



EPA New England Water Infrastructure Outreach provides tools, examples, and technical assistance for water infrastructure operators and managers, local officials, and other decision-makers for more effective and sustainable water infrastructure management. For more information see <http://www.epa.gov/region1/sso/toolbox.html>

## Wastewater Siphon Elimination

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### *If You Could Eliminate A Siphon, Would You?*

Inverted siphons carry wastewater flows under rivers, canals, roads, etc. These structures can present problems, and communities look for ways to avoid siphons in their wastewater collection system when possible. Siphons require periodic flushing maintenance and, during low flow times, the wastewater velocity can be low, which unfortunately creates ideal conditions for sediment to deposit and cause blockages.

Laconia New Hampshire, a small city on the shores of Lake Winnepesaukee in central New Hampshire, has a number of inverted siphons in their wastewater system. The Public Works Department manages more than 100 miles of collection system piping (see sidebar), the majority of which is 6 and 8 inch vitrified clay (VC) pipe ranging from 50 years old to over 110 years old. Some parts of the sewer system date back to the 1880s.

### City of Laconia

#### By the Numbers



Population 16,000

18 Pump Stations

91 miles of collection system

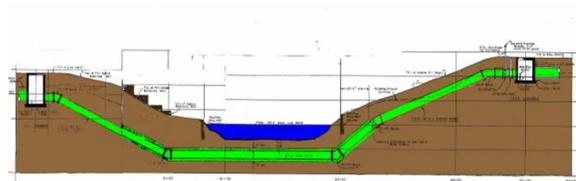
13 miles of force main

14 siphons

For many years, the Department has been working to improve the structural condition of its sewer system through repairs and rehabilitation. The Department coordinates underground work, as applicable, with road projects. A prioritized list of streets to be paved is developed each year and distributed to water, wastewater, electric, gas and communication utilities to facilitate coordination of all underground work. Recently, this coordination led to an opportunity for Laconia to remove a couple of problems from its Trouble Spot Maintenance list, including a sewer siphon.

### **Trouble Spot Identified**

In Laconia's downtown area, a single barrel siphon built in the late 1800s ran under a stormwater box culvert. The siphon and sewers in this area were plagued with recurring blockages and required frequent line cleaning. Upon investigation, it was discovered that the outlet of the siphon was at a higher elevation than the inlet, thereby creating debris buildup. There were also concerns with the pipe sizes and slopes of some sewers in the area. The sewer line upstream of the siphon was an old 6 inch VC pipe that would also back-up and surcharge the upstream manhole. In addition, the manholes had little slope, if any, from invert in to invert out.



The siphon and each of the pipes were on the Trouble Spot Maintenance List and individually on the capital improvement list. While as individual projects they did not warrant a high priority, viewed together, the projects became more cost effective and rose on the capital improvement ranking.

### The Fix

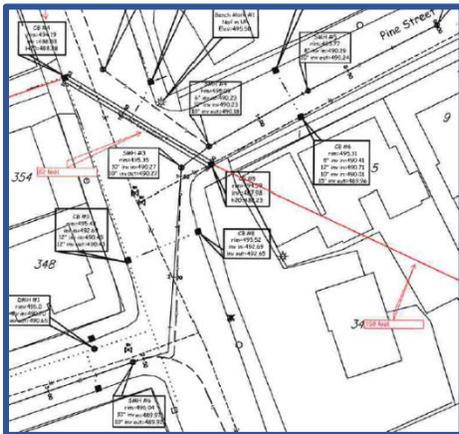
The project area was surveyed to provide information on the existing conditions, and utilities were located to evaluate potential conflicts with the design. Critical information for the design included getting the rim and invert elevations at the existing manholes and drainage structures.

The shallow slope of the length of sewer leading into the siphon was the limiting factor for re-design. This was compensated for by relocating a manhole further upstream and taking advantage of a portion of the existing sewer with a steeper slope and raising the tie-in elevation for the upstream invert.

***"By looking at several segments as a whole we were able to lower another section of sewer that was scheduled for replacement due to sulfide damage by 3 feet, while increasing the diameter to accommodate the additional flow being added further upstream."***

***Luke Powell, Assistant Director, Public Works***

The existing service connections required that the proposed sewer depth remain at or below



the existing sewer to avoid conflicts with service line slopes and still tie-in to the proposed line. This required increasing the pipe diameter to allow a shallower minimum slope to connect to the invert elevation of the downstream tie-in manhole. A hydraulic and hydrologic study was done to assess the culvert's ability to handle flows plus the re-aligned pipe. The change in slope of the sewer line allowed the pipe to go through the existing box culvert at the top portion of the culvert, which minimized any interference the new pipe may have on the culvert hydraulics.

### Coordination with Other Departments

As a policy, the Public Works Department notifies all utilities (water, sewer, electric, gas and communications) of the paving schedule to give all utilities an opportunity to make repairs before a road is re-surfaced. In this case, the elimination of the siphon and the replacement of some of the sewer pipes, as well as a water line replacement, were coordinated with the paving schedule.

### Obstacles

As with many underground projects, this one was complicated by other buried utilities. Laconia needed to be aware of the location of electrical conduit and gas pipes, contend with groundwater, and coordinate crossing the box culvert in two places. Bypass pumping of wastewater around the retired siphon was needed from the manhole upstream of the siphon to the manhole downstream during construction.

### Summary

Often, an emergency is needed to move a project to construction. That can be expensive. In other situations, as in this case, the City assessed the cumulative potential for improvement that doing several projects in the same area at the same time would bring. And, coordination between Laconia Public Works and Laconia Water Department resulted in a more cost-effective project.

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