

2 Valves Down, 2000 Services Out

Seattle's High Impact Shutdown Block Analysis

- Cheryl Capron, PO
- Jim McNerney
- Lilin Li

2022 PNWS-AWWA Conference

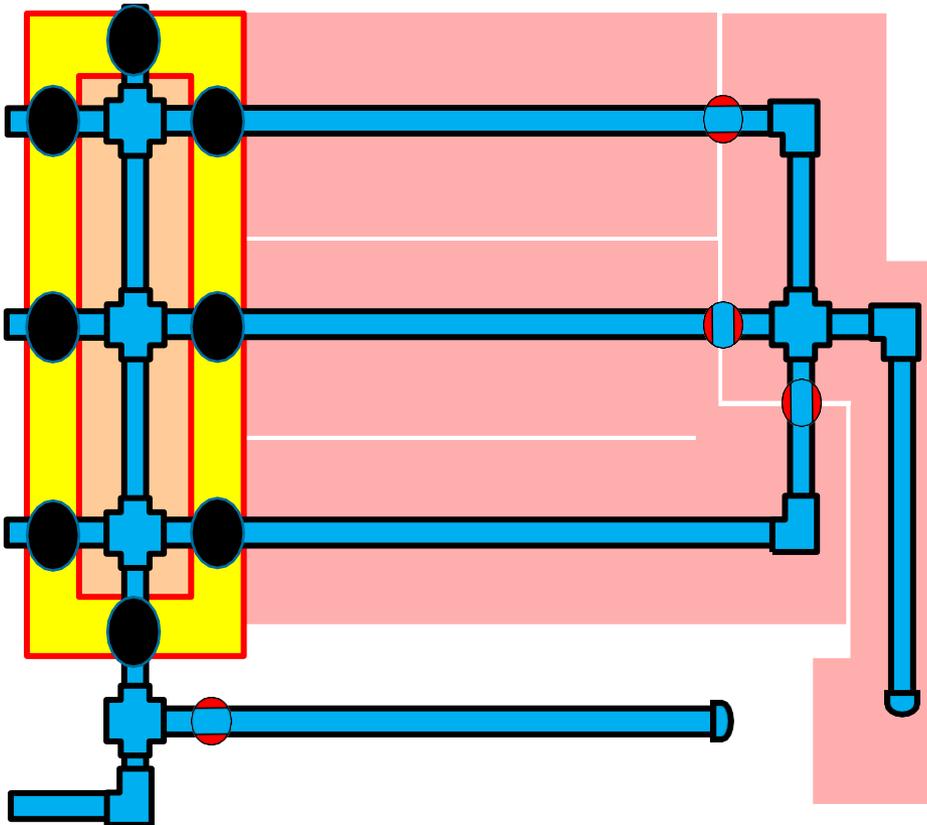
Seattle
 Public
Utilities



What's A Shutdown Block?

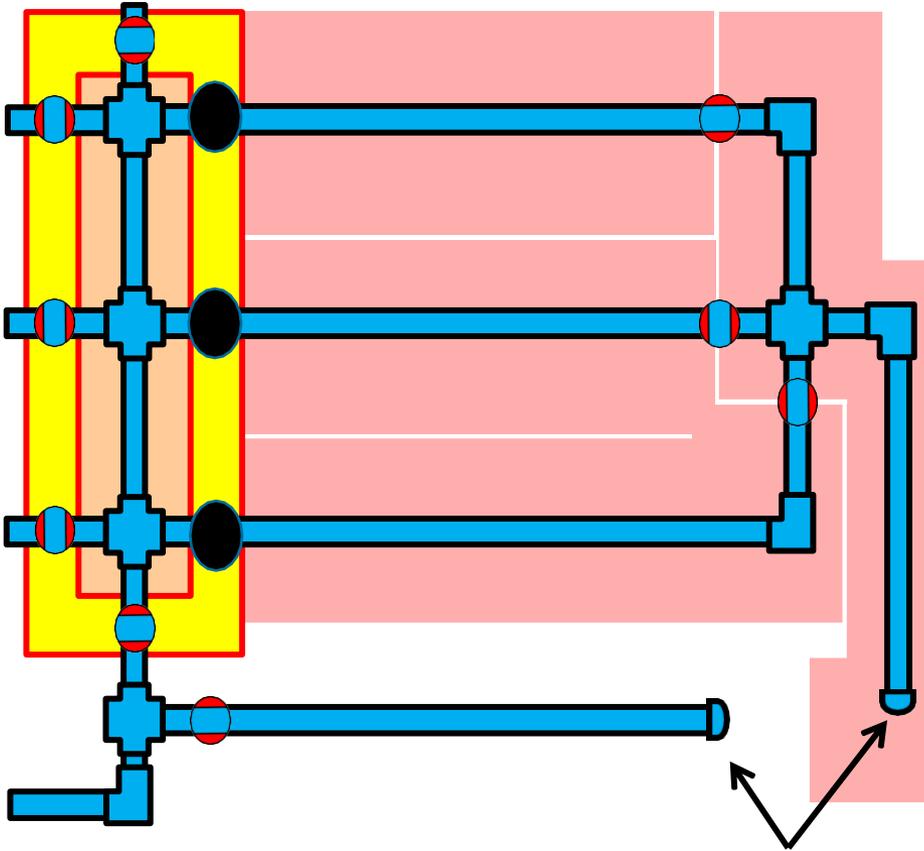
- All mains, services, hydrants & other facilities taken out of service when isolating a segment of pipe by closing valves.

Parent Shutdown Block



- The orange area
 - The main between the closed valves (the black ovals)
 - Everything attached to the main in the orange area

Subordinate Shutdown Blocks (4)



- The pink area
 - Every main fed only from the orange area
 - Everything attached to the mains in the pink area

If these were connected, there would be no subordinate shutdown blocks for this parent.

High Impact Shutdown Block (HISB)

- More than 130 services, or
- More than 20 hydrants, or
- More than 200 gpm average daily flow

We Need A Valve Maintenance Plan

- Critical valves get higher level of maintenance
- Criticality is a function of
 - Service outage due to failure
 - Valve won't shut down or re-open when needed
 - Outage impacts
 - Both sides of the valve

Criticality Is Rarely Just One Valve

- It's the specific combination of valves needed to shut down a segment of main
- Once a main segment is identified as critical...
 - The attached valves become critical

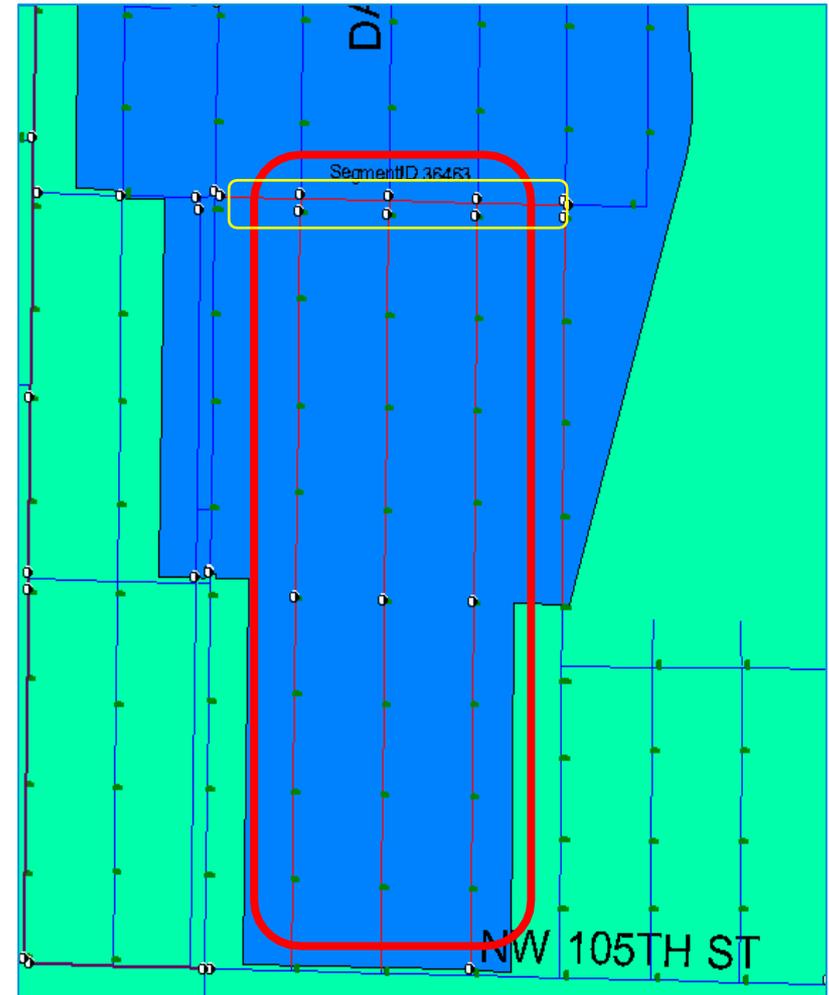
AWWARF Valve Management Model

- Apply it to distribution system mains
- Validate it with in-house experts on the distribution system & its operation

Dayton Av N & N 115 St

- 10 valves
- 28 hydrants
- 321 taps
- 29 gpm avg daily flow
- No critical customers

- 10,600 LF outage
 - 800 LF standard
 - 1320 LF typical



Model Validation

- Preliminary assessment of customer impact
 - Critical customers
 - Type of customer & potential economic impact
- Is this really a HISB?
 - Verify that no other feed exists & output is consistent
 - Model identified about 24 HISBs; 16 were validated

It Missed The Magnolia HISBs

- Why didn't it find ones we knew about?
 - Incorrect GIS data
 - Incorrect valve function tags meant valves that were normally closed were shown as normally open
 - Model assumed 2-way flow through PRVs
 - Feeder mains not included
 - Applied only to mains tagged as distribution, 8" or smaller

Manual Analysis of Feeder Mains (12" - 42")

- If there is a good 8" grid, focus elsewhere
 - Segment can be bypassed
 - Good fire protection
- Inventory supply-critical segments
 - Attached to reservoir outlet, pump station, PRV
- How far to nearest working hydrant?
 - 1200' by paved road is limit for running fire hoses
 - Trucks carry 800' of hose

Feeder Backbone Map

- Thick lines are feeders
- Thin lines are 8" distribution
- Smaller than 8" not shown
- Identify areas to focus on

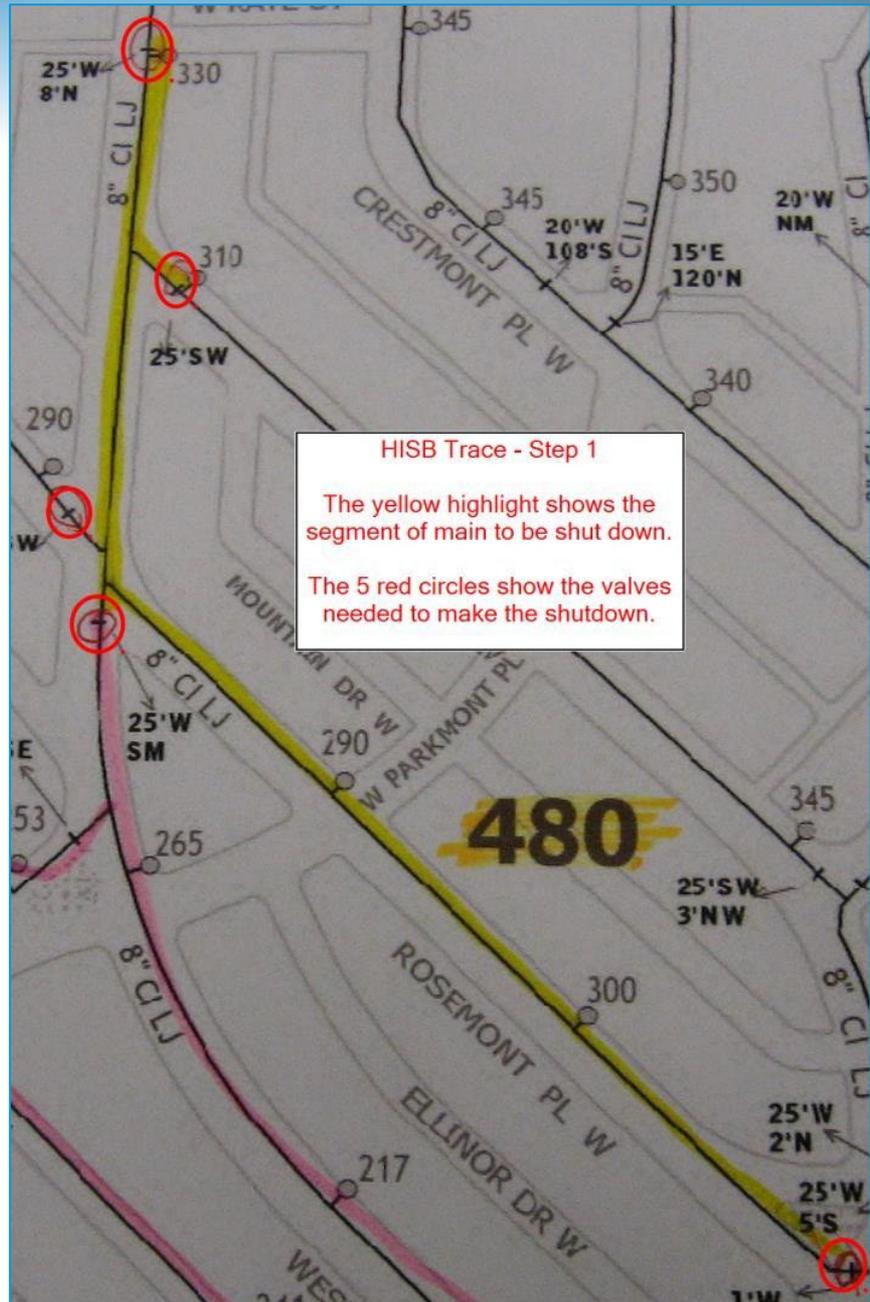


Identify The Shutdowns

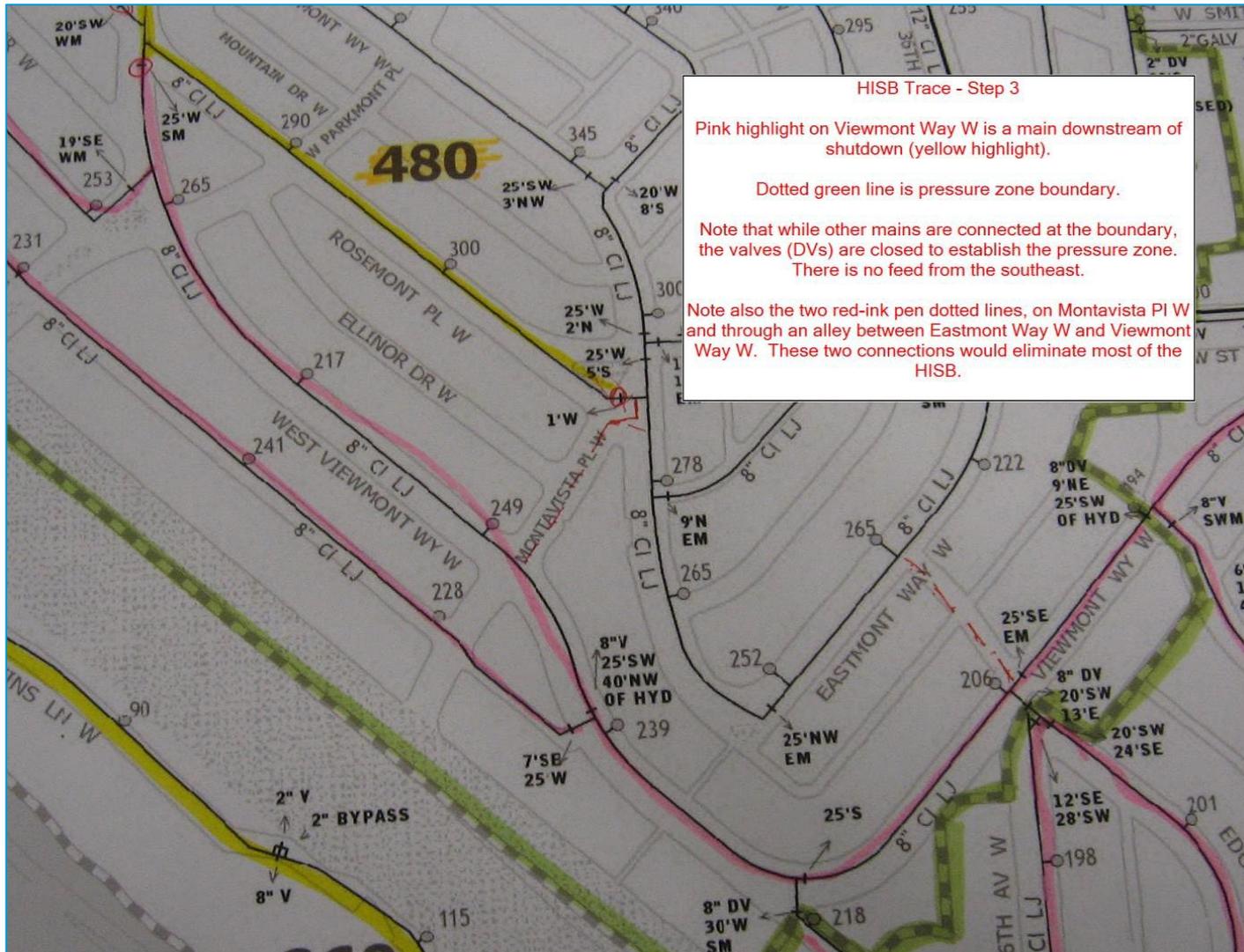
- Once the likely locations for HISBs are identified, move to a sectional map showing all mains, valves & hydrants.
- GIS with a query function is also very helpful at this stage.
- Start tracing...segment by segment

HISB Trace – Step 1

- Yellow line is main to be shut down.
- 5 red circles show the valves needed to make the shutdown.



HISB Trace – Step 3



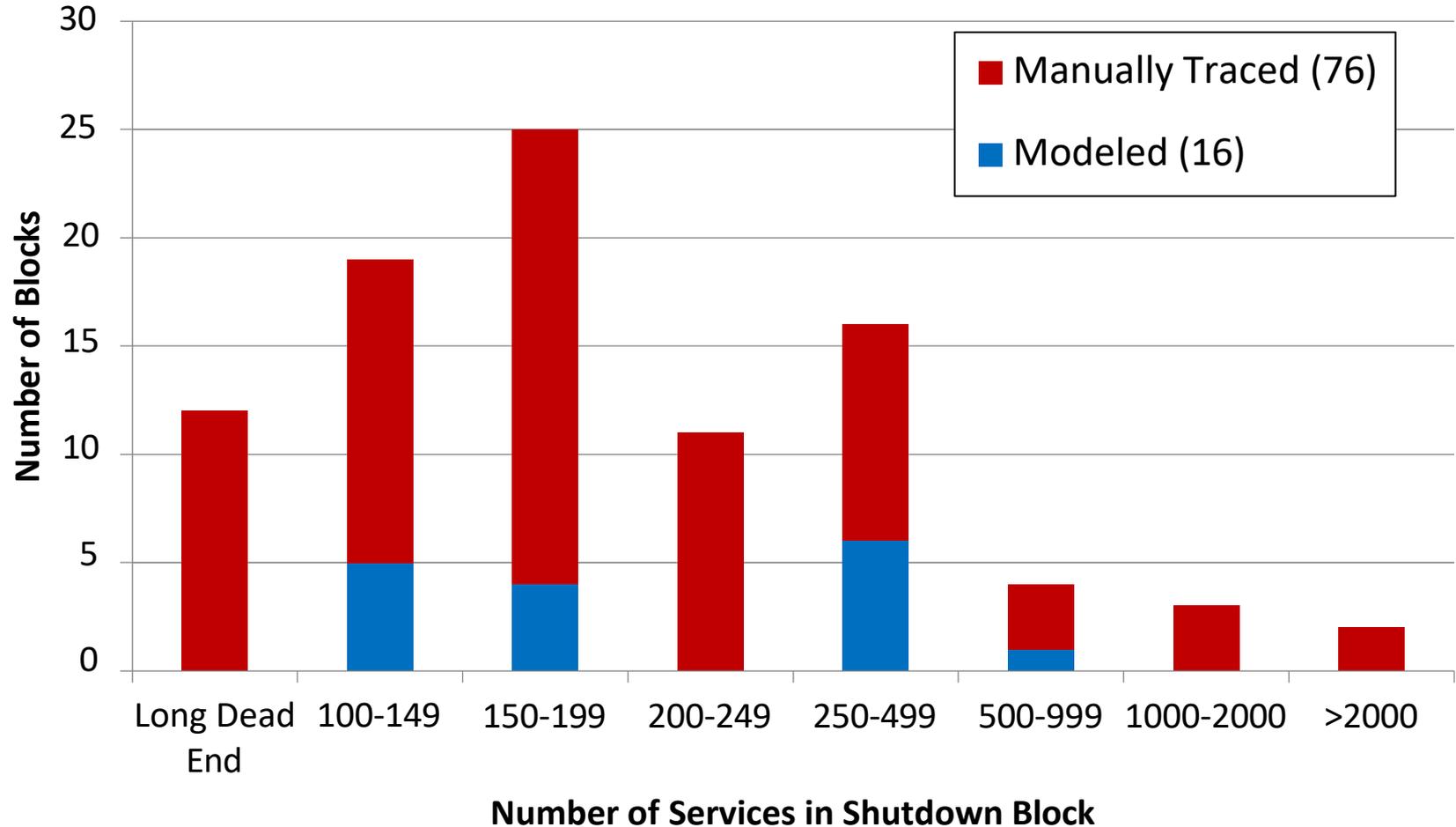
Does It Meet Thresholds?

- Once a potential HISB is traced out on paper, go to GIS & query by drawing a polygon
 - Number of services & hydrants
- Long dead ends
 - How far by paved road to nearest working hydrant?
 - Relay info to Seattle Fire Department

Record The Information

- Map page & pressure zone
- Location of parent shutdown
 - e.g. Avenue A from 4 St. to 8 St.
- Number of valves needed to make shutdown
- Number of affected services & hydrants
- Comments
 - Simple fixes?
 - Critical customers, single feed zone, etc.

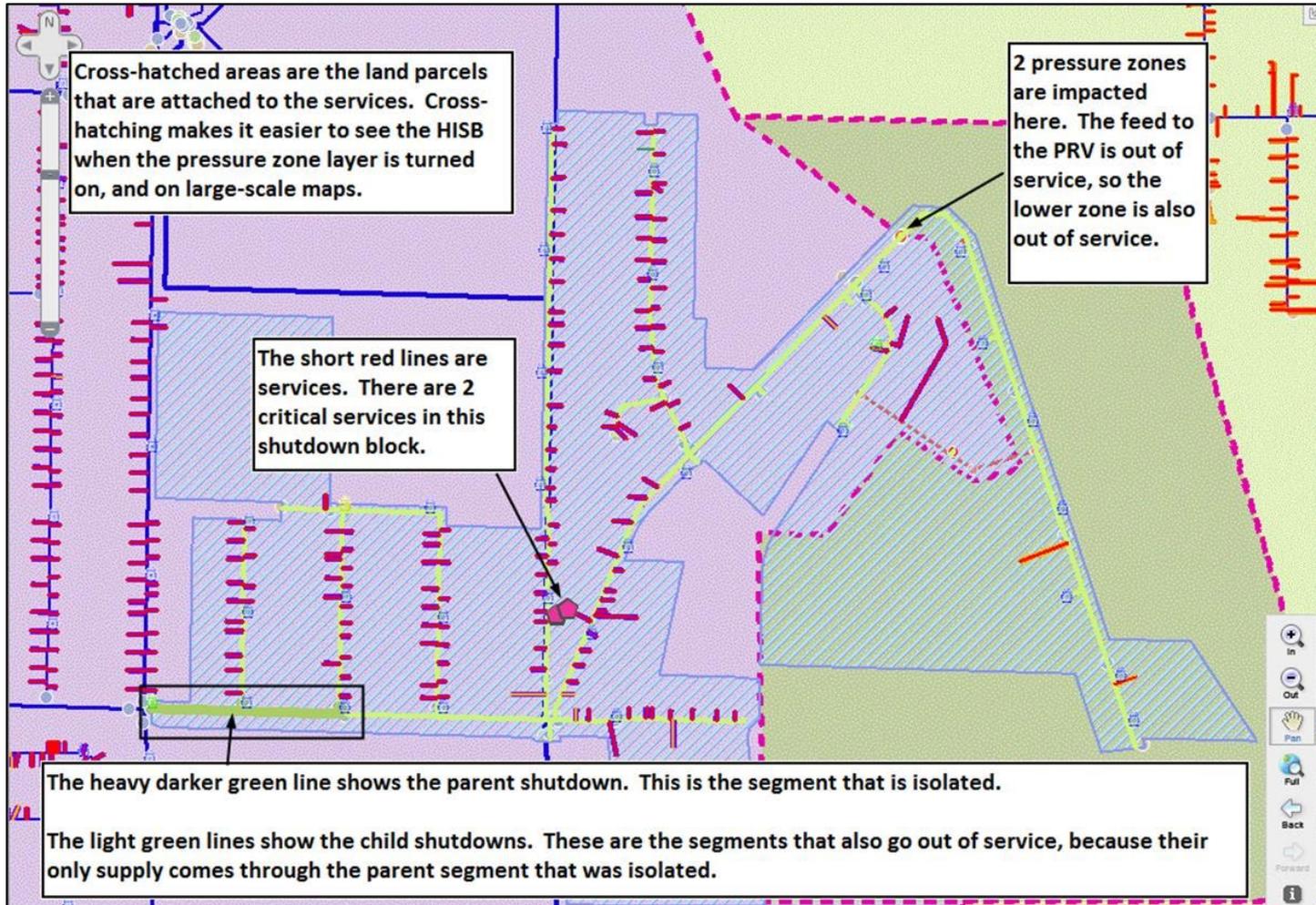
92 High Impact Shutdown Blocks



Share the Knowledge Via GIS

- Crews, operators & customer service agents know full extent of shutdowns
- Planners & plan reviewers can flag opportunities to implement solutions in conjunction with other projects
- GIS layer also visible to Seattle Fire Department

GIS Mapping



GIS Query of HISB Attributes

The screenshot displays the Geocortex Essentials UtiliView Water interface. The main window is titled "Report" and shows a "High Impact Shutdown Blocks" report for feature SW13. The report details are as follows:

Feature: SW13	
OBJECTID	53
HISB_FEA_KEY	5587450
HISB_ID	SW13
HISB_PARENT_ID	
HISB_CHILD_ID	
PRESSURE_ZONE_ID	585, 395PR
MAPBOOK SHEET	77, 302, 303
NUMBER OF VALVES	4
NUMBER OF HYDRANTS	32
NUMBER OF SERVICES	143
NUMBER OF CRITICAL SVCS	2
NO OF HIGH CONSUMPTION SVCS	1
INTERSECTIONS	8 SW & SW Roxbury
COMMENTS	Cascading PR zones also shut down.
FIELD WORK AROUND	
WATER CONTINGENCY	
FIRE CONTINGENCY	
SHAPE.AREA	0
SHAPE.Length	18316.970984501

The interface also includes a Layer List on the left with categories like Meter Reading, Cathodic, Non-SPU, Water Mains, and Water Structures. The Selection pane at the bottom left shows "High Impact Shutdown Block Mainlines (19)" and "High Impact Shutdown Blocks (1)". A scale bar at the bottom indicates a scale of 1:4800. The map background shows a red polygon representing the shutdown block and various utility lines.

Spaces For Field Work-Around Plan & Water Contingency Plan

- “Yes” indicates prepared plans, such as...
 - Alternate supplies
 - Big blue hose
 - Temporary PRV
 - Portable pump
 - Emergency response
 - Map out affected area & services
 - Decision trees
 - Communications templates



Manage the Asset & Plan the Solution

- Write that critical valve maintenance plan
- Fix the HISB
 - Can it be fixed at all, & if so, economically?
 - As a stand-alone project, or combined with other work?
- Would a temporary alternate supply work?
 - How about a bit of CIP plus temporary?

How's It Working Out?

- More accurate shutdown planning & notification
 - Fewer construction delays due to failure to notify
- Implemented several easy, low-cost fixes
 - Strategically planning the more challenging ones
- Incorporated fixes into
 - 2 fast-tracked SDOT projects
 - 2013 Fire Flow Improvements

Questions?

Cheryl Capron

ccapron.po@gmail.com