



MAGNOLIA

PIPE REPAIR PROJECT



King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Summer 2017

Damaged Pipe Investigation Summary

Overview

September 2016: King County operators become concerned that a 3,200-foot-long County sewer pipe located about 150 feet below West Galer Street is not working properly. The pipe was built to keep sewage and stormwater out of Puget Sound by sending excess flows to a storage tank near Smith Cove. It does not provide direct sewer service to homes or businesses.

Operators notice that no flows enter the tank after storms as expected. King County inspect nearby city sewer lines to see if the city system was contributing materials that could plug the pipe, but nothing is found. During a video inspection of the pipe, King County finds a soil blockage in the pipe, which explains why flows were not reaching the tank at Smith Cove.

November 2016: King County field staff find pieces of the County pipe in the storage tank. The County initiates a rapid response to find the break location and stabilize the area around it.

December 2016: County geotechnical engineers map underground conditions along the pipe alignment. The results lead the County to begin exploratory drilling and grouting along West Galer Street. The County contractor drills six-inch diameter holes primarily between Thorndyke Avenue West and 28th Avenue West to find areas of soil loss or loose soil along the pipe. The depth of the holes ranges from 135 to 180 feet. Grout is injected into any detected areas of loose soil or soil loss until they are stabilized.

County geophysicists use sound waves to map underground conditions around the pipe break. This map allows County geophysicists and geotechnical engineers to see potential areas of soil loss or loose soils underground, and gauge the effectiveness of grouting efforts.

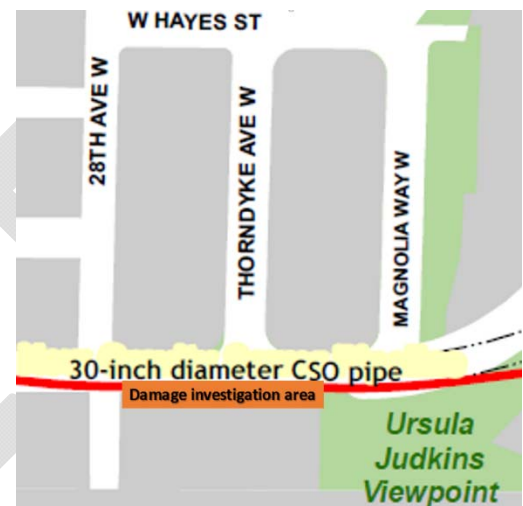
Surveys of existing surface settlement monitoring points along the pipe indicate no significant movement from previous readings taken during the pipe's installation in 2014-15.

January 2017: While attempting to clean the pipe, crews locate the pipe break at a joint just west of the Thorndyke Avenue West and West Galer Street intersection.

February-April 2017: The County convenes a public meeting on February 16 to update the community. Crews continue drilling and grouting in mid-February, finishing in early April. Crews drill a total of 15 holes. Existing surface settlement monitoring points along the pipeline route are surveyed again in February and April. No significant movement from previous readings.

May 2017: The area around the pipe break is determined to be stabilized. King County decides to move forward with the work necessary to bring the pipe into service while continuing to investigate the causes for the break.

June 2017: County crews restore the work area along West Galer Street.



(continue reading)

ALTERNATE FORMATS AVAILABLE: 206-477-5371 / TTY Relay 711

Findings and Results

The County pipe investigation provided the following information:

- The pipe broke at a joint just west of the West Galer Street and Thorndyke Avenue West intersection about 150 feet below ground – no other damage to the pipe was identified
- Soil loss due to the pipe break was confined to areas next to the break
- Surveyors found no signs of soil movement or elevation changes at ground level before, during or after the County's investigation and field work
- Approximately 350 cubic yards of soil was lost due to the pipe break – nearly all of the soil loss occurred 60-100 feet underground
- Vibration monitoring determined that vibration levels from the drilling were lower level than the vibration generated by Metro buses passing by the work site
- Crews inserted 580 cubic yards of grout – about 65 percent more than the documented amount of soil lost due to the pipe break

Magnolia Damaged Pipe Investigation by the Numbers	
Gallons of sewage and stormwater volume kept out of Puget Sound during storms when the storage tank is full	1.5 million
Feet of pipe installed to connect the sewer system to the tank near Smith Cove	3,200
Feet of pipe inspected by video camera	2,800
Cubic yards of grout inserted to stabilize area around pipe	581.3
Estimated cubic yards of soil lost due to the pipe break	356
Individual inquires responded to since field work began in December 2016	106
40-foot pipe segments installed to connect the sewer system to the tank	80
Weeks of field work during pipe investigation	16
Public-information-sharing activities since field work began in December 2016	16
Drilled holes in West Galer Street searching and filling areas of soil loss along the pipe	15
Diameter of the broken pipe (feet)	2.5
Broken pipe segments	1

(continue reading for more detailed information)

Detailed Project background

In 2014-15 King County installed a 3,200-foot sewer pipe under West Galer Street in Magnolia. The 30-inch diameter pipe was made out of fusible PVC (fPVC).

The pipe connects the existing sewer system to a 1.5-million-gallon storage tank near Smith Cove. The tank and pipe are part of the County's "Protecting Our Waters" program which builds facilities to keep sewage and stormwater out of Puget Sound and other local water bodies during storms. The excess flows are called Combined Sewer Overflows (CSOs).

Without the storage tank in service, CSOs in Magnolia are sent to Puget Sound to avoid sewage backups into homes, businesses and public spaces.



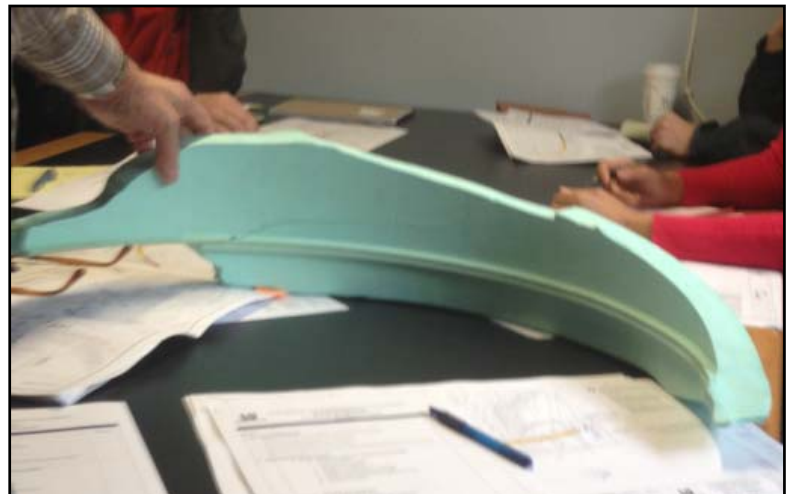
September 2016: Investigation begins

The tank did not fill up as expected after a September 2016 storm, which led operators to suspect the pipe was blocked. Bricks and sand were also found in the tank, which can end up in local sewer lines from construction sites. The County and City of Seattle worked together to inspect nearby city sewer lines to see if there were any obvious entry points. The inspections ruled out the city lines as a reason for the blockage.

County inspectors walking the pipeline and surveys of surface level elevation showed no change. At this point there was no indication of a problem with the pipe's integrity.

November 2016: Pipe break confirmed

King County confirmed the pipe was broken in November 2016 when pieces of the pipe drained into the storage tank near Smith Cove. The debris suggested the pipe broke at a joint. The County mobilized its project contractor for a rapid response to stabilize the area around the pipe and find the exact location of the break.



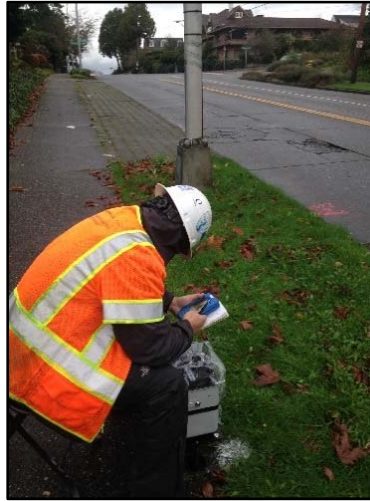
Pipe debris found in the storage tank indicated the pipe broke at a joint, so drilling inspections focused on joint locations

King County monitored surface conditions and survey points along the pipe during this time. No change in elevation was detected along the pipeline corridor.

December 2016: Surveying, drilling and grouting on West Galer Street

King County's top priority was stabilizing soils along the pipe. In December, County surveyors used geophysics to map underground conditions along the pipe.

Crews began drilling 6-inch holes in the soils above the pipe to locate areas of soil loss. Crews injected cementitious grout in any area of soil loss they found.



January 2017: Break located during pipe clean out

The County hired pipe cleaning specialists to remove the blockage in the pipe so that the break area could be inspected. Although crews removed the original blockage, the soil removed was quickly replaced by additional materials entering the pipe with groundwater, preventing a full inspection.

Tomographic surveyors mapped underground conditions around the broken pipe.



Crews found the pipe break location while attempting to clean the pipe out from the Magnolia Wet Weather Station.

February – June 2017: Public meeting, drilling resumes

King County updated the community on the investigation on Feb.16, 2017. Crews resumed drilling and grouting the following week. Crews ultimately drilled 15 holes along West Galer Street with the most intense activity occurring over the break area west of the West Galer Street and Thorndyke Avenue West intersection. The total amount of grout inserted exceeds the amount of soil removed.

In May, the County and its geotechnical experts determined the grouting sufficiently stabilized the area along the pipe.

In June, the County contractor restored the work area, repairing planter strips and driveways, filling in pilot holes and repaving as appropriate along West Galer Street. Work continues on a plan to bring the pipe into service.

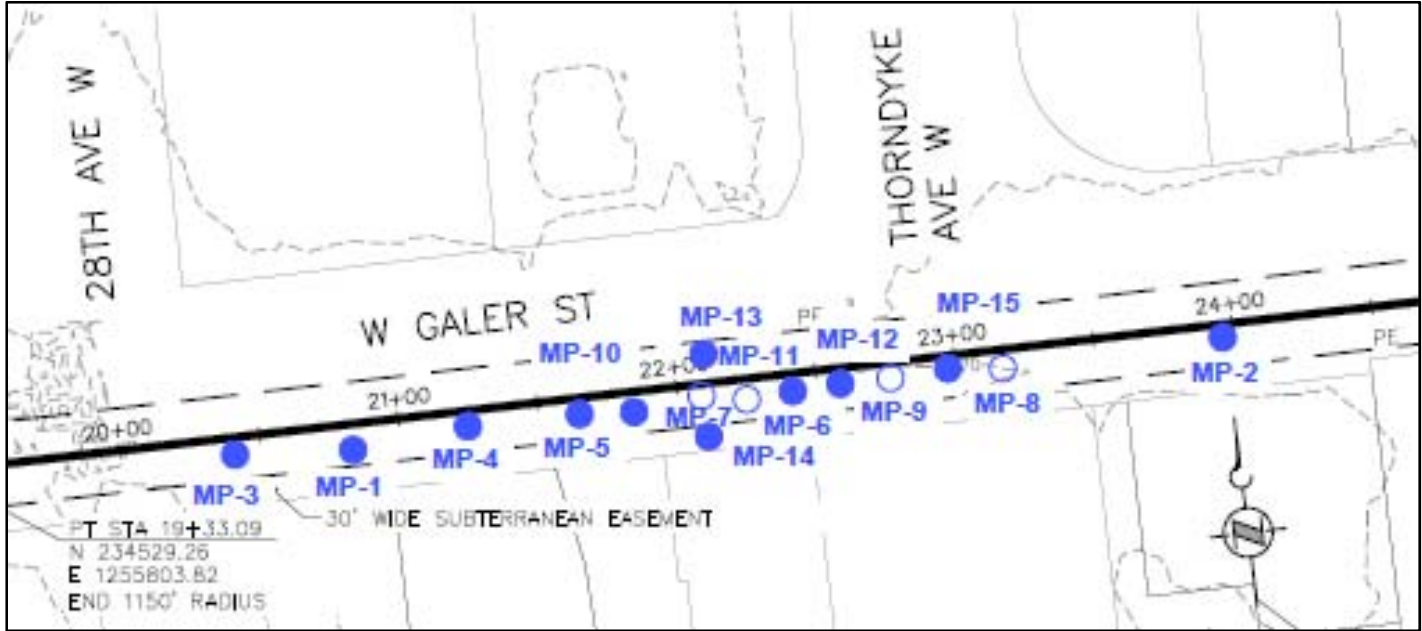


Drilling and grouting stabilized the area along the pipe under West Galer Street.



WTD Director Mark Isaacson discussed the project with interested community members on Feb. 16.

Drilling and grouting details



Each dot represents a 6-inch hole drilled by County contractors to search and fill areas of soil loss along the pipe.

Hole (MP = "Magnolia Pipe")	Depth (feet)	Inserted Grout Volume (cubic yards)
MP-1	135	5.0
MP-2	141.5	12.6
MP-3	135	2.1
MP-4	135	2.3
MP-5	135	2.6
MP-6	135	19.9
MP-7	135	98.0
MP-8	140	2.3
MP-9	140	27.0
MP-10	140	4.9
MP-11	140	23.0
MP-12	140	59.0
MP-13	140	198.0
MP-14	181.5	121.4
MP-15	140	3.2
		TOTAL 581.3