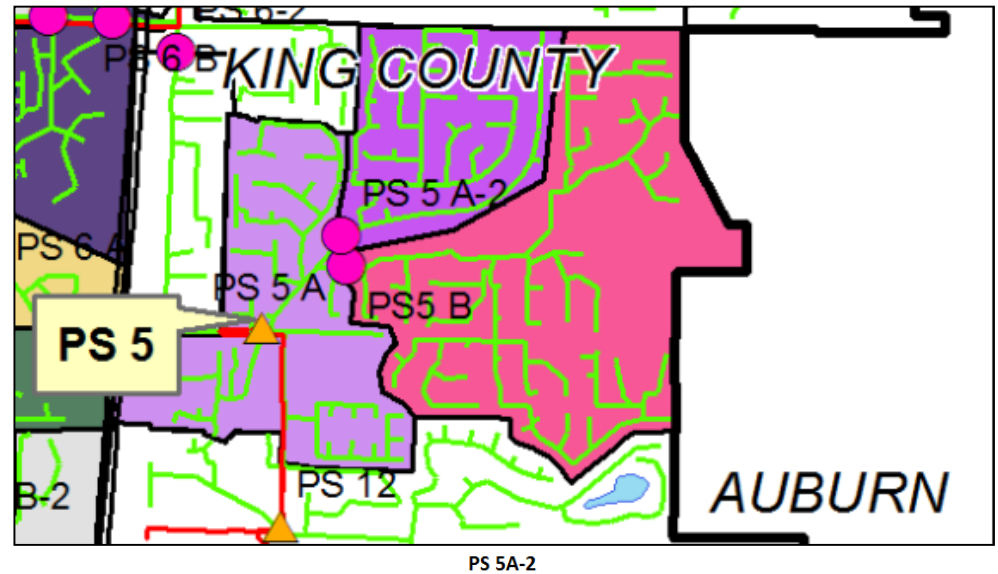
Pump Station 5

- Highest I/I rates
- Repeated wet-weather SSOs
- Aging assets (1960s vintage concrete pipes)



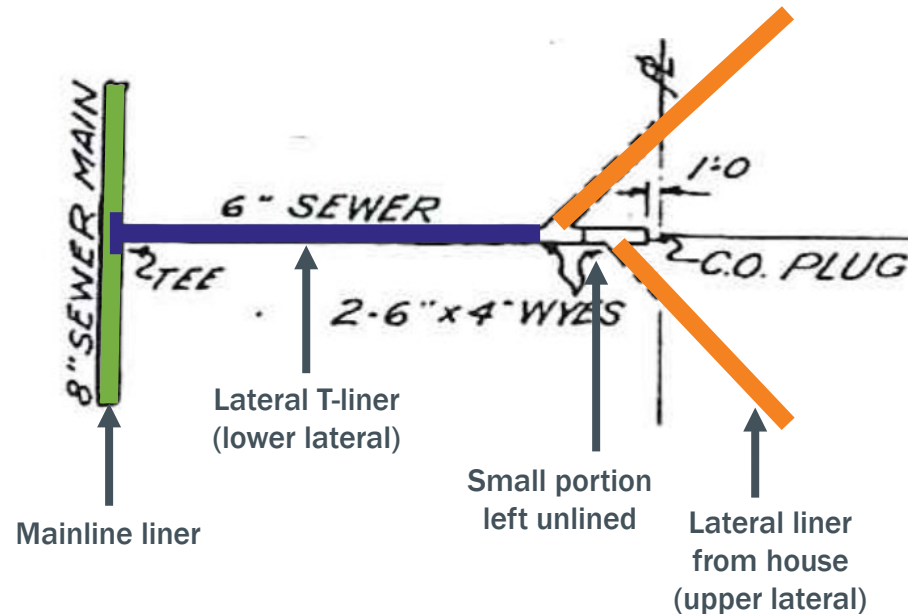
Pump Station 5A-2

- PS5 sub-divided into 3 areas
- Area A-2 chosen for pilot program
 - Reduce infiltration
 - Renew aging assets



Pilot Project Planning and Decisions

- Needed to address side sewers
 - District funded side sewer work to maximize participation
- Access required ROE permits
 - 75-80% of ROEs needed to proceed with construction



Lining of Shared Side Sewers

Public Outreach Process

- Necessary to inform neighborhood and gain acceptance
- Methods:
 - Mailer
 - Door-to-door contact
 - Public Meeting at local High School
- Coordination through construction

Lakehaven WATER & SEWER DISTRICT
 LAKEHAVEN WATER AND SEWER DISTRICT
 31627 1st Ave South • P.O. Box 4248 • Federal Way, Washington 98003-4248
 Federal Way: 253-945-1516 • Tacoma: 253-927-2922
 www.lakehaven.org

LAKEHAVEN SANITARY SEWER INFILTRATION REDUCTION PILOT PROJECT
 April 26, 2017

Dear Resident or Property Owner:

As you were previously notified, Lakehaven Water and Sewer District (LWSD) is initiating a pilot project in your neighborhood to evaluate a technique for reducing wet weather infiltration into the sanitary sewer system that occurs in the area during periods of wet weather.

The pilot project is planned for the sewer system upstream of the intersection of 42nd Street, S 290th S, 42nd Avenue S, S.

Lakehaven WATER & SEWER DISTRICT
PERMISSION TO ENTER PRIVATE PROPERTY

PROJECT: LWSD Sewer Infiltration Reduction Pilot Project

RECITALS

- Lakehaven Water and Sewer District (LWSD) is performing a pilot project (Project) that will evaluate the effectiveness of fitting sewer mains and private side sewers to reduce infiltration in a limited area of study in the Camelfoot neighborhood.
- As part of this study, LWSD will line sewer main lines and side sewers within the area of study to seal them from infiltration. In order for this study to be successful, private side sewers must be in a state of decay repair prior to sealing, and new cleanouts may need to be installed on the side sewer.
- By signing this Permission to Enter Private Property ("Agreement"), the Owner of the property intends to allow LWSD and/or contractors working on LWSD's behalf, to perform the following work on the owner's property:
 - Use internal cameras for inspection of the private property side sewer
 - Side sewer cleaning and root cutting, as necessary
 - Installation of a new cleanout on the existing side sewer at a location on the homeowner's property, located as close to the house as possible, as necessary
 - Side sewer repairs as necessary (open excavations)
 - Curbed-in-lance pipe (CIP) lining of the side sewer

MAILER
 This mailer will be placed on your property to inform you of the project and to request your permission to enter your property. It will also contain information about the project and how you can participate. It will be placed on your property on or about May 1, 2017. It will be placed on your property on or about May 1, 2017. It will be placed on your property on or about May 1, 2017.

Lakehaven WATER & SEWER DISTRICT
Lakehaven Sewer Rehabilitation Pilot Project

THE PROJECT
 Lakehaven Water and Sewer District (LWSD) is in the beginning phase of a capital program to improve the sewer system within the Tukwila Wastewater Treatment Plant collection area. As part of that program, LWSD is planning a pilot project to reduce the amount of groundwater leaking into the sewer system. This leakage, called infiltration, comes from pipes or cracks in the main sewer, manholes, and the side sewers from private homes. This project will substitute more sewers, manholes, and cleanouts in the pilot area.

LOCATION
 The pilot project is planned for the sewer system upstream of the intersection of 42nd Avenue S and S 290th Place. The include houses along S 381st Street, S 390th Street, S 399th Place, S 398th Place, S 399th Street, 41st Avenue S, 42nd Avenue S, and 42nd Place.

YOUR PARTICIPATION IS KEY!
 The pilot project will help LWSD design and evaluate future infiltration projects and policy recommendations. Sewer infrastructure will improve, just side sewer function and service the way will help LWSD determine whether the technology will be a viable tool to reduce infiltration and wastewater flows in the sewer system. There are several ongoing reasons for participation in the pilot project.

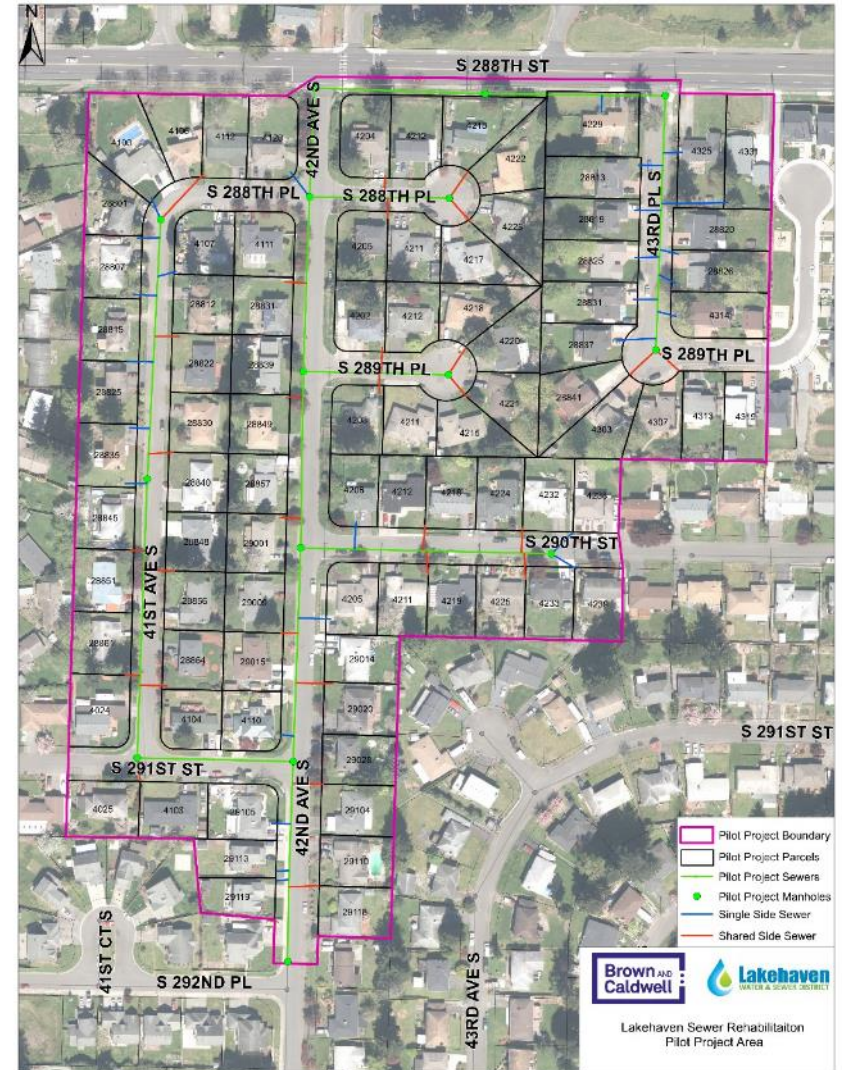
- A significant cost savings:** Reducing infiltration is the responsibility of the homeowner and not the District. If you fail, this pilot project will help LWSD determine whether the technology will be a viable tool to reduce infiltration and wastewater flows in the sewer system. There are several ongoing reasons for participation in the pilot project.
- A long term solution:** Reducing infiltration is the responsibility of the homeowner and not the District. If you fail, this pilot project will help LWSD determine whether the technology will be a viable tool to reduce infiltration and wastewater flows in the sewer system. There are several ongoing reasons for participation in the pilot project.
- An answer to your property:** Having the work done on your property is a more cost-effective and less disruptive way to improve your sewer system. It also allows you to schedule the work around your own schedule. It also allows you to schedule the work around your own schedule. It also allows you to schedule the work around your own schedule.

All participating homeowners will need to complete a Third-Party Entry (TPE) form. Please send yours for review by June 1st.

For further information:
 Sue M. Ray, P.E.
 LWSD Engineering Manager
 353 9th Ave S-500
 sray@lakehaven.org

Project Overview

- Bidding
- Pre-lining work
 - Pre-inspection
 - Cleanout installation
- Mainline lining
- Upper lateral lining
- Lower lateral lining



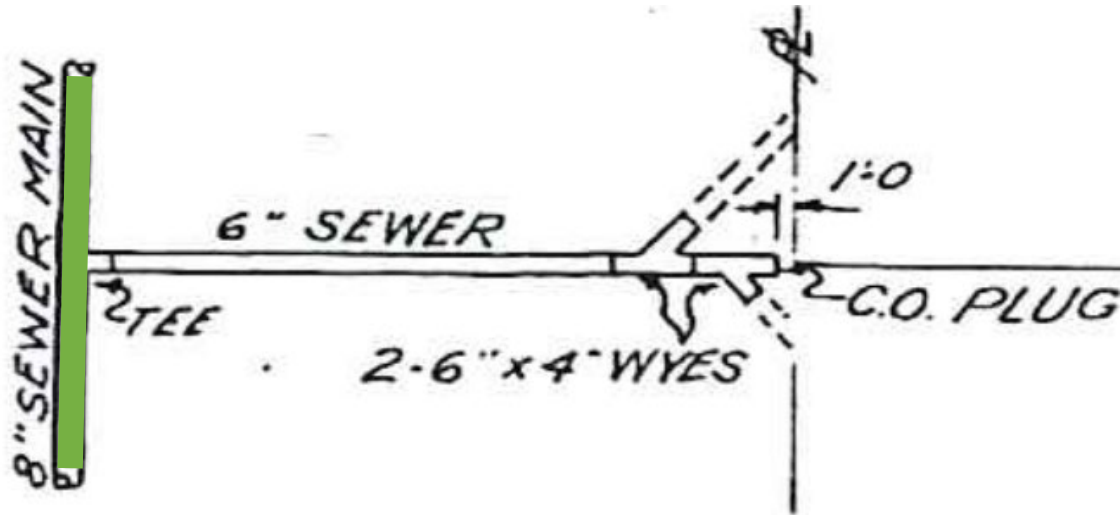
Pre-Lining Work

- CCTV of mainline and side sewers
- Cleanout locations
- VAC-A-TEE cleanout installations



Mainline Lining

- UV Lining Process



Mainline Lining

- UV Lining Process:
 - Side sewer locations measured



Side sewer location measurement

Mainline Lining

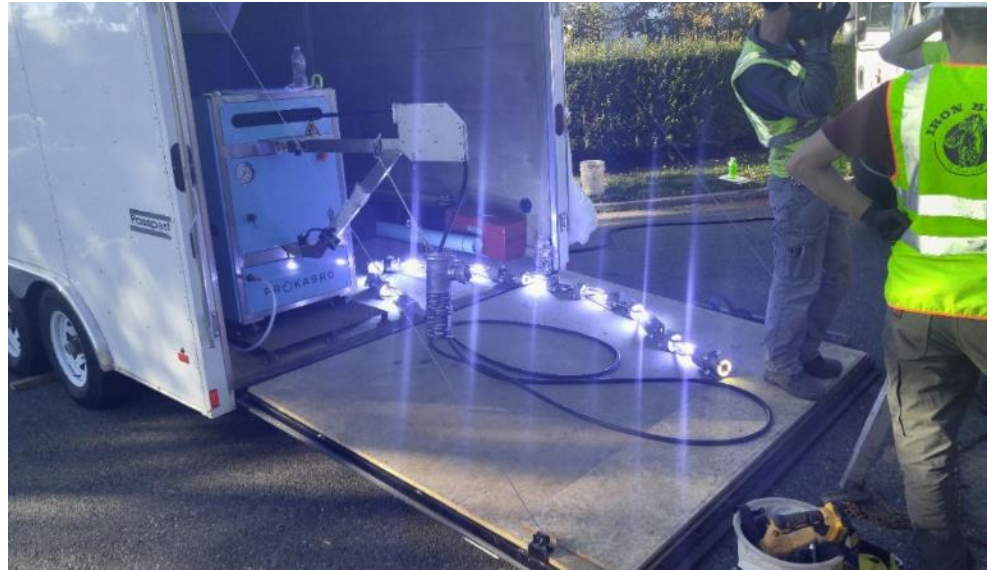
- UV Lining Process:
 - Side sewer locations measured
 - Line jetted
 - Flows plugged/diverted
 - Sleeved UV liner pulled through



UV liner inserted through manhole

Mainline Lining

- UV Lining Process:
 - Side sewer locations measured
 - Line jetted
 - Flows plugged/diverted
 - Sleeved liner pulled through
 - **Light train pulled through to opposite end**



UV light train

Mainline Lining

- UV Lining Process:
 - Side sewer locations measured
 - Line jetted
 - Flows plugged/diverted
 - Sleeved liner pulled through
 - Light train pulled through to opposite end
 - “Safety Caps” installed



Packer

Mainline Lining

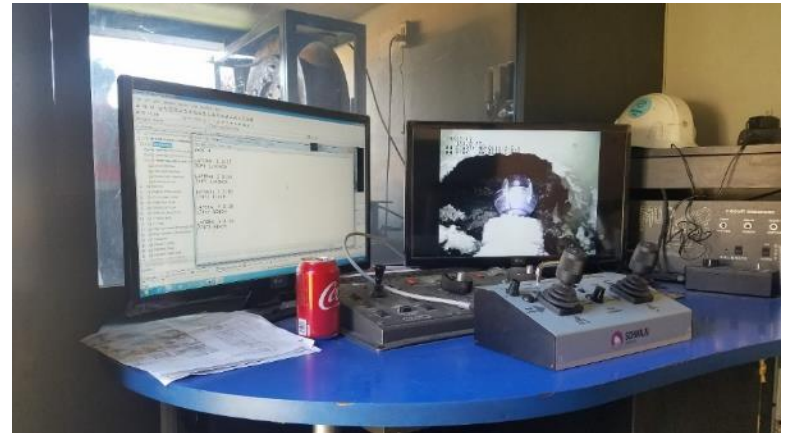
- UV Lining Process:
 - Side sewer locations measured
 - Line jetted
 - Flows plugged/diverted
 - Sleeved liner pulled through
 - Light train pulled through to opposite end
 - “Safety Caps” installed
 - **Pipe pressurized to specifications**
 - **Light train pulled back according to specified rate and pressure**



Curing of UV Lining

Mainline Lining

- UV Lining Process:
 - Side sewer locations measured
 - Line jetted
 - Flows plugged/diverted
 - Sleeved liner pulled through
 - Light train pulled through to opposite end
 - “Safety Caps” installed
 - Pipe pressurized to specifications
 - Light train pulled back according to specified rate and pressure
 - **Side sewers reinstated**



Side sewer reinstatement

Mainline Lining

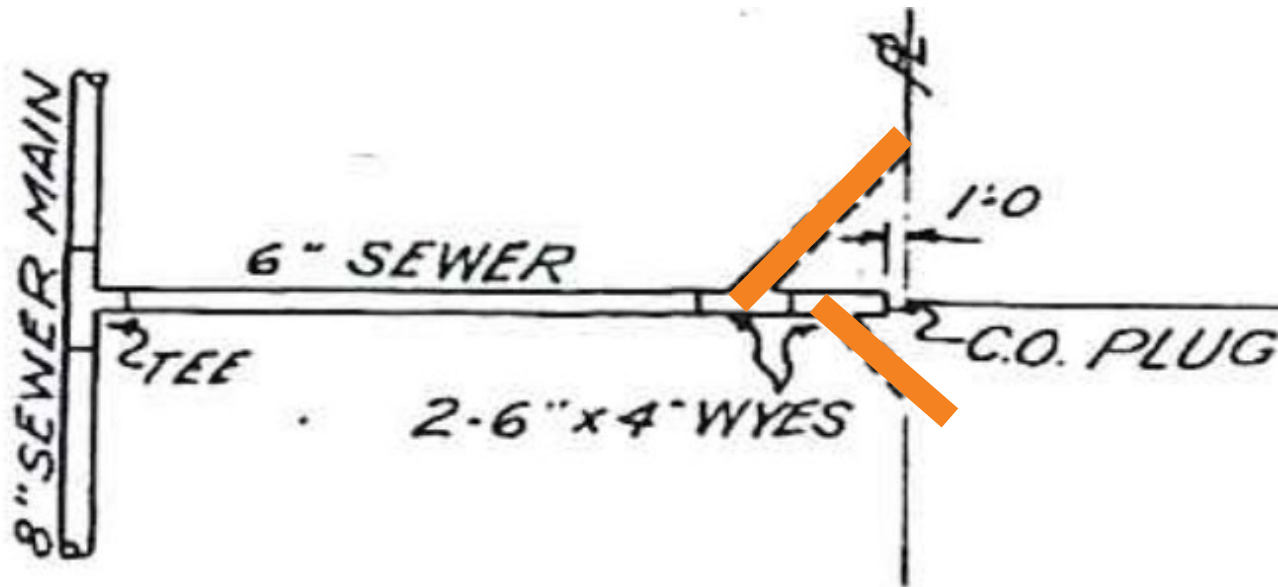
- UV Lining Process:
 - Side sewer locations measured
 - Line jetted
 - Flows plugged/diverted
 - Sleeved liner pulled through
 - Light train pulled through to opposite end
 - “Safety Caps” installed
 - Pipe pressurized to specifications
 - Light train pulled back according to specified rate and pressure
 - Side sewers reinstated
- Construction Issues
 - **None occurred**



Reinstated Sewer Line

Upper Lateral Lining

- Ambient cured lining of 4-inch-diameter side sewer process



Upper Lateral Lining

- Ambient cured lining of 4-inch-diameter side sewer process
 - Line inspected, repairs made to remove roots etc.
 - Liner prepared in trailer
 - Pre-cut or cut on site



Liner preparation

Upper Lateral Lining

- Ambient cured lining of 4-inch-diameter side sewer process
 - Line inspected, repairs made to remove roots etc.
 - Liner prepared in trailer
 - Pre-cut or cut on site
 - Resin mixed



Mixing Resin

Upper Lateral Lining

- Ambient cured lining of 4-inch-diameter side sewer process
 - Line inspected, repairs made to remove roots etc.
 - Liner prepared in trailer
 - Pre-cut or cut on site
 - Resin mixed
 - Liner wetted out



Liner wet-out

Upper Lateral Lining

- Ambient cured lining of 4-inch-diameter side sewer process
 - Line inspected, repairs made to remove roots etc.
 - Liner prepared in trailer
 - Pre-cut or cut on site
 - Resin mixed
 - Liner wetted out
 - **Inserted into inversion tank**



Inserting into inversion tank

Upper Lateral Lining

- Ambient cured lining of 4-inch-diameter side sewer process
 - Line inspected, repairs made to remove roots etc.
 - Liner prepared in trailer
 - Pre-cut or cut on site
 - Resin mixed
 - Liner wetted out
 - Inserted into inversion tank
 - Liner transported to cleanout in inversion tank
 - Liner inserted into cleanout



Inserting into cleanout

Upper Lateral Lining

- Ambient cured lining of 4-inch-diameter side sewer process
 - Line inspected, repairs made to remove roots etc.
 - Liner prepared in trailer
 - Pre-cut or cut on site
 - Resin mixed
 - Liner wetted out
 - Inserted into inversion tank
 - Liner transported to cleanout in inversion tank
 - Liner inserted into cleanout
 - **Pressure cap installed or inversion tank remains connected**
 - **Liner resin cures under pressure for 2 hours**



Pressure cap

Upper Lateral Lining

- Ambient cured lining of 4-inch-diameter side sewer process
 - Line inspected, repairs made to remove roots etc.
 - Liner prepared in trailer
 - Pre-cut or cut on site
 - Resin mixed
 - Liner wetted out
 - Inserted into inversion tank
 - Liner transported to cleanout in inversion tank
 - Liner inserted into cleanout
 - Pressure cap installed or inversion tank remains connected
 - Liner resin cures under pressure for 2 hours
 - **Bladder removed, cleanout capped**



Bladder removal



Reinstated upper lateral

Upper Lateral Lining

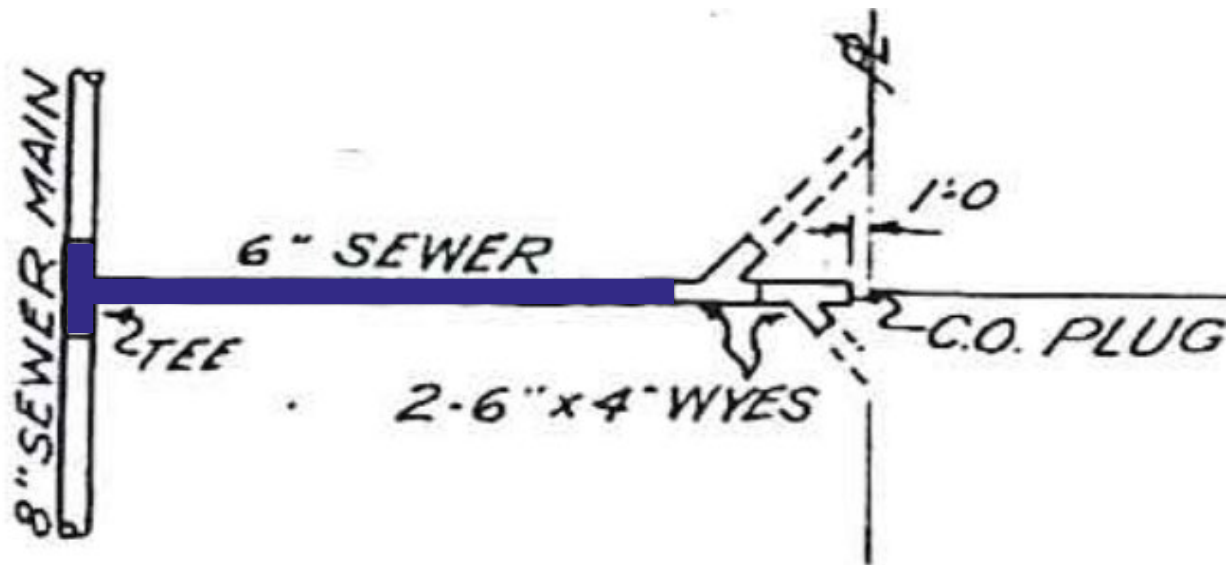
- Construction issues
 - Improper curing
 - Issues with pressure caps malfunctioning
 - Bladder failure causing pressure loss
 - Resin/BPO ratios



Improperly cured liner portion

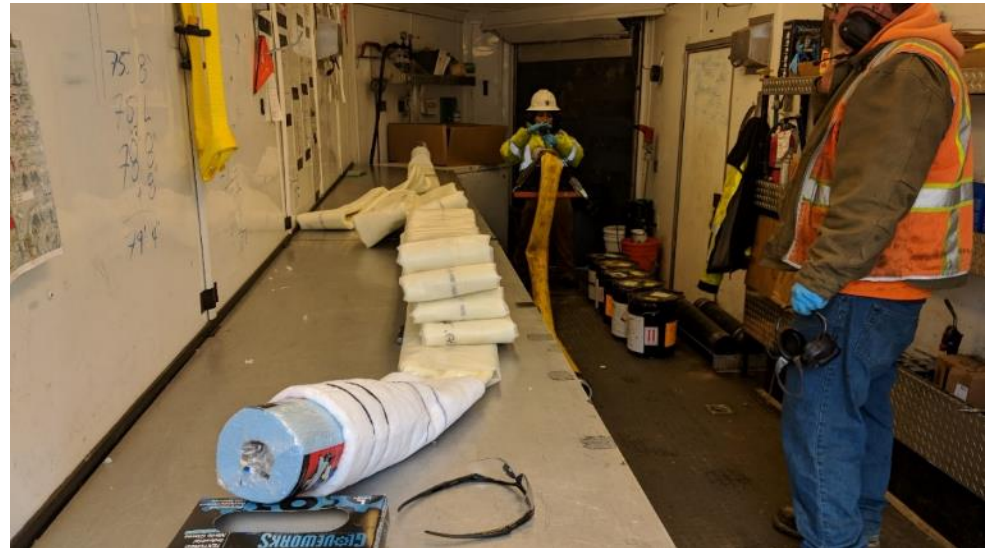
Lower Lateral Lining

- Steam cured lining and T-lining of 6-inch-diameter side sewer process



Lower Lateral Lining

- Steam cured lining and T-lining of 6-inch-diameter side sewer process
 - Line inspected, repairs made to remove roots etc.
 - Liner prepared in trailer
 - Hydrophilic gaskets installed



Lateral liner preparation

Lower Lateral Lining

- Steam cured lining and T-lining of 6-inch-diameter side sewer process
 - Line inspected, repairs made to remove roots etc.
 - Liner prepared in trailer
 - Hydrophilic gaskets installed
 - **Mixing and wetting out resin**
 - **Inserted into steam cure bladder and launcher**



T-liner set-up

Lower Lateral Lining

- Steam cured lining and T-lining of 6-inch-diameter side sewer process
 - Line inspected, repairs made to remove roots etc.
 - Liner prepared in trailer
 - Hydrophilic gaskets installed
 - Mixing and wetting out resin
 - Inserted into steam cure bladder and launcher
 - Transported to manhole



Work near manhole

Lower Lateral Lining

- Steam cured lining and T-lining of 6-inch-diameter side sewer process
 - Line inspected, repairs made to remove roots etc.
 - Liner prepared in trailer
 - Hydrophilic gaskets installed
 - Mixing and wetting out resin
 - Inserted into steam cure bladder and launcher
 - Transported to manhole
 - **Camera inserted into cleanout**
 - **T-liner pulled through and lined up with side sewer**
 - **Inverted into side sewer**



Camera view of inversion

Lower Lateral Lining

- Steam cured lining and T-lining of 6-inch-diameter side sewer process
 - Line inspected, repairs made to remove roots etc.
 - Liner prepared in trailer
 - Hydrophilic gaskets installed
 - Mixing and wetting out resin
 - Inserted into steam cure bladder and launcher
 - Transported to manhole
 - Camera inserted into cleanout
 - T-liner pulled through and lined up with side sewer
 - Inverted into side sewer
 - **Steam cured for 30 minutes**



Steam Truck



Support Trucks

Lower Lateral Lining

- Steam cured lining and T-lining of 6-inch-diameter side sewer process
 - Line inspected, repairs made to remove roots etc.
 - Liner prepared in trailer
 - Hydrophilic gaskets installed
 - Mixing and wetting out resin
 - Inserted into steam cure bladder and launcher
 - Transported to manhole
 - Camera inserted into cleanout
 - T-liner pulled through and lined up with side sewer
 - Inverted into side sewer
 - Steam cured for 30 minutes



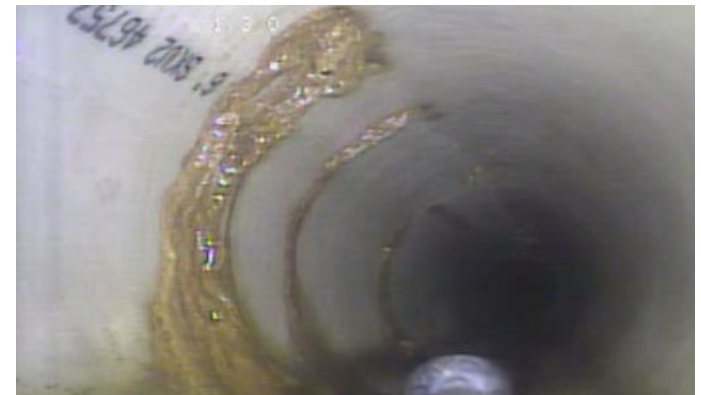
Reinstated lower lateral

Lower Lateral Lining

- Construction Issues
 - Blind shot from MH without cleanout.
 - Liner hung-up in pipe and did not invert
 - Portion of pipe vactored and repaired
- T-liner seam seal
- Lined over side sewer caused home backup
- Steam truck ran out of gas during a cure



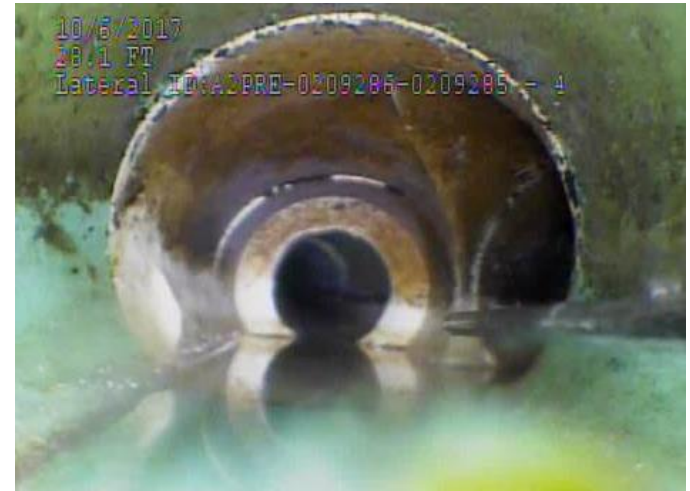
Repair pit for un-inverted liner portion



Infiltration at T-liner seam

Post-Lining Process

- Completion CCTV/Review of final results
- Emergency repairs made
 - Side sewer lined over
- Final repairs of remaining issues
 - Seam with infiltration
 - Cleanup of rough transitions



Final Construction Statistics and Cost

84 out of 86 houses participated

73 Vac-A-Tee clean outs installed

44 T-Liners installed

3,890 feet of 8-inch mainline UV liner

4,725 feet of side sewer:

1,170 feet of 6-inch side sewer

3,015 feet of 4-inch side sewer

\$1,141,084 total construction value (before tax)

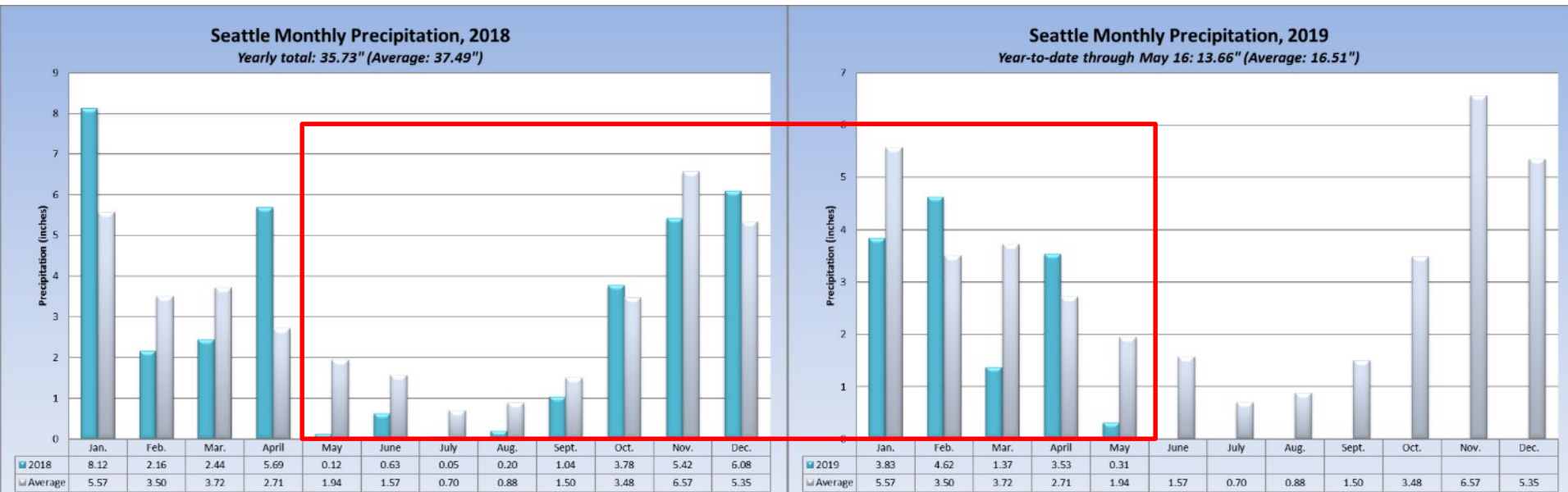
\$155/ft for side sewers with cleanouts, \$125/ft without cleanouts

\$105/ft for mainlines

5 months of construction

Post Construction Monitoring

- Meter reinstalled 5/1/2018



- Average rain over time period: 37.8 inches
- Received rain over time period: 30.9 inches

Post Construction Monitoring

- Meter reinstalled 5/1/2018
 - Estimated flow reduction:

Post Construction Monitoring

- Meter reinstalled 5/1/2018
 - Estimated flow reduction:



Post Construction Monitoring

- Meter reinstalled 5/1/2018
 - Estimated flow reduction:



- Suspect post metering data
- Completing Pilot Project 2 (mainlines only)
- Will continue to monitor through the 2019/20 wet weather season

Thoughts on Private Property Work

- Needs planning and upfront communication
- Don't over promise
- Not scary
- Construction crews need to be willing to talk to private property owners
- Law is on your side
- Does Owner Contribute any \$\$\$


AGO 2009 No. 5:

- *Municipal sewer districts have statutory authority to use public funds to repair or replace side sewers located on private property if doing so will increase sewer capacity by reducing infiltration and inflow. Use of public funds to do so does not constitute an unconstitutional gift or loan of public funds if the district acts without donative intent and can demonstrate that the action will result in significant benefit to the public.*

Phase 2

- Completing Phase 2 today!
 - Mainlines, connections at the main, and MH's
- CIPP lining of 6,130' of 8" and 10" pipe
- 73 connections with the main (3' T-Liners)
- Coating of 34 MH's
- \$950,000 w/tax

March 2019



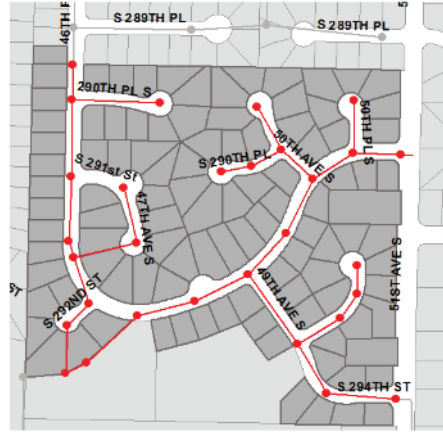
Lakehaven Sewer Rehabilitation Pilot Projects

THE PROJECT

Lakehaven Water and Sewer District (LWSD) is implementing a capital program to improve the sewer system within the Redondo Wastewater Treatment Plant collection area. As part of that program, LWSD is planning a project to reduce the amount of groundwater leaking into the sewer system. This leakage, called infiltration, comes from gaps or cracks in the main sewer, manholes, and the side sewers from peoples' homes. This project will rehabilitate main sewers and manholes in the pilot area.

LOCATION

The project is planned for the sewer system upstream of the intersection of S 292nd Street and 46th Place S. This includes houses along 46th Place S, 290th Place S, 291st Street, 47th Avenue S, S 292nd Street, S 290th Place, 50th Avenue S, 50th Place S, 49th Avenue S, S 293rd Street and S 294th Street.




The map shows a grid of streets including 46th Pl, S 289th Pl, S 290th Pl S, S 291st St, S 292nd St, S 293rd St, S 294th St, 47th Ave S, 49th Ave S, 50th Ave S, 50th Pl S, and 51st Ave S. Red lines and dots indicate the project area and manhole locations.

CIPP Lining – Not Just for I/I

- District has leveraged larger I/I projects to get commodity pricing for smaller structural repairs

March 2019





Lakehaven Sewer Rehabilitation Project

THE PROJECT
Lakehaven Water and Sewer District (LWSD) is implementing a capital program to rehabilitate deficient portions of the sewer system. As part of that program, LWSD is planning a project to install a structural liner in the sewer your house is connected to.

LOCATION
The project is planned for the sewer system between S 287th Street and S 288th Street, bounded by 13th Avenue S and 14th Avenue S.

These sewers, while in your backyards, are within a LWSD owned utility easement. LWSD, their engineering consultant, and the construction company may need to enter your backyard to access the sewer. You will be notified if this is needed.




March 2019

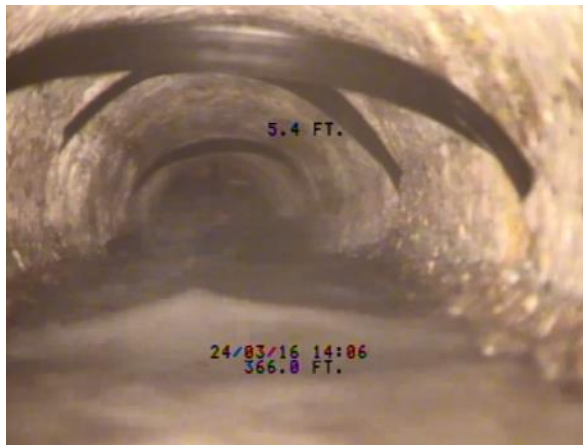

Lakehaven Sewer Rehabilitation Project

THE PROJECT
Lakehaven Water and Sewer District (LWSD) is implementing a capital program to rehabilitate deficient portions of the sewer system. As part of that program, LWSD is planning a project to install a structural liner in the sewer shown below in red.

LOCATION
The project is planned for a section of sewer (shown in red) along 39th Place SW at the intersection with 39th Avenue SW.



UV cured in place pipe rehabilitation of sewer main in the street, right of way.





Thank you. Questions?

Ken Miller, PE

kmiller@lakehaven.org

253-946-5405

Bob Jacobsen, PE

bjacobsen@brwncald.com

206-749-2307

