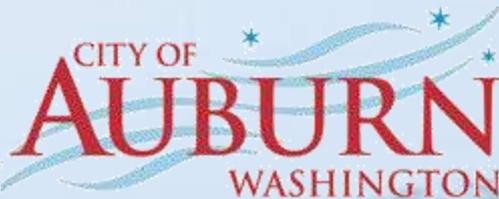


Implementation of a Unidirectional Flushing Program – A Great Way to Flush

Susan Fenhaus – City of Auburn

Dan Reisinger – Carollo Engineers



Introductions

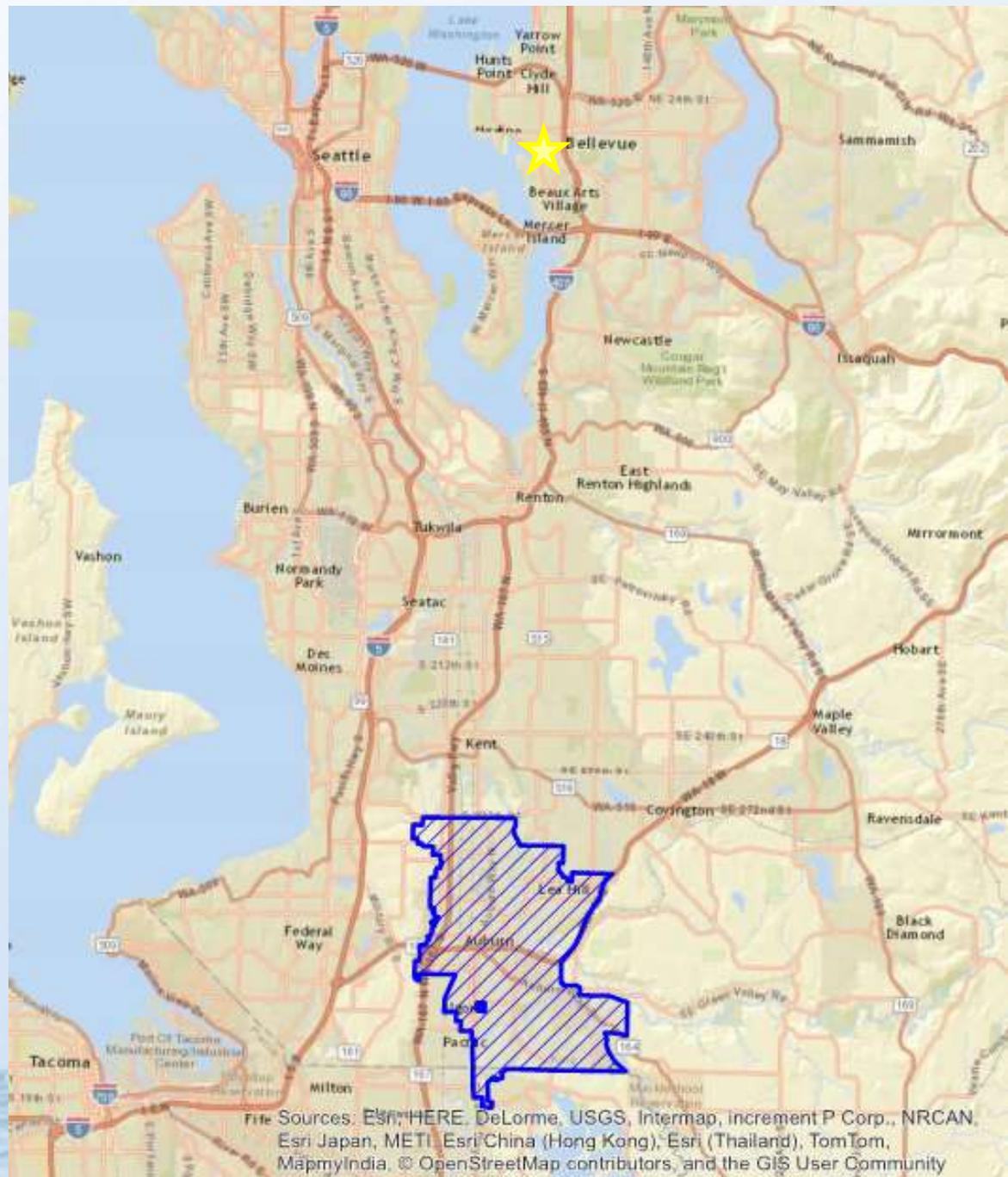
- Susan Fenhaus – Water Utility Engineer, City of Auburn
- Dan Reisinger – Lead Water Resources Engineer, Carollo

Agenda

- Unidirectional flushing (UDF) Background
- Auburn's UDF Program
 1. Program Planning
 2. Flushing Sequence Formulation
 3. Pre-flushing activities
 4. Flushing and other O&M activities
 5. Post-flushing updates
- Questions

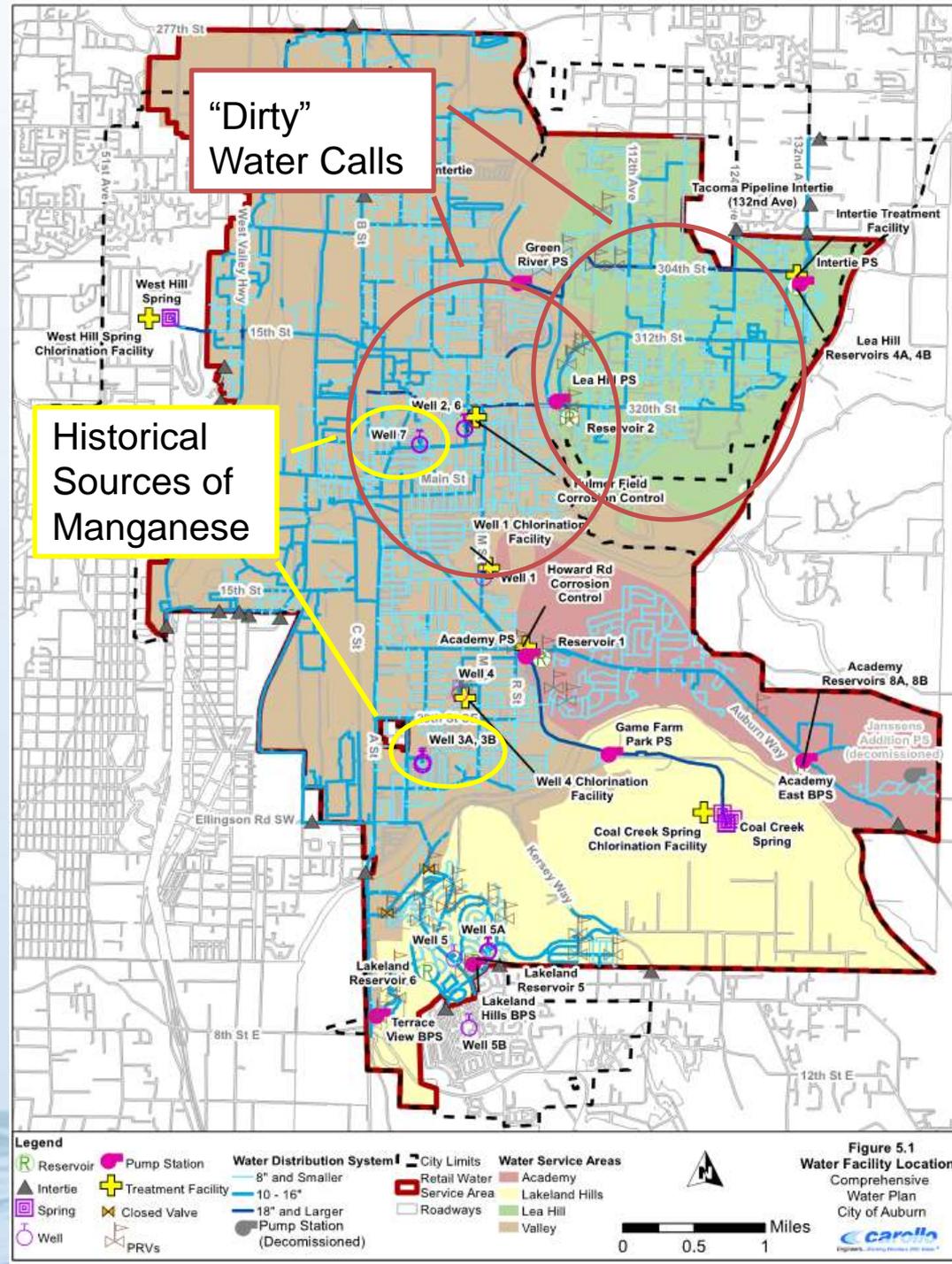
Auburn, WA

- City owned water system (DOH ID 03350V)
- Located in King and Pierce County, WA
- First city supply in 1884
- Serves approximately 56,000 people through 14,000 retail accounts

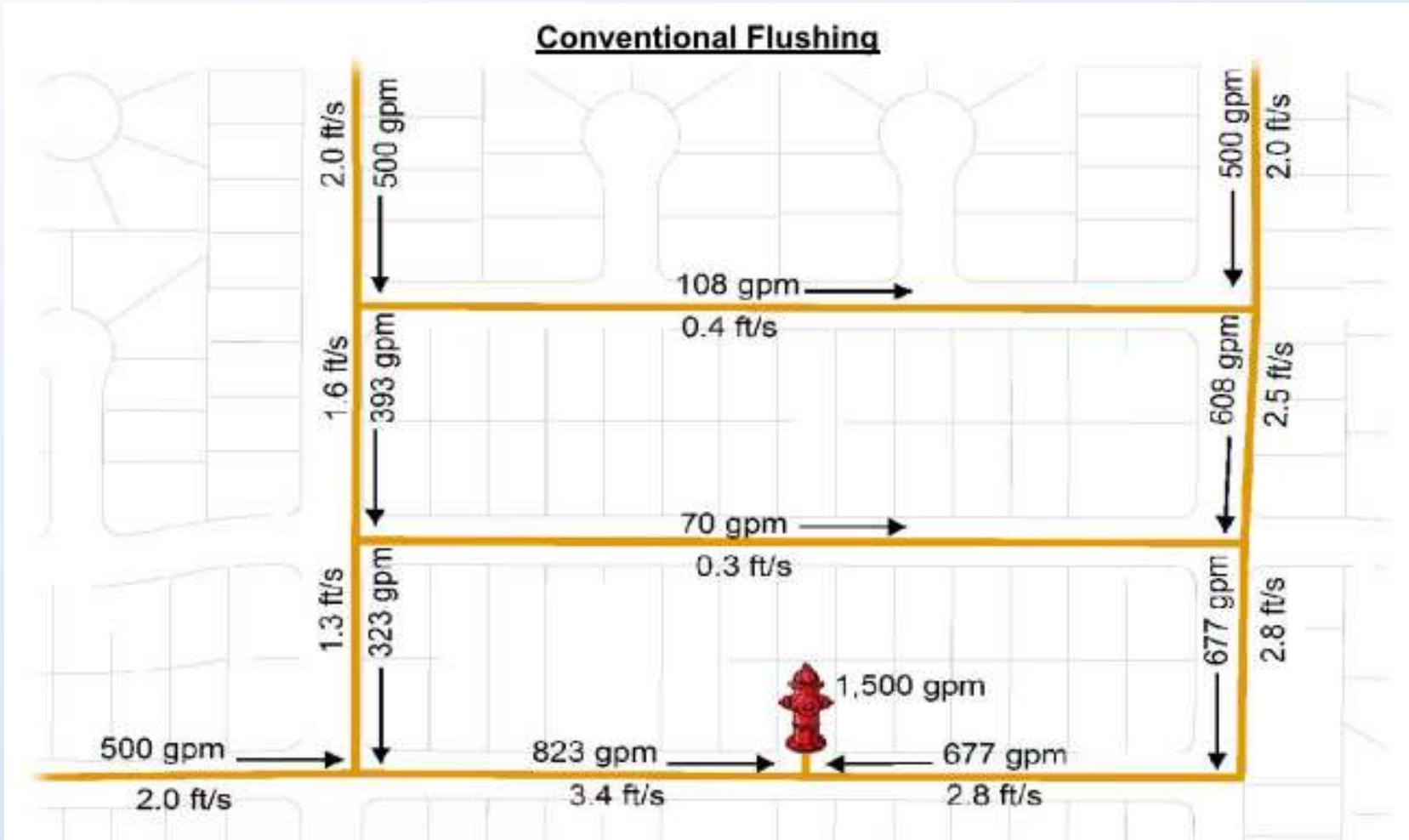


Precipitated Manganese caused periodic “dirty” water calls

- High manganese sources historically used for summer peaking
- Most calls in Downtown and Lea Hill areas
- Also caused issues with system O&M

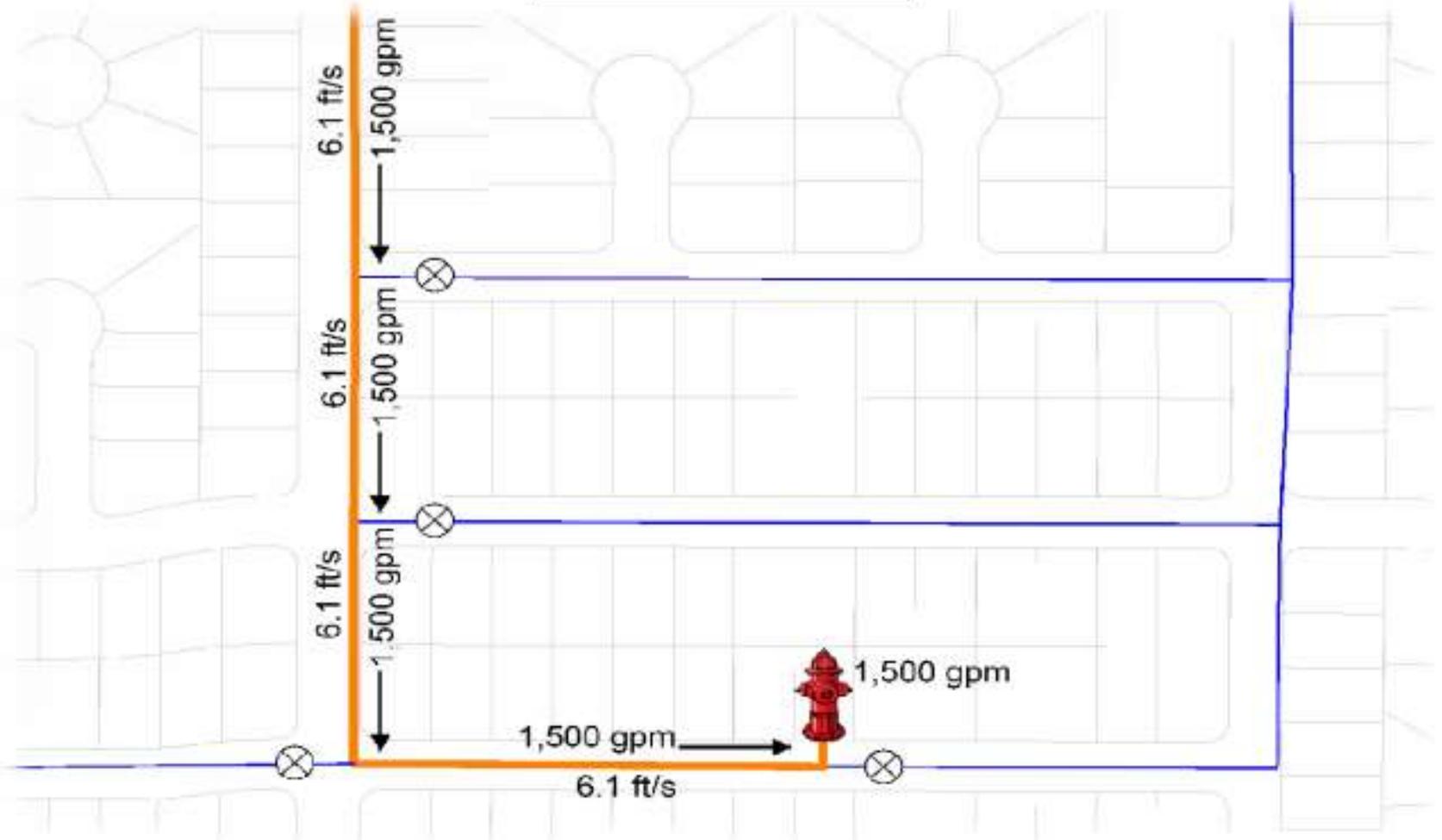


Conventional flushing receives water from multiple directions



Unidirectional Flushing (UDF) limits flow to a single direction

Unidirectional Flushing



UDF benefits outweighed its challenges in Auburn



Auburn's UDF Program Elements

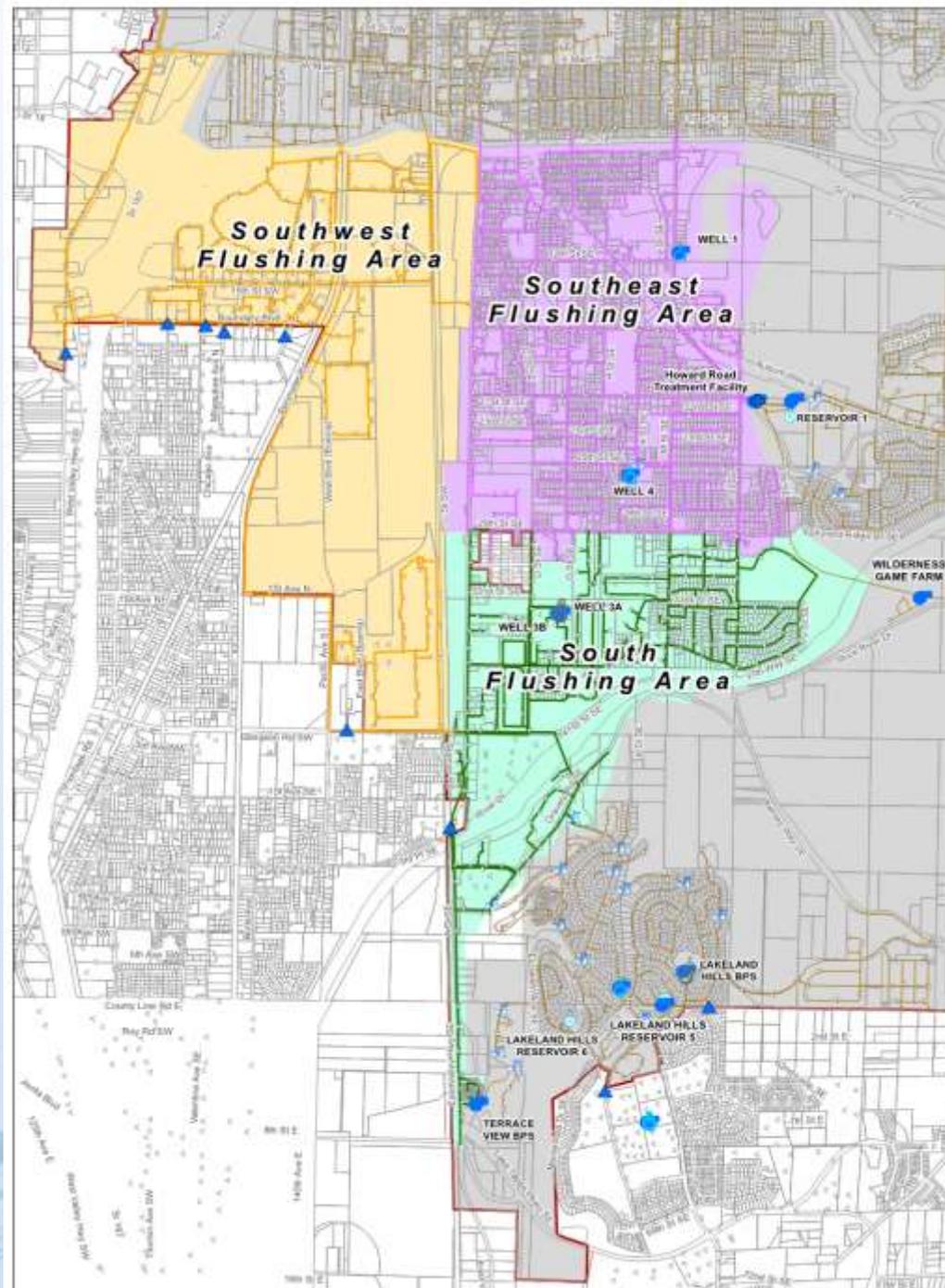
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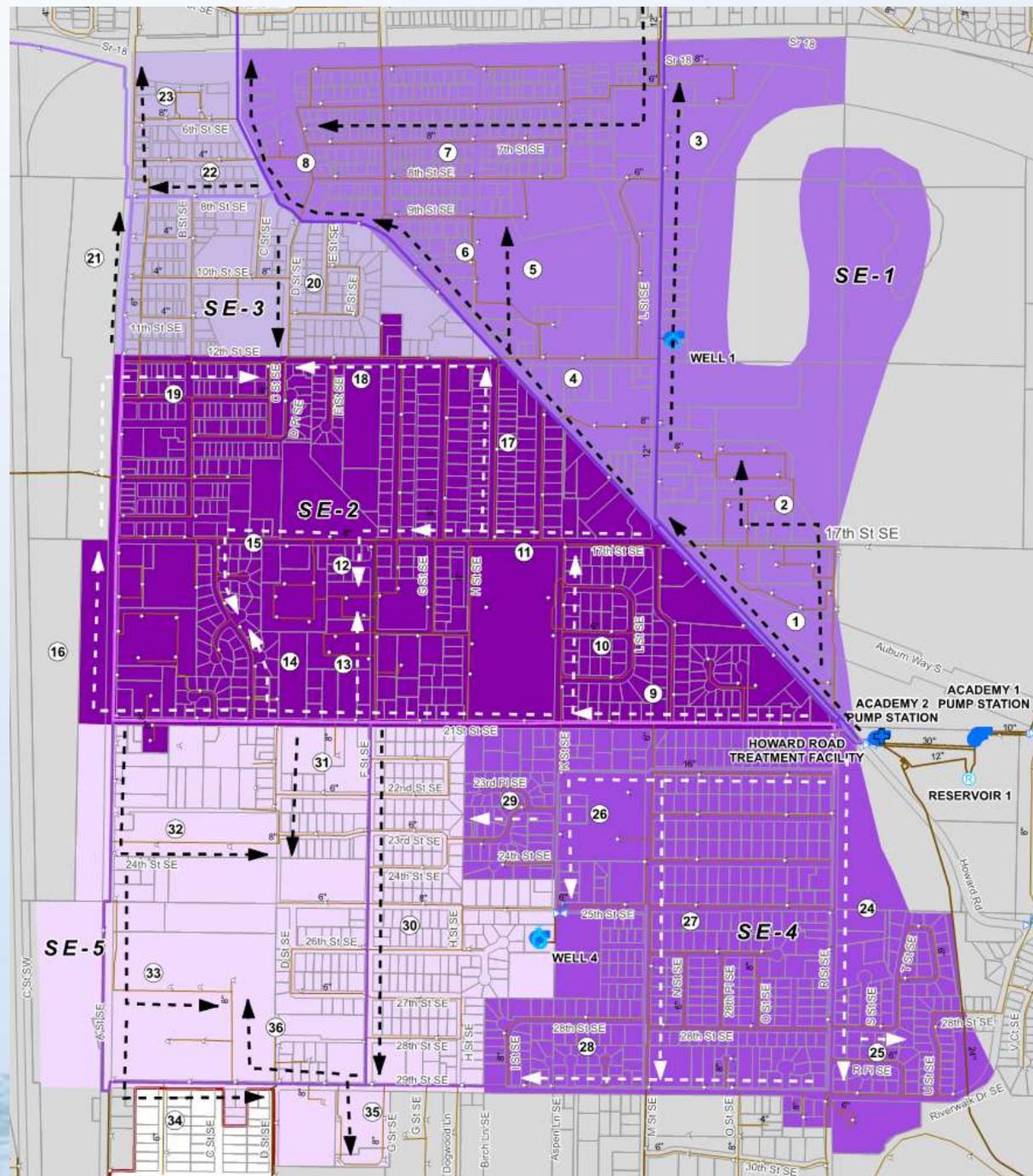
Individual Service Areas were divided into manageable areas called Flushing Areas

- Aids in preparing for flushing activities



Smaller Flushing Zones created working areas

- Typically includes 25-50 flushing sequences
- Includes general route of flushing



Auburn's UDF Program Elements

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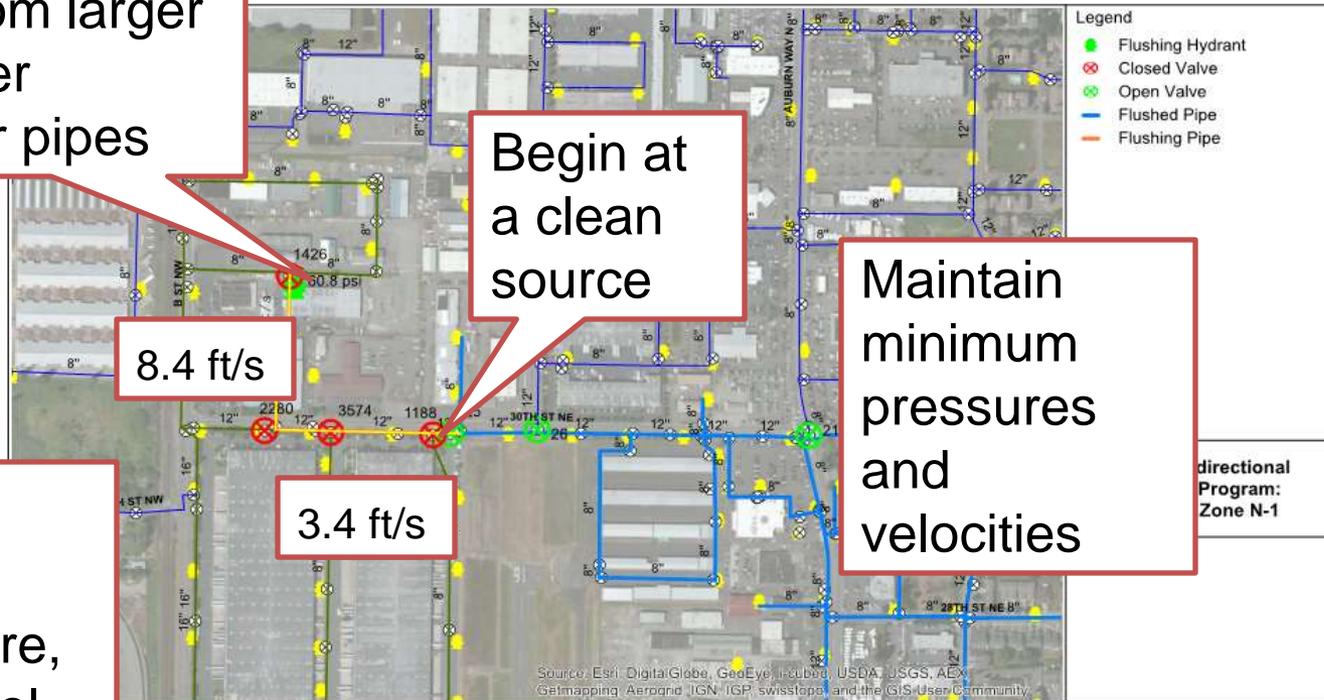
Flushing Sequences target a specific pipe segment by opening a hydrant and closing system valves

Flush from larger to smaller diameter pipes

Begin at a clean source

Maintain minimum pressures and velocities

Consider stormwater infrastructure, traffic control, and other constraints



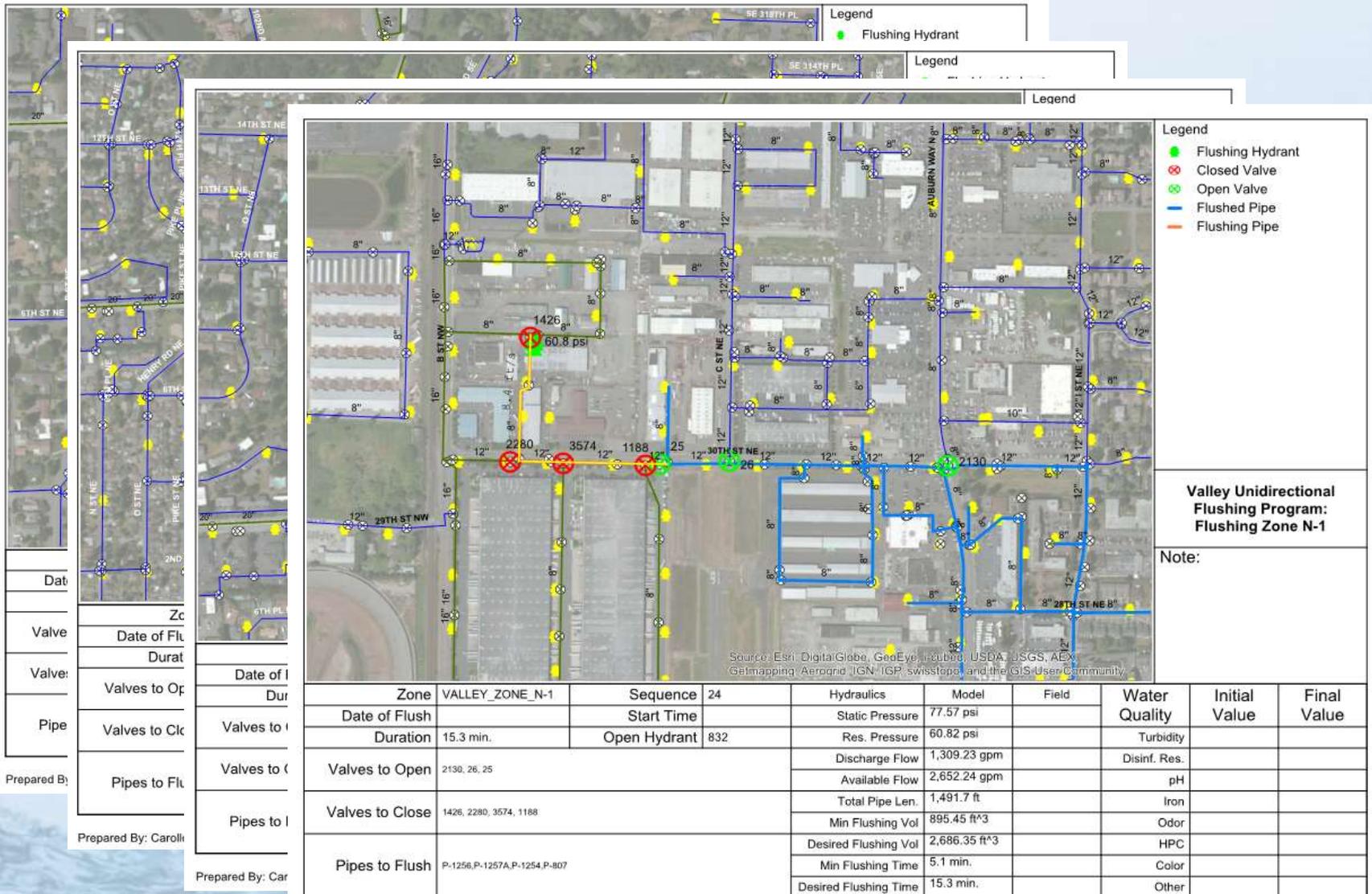
8.4 ft/s

3.4 ft/s

60 psi

Zone	VALLEY_ZONE_N-1	Sequence	24	Hydraulics	Field	Water Quality	Initial Value	Final Value
Flush		Start Time		Static Pressure	60	Turbidity		
ration	15.3 min.	Open Hydrant	832	Res. Pressure	psi	Disinf. Res.		
Open	2130, 26, 25			Discharge Flow		pH		
Close	1426, 2280, 3574, 1188			Available Flow		Iron		
				Total Pipe Len.	1,491.7 ft	Odor		
				Min Flushing Vol	895.45 ft ³	HPC		
				Desired Flushing Vol	2,686.35 ft ³	Color		
				Min Flushing Time	5.1 min.	Other		
				Desired Flushing Time	15.3 min.			
Pipes to Flush	P-1256,P-1257A,P-1254,P-807							

Flushing Journal combines all sequences for an area



Caution should be taken with heavily tuberculated cast iron pipe

- UDF can **create** water quality problems in tuberculated cast iron pipe.
- Issue can be avoided by maintaining velocity in typical ranges.
 - Requires an assumption of the reduction in pipe ID when calculating velocity.



<http://www.gazette.net/article/20110907/NEWS/709079614/1094/1094/twenty-year-water-main-rehab-program-to-extend-indefinitely&template=gazette>

Early review of sequences saves effort

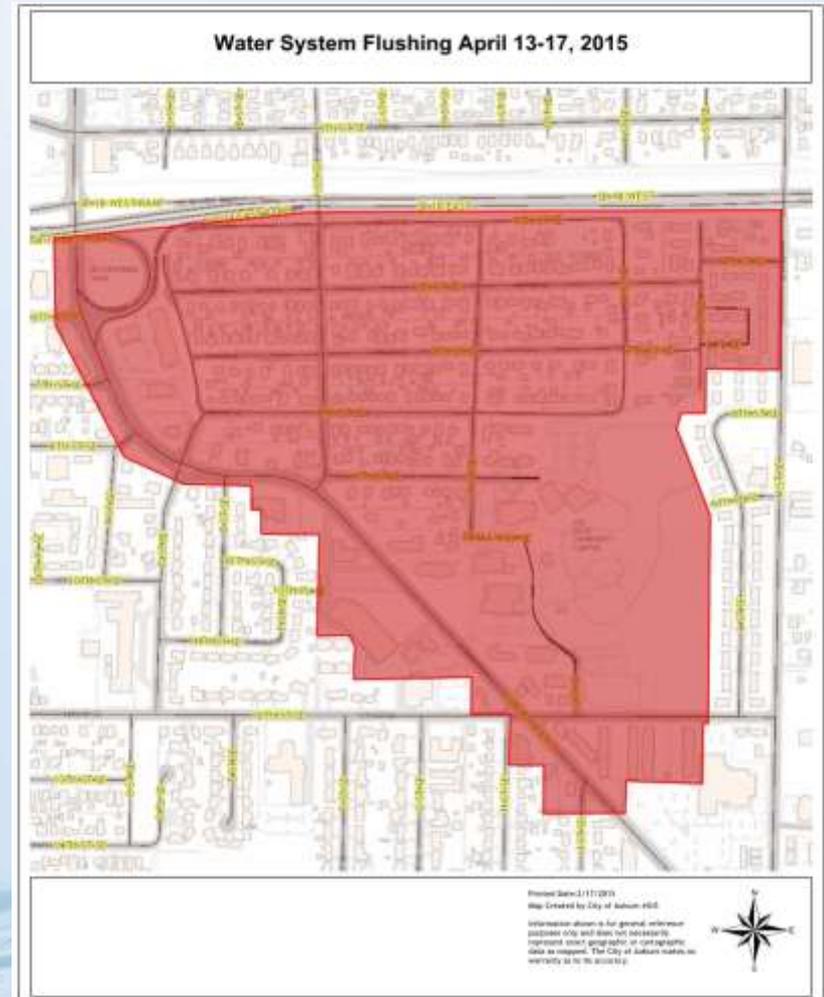
- Rearranging or modifying sequences can be time consuming.
- Early review with Engineering and Operations staff helped avoid issues.
- Auburn's staff did a great job adapting sequences in the field.

Auburn's UDF Program Elements

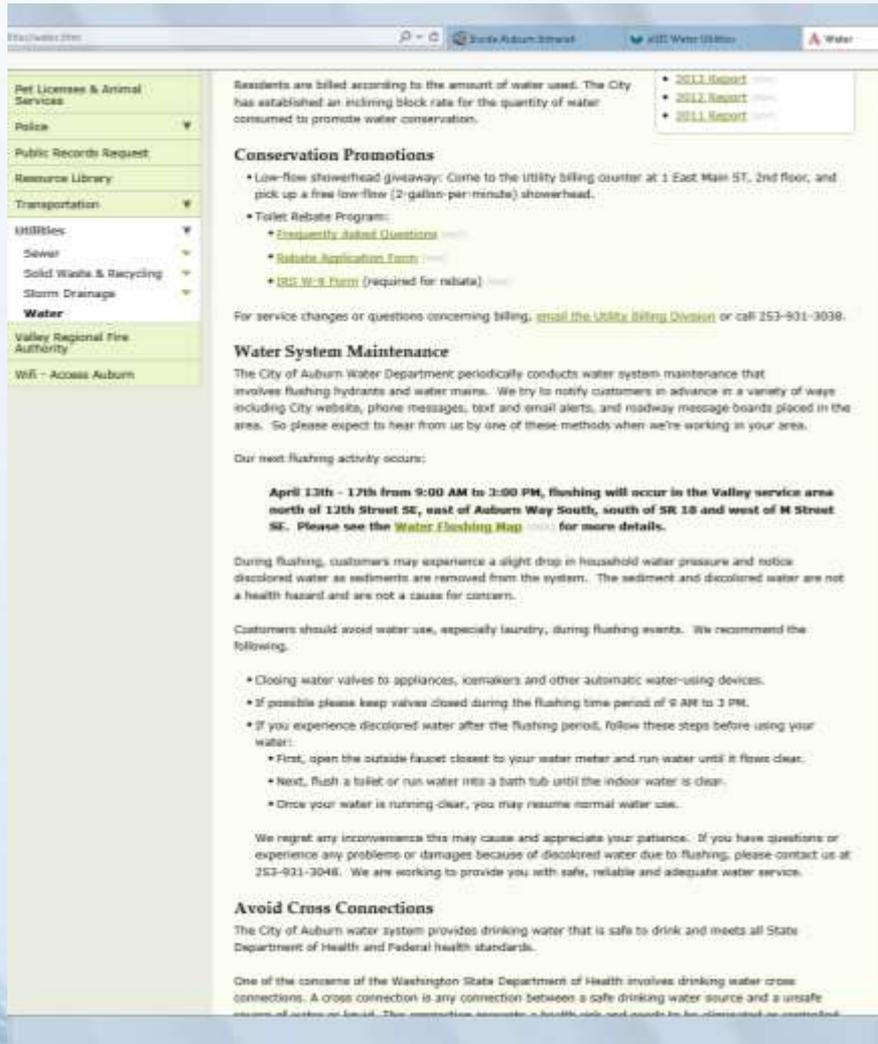
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Pre-flushing activities ensure safe and efficient UDF

- Site Visit, if necessary
 - Verify valves locations
- Coordination of Stormwater Drainage
- Review and Planning for Traffic Control
- Public Notification



Public Notification is provided before flushing



The screenshot shows a web browser window with the URL "http://www.auburnwa.gov". The page is titled "Water" and contains the following sections:

- Residents are billed according to the amount of water used.** The City has established an increasing block rate for the quantity of water consumed to promote water conservation.
- Conservation Promotions**
 - Low-flow showerhead giveaway: Come to the utility billing counter at 1 East Main ST, 2nd floor, and pick up a free low-flow (2-gallon-per-minute) showerhead.
 - Toilet Rebate Program:
 - [Frequently Asked Questions](#)
 - [Rebate Application Form](#)
 - [BSC W-8 Form](#) (required for rebate)
- For service changes or questions concerning billing, [email the Utility Billing Division](#) or call 253-931-3038.
- Water System Maintenance**

The City of Auburn Water Department periodically conducts water system maintenance that involves flushing hydrants and water mains. We try to notify customers in advance in a variety of ways including City websites, phone messages, text and email alerts, and roadway message boards placed in the area. So please expect to hear from us by one of these methods when we're working in your area.

Our next flushing activity occurs:

April 13th - 17th from 9:00 AM to 3:00 PM, flushing will occur in the Valley service area north of 12th Street SE, east of Auburn Way South, south of SR 18 and west of M Street SE. Please see the [Water Flushing Map](#) for more details.

During flushing, customers may experience a slight drop in household water pressure and notice discolored water as sediments are removed from the system. The sediment and discolored water are not a health hazard and are not a cause for concern.

Customers should avoid water use, especially laundry, during flushing events. We recommend the following:

 - Closing water valves to appliances, washers and other automatic water-using devices.
 - If possible please keep valves closed during the flushing time period of 9 AM to 3 PM.
 - If you experience discolored water after the flushing period, follow these steps before using your water:
 - First, open the outside faucet closest to your water meter and run water until it flows clear.
 - Next, flush a toilet or run water into a bath tub until the indoor water is clear.
 - Once your water is running clear, you may resume normal water use.

We regret any inconvenience this may cause and appreciate your patience. If you have questions or experience any problems or damages because of discolored water due to flushing, please contact us at 253-931-3048. We are working to provide you with safe, reliable and adequate water service.
- Avoid Cross Connections**

The City of Auburn water system provides drinking water that is safe to drink and meets all State Department of Health and Federal health standards.

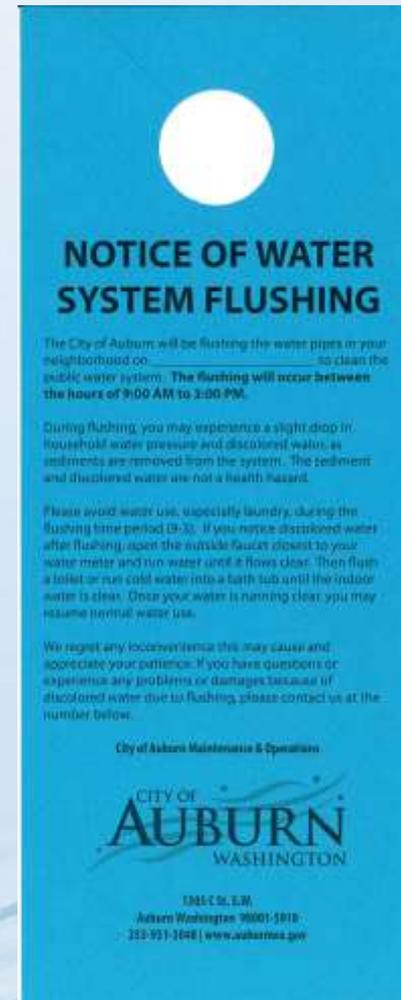
One of the concerns of the Washington State Department of Health involves drinking water cross connections. A cross connection is any connection between a safe drinking water source and a unsafe source of water or soil. This connection creates a health risk and needs to be eliminated or corrected.



Code Red

Lessons Learned - Door Tags were confusing to customers

- Door Tagging was initially used for notification.
- Customers were confused and called for clarification.
- Labor intensive to perform.
- Direct contact with customers sensitive to water quality (medical, industrial, etc.) was still needed.



Auburn's UDF Program Elements

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Auburn has combined multiple O&M programs with UDF

- UDF Program
 - Pipe Flushing
 - Valve exercise program
 - Hydrant flushing program
- Three person crew
 - Flushes Monday – Thursday
 - Friday prep for next week
 - Typically complete 25 flushing sequences per week
- Hydrant inspection program remains separate

Crews set up before implementing a flush



Traffic control creates a safe environment for City staff and residents



Stormwater drainage is used to move water safely offsite



Sometimes there is only one storm inlet...



Initially, flushing may create substantial turbidity and discoloration



Manganese gives a distinctive purple hue to the water



Water typically clears within 20 minutes



Flushing is not stopped until water meets City's turbidity criteria



Water is ready to drink after flushing



Flushing removed surprising amounts of cobbles and other debris



Large cobbles likely from pipe installation decades before...



City O&M staff restore the area after flushing

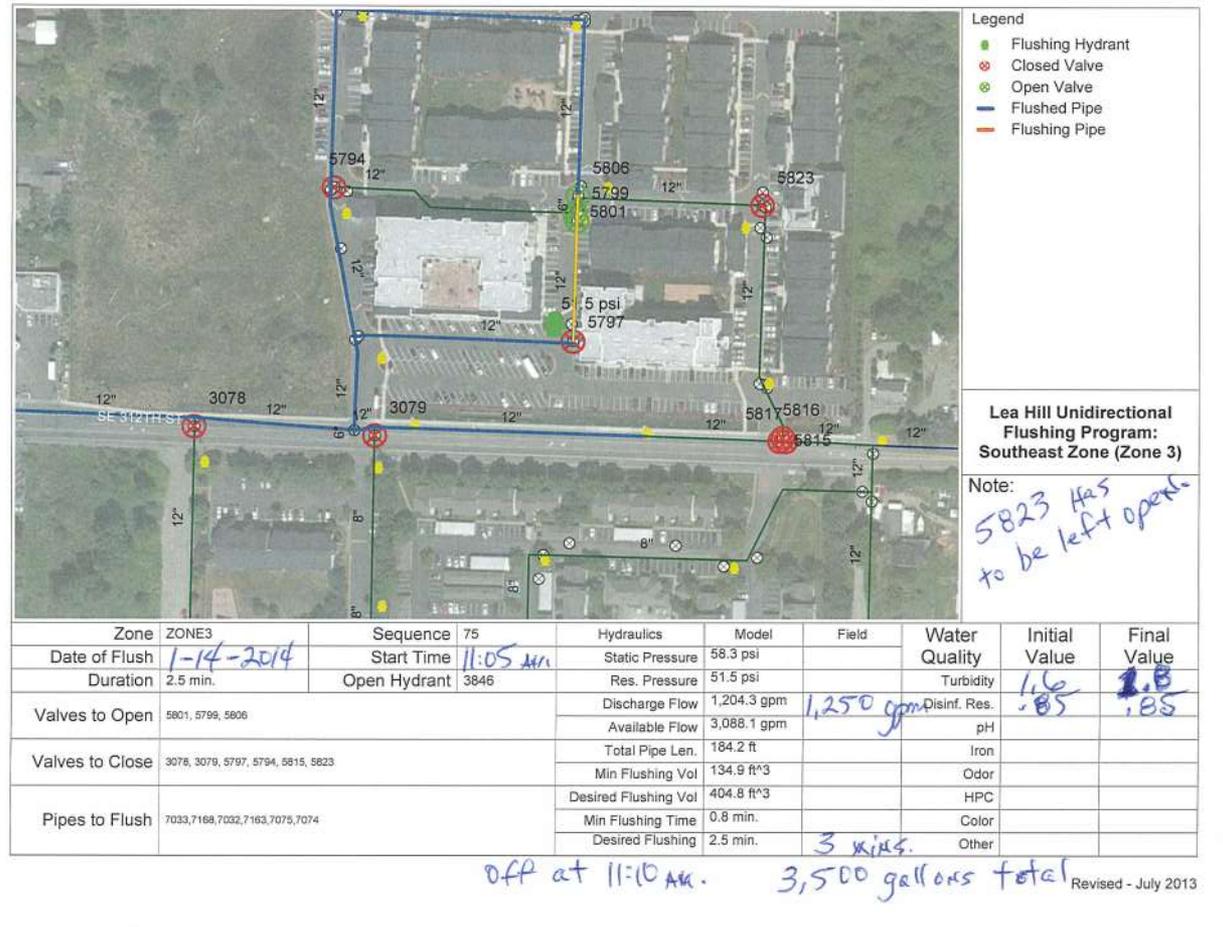


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Post-flush updates help correct and improve subsequent flushing

- Save field documentation
 - Time of Flush
 - Volume (gal)
 - Flow (gpm)
 - Water Quality



GIS is updated with the field-verified location of pipes and valves

2nd & F St NW water map



Printed Date: 2/26/2015
Map Created by City of Auburn eGIS
Information shown is for general reference purposes only and does not necessarily represent exact geographic or cartographic data as mapped. The City of Auburn makes no warranty as to its accuracy.



Dirty water calls have been cut in half since implementing UDF

Category	2009	2010	2011	2012	2013	2014
Appearance	26	11	16	19	11	5

Thank you to our UDF team members!

- The flushing crew – Brent, Travis, Michael, and Greg
- Allen Hunter
- Josh Flanders
- Jirong Lu
- Lara Kammereck
- Aurelie Nabonnand
- Ryan Orgill