Seattle Public Utilities Broadview Pilot Project Flood Grouting Sanitary Sewers

NACWA 2012 Winter Conference
Facilities and Collection Systems Committee
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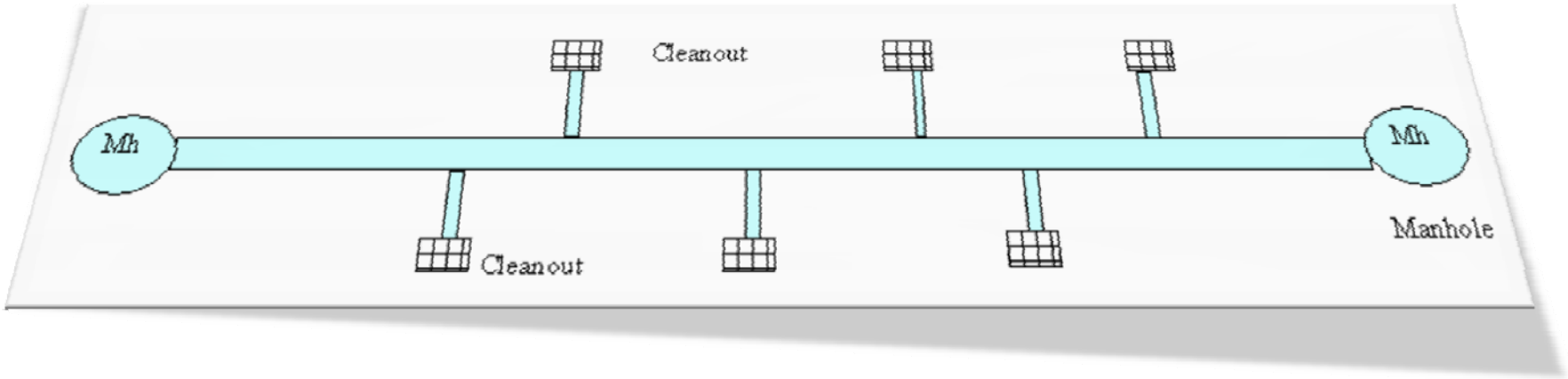
February 13, 2012

Brown AND Caldwell

Flood Grouting Overview

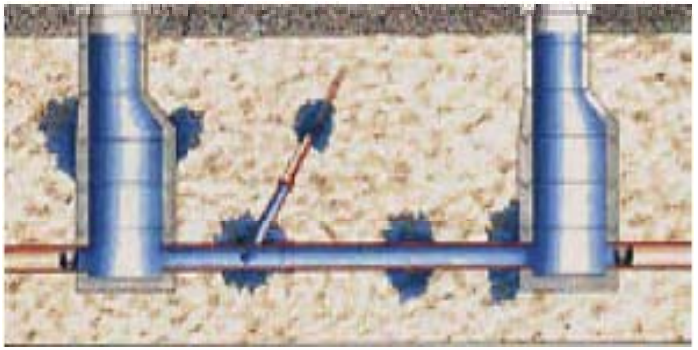
- Flood grouting is the process of flooding the sewer system with a two part silicate chemical mixture that seals all joints, cracks, and defects

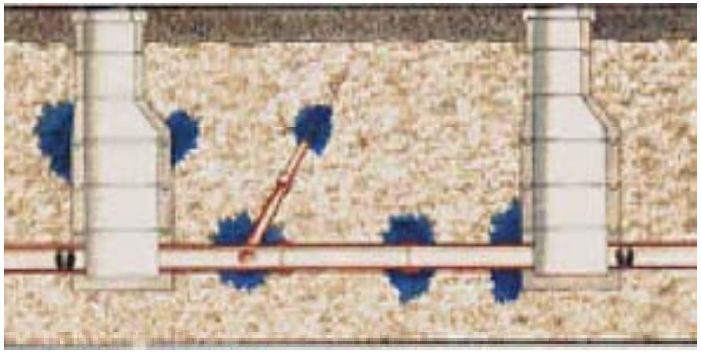
- The grout is applied to a MH to MH section including the mainline and all side sewers at once



Flood Grouting Process Overview

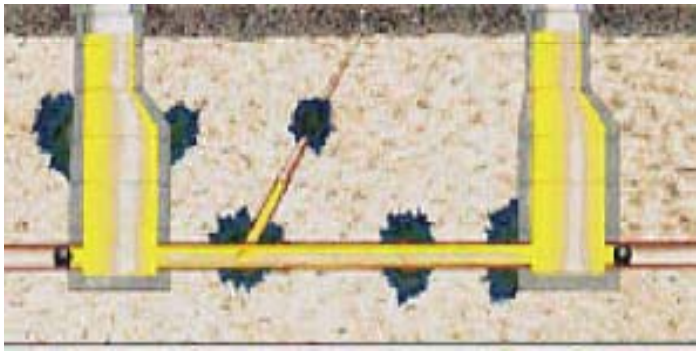
- Place inflatable plugs into sewer mains and laterals.
- Fill manhole with S1
- When optimum penetration has been achieved, rapidly pump out S1
- Remove plugs
- Rinse inside of sewers, laterals, and manholes

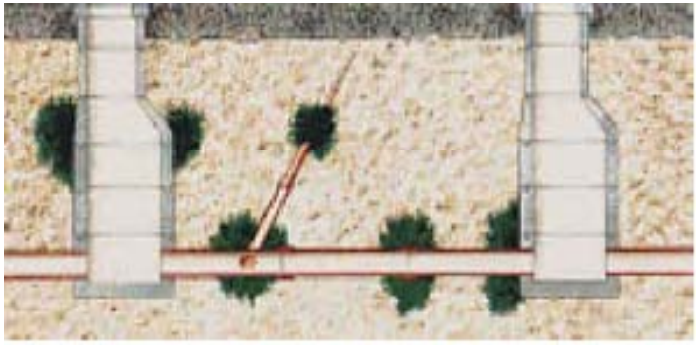




Flood Grouting Process Overview

- Re-install inflatable plugs
- Pour S2 into manhole
- S2 reacts with S1 in the ground, forming a gel, then hardening to a concrete-like matrix
- S2 is then pumped out.
- After flushing, the sewer is returned to service.





Flood Grouting

S1

S2

Mixing

Instant reaction

Flood Grouting

Sample excavations

Project site

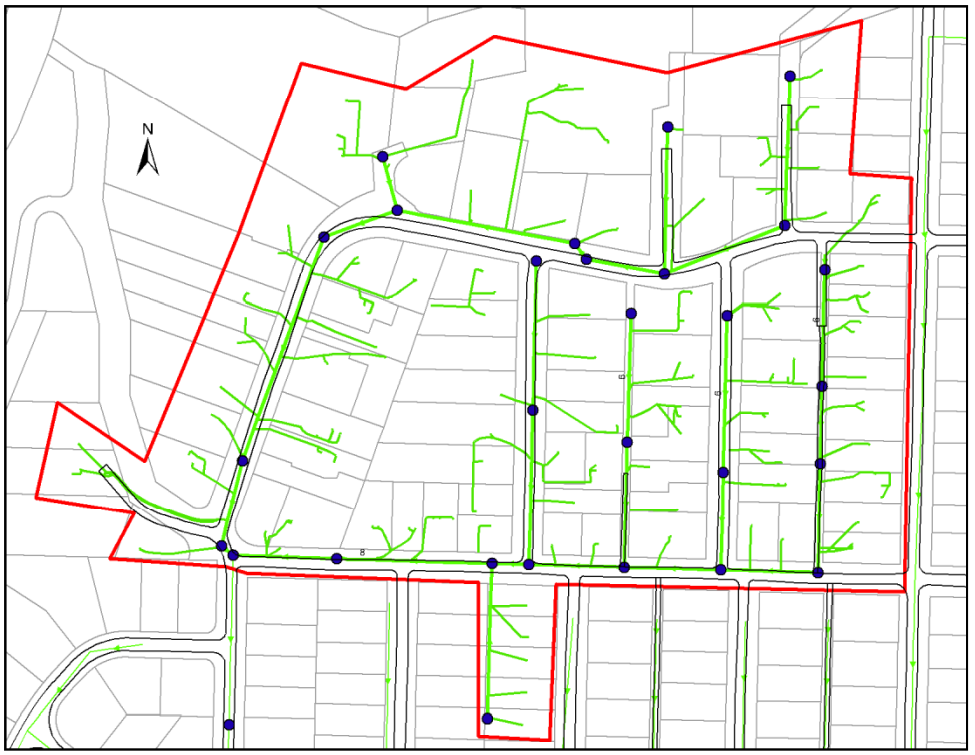
Broadview neighborhood

Seattle, Washington

- Residential, built in 50s and 60s
- Separated sanitary sewer system
- Repeated history of basement backups and SSOs during large storm events

Project site

- 27 – MH to MH sections
- MHs – 4 to 16 feet deep
- 5,913 ft of 6" to 8" concrete sewer mains
- 9,725 ft of 4" to 8" laterals (concrete & PVC)
- 88 parcels over 30 acres
- 95% sign-up rate (no cost)



<u>BCE Evaluated Technologies:</u>

- CIPP
- Pipe bursting
- Joint grouting
- **Flood grouting**

Construction

- Set up sewer bypass if needed
- Install plugs on laterals and mainlines

Construction

S1 Flooding
Heavier than water
“Syrupy”

S2 Flooding
SG and viscosity similar to water

Construction

- Issues
  - Topography

Liquid level

30 ft difference between MHs

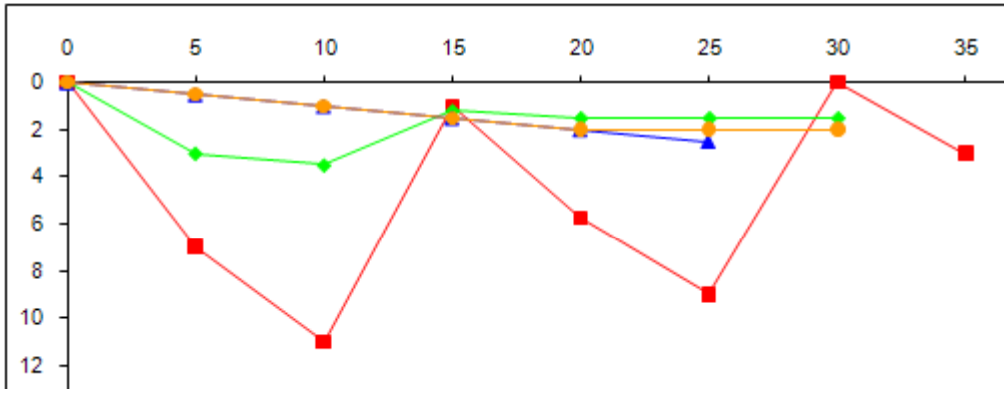
Risers to manipulate hydraulic grade

Hydraulic loading on the plugs

Project Evaluation

- Initial post exfiltration rates are promising

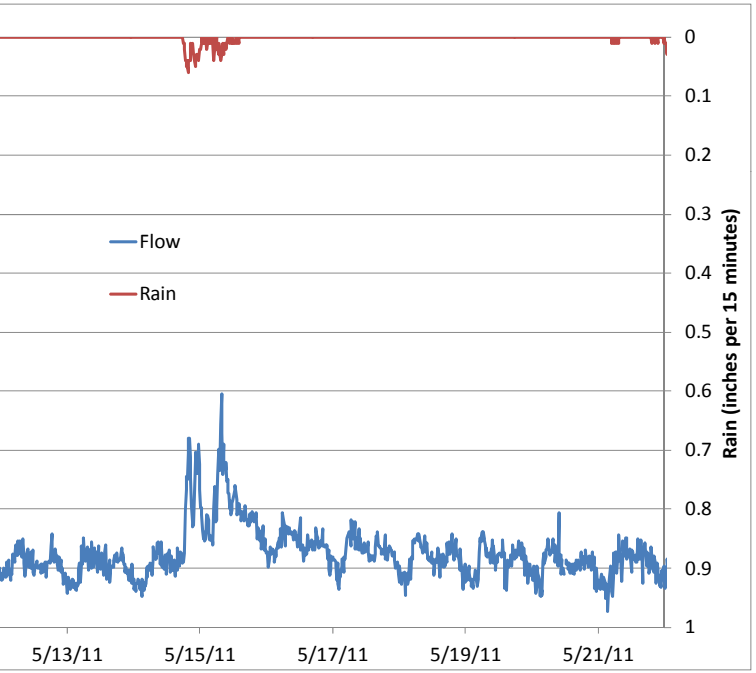
Flooded parts.	MH 98	MH 98	MH+Main+lat	MH+Main+lat
Time	9:54	10:50	12:23	13:35
minutes	sinking (inch) 1. cycle S1	sinking (inch) 1. cycle S2	sinking 2. cycle S1	sinking 2. cycle S2
0	0	0	0	0
5	7	3	0.5	0.5
10	11	3.5	1	1
15	1	1.2	1.5	1.5
20	5.75	1.5	2	2
25	9	1.5	2.5	2
30	0	1.5		2
35	3			
40				
70				



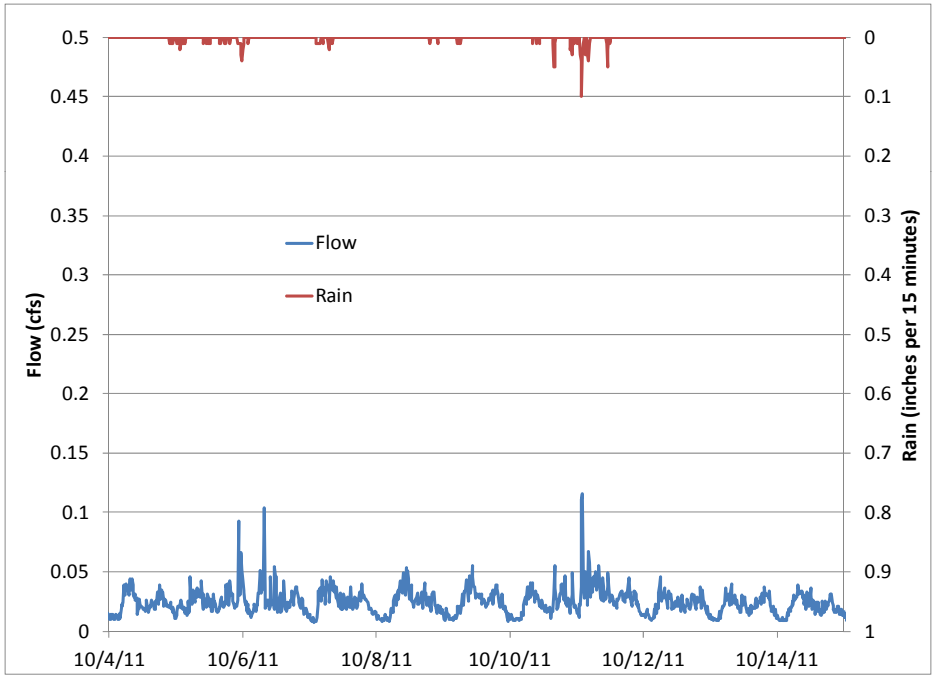
Upstream MH	Downstream MH	Before Loss	After Loss	Reduction
218-108	218-107	1.3	0.08	94%
218-104	218-103	5	0	100%
218-103	218-101	5	0	100%
218-078	218-077	10	0	100%
218-112	218-111	14	0	100%
218-105	218-104	16	0	100%
218-097	218-098	62	0	100%
218-100	218-225	94	0	100%
218-111	218-110	169	0	100%
218-070	218-096	43	2	95%
218-109	218-106	50	1	98%
218-220	218-100	98	2	98%
218-075	218-074	23	1	96%
218-102	218-101	25	0	100%
218-101	218-100	16	1	94%
218-106	218-103	17	1	94%
218-110	218-109	182	0	100%
218-107	218-106	160	0.3	100%
218-073	218-072	6	0	100%
218-071	218-072	2	0	100%
218-210	218-102	80	0	100%
218-077	218-075	5	0	100%
218-096	218-097	20	0	100%
218-225	218-098	5	0	100%
218-072	218-070	19	0	100%
218-076	218-075	6	0	100%
218-074	218-073	2	0	100%
Total		1135.3	8.38	99%

ject Evaluation (Project Complete 10/1/11)

ill too early to see flow meter results, small storm



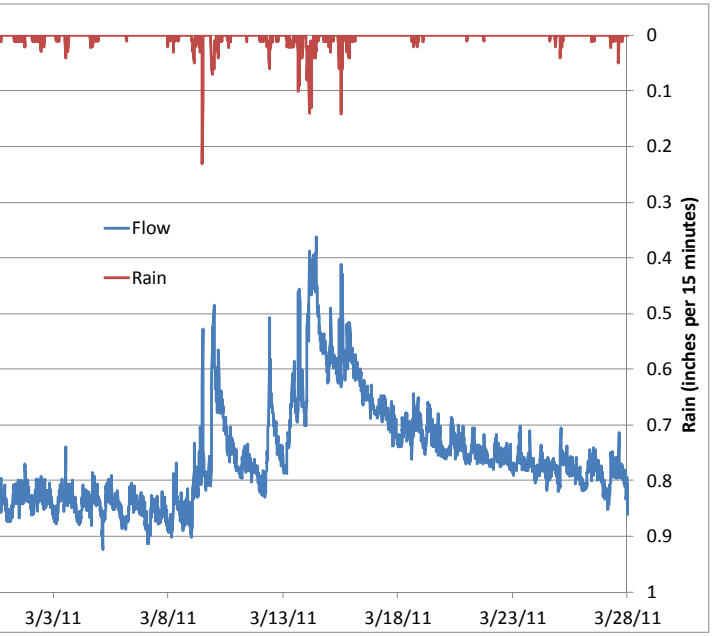
Before (May 2011)

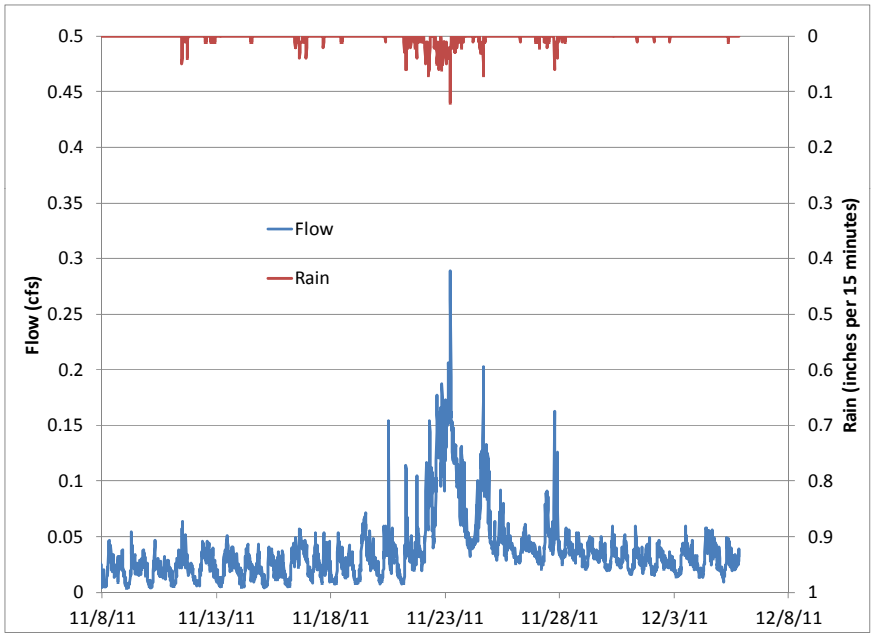


After (October 2011)

ject Evaluation (Project Complete 10/1/11)

ill too early to see flow meter results, big storm





Before

March 2011

After

November 2011

oject Evaluation

oject cost is approximately $1.5M
Vs estimate of $3.5M for CIPP or bursting

ontinued flow monitoring through spring of 2012

ng County modellling to determine removal rates
WERF funding with final report due Dec. 2012

PU may use this technology in other areas if
fective

sing remaining chemical to seal manholes

Questions?

For more information please contact:

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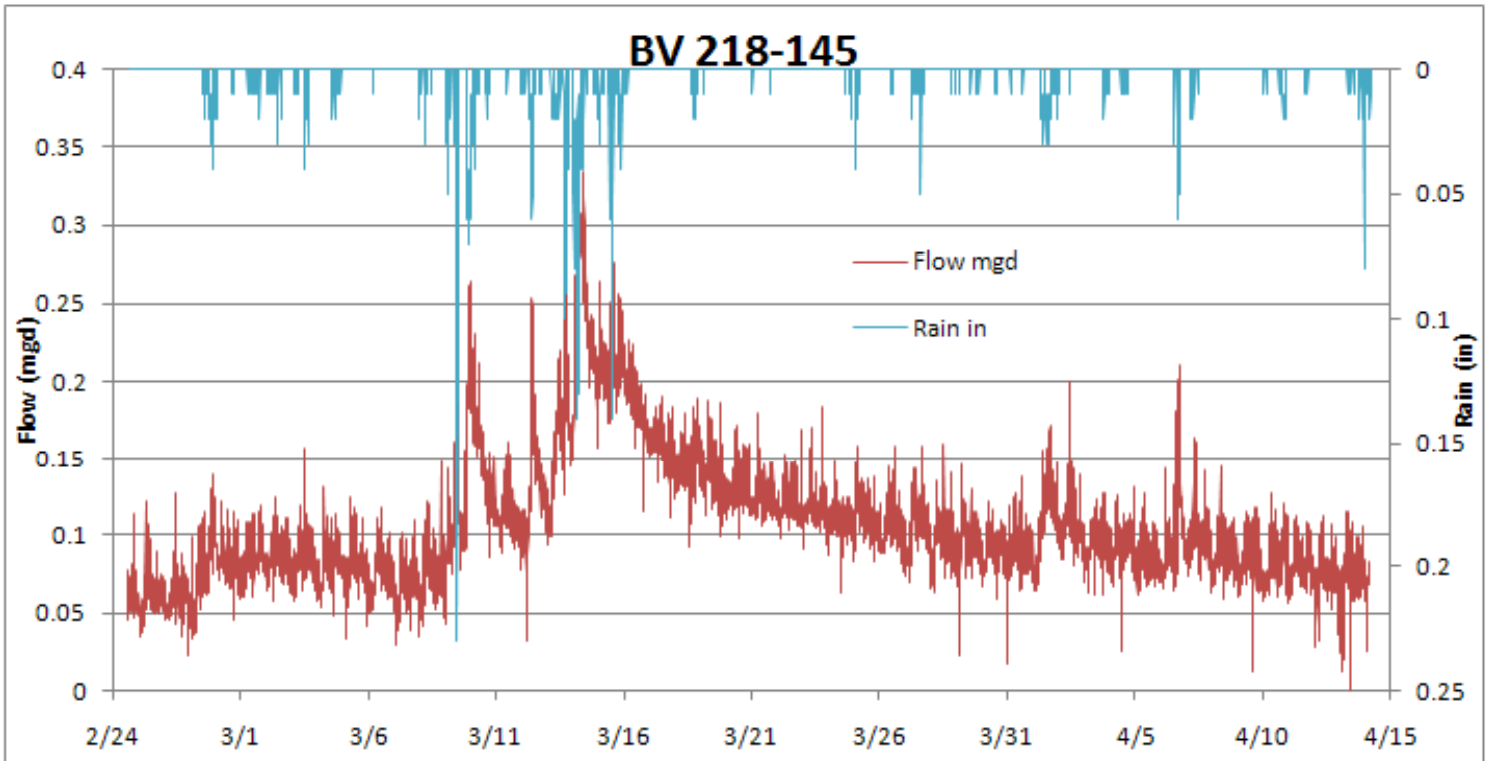
Brown AND

Extra Slides

oject site

ow monitoring and modeling indicate that filtration is key wet weather component



oject site

eed community support for project – 1st time for PU to work on private property

- ntroduction letter mailed
- Public presentation
- Right-of-Entry mailed with additional information
- 2nd mailing
- Phone calls
- Certified mailings
- Open house at the site

chieved 95 percent sign up rate

ood Grouting

Component is a sodium silicate
aterglass or liquid glass
de by melting sand and
assium and dissolved in water
cate solutions have been
lied in:
Roads
Anti corrosion coatings
Fire resistant coatings
Soil stabilization
Dikes, slurry walls
ncapsulate contaminates

Flood Grouting is

S1 + S2 +soil particles/aggregate = silicate conglomerate

Flood Grouting can:

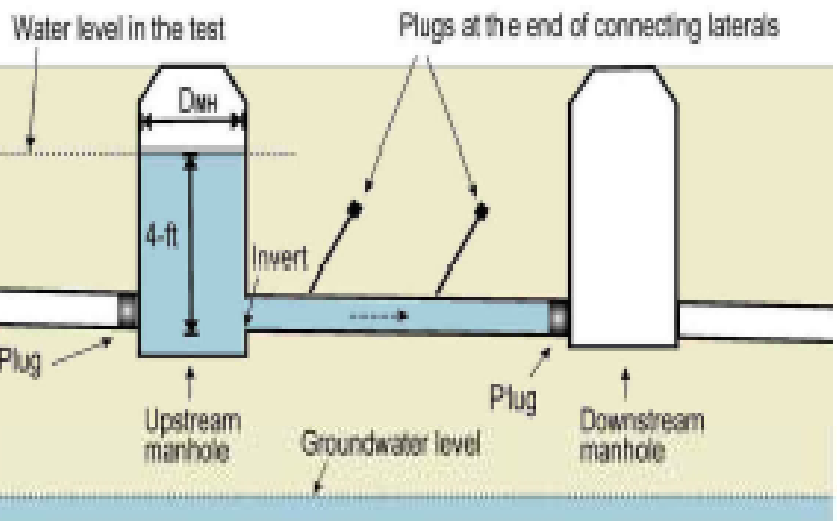
- Provide a stable environement for the pipes
- Eliminates infiltration AND exfiltration
- Stop biogenic sulfur corrosion
- Coat concrete pipes
- Reduce root ingress
- Resist oil and organic solvents

ial Steps

terals, mainlines, and MHs need to be cleaned and examined
move debris, roots, grease, incrustations, deposits etc.
cate alignment, side branches, sags, signifcant defects

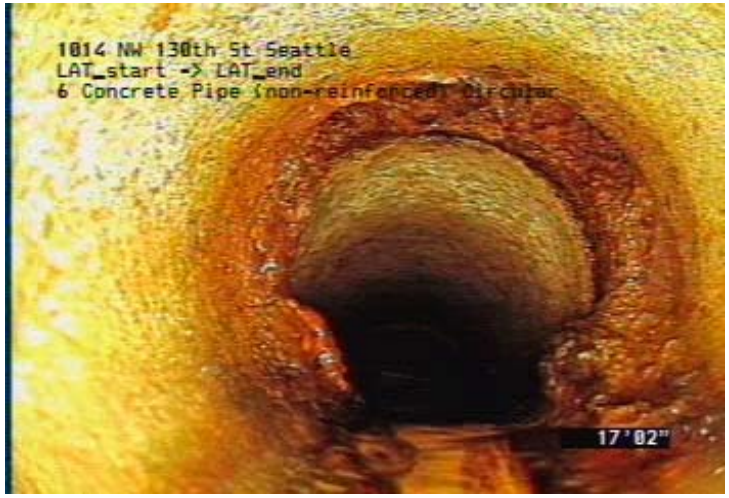
tall missing cleanouts
ac-a-Tee

ean water test



nstruction

- ompleted initial CCTV nd cleaning
- Determined some GIS mapping was off
- Found that no repairs were needed
- Discovered that 3 MHs did not exist
- SPU installed under ongoing maintenance
- Found that some mainline pipe changed diameters mid span
- Extensive signs of infiltration



nstruction

stalled all cleanouts with the Vac-a-Tee method

nstruction

sues

Leaking through pavement

erational Lessons Learned

de sewer plugs are the “Achilles heel” of flood grouting

epth of side sewers is a challenge

aterial handling

Equipment maintenance

transportation - legal vehicle weight, brakes

eed solid inspection data in conjunction with accurate apping

oject Lessons Learned

- eed accurate mapping up front
- pography, side sewer configuration, and ndscaping will limit the extent of side sewer ealed
  - Only able to seal about 30 percent of the total side sewer length
- onduct clean water tests on all sections ahead time
- e prepared for spill response, both public and ivate
- ctively involve Engineer throughout project