FOCUS ON WASTEWATER

In the articles below, Bryanna Denis, Professional Engineer and Project Manager for Wright-Pierce (an environmental engineering firm providing consulting services to the Town of Falmouth) and Falmouth Town Manager, Nathan Poore, examine the history of Falmouth’s wastewater collection and treatment systems, the issues surrounding West Falmouth’s connectivity to the current system, and the plans to upgrade and improve the system for current and future needs. These articles first appeared in The Falmouth Focus in October 2020 and April 2021.

Falmouth’s Wastewater Systems

By Bryanna Denis, PE, LSE, Wright-Pierce

Most residents rarely consider sewage or wastewater collection and treatment systems. Why should they? As long as your toilet flushes, everything is working...right?!? There are, of course, a few instances when thinking about wastewater is unavoidable, for example: paying your sewer bill or having your septic tank pumped, sewer construction in front of your house or on your route to work, and when your toilet gets clogged. The good news is that, most of the time, wastewater systems work very well. However, like other public infrastructure such as roads, bridges, and schools, these systems need maintenance to continue to function properly and serve the public.

“The collective work of Town staff, Maine Department of Environmental Protection, and consulting engineers protects public health and the environment from...us. Civilization, a high standard of living, population density, industry, and many other things all produce plenty of waste. Our job is to plan, design, construct, regulate, operate, and maintain the infrastructure that collects, conveys, and treats wastewater. If we do our job, most people don’t need to think too much about sewage.

In order to keep things working as they should, the Town of Falmouth is implementing a phased upgrade of the Town’s existing wastewater system to ensure that sewage is adequately conveyed and treated now and in the future.

Falmouth’s wastewater treatment facility on Clearwater Drive.
How Falmouth’s Sewer System Works

By Bryanna Denis, PE, LSE, Wright-Pierce

The Town of Falmouth’s extensive wastewater collection and treatment system consists of 56 miles of gravity sewer and force mains, 31 pump stations, and a 1.56 MGD (million gallon per day) wastewater treatment facility (WWTF) on Clearwater Drive. This system serves 2480 households and businesses in Falmouth and approximately 1100 in Cumberland.

So how does it work? Water and waste from a home or business is flushed through a building’s pipes until it reaches local sewers which are owned and operated by the Town of Falmouth. Wastewater flows through Falmouth’s gravity sewers to the treatment facility.

Gravity sewers utilize pipes that are sloped downwards, harnessing the force of gravity to convey sewage through the system. In some low-lying areas, however, pumping is required via a pump station. Pumps or compressors located in a pump station (sometimes called a lift station) provide the energy to propel wastewater into what is known as a force main. A force main is simply a pressurized sewer pipe that conveys wastewater in areas where gravity sewage flow is not possible.

Falmouth’s original sewer system was constructed in 1969. It included 7 pump stations and 10 miles of sewer collection lines primarily serving the Route 1, Route 88, and Middle Road areas of town. A decade later, the utility expanded to include Cumberland. From the 1980s to today, expansion continued westward with the development of The Woodlands, the Falmouth Schools campus, the Exit 53/Route 100 area, the Winn Road/Falmouth Country Club area, and the Pleasant Hill area. Since the late 1980s, the majority of wastewater pumping and collection systems in West Falmouth — meaning the area west of Interstate 295 — have been designed and constructed by private developers as needed to serve their specific developments. This infrastructure was then typically turned over to the Town for ownership, operation, maintenance, and future capital upgrades. Unfortunately, these systems were developed without the benefit of a clear master plan for the best way to expand the overall sewer system and with little consideration for serving potential future development in West Falmouth.

As sewer was extended further and further into West Falmouth, the system grew into a large “daisy-chain” of pumping stations. Sewage from pump station A is pumped to pump station B which then pumps to pump station C and so on. In some cases, sewage is pumped through no less than eight pump stations before it reaches the treatment plant. When these pumping stations were installed, flows were low and there were no capacity problems. But as more development occurred and more pump stations were added, the systems installed twenty to thirty years ago have not only aged, but also developed capacity limitations that, in some cases, caused sewer backups. This issue is expected to only get worse with additional development and as systems reach the end of their life span, which is typically thirty years or so.
The diagram below of the major West Falmouth sewer pumping stations illustrates how they are connected or “daisy-chained” to one another. The flow rate, shown in gallons per minute (GPM), is the maximum flow rate of the pumps. The year indicates the year that the station was built or upgraded. Since the pumps do not pump all the time, there is limited storage capacity at each pump station and in the piping system, which allows for a slightly larger capacity station to pump into a smaller capacity station as long as the larger capacity station isn’t running too often. However, as pump run times increase due to growth and during wet weather periods when groundwater and surface water migrates into sewer collection systems, smaller downstream pump stations can quickly get overwhelmed.

In contrast, the area east of Interstate 295, is a good example of a collection system that was planned before it was built. Rather than a daisy-chain layout, there are two larger pump stations (Mill Creek and Clearwater) that collect flow from several smaller pump stations and gravity sewers and pump directly to the Wastewater Treatment Facility.

In the early 2000s it became apparent to the Town that capacity issues were beginning to crop up in the West Falmouth collection and pumping system. Between 2004 and 2008, the Town significantly upgraded the wastewater treatment facility on Clearwater Drive and completed an interim upgrade at the Lunt Road Pump Station. A 2009 Pump Station Assessment provided Town officials with valuable information to help understand the existing collection system needs and to plan for future upgrades. This assessment detailed existing conditions of all Town pump stations and made recommendations for future improvements such as the 2014-2016 Mill Creek Pump Station upgrade. It also included a separate technical memorandum identifying the concerns with the West Falmouth daisy-chained system and the resulting challenges associated with this approach to growth. This 2009 memorandum recommended that the Town develop a sewer master plan for West Falmouth.

From the figure above, it is easy to see that the Falmouth Road, Pinehurst Drive, and Woodlands Clubhouse Stations are all undersized. Moreover, this daisy-chain approach, while less costly to developers at the time of development, has resulted in the need for capacity increases to multiple stations, force mains, and gravity sewers later as the flows increase over time.
future sewered growth; and provide recommendations moving forward to allow the Town to improve its sewered growth potential from a wastewater management perspective. This assessment also called for the development of a West Falmouth Master Plan, while at the same time noting: “Regardless of whether or not the community experiences sewered growth, the Town must reinvest in its underground infrastructure as it ages. Buried pipe, while out of sight and out of mind, has a finite life and must be renewed or replaced. Peak flows will continue to grow in an aging sewer system regardless of sewered growth requiring attention to this vital community asset.” (Paul Birkel and Chris Dwinal, Wright-Pierce to Pete Clark, Superintendent, Falmouth Wastewater Department, Wastewater Treatment Plant Capacity Assessment and Impacts on Future Development/Growth in Falmouth and Cumberland, Memorandum, May 22, 2013).

The Development of the West Falmouth Sewer Master Plan

By Bryanna Denis, PE, LSE, Wright-Pierce

Falmouth’s wastewater treatment systems were originally constructed in 1969 and substantially expanded throughout the 1980s. Over the past twenty years, the Town of Falmouth has initiated a systematic process for planning and upgrading its existing sewer infrastructure to meet the community’s needs. Some of the upgrades, studies, plans, and reports that have been completed since 2000 include:

- 2002 Wastewater Facilities Update (following completion of the 2000 Comprehensive Plan)
- 2004-2008 Design and construction of wastewater treatment facility upgrade
- 2006 Construction of the Lunt Road Pump Station Upgrade
- 2009 Pump Station Assessment (Town-wide, including evaluation of West Falmouth Pumping System)
- 2013 Updated Comprehensive Plan
- 2013 Wastewater Capacity Assessment
- 2013 Infiltration and Inflow Study
- 2014-2016 Mill Creek Pump Station and Force Main Study, Design and Construction
- 2014-2017 West Falmouth Sewer Master Plan
- 2018 to current – Design of Phase 1 upgrades to West Falmouth system

Following the approval of the 2000 Comprehensive Plan, the Town undertook upgrades to the Wastewater Treatment Facility (WWTF) and Lunt Road Pump Station. In 2009, the Town commissioned a Comprehensive Pump Station Assessment to provide a basis for the development of a Comprehensive Capital Improvements Program. The assessment examined 7 pump stations constructed between 1969 and 1971 and an additional 16 stations constructed between 1978 and 2007. The study also noted that some of the Town’s existing gravity sewers dated to the 1940s.

In its recommendations, the Pump Station Assessment prioritized upgrades and improvements to pump stations and force mains over the next 14+ years. One of the first priorities, “strongly” recommended to be completed within two years, was the development of a West Falmouth Master Sewer Plan. Because upgrades to one pump station can impact adjacent stations, this plan would allow for a comprehensive approach to any potential upgrades throughout the
system. Furthermore, in an additional technical addendum, it was noted: “the Town is now faced with capacity limitations in several sections of the West Falmouth sewer system that may preclude future development. Although there is additional capacity in certain interceptors and pump stations, there are a number of bottlenecks which means that as a system, there is minimal or no additional capacity for development in West Falmouth at this time” (Chris Dwinal, Kattie Collins, Evaluation of West Falmouth Pumping System Pump Station Assessment, April 15, 2009).

“The West Falmouth Sewer Master Plan identified deficiencies under current conditions, such as aging infrastructure, capacity limitations, and bottlenecks in gravity sewer, pump stations, and force mains.”

A key part of the Town’s wastewater system is its Wastewater Treatment Facility (WWTF). Upon completion of the 2013 Comprehensive Plan, the Town commissioned an assessment of the capacity of its wastewater treatment plant. This assessment noted that the WWTF “has significant capacity to handle sewered growth.” However, the report cautioned that “peak flow conditions which occur during extreme wet weather events have the plant operating near its hydraulic capacity.” The assessment noted that it was “imperative...to identify and remove extraneous flows to maintain the current level of treatment and exceptional plant performance.” The report concluded: “Select sections of the existing collection system, including gravity sewers and pump stations, are currently at capacity and further study is required, particularly in West Falmouth, to determine the best options to address these limitations...Regardless of whether or not the community experiences sewered growth, the Town must reinvest in its underground infrastructure as it ages” (Paul Birkel and Chris Dwinal, Wright-Pierce, to Pete Clark, Superintendent, Falmouth Wastewater Department, Wastewater Treatment Plant Capacity Assessment and Impacts on Future Development/Growth in Falmouth and Cumberland, Memorandum, May 22, 2013).

Incorporating information from these previous plans and assessments, the West Falmouth Sewer Master Plan identified deficiencies under current conditions, such as aging infrastructure, capacity limitations, and bottlenecks in gravity sewer, pump stations, and force mains. The plan recommended a series of upgrades to address these current problems, while also planning for the impact of growth over the next 20-40 years. In some cases, when making upgrades to current systems, extra capacity can be created for relatively little extra cost to serve long term needs. The West Falmouth Master Plan was finalized in 2017 and provided the Town with the information it needed to take a planned approach to addressing current capacity issues as well as future sewered growth in West Falmouth.

Recommendations from the West Falmouth Master Plan included upsizing the Middle Road sewer, as well as upsizing the Lunt Road and Middle Road pump stations. In addition, since the Mill Road and Leighton Road Pump Stations were shown to overwhelm the Falmouth Road Pump Station during high flow periods, one of the most important recommendations in the West Falmouth Sewer Master Plan was to upsize the Falmouth Road Pump Station and its associated force main. This upgrade will not only alleviate the current capacity bottleneck in the system but will also eliminate the “daisy-chain” flow through multiple pump stations.

To explain this further, flows from the Falmouth Road Pump Station currently need to be pumped two more times through capacity-limited pump stations before reaching the Lunt Road Pump Station. The West Falmouth Sewer Master Plan recommended that the...
new Falmouth Road Pump Station Force Main bypass the Pinehurst Drive and Woodlands Clubhouse stations. This solution allows for future growth, but also reduces the overall cost to the Town by eliminating the need to upsize the Pinehurst Drive and Woodlands Clubhouse stations at the same time as Falmouth Road Pump Station.

The new flow path in West Falmouth, shown in red, would look something like the diagram below.

During the preliminary design and routing analysis of the Falmouth Road Pump Station Force Main, the Town and Wright-Pierce investigated the CMP route and found there were significant challenges that would make that route more costly than initially thought. Though this route would have the least construction impact to homeowners, the route had both wetlands and a stream crossing, significant ledge outcrops, and steep slopes and valleys. The wetland area and steep slopes would prevent access to the pipe after construction, so it would be impossible for the Town to access the pipe for maintenance or repair in the future without the additional construction of a gravel access road. In addition, the transmission corridor is owned by several private landowners. CMP only holds an easement. Obtaining easements and approvals from both property owners and CMP could be costly and complicated.

Following a more detailed evaluation and cost assessment of the original CMP route, the Town and Wright-Pierce looked closer at a proposed route through The Woodlands as a less expensive choice. In 2018, upon hearing concerns from The Woodlands Homeowners Association, the Town of Falmouth requested that Wright-Pierce re-evaluate six possible options for rerouting the force main.
The next critical phase in Falmouth’s wastewater infrastructure modernization is to implement one of the most important components of the West Falmouth Sewer Master Plan: upsize the Falmouth Road Pump Station and its associated force main. Currently, West Falmouth wastewater flows through public wastewater lines running under The Woodlands neighborhood, visiting two pump stations on Pinehurst Drive and at The Woodlands Clubhouse, before exiting at Woods Road. This existing infrastructure imposes capacity bottlenecks in the system, and the “daisy-chain” flow of wastewater from West Falmouth through multiple pump stations creates engineering complexity and failure points.

Based on the Master Plan recommendation, the Town determined that the Town’s existing wastewater easement under Woodlands Drive is the best route for the upgraded force main. This new force main, running in a separate pipe, would completely bypass the Pinehurst and Woodlands Clubhouse stations. It is the least expensive route and, because the Town already holds an easement to the property, would not require the taking of private property by eminent domain. Non-financial factors also favor the Woodlands Drive route, including minimizing blasting disruptions to Town residents, mitigating environmental impacts, and facilitating future ease of maintenance.

The Woodlands Homeowners Association (WHA) has voiced opposition to the plan to upgrade the Town’s infrastructure via the Woodlands route. Woodlands residents have expressed concern about risk to underground utilities, safety, and impact to the community. Trying to find an amicable resolution with the WHA, the Town has delayed the project for several years and instructed Wright-Pierce engineering firm to prepare multiple revised route evaluations to see if any alternative route could be feasible and cost-effective. Each of Wright-Pierce’s evaluations have ranked the Woodlands Drive route as the most cost effective and least risky.

This month, the WHA and the Town failed to reach an agreement at a mediation before an impartial mediator. The Town has made every effort to accommodate the concerns of the WHA. However, implementing the West Falmouth Sewer Master Plan recommendation will have far-reaching benefit for the entire community and remains necessary to ensure the integrity of an aging wastewater system and to increase capacity for future commercial and residential demand in West Falmouth. Further delays will increase costs of the project, as well as risk a failure in the existing infrastructure. Therefore, the Town intends to resume and complete the design of the project through the Woodlands this year while continuing to work with the WHA to minimize construction impacts to The Woodlands community. Construction would be expected to occur in 2022.