Unique Solutions to Residential Sewer Backups

It’s the people who make it unique
Residential Sewer Backups

- Side sewer issue?
- Operations/maintenance shortfall?
- Capacity limitation?

No matter what the root cause, it’s personal to the customer
So what can we do about it?

Increase System Capacity
• Upsize pipes & treatment facilities
• Storage

Reduce Demand
• I&I Reduction

Protect the homes
• Valves
• Grinder Pumps
Residential Backups and Working on Side Sewers

• Gather accurate data
• Side sewer ownership and responsibilities
• Side sewer policy
• Encourage reporting
2 Pilot Projects in Broadview

- Measure cost-effectiveness
- Private Property
- Applicable Citywide?
- Protect homes while we figure it out
- Build trust
Where is Broadview?
Broadview Neighborhood

• Residential, built in 50s & 60s
• Separated sanitary sewer system
• Repeated history of backups and SSOs during storms
• I&I significant, but not uniform
• Laterals a significant source of infiltration
Conditions vary
Pilot 1 - Flood Grouting

Flood grouting is a two part liquid mixture that seals all joints, cracks, and defects in the sewer system.

1. Fill
2. Empty
3. Fill
4. Empty
Selecting the Pilot Area

King County Facilities
Public Participation

Community support for project critical: first time for SPU to work on private property.

Extensive outreach

Achieved 95 percent sign up rate
Issues that came up

• Steep hills
• Placement of cleanouts
• Failed plugs

Overall
Well Received and Effective
Pilot 2 - Backflow Valves

Knife Gate

Flap

Ground Level Access

(Fig. A) Demonstration of flow:
The Clean Check® assembly includes: (1) lower collar with flapper, (2) upper collar & (3) valve body. When water flows through the system (green arrows), the flapper opens allowing waste to flow from the home/building to the sewer. In the event of a backup (red arrows), the flapper will seal preventing sewage backup into your home/building.

- Prevent sewage backup into a residence or building as a result of a plugged sewer system.
- Valve flapper seals the system, blocking reverse flow.
Steps in engaging the public

Individual support for project critical

- Extensive outreach to 90 potential candidates
- Basement elevations & questionnaires to 73 homes

81 percent continued participation
And then there were 73
- Listening to stories

- Sad stories
- Frustration
- Appreciation
- Wonderful customers

90 homes screened – 73 followed into selection
Back to the modeling

Establishing Criteria for installation

• Safety factor

<table>
<thead>
<tr>
<th>Back-up Elevation</th>
<th>Simulation with Backflow Preventers</th>
<th>30% Additional Flow</th>
<th>Proposed Plan &amp; comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preven+er Engaged (HGL Δ HGL)</td>
<td>Preventer Engaged</td>
<td></td>
</tr>
<tr>
<td>433.03</td>
<td>437.8 (0.7) YES</td>
<td>YES</td>
<td>Needs valve. High priority</td>
</tr>
<tr>
<td>439.28</td>
<td>439.0 (1.5) YES</td>
<td>YES</td>
<td>Needs valve @ +20%</td>
</tr>
<tr>
<td>441.05</td>
<td>441.1 (2.8) YES</td>
<td>YES</td>
<td>Needs valve. No history</td>
</tr>
<tr>
<td>442.84</td>
<td>441.8 (3.4) YES</td>
<td>YES</td>
<td>Needs valve @ +20%</td>
</tr>
<tr>
<td>430.26</td>
<td>427.1 (0.0)</td>
<td>No Valve - should be ok at +30%</td>
<td></td>
</tr>
<tr>
<td>432.08</td>
<td>429.5 (0.0)</td>
<td>No Valve - should be ok at +30%</td>
<td></td>
</tr>
<tr>
<td>432.30</td>
<td>432.3 (0.0) YES</td>
<td>Needs valve. History unclear. Model indicates need.</td>
<td></td>
</tr>
<tr>
<td>437.02</td>
<td>438.3 (0.0) YES</td>
<td>Needs valve. Sump connects upstream of the last SS connection to side sewer.</td>
<td></td>
</tr>
</tbody>
</table>
And then there were 33

40 homes did not meet the criteria

• Letter to those not eligible

• Letter to candidates
Valve agreements

Legal document that attaches to deed

10-year period

Maintenance requirements

Notaries

Modifications w/o notice

TIME

THIS BACKFLOW VALVE FOR SIDE SEWER AGREEMENT (this “Agreement”) is dated _______________, 2011. It is between (the “Owner”) and the CITY OF SEATTLE, a Washington municipal corporation (the “City”).

RECITALS
WHEREAS, The Owner is the owner of the real property described in the attached Exhibit A (the “Property”); and
WHEREAS, The City has proposed to have a contractor (“City Contractor”) install a Backflow valve in the side sewer line serving the Property (the “Backflow Valve”). This installation will be at no cost to the Owner; and
WHEREAS, The Owner desires to allow the City Contractor to install a Backflow Valve in the side sewer located within their property, the Owner and City hereby agree as follows:

AGREEMENT

For exchange of mutual and offsetting benefits, the receipt and sufficiency of which are hereby acknowledged, the City and Owner agree as follows:

A. Installation of Backflow Valve.
The Owner hereby grants permission for the City and City Contractor to enter the Property to install a Backflow Valve. The Owner will allow the City Contractor reasonable access to the Property to complete the necessary work. The Owner understands and acknowledges that the City Contractor must excavate down to the sewer line in order to install the Backflow Valve, and that this excavation may occur outside the home or in the basement floor. The installation of the Backflow Valve is at no cost to the Owner. Upon completion of the work described herein SPU or City Contractor shall make reasonable efforts to restore the property as near as possible to its condition prior to the work.

B. Maintenance and Functioning of Backflow Valve.
After the installation of the Backflow Valve, the Owner is exclusively responsible for the maintenance of the Backflow Valve. The Backflow Valve, when
And then there were 27
(And right now, there are 23)

6 refused the valve

4 say they would like one
Contracting!

The City is not set up to work on Private Property!

• Blanket Contracts

• Job Order Contract
Installation

Flap – 20 Installed under Blanket contracts
Alarms
Working under a blanket

SPU staff ended up serving as the general Plumber and Electrician

Tracking & Reporting

Quality Control & mistakes
Knife Gates

How to put this into that
Working under JOC

• Knife gates & disconnections

• Oversight is expensive

• Establish & communicate roles

• Some customers are challenging!
## Participation Summary

<table>
<thead>
<tr>
<th>Outreach Efforts</th>
<th>Flood Grouting</th>
<th>Backflow Valves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introductory letter</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Public Presentation</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Right of Entry form</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Follow up mailings</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Follow up calls</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Door hangers</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Certified mailing</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Open house</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Participation</strong></td>
<td><strong>95%</strong></td>
<td><strong>81%</strong></td>
</tr>
<tr>
<td>Basement survey/ questionnaire</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Follow up letters in/out of Pilot?</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Individual visits w/ candidates</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Legal agreements</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Follow up phone calls</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Registered letters</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Scheduling</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Inspection</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Participation of eligible candidates</strong></td>
<td><strong>95%</strong></td>
<td><strong>70%</strong></td>
</tr>
</tbody>
</table>
What determines the participation rate?

What’s the benefit to me?

What’s the risk to me?
Working on Side Sewers

Introduces new issues

• Whose responsibility is it?

• Need to consider willingness to participate

• Right of Access

• Public funds for private side sewers?

• Consistent messaging targeted at different audiences

• Construction QC
Residential Sewer Backups are a part of the bigger picture

- Bringing CSO and SSO reduction efforts together
- Side Sewer Policy
- Identifying and tracking causes of backups
- Encourage reporting
- Building trust
Questions?

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Backflow Valve Costs

Flap valve w/ alarm – installation
$ 8,882

Flap valve w/o alarm – installation
$4,003

Knife Gate Installation
$43,000

Investigation, development & support
$314,250
### Evaluation - Modeling

*Based on analysis of a 10 year storm return frequency*

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Before project</th>
<th>After project</th>
<th>Percent reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak hour I/I (mgd)*</td>
<td>0.37</td>
<td>0.27</td>
<td>27</td>
</tr>
<tr>
<td>Peak 24-hr I/I (mgd)*</td>
<td>0.25</td>
<td>0.14</td>
<td>44</td>
</tr>
<tr>
<td>Maximum event vol. (mg)*</td>
<td>5.7</td>
<td>1.5</td>
<td>72</td>
</tr>
<tr>
<td>Annual average I/I (mgd)</td>
<td>0.037</td>
<td>0.009</td>
<td>72</td>
</tr>
<tr>
<td>Dry weather flow (mgd)</td>
<td>0.03</td>
<td>0.025</td>
<td>15</td>
</tr>
</tbody>
</table>
How we know it’s Infiltration

Flow monitoring and modeling indicate that infiltration is key wet weather component