COMPREHENSIVE PUMP STATION ASSESSMENT

for the

TOWN OF FALMOUTH, MAINE

JULY 2009

WRIGHT-PIERCE
Engineering a Better Environment

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EXECUTIVE SUMMARY

ES.1 BACKGROUND

The Town of Falmouth's wastewater conveyance system includes approximately 41 miles of gravity sewers and force mains and 23 pump stations that convey sewage to the Richard B. Goodenow Wastewater Treatment Facility (WWTF) located at 250 Clearwater Drive. The WWTF and seven of the pump stations were constructed between 1969 and 1971 as part of a three phase project. The remaining 16 stations were constructed between 1978 and 2007 (mostly by developers) and later turned over to the Town for long-term operations and maintenance. Some of the Town's existing gravity sewers pre-date the construction of the WWTF and were constructed as early as the 1940s. A portion of the Town's gravity collection, pumping and treatment facilities serves the town of Cumberland as well. Figure 1-1, included at the end of Section 1, shows a map of the collection system, pump stations and WWTF. These pumping stations are critical to the operation of the entire sanitary collection system and require regular maintenance and periodic upgrades to ensure they are reliable and cost effective to operate.

ES.2 PURPOSE AND OBJECTIVES

Wright-Pierce was retained to conduct an evaluation of the pump stations in an effort to identify the existing condition of each station, identify any code violations, identify the need for upgrades or replacements of equipment that has exceeded its intended service life, and evaluate the need for capacity increases to ensure sufficient pumping capacity for a 20-year planning period. Wright-Pierce was also retained to evaluate the capacity of seven gravity interceptors and recommend upgrades based on capacity limitations or other factors. The purpose of this Comprehensive Pump Station assessment was to provide the Town with a basis for the development of a Comprehensive Capital Improvements Program.

ES.3 SUMMARY OF FINDINGS

The Town's operation and maintenance staff has been very proactive in maintaining the infrastructure and equipment in the system and this is clearly seen in how long some of the equipment has been operating (several stations are almost 40 years old and are still using much of the original equipment that has been repaired or rebuilt). With that said, several of the stations are reaching the end of, or have exceeded, their design life (capacity still remains, but components need replacement) and several stations are approaching their maximum capacity and have little or no additional capacity to handle additional flows. Below is brief summary of findings of the pump stations and of the interceptors that were evaluated. In addition, a brief discussion on force mains has been included as well as a discussion of the West Falmouth system.

ES.3.1 Pump Stations Findings

In an effort to minimize the length of this summary, a brief overview of the recommended improvements has been included. Additional information on specific improvements can be found in Section 3 and in the technical memorandums completed by the various building services disciplines in Appendix A.

- The following stations are nearing their existing pumping capacity or have reached the end of their design life and will require a comprehensive upgrade:
    - Mill Creek Pump Station
    - Brown Street Pump Station
    - Woodlands Clubhouse Pump Station
    - Pinehurst Drive Pump Station
- The following stations have adequate pumping capacity at this time but still require non-capacity related upgrades:
    - Clearwater Drive Pump Station (building improvements)
    - High School Pump Station (new pumps)
    - Middle Road Pump Station (permanent generator upgrade, potential capacity upgrade pending additional development)

- Falmouth Road Pump Station (building improvements)
- Thornhurst Drive Pump Station (permanent generator upgrade)
- Underwood Road Pump Station (permanent generator and VFD upgrade)

- The remaining pump stations appear to have adequate pumping capacity at this time and will require only minor improvements, such as upgrades to the aging telemetry system used for communications.
- The existing telemetry system is 25 years old. Some of the equipment is no longer manufactured which means that spare parts will be increasingly difficult to acquire. As such, a complete telemetry upgrade at the WWTF and at each pump station is recommended. For all stations that require a new pump control panel as well, we recommend that the control and telemetry be incorporated into one panel. There are a number of stations that have relatively new control panels, and in these cases, we would recommend that just the telemetry panel be replaced.

Prior to any of the upgrades being completed, we recommend that the Town first perform the following work:

- Six of the existing pump stations are "can" style stations and utilize a below-grade steel enclosure or "can" to house the pumps, valves, controls, etc. As these are the oldest stations in Town and are approaching 40 years old, we recommend that the Town perform ultrasonic testing of "can" stations to verify their structural integrity for continued use.
- Complete a radio path study to layout the new radio network. Once this has been completed, the upgrades can be spread out over several phases and completed as funds become available.
- Complete a sewer system evaluation study of the Brown Street and Thornhurst Drive Pump Station drainage areas to identify sources of inflow and infiltration. Information from this study will then be used to determine the required capacity at the Brown Street Pump Station.
- Conduct flow monitoring in the Route 88 sewer interceptor to confirm current flows during both dry and wet weather before the Mill Creek Pump Station upgrade and before

replacement of any sewer pipes (see Section ES.3.2 below for a discussion of the interceptor capacity).

- The Town should consider holding Cumberland to the requirement (per the original agreement) to maintain a flow meter located at the town line on Route 88 to monitor all of the flows coming from Cumberland and to provide the Town with flow data taken at a more frequent interval (i.e. every fifteen minutes rather than monthly totals the Town currently receives). This data will then be used to determine the required capacity at the Mill Creek Pump Station, if pipe replacement is required in Route 88, or if infiltration and inflow removal projects may be required in Falmouth or Cumberland to control flows.
- We strongly recommend that a sewer master plan for the West Falmouth collection and pumping systems is developed prior to any additional development. Section ES.3.4 further outlines the reasons for this.

ES.3.2 Interceptor Findings

The interceptor assessment considered information on the existing conditions of the interceptors gathered through many different means including information provided by the WWTF staff, record drawings of the interceptors, and capacity analysis performed utilizing Hydraflow Storm Sewers 8.0. This effort did not involve any review of television records of sewers, records of sewer construction techniques or any field observations of the interceptors. Refer to Section 4 and Appendix D for additional information. Figure 1-1 and the maps included in Appendix D show the location of the interceptors. The following is a brief summary of findings for each interceptor evaluated as part of this assessment.

- West Falmouth Interceptor: It appears that several sections of this line are at capacity and already begin to surcharge under peak conditions. In addition, the pipe that crosses the I-95 Turnpike Spur will likely be a bottleneck in the near future if any additional flow is added to West Falmouth. Further investigation will be required as the actual invert elevations of this pipe are unknown at this time. In addition, sections of this interceptor

between the Turnpike Spur and the Lunt Road Pump Station may need to be replaced with larger pipes to accommodate future growth.

- Woodlands Club Interceptor: It appears that this interceptor has approximately 150 gpm of additional capacity available.
- Exit 52 Interceptor: This interceptor has approximately 340 gpm of total capacity. While estimates of current flows were not prepared as part of this evaluation, it appears that this interceptor has sufficient capacity to support some growth in the drainage area it serves.
- Middle Road Interceptor: It appears that this interceptor has approximately 150 gpm of additional capacity available.
- Route 88 Interceptor: It appears that this interceptor has no additional capacity at this time as the modeling showed that several sections of pipe have already begun to surcharge under peak conditions. Because of the flows used in the model are only estimates, as noted above, this interceptor would be a good candidate for flow monitoring to gain information on actual flows and surcharge conditions prior to spending significant capital upgrading pipes that may not be at capacity.
- Foreside Interceptor: It appears that this interceptor has approximately 50 gpm of additional capacity available. Although there is limited potential for future growth in this area, pipes are nearing capacity. Limited flow monitoring in this area could be used to confirm actual flows and to help identify high value infiltration and inflow projects that may reduce flows to this interceptor.
- Mackworth (Lower Route 1) Interceptor: Based on the existing flow assumptions, this interceptor has approximately 370 gpm of additional capacity available. In addition, it is estimated that the section north of Hammond Road has an extra 700 gpm of capacity (this section has a larger pipe diameter).

ES.3.3 Force Mains

The force mains in the system range in age from two to almost 40 years old and are constructed of various materials including polyvinyl chloride (PVC), high density polyethylene (HDPE), ductile iron (DI) and asbestos concrete (AC). The life of a force main is dependent on a number of factors such as type of material, aggressiveness of soils around the pipe (i.e. corrosive soils),

amount of grit in the wastewater (higher quantities of grit can lead to degradation of pipe walls especially at the invert), operating pressure and velocities in the pipe (higher pressure or velocity can lead to more wear and therefore shorter life), construction techniques (poor installation practices can lead to pipe damage), etc. Additionally, it is extremely difficult to assess the condition of a force main as there is really no cost effective way to inspect it. Typically, force mains are only replaced when a known problem exists or when the pipe needs to be increased in size to accommodate more flow.

At this time, we recommend that the Town continue to monitor the pumping performance as a means to identify potential problems rather than attempting to perform costly analysis of the force mains via TV inspection (which would require access points to be excavated every 300-600 feet along the length of the force main) or other means. It is also recommended that the Town begin to set aside funds in capital reserve each year to pay for eventual replacement. A methodology for determining the amount to place in capital reserve each year is included in Section 3.

ES.3.4 West Falmouth

Since the late 1980's, the wastewater pumping and collection systems in West Falmouth have been designed and constructed by private developers as needed to serve their specific development, with little or no consideration for serving future development. Following construction, ownership of these pump stations were turned over to the Town for operation and maintenance. As a result, the system has been constructed as a large "daisy-chain" (i.e. station A pumps to station B which pumps to station C with all pump stations being of similar size) as sewer was extended farther and farther into West Falmouth. Although this method tends to be the least expensive and most direct method for sewer expansion initially, it can quickly become expensive when growth occurs. For example, in the case above, if station A is upgraded to serve new development, stations B and C will also require a capacity upgrade because they are downstream of the new, larger station. The question then becomes, who is responsible for the costs associated with the upgrades? Should the developer of a new residential or commercial project that impacts station A be required to upgrade three pump stations before they can tie in or

is the Town's responsibility to spread the burden of upgrade across the entire sewer user base in the interest of economic development and growth of the tax base?

Unfortunately, this type of problem is not an uncommon problem for many communities in Maine and throughout New England. Sewers were extended and pump stations were built on demand without adequate long-term planning to consider future sewered growth and the potential implications on sizing and location. Because of the lack of adequate long-term sewer planning for West Falmouth, the Town is now faced with capacity limitations in several sections of the West Falmouth sewer system that may either preclude future development or make it cost-prohibitive. Prior to adding any new sewer users to the collection system, we strongly recommend that the Town develop a sewer master plan that will allow the Town to dictate how future developments in West Falmouth will be sewered. Sewer master plans take natural drainage areas and the development potential within these drainage areas into account when determining where pump stations should be located and how large they should be.

Based on the work completed as part of this evaluation, Pinehurst Pump Station, Woodlands Clubhouse Pump Station and the West Falmouth interceptor are currently the most limited infrastructure in the West Falmouth collection system. A more in-depth description and analysis for this area are included in Appendix C.

ES.4 SUMMARY OF RECOMMENDED UPGRADES, COSTS AND PRELIMINARY SCHEDULE FOR IMPLEMENTATION

The upgrades and improvements recommended are presented in Table ES-1 below. They are organized into short-term (0-7 years), mid-term (7-14 years) and long-term (greater than 14 years) timeframes. The costs associated with any upgrades and/or improvements have also been included.

As discussed in Section 3, the cost estimates represented in this report are preliminary and do not constitute a preliminary engineering effort. During any preliminary engineering effort, the specific scope and associated cost will be further evaluated and refined; however, the costs

presented herein should assist the Town in developing a capital improvements plan for the collection system infrastructure. The project costs include an allowance of 45% of the estimated construction costs to account for construction contingency, design and construction engineering, and permitting as well as financing, administrative and legal expenses. The project cost information presented herein is in current dollars and is based on ENR Index 8534 (March 2009).

TABLE ES-1
IMPLEMENTATION SCHEDULE

Upgrade/Improvements by Priority	Estimated Cost
Near Term (0-2 years)	
Ultrasonic Testing of all "Cans"	$10,000
Sewer System Evaluation Study (Brown Street and Thornhurst Drive drainage areas) [1]	$60,000
West Falmouth Master Plan	$50,000
Route 88 Sewer Flow Monitoring	$25,000
Foreside Interceptor Flow Monitoring	$15,000
Radio Path Study (Telemetry)	$8,500
Cumberland Metering (Route 88)[2]	--
Total Near-Term Improvements	**$168,500**
Short Term (2-7 years)	
Mill Creek Pump Station Upgrade	$1,950,000
WWTF Telemetry Upgrade	$8,000
Brown Street Pump Station Upgrade	$490,000
Clearwater Drive Pump Station Upgrade[3]	$74,000
Woodlands Clubhouse Pump Station Upgrade	$500,000
Pinehurst Drive Pump Station and Force Main Upgrade	$500,000
High School Pump Station Upgrade/Remove Falmouth Road/High School concurrent pumping restriction	$84,000
Middle Road Pump Station Generator	$19,000
West Falmouth Interceptor Upgrade	--[4]
Total Short-Term Improvements	**$3,625,000**
Mid-Term (7-14 years)	
Falmouth Road Pump Station Improvements	$34,000
Thornhurst Drive Pump Station Generator Upgrade	$34,000
Underwood Road Pump Station Generator and VFD Upgrade	$56,000
Control and Telemetry Panel Upgrades[5]	
Old Mill Road Pump Station	$24,000
Handy Boat Pump Station	$28,000
Underwood Road Pump Station	$26,000
Johnson Road Pump Station	$28,000

Upgrade/Improvements by Priority	Estimated Cost
Northbrook Drive Pump Station	$32,000
Telemetry Panel Upgrades[5]	
Lunt Road Pump Station	$23,000
Hedgerow Drive Pump Station	$23,000
Thornhurst Drive Pump Station	$23,000
Waite's Landing Pump Station	$23,000
Landing Woods Lane Pump Station	$24,000
Baysite Drive Pump Station	$27,000
Leighton Road Pump Station	$20,000
Mill Road Pump Station	$25,000
Farm Gate Pump Station	$23,000
Total Mid-Term Improvements	**$473,000**
Long-Term (> 14 years)	
Woodlands Drive Pump Station Improvements	$73,000
Middle Road Pump Station Improvements	$36,000[6]
Total Long-Term Improvements	**$109,000**

Notes:

1. Costs to remove identified sources of I/I are indeterminate at this time and will depend on what is found during the SSES.
2. Assumes Cumberland will carry any costs associated with either reinstating the existing Parshall flume or installing a new flow metering device.
3. Assumes capacity upgrade is not required.
4. Cost indeterminate at this time, but could be in the range of $1.0 to $2.0 million depending results if sewer master plan.
5. Control and/or telemetry panel upgrades at these stations can be phased over a number of years as the capital becomes available to complete the work. However, the existing Aquatrol master panel at the WWTF would need to be maintained if the telemetry upgrades are not completed as part of one project. In addition, these costs also include other miscellaneous maintenance items noted in Section 3.
6. These items can be completed separately or combined with the control and/or telemetry upgrade.

SECTION 1

INTRODUCTION

1.1 BACKGROUND

The Town of Falmouth's wastewater conveyance system includes approximately 41 miles of gravity sewers and force mains and 23 remote pump stations that convey sewage to the Richard B. Goodenow Wastewater Treatment Facility (WWTF) located at 250 Clearwater Drive. Figure 1-1 at the end of this Section shows a map of the collection system, pumping stations and WWTF.

These pumping stations are critical to the operation of the entire sanitary collection system and require regular maintenance and periodic upgrades to ensure they are reliable and cost effective to operate. Wright-Pierce was retained to conduct an evaluation of the pump stations in an effort to identify the existing condition of each station, identify any code violations, identify the need for upgrades or replacements of equipment that has exceeded its intended service life, and evaluate the need for capacity increases to ensure sufficient pumping capacity for a 20-year planning period. Wright-Pierce was also retained to evaluate the capacity of seven gravity interceptors and recommend upgrades based on capacity limitations or other factors. The Town intends to use this evaluation to assist them in developing a long-term capital improvements program.

1.2 PURPOSE AND SCOPE OF THE COMPREHENSIVE PUMP STATION ASSESSMENT

The purpose of this Comprehensive Pump Station assessment was to provide the Town with a basis for the development of a Comprehensive Capital Improvements Program. The scope of the assessment included the following tasks:

- Evaluate available data including record drawings as well as pump run time and electrical usage data;
- Establish projected flows for each pump station;
- Conduct site visits to perform facility and capacity assessments of each pump station and prepare technical memorandum summarizing the findings;
- Conduct an assessment of selected interceptor sewers in the Town;
- Identify and review various alternatives available to solve the identified problems and position the Town for future sewered growth and funding opportunities; and
- Provide cost information for the recommended alternatives.

This report is divided into sections, as follows:

- Executive Summary
- Section 1 - Introduction
- Section 2 - Existing Conditions
- Section 3 - Pump Station Findings, Alternatives Evaluation and Recommendations
- Section 4 - Interceptor Findings, Alternatives Evaluation and Recommendations
- Section 5 - Priority Listing and Preliminary Schedule for Implementation

The report also has several appendices.

Staff members from the Town of Falmouth were key participants in this evaluation and were integral in providing insight into current operations and assessment of possible alternatives to improve operations.

Fig 1-1

SECTION 2

EXISTING CONDITIONS

2.1 INTRODUCTION

The Town of Falmouth, Maine owns, operates, maintains and performs capital improvements on 23 wastewater pump stations, along with force mains and 41 miles of gravity collection sewers. These facilities serve Falmouth and the town of Cumberland. The Town's Water Pollution Control Department (WPCD) is responsible for the operation and maintenance of the pump stations, force mains and gravity sewers within Falmouth. Additionally, the WPCD staff is also responsible for either implementing or recommending capital improvements. The pump stations include 15 submersible stations (15 HP and less), six Smith and Loveless "can-style" stations (7.5 to 50 HP), and two suction-lift stations (25 and 30 HP). Force mains range in size from 4-inch to 14-inch and gravity sewers range in size from 8-inch to 24-inch. Key information on all 23 pump stations and force mains is included in the Table 2-1 below.

Seven of the pump stations and force mains were constructed between 1969 and 1971 as part of an initial three-phase project to construct the Town's WWTF and collection system. The remaining sixteen stations and force mains were constructed between 1978 and 2007 by developers and ownership turned over to the Town for long-term operation and maintenance. Gravity sewers were constructed as early as the 1940s and are constructed of various materials including polyvinyl chloride (PVC), asbestos cement (AC) and vitrified clay (VC).

The Portland Water District (PWD) provides sanitary sewer collection and pumping facilities for the town of Cumberland. The town of Falmouth entered into an agreement with PWD in 1981 (amended in 2002) to accept wastewater from the town of Cumberland and pump that flow to the Falmouth WWTF for treatment. PWD tied the town of Cumberland's collection system into the Route 88 interceptor leading to Mill Creek Pump Station in 1981 and into the Route 1 interceptor leading to Johnson Road Pump Station in 2002. PWD owns capacity in the Route 88 and Mill Creek Interceptors and Mill Creek and Johnson Road Pump Stations.

There are three major pump stations in the Town that pump directly to the WWTF: Mill Creek Pump Station, Lunt Road Pump Station and Clearwater Drive Pump Station. Mill Creek Pump Station collects the majority flow in the portion of town east of Interstate 295 (I-295). Lunt Road Pump Station collects all flow from the portion of town west of I-295. Clearwater Drive Pump Station collects flows from the southeastern portion of town including Mackworth Island via gravity sewers as well as via Brown Street Pump Station. A more detailed discussion of each pump station is included in Section 3.

TABLE 2-1
PUMP STATIONS SUMMARY

Pump Station		Pump	Pump		Force Main		Date in
No.	Name	Station Type	Manufacturer	Generator	Size (in.)	Length (ft.)	service
1	Old Mill Road	"Can-Style"	Smith & Loveless	No	6	777	1971
2	Brown Street	"Can-Style"	Smith & Loveless	Yes	6	1102	1971
3	Clearwater Drive	"Can-Style"	Smith & Loveless	Yes	8	2122	1971
4	Lunt Road	Suction-Lift	Smith & Loveless	Yes	8	1291	2006
5	Mill Creek	"Can-Style"	Smith & Loveless	Yes	14	7302	1971
6	Handy Boat	"Can-Style"	Smith & Loveless	Yes	6	957	1971
7	Underwood Road	"Can-Style"	Smith & Loveless	No	6	335	1971
8	Hedgerow Drive	Submersible	Barnes	No	4	912	1977
9	Thornhurst Drive	Submersible	Barnes	No	3	730	1978
10	Waite's Landing	Submersible	Barnes	No	4	978	1978
11	Landing Woods Lane	Submersible	Barnes	No	4	910	1978
12	Middle Road	Submersible	Flygt	No	6	4412	1981
13	Baysite Drive	Submersible	Barnes	Yes	6	1113	1986
14	Woodlands Drive	Submersible	Hydromatic	No	4	772	1987
15	Pinehurst Drive	Submersible	Hydromatic	Yes	4	1465	1987
16	Woodlands Clubhouse	Submersible	Hydromatic	Yes	6	2013	1987
17	High School	Submersible	Hydromatic	No	6	2916	1989
18	Johnson Road	Submersible	Hydromatic	No	4	1150	1990
19	Northbrook Drive	Submersible	Hydromatic	No	4	704	1990
20	Leighton Road	Submersible	Gorman-Rupp	Yes	6/8	3211	1998
21	Falmouth Road	Suction-Lift	Gorman-Rupp	Yes	6	5503	1998
22	Mill Road	Submersible	Hydromatic	Yes	6	6137	2002
23	Farm Gate	Submersible	Barnes	No	3	800	2007

An evaluation of several of the Town's interceptors was also completed to determine the condition and available capacity of each interceptor and to identify any bottlenecks in the interceptors. Table 2-2, below, provides key information on the interceptors evaluated. A more detailed discussion of each interceptor is included in Section 4.

TABLE 2-2
INTERCEPTOR SUMMARY

Name of Interceptor	Description of Interceptor	Area Served
West Falmouth	Begins at the Woodland's Clubhouse Pump Station terminus manhole, travels east along Woods Road to Middle Road then south along Middle Road across ME Turnpike Spur to Lunt Road then east on Lunt Road across Interstate 295 to the Lunt Road Pump Station	Entire collection system west of Interstate 295
Woodland's Club	Begins at the Pinehurst Drive Pump Station terminus manhole, travels east along Woodlands Drive to the Woodlands Clubhouse Pump Station	Entire collection system west of the Woodlands Country Club
Exit 52	Begins in the West Falmouth Crossing shopping complex and travels northeast along Leighton Road to the Leighton Road Pump Station	West Falmouth Crossing shopping complex
Middle Road	Begins on Pleasant Hill Road near Clifton Road and travels east to Middle Road then north on Middle Road to the Middle Road Pump Station	Middle Road, Pleasant Hill Road, Merrill Road, Blueberry Lane and side streets area
Rt. 88	Begins at the Cumberland/Falmouth town line and travels south on Route 88 to the Mill Creek Pump Station	Serve large portion of Cumberland and Route 88 area north of Mill Creek Pump Station
Foreside	Begins at the Underwood Road Pump Station terminus manhole and travels south, cross-country to the Handy Boat Pump Station	Falmouth Foreside area
Mackworth Point	Begins at the intersection of Route 1 and Bay Shore Drive and travels east and then north along Bay Shore Drive, Shoreline Drive and cross-country to the Brown Street Pump Station	Mackworth Island and Brown Street drainage area

2.2 GENERAL DESCRIPTION OF EXISTING PUMP STATIONS

Wright-Pierce conducted site visits to key pump stations on January 15, 2009 to review the existing equipment and operations including buildings and structures, mechanical and HVAC equipment, instrumentation and control systems, emergency generators and electrical equipment. The information obtained during these site visits has been summarized into pump station inventory sheets included in Section 3. The inventory sheets also include information on grease

accumulation and concrete corrosion in wet wells, clogging issues with the pumps, nuisance odors, life safety issues and site layout and security issues.

The following sections review the types of pump stations, the existing telemetry system and the emergency power provisions at each station.

2.2.3 Pump Station Types

Falmouth currently has three styles of pumping stations: "can-style", submersible and suction-lift. Each of these types of stations is briefly described below.

2.2.3.1 "Can-Style" Pumping Station

The "can-style" pumping stations in the Town are all manufactured by Smith & Loveless as noted in Table 2-1. These stations consist of a precast concrete wet well and an underground steel "can" that contains centrifugal, non-clog pumps; suction and discharge piping and shut-off valves; VFDs (where applicable); and control panels. The below ground "cans" are provided with an at-grade access opening and ladder. The telemetry panels are located outside at each station with the exception of Mill Creek and Clearwater Pump Stations. These stations have been provided with a generator building that also houses the telemetry panels.

2.2.3.2 Submersible Pumping Station

The Town's submersible style pumping stations have precast concrete wet wells that contain submersible pumps which can be removed via guide rails and cables. The shut-off valves are either located in the wet well (Hedgerow Drive, Thornhurst Drive, Waite's Landing, Landing Woods Lane, and Baysite Drive Pump Stations) or in a separate valve pit (Middle Road, Woodlands Drive, Pinehurst Drive, Woodlands Clubhouse, High School, Johnson Road, Northbrook Drive, Leighton Road, Mill Road, and Farm Gate Pump Stations). Control and telemetry panels are located outside with the exceptions of Baysite Drive and Leighton Road Pump Stations. Baysite Drive Pump Station has been provided with a generator building and Leighton Road Pump Station has a building originally provided for odor control chemical

addition (although no longer used for this purpose). These buildings also house the control and telemetry panels.

2.2.3.3 Suction-Lift Pumping Station

The Town's suction-lift style pumping stations have been provided with precast concrete wet wells, but the pumps sit on the wet well cover with suction piping that drops vertically to the wet well below. Lunt Road Pump Station has been provided with a fiberglass enclosure that contains the pumps, the shut-off valves, pressure gages and the control panel. The telemetry panel is located outside. Falmouth Road Pump Station has been provided with a building (constructed over the top of part of the wet well) that houses the pumps, the shut-off valves, pressure gages and the control and telemetry panels.

2.2.4 Existing Telemetry System

The Town's existing pump station telemetry is based on the Aquatrol W1300 remote telemetry system. The Aquatrol W1300 system consists of a master panel at the WWTF, installed in 1984, that scans and displays data and alarms from each pump station. Each remote pump station has an Aquatrol remote telemetry unit (RTU) panel that monitors one analog input (wet well level) and up to six discrete inputs (pump running, pump fault, normal power failure, etc.). The RTU panel at each station communicates directly with the master panel at the WWTF via a directional antenna and a two-way VHF radio. There are no repeaters in the Town's system.

The master panel at the WWTF is located in the office area of the Control Building and displays pump station alarms using red lights and wetwell level data using LED indicators. All data is then transferred to a SCADA computer located in the same area. The SCADA system trends the pump station data and alarms with time stamps. A 16-channel RACO Autodialer monitors all pump station alarms and provides call-out alarms during unstaffed hours. The pump station SCADA system and teledialer are separate from the WWTF SCADA system and teledialer. Refer to the Instrumentation Technical Memo included in Appendix A for more information.

2.2.5 Emergency Power Provisions

As noted in Table 2-1, 11 of the 23 pump stations have dedicated emergency power generators - four propane powered and seven diesel powered. The remaining 12 pump stations are served by a Town-owned portable generator. In addition, 8 pump stations have been provided with underground storage tanks adjacent to the wet well. The tanks were originally installed to provide additional storage capacity during power outages; however several of these stations have since been provided with emergency power generators as well. Table 2-3 below summarizes the emergency power and storage provisions at each pump station.

TABLE 2-3
EMERGENCY POWER AND STORAGE PROVISIONS SUMMARY

Pump Station		Generator	Generator Plug	Underground Storage Tank
No.	Name			
1	Old Mill Road		✓	
2	Brown Street	✓		✓
3	Clearwater Drive	✓		
4	Lunt Road	✓		✓
5	Mill Creek	✓		
6	Handy Boat	✓		✓
7	Underwood Road		✓	
8	Hedgerow Drive		✓	
9	Thornhurst Drive		✓	
10	Waite's Landing		✓	
11	Landing Woods Lane		✓	
12	Middle Road		✓	
13	Baysite Drive	✓		
14	Woodlands Drive		✓	✓
15	Pinehurst Drive	✓		✓
16	Woodlands Clubhouse	✓		✓
17	High School		✓	✓
18	Johnson Road		✓	
19	Northbrook Drive		✓	✓
20	Leighton Road	✓		
21	Falmouth Road	✓		
22	Mill Road	✓		
23	Farm Gate		✓	

SECTION 3

PUMP STATION FINDINGS, ALTERNATIVES EVALUATION AND RECOMMENDATIONS

The purpose of this section of the report is to present the existing conditions at each pump station, identify upgrade needs, evaluate alternatives for upgrade (when consideration of multiple alternatives is worthwhile), and develop final recommendations for each pump station.

The information presented on the existing conditions of each pump station was gathered through many different means including information provided by the WWTF staff, design plans for the pump stations, and site visits and drawdown testing by Wright-Pierce (W-P) staff. We have attempted to gather the most accurate information possible for each station to facilitate our evaluation.

This section includes comprehensive information on all 23 pump stations. The first two pages of each pump station write-up is the printout of a 2-3 page Excel spreadsheet which includes an inventory of all key information for the pump station. It also includes narrative write-ups by each building design discipline (architectural, electrical, mechanical, etc.). More detailed write-ups by each building design discipline are included in their detailed memorandums in Appendix A. Following the 2-3 page Excel spreadsheet, a discussion on current pump run times/flows as well as estimate of future flow requirements is provided. This is followed by a discussion on various alternatives for upgrade (when appropriate). Lastly, final recommendations for the pump stations are presented.

Planning-level project costs have been prepared for the recommended facilities and are also presented in this section. These planning-level costs were developed using standard cost estimating procedures consistent with industry standards. Total project capital costs include an allowance of 45% of the estimated construction costs to account for construction contingency, design and construction engineering, permitting, as well as financing, administrative and legal expenses. The project cost information presented herein is in current year dollars and is based on

ENR Index 8534 (March 2009). Future referencing to this index will allow for reasonable adjustments to costs to bring projects up to date.

These estimates have been developed primarily for evaluating alternative solutions and are generally reliable for determining the relative costs of various options. Many factors arise during preliminary and final design (e.g. foundation conditions, owner selected features and amenities, code issues, etc.) that can not be definitively identified and estimated at this time. These factors are typically covered by the 45% allowance described above; however, this allowance may not be adequate for all circumstances.

General Observations

In addition to the specific observations included under each pump station write-up below, the following list includes general observations made at various stations and recommendations to address the issues:

- Although the existing telemetry system is in relatively good condition for its age (originally installed in 1984), it is antiquated and no longer manufactured. Should any part fail, getting replacement parts will become increasingly more difficult. As such, we are recommending that the Town completely upgrade their telemetry system. Costs to upgrade each station are included under the respective sections below. The estimated cost to upgrade the master telemetry panel at the WWTF is $8,000. We also strongly recommend that a radio path analysis be completed to design and prove out the new radio network. The estimated cost to perform the study alone would be about $8,500, additional costs may be incurred if repeater sites are required. Refer to the Instrumentation Technical Memo in Appendix A for more information on the existing system and recommended improvements.
- As noted in Section 2, six out of the Town's 23 pump stations are Smith & Loveless "can" style stations which were put online in 1971. The Town has noted that they would like to move away from this style station as operators are required to enter the "can" to access the pumps, valves and controls; these spaces are confined spaces and increase opportunities for hazardous conditions due to falling, etc. We recommend that as each of

these stations is upgraded, the Town should consider an alternate style station. In the meantime, because these "can" structures are almost 40 years old, we recommend that the Town perform ultrasonic testing of the steel structure at any station where it will continue to be used to ensure that it is structurally sound. As it will likely be more than a year or two before any of the stations with "cans" is upgraded, we recommend testing all six stations; the testing will cost approximately $10,000. If the structures are found to be sound, the Town may want to consider replacing the sacrificial anodes on each structure that may be used indefinitely (i.e. Old Mill Road, Clearwater Drive, Handy Boat and Underwood Road Pump Stations). This procedure requires considerable excavation around the can (installation of anodes is recommended at five to ten feet away from the side and three feet above the base of the structure, four equally spaced anodes are recommended per structure); however if the anodes are at or near the end of their life, the structures integrity could quickly go from good to bad.

- It was noted that power, control and signal wiring were sometimes run in a common conduit. Under ideal situations, high voltage (480V and even 230V) power wiring should be run separately from lower voltage (120V) control wiring. In addition, analog signal wiring should be run separately from power or control wiring as the higher voltage can create background "noise" and adversely affect the signal. Although it is not cost effective to install new conduit and run new wiring at every station, this standard should be incorporated into all future upgrades.
- It was noted that many stations did not have explosion proof seal fittings and intrinsically safe relays for the float switches and level measurement devices. As wet wells are considered Class I, Division 1 spaces, this is a code requirement for new pump stations. We recommend incorporating this standard into all stations as part of any controls upgrade at the pump stations. The cost to complete this work is included in the instrumentation costs under each pump station cost estimate.
- It was noted that many stations had junction boxes located within the wetwell and that the junction boxes did not have leak tight seals as required by code. New junction boxes located outside the wet well with the appropriate seals should be provided at each pump stations where this is the case. Based on conversations with the Town, this is an issue they are already working to address.

- It was noted that conduits entering the wet well often either didn't have a seal or the seal had deteriorated. We recommend that the Town provide leak-tight seals for all conduits. The approximate cost per seal is $150.
- In addition, it was noted that none of hatches for wet well and valve pits have been provided with fall protection grating or netting. Although this it not an OSHA requirement, it is good practice and we recommend that the Town incorporate this standard into future upgrade. Wright-Pierce's standard is to incorporate fall protection into new designs or upgrades.

Force Main Discussion

Force mains in the Town of Falmouth vary in age from two years to almost forty years old and, based on available information, are constructed from polyvinyl chloride (PVC), high density polyethylene (HDPE), ductile iron (DI) and asbestos concrete (AC). Table 3-1 below summarizes the age, material and approximate operating pressure of each force main in the Town.

TABLE 3-1
SUMMARY OF FORCE MAIN INFORMATION

Pump Station		Force Main			
No.	Name	Approx. Age (yrs.)	Size (in.)	Material	Operating Pressure (psi)[1]
1	Old Mill Road	38	6	AC	27
2	Brown Street	38	6	PVC or AC[2]	31
3	Clearwater Drive	38	8	AC	24
4	Lunt Road	3	8	HDPE	43
5	Mill Creek	38	14	AC	32
6	Handy Boat	38	6	AC and CI[2]	40
7	Underwood Road	38	6	AC[2]	23
8	Hedgerow Drive	32	4	PVC	61[3]
9	Thornhurst Drive	31	3	PVC	50[3]
10	Waite's Landing	31	4	PVC	23[3]
11	Landing Woods Lane	31	4	PVC	13[3]
12	Middle Road	28	6	DI	74[3]
13	Baysite Drive	23	6	PVC[2]	71[3]
14	Woodlands Drive	22	4	PVC	14
15	Pinehurst Drive	22	4	PVC	29
16	Woodlands Clubhouse	22	6	PVC	19

17	High School	20	6	PVC[2]	22[3]
18	Johnson Road	19	4	PVC	29
19	Northbrook Drive	19	4	PVC	23
20	Leighton Road	11	6/8	PVC and DI	15
21	Falmouth Road	11	6	PVC	58
22	Mill Road	7	6	PVC	28
23	Farm Gate	2	3	PVC	11

1. Indicates the maximum operating pressure at the pump and is based on the pump design criteria provided at the Town (i.e. TDH) unless otherwise noted. The actual pressure will differ along the length of the force main.
2. Based on best available information provided by the Town.
3. The pump design is unknown for this station. The operating pressure was estimated based the current capacity of one pump, length of pipe and difference in pump centerline and discharge elevations and does not take into account minor losses.

In general, it is difficult to project the life expectancy of a force main as it is dependent on several factors including operating pressure of the force main, velocity (increased wear proportional to increased velocity), amount of grit in the wastewater (high quantities of grit can lead to degradation of pipe walls), aggressiveness of soils around the force main and the material of construction of the force main. Many of the Town's more recent force mains are constructed of PVC or PE pipe which would eliminate the concern with aggressive soils. Force mains that are older, are constructed of unknown material and operate under higher pressure would be at the most risk for failure, but even the presence of aggressive soils or poor construction techniques could result in the failure of a new force main under lower pressure.

Typically, force mains are only replaced when a known problem exists or the pipe needs to be increased in size to accommodate more flow. Examples of known problems include a failure in the force main or a known manufacturer's defect in a particular type of pipe (i.e. it was discovered that precast concrete pipe manufactured in the early 1970's by a particular manufacturer was constructed with pre-stressed reinforcing wire that is susceptible to snapping or breaking which has reduced the structural integrity of the pipe). In the industry, force mains are usually operated until there is a failure at which time a repair is made or a more in-depth evaluation of the force main is conducted. At this time, we recommend that the Town continue to monitor the pumping performance as a means to identify potential problems rather than attempting to perform costly analysis of the force mains via TV inspection (which would require

access points to be excavated every 300-600 feet along the length of the force main) or other means.

It is also recommended that the Town begin to set aside funds in capital reserve each year to pay for eventual replacement. One method to calculate the annual capital reserve is to assume that the average service life of all force mains is 50 years. The current average age of all force mains in Falmouth is 24 years. The length of force mains in Falmouth is 47,612 feet. Assuming an average replacement value of $125 per linear foot, the total replacement cost of the force mains in Falmouth is nearly $6 million. Because the average remaining service life of all force mains is 26 years, the Town should be setting aside approximately $230,000 per year in reserve to fund the eventual replacement of force mains. This is a significant amount of money to be raised each year. Since some force mains (or portions of force mains) will last longer than 50 years, any amount that can be set aside each year will reduce the amount of money that needs to be bonded by the Town in the future.

INSERT INVENTORY SHEET

INSERT INVENTORY SHEET

3.1 OLD MILL ROAD PUMP STATION (NO. 1)

Old Mill Road Pump Station accepts flow from a small neighborhood. It pumps to the gravity sewer on Edgewater Street which flows to the Mill Creek Pump Station. Sewer users in this drainage area are characterized as residential.

3.1.1 Flow Assessment

The station has two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 3, 2008 is shown in Table 3-2 below.

TABLE 3-2
OLD MILL ROAD PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	110	110	Unk.[1]
Actual	137	86	Unk.[1,2]
Design TDH (ft.)	63	63	Unk.[1]

1. Unk. = Unknown.
2. Due to the small drainage area, there was inadequate flow to perform a two pump drawdown test.

The following information was considered when assessing the current capacity of the Old Mill Road Pump Station and determining the future capacity needs.

- The original design capacity of the pump station from 1971 was 110 gpm with one pump operating.
- Based on drawdown testing, the current capacity of the pump station is approximately 85-140 gpm depending on which pump is operating. With both pumps operating, the capacity is probably slightly higher.
- The Town noted that they have checked Pump 2 multiple times to ensure that it is not clogged and have verified that the check valve is operating correctly; however, they have not been able to determine why Pump 2 has a lower capacity than Pump 1. It was also

noted that Pump 2 has a slightly higher amperage draw than Pump 1 and that it operates at a lower speed than its rated speed (1720 rpm vs. 1770 rpm).

- Pump run times for 2006 and 2007 indicate that even under peak conditions, the combined pump run time is less than two hours per day; a graph showing pump run times has been included in Appendix B.
- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow at this station is 9 gpm. Note: This is based on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.
- This drainage area has little area for additional development. It has been assumed that wastewater flows to the station will increase very little.
- The ideal maximum flow for the 6-inch diameter force main from Old Mill Road Pump Station is approximately 440 gpm at 5 feet per second velocity and the minimum recommended flow is approximately 175 gpm at 2 feet per second velocity. The force main at this station is oversized; however, the Town has not had any issues with clogging to date.
- Although the capacity of Pump 2 is considerably lower than Pump 1 and the original design capacity, it appears that Old Mill Road Pump Station has more than adequate capacity to handle existing and future flows. No capacity upgrade is necessary.

3.1.2 Recommendations and Costs

Based on the above discussion of the Old Mill Road Pump Station and the building services technical memos in Appendix A, we recommend that the Town continue to use the existing pump station with the following improvements:

- Monitor the capacity of Pump 2; replace if capacity is no longer sufficient to handle incoming flows or run times for this pump increase dramatically.
- Install a new PLC-based pump control and telemetry panel mounted near the wet well on unistrut in a NEMA 4X enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).

- Remove the existing bubbler system and use the existing submersible pressure transducer to provide a level signal to the PLC for remote indication of wetwell level as well as for pump operation. Install a new float system in the wet well, hardwired to the pumps, to provide pump control back-up should the submersible pressure transducer or PLC fail.

The estimated cost to complete the improvements is $24,000. This does not include costs to replace Pump 2.

INSERT INVENTORY SHEET

INSERT INVENTORY SHEET

3.2 BROWN STREET PUMP STATION (NO. 2)

Brown Street Pump Station accepts flow from Mackworth Island and development along either side of the Lower Route 1 area. It pumps directly to the Clearwater Drive Pump Station. Sewer users in this drainage area are characterized as residential and commercial.

3.2.1 Flow Assessment

The station has with two pumps designed to operate in a lead/lag arrangement. Variable frequency drives (VFDs) were installed to normalize flow to the Clearwater Drive Pump Station and, eventually, to the wastewater treatment facility (WWTF). However, since the recent WWTF upgrades were completed, the VFDs have not been needed to normalize flow as the upgraded WWTF is now capable of handling the variation in flow. At the recommendation of Smith & Loveless, the original two-vane impeller on Pump 2 was replaced with a new single-vane impeller pump because of issues with clogging; Pump 1 does not clog. The VFD is used to limit the maximum speed of this pump as the new pump draws higher amperage than the original pump. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 9, 2008 is shown in Table 3-3 below.

TABLE 3-3
BROWN STREET PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	420	420	580[1]
Actual	352	298	407
Design TDH (ft.)	69	53	Unk.[2]

1. Estimated original capacity.
2. Unk. = Unknown.

The following information was considered when assessing the current capacity of the Brown Street Pump Station and determining the future capacity needs.

- The original design capacity of the pump station from 1971 was 420 gpm with one pump operating. However, analysis of the original pumping system indicates that the pumps may have had a capacity of approximately 480 gpm with one pump operating and 580 gpm with two pumps operating.
- Based on drawdown testing, the current capacity of the pump station is approximately 410 gpm with two pumps operating which is lower than the original capacity of one pump.
- Pump run times for 2006 and 2007 indicate that during peak conditions, two pumps operated almost continuously for several days; a graph showing pump run times has been included in Appendix B. It should be noted that at the existing capacity of 410 gpm with two pumps running, the station is still operating below its original design capacity.
- Even at the decreased pumping capacity of the station, the existing pumps have been able to able to keep up with the average and peak flows to date. Also, even though the both pumps have operated continuously for several days, there have been no reports of surcharging to grade or backups in homes. This would indicate that peak flows to the pump station are around 410 gpm.
- Based on conversations with the Town, there is little or no additional development planned for this drainage area in the next 20 years, although there is little information available on future development at the Governor Baxter School for the Deaf on Mackworth Island. It has been assumed that wastewater flows to the station will not increase markedly, but infiltration and inflow (I/I) will likely continue to increase without supplemental removal efforts in the collection system. Refer to Section 4.7.2 for further discussion on I/I in this drainage area.
- The ideal maximum flow for the 6-inch diameter force main from Brown Street is approximately 440 gpm at 5 feet per second velocity.
- Based on the above analysis, the Brown Street Pump Station should be upgraded, at a minimum, to return to a design capacity of 420 gpm with one pump operating and approximately 550 gpm with two pumps operating.

3.2.2 Alternatives Evaluation

There are several upgrade options for the pump station wet well and dry well at the Brown Street Pump Station as follows:

- Keep existing can-style pump station and replace pumps, controls, etc. This would require ultrasonic testing of the existing can to ensure the structural integrity of the steel for another 20 years and potentially replacement of the sacrificial anodes. We would also recommend removing all of the pump controls and electrical equipment from the can and mounting them outside on a concrete pad or housing them in a new building. The new pumps would need to be retrofitted with either 15 or 20 HP motors.
- Replace the existing can-style pump station with a new submersible pump station. Pump controls and electrical equipment could be mounted outside on a concrete pad or housed in a new building. Initial analysis indicates that new submersible pumps capable of providing 420 gpm each would require 20 HP motors, and possibly 25 HP motors.
- Construct a new, wetwell-drywell pump station with concrete walls and a masonry-brick superstructure. This would require a large excavation of over 20 feet in depth to allow a new wet well to be constructed and a new lower level to house the pumps. This would represent the top-of-the-line in pump station options, but it also represents the most costly option. Also, given the small site and proximity to wetlands, it would be difficult and costly to construct this type of pump station at this location, while maintaining pumping capability with the existing pump station. Given the cost and environmental issues, this option has been eliminated from further consideration.
- Construct a new, suction-lift style pump station (Smith & Loveless or Gorman-Rupp style) with the pumps skid-mounted on the cover of the existing wet well. A fiberglass enclosure similar to Lunt Road Pump Station or a stick-built building similar to Falmouth Road Pump Station could be provided to house the pumps, controls and electrical equipment; otherwise, the controls and electrical equipment could be mounted outside on a concrete pad. This option represents a compromise between the full wetwell-drywell pump station and the reuse of the existing can. This would eliminate the need for operations staff to climb down 20 feet to access pumps and electrical equipment and

simplify pump removal/replacement in the future. One major issue with this option is that the depth of the wet well would preclude mounting these pumps at grade. Smith & Loveless offers a can-style structure that can be mounted 5 to 6 feet below grade that can allow suction-lift pumps to be utilized.

The type/style of pump station selected for the upgrade should be considered further in a preliminary design phase. Although the pumps required for a submersible station may be 20 or 25 HP (which exceeds the Town's typical maximum submersible pump size of 15 HP), this style pump station may be the more cost effective option and will also eliminate the need for an operator to climb down into a recessed enclosure to access equipment, as would be the case with the suction-lift option. In addition, although the pumps may be a larger HP than the Town prefers for a submersible station, the actual weight and size of the pump may not be that much different than for a 15 HP pump. For purposes of this assessment, the recommendations in the next section are based on conversion to the suction-life style station mounted in a steel-enclosure approximately 5 to 6 feet below grade as this will likely be the costlier of the two options. However, we recommend that both options are considered further during preliminary design.

3.2.3 Recommendations and Costs

Before the Town completes any upgrades at the Brown Street Pump Station, we recommend that a Sewer System Evaluation Study (SSES) of the Brown Street Pump Station drainage area be conducted to identify sources of I/I. The SSES would likely consist of smoke testing, manhole inspections and potentially select household inspections (based on the findings of the smoke testing) or dye testing. The findings of this study will assist the Town if evaluating whether or not to increase the size of the Brown Street Pump Station. At this time, we recommend that the Town allocates $50,000 to complete the SSES; however the fee will be subject to change (up or down) based on the final scope of work.

Although the size (HP) and type of the upgraded station is not known at this time, for planning purposes, we also recommend that the Town plan for and eventually perform the following upgrades and improvements:

- Convert the existing Smith and Loveless "can" station to a new suction-lift style station with a fiberglass enclosure (similar to Lunt Road Pump Station).
- Replace the two existing pumps with new 15 or 20 HP pumps. The Town could install new 15 HP pumps capable of providing an estimated 420 gpm with a single pump operating and 500 gpm with two pumps operating. This would provide almost 100 gpm of additional capacity compared to the existing pumps which have been able to handle peak flows to date as indicated in Section 3.2.1. If more capacity was desired, the Town could install larger 20 HP pumps capable of providing up to approximately 540 gpm with a single pump operating and 620 gpm with two pumps operating. The new pumps would be similar in design to Smith & Loveless or Gorman Rupp suction lift pumps. Costs have been included in the estimate below to provide two new 20 HP pumps.
- Reuse existing VFDs or install two new VFDs. The existing VFDs are newer and may be reused if the new pumps are 15 HP. If the new pumps are 20 HP, new VFDs will be required. Costs have been included in the estimate below to provide new VFDs.
- Repair and retrofit the existing eight-foot diameter wet well to accept the new pumps and enclosure. Note: During preliminary or final design, the wet well should be drawn down, cleaned and inspected for structural integrity; repairs should be made as necessary.
- Install new six-inch suction and discharge piping and valves as necessary to pipe to the existing force main.
- Install a new PLC-based pump control and telemetry panel mounted near the wet well on a concrete pad in a NEMA 4X enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).
- Replace existing bubbler tube system and float switches with a new submersible pressure transducer and back-up float switches.
- Replace the existing electrical service and disconnect switch. (Although the existing service and switch may be sized appropriately to handle the new equipment with minor modifications, due to the age of the equipment it is likely that they no longer meet current standards. This issue can be evaluated further during preliminary design; however, costs have been included in the estimate below to replace the equipment.)

- Install new conduit and wiring as necessary to install the new pumps, instrumentation and controls.
- Reuse or replace the existing generator and automatic transfer switch (ATS) depending on the final pump selection. (The way generators were sized and constructed in the past differs from the way generators are sized and constructed today. As such, a generator built 20 years ago will likely be rated to handle a higher electrical loading than one built today.) If the existing pumps are replaced with similar pumps with 15 HP motors and smaller impellers, the existing generator may be able to be reused. If 20 HP or larger motors are installed, the generator may need to be replaced. This issue will be further evaluated during preliminary design. Costs have been included in the estimate below to replace the existing generator and ATS.
- Remove existing equipment from existing "can" and fill the can with flowable fill in-place.

The estimated cost to complete these improvements is $490,000. It should also be noted that any major improvements to the Brown Street Pump Station will likely require a NRPA permit as the station is adjacent to coastal wetlands.

INSERT INVENTORY SHEET

INSERT INVENTORY SHEET

3.3 CLEARWATER DRIVE PUMP STATION (NO. 3)

Clearwater Drive Pump Station accepts flow from the area along the southern part of Route 1 including flows from Brown Street Pump Station. It is one of three stations that pump directly to the WWTF. Sewer users in this drainage area are characterized as residential and commercial.

3.3.1 Flow Assessment

The station has two pumps designed to operate in a lead/lag arrangement. Variable frequency drives (VFDs) were installed to normalize flow to the WWTF. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 4, 2008 is shown in Table 3-4 below.

TABLE 3-4
CLEARWATER DRIVE PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	580	580	Unk.[1]
Actual	573	579	683
Design TDH (ft.)	55	55	Unk.[1]

1. Unk. = Unknown.

The following information was considered when assessing the current capacity of the Clearwater Drive Pump Station and determining the future capacity needs.

- The original design capacity of the pump station from 1971 was 580 gpm with one pump operating and the design capacity with two pumps operating is unknown.
- Based on drawdown testing, the current capacity of the pump station is approximately the same as the original capacity.
- Pump run times for 2006 and 2007 indicate that during peak conditions, two pumps operated almost continuously for several days.
- Based on conversations with the Town, there is little or no additional development planned for this drainage area in the next 20 years, although flows to this station could

increase by 140 gpm at a minimum if the Brown Street Pump Station is upgraded. In addition, infiltration and inflow will likely increase without supplemental removal efforts in the drainage area (including the Brown Street Pump Station drainage area).

- The ideal flow range for the 8-inch diameter force main from Clearwater Drive Pump Station is approximately 550 to 780 gpm at 3.5 to 5 feet per second velocity.
- Based on the above analysis, if the Brown Street Pump Station is upgraded and infiltration and inflow sources are not removed to compensate for the additional flow, the Clearwater Drive Pump Station will likely require an upgrade to increase the capacity of the station to handle peak flow conditions.

3.3.2 Recommendations and Costs

The pumps at this station were rebuilt in 2006 and provided with new volutes and impellers and the station is now operating near its original design capacity. In addition, if the Town is able to remove the known I/I sources in the Brown Street drainage area; the peak flows from Brown Street Pump Station will be reduced. As a result, we recommend that the Town re-evaluate the need for a capacity upgrade once the Brown Street Pump Station upgrade and I/I removal have been completed. In the meantime, we recommend that the Town perform the following improvements:

- Perform the following improvements to the existing generator building:
    - Provide emergency battery lighting in case of generator failure.
    - Replace the roof shingles and add a ridge vent.
    - Replace existing wooden rake and eave trim and soffit trim and cover with aluminum break metal. Replace existing soffit with vented aluminum soffit.
    - Recaulk all exterior penetrations in the brick veneer.
    - Provide weather stripping for the door.
    - Return exhaust fan and inlet damper to service. Repair as necessary and install new thermostat for control.
    - Plug existing floor drain from the building to the wet well.

- Provide secondary containment for the existing 330 gallon steel diesel storage tank. Alternatives may include constructing a CMU or concrete wall around it, installing a prefabricated steel or polyethylene dike unit, or installing a new, double wall tank with leak detection.
- Replace corroded ceiling supported threaded rod equipment hangars.
- Relocate the exhaust fan or the main service disconnect switch in the generator building to provide the minimum code-required working space in front of the main service disconnect switch.
- Remove all stored equipment and spare parts from the working space in front of electrical equipment.

- Perform the following improvements to the "can":
  - Paint the top surface of the rungs on the "can" ladder with grit epoxy paint or apply anti-slip abrasive tape.
  - Remove peeling paint on the floor and repaint.
  - Provide conduit seals on all conduits between the "can" and the generator building.
- Install a new PLC-based pump control and telemetry panel mounted in the generator building in a NEMA 12 enclosure and a local control station in the "can" (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A). There appears to be old electrical equipment mounted on the walls of the generator building that is no longer in service; this equipment can be removed as needed to provide space for the new control panel.
- Remove the existing bubbler system and use the existing submersible pressure transducer to provide a level signal to the PLC for remote indication of wetwell level as well as for pump operation. Install a new float system in the wet well, hardwired to the pumps, to provide pump control back-up should the submersible pressure transducer or PLC fail.
- Relocate the VFDs from the "can" to the generator building if space allows.

The estimated cost to complete the improvements is $74,000.

INSERT INVENTORY SHEET

INSERT INVENTORY SHEET

3.4 LUNT ROAD PUMP STATION (NO. 4)

Lunt Road Pump Station accepts flow from all of western Falmouth including Woodlands Clubhouse and Middle Road Pump Stations in addition to the Farm Gate Pump Station. It is one of three stations that pump directly to the WWTF. Sewer users in this drainage area are characterized as residential, commercial and institutional.

3.4.1 Flow Assessment

The station was upgraded from a can style station to a suction lift style station in 2006 and was provided with two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 4, 2008 is shown in Table 3-5 below.

TABLE 3-5
LUNT ROAD PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	600	600	Unk.[1]
Actual	592	597	664
TDH (ft.)			
Design	100	100	Unk.[1]
Actual	92	88	104

1. Unk. = Unknown.

The following information was considered when assessing the current capacity of the Lunt Road Pump Station and determining the future capacity needs.

- The original design capacity of the pump station from the 2006 upgrade was 600 gpm with one pump operating.
- Based on drawdown testing, the current capacity of the pump station is approximately the same as the original design capacity. Operating two pumps results in only a 10% increase in capacity to approximately 660 gpm.

- Pump run times for 2006 (after the station was upgraded) and 2007 indicate that under peak conditions, the combined run time of the pumps in a 24-hour period is about 36 hours. However, this data is somewhat speculative given the limited rainfall that was occurring during this time. A better estimate of maximum combined run time for the two pumps during a 24-hour period is approximately 25 hours.
- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow range at this station is estimated to be 350 gpm to 470 gpm depending on how the pump cycles (i.e. one pump operating or two pumps operating). Note: This is based on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.
- West Falmouth, particularly the area around the turnpike exit, has significant growth potential and the potential to add sewered flow over the next 20 years. Additionally, providing sewer service to neighborhoods with a high incidence of septic system failures within the Middle Road Pump Station drainage area could add to the flow to the Lunt Road Pump Station. There is also a new 75 unit residential condominium subdivision (Ridgewood Estates) off Falmouth Road that will contribute flow to the Lunt Road Pump Station.
- The ideal maximum flow for the 8-inch diameter force main from Lunt Road Pump Station is approximately 780 gpm at 5 feet per second velocity and the minimum recommended flow is approximately 310 gpm at 2 feet per second velocity.

3.4.2 Recommendations and Costs

Based on the discussion above, it appears that the Lunt Road Pump Station may need to be upgraded again in the next 20 years. Peak flow reductions anticipated at Falmouth on the Green should provide some relief (pending removal of leaking septic tanks piped into the collection system). However, the station was completely upgraded in 2006 and currently has sufficient capacity to meet the needs of West Falmouth. The Town should continue to track run times at this station and evaluate the remaining capacity for each new development proposal.

At this time, we recommend that the Town continue to use the existing pump station with the following improvements:

- Install a new telemetry panel mounted near the wet well on unistrut in a NEMA 4X enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).

The estimated cost to complete the improvements is $23,000.

INSERT INVENTORY SHEET

Town of Falmouth, Maine
Comprehensive Pump Station Evaluation
Lunt Road Pump Station (No. 4)

General Pump Station Information					
Location:		Off Lunt Rd. just east of the I-295 overpass (private drive)			
Coordinates (Lat./Long.):		43.7235152	-70.2419294		
Elevation, ft.:		20.0			
Distance from WWTF, miles:		1.1			
Year Constructed:	1971	Upgraded:	2006		
Design Capacity of Station, gpm:		600			
Station Type:		Smith & Loveless Suction Lift			
No. of Pumps:		2			
		P1	P2		
Year Installed:		2006	2006		
Design Capacity of Pumps, gpm:		600	600		
Design TDH of Pumps, ft.:		100	100		
Pump Make/Model:		S&L/4C3B	S&L/4C3B		
Motor Size, HP:		30	30		
Pump Speed, rpm:		1770	1770		
Drive Type:		N/A	N/A		
Drive Make:		N/A	N/A		
Seal Type:		Mechanical	Mechanical		
Seal Make:		Unk.	Unk.		
Service Voltage:	460	Hertz: 60	Phase:	3	
Force Main Diam., in.:	8	Length, ft.:	1,291		

Generator Information			
Make/Model:	Olympian/D80P4		
Year Installed:	2006		
Fuel Type:	Propane	Size, kW:	80

Controls Information			
Pump Control Scenario:	P1 and P2 are automatically alternated as the lead pump Pumps are operated based on level setpoints in the wet well		
Pump Control Panel:			
Type:	Relay-based		
Location:	Fiberglass enclosure		
Flow Meter:			
Type:	N/A		
Make/Model:	N/A		
Alarm Transmission:	Aquatrol RTU Panel		
Level Controls:			
Pump/Alarms:	Submersible Pressure Transducer		
Level:	Submersible Pressure Transducer (to telemetry)		
MCC:			
Type:	N/A	Location:	N/A
Make/Model:	N/A		

HVAC							
Heating:				Ventilation:			
Location:	N/A			Location:	N/A		
Make:	N/A	Model:	N/A	Make:	N/A	Model:	N/A
Year Installed:	N/A			Year Installed:	N/A		
Quantity:	N/A	Size, kW:	N/A	Quantity:	N/A	Size, kW:	N/A

Town of Falmouth, Maine
Comprehensive Pump Station Evaluation
Lunt Road Pump Station (No. 4)

Condition of Equipment/Identified Issues		
Capacity: Recent capacity assessment via the WWTF flume on 12/04/08 indicated that the pumps have the following capacities: P1-592 gpm at 92' TDH, P2-597 gpm at 88' TDH, and P1/P2-664 gpm at 104' TDH. It should be noted that the pressure gages do not account for the static head between the pumps and the water surface in the wet well. The current two pump capacity is approximately equal to the original design capacity of the pumps and appears to be adequate to handle existing flows as, each pump runs for about 4 hours per day on average and about 10-20 hours per day under peak conditions.		
Exterior Site: The site has proper drainage to prevent run-off from entering the wet well.		
Building Structures (if applicable): A fiberglass enclosure was provided by Smith & Loveless for the pumps, panel and valves. The enclosure appears to be in good condition.		
Wet Well: When this station was upgraded in 2006, the new pumps were installed in the overflow tank. The old wet well continues to receive influent gravity flows and is connected to the new wet well via a pipe, so the old wet well now serves as an "in-line" storage tank.		
Dry Well (if applicable): Not applicable		
Valve Pit (if applicable): Not applicable		
Electrical/Instrumentation: No deficiencies were noted in the electrical and instrumentation equipment.		
HVAC: N/A		
Security Measures: All outdoor equipment has been provided with a lock.		
Other:		
Miscellaneous Issues:		
Grease Accumulation?	Yes / **No**	
Clogging Issues?	Yes / **No**	
Nuisance Odors?	Yes / **No**	
Concrete Corrosion?	Yes / **No**	

3.5 MILL CREEK PUMP STATION (NO. 5)

Mill Creek Pump Station is the largest and most important pump station in Falmouth as the station accepts all flow from the Route 88 and Route 1 areas north of the Town forest, including all flow from Cumberland. It is one of three stations that pump directly to the wastewater treatment facility (WWTF). Several pump stations including Hedgerow Drive, Johnson Road, Northbrook Road, Baysite Drive, Underwood Road, Handy Boat, Old Mill Road, and Thornhurst Road Pump Stations pump to Mill Creek Pump Station. The station originally to accepted flow from the Lunt Road Pump Station, but as part of an upgrade in 2006, a new force main was installed from the Lunt Road Pump Station directly to the wastewater treatment facility (WWTF). Sewer users in this drainage area are characterized as residential and commercial.

3.5.1 Flow Assessment

The station was originally provided with two smaller lead/lag pumps and one larger high flow pump; however all three pumps have since been replaced and/or rebuilt and the station now has two larger lead pumps with VFDs and one smaller lag pump. The current design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 4, 2008 is shown in Table 3-6 below.

TABLE 3-6
MILL CREEK PUMP STATION - PUMP CAPACITIES

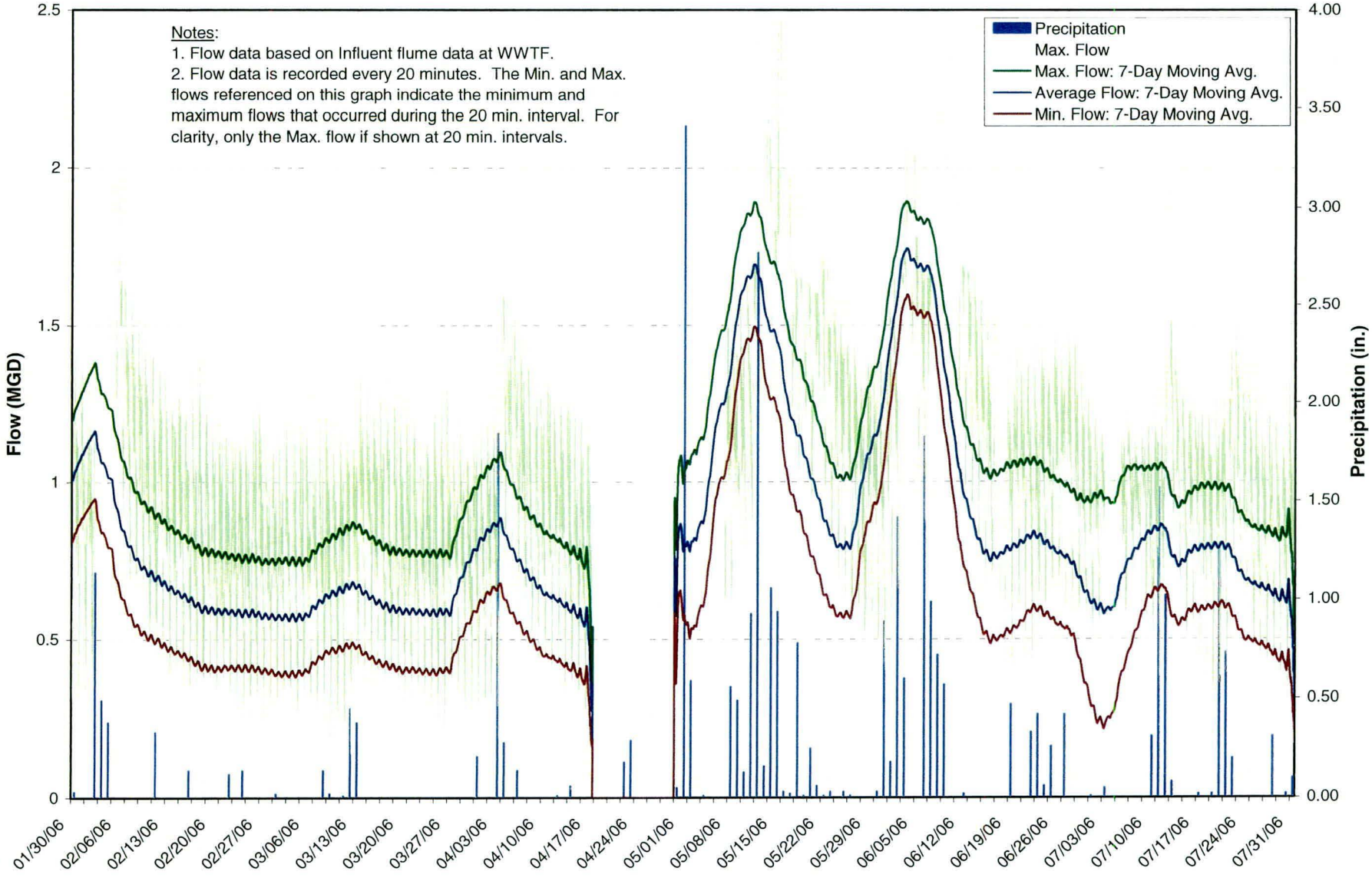
	Pump 1	Pump 2	Pump 3	Pumps 1&2	Pumps 2&3
Flow (gpm)					
Design	1,500	850	1,500	Unk.	Unk.
Actual	1,306	1,013	1,309	1,666	1,642
Design TDH (ft.)	69	53	75	Unk.	Unk.

1. Unk. = Unknown.

The following information was considered when assessing the current capacity of the Mill Creek Pump Station and determining the future capacity needs.

- The original design capacity of the pump station from 1971 was 3.074 million gallons per day (MGD) or 2,140 gpm.
- Based on drawdown testing, the current capacity of the pump station is approximately 2.4 MGD (1,670 gpm) or 0.674 MGD (470 gpm) below design capacity.
- Flows from the station are measured using the Parshall flume in Influent Channel No. 2 at the WWTF. Figure 3-1 shows flows from this pump station during an extended dry weather period followed by a wet period (February to July 2006). Average dry weather flow to this pump station is approximately 0.60 MGD (420 gpm), with peak dry weather daily flows of approximately 1.44 MGD (1,000 gpm). The maximum 20 minute flow rate (wet weather) during this period was approximately 2.5 MGD (1,740 gpm). This flow is consistent with the results of the drawdown testing which showed a peak station capacity of 2.4 MGD (1,670 gpm).
- The Portland Water District (PWD) owns 1.076 MGD (750 gpm) of peak flow capacity in the Mill Creek Pump Station (35% of 3.074 MGD). The agreement does not specify peak daily, peak hourly or peak instantaneous flow. Flows from Cumberland arrive to the pump station via the Route 88 interceptor (takes flows from Foreside Pump Station in Cumberland and some gravity flow along Route 88) and via the Mill Creek Interceptor located between Route 1 and Mill Creek Pump Station.
- Despite the 1.076 MGD limit at Mill Creek, the Foreside Road Pump Station currently has a 1-pump capacity of approximately 1.26 MGD (875 gpm) and a 2-pump capacity of 1.73 MGD (1,200 gpm). The pumps at this station were recently replaced and PWD does not anticipate any capacity issues with this pump station for the foreseeable future. Neither pump is provided with a VFD. Reportedly, the only time in which two pumps operate is when the lead pump becomes clogged. Assuming this is correct, without VFDs the station could deliver 1.26 MGD to the Mill Creek Pump Station, plus any gravity flows between the Foreside Road Pump Station and the town line (estimated at 25 gpm). It is our understanding that the Portland Water District is planning on reinstituting the flow meter located at the town line on Route 88 to monitor all of the flows coming from Cumberland (both pumped and gravity) at a more frequent intervals (i.e. every fifteen minutes).

FIGURE 3-1
MILL CREEK PUMP STATION FLOWS (FEBRUARY TO JULY 2006)



- An evaluation of select Foreside Road Pump Station data provided by the Portland Water District for wet weather events during 2008 and 2009 yielded the following results:
    - The peak day flow rate from the Foreside Road Pump Station was approximately 325 gpm.
    - The peak hourly flow rate from the pump station is approximately 645 gpm.
    - The peak instantaneous flow rate from the pump station is equal to the pump capacity of approximately 875 gpm. The maximum duration of 875 gpm pump runs was less than 15 minutes during 2008 and 2009 wet weather events.
- In addition to the 1.26 MGD (875 gpm) flow from the Foreside Pump Station, assume 25 gpm from the homes along Route 88 that flow by gravity to the Cumberland-Falmouth town line. Additionally, Cumberland owns 100 gpm of capacity in the Johnson Road Pump Station, but flows to this station are currently less than 100 gpm. If we assume that Cumberland currently uses half their Johnson Road Pump Station capacity (50 gpm), all totaled, Cumberland could currently send flows up to 1.37 MGD (950 gpm) to the Mill Creek Pump Station. Given the current station capacity of around 2.4 MGD (1,670) gpm, this leaves 1.03 MGD (720 gpm) of capacity for Falmouth.
- In the future, if both pumps operate at Foreside Road Pump Station and Cumberland sends peak flows of 100 gpm to Johnson Road Pump Station, peaks flows from Cumberland to Mill Creek Pump Station could total 1.91 MGD (1,330 gpm) for short durations. Clearly, this exceeds the flow limit of 750 gpm. Once the existing Parshall flume at the town line is in service, the Town should routinely evaluate flows from Cumberland and begin discussions with the Portland Water District about the possibility of infiltration and inflow removal projects in Cumberland to ensure that the peaky daily and peak hourly flows from all of Cumberland stay below 750 gpm. It is likely that peaky hourly flows from Cumberland are currently close to or exceeding 750 gpm (Foreside Pump Station + downstream gravity flows + Johnson Road/Route 1 flows).
- If Mill Creek Pump Station is increased to its original design capacity of 3.074 MGD (2,140 gpm), this provides 2.0 MGD (1,390 gpm) of peak hourly capacity in the Route 88 and Route 1 area of Falmouth, assuming Cumberland peak hourly flows remain below 750 gpm . An increase in capacity to 3.5 MGD (2,430 gpm) would add another 0.43 MGD (300 gpm) of peak capacity for Falmouth.

- The ideal maximum flow for the 14" force main from Mill Creek is approximately 3.5 MGD (2,430 gpm) at 5 feet per second velocity, but the force main could support flows up to and exceeding 5 MGD (3,470 gpm). However, the peak capacity of the WWTF is only 4.88 MGD (3,390 gpm) and both Clearwater Pump Station and Lunt Road Pump Station, if pumping at full capacity simultaneously, can deliver 1.6 MGD (1,110 gpm) to the WWTF.
- Based on the above analysis, the Mill Creek Pump Station should be upgraded to the original capacity of 3.074 MGD (2,140 gpm) and possibly up to 3.5 MGD (2,430 gpm). This would allow some increased capacity to handle any potential future flows that may come from development along Route 1. The actual pump capacity selected will depend on the size of the electrical service and emergency generator. It is important to note that any increase in capacity above 3.28 MGD (2,280 gpm), coupled with full capacity runs at both Clearwater and Lunt Road Pump Stations, would exceed the peak capacity of the WWTF.

3.5.2 Alternatives Evaluation

There are several upgrade options for the pump station wet well and dry well at the Mill Creek Pump Station as follows:

- Keep existing can-style pump station and replace pumps, controls, etc. This would require ultrasonic testing of the existing can, and potentially the replacement of the sacrificial anodes, to ensure the structural integrity of the steel for another 20 years. We would also recommend removing all of the pump controls and electrical equipment from the can and either installing them in the generator building (if space exists), mounting them outside on unistrut (ok for controls, not recommended for 480 volt power), or housing them in a new building above flood level. In addition, the existing dry well is already smaller than what is typically recommended for a station of this pumping capacity. The Town has indicated that they would like to move away from the can-style pump stations to eliminate the need for personnel to enter the can to maintain equipment. For these reasons, we have eliminated this option from further consideration.

- Replace the existing can-style pump station with a new submersible pump station. A new building to house the controls and electrical equipment would be recommended. While this likely the lowest capital cost operation, we would not recommend a submersible-style station for this large of a pump station given issues with pump maintenance and service. Accordingly, we have eliminated this option from further consideration.
- Construct a new, wetwell-drywell pump station with concrete walls and a masonry-brick superstructure. This would require a large excavation of over 20 feet in depth to allow a new wet well to be constructed and a new lower level to house the pumps. This would represent the top-of-the-line in pump station options, but it also represents the most costly option. Also, given the small site, it would be difficult and costly to construct this type of pump station at this location. At this time, we have eliminated this option from further consideration.
- Construct a new, suction-lift style pump station (Smith & Loveless or Gorman-Rupp style) with the pumps located at an upper or mid-level within a new building that would also house electrical and controls equipment. This option represents a compromise between the full wetwell-drywell pump station and the reuse of the existing can. This would eliminate the need for operations staff to enter a confined space and climb down 20 feet to access pumps and electrical equipment, and would simplify pump removal/replacement in the future.

Given the above information, Wright-Pierce recommends that the Town proceed with a new suction-lift style pump station at this location. Recommendations in the next section are based on conversion to this type of station.

3.5.3 Recommendations and Costs

Based on the above discussion of the Mill Creek Pump Station and the building services technical memos in Appendix A, we recommend that the Town perform the following upgrades and improvements:

- Convert the existing Smith and Loveless "can" station to a new suction-lift style station.
- Construct a new building (approximately 24-foot by 24-foot) over the top of the existing wet well to house the new pumps, valves, VFDs, and control and telemetry panel (similar to Falmouth Road Pump Station). Alternatively, in order to allow the existing pump station and wet well to function during part of the construction, the new building could be constructed either west or south of the existing pump station. This would necessitate either an expansion of the existing wet well to the south or the construction of new wet well to the west. From a sequencing perspective, it would be much easier to build a completely new station (i.e. no bypass pumping required); however due to the layout and size of the existing site, this may not be possible. During preliminary design of the station, a topographic survey of the site should be completed to assist in layout of potential options for this station.
- Replace the three existing pumps with three 50 HP pumps, two of which would provide the original design capacity of 3.074 MGD with one as a stand-by. During preliminary design, the potential to gain additional capacity by upsizing to 60 HP pumps will be evaluated.
- Install three new VFDs.
- Install new 10-inch suction and eight-inch discharge piping and valves as necessary to pipe to the existing force main.
- Repair and retrofit the existing 10-foot by 14-foot wet well to accept the new pumps and the new building. Raise the top of the wet well (finished floor elevation of the new building) one to two feet to prevent flooding. Note: During preliminary or final design, the wet well should be drawn down, cleaned and inspected for structural integrity; repairs should be made as necessary. Pending the final location chosen for the new building, the wet well may need to be expanded or replaced with a new, larger wet well.
- Replace three existing 24-inch sluice gates in the wet well with new, similarly sized sluice gates or install new sluice gates if a new wet well is constructed.
- Replace existing ultrasonic transducer, submersible pressure transducer and float switches with new submersible pressure transducers and back-up float switches.

- Install a new PLC-based pump control and telemetry panel mounted in the new building in a NEMA 12 enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).
- Replace the existing generator and automatic transfer switch (ATS) with a new 150 kW diesel generator.
- Replace the existing electrical service and disconnect switch. (Although the existing service and switch may be sized appropriately to handle the new equipment with minor modifications, due to the age of the equipment it is likely that they no longer meet current standards. This issue can be evaluated further during preliminary design; however, costs have been included in the estimate below to replace the equipment.)
- Install new conduit and wiring as necessary to install the new pumps, instrumentation, VFDs and controls.
- Perform the following improvements to the existing generator building:
    - Provide emergency battery lighting in case of generator failure.
    - Replace the roof shingles and add a ridge vent.
    - Replace existing wooden rake and eave trim and soffit with aluminum break metal trim and a vented aluminum soffit.
    - Remove exhaust fan and inlet damper. Provide new damper and louvers for new generator.
    - Plug existing floor drain from the building to the influent manhole.
    - Provide secondary containment for the existing 330 gallon steel diesel storage tank. Alternatives may include constructing a CMU or concrete wall around it, installing a prefabricated steel or polyethylene dike unit, or installing a new, double wall tank with leak detection.
    - Replace corroded ceiling supported threaded rod equipment hangars.
- Perform site improvements as necessary to provide proper drainage and snow removal around the existing generator building and the new pump and controls building.
- Remove existing equipment from existing "can" and fill the can with flowable fill in-place.

In addition to the above-mentioned recommendations, we also recommend the Town perform the following general maintenance items to the existing generator building.

- Recaulk the openings in brick veneer on exterior walls.
- Recaulk any unsealed conduit openings in the exterior walls.
- Replace weather stripping around door.
- Refinish the floor.

The estimated cost to complete the improvements is $1,950,000. It should also be noted that any major improvements to the Mill Creek Pump Station will likely require a NRPA permit as the station is adjacent to a tide-influenced stream.

Insert Inventory Sheet

Insert Inventory Sheet

3.6 HANDY BOAT PUMP STATION (NO. 6)

Handy Boat Pump Station accepts gravity flows from several small neighborhoods along Falmouth Foreside and the Underwood Road Pump Station. It pumps to the gravity sewer in Route 88 which eventually flows to Mill Creek Pump Station. Sewer users in this drainage area are characterized as residential and some commercial.

3.6.1 Flow Assessment

The station was originally provided with two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 9, 2008 is shown in Table 3-7 below.

TABLE 3-7
HANDY BOAT PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	500	500	Unk.[1]
Actual	438	485	532
Design TDH (ft.)	93	93	Unk.[1]

1. Unk. = Unknown.

The following information was considered when assessing the current capacity of the Handy Boat Pump Station and determining the future capacity needs.

- The original design capacity of the pump station from 1971 was 500 gpm with one pump operating.
- Based on drawdown testing, the current capacity of the pump station is approximately 532 gpm with two pumps operating.
- Even at the decreased pumping capacity of the station, the existing pumps have been able to able to keep up with the average and peak flows to date.

- Pump run times for 2006 and 2007 indicate that even under peak conditions, the combined pump run time is about 12 hours per day.
- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow at this station is 232 gpm. Note: This is based on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.
- This drainage area has limited potential for additional residential development. It has been assumed that wastewater flows to the station will increase only marginally, if at all.
- The ideal maximum flow for the 6-inch diameter force main from Handy Boat Pump Station is approximately 440 gpm at 5 feet per second velocity and the minimum recommended flow is approximately 175 gpm at 2 feet per second velocity. The flow rates seen at this station produce slightly higher velocities in the force main; however at 6 feet per second, they are still within an acceptable range.
- Although the capacity of Pump 2 is considerably lower than Pump 1 and the capacity of both pumps is less than the original design capacity, it appears that Handy Boat Pump Station has adequate capacity to handle existing and future flows. No capacity upgrade is necessary.

3.6.2 Recommendations and Costs

Although the station is aging, due to the high costs associated with upgrading the station we recommend that the Town continue to use the existing station. In the future, as the existing equipment begins to fail, the Town may want to consider replacing the station with a suction lift style station similar to what is proposed at Brown Street to eliminate the below-ground "can". For now, based on the above discussion of the Handy Boat Pump Station and the building services technical memos in Appendix A, we recommend that the Town continue to use the existing pump station with the following improvements:

- Monitor the capacity of Pump 2; replace if capacity is no longer sufficient to handle incoming flows or run times for this pump increase dramatically.

- Install a new PLC-based pump control and telemetry panel mounted near the wet well on unistrut in a NEMA 4X enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).
- Remove the existing bubbler system and use the existing submersible pressure transducer to provide a level signal to the PLC for remote indication of wetwell level as well as for pump operation. Install a new float system in the wet well, hardwired to the pumps, to provide pump control back-up should the submersible pressure transducer or PLC fail.

The estimated cost to complete the improvements is $28,000. This does not include costs to replace Pump 2.

Insert Inventory Sheet

Insert Inventory Sheet

3.7 UNDERWOOD ROAD PUMP STATION (NO. 7)

Underwood Road Pump Station accepts gravity flows from several small neighborhoods along Falmouth Foreside. It pumps to the gravity sewer in Amerescoggin Road which eventually flows to Handy Boat Pump Station. Sewer users in this drainage area are characterized as residential.

3.7.1 Flow Assessment

The station has two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 5, 2008 is shown in Table 3-8 below.

TABLE 3-8
UNDERWOOD ROAD PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	115	115	Unk.[1]
Actual	133	102	141
Design TDH (ft.)	53	53	Unk.[1]

1. Unk. = Unknown.

The following information was considered when assessing the current capacity of the Underwood Road Pump Station and determining the future capacity needs.

- The original design capacity of the pump station from 1971 was 115 gpm with one pump operating.
- Based on drawdown testing, the current capacity of the pump station is approximately 141 gpm with two pumps operating.
- Pump run times for 2006 and 2007 indicate that even under peak conditions, the combined pump run time is less than three hours per day.
- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow at this station is 15 gpm. Note: This is based

on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.

- This drainage area has little area for additional development. It has been assumed that wastewater flows to the station will increase only marginally, if at all.
- The ideal maximum flow for the 6-inch diameter force main from Underwood Road Pump Station is approximately 440 gpm at 5 feet per second velocity and the minimum recommended flow is approximately 175 gpm at 2 feet per second velocity. The force main at this station is oversized; however, the Town has not had any issues with clogging to date.
- The Town noted that during storm events when the station loses power, it is difficult to reach with a portable generator or a tank truck as it is located at the bottom of a steep hill.
- Based on the above analysis, it appears that Underwood Road Pump Station has more than adequate capacity to handle existing and future flows. No capacity upgrade is necessary.

3.7.2 Recommendations and Costs

Although the station is aging, due to the high costs associated with upgrading the station we recommend that the Town continue to use the existing station. In the future, as the existing equipment begins to fail, the Town may want to consider replacing the station with a submersible-style or suction-lift style station to eliminate the below-ground "can". For now, based on the above discussion of the Underwood Road Pump Station and the building services technical memos in Appendix A, we recommend that the Town continue to use the existing pump station with the following improvements:

- Raise the wet well frame and cover above-grade to prevent surface water from draining into the wet well.
- Install a new PLC-based pump control and telemetry panel mounted near the wet well on unistrut in a NEMA 4X enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).

- Remove the existing bubbler system and use the existing submersible pressure transducer to provide a level signal to the PLC for remote indication of wetwell level as well as for pump operation. Install a new float system in the wet well, hardwired to the pumps, to provide pump control back-up should the submersible pressure transducer or PLC fail.
- Provide a permanent 30 kW propane generator and automatic transfer switch. Replace the existing rotophase unit with VFDs to provide single to three phase power conversion for the pumps.

The estimated cost to complete the improvements is $82,000.

Insert Inventory Sheet

Insert Inventory Sheet

3.8 HEDGEROW DRIVE PUMP STATION (NO. 8)

Hedgerow Drive Pump Station accepts gravity flows from a small portion of Hedgerow Drive only. It pumps to a gravity sewer in Hedgewood Drive which flow to a gravity sewer in Route 88 which eventually flows to Mill Creek Pump Station. Sewer users in this drainage area are characterized as residential.

3.8.1 Flow Assessment

The station has two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 5, 2008 is shown in Table 3-9 below.

TABLE 3-9
HEDGEROW DRIVE PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	Unk.[1]	Unk.[1]	Unk.[1]
Actual	90	110	Unk.[1,2]
Design TDH (ft.)	Unk.[1]	Unk.[1]	Unk.[1]

1. Unk. = Unknown.
2. Due to the small drainage area, there was inadequate flow to perform a two pump drawdown test.

The following information was considered when assessing the current capacity of the Hedgerow Drive Pump Station and determining the future capacity needs.

- The original design capacity of the pump station is unknown.
- Based on drawdown testing, the current capacity of the pump station is approximately 90-110 gpm depending on which pump is operating.
- Pump run times for 2006 and 2007 indicate that even under peak conditions, the combined pump run time is less than one hour per day.
- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow at this station is 2 gpm. Note: This is based

on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.

- This drainage area has little area for additional development. It has been assumed that wastewater flows to the station will increase only marginally, if any.
- The ideal maximum flow for the 4-inch diameter force main from Hedgerow Drive Pump Station is approximately 195 gpm at 5 feet per second velocity and the minimum recommended flow is approximately 80 gpm at 2 feet per second velocity.
- Based on the above analysis, it appears that Hedgerow Drive Pump Station has more than adequate capacity to handle existing and future flows. No capacity upgrade is necessary.

3.8.2 Recommendations and Costs

There is the potential that the large undeveloped parcel to the northwest of the station (off Route 1) could be developed. If this happens, the gravity sewer from Hedgerow Drive may be able to tie into any new sewers and drain by gravity to Route 1, eliminating the need for the pump station. For now, based on the above discussion of the Hedgerow Drive Pump Station and the building services technical memos in Appendix A, we recommend that the Town continue to use the existing pump station with the following improvements:

- Install a new telemetry panel mounted near the wet well on unistrut in a NEMA 4X enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).

The estimated cost to complete the improvements is $23,000.

Insert Inventory Sheet

Insert Inventory Sheet

3.9 THORNHURST DRIVE PUMP STATION (NO. 9)

Thornhurst Drive Pump Station accepts gravity flows from a small residential area as well as Waite's Landing and Landing Woods Lane Pump Stations. It pumps to the gravity sewer in Route 88 which eventually flows to Mill Creek Pump Station. Sewer users in this drainage area are characterized as residential.

3.9.1 Flow Assessment

The station has two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 5, 2008 is shown in Table 3-10 below.

TABLE 3-10
THORNHURST DRIVE PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	Unk.[1]	Unk.[1]	Unk.[1]
Actual	124	119	127
Design TDH (ft.)	Unk.[1]	Unk.[1]	Unk.[1]

1. Unk. = Unknown.

The following information was considered when assessing the current capacity of the Thornhurst Drive Pump Station and determining the future capacity needs.

- The original design capacity of the pump station is unknown.
- Based on drawdown testing, the current capacity of the pump station is approximately 127 gpm with two pumps operating.
- Pump run times for 2006 and 2007 indicate that under peak conditions, the combined pump run time is about 19 hours per day.
- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow at this station is 98 gpm. Note: This is based

on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.

- The force main diameter at this station is unknown.
- The Town noted that during storm events when the station loses power, it has to be monitored closely to ensure that the wet well doesn't overflow as there is a considerable amount of flow reaching the station due to I/I even when Waite's Landing and Landing Woods Lane Pump Stations are without power. An emergency source of power is critical to prevent a possible sanitary sewer overflow (SSO).
- The Thornhurst Drive Pump Station approaches its capacity during wet weather, primarily due to I/I in the collection system. In addition, there is some undeveloped land to the north of the pump station that could support residential development in the future. Over the short term, the Town has two choices - conduct flow monitoring and I/I removal in the collection system to reduce flows and free up capacity for possible future development or increase the size of this pump station to perhaps 200 gpm to provide capacity for future growth. We would recommend that the Town perform I/I removal in the short-term and leave the pump station upgrade to be paid for by future developers.

3.9.2 Recommendations and Costs

Prior to any upgrades at the pump station, we recommend the Town complete a Sewer System Evaluation Study (SSES) of the Thornhurst Drive Pump Station drainage area. The evaluation of this drainage area could be lumped into the SSES completed in the Brown Street Pump Station drainage area; if the evaluations are completed together, the Thornhurst Drive work could likely be completed for an additional $10,000 depending on the final scope of the evaluation. In addition to the SSES, based on the above discussion of the Thornhurst Drive Pump Station and the building services technical memos in Appendix A, we also recommend that the Town continue to use the existing pump station with the following improvements:

- Install a new telemetry panel mounted near the wet well on unistrut in a NEMA 4X enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).

- Provide a new main electrical disconnect switch mounted in a NEMA 4X enclosure.
- Provide a permanent 35 kW propane generator and automatic transfer switch.

The estimated cost to complete these improvements is $61,000. If the Town decides to upsize the pump station to allow for 200 gpm pumps in the future, the estimated cost is approximately $200,000 which includes new pumps, electrical service and generator.

Insert Inventory Sheet

Insert Inventory Sheet

3.10 WAITE'S LANDING PUMP STATION (NO. 10)

Waite's Landing Pump Station accepts gravity flows from a small residential area as well as from Landing Woods Lane Pump Station. It pumps to the gravity sewer in Elm Drive which eventually flows to Thornhurst Drive Pump Station. Sewer users in this drainage area are characterized as residential.

3.10.1 Flow Assessment

The station has with two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 5, 2008 is shown in Table 3-11 below.

TABLE 3-11
WAITE'S LANDING PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	Unk.[1]	Unk.[1]	Unk.[1]
Actual	106	106	123
Design TDH (ft.)	Unk.[1]	Unk.[1]	Unk.[1]

1. Unk. = Unknown.

The following information was considered when assessing the current capacity of the Waite's Landing Pump Station and determining the future capacity needs.

- The original design capacity of the pump station is unknown.
- Based on drawdown testing, the current capacity of the pump station is approximately 123 gpm with two pumps operating.
- Pump run times for 2006 and 2007 indicate that under peak conditions, the combined pump run time is about 10 hours per day. It should be noted that although the pump run times for this drainage area are minimal, they are still considered excessive the small number of homes that drain to the pump station.
-

- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow at this station is 44 gpm. Note: This is based on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.
- This drainage area has little area for additional development. It has been assumed that wastewater flows to the station will increase only marginally, if any.
- The ideal maximum flow for the 4-inch diameter force main from Waite's Landing Pump Station is approximately 195 gpm at 5 feet per second velocity and the minimum recommended flow is approximately 80 gpm at 2 feet per second velocity.
- Based on the above analysis, it appears that Waite's Landing Pump Station has adequate capacity to handle existing and future flows. No capacity upgrade is necessary.

3.10.2 Recommendations and Costs

Based on the above discussion of the Waite's Landing Pump Station and the building services technical memos in Appendix A, we recommend that the Town continue to use the existing pump station with the following improvements:

- Install a new telemetry panel mounted near the wet well on unistrut in a NEMA 4X enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).

The estimated cost to complete the improvements is $23,000.

Insert Inventory Sheet

Insert Inventory Sheet

3.11 LANDING WOODS LANE PUMP STATION (NO. 11)

Landing Woods Lane Pump Station accepts gravity flows from a small residential area. It pumps to the gravity sewer in Waite's Landing Road which eventually flows to Waite's Landing Pump Station. Sewer users in this drainage area are characterized as residential.

3.11.1 Flow Assessment

The station has two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 5, 2008 is shown in Table 3-12 below.

TABLE 3-12
LANDING WOODS LANE PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	Unk.[1]	Unk.[1]	Unk.[1]
Actual	110	123	128
Design TDH (ft.)	Unk.[1]	Unk.[1]	Unk.[1]

1. Unk. = Unknown.

The following information was considered when assessing the current capacity of the Landing Woods Lane Pump Station and determining the future capacity needs.

- The original design capacity of the pump station is unknown.
- Based on drawdown testing, the current capacity of the pump station is approximately 128 gpm with two pumps operating.
- Pump 1 was replaced in 2002 and is a different model than Pump 2.
- Pump run times for 2006 and 2007 indicate that under peak conditions, the combined pump run time is less than four hours per day.
- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow at this station is 18 gpm. Note: This is based

on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.

- This drainage area is currently built out with little area for additional development unless the Portland Country Club was redeveloped and some flow was diverted to this station. It has been assumed that wastewater flows to the station will increase only marginally, but infiltration and inflow will likely continue to increase without supplemental removal efforts in the collection system. (It should be noted that although the pump run times for this drainage area are minimal, they are still considered excessive the small number of homes that drain to the pump station. The Town has noted that their investigations indicate that that likely source of I/I in this area is a perimeter drain at the end of the road which would likely not be cost effective to remove.)
- The ideal maximum flow for the 4-inch diameter force main from Landing Woods Lane Pump Station is approximately 195 gpm at 5 feet per second velocity and the minimum recommended flow is approximately 80 gpm at 2 feet per second velocity.
- Based on the above analysis, it appears that Landing Woods Lane Pump Station has adequate capacity to handle existing and future flows. No capacity upgrade is necessary.

3.11.2 Recommendations and Costs

There is the potential that the gravity sewer from Landing Woods Lane could be rerouted to tie into the Portland Country Club sewers which would eliminate the need for the Landing Woods Lane Pump Station; however this is unlikely due to the costs associated with installing new pipe and obtaining the necessary easements. Based on the above discussion of the Landing Woods Lane Pump Station and the building services technical memos in Appendix A, we recommend that the Town continue to use the existing pump station with the following improvements:

- Remove dead tree adjacent to the pump station to prevent damage to the station should it fall.
- Install a new telemetry panel mounted near the wet well on unistrut in a NEMA 4X enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).

The estimated cost to complete the improvements is $24,000.

Insert Inventory Sheet

Town of Falmouth, Maine
Comprehensive Pump Station Evaluation
Middle Road Pump Station (No. 12)

General Pump Station Information					
Location:			On left side of Middle Rd. approx. 800 ft. north of Maccabe Rd.		
Coordinates (Lat./Long.):			43.7139267	-70.2537962	
Elevation, ft.:			19.0		
Distance from WWTF, miles:			2.1		
Year Constructed:	1981		Upgraded:	N/A	
Design Capacity of Station, gpm:			Unk.		
Station Type:			Submersible		
No. of Pumps:			2		
			P1	P2	
Year Installed:			2005	2005	
Design Capacity of Pumps, gpm:			Unk.	Unk.	
Design TDH of Pumps, ft.:			Unk.	Unk.	
Pump Make/Model:			Flygt/CP3127	Flygt/CP3127	
Motor Size, HP:			10	10	
Pump Speed, rpm:			Unk.	Unk.	
Drive Type:			N/A	N/A	
Drive Make:			N/A	N/A	
Seal Type:			Mechanical	Mechanical	
Seal Make:			Unk.	Unk.	
Service Voltage:	230	Hertz:	60	Phase:	3
Force Main Diam., in.:		6	Length, ft.:	4,412	

Generator Information			
Make/Model:	N/A (Portable generator plug provided)		
Year Installed:	N/A		
Fuel Type:	N/A	Size, kW:	N/A

Controls Information			
Pump Control Scenario:	P1 and P2 are automatically alternated as the lead pump Pumps are operated based on float switches in the wet well		
Pump Control Panel:			
Type:	Relay-based		
Location:	Mounted outside		
Flow Meter:			
Type:	N/A		
Make/Model:	N/A		
Alarm Transmission:	Aquatrol RTU Panel		
Level Controls:			
Pump/Alarms:	Float Switches		
Level:	Submersible Pressure Transducer (to telemetry)		
MCC:			
Type:	N/A	Location:	N/A
Make/Model:	N/A		

HVAC							
Heating:				Ventilation:			
Location:	N/A			Location:	N/A		
Make:	N/A	Model:	N/A	Make:	N/A	Model:	N/A
Year Installed:	N/A			Year Installed:	N/A		
Quantity:	N/A	Size, kW:	N/A	Quantity:	N/A	Size, kW:	N/A

Town of Falmouth, Maine
Comprehensive Pump Station Evaluation
Middle Road Pump Station (No. 12)

Condition of Equipment/Identified Issues		
Capacity: Recent capacity assessment via drawdown testing on 12/05/08 indicated that the pumps have the following capacities: P1-78 gpm, P2-94 gpm and P1/P2-102. Pressure gages were not available to obtain the corresponding TDH values. The design capacity of this pump station is unavailable; however comparison of drawdown testing results from 2005 indicate that the pumps have lost capacity. Regardless, it appears that the station has adequate capacity to handle existing flows as each pump runs for about 3-4 hours per day on average and about 5-10 hours under peak conditions.		
Exterior Site: The site appears provide proper drainage to prevent run-off from entering the wet well and has a considerable amount of additional space for potential future upgrades.		
Building Structures (if applicable): Not applicable		
Wet Well: The wet well hatch is steel; the Town has removed some of the webbing material to make it easier to open and close the hatch. The seal around the vent has a hole and should be repaired.		
Dry Well (if applicable): Not applicable		
Valve Pit (if applicable): Sump drain leaks consistently at about 1/2 gpm; Town suspects that the pipe may be broken between the valve pit and the wet well.		
Electrical/Instrumentation: Conduit, boxes and fittings are in good condition. The pump control and telemetry panels and electrical equipment are in good condition; however the electrical equipment enclosure does not appear to have a NEMA rating. The conduit from the panel into the wet well is not sealed. Power and control wiring are run in the same conduit. The junction box at the wet well is located in the wet well and is corroded. The Town noted that this station is prone to losing power.		
HVAC: Not applicable		
Security Measures: All outdoor equipment has been provided with a lock.		
Other:		
Miscellaneous Issues:		
Grease Accumulation?	Yes / **No**	
Clogging Issues?	**Yes** / No	Pump 2 tends to clog due to influent pipe being located next to the pump.
Nuisance Odors?	Yes / **No**	
Concrete Corrosion?	Yes / **No**	

Insert Inventory Sheet

3.12 MIDDLE ROAD PUMP STATION (NO. 12)

Middle Road Pump Station accepts gravity flows from the Pleasant Hill Road area as well as several other side streets off Middle Road. It pumps to the gravity sewer in Middle Road near the Lunt Road intersection which eventually flows to Lunt Road Pump Station. Sewer users in this drainage area are characterized as residential.

3.12.1 Flow Assessment

The station has two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 5, 2008 is shown in Table 3-13 below.

TABLE 3-13
MIDDLE ROAD PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	Unk.[1]	Unk.[1]	Unk.[1]
Actual	78	94	102
Design TDH (ft.)	Unk.[1]	Unk.[1]	Unk.[1]

1. Unk. = Unknown.

The following information was considered when assessing the current capacity of the Middle Road Pump Station and determining the future capacity needs.

- The original design capacity of the pump station is unknown.
- Based on drawdown testing, the current capacity of the pump station is approximately 102 gpm with two pumps operating.
- Pump run times for 2006 and 2007 indicate that under peak conditions, the combined pump run time is about 17 hours per day.
- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow at this station is 61 gpm. Note: This is based

on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.

- This drainage area will likely see some additional flow over the next 20 years. There are several side streets off Allen Avenue Extensions with a number of failing septic systems. If a new sewer is constructed, it could potentially drain to the Middle Road Pump Station.
- The ideal maximum flow for the 6-inch diameter force main from Middle Road Pump Station is approximately 440 gpm at 5 feet per second velocity and the minimum recommended flow is approximately 175 gpm at 2 feet per second velocity. The force main at this station is oversized; however, the Town has not had any issues with clogging to date.
- The Town noted that Pump 2 is prone to clogging due to the influent to the wet well discharging directly adjacent to the pump.
- The Town noted that during storm events when the station loses power, it has to be monitored closely to ensure that the wet well doesn't overflow. A portable generator is often required almost continually and limits availability of the portable generator for other pump stations without permanent generators.
- Based on the above analysis, it appears that Middle Road Pump Station has adequate capacity to handle existing flows for the near future. However, if the areas with failed septic systems tie into this drainage area, the Town should re-evaluate the need for a capacity upgrade at this pump station. The new station should have a minimum capacity of 200 gpm to maintain a velocity of at least two feet per second in the force. Consideration should be given at this time to alternate wet well layouts or pump styles to address the clogging issues and repairing the leaking sump drain line between the valve pit and the wet well.

3.12.2 Recommendations and Costs

Based on the above discussion of the Middle Road Pump Station and the building services technical memos in Appendix A, we recommend that the Town continue to use the existing pump station with the following improvements:

- Replace existing steel hatch with a new aluminum hatch.
- Reseal vent penetration in the wet well cover.
- Install a new PLC-based pump control and telemetry panel mounted near the wet well on unistrut in a NEMA 4X enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).
- Provide a new main electrical disconnect switch mounted in a NEMA 4X enclosure.
- The Town suggested the possibility of re-using the old 30 kW generator from Lunt Road Pump Station. The generator is adequate to operate the existing 10 HP pumps; however if the station receives a capacity upgrade in the future, a larger generator will be required. Also, if the Town chooses to use the 30 kW propane generator, either reduced voltage soft starters (RVSS) or VFDs will be required to reduce the current required to start the pumps.

The estimated cost to complete the improvements less the cost to relocate the new generator is $36,000. The estimated cost to relocate the generator from Lunt Road Pump Station and to provide two new RVSSs is $19,000. If the Town decides to upsize the pump station to allow for 200 gpm pumps, the estimated cost is approximately $200,000 which includes new pumps, electrical service and generator.

Insert Inventory Sheet

Insert Inventory Sheet

3.13 BAYSITE DRIVE PUMP STATION (NO. 13)

Baysite Drive Pump Station accepts gravity flows from a medium-sized condominium development. It pumps to the gravity sewer in Route 88 which eventually flows to Mill Creek Pump Station. Sewer users in this drainage area are characterized as residential.

3.13.1 Flow Assessment

The station has two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 5, 2008 is shown in Table 3-14 below.

TABLE 3-14
BAYSITE DRIVE PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	Unk.[1]	Unk.[1]	Unk.[1]
Actual	93	102	108
Design TDH (ft.)	Unk.[1]	Unk.[1]	Unk.[1]

1. Unk. = Unknown.

The following information was considered when assessing the current capacity of the Baysite Drive Pump Station and determining the future capacity needs.

- The original design capacity of the pump station is unknown.
- Based on drawdown testing, the current capacity of the pump station is approximately 108 gpm with two pumps operating.
- Pump run times for 2006 and 2007 indicate that under peak conditions, the combined pump run time is about 6 hours per day.
- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow at this station is 26 gpm. Note: This is based on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.

- This drainage area is mostly built out with minimal area for additional development. It has been assumed that wastewater flows to the station will not increase significantly, but infiltration and inflow will likely continue to increase without supplemental removal efforts in the collection system.
- The ideal maximum flow for the 6-inch diameter force main from Baysite Drive Pump Station is approximately 440 gpm at 5 feet per second velocity and the minimum recommended flow is approximately 175 gpm at 2 feet per second velocity. The force main at this station is oversized; however, the Town has not had any issues with clogging to date.
- Elimination of this pump station by extending the gravity sewer on Baysite Drive to the Underwood Road Pump Station collection system was considered; however, due to the deep ravine between the two drainage areas and the difficulty in obtaining necessary easements to private property, this alternative would likely be cost prohibitive.
- Based on the above analysis, it appears that Baysite Drive Pump Station has adequate capacity to handle existing and future flows. No capacity upgrade is necessary.

3.13.2 Recommendations and Costs

Based on the above discussion of the Baysite Drive Pump Station and the building services technical memos in Appendix A, we recommend that the Town continue to use the existing pump station with the following improvements:

- Install a louver operator and thermostat controls and return the generator intake louver to service.
- Install a new telemetry panel mounted in the Generator Building in a NEMA 12 enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).
- Provide emergency battery lighting in the building in case of generator failure.

The estimated cost to complete the improvements is $27,000.

Town of Falmouth, Maine
Comprehensive Pump Station Evaluation
Woodland's Drive Pump Station (No. 14)

General Pump Station Information					
Location:		From Maplewood Circle, approx. 0.2 mi. south on Woodlands Dr. on right			
Coordinates (Lat./Long.):		43.7330990	-70.2687630		
Elevation, ft.:		129.0			
Distance from WWTF, miles:		4			
Year Constructed:	1987	Upgraded:	N/A		
Design Capacity of Station, gpm:		110			
Station Type:		Submersible			
No. of Pumps:		2			
		P1	P2		
Year Installed:		1987	1987		
Design Capacity of Pumps, gpm:		110	110		
Design TDH of Pumps, ft.:		32	32		
Pump Make/Model:		Hydromatic/ S4M	Hydromatic/ S4M		
Motor Size, HP:		3	3		
Pump Speed, rpm:		1150	1150		
Drive Type:		N/A	N/A		
Drive Make:		N/A	N/A		
Seal Type:		Mechanical	Mechanical		
Seal Make:		Unk.	Unk.		
Service Voltage:	230	Hertz:	60	Phase:	3
Force Main Diam., in.:		4	Length, ft.:	772	

Generator Information			
Make/Model:	N/A (Portable generator plug provided)		
Year Installed:	N/A		
Fuel Type:	N/A	Size, kW:	N/A

Controls Information			
Pump Control Scenario:	P1 and P2 are automatically alternated as the lead pump Pumps are operated based on float switches in the wet well		
Pump Control Panel:			
Type:	Relay-based		
Location:	Mounted outside		
Flow Meter:			
Type:	N/A		
Make/Model:	N/A		
Alarm Transmission:	Aquatrol RTU Panel		
Level Controls:			
Pump/Alarms:	Float Switches		
Level:	Submersible Pressure Transducer (to telemetry)		
MCC:			
Type:	N/A	Location:	N/A
Make/Model:	N/A		

HVAC							
Heating:				Ventilation:			
Location:	N/A			Location:	N/A		
Make:	N/A	Model:	N/A	Make:	N/A	Model:	N/A
Year Installed:	N/A			Year Installed:	N/A		
Quantity:	N/A	Size, kW:	N/A	Quantity:	N/A	Size, kW:	N/A

Town of Falmouth, Maine
Comprehensive Pump Station Evaluation
Woodland's Drive Pump Station (No. 14)

Condition of Equipment/Identified Issues		
Capacity: Recent capacity assessment via drawdown testing on 12/05/08 produced questionable results as each pump operating alone produced more than both pumps operating at the same time. However drawdown testing results from 2000 (P1-153 gpm and P2-117) indicate that the pumps have a greater capacity than the original design capacity of the pumps. It appears that the station has adequate capacity to handle existing flows as each pump runs for about 30 minutes per day on average and less than 1 hour under peak conditions.		
Exterior Site: It appears that run-off from the road would likely drain to the pump station wet well and overflow tank area.		
Building Structures (if applicable): Not applicable		
Wet Well: Refer to Exterior Site section. No other deficiencies noted.		
Dry Well (if applicable): Not applicable		
Valve Pit (if applicable): Not applicable		
Electrical/Instrumentation: Conduit, boxes and fittings are in good condition. The pump control and telemetry panels and electrical equipment are in fair to poor condition; however they do not appear to have a NEMA rating. The conduit from the panel into the wet well is not sealed. Power and control wiring are run in the same conduit. The junction box at the wet well is located in the wet well and is corroded. The existing main disconnect switch is fed through an old disconnect switch which is being used as a junction box. A rotophase unit is provided to convert between single and three phase power to run the pumps and is in fair condition. Above-grade conduit is flexible and, by code, should be rigid steel.		
HVAC: Not applicable		
Security Measures: All outdoor equipment has been provided with a lock.		
Other: Town noted that the terminus manhole structure had deteriorated. This station has been provided with an overflow storage tank.		
Miscellaneous Issues:		
Grease Accumulation?	Yes / **No**	
Clogging Issues?	Yes / **No**	
Nuisance Odors?	Yes / **No**	
Concrete Corrosion?	Yes / **No**	

Insert Inventory Sheet

Insert Inventory Sheet

3.14 WOODLANDS DRIVE PUMP STATION (NO. 14)

Woodlands Drive Pump Station accepts gravity flows from a portion of the Woodlands Club development. It pumps to a gravity sewer in Woodlands Drive that eventually drains to the Pinehurst Drive Pump Station. Sewer users in this drainage area are characterized as residential.

3.14.1 Flow Assessment

The station has two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by WWTF staff in 2000 are shown in Table 3-15 below. As noted on the pump station evaluation sheet, the draw down testing performed by W-P and WWTF staff on December 5, 2008 produced questionable results which were not used in this evaluation.

TABLE 3-15
WOODLANDS DRIVE PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	110	110	Unk.[1]
Actual[2]	153	117	Unk.[1]
Design TDH (ft.)	32	32	Unk.[1]

1. Unk. = Unknown.
2. Actual results listed are based on drawdown testing completed by the Town in 2000.

The following information was considered when assessing the current capacity of the Woodlands Drive Pump Station and determining the future capacity needs.

- The original design capacity of the pump station from 1987 was 110 gpm with one pump operating.
- Based on drawdown testing, the current capacity of the pump station is approximately 117-153 gpm depending on which pump is operating.
- Pump run times for 2006 and 2007 indicate that even under peak conditions, the combined run time of the pumps was less than two hours per day.

- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow at this station is 10 gpm. Note: This is based on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.
- Based on conversations with the Town, it is anticipated that there will be little additional flow added to this drainage area over the next 20 years.
- The ideal maximum flow for the 4-inch diameter force main from Woodlands Drive Pump Station is approximately 195 gpm at 5 feet per second velocity and the minimum recommended flow is approximately 80 gpm at 2 feet per second velocity.
- Based on the above analysis, it appears that Woodlands Drive Pump Station has adequate capacity to handle existing and future flows. No capacity upgrade is necessary.

3.14.2 Recommendations and Costs

Based on the above discussion of the Woodlands Drive Pump Station and the building services technical memos in Appendix A, we recommend that the Town continue to use the existing pump station with the following improvements:

- Raise manhole frames and covers on bypass tank and install raised tank cover on wet well to prevent run-off from entering the tanks.
- Install a new PLC-based pump control and telemetry panel mounted near the wet well on unistrut in a NEMA 4X enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).
- Replace all outdoor exposed flexible conduit with rigid steel conduit.
- Relocate the existing portable generator plug out from under the main disconnect enclosure for easier access.
- Replace existing rotophase unit with new VFDs for phase conversion.
- Provide a new main electrical disconnect switch and a new panelboard with enough circuit breakers to feed the existing equipment in NEMA 4X enclosures.

The estimated cost to complete the improvements is $73,000.

Insert Inventory Sheet

Insert Inventory Sheet

Town of Falmouth, Maine
Comprehensive Pump Station Evaluation
Pinehurst Drive Pump Station (No. 15)

General Pump Station Information					
Location:		Southern side of the turn-around at the end of Pinehurst Ln.			
Coordinates (Lat./Long.):		43.7401205	-70.2684197		
Elevation, ft.:		124.0			
Distance from WWTF, miles:		3.8			
Year Constructed:	1987	Upgraded:	N/A		
Design Capacity of Station, gpm:		125			
Station Type:		Submersible			
No. of Pumps:		2			
		P1	P2		
Year Installed:		1987	1987		
Design Capacity of Pumps, gpm:		125	125		
Design TDH of Pumps, ft.:		68	68		
Pump Make/Model:		Hydromatic/ S4MN	Hydromatic/ S4MN		
Motor Size, HP:		10	10		
Pump Speed, rpm:		1750	1750		
Drive Type:		N/A	N/A		
Drive Make:		N/A	N/A		
Seal Type:		Mechanical	Mechanical		
Seal Make:		Unk.	Unk.		
Service Voltage:	208	Hertz:	60	Phase:	3
Force Main Diam., in.:	4	Length, ft.:	1,465		

Generator Information			
Make/Model:	Olympian/D40P3		
Year Installed:	2002		
Fuel Type:	Diesel	Size, kW:	40

Controls Information			
Pump Control Scenario:	P1 and P2 are automatically alternated as the lead pump Pumps are operated based on float switches in the wet well		
Pump Control Panel:			
Type:	Relay-based		
Location:	Mounted outside		
Flow Meter:			
Type:	N/A		
Make/Model:	N/A		
Alarm Transmission:	Aquatrol RTU Panel		
Level Controls:			
Pump/Alarms:	Float Switches		
Level:	Submersible Pressure Transducer (to telemetry)		
MCC:			
Type:	N/A	Location:	N/A
Make/Model:	N/A		

HVAC							
Heating:				Ventilation:			
Location:	N/A			Location:	N/A		
Make:	N/A	Model:	N/A	Make:	N/A	Model:	N/A
Year Installed:	N/A			Year Installed:	N/A		
Quantity:	N/A	Size, kW:	N/A	Quantity:	N/A	Size, kW:	N/A

Town of Falmouth, Maine
Comprehensive Pump Station Evaluation
Pinehurst Drive Pump Station (No. 15)

Condition of Equipment/Identified Issues		
Capacity: Recent capacity assessment via drawdown testing on 12/08/08 indicated that the pumps have the following capacities: P1-154 gpm, P2-150 gpm and P1/P2-167. Pressure gages were not available to obtain the corresponding TDH values. The existing capacity of both pumps are higher than the original design capacity. It appears that the station has adequate capacity to handle existing flows as each pump runs for about 3-4 hours per day on average and about 7-8 hours under peak conditions. The motors for both pumps have been repaired (Pump 1-2000 and Pump 2-2006).		
Exterior Site: The site appears to have proper drainage to prevent run-off from entering the wet well.		
Building Structures (if applicable): Not applicable		
Wet Well: No deficiencies were noted.		
Dry Well (if applicable): Not applicable		
Valve Pit (if applicable): Not applicable		
Electrical/Instrumentation: Conduit, boxes and fittings are in good condition. The pump control and telemetry panels and electrical equipment are in fair condition; however they do not appear to have a NEMA rating. The generator appears to be in good condition. The conduit from the panel into the wet well is not sealed. Power and control wiring are run in the same conduit. The junction box at the wet well is located in the wet well and is corroded. The existing main disconnect switch is fed through an old disconnect switch which is being used as a junction box. Above-grade conduit is flexible and, by code, should be rigid steel.		
HVAC: Not applicable		
Security Measures: All outdoor equipment has been provided with a lock.		
Other: This station has been provided with an overflow storage tank.		
Miscellaneous Issues:		
Grease Accumulation?	Yes / **No**	
Clogging Issues?	Yes / **No**	
Nuisance Odors?	Yes / **No**	
Concrete Corrosion?	Yes / **No**	

3.15 PINEHURST DRIVE PUMP STATION (NO. 15)

Pinehurst Drive Pump Station accepts gravity flows from a portion of the Woodlands Club development as well as from High School, Falmouth Road and Woodlands Drive Pump Stations. Overall, the Pinehurst Pump Station takes all of the wastewater flow from sewered development west of the pump station including the Exit 10 area and the Falmouth on the Green country club. It pumps to the gravity sewer in Woodlands Drive that eventually drains to the Woodlands Clubhouse Pump Station. Sewer users in this drainage area are characterized as residential.

3.15.1 Flow Assessment

The station has two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 8, 2008 is shown in Table 3-16 below.

TABLE 3-16
PINEHURST DRIVE PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	125	125	Unk.[1]
Actual	154	150	167
Design TDH (ft.)	68	68	Unk.[1]

1. Unk. = Unknown.

The following information was considered when assessing the current capacity of the Pinehurst Drive Pump Station and determining the future capacity needs.

- The original design capacity of the pump station from 1987 was 125 gpm with one pump operating.
- Based on drawdown testing, the current capacity of the pump station is approximately 167 gpm with two pumps operating.
- Pump run times for 2006 and 2007 indicate that under peak conditions, the combined run time of the pumps was approximately 16 hours per day.

- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow at this station is 99 gpm. Note: This is based on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.
- The ideal maximum flow for the 4-inch diameter force main from Pinehurst Drive Pump Station is approximately 195 gpm at 5 feet per second velocity and the minimum recommended flow is approximately 80 gpm at 2 feet per second velocity.
- Because a great deal of West Falmouth is currently undeveloped, there is considerable potential for additional sewered growth in this area. A memo has been developed (refer to "Evaluation of West Falmouth Collection System" memo included in Appendix C) that considers the collection system and pumping stations in West Falmouth as a whole and the potential affects of future growth in this area. The memo also discusses Pinehurst Drive Pump Station's future needs.

3.15.2 Recommendations and Costs

As discussed in the "Evaluation of West Falmouth Collection System" memo included in Appendix C, this station will require a capacity upgrade. As noted in the memo, prior to any upgrade or addition of sewer users to the drainage area, we recommend that the Town develops a master plan for the West Falmouth area. From the master plan, the Town will be able to better determine how large the upgraded station should be. For planning purposes at this time, it is estimated that the cost to upgrade this station (including increasing the size of the force main) would be approximately $500,000.

Insert Inventory Sheet

Insert Inventory Sheet

Town of Falmouth, Maine
Comprehensive Pump Station Evaluation
Woodlands Clubhouse Pump Station (No. 16)

General Pump Station Information					
Location:		From Woods Rd., approx. 0.2 mi. down Woodlands Dr. on left (Clubhouse parking lot)			
Coordinates (Lat./Long.):		43.7393841	-70.2577876		
Elevation, ft.:		140.0			
Distance from WWTF, miles:		3.2			
Year Constructed:	1987	Upgraded:	N/A		
Design Capacity of Station, gpm:		240			
Station Type:		Submersible			
No. of Pumps:		2			
		P1	P2		
Year Installed:		1987	1987		
Design Capacity of Pumps, gpm:		240	240		
Design TDH of Pumps, ft.:		43	43		
Pump Make/Model:		Hydromatic/ S4MN	Hydromatic/ S4MN		
Motor Size, HP:		7.5	7.5		
Pump Speed, rpm:		1750	1750		
Drive Type:		N/A	N/A		
Drive Make:		N/A	N/A		
Seal Type:		Mechanical	Mechanical		
Seal Make:		Unk.	Unk.		
Service Voltage:	208	Hertz:	60	Phase:	3
Force Main Diam., in.:	6	Length, ft.:	2,013		

Generator Information			
Make/Model:	Olympian/D40P3		
Year Installed:	2002		
Fuel Type:	Diesel	Size, kW:	40

Controls Information			
Pump Control Scenario:	P1 and P2 are automatically alternated as the lead pump Pumps are operated based on float switches in the wet well		
Pump Control Panel:			
Type:	Relay-based		
Location:	Mounted outside		
Flow Meter:			
Type:	N/A		
Make/Model:	N/A		
Alarm Transmission:	Aquatrol RTU Panel		
Level Controls:			
Pump/Alarms:	Float Switches		
Level:	Submersible Pressure Transducer (to telemetry)		
MCC:			
Type:	N/A	Location:	N/A
Make/Model:	N/A		

HVAC							
Heating:				Ventilation:			
Location:	N/A			Location:	N/A		
Make:	N/A	Model:	N/A	Make:	N/A	Model:	N/A
Year Installed:	N/A			Year Installed:	N/A		
Quantity:	N/A	Size, kW:	N/A	Quantity:	N/A	Size, kW:	N/A

Town of Falmouth, Maine
Comprehensive Pump Station Evaluation
Woodlands Clubhouse Pump Station (No. 16)

Condition of Equipment/Identified Issues		
Capacity: Recent capacity assessment via drawdown testing on 12/09/08 indicated that the pumps have the following capacities: P1-141 gpm and P2-155; the test for P1 and P2 combined produced questionable results as the combined pump capacity was less than the capacity of a single pump. The existing capacity of both pumps is considerably lower than the original design capacity; however it appears that the pumps are able to handle existing flows as each pump runs for about 3-5 hours per day on average and about 7-9 hours under peak conditions.		
Exterior Site: The site appears to have proper drainage to prevent run-off from entering the wet well.		
Building Structures (if applicable): Not applicable		
Wet Well: No deficiencies were noted.		
Dry Well (if applicable): Not applicable		
Valve Pit (if applicable): Not applicable		
Electrical/Instrumentation: Conduit, boxes and fittings are in good condition. The pump control and telemetry panels and electrical equipment are in fair condition; however they do not appear to have a NEMA rating. The generator appears to be in good condition. The conduit from the panel into the wet well is not sealed. Power and control wiring are run in the same conduit. The junction box at the wet well is located in the wet well and is corroded. The existing main disconnect switch is fed through an old disconnect switch which is being used as a junction box. The new disconnect then feeds two circuit breakers in different locations. The transformer is mounted on the ground below the main disconnect switch. Above-grade conduit is flexible and, by code, should be rigid steel.		
HVAC: Not applicable		
Security Measures: All outdoor equipment has been provided with a lock.		
Other: This station has been provided with an overflow storage tank.		
Miscellaneous Issues:		
Grease Accumulation?	Yes / **No**	
Clogging Issues?	Yes / **No**	
Nuisance Odors?	Yes / **No**	
Concrete Corrosion?	Yes / **No**	

3.16 WOODLANDS CLUBHOUSE PUMP STATION (NO. 16)

Woodlands Clubhouse Pump Station accepts gravity flows from a portion of the Woodlands Club as well as from Pinehurst Drive and Woodlands Drive Pump Stations. It pumps to the West Falmouth Interceptor that eventually drains to the Lunt Road Pump Station. Sewer users in this drainage area are characterized as residential and some commercial.

3.16.1 Flow Assessment

The station was originally provided with two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 9, 2008 is shown in Table 3-17 below.

TABLE 3-17
WOODLANDS CLUBHOUSE PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	240	240	Unk.[1]
Actual	141	155	Unk.[2]
Design TDH (ft.)	43	43	Unk.[1]

1. Unk. = Unknown.
2. The drawdown testing result with two pumps operating was questionable as it indicated that the capacity was less than with one pump operating.

The following information was considered when assessing the current capacity of the Woodlands Clubhouse Pump Station and determining the future capacity needs.

- The original design capacity of the pump station from 1987 was 240 gpm with one pump operating.
- Based on drawdown testing, the current capacity of the pump station is approximately 141-155 gpm depending on which pump is operating.
- Even at the decreased pumping capacity of the station, the existing pumps have been able to able to keep up with the average and peak flows to date.

- Pump run times for 2006 and 2007 indicate that under peak conditions, the combined run time of the pumps is about 16 hours per day.
- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow at this station is 103 gpm. Note: This is based on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.
- Based on conversations with the Town, it is anticipated that there will be little additional flow added to this drainage area over the next 20 years.
- The ideal maximum flow for the 6-inch diameter force main from Woodlands Clubhouse Pump Station is approximately 440 gpm at 5 feet per second velocity and the minimum recommended flow is approximately 175 gpm at 2 feet per second velocity.
- Refer to "Evaluation of West Falmouth Collection System" memo included in Appendix C for further assessment of Woodlands Clubhouse Pump Station's future needs.

3.16.2 Recommendations and Costs

As discussed in the "Evaluation of West Falmouth Collection System" memo included in Appendix C, this station will require a capacity upgrade if Pinehurst Drive Pump Station is upgraded without rerouting its force main around Woodlands Clubhouse Pump Station. Further investigation is required to determine the required capacity of the station; however it is estimated that the cost to upgrade this station would be approximately $400,000.

Should the Town opt to reroute the force main from Pinehurst Pump Station around Woodlands Clubhouse Pump Station, the recommended upgrades to the pump station (new controls and telemetry panel and miscellaneous electrical work) would be approximately $46,000. The cost to extend the Pinehurst Drive Pump Station force main around Woodlands Clubhouse Pump Station would be at least $200,000 and possibly higher, pending a review of its feasibility.

Town of Falmouth, Maine
Comprehensive Pump Station Evaluation
High School Pump Station (No. 17)

General Pump Station Information					
Location:		Adjacent to the tennis courts at the middle school off Woodville Rd.			
Coordinates (Lat./Long.):		43.7365698	-70.2748432		
Elevation, ft.:		107.0			
Distance from WWTF, miles:		3.8			
Year Constructed:	1989	Upgraded:	N/A		
Design Capacity of Station, gpm:		Unk.			
Station Type:		Submersible			
No. of Pumps:		2			
		P1	P2		
Year Installed:		1989	2008		
Design Capacity of Pumps, gpm:		Unk.	Unk.		
Design TDH of Pumps, ft.:		Unk.	Unk.		
Pump Make/Model:		Hydromatic/ S4MN	Hydromatic/ S4MN		
Motor Size, HP:		5	5		
Pump Speed, rpm:		1750	1750		
Drive Type:		N/A	N/A		
Drive Make:		N/A	N/A		
Seal Type:		Mechanical	Mechanical		
Seal Make:		Unk.	Unk.		
Service Voltage:	208	Hertz:	60	Phase:	3
Force Main Diam., in.:	6	Length, ft.:	2,916		

Generator Information			
Make/Model:	N/A (Portable generator plug provided)		
Year Installed:	N/A		
Fuel Type:	N/A	Size, kW:	N/A

Controls Information			
Pump Control Scenario:	P1 and P2 are automatically alternated as the lead pump Pumps are operated based on float switches in the wet well		
Pump Control Panel:			
Type:	Relay-based		
Location:	Mounted outside		
Flow Meter:			
Type:	N/A		
Make/Model:	N/A		
Alarm Transmission:	Aquatrol RTU Panel		
Level Controls:			
Pump/Alarms:	Float Switches		
Level:	Submersible Pressure Transducer (to telemetry)		
MCC:			
Type:	N/A	Location:	N/A
Make/Model:	N/A		

HVAC							
Heating:				Ventilation:			
Location:	N/A			Location:	N/A		
Make:	N/A	Model:	N/A	Make:	N/A	Model:	N/A
Year Installed:	N/A			Year Installed:	N/A		
Quantity:	N/A	Size, kW:	N/A	Quantity:	N/A	Size, kW:	N/A

Town of Falmouth, Maine
Comprehensive Pump Station Evaluation
High School Pump Station (No. 17)

Condition of Equipment/Identified Issues		
Capacity: Recent capacity assessment via drawdown testing on 12/04/08 indicated that the pumps have the following capacities: P1-229 gpm, P2-218 gpm and P1/P2-273. Pressure gages were not available to obtain the corresponding TDH values. The design capacity of this pump station is unavailable; however comparison of drawdown testing results from 2000 indicate that the pumps have lost some capacity. Regardless, it appears that the station has adequate capacity to handle existing flows as each pump runs for about 15-30 minutes per day on average and less than 1 hour under peak conditions.		
Exterior Site: It appears that run-off from the road would likely drain to the pump station wet well area.		
Building Structures (if applicable): Not applicable		
Wet Well: Refer to Exterior Site and Security Measures sections. No other deficiencies noted.		
Dry Well (if applicable): Not applicable		
Valve Pit (if applicable): Refer to Security Measures section. No other deficiencies were noted.		
Electrical/Instrumentation: Conduit, boxes and fittings are originals and are in fair to poor condition. The pump control and telemetry panels and electrical equipment are in fair to poor condition and do not appear to have a NEMA rating. The conduit from the panel into the wet well is not sealed. Power and control wiring are run in the same conduit which is a code violation; in addition, the conduit is overfilled and enters the wet well directly without a junction box.		
HVAC: Not applicable		
Security Measures: The padlock clips on the wet well and valve pit hatches have been damaged and are no longer lockable. The equipment panels have been provided with locks.		
Other: This station has been provided with an overflow storage tank.		
Miscellaneous Issues:		
Grease Accumulation?	Yes / **No**	
Clogging Issues?	Yes / **No**	
Nuisance Odors?	Yes / **No**	
Concrete Corrosion?	Yes / **No**	

3.17 HIGH SCHOOL PUMP STATION (NO. 17)

High School Pump Station accepts gravity flows from the middle school and high school as well as from a handful of residential homes. It pumps directly to Pinehurst Drive Pump Station via a partially shared force main with Falmouth Road Pump Station. Sewer users in this drainage area are characterized as institutional and residential.

3.17.1 Flow Assessment

The station has two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current actual based on drawdown testing completed by W-P and WWTF staff on December 4, 2008 is shown in Table 3-18 below.

TABLE 3-18
HIGH SCHOOL PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	Unk.[1]	Unk.[1]	Unk.[1]
Actual	229	218	273
Design TDH (ft.)	Unk.[1]	Unk.[1]	Unk.[1]

1. Unk. = Unknown.

The following information was considered when assessing the current capacity of the High School Pump Station and determining the future capacity needs.

- The original design capacity of the pump station is unknown.
- Based on drawdown testing, the current capacity of the pump station is approximately 273 gpm with two pumps operating.
- Pump run times for 2006 and 2007 indicate that under peak conditions, the combined run time of the pumps is less than two hours per day.
- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow at this station is 19 gpm. Note: This is based

on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.

- Based on conversations with the Town, it is anticipated that there will be little additional flow added to this drainage area over the next 20 years.
- The ideal maximum flow for the 6-inch diameter force main from High School Pump Station is approximately 440 gpm at 5 feet per second velocity and the minimum recommended flow is approximately 175 gpm at 2 feet per second velocity.
- The Town noted that the Falmouth Road Pump Station and the High School Pump Station are not allowed to run at the same time as the Pinehurst Drive Pump Station cannot handle the combined flows from both upstream stations.
- Based on the above analysis, it appears that High School Pump Station has adequate capacity to handle existing and future flows. No capacity upgrade is necessary.

3.17.2 Recommendations and Costs

Based on the above discussion of the High School Pump Station, the "Evaluation of West Falmouth Collection System" memo included in Appendix C, and the building services technical memos in Appendix A, we recommend that the Town perform with the following:

- Replace the existing pumps with smaller pumps to reduce the capacity of the pump station to 175 gpm to allow this pump station and Falmouth Road Pump Station to operate concurrently once the Pinehurst Pump Station is upgraded.
- Replace existing wet well and valve pit covers with new, raised covers to prevent run-off from entering the tanks. Provide new, locking hatches.
- Install a new PLC-based pump control and telemetry panel mounted near the wet well on unistrut in a NEMA 4X enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).
- Provide a new main electrical disconnect switch mounted in a NEMA 4X enclosure.

The estimated cost to complete the improvements is $84,000.

Insert Inventory Sheet

Insert Inventory Sheet

3.18 JOHNSON ROAD PUMP STATION (NO. 18)

Johnson Road Pump Station accepts gravity flows from portions of Johnson Road, several side streets off Johnson Road, and flow from Route 1 north of Johnson Road, including flow from Cumberland. It pumps to the gravity sewer in Route 1 which eventually flows to Mill Creek Pump Station via the Mill Creek interceptor. Sewer users in this drainage area are characterized as residential and commercial.

3.18.1 Flow Assessment

The station has two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 5, 2008 is shown in Table 3-19 below.

TABLE 3-19
JOHNSON ROAD PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	250	250	Unk.[1]
Actual	261	270	283
Design TDH (ft.)	68	68	Unk.[1]

1. Unk. = Unknown.

The following information was considered when assessing the current capacity of the Johnson Road Pump Station and determining the future capacity needs.

- The original design capacity of the pump station from the 2000 upgrade was 250 gpm with one pump operating.
- Based on drawdown testing, the current capacity of the pump station is approximately 283 gpm with two pumps operating.
- Pump run times for 2006 and 2007 indicate that under peak conditions, the combined pump run time is approximately nine hours per day.

- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow at this station is 96 gpm. Note: This is based on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.
- This drainage area could potentially see some additional flow from the properties in Falmouth over the next 20 years if undeveloped parcels north, east and south of the pump station are developed.
- Additionally, the Town of Cumberland currently owns 100 gpm of capacity in the Johnson Road Pump Station. The current flow from Cumberland is unknown as the metering structure owned and operated by the Portland Water District is not functional. Currently, the Portland Water District provides water use data to Falmouth for billing purposes. The maximum daily water use from January 2006 to October 2008 was approximately 4,500 gallons, with average water use of approximately 3,000 gpd. This equates to an average water use of 2 gpm over 24 hours or 4 gpm over 12 hours. Assuming a peaking factor of 6, it is expected that peak flows from Cumberland could certainly be as high as 25 gpm and even higher.
- The ideal maximum flow for the 4-inch diameter force main from Johnson Road Pump Station is approximately 195 gpm at 5 feet per second velocity and the minimum recommended flow is approximately 80 gpm at 2 feet per second velocity. The flow rates seen at this station produce higher velocities in the force main than what is recommended.
- The Town noted that Pump 2 is somewhat prone to clogging due to the influent to the wet well discharging directly adjacent to the pump.
- Even if 100 gpm of additional flow from Cumberland (which is unlikely) was added to the current flow, it appears that Johnson Road Pump Station has adequate capacity to handle existing and future flows. No capacity upgrade is necessary at this time. The clogging issue with Pump 2 should continue to be monitored and, if necessary, alternate wet well layouts or pump options should be considered.

3.18.2 Recommendations and Costs

Based on the above discussion of the Johnson Road Pump Station and the building services technical memos in Appendix A, we recommend that the Town continue to use the existing pump station with the following improvements:

- Install a new PLC-based pump control and telemetry panel mounted near the wet well on unistrut in a NEMA 4X enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).

The estimated cost to complete the improvements is $28,000.

Insert Inventory Sheet

3.19 NORTHBROOK DRIVE PUMP STATION (NO. 19)

Northbrook Drive Pump Station accepts gravity flows from Northbrook Drive only including flows from an Alzheimer's care facility. It pumps to the gravity sewer in Route 1 which eventually flows to Mill Creek Pump Station via the Mill Creek Interceptor. Sewer users in this drainage area are characterized as residential, commercial and institutional.

3.19.1 Flow Assessment

The station has two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by WWTF staff in 2000 are shown in Table 3-20 below. As noted on the pump station evaluation sheet, the draw down testing performed by W-P and WWTF staff on December 5, 2008 produced questionable results which were not used in this evaluation.

TABLE 3-20
NORTHBROOK DRIVE PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	120	120	Unk.[1]
Actual[2]	140	140	Unk.[1]
Design TDH (ft.)	54	54	Unk.[1]

1. Unk. = Unknown.
2. Actual results listed are based on drawdown testing completed by the Town in 2000.

The following information was considered when assessing the current capacity of the Northbrook Drive Pump Station and determining the future capacity needs.

- The original design capacity of the pump station from 1990 was 120 gpm with one pump operating.
- Based on drawdown testing, the current capacity of the pump station is approximately 140 gpm with one pump operating.

- Pump run times for 2006 and 2007 indicate that under peak conditions, the combined pump run time is less than three hours per day.
- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow at this station is 18 gpm. Note: This is based on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.
- Based on conversations with the Town, it is anticipated that there will be little additional flow added to this drainage area over the next 20 years.
- The ideal maximum flow for the 4-inch diameter force main from Northbrook Drive Pump Station is approximately 195 gpm at 5 feet per second velocity and the minimum recommended flow is approximately 80 gpm at 2 feet per second velocity.
- Based on the above analysis, it appears that Northbrook Drive Pump Station has adequate capacity to handle existing and future flows. No capacity upgrade is necessary.

3.19.2 Recommendations and Costs

Based on the above discussion of the Northbrook Drive Pump Station and the building services technical memos in Appendix A, we recommend that the Town continue to use the existing pump station with the following improvements:

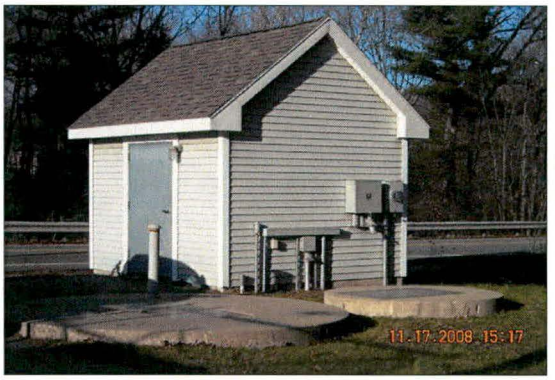
- Raise manhole frames and covers on overflow tanks to prevent run-off from entering.
- Install a new PLC-based pump control and telemetry panel mounted near the wet well on unistrut in a NEMA 4X enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).

The estimated cost to complete the improvements is $32,000.

Insert Inventory Sheet

Town of Falmouth, Maine
Comprehensive Pump Station Evaluation
Leighton Road Pump Station (No. 20)

General Pump Station Information					
Location:		From Gray Rd., approx. 0.2 mi. NE on Leighton Rd. on right			
Coordinates (Lat./Long.):		43.7374579	-70.2940635		
Elevation, ft.:		37.0			
Distance from WWTF, miles:		4.6			
Year Constructed:	1998	Upgraded:	N/A		
Design Capacity of Station, gpm:		270			
Station Type:		Submersible			
No. of Pumps:		2			
		P1	P2		
Year Installed:		2001	1998		
Design Capacity of Pumps, gpm:		270	270		
Design TDH of Pumps, ft.:		34	34		
Pump Make/Model:		Gorman-Rupp/ JSV3F	Gorman-Rupp/ JSV3F		
Motor Size, HP:		6.2	6.2		
Pump Speed, rpm:		1750	1750		
Drive Type:		N/A	N/A		
Drive Make:		N/A	N/A		
Seal Type:		Mechanical	Mechanical		
Seal Make:		Unk.	Unk.		
Service Voltage:	230	Hertz:	60	Phase:	3
Force Main Diam., in.:	6	Length, ft.:	3,211		



Generator Information			
Make/Model:	Olympian/G020F1		
Year Installed:	2000		
Fuel Type:	Propane	Size, kW:	20

Controls Information			
Pump Control Scenario:	P1 and P2 are automatically alternated as the lead pump Pumps are operated based on level setpoints in the wet well		
Pump Control Panel:			
Type:	Relay-based		
Location:	Mounted inside building		
Flow Meter:			
Type:	N/A		
Make/Model:	N/A		
Alarm Transmission:	Aquatrol RTU Panel		
Level Controls:			
Pump/Alarms:	Ultrasonic		
Level:	Ultrasonic (to telemetry)		
MCC:			
Type:	N/A	Location:	N/A
Make/Model:	N/A		

HVAC							
Heating:				Ventilation:			
Location:	Building			Location:	Building		
Make:	Unk.	Model:	Unk.	Make:	Unk.	Model:	Unk.
Year Installed:	1998			Year Installed:	1998		
Quantity:	1	Size, kW:	Unk.	Quantity:	1	Size, kW:	Unk.

Town of Falmouth, Maine
Comprehensive Pump Station Evaluation
Leighton Road Pump Station (No. 20)

Condition of Equipment/Identified Issues		
Capacity: Recent capacity assessment via drawdown testing on 12/04/08 indicated that the pumps have the following capacities: P1-196 gpm, P2-208 gpm, and P1/P2-257 gpm. Pressure gages were not available to obtain the corresponding TDH values. The current two pump capacity is approximately 15 gpm less than the original design capacity of one pump; however, it appears that the station has adequate capacity to handle existing flows as each pumps run for about 30 minutes per day on average and less than an hour under peak conditions.		
Exterior Site: The site provides proper drainage to prevent run-off from entering the wet well.		
Building Structures (if applicable): Building appears to be in good condition; no deficiencies were noted.		
Wet Well: No deficiencies were noted.		
Dry Well (if applicable): Not applicable		
Valve Pit (if applicable): No deficiencies were noted.		
Electrical/Instrumentation: Force main is heat traced. This pump station was not visited by an electrical or instrumentation engineer as part of the pump station evaluation. Electrical findings are expected to be comparable with Falmouth Rd. Pump Station.		
HVAC: Not applicable		
Security Measures: All outdoor equipment has been provided with a lock.		
Other:		
Miscellaneous Issues:		
Grease Accumulation?	**Yes** / No	
Clogging Issues?	Yes / **No**	
Nuisance Odors?	Yes / **No**	
Concrete Corrosion?	**Yes** / No	Terminus manhole has some corrosion

Insert Inventory Sheet

3.20 LEIGHTON ROAD PUMP STATION (NO. 20)

Leighton Road Pump Station accepts gravity flows from West Falmouth Crossing plaza as well as a handful of residential homes. It pumps via a partially shared force main with Mill Road Pump Station to the Falmouth Road Pump Station. Sewer users in this drainage area are characterized as commercial and residential.

3.20.1 Flow Assessment

The station has two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 4, 2008 is shown in Table 3-21 below.

TABLE 3-21
LEIGHTON ROAD PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	270	270	Unk.[1]
Actual	196	208	257
Design TDH (ft.)	34	34	Unk.[1]

1. Unk. = Unknown.

The following information was considered when assessing the current capacity of the Leighton Road Pump Station and determining the future capacity needs.

- The original design capacity of the pump station from 1998 was 270 gpm with one pump operating.
- Based on drawdown testing, the current capacity of the pump station is considerably lower than the original design capacity. Even with both pumps operating, the capacity is lower than the original design capacity with one pump operating.
- Even at the decreased pumping capacity of the station, the existing pumps have been able to able to keep up with the average and peak flows to date.

- Pump run times for 2006 and 2007 indicate that even under peak conditions, the combined run time of the pumps was less than two hours per day.
- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow at this station is 13 gpm. Note: This is based on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.
- Based on conversations with the Town, it is anticipated that there will be little additional flow added to this drainage area over the next 20 years.
- The ideal maximum flow for the 6-inch diameter force main from Leighton Road Pump Station is approximately 440 gpm at 5 feet per second velocity and the minimum recommended flow is approximately 175 gpm at 2 feet per second velocity.
- The Town noted two potential causes for the decrease in pumping capacity at this station. It could be grease build-up in the force main as this station receives a considerable amount of grease. It could also be caused by increased friction loss conditions caused by from the connection of Mill Road Pump Station's force main in 2002. Drawdown testing performed by the Town in 2001 indicated that Pump 1 had a capacity of 274 gpm and Pump 2 had a capacity of 262 gpm.
- The Town noted that the terminus manhole for this station is corroded. This is likely due to the minimal run time when the station was originally built due to low flows from the drainage area. Now that the drainage area has seen increased development and increased flows at the station (leading to more regular pump cycling), the wastewater doesn't sit in the wet well and force main as long and therefore doesn't produce the hydrogen sulfide that it did in the past. The Town should continue to monitor the terminus manhole and either replace or repair as needed in the future.
- Based on the above analysis, it appears that Leighton Road Pump Station has more than adequate capacity to handle existing and future flows, even with the reduced capacity of the pumps. No capacity upgrade is necessary.

3.20.2 Recommendations and Costs

Based on the above discussion of the Leighton Road Pump Station and the building services technical memos in Appendix A, we recommend that the Town continue to use the existing pump station with the following improvements:

- Continue to monitor pump station capacity by performing annual drawdown tests at this station and monitoring pump run times.
- Install a new telemetry panel mounted in the building in a NEMA 12 enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).

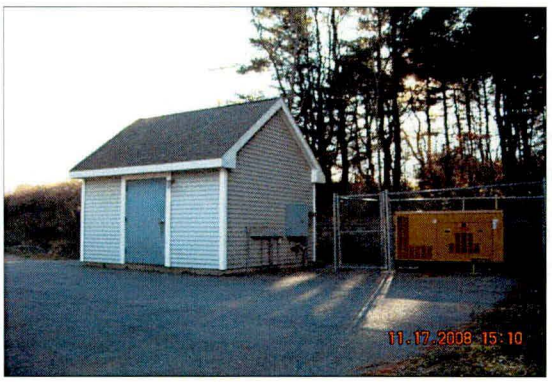
The estimated cost to complete the improvements is $20,000.

Insert Inventory Sheet

Insert Inventory Sheet

Town of Falmouth, Maine
Comprehensive Pump Station Evaluation
Falmouth Road Pump Station (No. 21)

General Pump Station Information					
Location:		From Woodville Rd., approx. 0.5 mi. NW on Falmouth Rd. on right			
Coordinates (Lat./Long.):		43.7384980	-70.2843029		
Elevation, ft.:		35.0			
Distance from WWTF, miles:		4			
Year Constructed:	1998	Upgraded:	N/A		
Design Capacity of Station, gpm:		250			
Station Type:		Gorman-Rupp Suction Lift			
No. of Pumps:		2			
		P1	P2		
Year Installed:		1998	1998		
Design Capacity of Pumps, gpm:		250	250		
Design TDH of Pumps, ft.:		134	134		
Pump Make/Model:		Gorman-Rupp/ T3A-B	Gorman-Rupp/ T3A-B		
Motor Size, HP:		25	25		
Pump Speed, rpm:		2365	2365		
Drive Type:		N/A	N/A		
Drive Make:		N/A	N/A		
Seal Type:		Mechanical	Mechanical		
Seal Make:		Unk.	Unk.		
Service Voltage:	460	Hertz:	60	Phase:	3
Force Main Diam., in.:	6	Length, ft.:	5,503		



Generator Information			
Make/Model:	Olympian/G0100F1		
Year Installed:	2000		
Fuel Type:	Propane	Size, kW:	100

Controls Information			
Pump Control Scenario:	P1 and P2 are automatically alternated as the lead pump Pumps are operated based on level setpoints in the wet well		
Pump Control Panel:			
Type:	Relay-based		
Location:	Mounted inside building		
Flow Meter:			
Type:	N/A		
Make/Model:	N/A		
Alarm Transmission:	Aquatrol RTU Panel		
Level Controls:			
Pump/Alarms:	Ultrasonic		
Level:	Ultrasonic (to telemetry)		
MCC:			
Type:	N/A	Location:	N/A
Make/Model:	N/A		

HVAC							
Heating:				Ventilation:			
Location:	Building			Location:	N/A		
Make:	Empire	Model:	DV-35-28G	Make:	N/A	Model:	N/A
Year Installed:	1998			Year Installed:	N/A		
Quantity:	1	Size, kW:	Unk.	Quantity:	N/A	Size, kW:	N/A

Town of Falmouth, Maine
Comprehensive Pump Station Evaluation
Falmouth Road Pump Station (No. 21)

Condition of Equipment/Identified Issues		
Capacity: Recent capacity assessment via drawdown testing on 12/04/08 indicated that the pumps have the following capacities: P1-220 gpm, P2-159 gpm, and P1/P2-245 gpm. The current two pump capacity is approximately equal to the original design capacity of one pump; however, it appears that the station has adequate capacity to handle existing flows as each pumps run for about 2 hours per day on average and about 4-5 hours under peak conditions.		
Exterior Site: The site provides proper drainage to prevent run-off from entering the wet well.		
Building Structures (if applicable): Roofing appears to be in good condition. In places, the corner boards and J-channels are broken and should be replaced. The exhaust fan is currently mounted on the vinyl siding of the building; the siding should be terminated around a mounting block with J-channels and the heater should be mounted on the mounting block. The north side of the building has some mildew which should be washed off. Remove the open channel over the top of the door and provide a flush edge to prevent snow buildup; repaint the door (edges are not currently painted). The concrete slab, interior walls and ceiling appear to be in good condition. Conduit between wet well and building are not sealed.		
Wet Well: There is some corrosion of the concrete wall and exposure of aggregate.		
Dry Well (if applicable): Not applicable		
Valve Pit (if applicable): Not applicable		
Electrical/Instrumentation: Circuit breakers, disconnect switch, panel board, transformer, switches and receptacles, conduit systems, boxes and fittings are in good condition. Generator appears to be in good condition. Lighting is in good condition. There are no lighted exit signs or battery-operated emergency lighting in the building. Conduits from the generator building to the can are not sealed. The pump station control and telemetry panels are in good condition.		
HVAC: The heating equipment in the building is in good condition. There is no ventilation in the building.		
Security Measures: All outdoor equipment has been provided with a lock.		
Other:		
Miscellaneous Issues:		
Grease Accumulation?	Yes / **No**	
Clogging Issues?	Yes / **No**	
Nuisance Odors?	Yes / **No**	
Concrete Corrosion?	**Yes** / No	

3.21 FALMOUTH ROAD PUMP STATION (NO. 21)

Falmouth Road Pump Station accepts gravity flows from a small residential area along Falmouth Road in addition to flows from Mill Road and Leighton Road Pump Stations. It pumps via a partially shared force main with High School Pump Station to the Pinehurst Drive Pump Station. Sewer users that flow by gravity to this pump station are characterized as residential.

3.21.1 Flow Assessment

The station has two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 4, 2008 is shown in Table 3-22 below.

TABLE 3-22
FALMOUTH ROAD PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	250	250	Unk.[1]
Actual	220	159	245
Design TDH (ft.)	134	134	Unk.[1]

1. Unk. = Unknown.

The following information was considered when assessing the current capacity of the Falmouth Road Pump Station and determining the future capacity needs.

- The original design capacity of the pump station from 1998 was 250 gpm with one pump operating.
- Based on drawdown testing, the current capacity of the pump station is lower than the original design capacity. Pump 2, especially, has lost considerable capacity. Even with both pumps operating, the capacity is slightly lower than the original design capacity with one pump operating.
- Even at the decreased pumping capacity of the station, the existing pumps have been able to able to keep up with the average and peak flows to date.

- The Town noted that the tolerances were adjusted on Pump 1 in 2006, increasing the capacity by about 35 gpm and suggested that Pump 2 may be due for an adjustment as well.
- Pump run times for 2006 and 2007 indicate that even under peak conditions, the combined run time of the pumps was less than 10 hours per day.
- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow at this station is 87 gpm. Note: This is based on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.
- There is significant room for future development upstream of this pump station; however based on conversations with the Town, it is anticipated that there will be little additional flow added to this drainage area over the next 20 years.
- The ideal maximum flow for the 6-inch diameter force main from Falmouth Road Pump Station is approximately 440 gpm at 5 feet per second velocity and the minimum recommended flow is approximately 175 gpm at 2 feet per second velocity.
- The Town noted that the Falmouth Road Pump Station and the High School Pump Station are not allowed to run at the same time as the Pinehurst Drive Pump Station cannot handle the combined flows from both upstream stations.
- Based on the above analysis, it appears that Falmouth Road Pump Station has adequate capacity to handle existing and future flows. However, if the outlook for development upstream of this pump station and increased flow to this station changes, the capacity of the station will need to be re-evaluated.

3.21.2 Recommendations and Costs

Based on the above discussion of the Falmouth Road Pump Station, the "Evaluation of West Falmouth Collection System" memo included in Appendix C, and the building services technical memos in Appendix A, we recommend that the Town continue to use the existing pump station with the following improvements:

- Adjust tolerances on Pump 2 and reassess capacity.
- Perform the following improvements to the existing generator building:
    - Provide emergency battery lighting in case of generator failure.
    - Replace broken corner boards and J-channels on exterior trim.
    - Provide a mounting block on the exterior of the building for the monitor heater. Terminate the siding around the mounting block with J-channels.
    - Wash mildew off all exterior surfaces of the building.
    - Replace the open channel over the top of the door with a flush top edge that will prevent snow from accumulating and causing the door to deteriorate.
    - Repaint the door.
- Repair degraded interior surfaces of concrete wet well with an epoxy-based overlay (resistant to hydrogen sulfide).
- Install a new telemetry panel mounted in the building in a NEMA 12 enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).

The estimated cost to complete the improvements is $34,000.

Insert Inventory Sheet

Town of Falmouth, Maine
Comprehensive Pump Station Evaluation
Mill Road Pump Station (No. 22)

General Pump Station Information					
Location:		From Gray Rd., approx. 200 ft. east on Mill Rd. on right			
Coordinates (Lat./Long.):		43.7444310	-70.2969556		
Elevation, ft.:		Unk.			
Distance from WWTF, miles:		4.9			
Year Constructed:	2002	Upgraded:	N/A		
Design Capacity of Station, gpm:		200			
Station Type:		Submersible			
No. of Pumps:		2			
		P1	P2		
Year Installed:		2002	2002		
Design Capacity of Pumps, gpm:		200	200		
Design TDH of Pumps, ft.:		65	65		
Pump Make/Model:		Hydromatic/ S4P	Hydromatic/ S4P		
Motor Size, HP:		7.5	7.5		
Pump Speed, rpm:		1750	1750		
Drive Type:		N/A	N/A		
Drive Make:		N/A	N/A		
Seal Type:		Mechanical	Mechanical		
Seal Make:		Unk.	Unk.		
Service Voltage:	208	Hertz:	60	Phase:	3
Force Main Diam., in.:	6	Length, ft.:	6,137		

Generator Information			
Make/Model:	Olympian/D30-6		
Year Installed:	2004		
Fuel Type:	Diesel	Size, kW:	30

Controls Information			
Pump Control Scenario:	P1 and P2 are automatically alternated as the lead pump Pumps are operated based on level setpoints in the wet well		
Pump Control Panel:			
Type:	Relay-based		
Location:	Mounted outside		
Flow Meter:			
Type:	N/A		
Make/Model:	N/A		
Alarm Transmission:	Aquatrol RTU Panel		
Level Controls:			
Pump/Alarms:	Ultrasonic		
Level:	Ultrasonic (to telemetry)		
MCC:			
Type:	N/A	Location:	N/A
Make/Model:	N/A		

HVAC							
Heating:				Ventilation:			
Location:	N/A			Location:	N/A		
Make:	N/A	Model:	N/A	Make:	N/A	Model:	N/A
Year Installed:	N/A			Year Installed:	N/A		
Quantity:	N/A	Size, kW:	N/A	Quantity:	N/A	Size, kW:	N/A

Town of Falmouth, Maine
Comprehensive Pump Station Evaluation
Mill Road Pump Station (No. 22)

Condition of Equipment/Identified Issues		
Capacity: Recent capacity assessment via drawdown testing on 12/04/08 indicated that the pumps have the following capacities: P1-204 gpm, P2-196 gpm, and P1/P2-235 gpm. Pressure gages were not available to obtain the corresponding TDH values. The current capacity of each pump is very near the original design capacity and appears adequate to handle existing flows as each pump runs for about 1-2 hours per day on average and about 3-4 hours under peak conditions.		
Exterior Site: The site provides proper drainage to prevent run-off from entering the wet well.		
Building Structures (if applicable): Not applicable		
Wet Well: No deficiencies were noted.		
Dry Well (if applicable): Not applicable		
Valve Pit (if applicable): No deficiencies were noted.		
Electrical/Instrumentation: This pump station was not visited by an electrical or instrumentation engineer as part of the pump station evaluation. Given that the station is only 7 years old, electrical or instrumentation issues are not expected.		
HVAC: Not applicable		
Security Measures: All outdoor equipment has been provided with a lock.		
Other:		
Miscellaneous Issues:		
Grease Accumulation?	Yes / **No**	
Clogging Issues?	Yes / **No**	
Nuisance Odors?	Yes / **No**	
Concrete Corrosion?	Yes / **No**	

Insert Inventory Sheet

3.22 MILL ROAD PUMP STATION (NO. 22)

Mill Road Pump Station accepts flow from all of Falmouth west of Mill Road including Falmouth on the Green. It pumps via a partially shared force main with Leighton Road Pump Station to the Falmouth Road Pump Station. Sewer users in this drainage area are characterized as residential.

3.22.1 Flow Assessment

The station has two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 4, 2008 is shown in Table 3-23 below.

TABLE 3-23
MILL ROAD PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	200	200	Unk.[1]
Actual	204	196	235
Design TDH (ft.)	65	65	Unk.[1]

1. Unk. = Unknown.

The following information was considered when assessing the current capacity of the Mill Road Pump Station and determining the future capacity needs.

- The original design capacity of the pump station from 2002 was 200 gpm with one pump operating.
- Based on drawdown testing, the current capacity of the pump station is about the same as the original design capacity. With both pump operating, the capacity is slightly higher.
- Pump run times for 2006 and 2007 indicate that even under peak conditions, the combined run time of the pumps was less than eight hours per day.
- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow at this station is 64 gpm. Note: This is based

on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.

- Based on conversations with the Town, it is anticipated that there will be little additional flow added to this drainage area over the next 20 years.
- The ideal maximum flow for the 6-inch diameter force main from Mill Road Pump Station is approximately 440 gpm at 5 feet per second velocity and the minimum recommended flow is approximately 175 gpm at 2 feet per second velocity.
- Based on the above analysis, it appears that Mill Road Pump Station has adequate capacity to handle existing and future flows. No capacity upgrade is necessary.

3.22.2 Recommendations and Costs

Based on the above discussion of the Mill Road Pump Station and the building services technical memos in Appendix A, we recommend that the Town continue to use the existing pump station with the following improvements:

- Install a new telemetry panel mounted near the wet well on unistrut in a NEMA 4X enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).

The estimated cost to complete the improvements is $25,000.

Insert Inventory Sheet

Insert Inventory Sheet

3.23 FARM GATE PUMP STATION (NO. 23)

Farm Gate Pump Station is the Town's newest pump station and accepts flow from a small residential sub-development off Clearwater Drive near the WWTF. It pumps directly to Lunt Road Pump Station. Sewer users in this drainage area are characterized as residential.

3.23.1 Flow Assessment

The station has two pumps designed to operate in a lead/lag arrangement. The design capacity of the pumps as well as the current capacity based on drawdown testing completed by W-P and WWTF staff on December 3, 2008 is shown in Table 3-24 below.

TABLE 3-24
FARM GATE PUMP STATION - PUMP CAPACITIES

	Pump 1	Pump 2	Pumps 1&2
Flow (gpm)			
Design	120	120	Unk.[1]
Actual	110	125	157
Design TDH (ft.)	25	25	Unk.[1]

1. Unk. = Unknown.

The following information was considered when assessing the current capacity of the Farm Gate Pump Station and determining the future capacity needs.

- The original design capacity of the pump station from 2007 was 120 gpm with one pump operating.
- Based on drawdown testing, the current capacity of the pump station is about the same as the original design capacity although Pump 1 has a slightly lower capacity.
- Pump run times for 2006 and 2007 indicate that even under peak conditions, the combined run time of the pumps was less than one hour per day.
- Based on the combined peak day run time of the pumps and the existing capacity of the station, the estimated average peak day flow at this station is 3 gpm. Note: This is based

on daily pump run times; therefore it is not an indication of peak instantaneous flows to the station.

- Based on conversations with the Town, it is anticipated that there will likely be some additional flow to this drainage area over the next 20 years as the sub-development is built-out.
- The size of the force main is unknown.
- Based on the above analysis, it appears that Farm Gate Pump Station has adequate capacity to handle existing flows and any additional future flows from new construction in the sub-development. No capacity upgrade is necessary.

3.23.2 Recommendations and Costs

Based on the above discussion of the Farm Gate Pump Station and the building services technical memos in Appendix A, we recommend that the Town continue to use the existing pump station with the following improvements:

- Install a new telemetry panel mounted near the wet well on unistrut in a NEMA 4X enclosure (for more information on recommended controls, refer to the Instrumentation Technical Memo in Appendix A).

The estimated cost to complete the improvements is $23,000.

SECTION 4

INTERCEPTOR FINDINGS, ALTERNATIVES EVALUATION AND RECOMMENDATIONS

As part of the comprehensive pump station evaluation, the Town requested that Wright-Pierce evaluate several interceptors to ascertain the existing conditions, identify any maintenance or capital improvement needs, and develop final recommendations for each interceptor. The interceptors evaluated include:

- West Falmouth interceptor;
- Woodlands Club interceptor;
- Exit 52 interceptor;
- Middle Road interceptor;
- Route 88 interceptor;
- Foreside interceptor; and
- Mackworth (Lower Route 1) interceptor serving Brown Street Pump Station.

The information presented on the existing conditions of the interceptors was gathered through many different means including information provided by the WWTF staff, record drawings of the interceptors, and capacity analysis performed utilizing Hydraflow Storm Sewers 8.0. We have attempted to gather the most accurate information possible for each interceptor. This effort did not involve any review of television records of sewers, records of sewer construction techniques or any field observations of the interceptors.

The intention of the modeling effort was to estimate remaining capacity in the interceptors. This was done by making reasonable assumptions on existing flows from pump stations, residential gravity flows and infiltration and inflow (I/I) in the area tributary to the interceptor. The result of the modeling is discussed under each interceptor section below; however, for more information on existing flow assumptions refer to the Interceptor Modeling - Flow Assumptions memo included in Appendix D. In addition, figures showing the interceptors and select manhole

numbering are also included in Appendix D. It should be noted that manhole numbers referenced in this report reflect the manhole numbering noted on the record drawings for each interceptor.

4.1 WEST FALMOUTH INTERCEPTOR

The portion of the West Falmouth Interceptor that was included in this evaluation begins at the terminus manhole of the Woodlands Clubhouse Pump Station and travels approximately 8,800 linear feet along Woods Road to Longwoods Road, then across the Maine Turnpike Spur to Middle Road, then to Lunt Road and across Interstate 295, where it continues to the Lunt Road Pump Station. The interceptor was constructed in several phases between 1969 and 1987, ranges in size from 8 to 12 inches in diameter, and is constructed of asbestos concrete (AC) and polyvinyl chloride (PVC) pipe (although it is not specifically noted on the record drawings it is assumed that the newer pipe is PVC due to year of construction).

4.1.1 Existing Conditions

AC pipe is known to have a high strength; however, AC pipe is susceptible to acid corrosion and hydrogen sulfide attack. With proper construction (i.e. proper bedding and installation of gaskets) and maintenance and under suitable installation conditions (i.e. non-corrosive groundwater), sewers constructed with AC pipe have been known to last for 100 plus years.

PVC pipe is known to have a high strength and to be highly resistant to corrosion. Although PVC pipe has only come into use within the past 20 to 30 years, it is thought that with proper construction and maintenance sewer constructed of PVC may potentially last for more than 100 years.

Although physical inspection of the interceptor was not performed as part of this evaluation, based on age and material it is likely that with proper maintenance these sewers will not need to be replaced within the next 20 years, unless required for increased capacity. The Town should consider TV inspection of the AC pipe within the next 20 years to inspect for root intrusion, joint integrity and corrosion. Manholes should also be inspected. There have been issues with

hydrogen sulfide corrosion at locations upstream of this interceptor which could result in downstream issues.

4.1.2 Modeling Results

Based on the existing flow assumptions, it appears that this interceptor may already surcharge up into the following manholes: 230, 231 and 236 (refer to the West Falmouth Interceptor figure in Appendix D for a map of the interceptor) where the sewer lines are eight-inch diameter pipes and were laid at minimum slope. As a result, it is estimated that there is no additional capacity in the interceptor upstream of manhole 230.

The Town has expressed some concern that the line crossing the I-95 Turnpike Spur was a potential bottleneck for flows from West Falmouth. We agree that this line could potentially be a bottleneck; however at this time we are unable to verify whether or not this is true. The original 8-inch diameter pipe was replaced with a 12-inch diameter pipe when the Maine Turnpike Authority (MTA) replaced the bridge deck a number of years ago. Invert information on the new line is unavailable at this time; however field observation by the Town indicate that there are several 45 degree bends in this line and that portions are actually laid at a slightly negative slope (it is suspected that MTA required a certain clearance beneath the bridge deck which required that the pipe be raised from its original elevation) and that the manhole upstream of this line is regularly surcharged to "push" flow through the bridge crossing pipe. As part of the West Falmouth master plan study that is recommended are part of this report, further investigation of this area should be conducted (i.e. surveying) to determine the slope of the line and the actual capacity.

Although we are unable to comment on the portion of the interceptor upstream of the I-95 Turnpike Spur without survey information, we were able to verify that additional capacity could be gained in other sections of this interceptor by replacing sections of pipe with larger diameter pipe. Results showed the following:

- Approximately 620 gpm of additional capacity can be gained by replacing all existing eight-inch diameter pipe (approximately 3,800 linear feet between manholes 229 and 269) downstream of the I-95 Turnpike Spur with 12-inch diameter pipe.

4.2 WOODLANDS CLUB INTERCEPTOR

The Woodlands Club Interceptor begins at the Pinehurst Pump Station terminus manhole and travels approximately 1,800 linear feet east to the Woodlands Clubhouse Pump Station. The interceptor was constructed in 1987, is eight inches in diameter and is constructed of PVC pipe.

4.2.1 Existing Conditions

Refer to Section 4.1.1 for a discussion of the properties of PVC pipe. Although physical inspection of the interceptor was not performed as part of this evaluation, based on age and material it is likely that with proper maintenance these sewers will not need to be replaced within the next 20 years, unless required for increased capacity.

Based on the record drawings provided, the last section of pipe between manhole 1 and the wet well at the Woodlands Clubhouse Pump Station is fairly flat and much lower than the rest of the interceptor (which may have been necessary to cross under a stream on the Club property) and is likely to surcharge during high flow conditions. As a result, we recommend that the Town monitor this line and clean it more often as necessary to ensure that solids do not build up which can decrease the capacity of the line and result in large "slugs" of solids entering the pump station during times when cleansing velocities (generally 3 fps or greater) are reached.

4.2.2 Modeling Results

Based on the existing flow assumptions, this interceptor has approximately 150 gpm of additional capacity available (assuming that the last discharge section into the Woodlands Clubhouse Pump Station is allowed to surcharge). At flows greater than this, surcharging begins at manhole 2.

4.3 EXIT 52 INTERCEPTOR

The portion of the Exit 52 Interceptor that was included in the evaluation begins at the southwest entrance to the West Falmouth Shopping Plaza on Gray Road (Route 100) and travels approximately 1,300 linear feet through the plaza and then along Leighton Road to the Leighton Road Pump Station. The interceptor was constructed in the late 1990's, is eight inches in diameter, and is constructed of PVC pipe (although it is not specifically noted on the record drawings, it is assumed that the pipe is PVC due to year of construction).

4.3.1 Existing Conditions

Refer to Section 4.1.1 for a discussion of the properties of PVC pipe. Although physical inspection of the interceptor was not performed as part of this evaluation, based on age and material it is likely that with proper maintenance these sewers will not need to be replaced within the next 20 years, unless required for increased capacity.

4.3.2 Modeling Results

It should be noted that drawings for the five pipe sections on the upstream end of the interceptor were not available. For modeling purposes, it was assumed that these pipe sections are eight-inch diameter and laid at minimum slope. Based on this assumption, the total capacity of this interceptor is approximately 340 gpm, plus a limited allowance for I/I. At flows greater than this, surcharging begins at manholes R, S and T. If these pipe lengths are laid at a greater slope, the capacity of the interceptor will be greater.

As this is a primarily commercial area and there are no upstream pump stations, no existing flow assumptions were included in the model except for I/I flows. Therefore the capacity of 340 gpm noted above is total capacity of the interceptor (plus a limited allowance for I/I) rather than additional capacity.

The Town has indicated that there is about 30 acres of undeveloped property in this drainage area, classified as mixed use commercial, which may be developed in the future. Assuming an

average daily flow rate of 700 gpd/acre, an additional 30 percent for I/I and a peaking factor of 4 (not applied to the I/I flow), a conservative estimate of peak daily flows from this area would likely be around 65 gpm. This appears to be well within the capacity of the existing interceptor; however existing flow to the interceptor should be verified. Additionally, although the interceptor may be able to handle the additional flow, several of the downstream pump stations and the West Falmouth Interceptor have little or no additional capacity at this time. Refer to the "Evaluation of West Falmouth Pumping System" memo in Appendix C for more information.

4.4 MIDDLE ROAD INTERCEPTOR

The Middle Road Interceptor begins at the intersection of Thistle Lane and Pleasant Hill Road and travels approximately 3,700 linear feet west on Pleasant Hill Road and then north on Middle Road to the Middle Road Pump Station. The interceptor was constructed in two phases in 1983 and 1990, is eight inches in diameter, and is constructed of PVC pipe (although it is not specifically noted on the record drawings it is assumed that the newer pipe is PVC due to year of construction).

4.4.1 Existing Conditions

Refer to Section 4.1.1 for a discussion of the properties of PVC pipe. Although physical inspection of the interceptor was not performed as part of this evaluation, based on age and material it is likely that with proper maintenance these sewers will not need to be replaced within the next 20 years, unless required for increased capacity.

Based on the record drawings, the downstream invert in manhole A (located at the pump station) is about three to four inches higher than the upstream invert. In addition, there are several sections of pipe (manholes 27 to 28, 29 to 30, 50 to 51, 52A to 52B, and 52C to 52D) that are laid at less than the minimum recommended slope. These areas may be prone to solids settling out during periods of low flow; however the relatively flat sections of pipe are preceded by sections of pipe with greater slopes, which likely allow adequate velocity to keep the flat sections cleaned out, particularly during periods of high flow. The Town should monitor these sections and clean them as necessary.

4.4.2 Modeling Results

Based on the existing flow assumptions, this interceptor has approximately 150 gpm of additional capacity available. At flows greater than this, surcharging begins at manhole 1 due to the additional head loss created by the difference in invert elevations in manhole A. Even if some surcharging in manhole 1 is allowed, only about 25 gpm of additional capacity is gained before manhole 28 begins to surcharge (downstream end of a long, fairly flat section).

4.5 ROUTE 88 INTERCEPTOR

The Route 88 Interceptor begins at the Falmouth-Cumberland town line in Route 88 and travels approximately 7,700 linear feet southwest to the Mill Creek Pump Station. The interceptor was constructed in 1969, ranges in size from 16 to 24 inches in diameter, and is constructed of AC pipe (although the record drawings indicate that this line is either AC or vitrified clay (VC), information provided by the Town indicates that this line is AC).

4.5.1 Existing Conditions

Refer to Section 4.1.1 for a discussion of the properties of AC pipe. Although physical inspection of the interceptor was not performed as part of this evaluation, based on age and material it is likely that with proper maintenance these sewers will not need to be replaced within the next 20 years, unless required for increased capacity. The Town should consider TV inspection of the AC pipe within the next 20 years to inspect for root intrusion, joint integrity and corrosion. Manholes should also be inspected.

4.5.2 Modeling Results

Assuming the existing flow assumptions made by Wright-Pierce are correct, it appears that this interceptor may already surcharge up into manholes 37, 75, 82, 83 and 84. While the estimated flow reaching manholes 37 and 75 does not appear to be sufficient to surcharge these pipe up into the manhole alone, surcharging of the wet well above the crown of the 24-inch influent pipe

(which can occur due to flows that exceed the diminished capacity of Mill Creek Pump Station) will result in flooding up into the manhole. An increase in capacity of the Mill Creek Pump Station and/or a deeper wet well (likely cost prohibitive due to the presence of bedrock) could prevent surcharging of these lines in the future. If manholes 37 and 75 are allowed to surcharge under normal conditions, it is estimated that there is an additional 725 gpm in capacity (above and beyond current flow estimates) between manhole 81 and the Mill Creek Pump Station.

Manholes 82, 83 and 84 are located in an area where the sewer is fairly flat. As a result, it is estimated that there is no additional capacity in this interceptor at this time. The model predicts that flows of approximately 3.2 MGD will result in surcharging of the pipes between these manholes and Wright-Pierce flow estimates that these pipes see flows of up to 3.3 MGD. If 2,800 feet of 18-inch pipe between manhole 84 and the Mill Creek Pump Station is replaced with 24-inch pipe, nearly 1,400 gpm of additional capacity is gained from Johnson Road to Mill Creek Pump Station. However, only 230 gpm of additional capacity (beyond current flow estimates) would be available above Johnson Road.

Because the flows used in the model are only estimates and due to the criticality of this gravity pipe to the communities of Falmouth and Cumberland, we would recommend that flow meters be installed in multiple locations within this interceptor to gain insight on actual flows and surcharge conditions prior to spending significant capital upgrading pipes that may not be at capacity. While engineering study costs can vary based on the number of flow meters and duration of flow monitoring, we would suggest a budget of $25,000 be established to confirm flows in this interceptor.

4.6 FORESIDE INTERCEPTOR

The Foreside Interceptor begins at the terminus manhole of the Underwood Road Pump Station and travels approximately 3,900 linear feet southwest along the shoreline to the Handy Boat Pump Station. The interceptor was constructed in 1969, ranges in size from 8 to 10 inches in diameter, and is constructed of AC pipe.

4.6.1 Existing Conditions

Refer to Section 4.1.1 for a discussion of the properties of AC pipe. Although physical inspection of the interceptor was not performed as part of this evaluation, based on age and material it is likely that with proper maintenance these sewers will not need to be replaced within the next 20 years, unless required for increased capacity. The Town should consider TV inspection of the AC pipe within the next 20 years to inspect for root intrusion, joint integrity and corrosion. Manholes should also be inspected.

It should be noted that there are several sections of pipe along the interceptor that are laid at less than the minimum recommended slope including one short section that is almost completely flat. These sections may be prone to solids settling out during periods of low flow; however the relatively flat sections of pipe are preceded by sections of pipe with greater slopes, which likely allow adequate velocity to keep the flat sections cleaned out, particularly during periods of high flow. The Town should monitor these sections and clean them as necessary.

4.6.2 Modeling Results

Based on the existing flow assumptions, this interceptor has approximately 50 gpm of additional capacity available. At flows greater than this, surcharging begins in manhole 116 near where the interceptor decreases from 10-inch diameter to eight-inch. It is estimated that there is another 45 gpm of additional capacity in the downstream ten-inch section.

In order to gain capacity greater than 50 gpm along the entire interceptor, significant portions of the eight-inch pipe would need to be replaced with ten-inch pipe. This would allow the interceptor to have approximately 95 gpm of additional capacity. In order to gain capacity greater than 95 gpm, the existing ten-inch pipe would need to be replaced with twelve-inch pipe.

Given the limited potential for growth in this area and the potentially high cost of replacing the existing sewers, the Town may wish to conduct flow monitoring in this area to determine actual flows and compare those with pipe capacity. The flow monitoring effort may discover pockets

of I/I that can be removed to "free-up" capacity and eliminate the need for extensive sewer pipe replacement.

4.7 MACKWORTH POINT (LOWER RT. 1) INTERCEPTOR

The Mackworth Point (Lower Rt. 1) Interceptor begins at the intersection of the Bay Shore Drive and travels approximately 4,700 linear feet northeast along the shoreline to the Brown Street Pump Station. The interceptor was constructed in 1969, ranges in size from 12 to 16 inches in diameter, and is constructed of AC pipe.

4.7.1 Existing Conditions

Refer to Section 4.1.1 for a discussion of the properties of AC pipe. Although physical inspection of the interceptor was not performed as part of this evaluation, based on age and material it is likely that with proper maintenance these sewers will not need to be replaced within the next 20 years, unless required for increased capacity or replacement due to I/I problems associated with the interceptor.

It was noted that this interceptor is regularly surcharged due to the normal pump on and off elevations at the Brown Street Pump Station. As a result, we recommend regular cleaning of this line to ensure that solids do not build up and decrease the capacity of the line. Also, we recommend that this line be TV inspected for corrosion (which may be caused due by hydrogen sulfide generation from settled solids or by brackish groundwater) and to ensure that there are no major leaks (particularly as this line runs along the shore and crosses under a stream).

4.7.2 Modeling Results

Based on the existing flow assumptions, this interceptor has approximately 370 gpm of additional capacity available. At flows greater than this, the line begins to surcharge upstream of manhole 18 near where the interceptor decreases from 16-inch diameter to 12-inch diameter. It is estimated that there is another 700 gpm of additional capacity in the downstream 16-inch section.

Pump run times and existing capacities from the Brown Street Pump Station indicate that peak flows to the station are currently around 410 gpm which is less than the assumed flow to the station used for modeling. Based on this information, there appears to be sufficient additional capacity in this pipe for the next 20 years. The Town noted that this area was known to have a significant amount of inflow and infiltration due to roof leaders and floor drains from homes on Greenway Drive, Carroll Street and Brown Street. Removal of these sources would reduce peak flows to Brown Street Pump Station and the WWTF.

SECTION 5

PRIORITY LISTING AND PRELIMINARY SCHEDULE FOR IMPLEMENTATION

Section 3 of this report presented the existing conditions of each of the Town's 23 pump stations and made recommendations for upgrade, along with planning-level cost estimates. There recommendations were made to maximize collection system infrastructure and ensure reliability over the next 20 years and beyond. The next logical step is to arrange the recommended upgrades from highest to lowest priority and to place these projects on the wastewater capital improvements plan. In an effort to assist the Town in developing this plan, this section presents all of the upgrades and improvements recommended in this report. The upgrades and improvements recommended are presented in Table 5-1 below. They are organized into short-term (0-7 years), mid-term (7-14 years) and long-term (greater than 14 years) timeframes. The costs associated with any upgrades and/or improvements have also been included.

As discussed in Section 3, the cost estimates represented in this report are preliminary and do not constitute a preliminary engineering effort. During any preliminary engineering effort, the specific scope and associated cost will be further evaluated and refined; however, the costs presented herein should assist the Town in developing a capital improvements plan for the collection system infrastructure.

TABLE 5-1
IMPLEMENTATION SCHEDULE

Upgrade/Improvements by Priority	Estimated Cost
Near Term (0-2 years)	
Ultrasonic Testing of all "Cans"	$10,000
Sewer System Evaluation Study (Brown Street and Thornhurst Drive drainage areas)[1]	$60,000
West Falmouth Master Plan	$50,000
Route 88 Sewer Flow Monitoring	$25,000
Foreside Interceptor Flow Monitoring	$15,000
Radio Path Study (Telemetry)	$8,500
Cumberland Metering (Route 88)[2]	--
Total Near-Term Improvements	**$168,500**
Short Term (2-7 years)	
Mill Creek Pump Station Upgrade	$1,950,000
WWTF Telemetry Upgrade	$8,000
Brown Street Pump Station Upgrade	$490,000
Clearwater Drive Pump Station Upgrade[3]	$74,000
Woodlands Clubhouse Pump Station Upgrade	$500,000
Pinehurst Drive Pump Station and Force Main Upgrade	$500,000
High School Pump Station Upgrade/Remove Falmouth Road/High School concurrent pumping restriction	$84,000
Middle Road Pump Station Generator	$19,000
West Falmouth Interceptor Upgrade	--[4]
Total Short-Term Improvements	**$3,625,000**
Mid-Term (7-14 years)	
Falmouth Road Pump Station Improvements	$34,000
Thornhurst Drive Pump Station Generator Upgrade	$34,000
Underwood Road Pump Station Generator and VFD Upgrade	$56,000
Control and Telemetry Panel Upgrades[5]	
Old Mill Road Pump Station	$24,000
Handy Boat Pump Station	$28,000
Underwood Road Pump Station	$26,000
Johnson Road Pump Station	$28,000
Northbrook Drive Pump Station	$32,000
Telemetry Panel Upgrades[5]	
Lunt Road Pump Station	$23,000
Hedgerow Drive Pump Station	$23,000
Thornhurst Drive Pump Station	$23,000
Waite's Landing Pump Station	$23,000
Landing Woods Lane Pump Station	$24,000
Baysite Drive Pump Station	$27,000

Leighton Road Pump Station	$20,000
Mill Road Pump Station	$25,000
Farm Gate Pump Station	$23,000
Total Mid-Term Improvements	**$473,000**
Long-Term (> 14 years)	
Woodlands Drive Pump Station Improvements	$73,000
Middle Road Pump Station Improvements	$36,000[6]
Total Long-Term Improvements	**$109,000**

Notes:

1. Costs to remove identified sources of I/I are indeterminate at this time and will depend on what is found during the SSES.
2. Assumes Cumberland will carry any costs associated with either reinstating the existing Parshall flume or installing a new flow metering device.
3. Assumes capacity upgrade is not required.
4. Cost indeterminate at this time, but could be in the range of $1.0 to $2.0 million depending results if sewer master plan.
5. Control and/or telemetry panel upgrades at these stations can be phased over a number of years as the capital becomes available to complete the work. However, the existing Aquatrol master panel at the WWTF would need to be maintained if the telemetry upgrades are not completed as part of one project. In addition, these costs also include other miscellaneous maintenance items noted in Section 3.
6. These items can be completed separately or combined with the control and/or telemetry upgrade.

In addition, as noted in the Section 3, the following stations have pumps with significantly decreased capacities that, although they are able to handle existing flows, should be monitored and replaced as necessary: Old Mill Road Pump Station, Handy Boat Pump Station, and Leighton Road Pump Station. Costs for these pump replacements have not been included.

WRIGHT-PIERCE
Engineering a Better Environment

MEMORANDUM

TO:	Chris Dwinal & Kattie Collins	DATE:	1/19/09
FROM:	Ron Williams	PROJECT NO.:	11371A
SUBJECT:	Town of Falmouth, Maine Comprehensive Pump Station Assessment Technical Memorandum - Architectural		

Chris & Kattie,

The following memo outlines my observations of three existing Falmouth pump station buildings known as Clearwater Drive, Mill Creek and Falmouth Road. These observations are based on a site visit conducted on 1-15-09. In addition to the observations are **recommendations**.

General

Each of the pump stations have small, one-story buildings to house equipment associated with the pump station including a generator and control equipment. The dry and wet wells associated with each building are separate structures. The wet well associated with the Falmouth Road building is a round concrete tank and the building to house the pumps, controls and telemetry was constructed over a portion of the tank. The other two buildings are separate from the wet wells. The Clearwater Drive and the Mill Creek buildings are nearly identical and look to be built around the seventies. The Falmouth Road building was built in 1999.

CLEARWATER DRIVE PUMP STATION BUILDING

The building appears to be a wood framed building with a brick veneer exterior finish and a painted plywood interior finish. The building has a pitched gable roof with asphalt shingles.

Observations/Recommendations:

- The asphalt shingles appear to be near the end of their expected life span. The building only has gable end vents and no ridge vent. **Replace** the shingles as part of any renovation project and **add** a ridge vent.
- The last two feet of roof surface at the eave consists of galvalum flashing and drip edge and appears to be in good condition.
- The rake, eave and soffit trim is painted wood. The paint is deteriorated and the wood is pitted. Soffit venting consists of small circle vents at approximately 12" o.c. **Replace** the wood trim and **cover** with aluminum break metal. **Replace** the soffit with vented aluminum soffit. One eave overhangs about 12" and the other overhangs about 4". The rakes are flush with the walls.

- The exterior wall finish is brick veneer and appears to be in good condition. **Recaulk** all exterior penetrations in the brick veneer.
- The caulking is failing at a copper pipe through one of the eave walls. **Recaulk** this penetration.
- The louvers are aluminum with a natural mill finish and appear in good condition.
- The exterior access door is a double hollow metal door in a hollow metal frame and appears in good condition but needs weather stripping. **Add** weather stripping to the door.
- On one side of the building the liquid cooler for the generator is mounted on galvanized, structural steel supports. The support structure appears to be in fair condition.
- The building has a concrete slab on grade/foundation with a natural finish and appears to be in good condition.
- The interior wall and ceiling finish is painted plywood and appears to be in good condition.

MILL CREEK PUMP STATION BUILDING

The building is almost identical in design to the Clearwater Drive building. Again it appears to be a wood framed building with a brick veneer exterior finish and a painted plywood interior finish. The building has a pitched gable roof with asphalt shingles.

Observations:

- The asphalt shingles appear to be near the end of their expected life span. The building only has gable end vents and no ridge vent. **Replace** the shingles as part of any renovation project and **add** a ridge vent.
- The last two feet of roof surface at the eave consists of galvalum flashing and drip edge and appears to be in good condition.
- The rake, eave and soffit trim is unfinished wood. Due to lack of finish the wood is deteriorating and should be replaced. Soffit venting consists of small circle vents at approximately 12" o.c. **Replace** the wood trim and **cover** with aluminum break metal. **Replace** the soffit with vented aluminum soffit. One eave overhangs about 12" and the other overhangs about 4". The rakes are flush with the walls.
- The exterior wall finish is brick veneer and appears to be in good condition. **Recaulk** all exterior penetrations in the brick veneer. The side wall with the 12" eave overhang is recessed approximately 12" leaving 12" wing walls on each end. Minor moisture staining and degradation to the concrete and masonry is present, especially at these wing walls. **Repoint** areas of masonry where mortar is missing.
- Caulking around a conduit pipe through one of the eave has failed. **Recaulk** this penetration.
- The louvers are aluminum with a natural mill finish and appear in good condition.

- The exterior access door is a double hollow metal door in a hollow metal frame and appears in good condition but needs weather stripping. **Add** weather stripping to the door.
- The exhaust pipe on one wall is deteriorated and should be replaced. See electrical for recommendations on this item.
- Concrete slab on grade/foundation appears to be in good condition. The interior floor surface is painted and pealing in spots. **Refinish** the floor.
- The interior wall and ceiling finish is painted plywood and appears to be in good condition.
- The intake air louver for the generator is closed in with polystyrene insulation board to prevent air leakage in the winter months. This could result in issues with sufficient combustion air for the generator if the insulation is left in place during a generator run. Also, the polystyrene is left exposed to the interior which is not allowed by code. If the interior opening remains closed, it should be covered with plywood or gypsum wall board to cover the insulation. Another option would be to replace the polystyrene insulation board with foil-faced polyisocyanurate insulation board rated for exposure.

The building is very close to a stream and it appears that the flood elevation could be a concern if the building needs to be expanded or replaced. The exterior brick veneer at the bottom of the wall could not be observed due to the high level of snow. Due to the nature of the site having a lot of slope and being tight, snow removal will also be an issue with any expansion or new building.

A new building of no larger than 24' x 24' is also proposed at this site to house new equipment.

FALMOUTH ROAD PUMP STATION BUILDING

The building is a wood framed building with vinyl siding on the exterior and a painted plywood/gypsum wall board interior finish. The building has a pitched gable roof with asphalt shingles. The building is 10 years old and is generally in good condition.

Observations:

- The asphalt shingles appear to be in good condition. Most of the shingles were covered with snow. The building has vinyl soffit vents. We assume the building has a ridge vent although the roof was covered with snow so we were unable to verify. The building does not have gable end vents.
- The rake and eave trim is aluminum break metal with a white finish and the soffit trim is white vinyl vented soffit. Both the aluminum trim and the vinyl soffit appear to be in good condition. The eave overhangs are approximately 12" and the rake overhangs are approximately 6".

- The exterior wall finish is gray vinyl clapboard style siding. The trim is white vinyl corner boards and J-channels. The casing trim around the door is white aluminum break metal. Some or the corner boards and J-channels are broken. **Replace** the broken corner boards and J-channels.
- The exhaust vent for the monitor heater is mounted on the vinyl siding and the caulking around it has failed. **Provide** a mounting block. **Terminate** the siding around the mounting block with J-channels. **Mount** the vent on the mounting block.
- The north side of the building has mildew on the siding and this should be washed off.
- The exterior access door is a single hollow metal door in a hollow metal frame. The inside and outside faces of the door are painted but the edges are not painted. The top of the door has an open channel that can collect snow and dirt which can lead to premature deterioration of the door. **Provide** a flush top edge for the door. **Repaint** the door.
- Concrete slab on grade/foundation appears to be in good condition. The interior floor surface is painted.
- The interior wall finish is painted plywood on the electrical panel wall and painted gypsum wallboard on the other walls and appears to be in good condition.
- The ceiling is painted gypsum wallboard and appears to be in good condition.

WRIGHT-PIERCE
Engineering a Better Environment

MEMORANDUM

TO:	Chris Dwinal & Kattie Collins	DATE:	January 28, 2009
FROM:	Dave Skidgel	PROJECT NO.:	11371A
SUBJECT:	Town of Falmouth, Maine Comprehensive Pump Station Assessment Technical Memorandum - Structural		

The purpose of this memo is to identify structural deficiencies and recommended repairs for the following three pump stations in the Town of Falmouth, Maine wastewater treatment collection system:

- Clearwater Drive Pump Station
- Mill Creek Pump Station
- Falmouth Road Pump Station

The recommendations are based on our site visit on Thursday, January 15, 2009. We were accompanied by Mark Damon from the Treatment Facility. The weather during the inspections was clear with temperatures around 0° F.

OBSERVATIONS

In general all pump stations were in good condition unless specifically noted. Following is a summary of each pump station:

Clearwater Drive Pump Station

The Clearwater Drive Pump Station consists of a small wood framed building with a brick façade and a below-grade painted steel pump station. The building encloses an emergency generator for the station. Following are my observations:

- The building and steel pump station appeared to be in overall good structural condition.
- Several of the ceiling-supported threaded rod equipment hangers in the building are corroded.
- The rungs on the ladder leading to the below grade pump station are smooth and may be slippery in damp conditions.
- There is paint peeling from the metal floor of the pump station.

Mill Creek Pump Station

The Mill Creek Pump Station consists of a small wood framed building with a brick façade, a below-grade painted steel pump station and a below grade concrete wet well. The building encloses an emergency generator for the station. Please note that my observations of the concrete wet well were limited to observations from the ground through a hatch. In addition, most of the concrete surfaces and grating were covered with debris. Following are my observations:

- The building and steel pump station appeared to be in overall good structural condition.
- Several of the ceiling supported threaded rod equipment hangers in the building are corroded.
- The rungs on the ladder leading to the below grade pump station are smooth and may be slippery in damp conditions.
- There is paint peeling from the metal floor of the pump station.
- The monorail system in the pump station does not have a load rating indicated on the beam (the beam supports a 1.5 ton Yale manual hoist and trolley).
- The platform at the bottom of the pump station ladder is corroded in spots where paint has peeled off.
- The ceiling of the pump station is corroded in spots where paint has peeled off.
- No major deficiencies were noted in the concrete wet well.

Falmouth Road Pump Station

The Falmouth Road Pump Station consists of a small wood framed building with vinyl siding and a below-grade concrete wet well. An emergency generator for the station is located ouside in a weatherproof enclosure adjacent to the building. Please note that I was not able to observe the concrete wet well from the ground. Following are my observations:

- The building appeared to be in overall good structural condition.
- Mark indicated that the concrete surfaces in the wet well are degraded with exposed aggregate. He mentioned that one of the developments that is tied into the collection system was sending septic wastewater into the system which may have created hydrogen sulfide which could have damaged the concrete. Mark indicated that the problem does not occur anymore.

RECOMMENDATIONS

Clearwater Drive Pump Station

- The corroded ceiling supported threaded rod equipment hangers in the building should be replaced with either stainless steel or hot dipped galvanized hangers.

- The top surfaces of the rungs on the ladder leading to the below grade pump station should be made non-slip by the application of either grit epoxy paint or anti-slip abrasive tape.
- The peeling paint should be removed from the metal floor of the pump station and the floor should be recoated.

Mill Creek Pump Station

- The corroded ceiling supported threaded rod equipment hangers in the building should be replaced with either stainless steel or hot dipped galvanized hangers.
- The top surfaces of the rungs on the ladder leading to the below grade pump station should be made non-slip by the application of either grit epoxy paint or anti-slip abrasive tape.
- Consideration should be given to cleaning the interior surfaces and performing a full interior inspection of the concrete wet well.

Falmouth Road Pump Station

- The internal surfaces that exhibit exposed aggregate and degradation should be repaired by applying a cementitious overlay. If Hydrogen Sulfide gas is expected to build up in the station, an epoxy mortar coating (or other H_2S resistant coating) should be installed.

WRIGHT-PIERCE
Engineering a Better Environment

MEMORANDUM

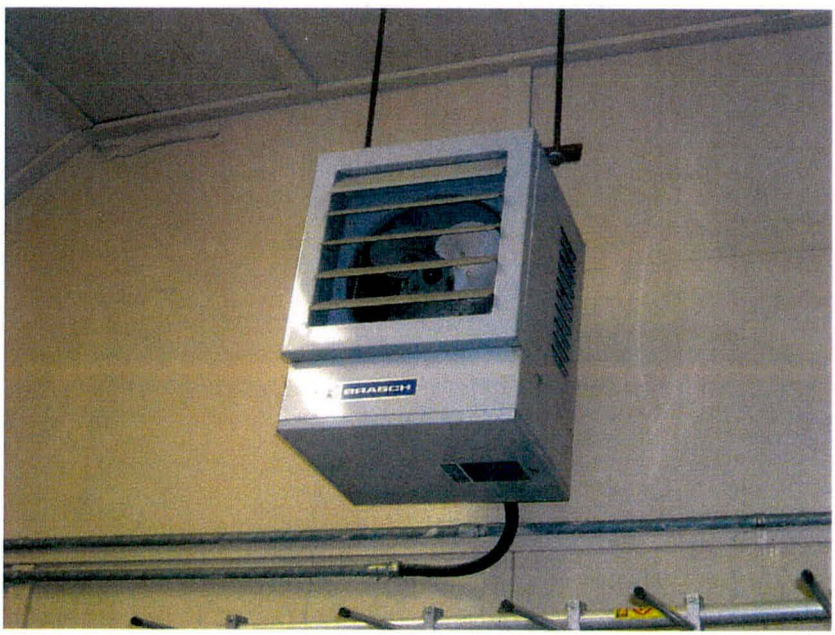
TO:	Chris Dwinal & Kattie Collins	DATE:	4/13/09
FROM:	Ralph Manglass	PROJECT NO.:	11371A
SUBJECT:	Town of Falmouth, Maine Comprehensive Pump Station Assessment Technical Memorandum - Mechanical(Revised)		

Site visits were made to these Sewage Pump Stations on 1/15/09. The weather was partly cloudy, windy and cold (~10F).

Clearwater Drive (No. 3)

The pump station is a Smith & Loveless "Can" type with a separate concrete influent wetwell. The ventilation, heating and sump pump for the station are operational and in serviceable condition.

The Generator Building is heated by a Brausch 2.5 kW electric unit heater with a Honeywell wall thermostat. The heater is in good operating condition.



There is an Acme Model DC30 (approximately 8000 cfm) wall mounted propeller exhaust fan and an inlet damper which were originally installed for generator cooling. The inlet damper linkage is disconnected. The fan and the damper unit are in good condition but are shut down at the power panel. The generator radiator and cooling fan is located outside.

There is a 330-gallon steel oil storage tank for the generator in the building that does not have secondary containment. It was noted that the floor drain in the building drains to the influent wetwell which would allow an oil spill to enter the sewage stream.

Recommendations:

The fuel tank should have secondary containment installed, either with a CMU or concrete wall or a prefabricated steel or polyethylene dike unit. The floor drain should be plugged.

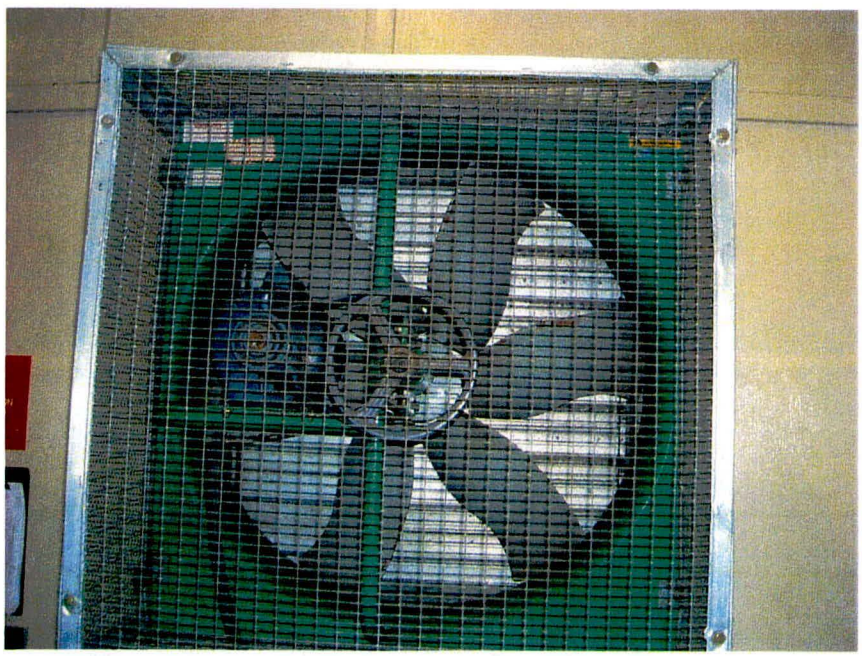
The exhaust fan and inlet damper should be put back into service to cool the building when the generator runs. The fan may be able to have its capacity reduced based on the actual thermal characteristics of the generator, since it may have been sized for the unit with the radiator indoors. A thermostat should be installed for fan/damper operation.

Mill Creek (No. 5)

The pump station is a Smith & Loveless "can" type with a separate concrete influent wetwell. The ventilation, heating and sump pump for the station are operational and in serviceable condition.

The Generator Building is heated by a Modine 1.5 kW electric unit heater in fair operating condition.

There is an Acme exhaust fan and inlet damper similar to the Clearwater Drive Generator Building, which are also shut off at the power panel. These are also in good condition and appear serviceable.



As at Clearwater, there is a 330-gallon steel oil storage tank for the generator in the building that does not have secondary containment, and a floor drain in the building that drains to the influent wetwell.

Recommendations:

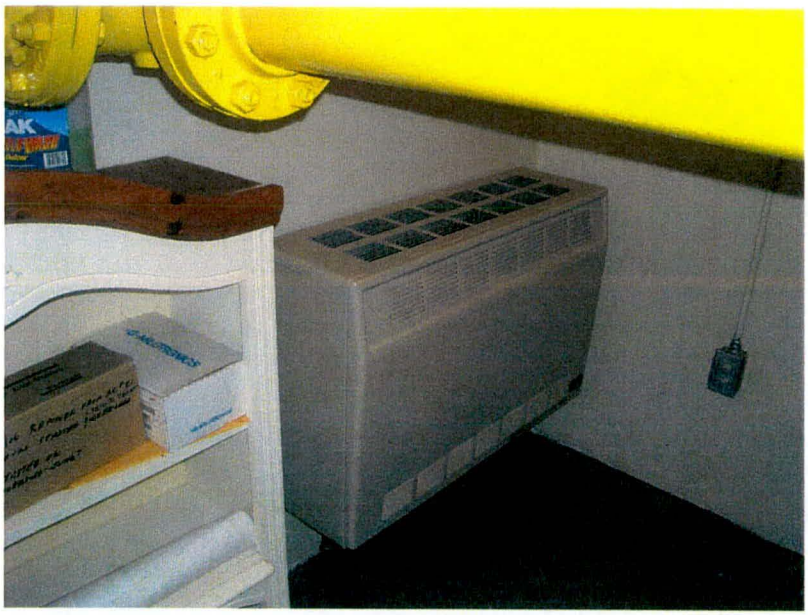
The same fuel tank issues apply as at Clearwater. A new generator is to be installed with a belly tank, so the existing fuel tank and accessories can be removed. The floor drain should be plugged.

The exhaust fan, damper/louvers, and the external radiator will be removed and new damper /louvers put in place for a replacement generator with and indoor, frame mounted radiator. The new generator installation will include a new exhaust system and wall penetration.

Falmouth Road (No.21)

This pump station is a concrete wetwell with an at-grade Control Building over part of the wetwell.

Control Building heating is provided by a direct vent, propane fired Empire Model DV-35-28G wall mounted heater (35,000 BTUH capacity). The unit is in good operating condition. It has a wall mounted, millivolt type thermostat. There is a buried propane tank across the driveway from the station.



There is no ventilation for the building. There is a packaged, propane-fired emergency generator adjacent to the control building.

Recommendations:

Some means of ventilating or cooling the building may be needed depending on the heat gain expected from the electrical equipment there.

Baysite Drive(No. 13)

The generator shed has a louver covered with plywood, which should be available for ccoling purposes when the generator runs.

Recommendations:

Install a motorized damper for the louver, interlocked with the generator.

WRIGHT-PIERCE
Engineering a Better Environment

MEMORANDUM

TO:	Chris Dwinal & Kattie Collins	DATE:	February 4, 2009
FROM:	Rob Meharg	PROJECT NO.:	11371A
SUBJECT:	Town of Falmouth, Maine Comprehensive Pump Station Assessment Technical Memorandum - Instrumentation		

Existing Pump Station Telemetry and SCADA System

Description

The existing pump station telemetry was installed in 1984 and is based on the Aquatrol W1300 remote telemetry system. The Aquatrol W1300 system consists of a master panel at the treatment plant that scans and displays data and alarms from all of the remote pump stations. Each remote pump station has an Aquatrol RTU panel that monitors one analog input and up to six discrete inputs. A built-in 300 baud frequency-shift-key (FSK) modem in each RTU communicates to the treatment plant master using a proprietary Aquatrol W1300 protocol via a VHF radio.

All remote sites directly communicate with directional YAGI antennas to the treatment plant master omni-directional antenna; there are no repeaters in the Town's system.

The treatment plant master panel displays pump station alarms using red lights and wetwell level data using LED indicators located on a large master panel in the treatment plant's laboratory / control room. All pump station data is then transferred to a SCADA computer using a CrossStar MT-200 W1300 Master Station circuit board. This circuit board emulates an Allen Bradley PLC-5. The card allows all of the Aquatrol data to be available to a non-proprietary SCADA computer through the DF-1 protocol over an RS-232 cable.

The pump station SCADA computer runs Trihedral VTS SCADA software. All pump station data is trended and all alarms are displayed and time-stamped on the SCADA computer. The pump station SCADA system is separate from the treatment SCADA system, which was installed in 2007 and is running Intellution iFix Version 4.0.

A 16-channel RACO Autodialer monitors all pump station alarms and provides call-out alarms. This Autodialer is only used for the pump stations; the treatment plant SCADA uses WIN911.

Existing Telemetry Evaluation

Since Falmouth is considering upgrading several pump stations and pump station control panels over the next few years, it is a good time to evaluate the existing pump station telemetry system as a whole and examine if the system is still viable, or if Falmouth would benefit from a more modern system.

The Aquatrol W1300 system was developed in the 1980's. The Aquatrol company was sold and then dissolved in the mid 1990's. Several former employees bought the rights to the Aquatrol products and they still maintain some of these legacy systems, offering parts, repairs, and limited new equipment. These companies are D^2 Services, Inc. in St. Paul, MN and CrosStar LLC. in Arden Hills, MN.

The Aquatrol telemetry equipment at Falmouth is in remarkably good condition for its age and has been well maintained over the years. Falmouth has also acquired spare equipment from other cities and towns that have replaced their Aquatrol systems, as well as bought new replacement parts.

The W1300 equipment is still manufactured and supported by D^2 Services; Falmouth bought a new W1300 from them as recently as 1999.

The weakest link in the telemetry system is currently the Master Station circuit board that connects the Master Telemetry Unit to the SCADA computer. The circuit board is no longer available and Falmouth does not have a spare. If this circuit board fails, the SCADA system would no longer have any way of monitoring the pump station alarms and data. While the pump station information would still be available on the master panel, all trending and time-stamping functions would not be available.

The W1300 telemetry system uses 25 KHz radio channels for communications. Since the W1300 system was installed, the FCC has put limitations on the bandwidth available for each frequency, lowering the channel size from 25 KHz to 12.5 KHz or in some places to 6.25 KHz. To comply with these new FCC regulations, Falmouth would need to install new narrow-band radios and possibly swap out the audio interface cards in each RTU panel.

The W1300 system only monitors alarms; currently there is no way to monitor status conditions such as "generator run", "pump run", etc.

New Telemetry System Discussion

Typically, most pump station telemetry systems that we have recently designed are based on PLCs, using the PLC's built-in communication functions in conjunction with a radio modem.

We generally recommend installing a PLC-based RTU at each pump station which collects all of the local data, which is then polled by a master PLC. We design the RTU panels as standardized as possible, including standard components and a standard PLC program, in order to make one set of spare parts interchangeable throughout the entire system.

The Master PLC is set up with a sequential polling sequence that allows both read and write functions to each of the remote RTUs. In Falmouth's case, the VHF radio frequency license could be reused, or the town could investigate using a spread spectrum, license-free radio.

A PLC based telemetry system would have the following benefits compared to the existing W1300 system:

- Higher density I/O - for example, an Allen Bradley Micrologix 1100 with Analog Input module will accept 10 Discrete Inputs, 6 Discrete Outputs, and 6 Analog Inputs.
- Transmits status signals as well as alarms
- System polling times would be faster, as most VHF radios can communicate at 4800 baud over a 12.5 KHz. channel. Faster speeds are available at higher frequencies such as 902-928 MHz spread spectrum.
- The ability to be integrated into a pump controller - the same RTU PLC could double as the pump controller if desired
- Allow possible remote control functions, such as remotely starting generators, changing setpoints, and changing Lead/Lag/Alternate settings
- Easily interfaces with a computer-based SCADA system
- Allow the pump stations to be integrated into the existing treatment plant SCADA software and use the same WIN911 Autodialing software, eliminating the need for two different call-out systems
- All PLC components are "off the shelf" and would be compatible with the PLC components already in use at the treatment plant
- There are many local suppliers, integrators, and programmers of PLC equipment available for support, repair, and maintenance of a new system, as opposed to the two suppliers of W1300 components

Telemetry Recommendations:

While the existing Aquatrol W1300 system is currently in working condition, is still supported, and has worked well over the years, we recommend taking this opportunity to consider upgrading the telemetry equipment to a more modern PLC-based system for the reasons listed above. We recommend designing a standard telemetry RTU / control panel that covers all telemetry and control requirements and installing this RTU / control panel throughout the system. The only exception would be the stations where the controls have been recently installed or upgraded (Lunt Road, Thornhurst, Hedgerow, Waites Landing, Baysite, Tidewater, Landing Woods, Mill Roasd, Falmouth Rd and Leighton Rd); these stations we recommend only

installing a new RTU panel that would monitor alarms and statuses from the existing control panels.

The Town already has standardized on Allen Bradley PLCs in the treatment plant. We recommend using the same brand PLC in the pump stations. This would ensure that common spare PLC parts at the plant could also cover the pump stations, no new software drivers would be required at the SCADA, and the new PLCs would communicate to the existing plant PLCs. An existing Allen Bradley SLC 5/05 processor is already located in the master control panel in the treatment plant - this PLC could be reused to function as the master polling PLC in the plant.

For the RTU / control panels, Allen Bradley Micrologix 1100 or 1400 PLCs are appropriately sized for the amount of I/O required. We recommend using an analog input module on each Micrologix, as the two built-in analog inputs are only good for 0 to 10VDC and have a resolution of 10 bits. The add-on module includes four 4-20mA inputs with a resolution of 15 bits.

There are two potential options that the Town can consider for radio communications: licensed VHF or spread spectrum. The advantages and disadvantages of these systems are as follows:

- Spread spectrum systems do not require licensing (VHF does).
- Spread spectrum systems can operate at a much higher bandwidth than VHF.
- VHF systems can transmit at up to 5 watts as opposed to spread spectrum which transmits at 1 watt. The shorter wavelength of the spread spectrum tends to be more susceptible to interference.
- Spread spectrum will likely require the use of at least one repeater site.

Although we would typically recommend the VHF system as it tends to be more reliable, the Town has expressed interest in considering 900 MHz spread spectrum radios. Regardless of which system is used, we strongly recommend that the Town hire a radio consultant, such as EII or RCM, to design and prove out a radio network. If the Town selects spread spectrum, possible repeater sites include the new police station radio tower, an antenna at the town hall, and a cellular antenna at the public works.

General Controls Recommendation

The Town can consider having two types of standardized control panels in the system: Pump Control / RTU panels for stations that require pump controls and telemetry upgrades and RTU panels for stations that do not require pump control panel upgrades but only telemetry upgrades.

Pump Controls / RTU Panels

We recommend new pump controls and telemetry at the following stations:

- Clearwater
- Brown Street

- Old Mill
- Handy Boat
- Underwood
- Mill Creek
- High School
- Clubhouse
- Pinehurst
- Woodland Drive
- Johnson Road
- Northbrook Drive

The pump controller / RTU panel would consist of a NEMA 4X (for outdoor locations) or NEMA 12 (for indoor locations) enclosure that houses all motor starters and control equipment. For outdoor installations the enclosure should have a blind door with a hinged inner panel which contains all indicator lights, through-door disconnect switches, and handswitches. We recommend using a small PLC such as the Allen Bradley Micrologix 1400 as the pump controller. This PLC can also be used to handle the telemetry. We recommend the following indications and controls at the panel:

- Hand/Off/Auto handswitch for each pump
- Pump 1 Lead/Pump 2 Lead/Alternate selector switch
- Pump 1 and 2 Run Lights
- Pump 1 and 2 Overload Alarm Lights
- Pump 1 and 2 Overtemperature Alarm Lights (where applicable)
- Alarm Reset
- Wetwell Level Display
- Elapsed Runtime Meters
- Duplex GFI
- High Level Alarm
- Low Level Alarm
- Wetwell Level LCD readout (in feet)

The town might consider the use of an Operator Interface Terminal (Panelview) at the stations that have VFDs, as this would give operators the capability of changing setpoints through the screen. The fixed speed float controlled stations do not need OITs.

The PLC would be programmed to start and stop the pumps in an alternating Lead/Lag sequence. For stations with VFDs, the PLC would be programmed to vary the pump speed proportionally between adjustable wetwell level setpoints.

We recommend building in a relay-based float backup system for the stations with VFDs, to provide a backup control mode if the submersible pressure transducer or PLC were to fail.

For the float controlled stations, the Town should consider allowing pump control based on either the floats or the submersible pressure transducer. This would allow the town to manually switch between the two if either instrument develops problems.

Each PLC can be directly polled by the master PLC at the treatment plant and we recommend the master reading the following information from the remote PLCs:

- Pump 1 Run
- Pump 1 Overload / Fault
- Pump 1 Speed (if applicable)
- Pump 2 Run
- Pump 2 Overload / Fault
- Pump 2 Speed (if applicable)
- Pump 3 Run (if applicable)
- Pump 3 Overload / Fault (if applicable)
- Pump 3 Speed (if applicable)
- Wetwell High Level
- Wetwell Low Level
- Generator Run (if applicable)
- ATS in Emergency Power Position (if applicable)
- Generator Fail (if applicable)
- Wetwell Level
- Power Failure

RTU - only panels:

We recommend retaining the pump control panels at the following stations since they have been installed or upgraded in the last 10-12 years.

- Thornhurst
- Hedgerow
- Waites Landing
- Baysite
- Tidewater
- Landing Woods
- Falmouth Rd
- Leighton Rd
- Lunt Road
- Mill Road

A standardized PLC-based RTU panel could be designed for these locations to monitor all available statuses and alarms. We recommend using an Allen Bradley Micrologix 1100 with an analog input module to monitor the following I/O:

- Pump 1 Run
- Pump 1 Overload
- Pump 2 Run
- Pump 2 Overload
- Wetwell High Level
- Wetwell Low Level
- Generator Run (if applicable)
- ATS in Emergency Power Position (if applicable)
- Generator Fail (if applicable)
- Wetwell Level
- Power Failure

Observation and Recommendations (grouped by pump station type):

Smith & Loveless "Can" Duplex Stations

- **Clearwater**
- **Brown Street**
- **Old Mill**
- **Handy Boat**
- **Underwood**

Existing I&C Conditions

Pump Controls

The pump control panels in the "can" stations are the original Smith & Loveless (S&L) pump control panels, located below grade in each "can", adjacent to the pumps. The S&L steel enclosures in each pump station house the circuit breakers, elapsed time meters, pump alternator, pump hand/off/auto switches, and pump start/stop pressure switches. The wetwell level is measured by a bubbler tube system with dual Gast compressors. Four adjustable Honeywell mercury pressure switches provide the following alarms and pump control setpoints: Low Wetwell Alarm / Pumps Off, High Water Alarm, Lead Pump Start and Lag Pump Start. An analog pressure gauge displays wetwell level in inches of water inside of each S&L control panels.

At Clearwater and Brown Street stations, the pump motor contactors have been removed from the control panel and the pumps are driven by VFDs. Clearwater uses two Toshiba VF-S11 drives and Brown St uses a Toshiba VF-S11 drive and a Toshiba H3 drive. The pump VFD

speed input is controlled either manually at the VFD (in Hand) or by 4-20mA signal (in Auto) from a submersible pressure transducer that varies the pump's speed proportionally to wetwell level. At this time, the Brown Street pumps are not being flow paced via the VFDs; the VFDs are set to run at a constant speed. The submersible pressure transducer is run in a conduit from the wetwell to the telemetry panel, and then to the VFDs. At all of these stations there are no explosion-proof seal fitting on the submersible pressure transducer conduit; there is only putty stuffed into it before it goes into the Aquatrol panel, which keeps wetwell gases out of the panel, but does not meet NFPA 820.

Telemetry

The Aquatrol panel monitors the following dry contacts:

- Data Fail
- Dry Well High Level
- Wet Well High Level
- Wet Well Low Level
- Pump Fail
- Generator Fail / Low Temp

The Aquatrol monitors the following 4-20mA signals:

- Wetwell level from the submersible pressure transducer

I&C Recommendations

If the below-grade structure of each can is sound and the Town decides to keep the station in its current configuration, we would recommend replacing and relocating the pump control panel and VFDs (for Brown and Clearwater) out of the can, in order to reduce the number of times operators need to climb down into the can. At Clearwater, the control panel could be located inside of the generator building. Other stations without structures available would need to locate the pump control panel on a unistrut stand in a NEMA 4X enclosure with a blind panel with an interior deadfront panel.

We recommend upgrading the original S&L control panels to new standardized PLC-based control and telemetry panels. A second Hand/Off/Remote handswitch station can be located down inside the can, so operators can start the pumps from either location if required.

We recommend removing the bubbler systems and mercury pressure switches and replacing them with the 4-20mA signal from the existing submersible pressure transducers. We also would recommend adding a hardwired backup float system to this station that would take over if the pressure transducer or PLC were to fail.

The existing VFDs at Clearwater are in almost new condition, and could be relocated into a separate enclosure in the generator building. This would need to be done one at a time in order to maintain pump station operation.

For the "can" stations that the town decides to entirely replace, we recommend designing a new standardized PLC-based pump control and telemetry panel.

Smith & Loveless "Can" Triplex Station

- **Mill Creek**

Existing I&C Conditions

Pump Controls

The pump controls are housed in the original S&L controls enclosure located below-grade in the can adjacent to the three pumps. The original S&L control panel has been modified from its original configuration. This control enclosure currently houses the pump hand/off/auto controls, a Pump 1 or 3 Lead selector, a Miltronics Hydroranger, the station's 120VAC circuit breakers, and the disconnect and motor starter for Pump 2. Pumps 1 and 3 are driven by VFDs, consisting of a Toshiba H9 for pump 1 and a Toshiba H3 for pump 3.

The pumps run in a Lead/Lag sequence, with Pump 1 or 3 always in the lead position, and Pump 2 as always the lag. Pumps 1 and 3 do not automatically alternate; an operator manually alternates the lead pumps once a week. There is no standby pump available; if the lead pump fails, the lag will continue, but the failed lead pump will stay off until an operator can get to the station and manually switch lead pumps.

A Miltronics Hydroranger I is used as the pump controller. The hydroranger's built-in relays are set up to start and stop the selected Lead and Lag pump based on adjustable level setpoints. The Hydroranger's 4-20mA output is sent to both VFDs to ramp the pump up and down proportionally based on the level signal.

Telemetry

The Aquatrol panel monitors the following dry contacts:

- Data Fail
- Dry Well High Level
- Wet Well High Level
- Wet Well Low Level
- Pump Fail
- Generator Fail / Low Temp

The Aquatrol monitors the following 4-20mA signals:

- Wetwell level from the submersible pressure transducer.
- There is a separate submersible pressure transducer in the wetwell that is only used to send a 4-20mA signal to the Aquatrol system.

In addition to the pump station instrumentation, there is also a float switch that is attached to a battery powered data logger. This float switch is mounted at a level that corresponds to when there is an overflow in the system. The data logger is used to time the duration of an overflow event.

I&C Recommendations

Since the Mill Creek station is recommended for complete replacement, the existing controls will be completely replaced as part of this recommended upgrade.

We recommend designing a standardized PLC-based pump control and telemetry panel. The submersible pressure transducer could be used to provide the process variable to control the pumps; the hydroranger could be reused or replaced with float switches to provide a backup control mode in case the PLC or submersible pressure transducer were to fail.

Gorman-Rupp Stations

- **Falmouth Road**
- **Leighton Road**

Existing I&C Conditions

Pump Controls

The pump controls at both stations are the original Gorman-Rupp controls that were installed in 1999 as part of the original pump stations. The controls at both stations are enclosed in NEMA 1 stainless steel enclosures. It houses pump 1 & 2 motor starters, a control power transformer, all circuit breakers, and all control and alarm relays. The enclosure includes the following hand controls and indications:

- Pump 1 and 2 Hand/Off/Auto switches
- Pump 1 and 2 Digital Elapsed Runtime meters
- Pump 1 and 2 Running indicating lights
- High Level Alarm Light
- Alarm Silence
- Reset Pushbuttons for each pump (appears to be unused)
- Pump 1 Lead/Pump 2 Lead/Alternate handswitch

A Miltronics Hydroranger ultrasonic level sensor starts and stops the pumps in a Lead/Standby sequence using the Hydroranger's internal level relays. The Hydroranger also supplies the 4-20mA signal monitored by the Aquatrol telemetry panel.

All controls equipment appears to be in excellent condition.

Telemetry

Each station has an Aquatrol panel that was built with new components in 1999 by D^2 Services, Inc.

The Aquatrol panel monitors the following dry contacts:

- Data Fail
- Power Fail
- Wet Well High Level
- Wet Well Low Level
- Pump Fail and Milltronics Power Fail
- Generator Fail / Low Temp

The Aquatrol monitors the following 4-20mA signals:

- Wetwell level from the Hydroranger ultrasonic level transmitter.

I&C Recommendations

The only controls recommendation at these stations would be to eventually upgrade the telemetry panel to a new PLC-based RTU.

Marley Hydromatic Submersible Stations

- **High School**
- **Clubhouse**
- **Pinehurst**
- **Woodland Drive**
- **Johnson Road**
- **Northbrook Drive**
- **Mill Road**

Existing I&C Conditions

Pump Controls

The pump controls at each of these stations are the original Marley Hydromatic controls that were installed with each pump station. Each station has a blank-fronted fiberglass enclosure that houses all circuit breakers, control relays, handswitches, a strip heater, motor contactors, and

elapsed runtime meters for the two pumps. Inside each enclosure is a hinged clear plexiglas sheet that covers the wiring and all internal components of the panel. Each pump has a Hand/Off/Auto switch that is accessible through holes in the plexiglas. Woodland and Pinehurst have disconnects that are mounted through the plexiglas and also have high temperature alarms. High School station does not have these features. Johnson Road and Northbrook Drive stations were not visited.

Each fiberglass enclosure is located outside and is exposed to the weather. The panels do not meet NEMA 4X standards; the sealing gaskets are dried out, each enclosure door only has one latch, and the doors fit very loosely to the enclosure.

The stations each use float switches to start and stop the pumps in an alternating Lead/Lag sequence and to provide alarms to the telemetry system. The five floats are configured in the following order:

- Low Level
- Pumps Off
- Lead Pump Start
- Lag Pump Start
- High Wetwell Level

The floats are wired directly to the control panel and do not pass through explosion proof seal fittings or intrinsically safe relays, both of which are required per NFPA 820 since the wetwells are classified as Class I Div I areas.

Telemetry

An Aquatrol panel monitors the following dry contacts at each of the stations:

- Data Fail
- Power Fail
- Wet Well High Level
- Wet Well Low Level
- Overflow Chamber High

The Aquatrol monitors the following 4-20mA signals:

- Wetwell level from the submersible pressure transducer.

I&C Recommendations

We recommend replacing each station's pump control panel with a standardized PLC-based control / RTU panel.

As we understand, the Town prefers submersible pressure transducers over ultrasonic level transducers. Therefore, we recommend using a submersible pressure transducer to display and monitor wetwell level, and the floats to control the station, the same way that the stations currently operate.

Barnes Submersible Stations

- **Thornhurst**
- **Hedgerow**
- **Waites Landing**
- **Baysite Drive**
- **Tidewater**
- **Landing Woods**

Existing I&C Conditions

Pump Controls

All of the Barnes submersible pump stations have relatively new pump control panels. All stations operate on floats and have fixed speed pumps, with the exception of Baysite, which has two VFDs. Hedgerow, Thornhurst, Landing Woods and Waites Landing have relay control panels built by Stultz Electric in the late 1990's. Tidewater has a new panel built in 2007 and Baysite Drive has a relatively new panel of an unknown age.

All pump control panels have the following controls located on the inner door of each panel (with the exception of Baysite, which is housed indoors and the controls are on the panel door):

- Hand/Off/Auto handswitch
- Pump 1 Lead/ Pump 2 Lead/Alternate
- Pump 1 & 2 Run Indication (with the exception of Baysite)
- Pump 1 & 2 Overload Indication (with the exception of Baysite)
- Elapsed Time Meters

All stations operate on a Lead/Lag sequence based on float switches. The float switches also provide alarm information to the telemetry panels.

The station that was visited (Thornhurst), did not have explosion-proof seal fittings from the wetwell or intrinsically safe relays and an intrinsically safe barrier for the float switches and submersible pressure transducer.

Telemetry

An Aquatrol panel monitors the following dry contacts at each of the stations:

- Data Fail
- Power Fail
- Wet Well High Level

- Wet Well Low Level

The Aquatrol monitors the following 4-20mA signals:
- Wetwell level from the submersible pressure transducer.

I&C Recommendations

We recommend maintaining the existing pump controls at these stations since the panels are relatively new and are in good condition. The only upgrade to the controls we recommend at this time would be to add intrinsically safe relays, barriers and explosion-proof seal fittings for all signals/conduits coming from the wetwell to meet NFPA 820 regulations.

We recommend upgrading the telemetry system with new PLC-based RTU panels.

Flygt Station
- **Middle Road**

Pump Controls
The Middle Road pump control panel is a float controlled Flygt panel that was installed as part of the original station.
The control panel consists of a NEMA 4 dead front control panel with an interior subpanel. The subpanel does not have a through-door disconnect, but has a slot cut into it to provide access to all circuit breakers. The subpanel has the elapsed time meters, pump hand/off/auto switches, pump run lights, and duplex receptacle on it. Alarms are based on the float switches.

Telemetry
The Aquatrol panel monitors the following dry contacts:
- Data Fail
- Power Fail
- Pump Cutout
- Wetwell Low Level
- Wet Well Low Level
- Pump Fail

The Aquatrol monitors the following 4-20mA signals:
- Wetwell level from the submersible pressure transducer

I&C Recommendations

This station is recommended for replacement. We recommend upgrading the pump controls and telemetry with a new PLC-based pump control / RTU panel.

Smith & Loveless Suction-Lift Station

- **Lunt Road**

Pump Controls

The Lunt Road pump control panel is a new proprietary ProtroniX panel furnished by Smith & Loveless as part of the station upgrade in 2006. This control panel uses a 4-20mA from a submersible pressure transducer to control the station and provide alarms, and uses floats in a backup control mode.

Telemetry

The Aquatrol panel monitors the following dry contacts:

- Data Fail
- Dry Well High
- Power Fail
- Wetwell Low Level
- Wet Well Low Level
- Pump Fail

The Aquatrol monitors the following 4-20mA signals:

- Wetwell level from the submersible pressure transducer

I&C Recommendations

We recommend maintaining the existing pump control panel at this station, since the panel was recently installed.

We recommend upgrading the telemetry system with new PLC-based RTU panels. It might be possible to connect the Allen Bradley PLC directly to the ProtroniX control panel, as there is an available Modbus RTU RS-232 port on the ProtroniX panel. If this is not available, the PLC could monitor the available dry contacts.

WRIGHT-PIERCE
Engineering a Better Environment

MEMORANDUM

TO:	Chris Dwinal & Kattie Collins	DATE:	January 21, 2009 REV: March 3, 2009
FROM:	Dan Marchand	PROJECT NO.:	11371A
SUBJECT:	Town of Falmouth, Maine Comprehensive Pump Station Assessment Technical Memorandum - Electrical		

Clearwater Drive Pump Station

Existing Conditions:

The pump station consists of a below-ground "tin can" station and adjacent building. The original Federal Pacific (FPE) electrical equipment, including circuit breakers, disconnect switches, panelboard and transformer, are all in fair condition. The existing exhaust fan and cage are impeding on the code-required working space of the main service disconnect. The code required working space is 3-1/2 feet infront of the equipment. There are two Toshiba VFD's and a panel with the pump circuit breakers as well as misc. 120V circuit breakers and controls located down in the "tin can". The two VFD's are new and in good condition. The panel appears to be original and is in fair condition.

Emergency power is supplied by a Caterpillar 60kW diesel generator and automatic transfer switch. The fuel storage tank is located inside the building. The generator appears to be in good condition.

Building lighting consists of industrial fluorescent fixtures, which are original equipment in good condition. There are no lighted exit signs or emergency battery lighting in the building.

Wiring devices such as switches and receptacles are in good condition. Conduit systems, boxes, and fittings within the building all appear in good condition. The conduits from the "tin can" to the building are not sealed. NEMA ratings for electrical equipment appear to be correct for all areas.

No fire alarm or security systems were noted in the building.

There is no gas detection system in this station, as it is not required.

There is some space available in the building for new electrical equipment, which might be required in the event of an upgrade to the pump station.

Code Related Recommendations:

Provide emergency battery lighting in the building as backup in the event of generator failure.

Provide new conduit seals for all existing conduits between the building and the "tin can".

Relocate the existing electrical equipment mounted on the wall with the main service disconnect switch in order to bring the station up to code. There is an existing pump control panel located on the wall within the building that appears not to be in service. The removal of this panel will allow for the relocation of the electrical equipment.

Remove all misc. equipment and parts from within the front of the electrical equipment.

Mill Creek Pump Station

Existing Conditions:

The pump station consists of a below-ground "tin can" station and adjacent building. The original Federal Pacific (FPE) electrical equipment, including circuit breakers, disconnect switches, panelboard and transformer, are all in fair condition. The existing exhaust fan and cage are impeding on the code required working space of the main service disconnect. There are two Toshiba VFD's, 1 motor starter and a panel with the pump circuit breakers as well as misc. 120V circuit breakers and controls located down in the "tin can". One VFD is new and the other has been recently rebuilt; both are in good condition. The motor starter is original and is in fair condition. The panel appears to be original and in fair condition.

Emergency power is supplied by a Caterpillar 200kW diesel generator and automatic transfer switch. The fuel storage tank is located inside the building. Generator appears to be in good condition.

Building lighting consists of industrial fluorescent fixtures, which are original equipment in good condition. There are no lighted exit signs or emergency battery lighting in the building.

Wiring devices such as switches and receptacles are in good condition. Conduit systems, boxes, and fittings within the building all appear in good condition. The conduits from the "tin can" to the building are not sealed. NEMA ratings for electrical equipment appear to be correct for all areas.

No fire alarm or security systems were noted in the building.

There is no gas detection system in this station, as it is not required.

There is some space available in the building for new electrical equipment, which might be required in the event of an upgrade to the pump station.

Code Related Recommendations:

Provide emergency battery lighting in the building as backup in the event of generator failure.

Provide new conduit seals for all existing conduits between the building and the "tin can".

Relocate all the existing electrical equipment in order to bring the station up to code. There is an existing pump control panel located on the wall within the building that appears not to be in service. The removal of this panel will allow for the relocation of the electrical equipment that is mounted on this wall.

Recommendations for a new Building

Provide a new electrical service to the building.

Provide all new electrical equipment (Main Disconnect, Transformer, Lighting Panel, lighting, emergency lighting, etc) all equipment to be locate in the existing building.

Provide a new disconnect switch in the new pump building.

Provide new VFD's and circuit breakers for the new pumps

Provide a new 200KW generator and transfer switch.

Falmouth Road Pump Station

Existing Conditions:

The pump station has a building that houses the process pumps and the electrical equipment. All the equipment was installed in 1999 when the station was constructed. The electrical equipment, including circuit breakers, disconnect switches, panelboard and transformer, are Square D and are all in good condition. There is a pump control panel located just inside the doorway. The pump control panel houses the two motor starters for the pumps.

Emergency power is supplied by a 100KW propane-fired Olympian generator located in an outdoor weatherproof enclosure and automatic transfer switch. Generator appears to be in good condition.

Building lighting consists of incandescent jelly jar type fixtures, which are original equipment in good condition. There are no lighted exit signs or emergency battery lighting in the building.

Wiring devices such as switches and receptacles are in good condition. Conduit systems, boxes, and fittings within the building all appear in good condition. The conduits from the wet well to the building are not sealed. NEMA ratings for electrical equipment appear to be correct for all areas.

No fire alarm or security systems were noted in the building.

There is no gas detection system in this station, as it is not required.

The pump station control panel and annunciator panel are original equipment and are in good condition.

There is no space for new electrical equipment.

Code Related Recommendations:

Provide emergency battery lighting in the building as backup in the event of generator failure.

Provide new conduit seals for all existing conduits between the building and the wet well.

High School Pump Station

Existing Conditions:

This is a submersible pump station with all the electrical and pump control equipment mounted on unistrut. The electrical equipment is housed in outdoor enclosures and appears to be in fair to poor condition. Emergency power consists of a plug for a mobile generator. The pump control panel is mounted behind a plexiglass door within an outdoor enclosure. The wiring within the control panel was not installed in a neat manner.

Conduit, boxes, and fittings are in fair to poor condition.

There does not appear to be any NEMA ratings on the outdoor enclosures.

The conduit from the pump control panel to the wet well is not sealed and consists of all power and control wiring. The conduit appears to be overfilled and enters the wet well directly without a junction box.

Code Related Recommendations:

Provide junction boxes between the wet well and the pump control panel. Provide conduit seals for all conduits entering the wet well. There should be separate conduits for power, control and signal wiring. The new junction boxes should be located exterior to the wet well.

Design Related Recommendations:

Provide a new main electrical disconnect switch mounted within a NEMA 4X rated enclosure.

Provide a new pump control panel mounted within a NEMA 4X rated enclosure.

Woodlands Clubhouse Pump Station

Existing Conditions:

This is a submersible pump station with all the electrical and pump control equipment mounted on unistrut. The electrical equipment is housed in outdoor enclosures and appears to be in fair condition. The incoming service enters an old disconnect switch which is now being used as a junction box and feeds a separate 100A main disconnect switch. The main disconnect switch then feeds two 20 amp and one 40 amp circuit breakers in two separate enclosures. There is a 30kVA transformer mounted on the ground below the main disconnect switch.

Emergency power consists of an Olympian 40KW diesel generator located within an outdoor weatherproof enclosure. Generator appears to be in good condition.

Conduit, boxes, and fittings appear to be in good condition. The conduits above grade are flexible type conduit.

There does not appear to be any NEMA ratings on the outdoor enclosures.

The conduit from the pump control panel to the wet well is not sealed and consists of all power and control wiring. There is a junction box within the wet well. The junction box appears to be corroded.

Code Related Recommendations:

Change the outdoor exposed flexible conduit to rigid steel conduit for all outdoor exposed conduits.

Provide new junction boxes between the wet well and the pump control panel. Provide conduit seals for all conduits entering the wet well. There should be separate conduits for power, control and signal wiring. The new junction boxes should be located exterior to the wet well.

Design Related Recommendations:

Provide a new main electrical disconnect switch mounted within a NEMA 4X rated enclosure.

Provide a new panelboard with enough circuit breakers to feed the existing equipment. New panelboard shall be located within a NEMA 4X rated enclosure.

Relocate the transformer so that it is located off of the ground.

Pinehurst Pump Station

Existing Conditions:

This is a submersible pump station with all the electrical and pump control equipment mounted on unistrut. The electrical equipment is housed in outdoor enclosures and appears to be in fair condition. The incoming service enters an old disconnect switch which is now being used as a junction box and feeds a separate 100A main disconnect switch. The main disconnect switch then feeds two 20 amp circuit breakers in the same enclosure.

Emergency power consists of an Olympian 40KW diesel generator located within an outdoor weatherproof enclosure. Generator appears to be in good condition.

Conduit, boxes, and fittings appear to be in good condition. There is also a portable generator plug which is not operational at this time. The conduits above grade are flexible type conduit.

There does not appear to be any NEMA ratings on the outdoor enclosures.

The conduit from the pump control panel to the wet well is not sealed and consists of all power and control wiring. There is a junction box within the wet well. The junction box appears to be corroded.

Code Related Recommendations:

Provide new junction boxes between the wet well and the pump control panel. Provide conduit seals for all conduits entering the wet well. There should be separate conduits for power, control and signal wiring. The new junction boxes should be located exterior to the wet well.

Change the outdoor exposed flexible conduit to rigid steel conduit for all outdoor exposed conduits.

Design Related Recommendations:

Provide a new main electrical disconnect switch mounted within a NEMA 4X rated enclosure.

Provide a new panelboard with enough circuit breakers to feed the existing equipment. New panelboard shall be located within a NEMA 4X rated enclosure

Woodlands Drive Pump Station

Existing Conditions:

This is a submersible pump station with all the electrical and pump control equipment mounted on unistrut. The electrical equipment is housed in outdoor enclosures and appears to be in fair condition. The incoming service enters an old disconnect switch which is now being used as a junction box and feeds a separate 100A main disconnect switch. The main disconnect switch then feeds two 20 amp circuit breakers in same enclosure. From these disconnect switches the power for the pumps runs through a 1-phase to 3-phase Roto-Phase. The Roto-Phase appears to be original and is in fair condition.

Emergency power consists of a portable generator outlet.

Conduit, boxes, and fittings appear to be in good condition. The conduits above grade are flexible type conduit.

There does not appear to be any NEMA ratings on the outdoor enclosures.

The conduit from the pump control panel to the wet well is not sealed and consists of all power and control wiring. There is a junction box within the wet well. The junction box appears to be corroded.

Code Related Recommendations:

Provide new junction boxes between the wet well and the pump control panel. Provide conduit seals for all conduits entering the wet well. There should be separate conduits for power, control and signal wiring. The new junction boxes should be located exterior to the wet well.

Relocate the portable generator plug from under the main disconnect enclosure for easier access.

Change the outdoor exposed flexible conduit to rigid steel conduit for all outdoor exposed conduits.

Design Related Recommendations:

Provide a new main electrical disconnect mounted within NEMA 4X rated enclosure.

Provide a new panelboard with enough circuit breakers to feed the existing equipment. New panelboard shall be located within a NEMA 4X rated enclosure.

Provide either new VFD's or a new transformer to transfer from 1-phase to 3-phase in order to remove the existing Roto-Phases.

Middle Road Pump Station

Existing Conditions:

This is a submersible pump station with all the electrical and pump control equipment mounted on unistrut. The electrical equipment is housed in outdoor enclosures and appears to be in good condition.

Emergency power consists of a portable generator outlet.

Conduit, boxes, and fittings appear to be in good condition.

There does not appear to be any NEMA ratings on the outdoor enclosures.

The conduit from the pump control panel to the wet well is not sealed and consists of all power and control wiring. There is a junction box within the wet well. The junction box appears to be corroded.

Code Related Recommendations:

Provide new junction boxes between the wet well and the pump control panel. Provide conduit seals for all conduits entering the wet well. There should be separate conduits for power, control and signal wiring. The new junction boxes should be located exterior to the wet well.

Design Related Recommendations:

Provide a new main electrical disconnect switch mounted within a NEMA 4X rated enclosure.

Thornhurst Pump Station

Existing Conditions:

This is a submersible pump station with all the electrical and pump control equipment mounted on unistrut. The electrical equipment is housed in outdoor enclosures and appears to be in good condition.

Emergency power consists of a portable generator outlet.

Conduit, boxes, and fittings appear to be in good condition.

There does not appear to be any NEMA ratings on the outdoor enclosures.

The conduit from the pump control panel to the wet well is not sealed and consists of all power and control wiring. There is a junction box within the wet well. The junction box appears to be corroded.

Code Related Recommendations:

Provide new junction boxes between the wet well and the pump control panel. Provide conduit seals for all conduits entering the wet well. There should be separate conduits for power, control and signal wiring. The new junction boxes should be located exterior to the wet well.

Design Related Recommendations:

Provide a new main electrical disconnect switch mounted within a NEMA 4X rated enclosure.

Brown Street Pump Station

Existing Conditions:

This is a "tin can" style pump station with all the electrical equipment mounted on unistrut above ground and all pump controls located within the "tin can". The electrical equipment is housed in outdoor enclosures and appears to be in good condition. There are two Toshiba VFD's and a panel with the pump circuit breakers as well as misc. 120V circuit breakers and controls located down in the "tin can". The two VFD's are new and in good condition. The panel appears to be original and is in fair condition.

Emergency power consists of a 40KW propane fired Olympian generator located within an outdoor weatherproof enclosure. Generator appears to be in good condition.

Conduit, boxes, and fittings appear to be in good condition.

There does not appear to be any NEMA ratings on the outdoor enclosures.

Design Related Recommendations:

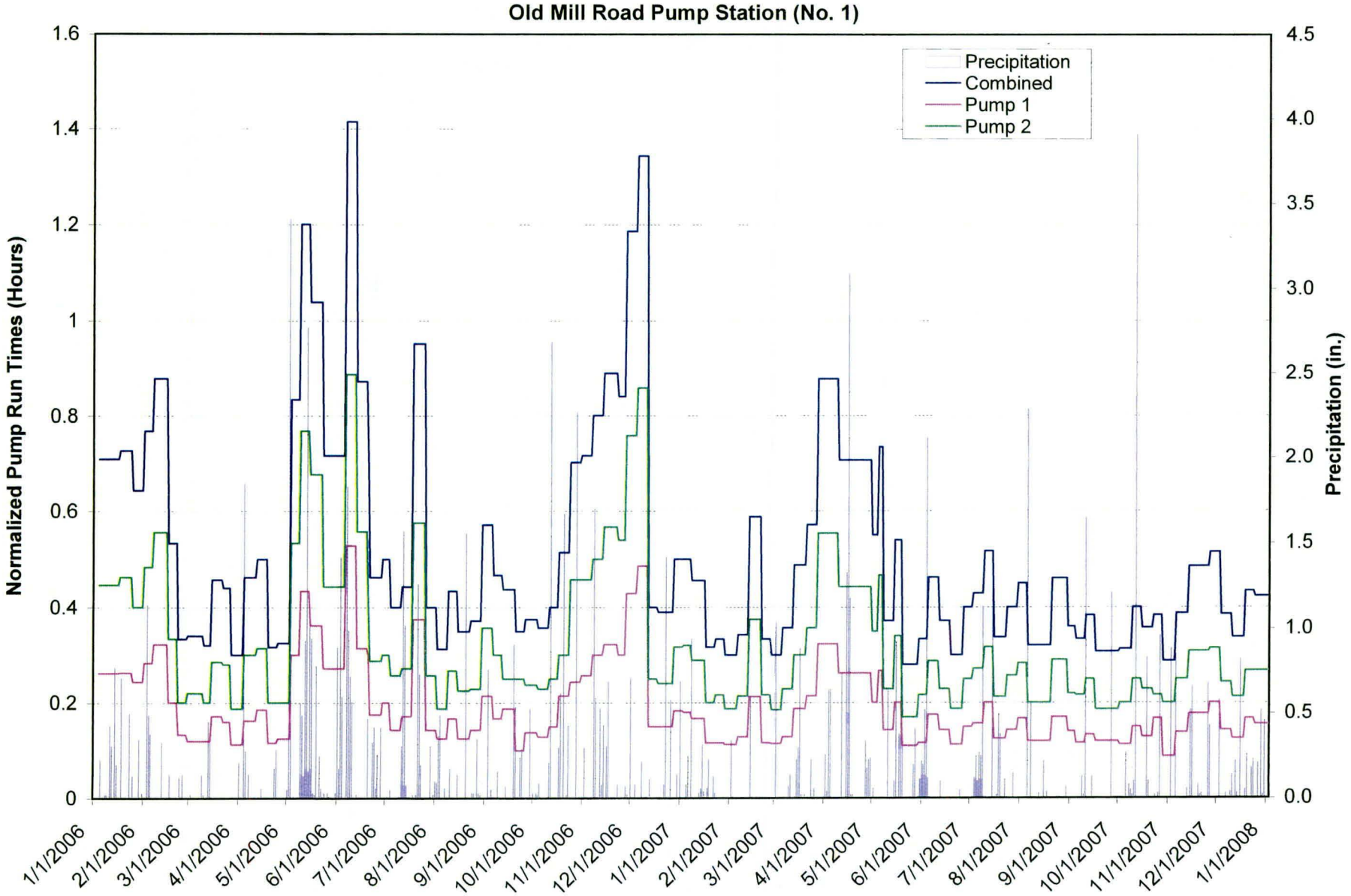
Provide a new electrical service to the pump station. The utility company will most likely require new pole mounted transformers to be installed.

Provide a new main disconnect switch in a NEMA 4X weatherproof enclosure.

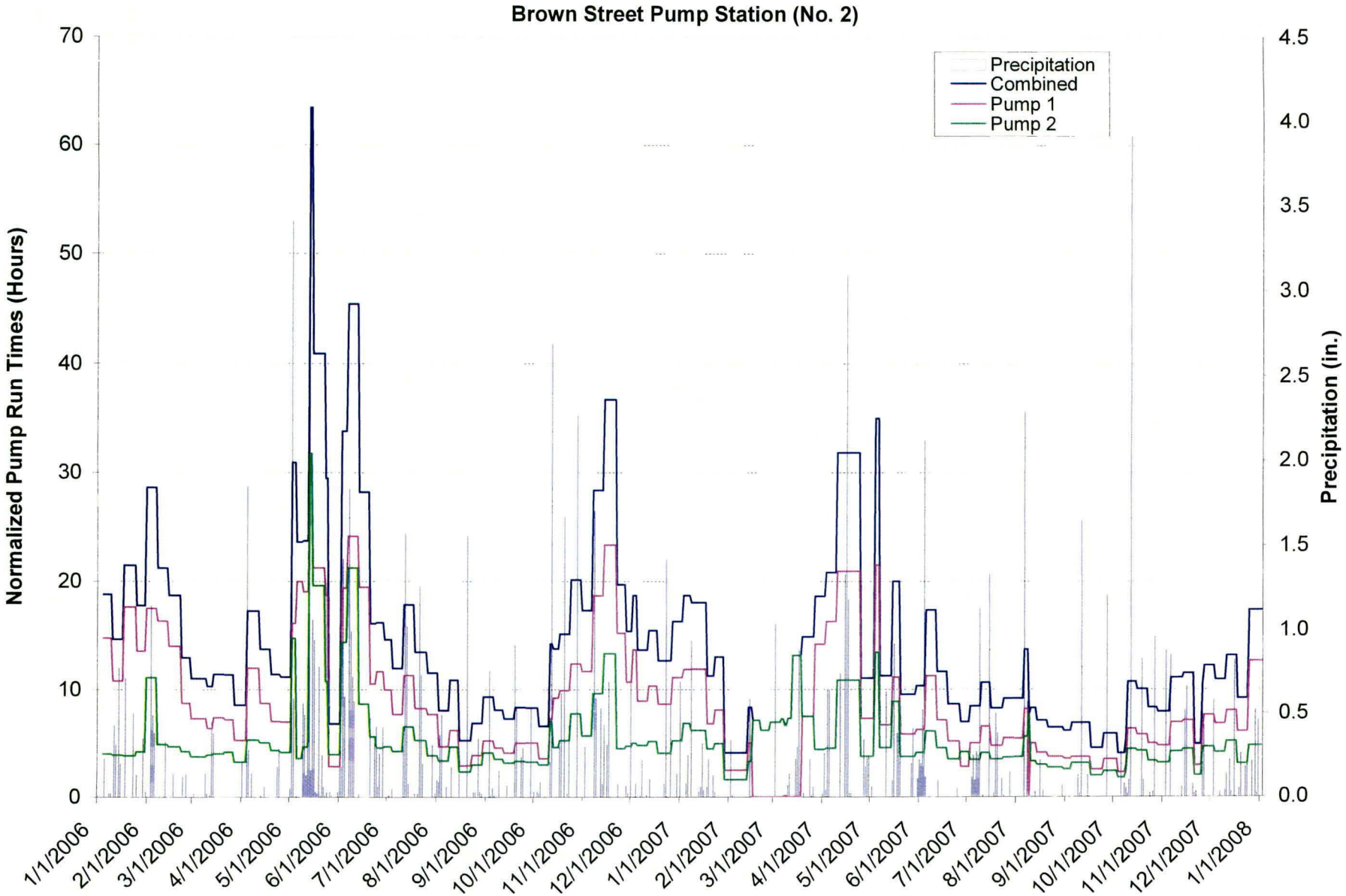
Provide new VFD's and circuit breakers for the new pumps in a NEMA 4X weatherproof enclosure.

Provide a new 50KW propane generator and transfer switch.

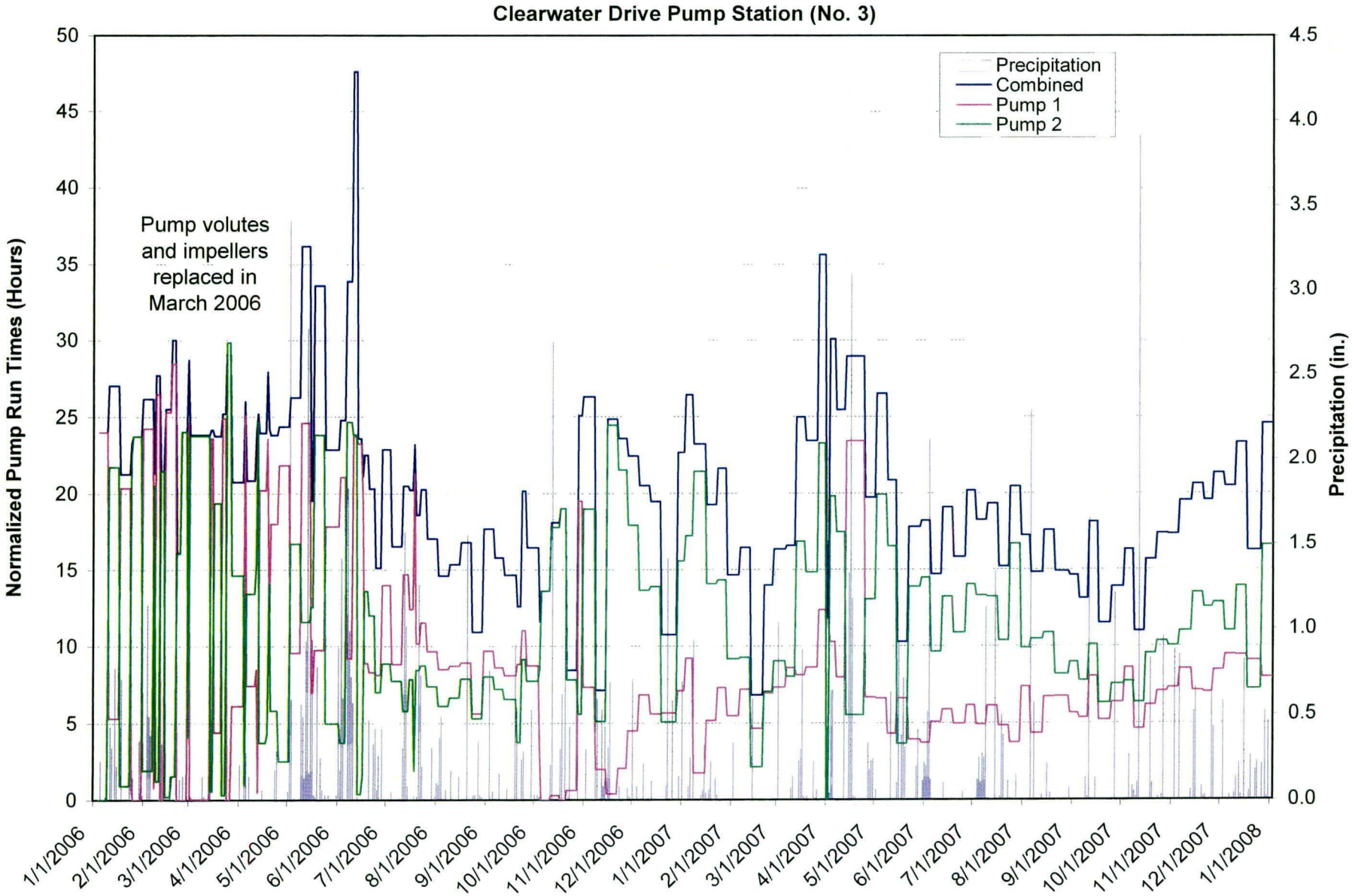
Town of Falmouth, Maine
Pump Station Assessment



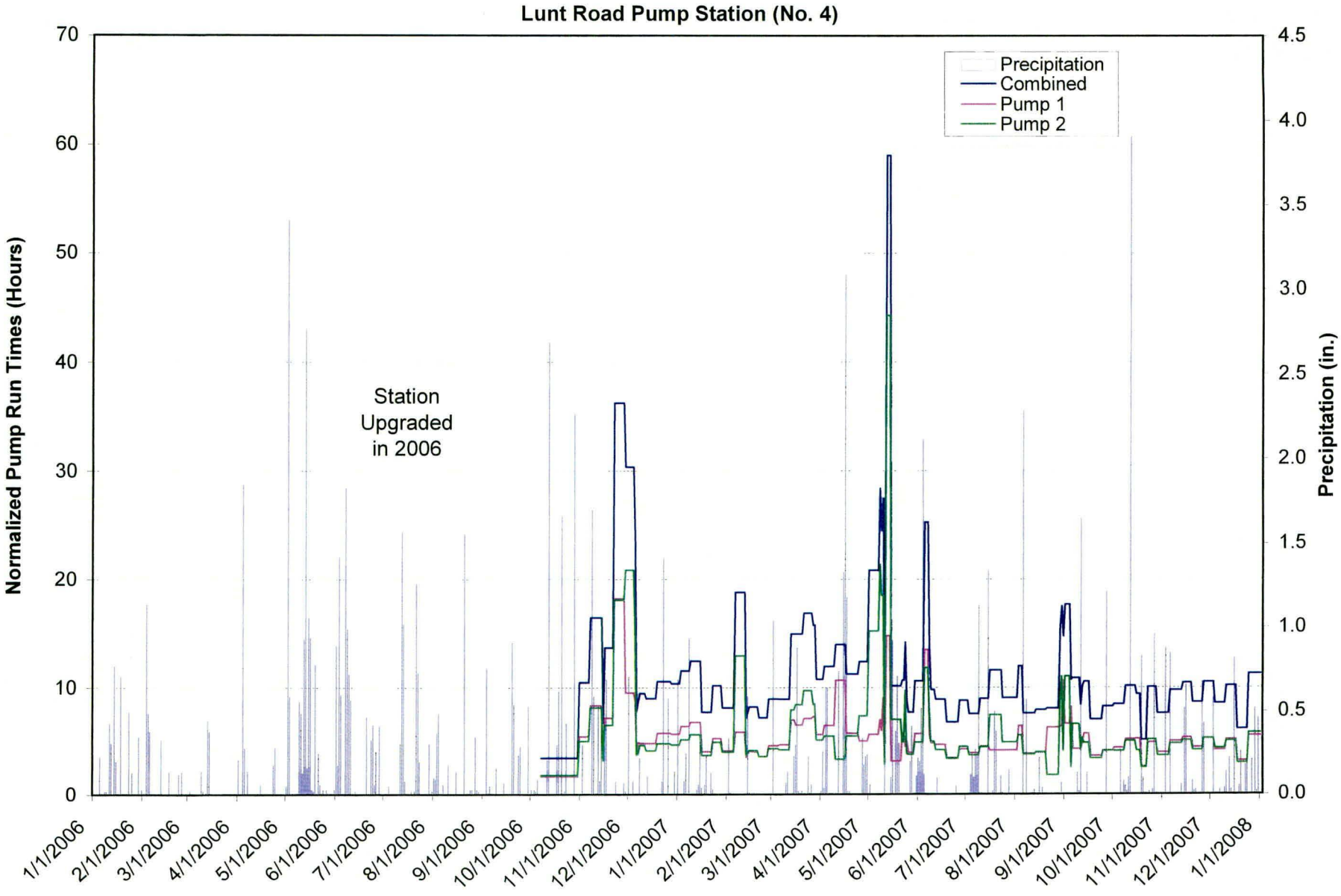
Town of Falmouth, Maine
Pump Station Assessment



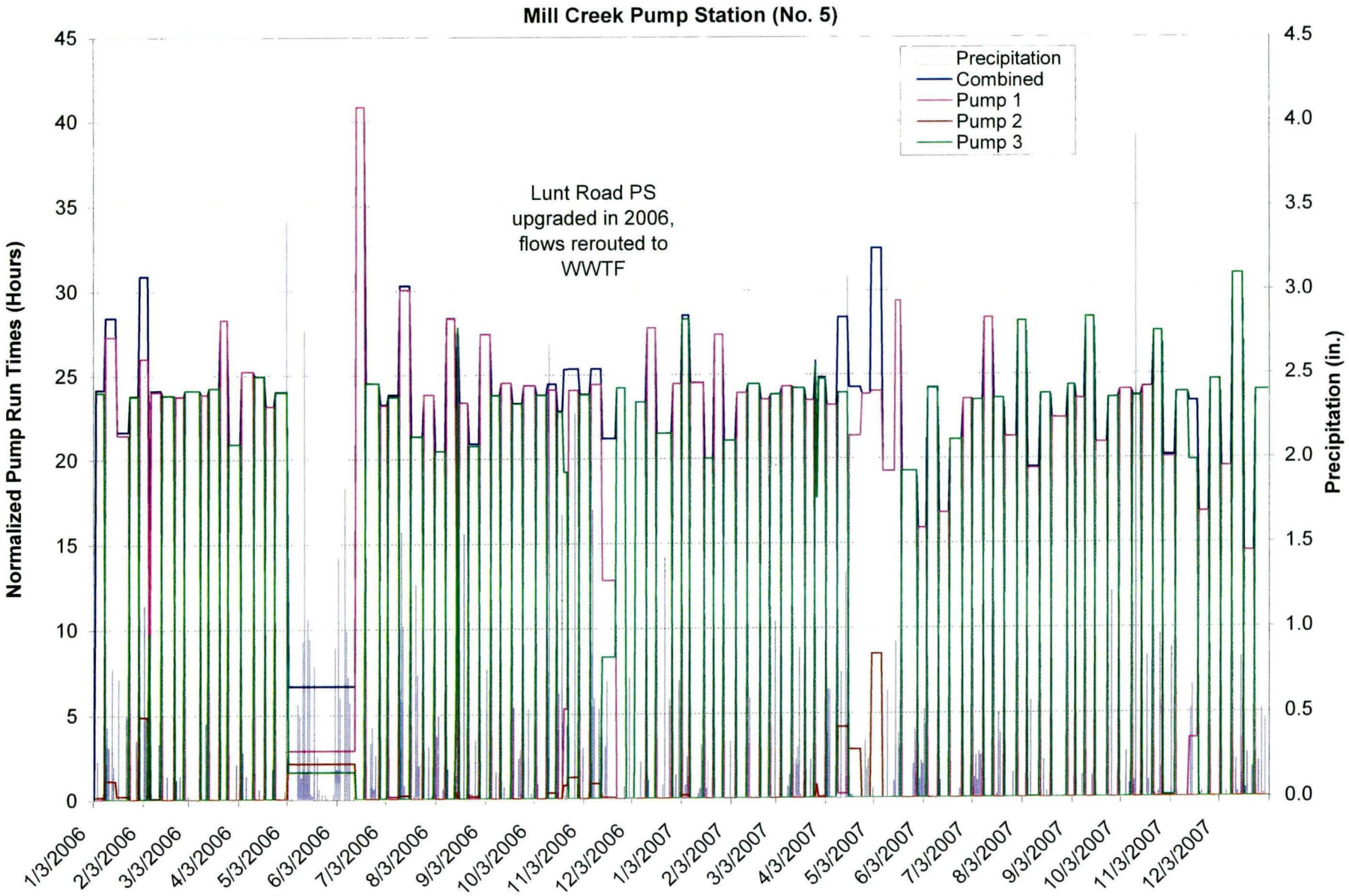
Town of Falmouth, Maine
Pump Station Assessment



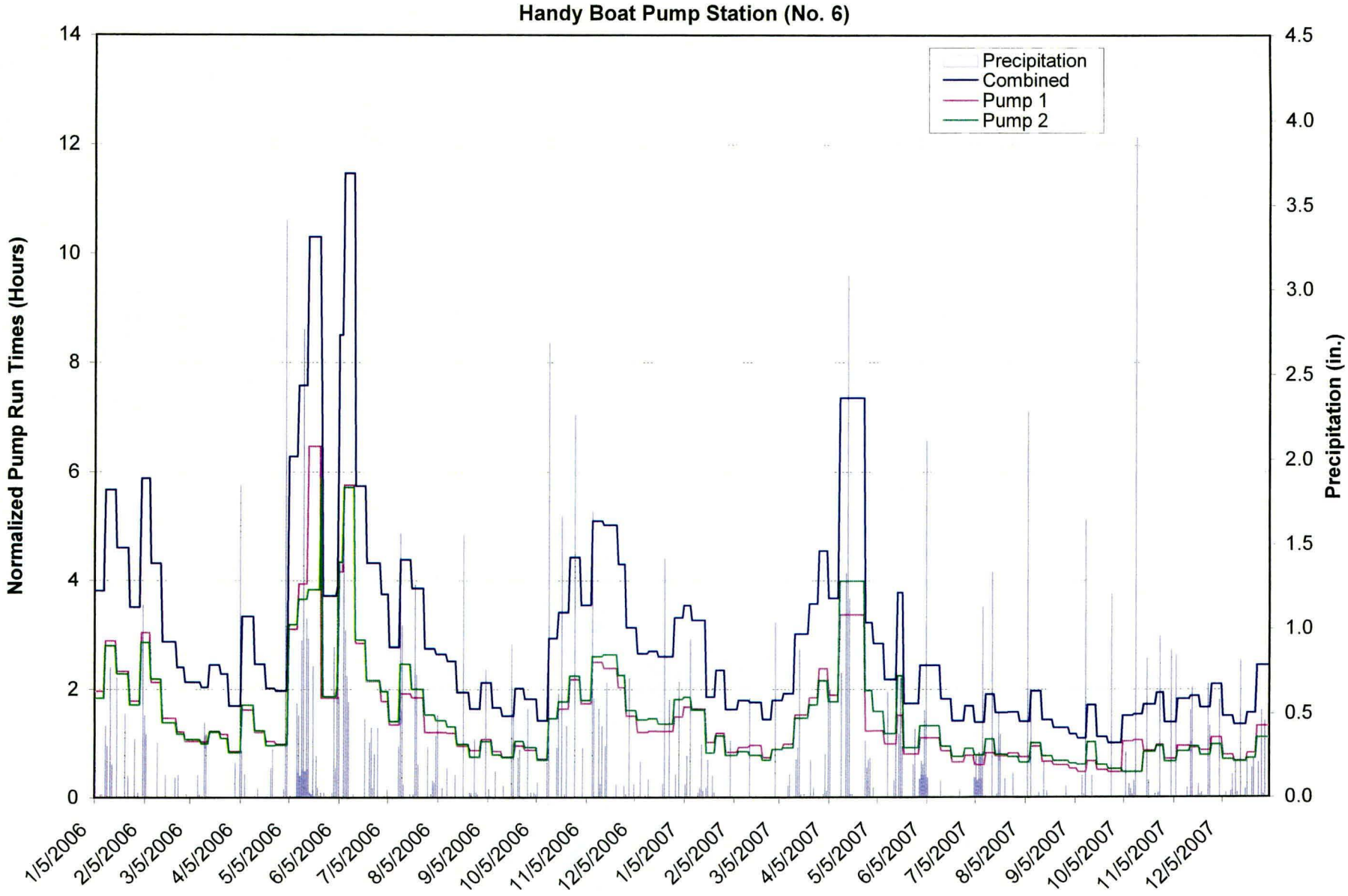
Town of Falmouth, Maine
Pump Station Assessment



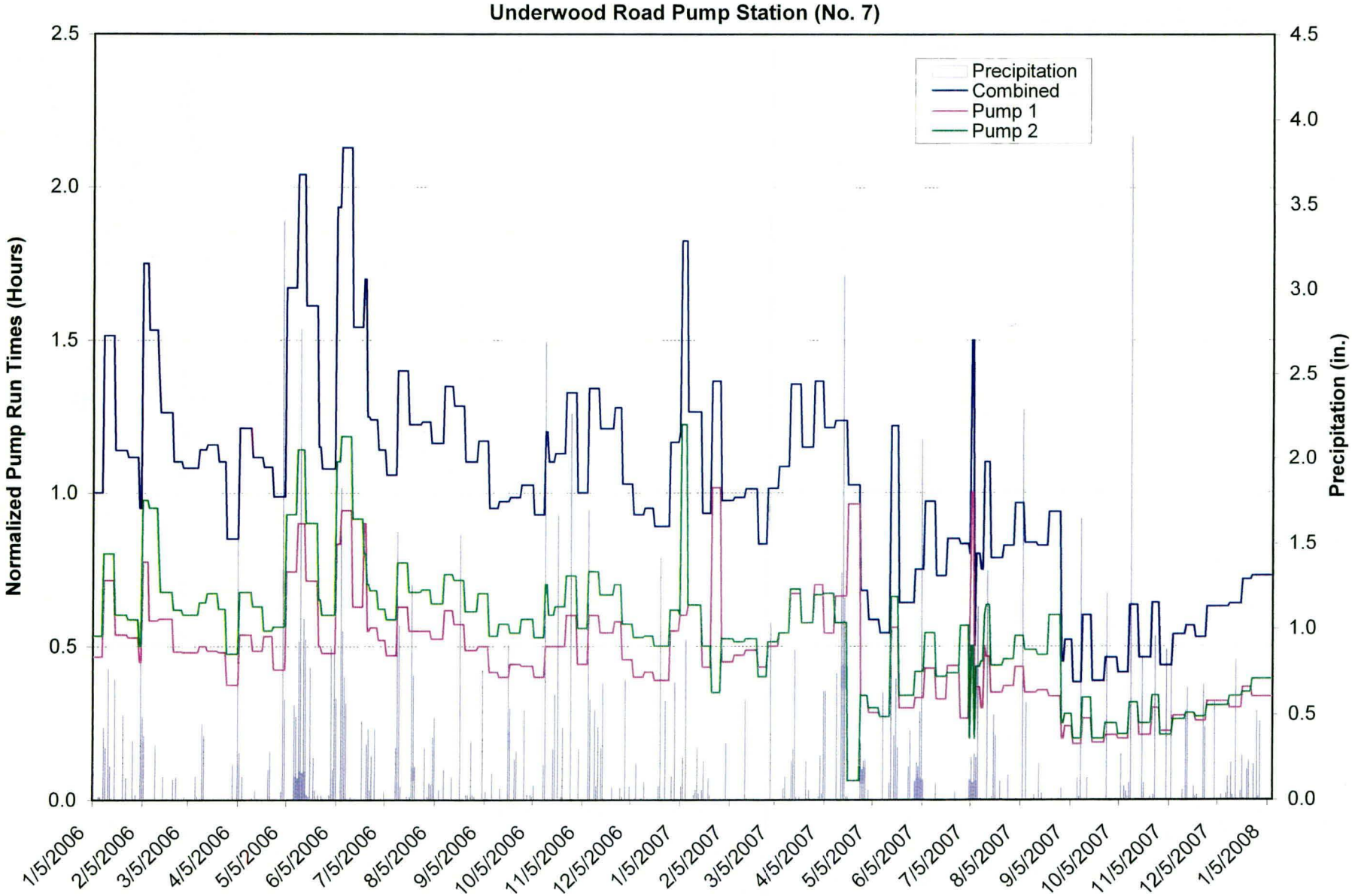
Town of Falmouth, Maine
Pump Station Assessment



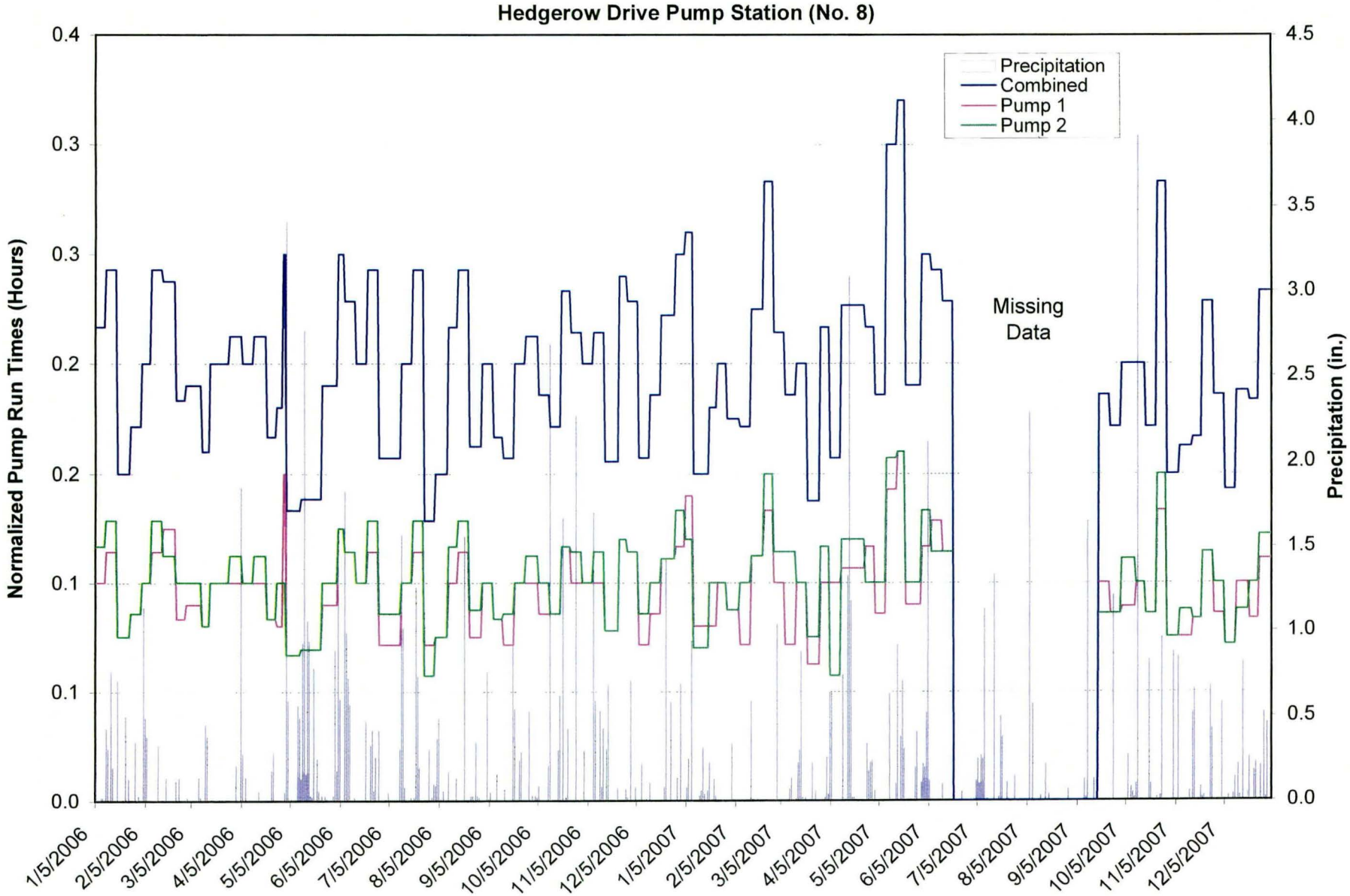
Town of Falmouth, Maine
Pump Station Assessment



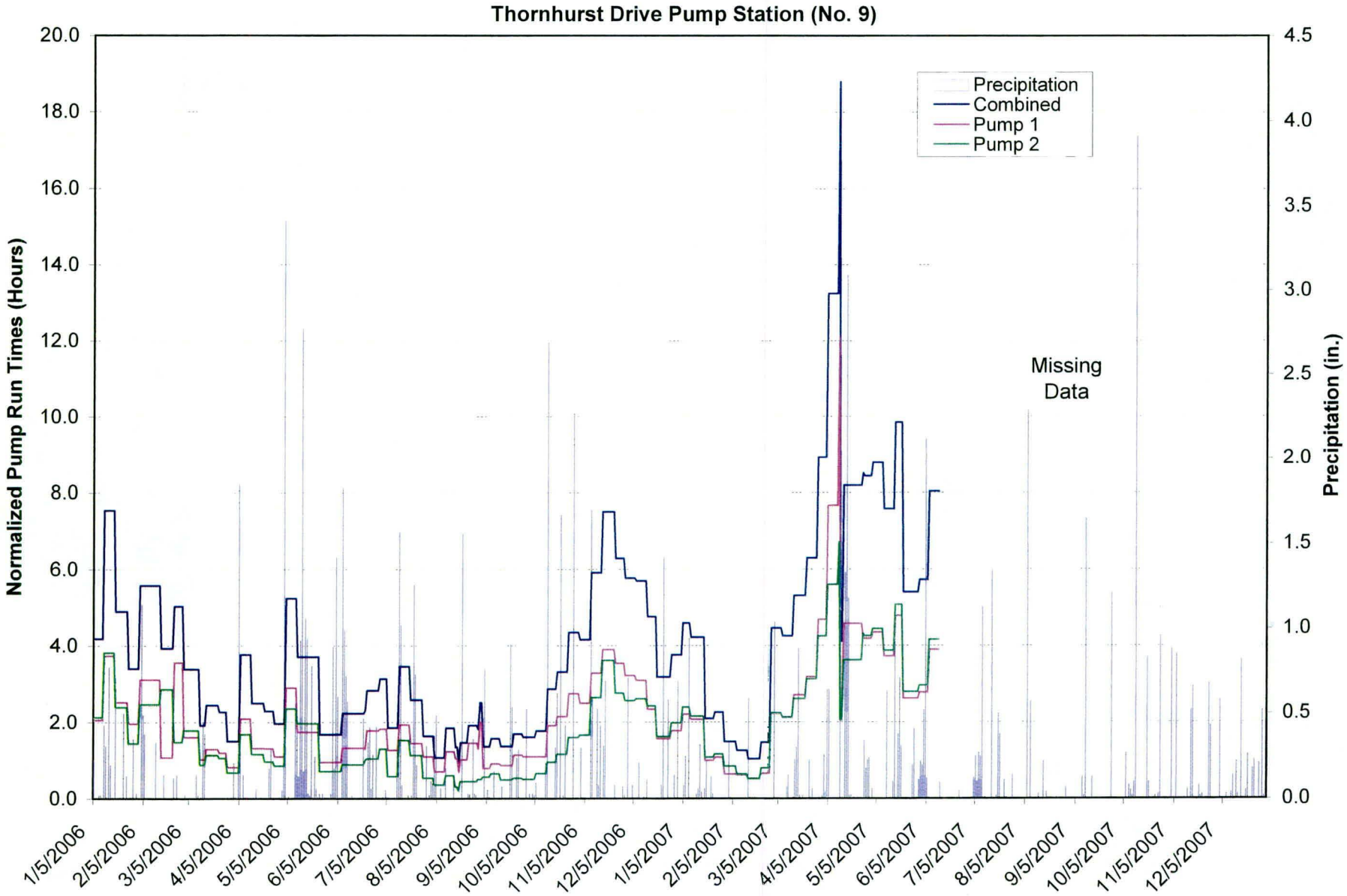
Town of Falmouth, Maine
Pump Station Assessment



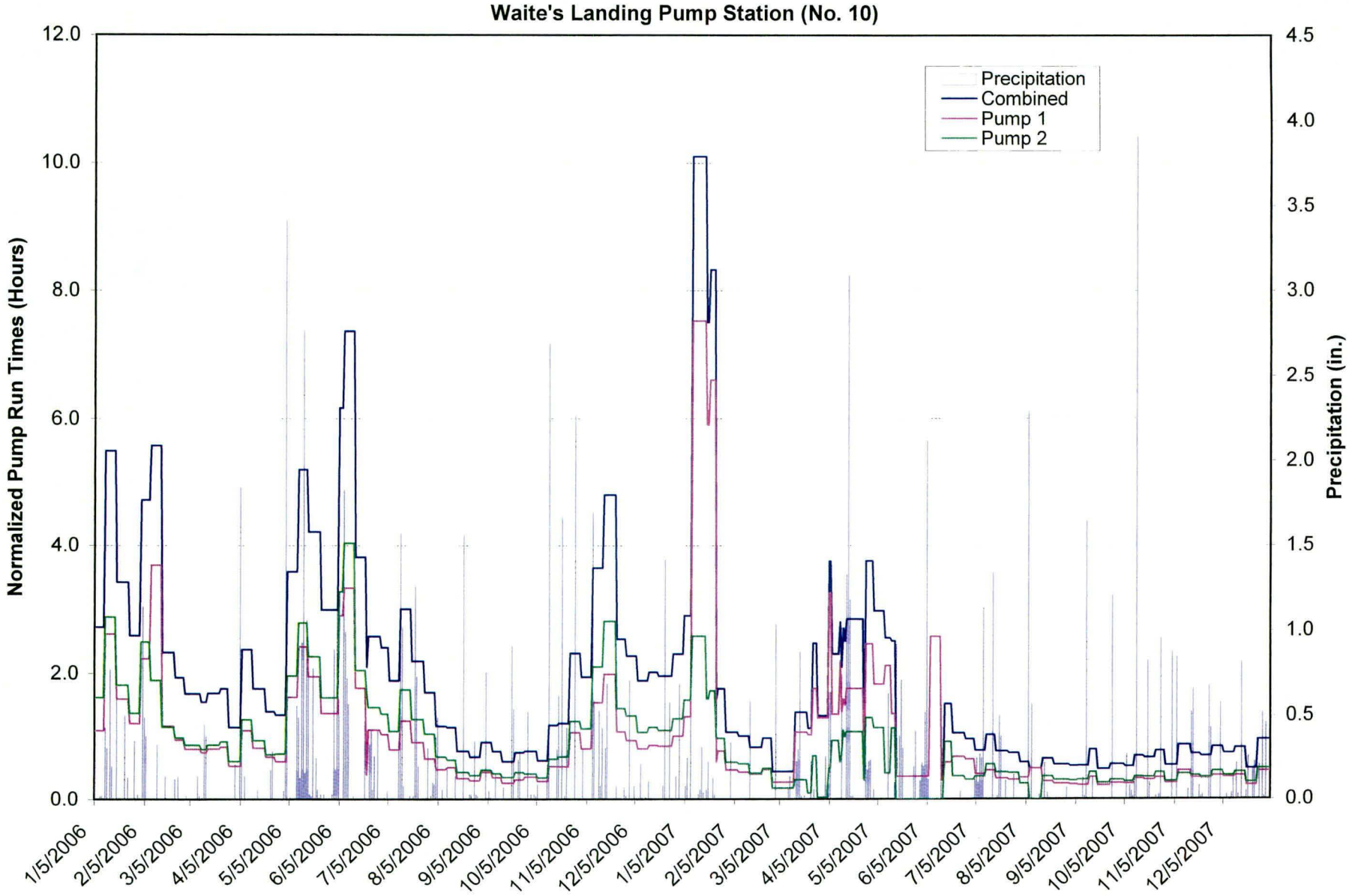
Town of Falmouth, Maine
Pump Station Assessment



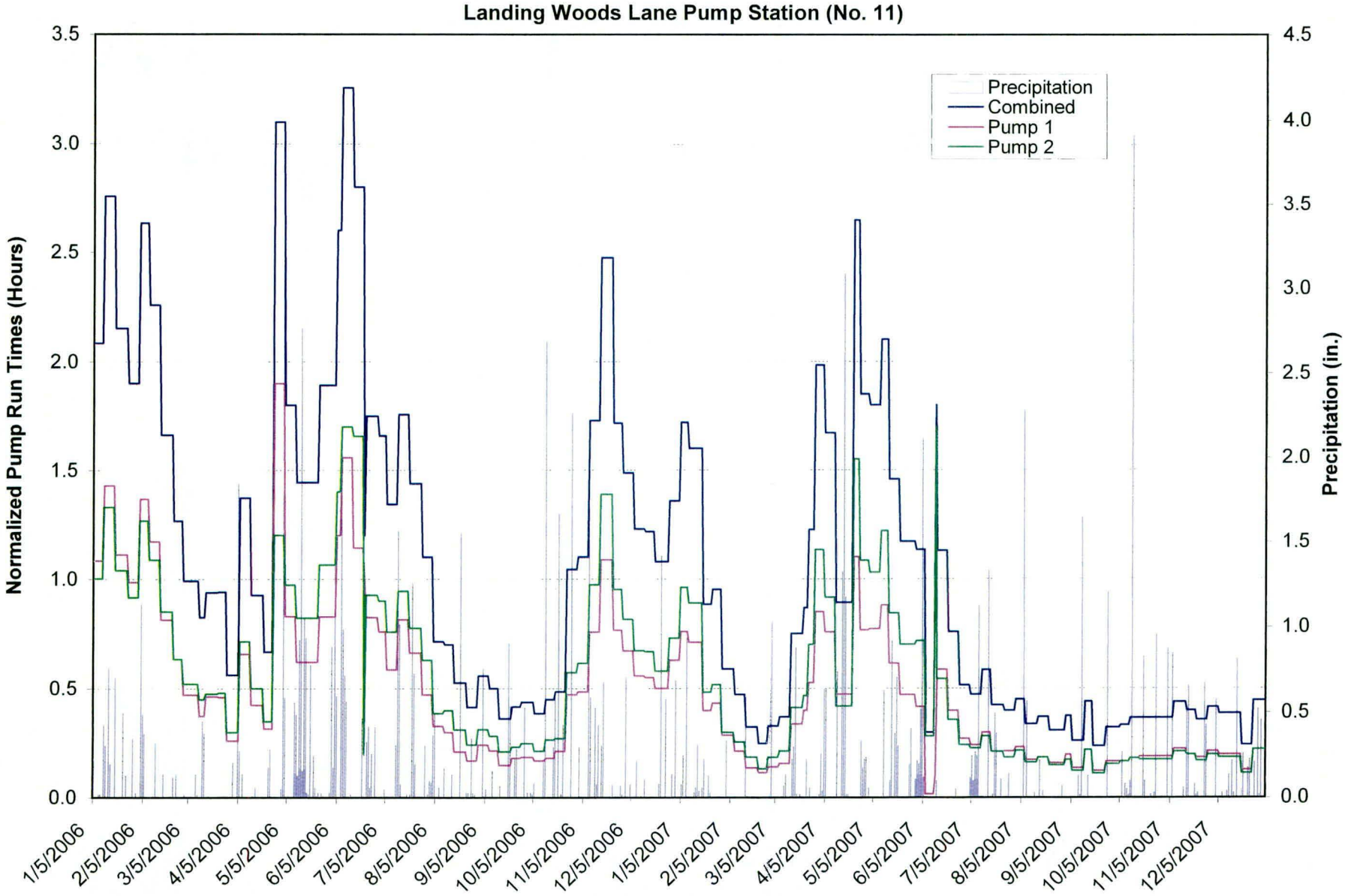
Town of Falmouth, Maine
Pump Station Assessment



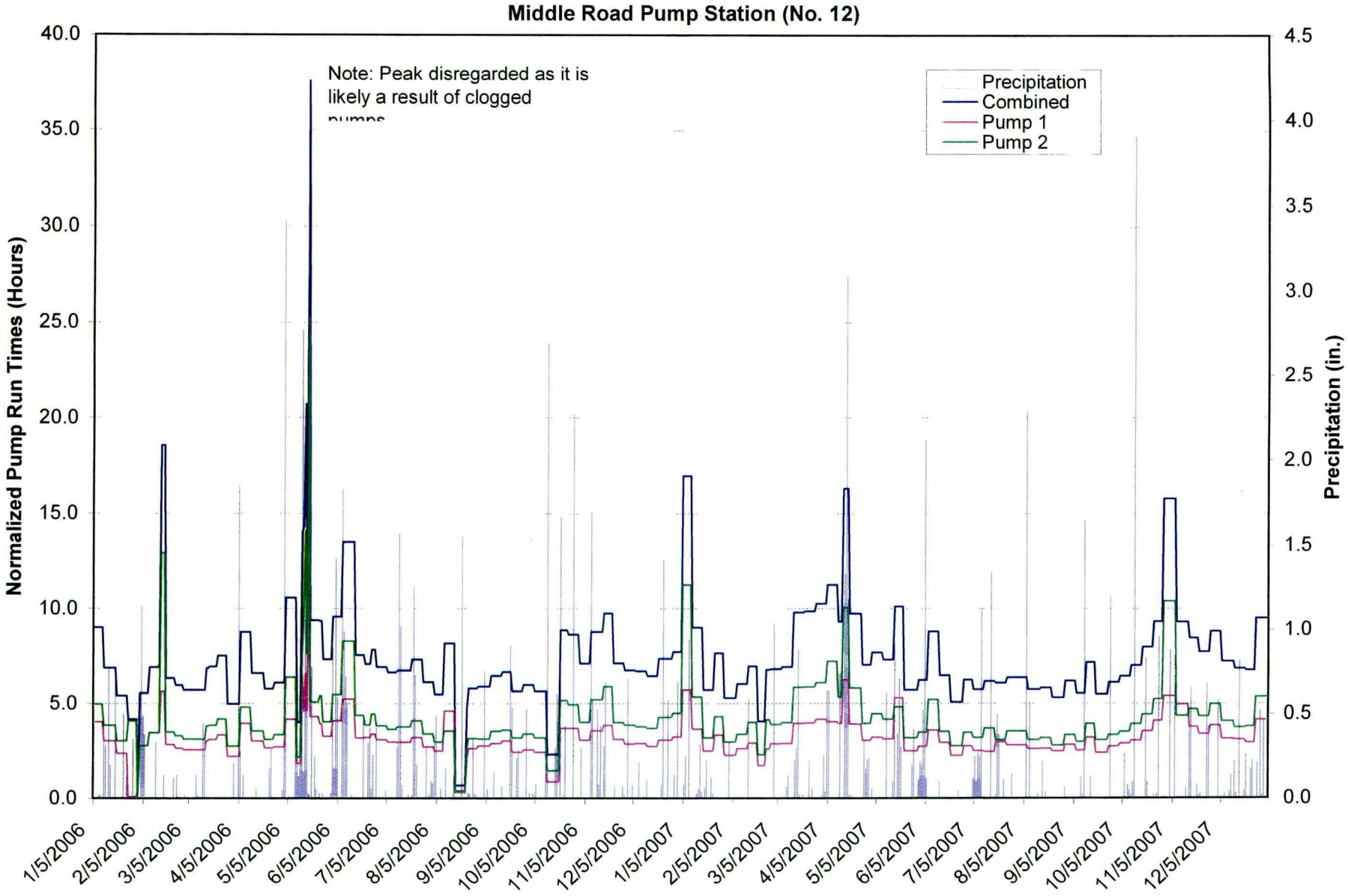
Town of Falmouth, Maine
Pump Station Assessment



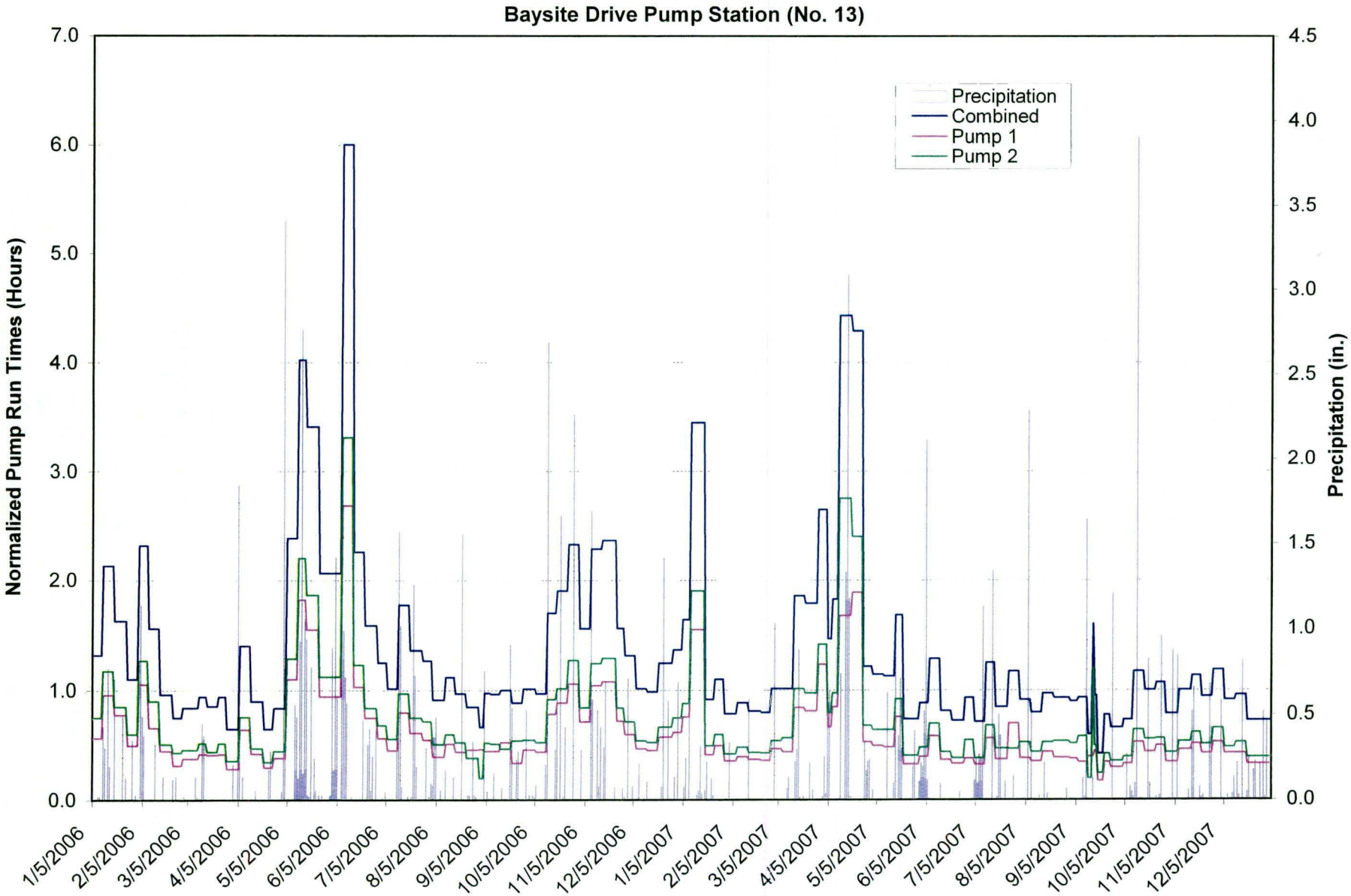
Town of Falmouth, Maine
Pump Station Assessment



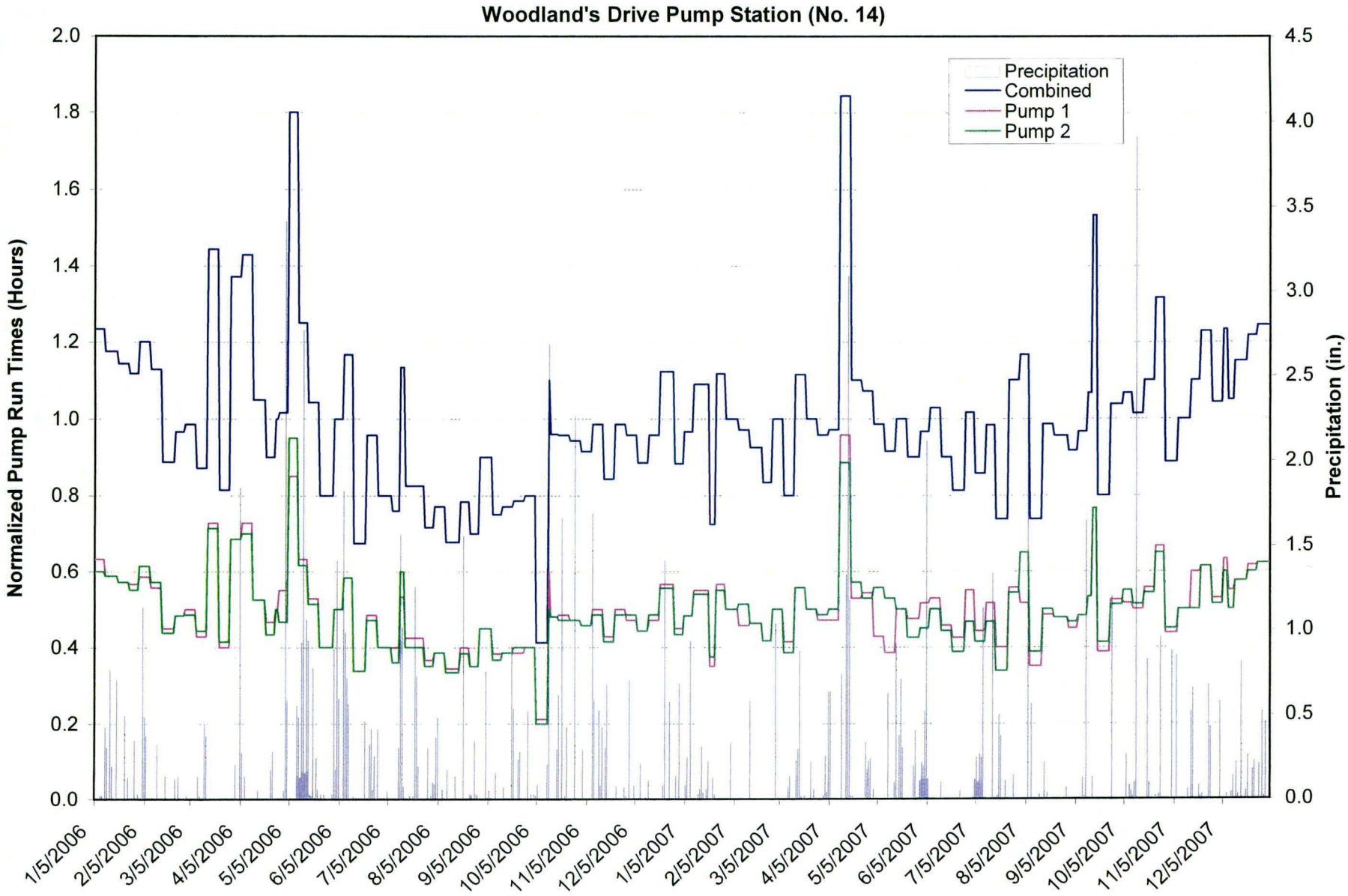
Town of Falmouth, Maine
Pump Station Assessment



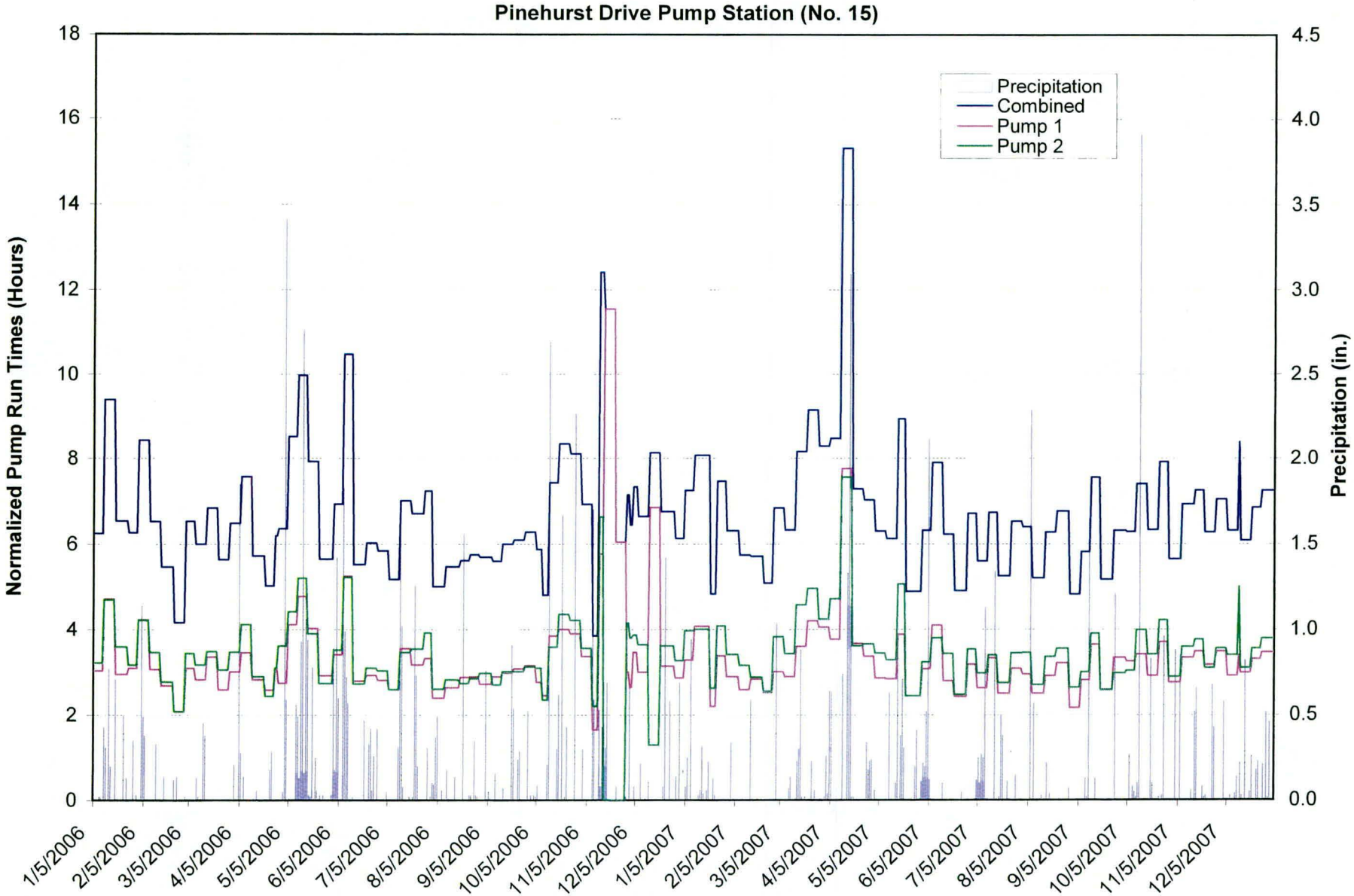
Town of Falmouth, Maine
Pump Station Assessment



Town of Falmouth, Maine
Pump Station Assessment



Town of Falmouth, Maine
Pump Station Assessment



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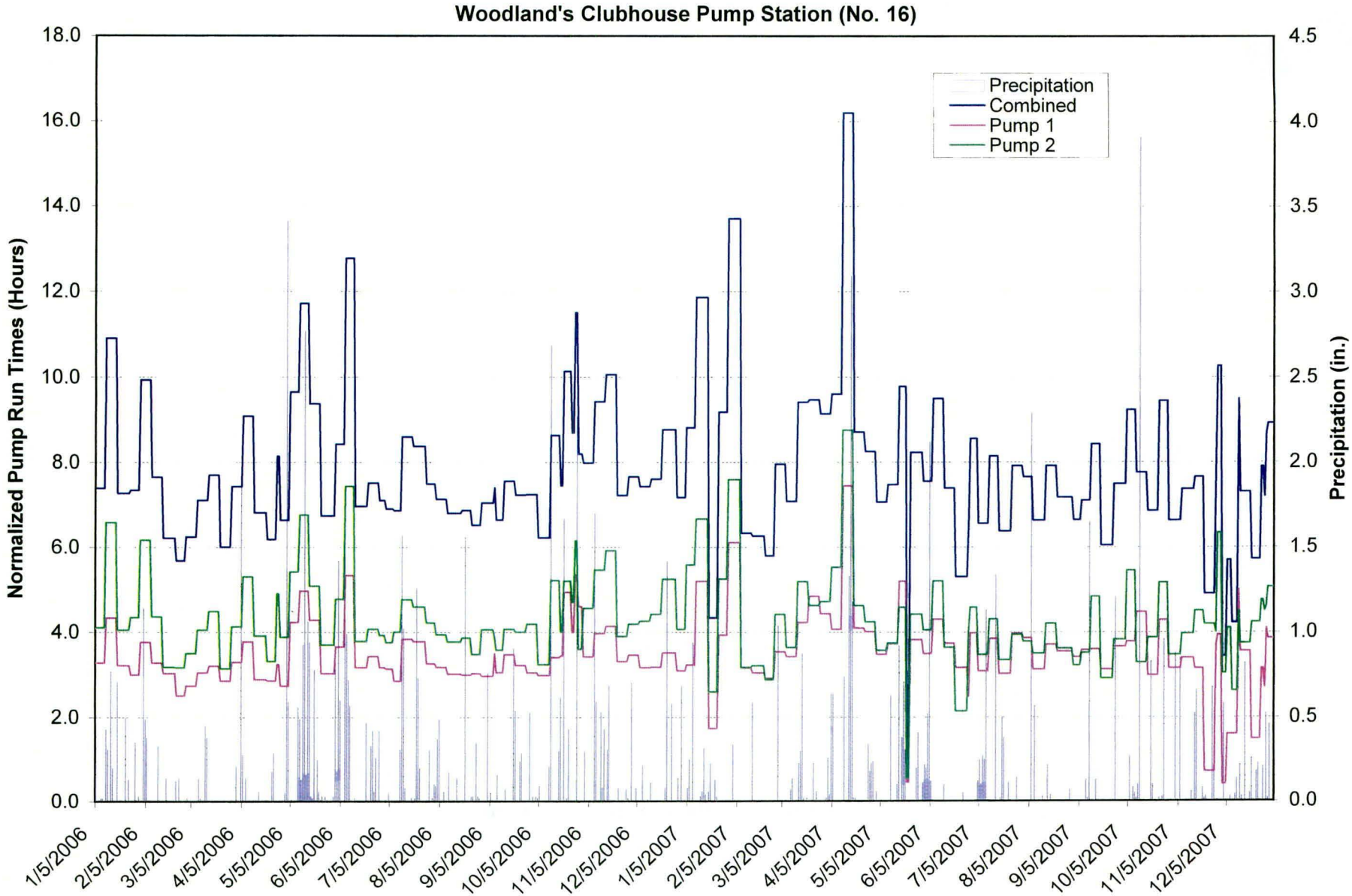
Pump Station Assessment



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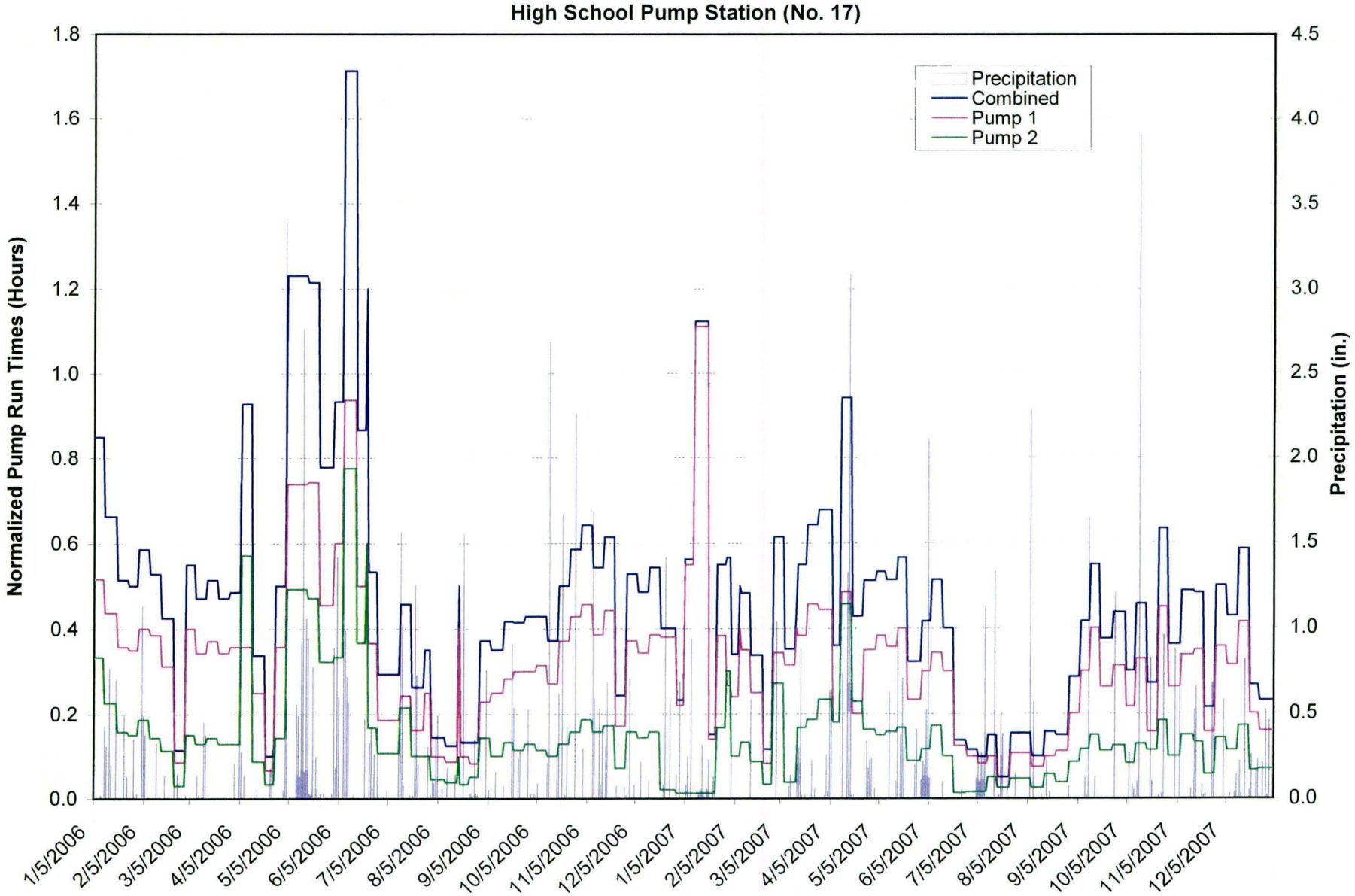

Town of Falmouth, Maine
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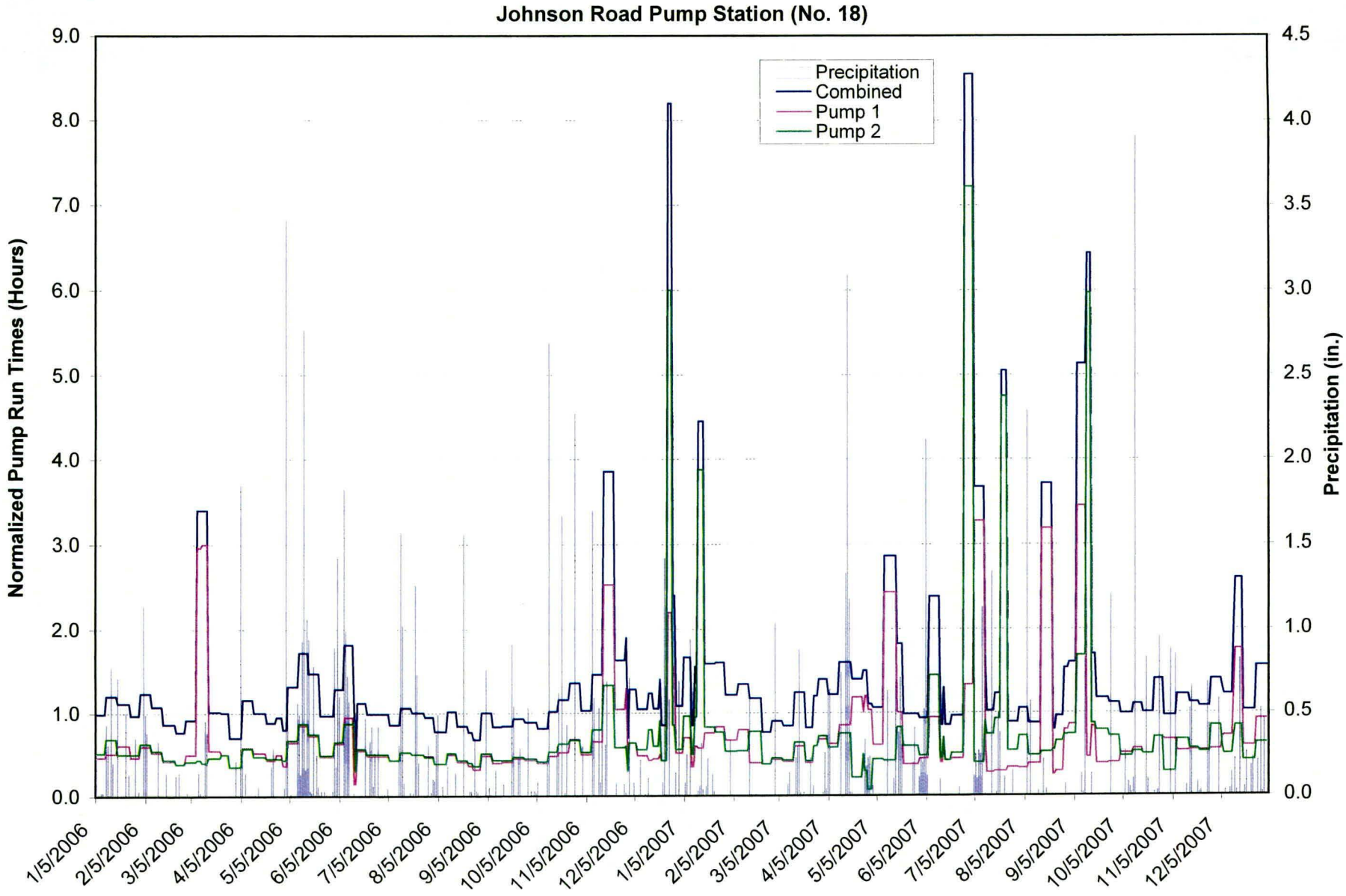

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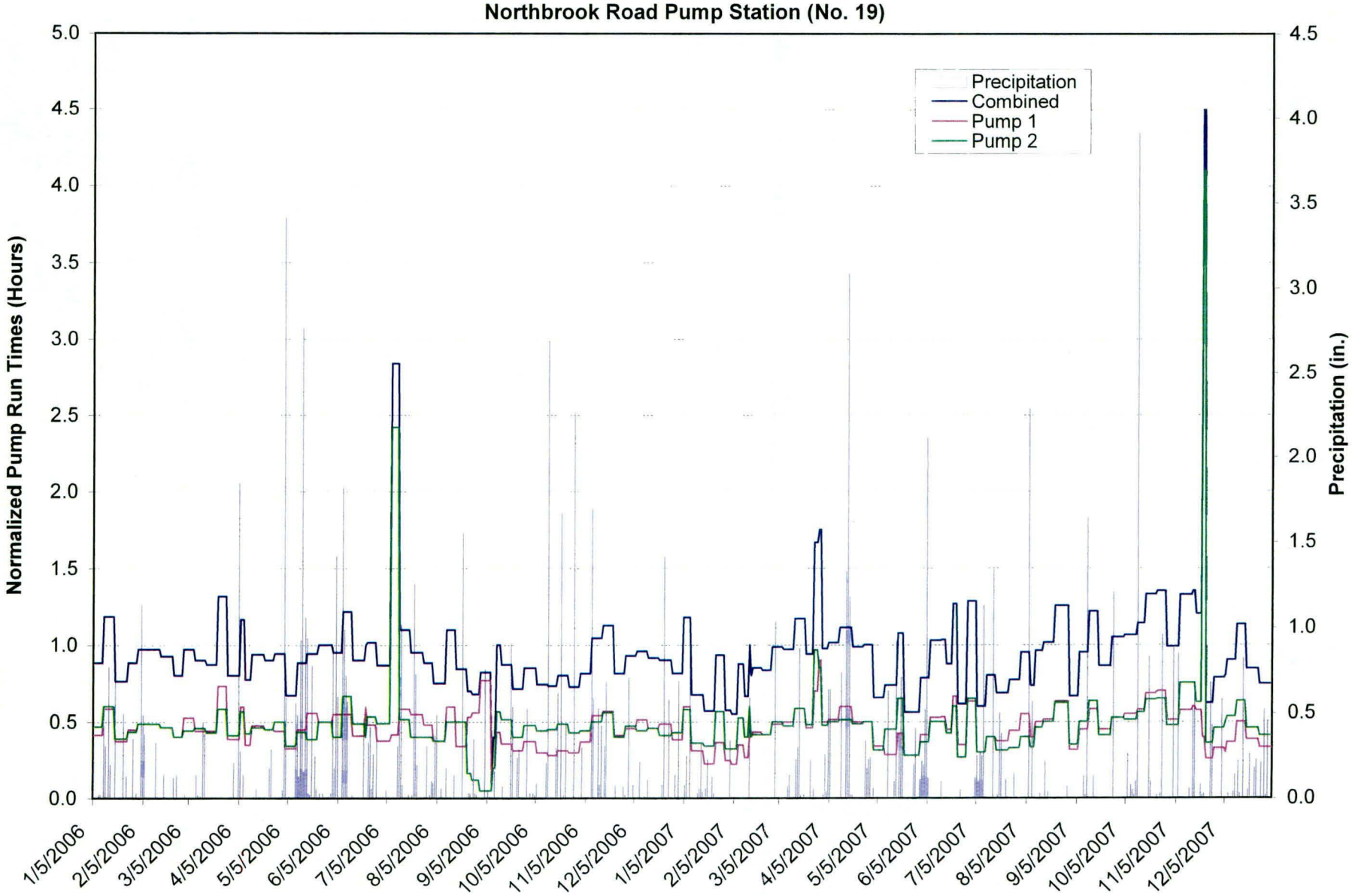

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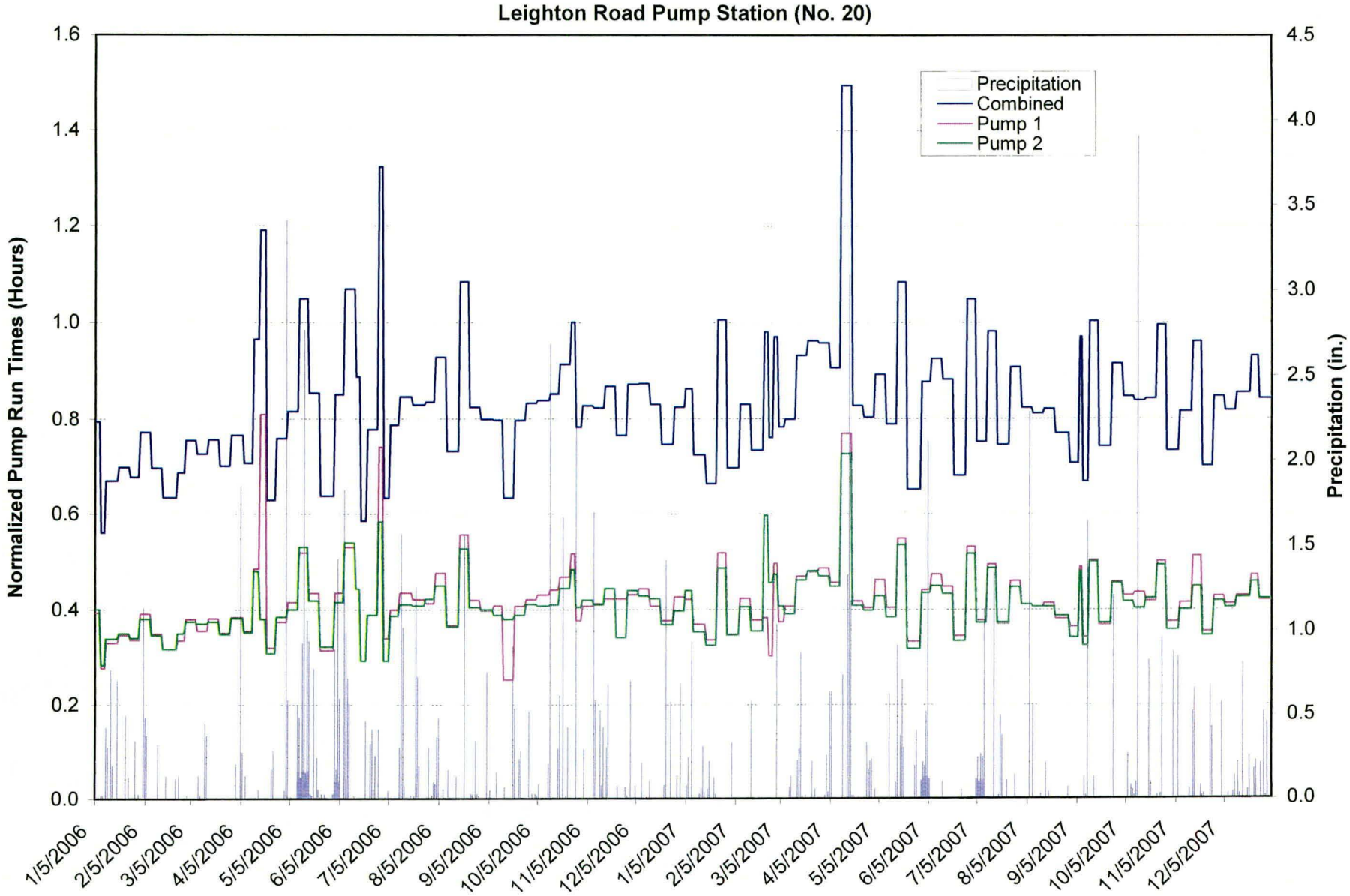
Pump Station Assessment



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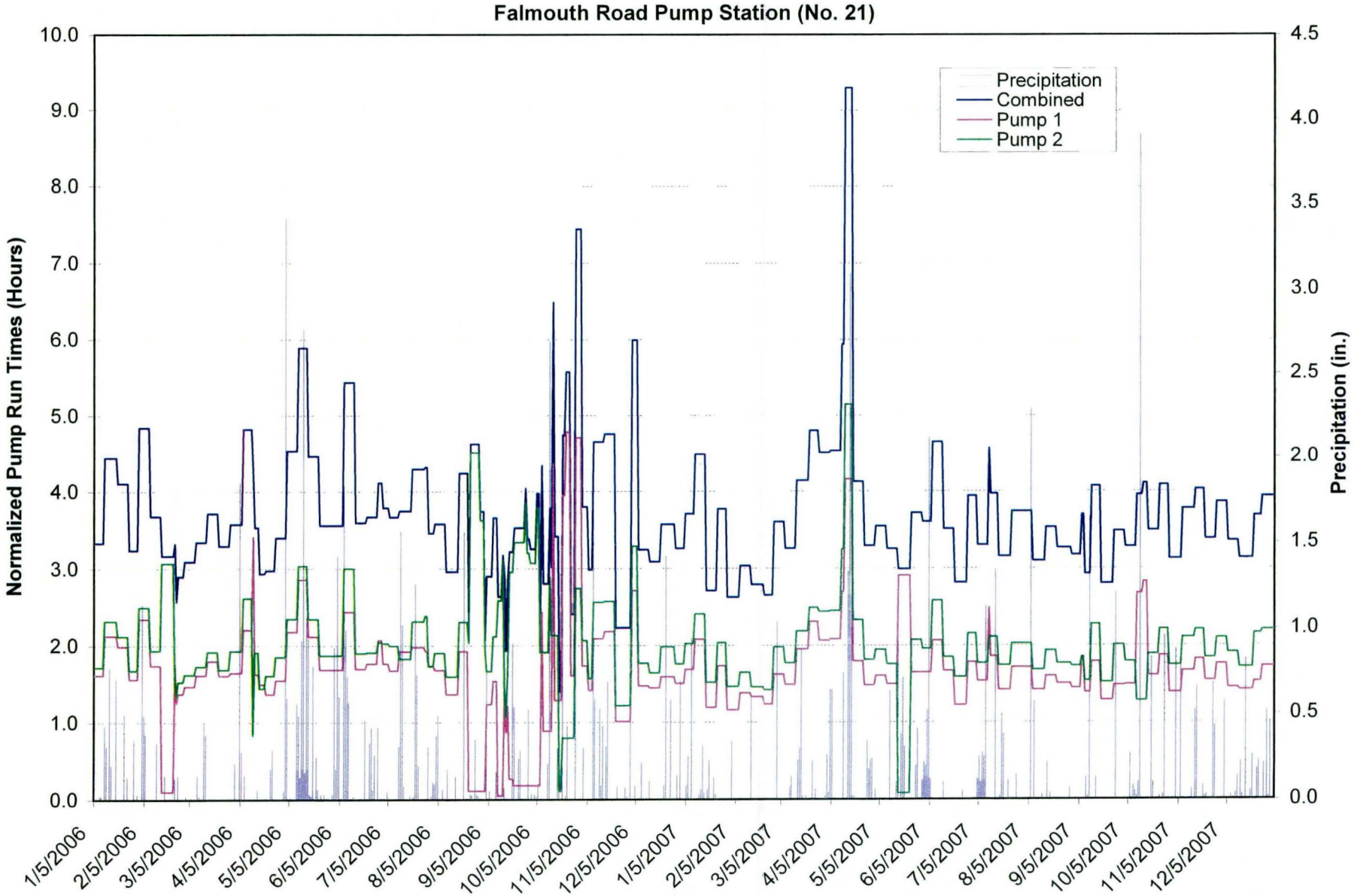
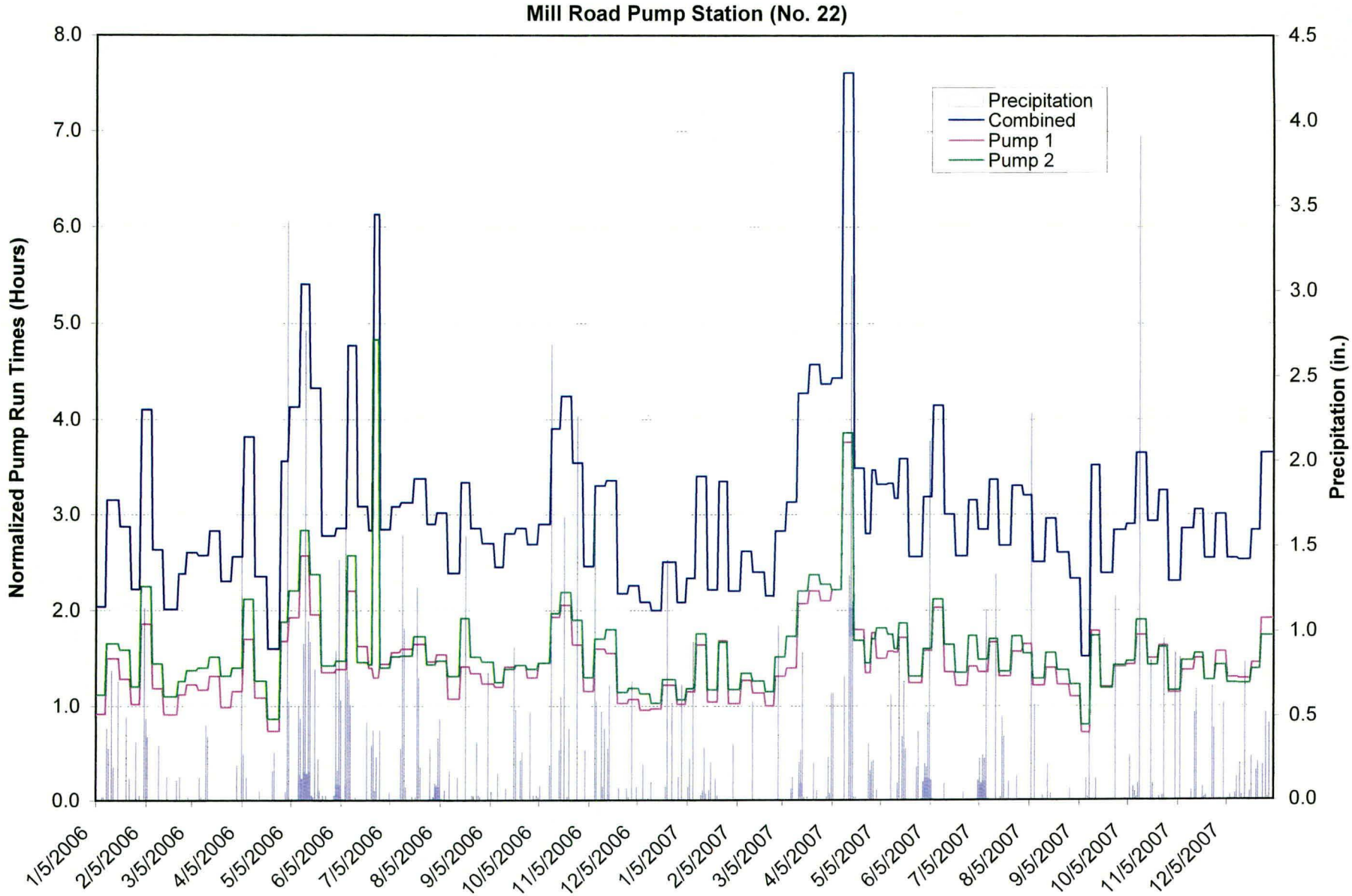
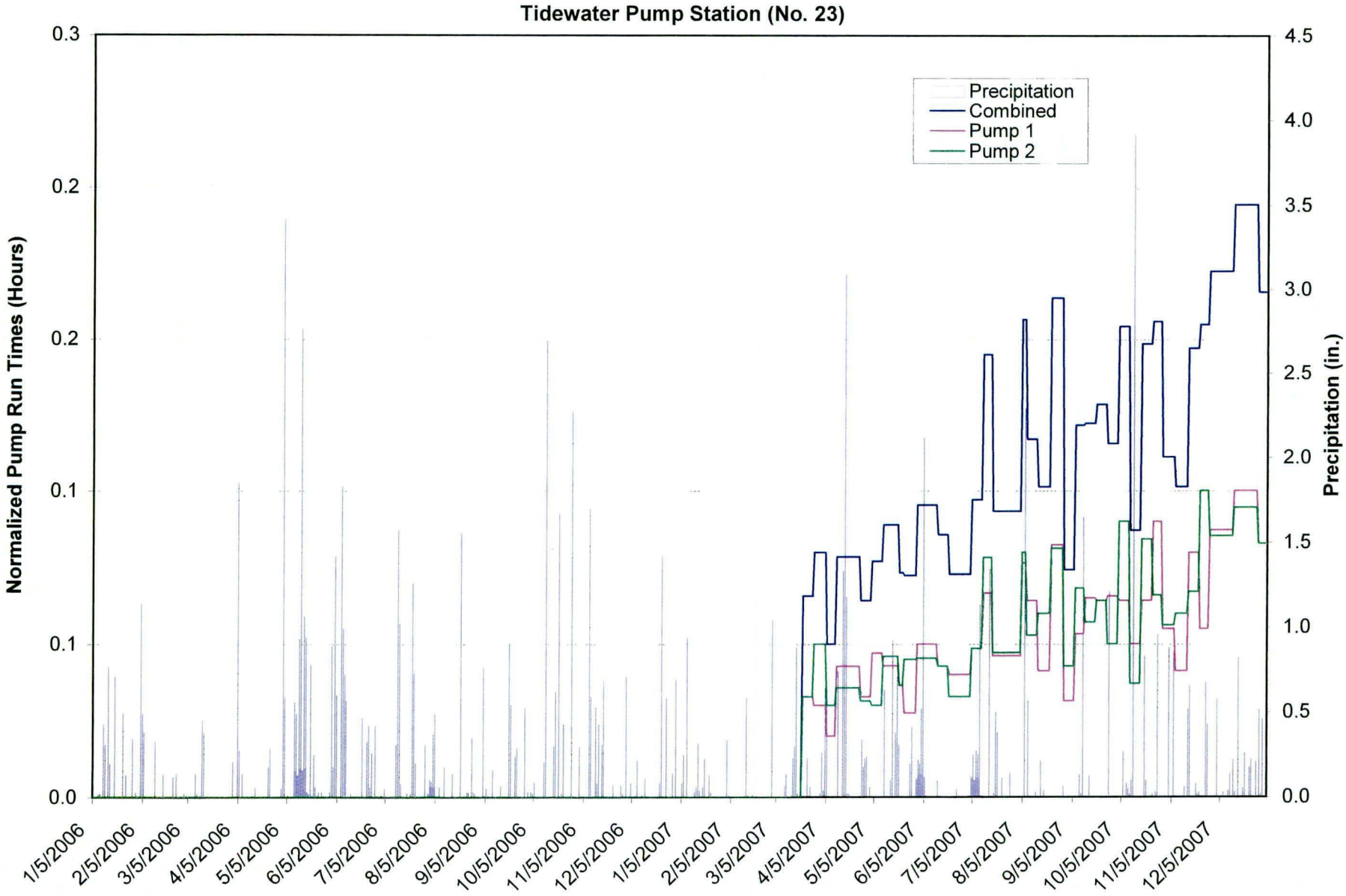
Pump Station Assessment



Town of Falmouth, Maine
Pump Station Assessment



Town of Falmouth, Maine
Pump Station Assessment



WRIGHT-PIERCE
Engineering a Better Environment

MEMORANDUM

TO:	File	DATE:	April 15, 2009 REV June 15, 2009
FROM:	Chris Dwinal, Kattie Collins	PROJECT NO.:	11371A
SUBJECT:	Evaluation of West Falmouth Pumping System Pump Station Assessment		

Since the late 1980's, wastewater pumping and collection systems in West Falmouth have been designed and constructed by private developers as needed to serve their specific development, with little or no consideration for serving future development in West Falmouth. Following construction, these pump stations were turned over to the Town for operations and maintenance. As a result, the system has been constructed as a large "daisy-chain" (i.e. station A pumps to station B which pumps to station C, etc.) as sewer was extended farther and farther into West Falmouth. Although this method tends to be the least expensive and most direct method for sewer expansion initially, it can quickly become expensive when growth occurs. For example, take the case where station A (100 gpm station) pumps to station B (125 gpm station) which pumps to station C (140 gpm station). If station A is upgraded to 200 gpm to serve new development, stations B and C will also require a capacity upgrade because they are downstream of the new, larger 200 gpm station. The question then becomes, who is responsible for the costs associated with the upgrades? Should the developer of a new residential subdivision be required to upgrade three pump stations before they can tie in? Is the Town's responsibility to spread the burden of upgrade across the entire sewer user base?

Unfortunately, this type of problem is not uncommon for many communities in Maine and throughout New England. Sewers were extended and pump stations were built on demand with little or inadequate long-term planning to consider future growth and the potential implications on sizing and location. Because of the lack of long-term sewer planning for West Falmouth, 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. A quick review of the system schematic included below clearly shows some of the limitations.

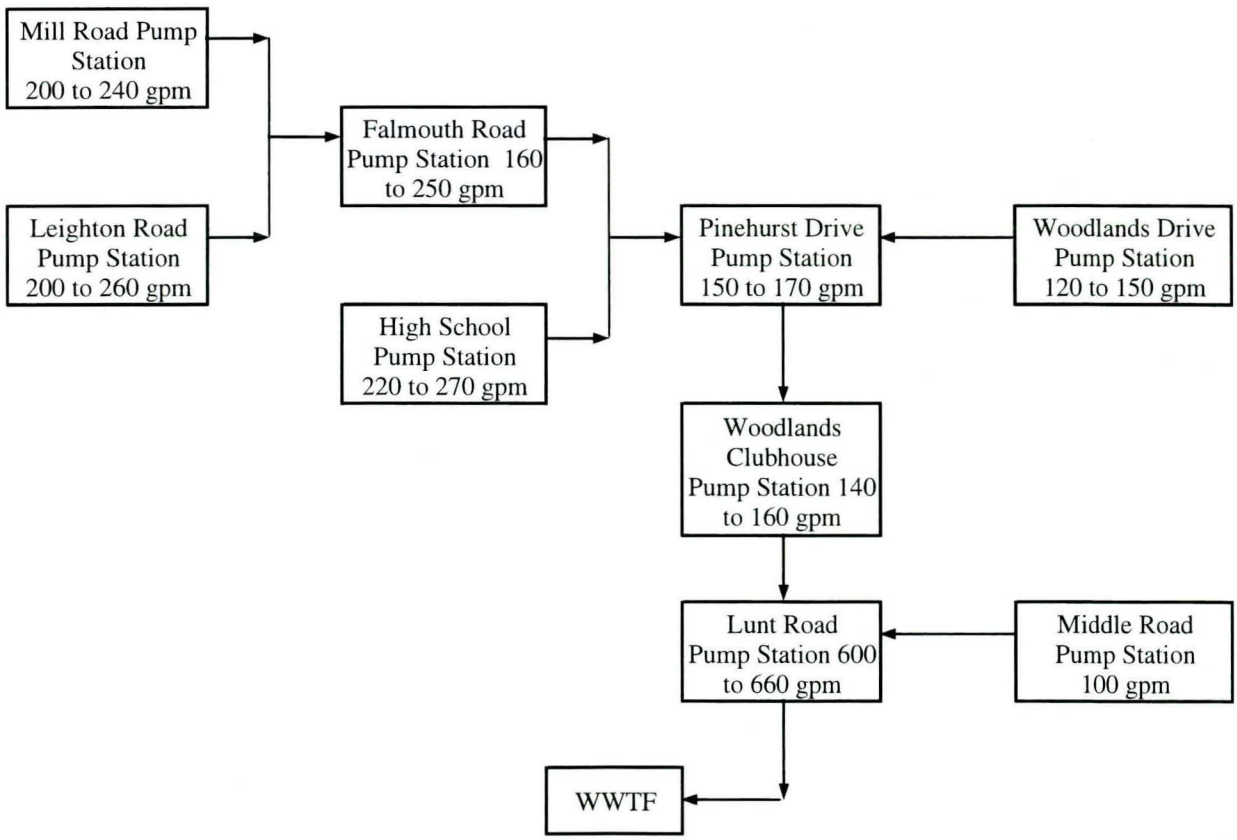
Prior to adding any new sewer users to the collection system, we strongly recommend that the Town develop a sewer master plan that will allow the Town to dictate how future developments in West Falmouth will be sewered. Sewer master plans take natural drainage areas and the development potential within these drainage areas into account when determining where pump stations should be located and how large they should be. East Falmouth (the oldest portion of the collection system) is a good example of how a collection system should be planned. Rather than the "daisy-chain" layout, there are two larger pump stations (Mill Creek and Clearwater) that

collect flow from smaller pump stations and gravity sewers and pump flow directly to the WWTF. In this system, there are fewer pump stations that could potentially be affected by the addition of flows.

In the interim, for planning purposes only, we have completed a preliminary evaluation of the existing pump stations in West Falmouth and the main interceptor between Woodlands Clubhouse Pump Station and Lunt Road Pump Station. Below you will find a description of the system, a discussion of limitations in the system, and preliminary costs associated with some of the major upgrades that will likely be needed.

System Description

A schematic of the West Falmouth wastewater pumping system along with current station pumping capacities is shown below.



The West Falmouth wastewater collection system was developed from east to west as follows:

- Lunt Road Pump Station - 1971 (upgraded in 2006)
- Middle Road Pump Station - 1981
- Woodland Drive, Pinehurst and Woodlands Clubhouse Pump Stations - 1987
- High School Pump Station - 1989
- Falmouth Road and Leighton Road Pump Stations - 1998
- Mill Road Pump Station - 2002

System Limitations

From the schematic diagram above, it is relatively apparent where there could be possible future capacity limitations as follows:

- If the Mill Road and Leighton Road Pump Stations were to ever receive flows equal to their design capacities and were to pump concurrently, the Falmouth Road Pump Station would need to have a capacity of at least 400 to 500 gpm. Currently, the average peak day flow (flow to the station on a peak day averaged over 24 hours) to Falmouth Road Pump Station is approximately 90 gpm. The peak instantaneous flow to this station exceeds 90 gpm, but it is not possible to determine this flow without flow meters. For purposes of this discussion, we will assume that Falmouth Road Pump Station will not require a capacity upgrade at this time.
- If Falmouth Road, High School and Woodlands Drive Pump Stations were to ever receive flow equal to their current design capacity and were to pump concurrently, the Pinehurst Drive Pump Station would need to have a capacity of 500 to 700 gpm. Currently, the average peak day flow to Pinehurst Drive Pump Station is 100 gpm.
- Since the Woodlands Clubhouse Pump Station is just downstream from Pinehurst Drive Pump Station, any upgrade to Pinehurst Drive Pump Station would require a similar, albeit slightly larger upgrade at the Woodlands Clubhouse Pump Station. Another option would be to reroute the Pinehurst Drive Pump Station force main around Woodlands Clubhouse Pump Station.
- If Pinehurst Drive Pump Station is upgraded to 500 to 700 gpm and Middle Road Pump Station requires an upgrade to a capacity of approximately 200 gpm (approximation based on potential future growth noted by Town), the Lunt Road Pump Station would require an upgrade to 700 to 900 gpm.
- Although we do not have a comprehensive understanding of all potential future growth in West Falmouth at this time, the Town has noted an additional 30 to 60 acres of undeveloped property that, if developed and sewered, could flow to Mill Road and Leighton Road Pump Stations. Even though these pump stations have the additional capacity, downstream stations such as Pinehurst Drive and Woodlands Clubhouse likely do not.

In addition, the following restrictions currently apply to the West Falmouth collection system and pump stations:

- Falmouth Road and High School Pump Stations pump via a partially shared six-inch diameter force main that discharges to Pinehurst Drive Pump Station. The stations are not allowed to run concurrently as Pinehurst Drive is not capable of handling the combined flows.
- Mill Road and Leighton Road Pump Station pump via a partially shared six-inch diameter force main that discharges to Falmouth Road Pump Station. These stations are allowed to pump concurrently.
- Pinehurst Drive Pump Station currently has a four-inch diameter force main which will limit any capacity increases at the station to around 200-250 gpm (force main velocity of about five to six feet per second).
- In addition to the potential restrictions at the pump stations, the 12-inch diameter section of the West Falmouth interceptor that travels over the Maine Turnpike Spur is known to surcharge whenever Woodlands Drive Pump Station operates. Based on conversations with the Town, it is thought that this section of pipe has at least a portion of negatively sloped pipe; however actual invert elevations of this line in relation to the rest of the interceptor are unknown at this time. (Refer to the Section 4 for more information on the West Falmouth interceptor.)

Preliminary Costs

All of the above noted capacity upgrades are speculative at this time and depend largely on future development trends in West Falmouth. Suffice to say, Pinehurst Drive and Woodlands Clubhouse are currently the limiting pump stations in West Falmouth. As currently configured, any upgrade to Pinehurst Drive would require a slightly larger upgrade to Woodlands Clubhouse and the West Falmouth Interceptor.

Without additional information about possible future development trends in West Falmouth, it is difficult to determine how large these two pump stations would need to be at this time. Given the large size of the High School Pump Station (as compared with its current flow), a reduction in capacity of this pump station could be considered. This, along with an upgrade to Pinehurst Drive Pump Station, would allow Falmouth Road and High School Pump Stations to operate concurrently. If the High School Pump Station is reduced in capacity to 175 gpm (station could be smaller, but 175 gpm maintains sufficient velocity in the 6-inch force main), an upgrade to Pinehurst Drive Pump Station to approximately 600 gpm could be justified.

The estimated cost to upgrade the Pinehurst Drive Pump Station to 600 gpm and the force main to the Woodlands Clubhouse Pump Station to 6-inches is $500,000. A similar upgrade to the Woodlands Clubhouse Pump Station would be approximately $400,000. Given the distance that

the force main from Pinehurst would need to be extended to bypass Woodland Clubhouse, it could cost $200,000 or more to extend this force main. Further investigation into the feasibility of routing the Pinehurst Drive force main around Woodlands Clubhouse Pump Station would be required.

WRIGHT-PIERCE
Engineering a Better Environment

MEMORANDUM

TO: File

DATE: January 26, 2009
REV: March 5, 2009

FROM: CAD/KMC

PROJECT NO.: 11371A

SUBJECT: Interceptor Modeling - Flow Assumptions
Pump Station Assessment

The table below summarizes the assumed flows (in addition to inflow and infiltration flows) used to model select interceptor sewers within the Town of Falmouth, Maine using Hydraflow Storm Sewers 8.0. In addition, the assumed starting HGL invert listed as well. The pump station flows are based on the worst case condition of either original design capacity or existing capacity based on recent capacity evaluation. Manhole numbers reference the numbers used on the record drawings for each interceptor.

The following assumptions regarding inflow and infiltration (I/I) were utilized:

- I/I Flow Rate: Pre-1970 Sewers - 8,000 gpd/in.-mi.
  1980s Sewers - 5,000 gpd/in-mi.
  Post 1990 Sewers - 1,000 gpd/in.-mi.
- The I/I flows were added at the upstream manhole of each pipe section.
- I/I calculations do not take into account I/I coming from side streets.

ASSUMED INTERCEPTOR FLOWS

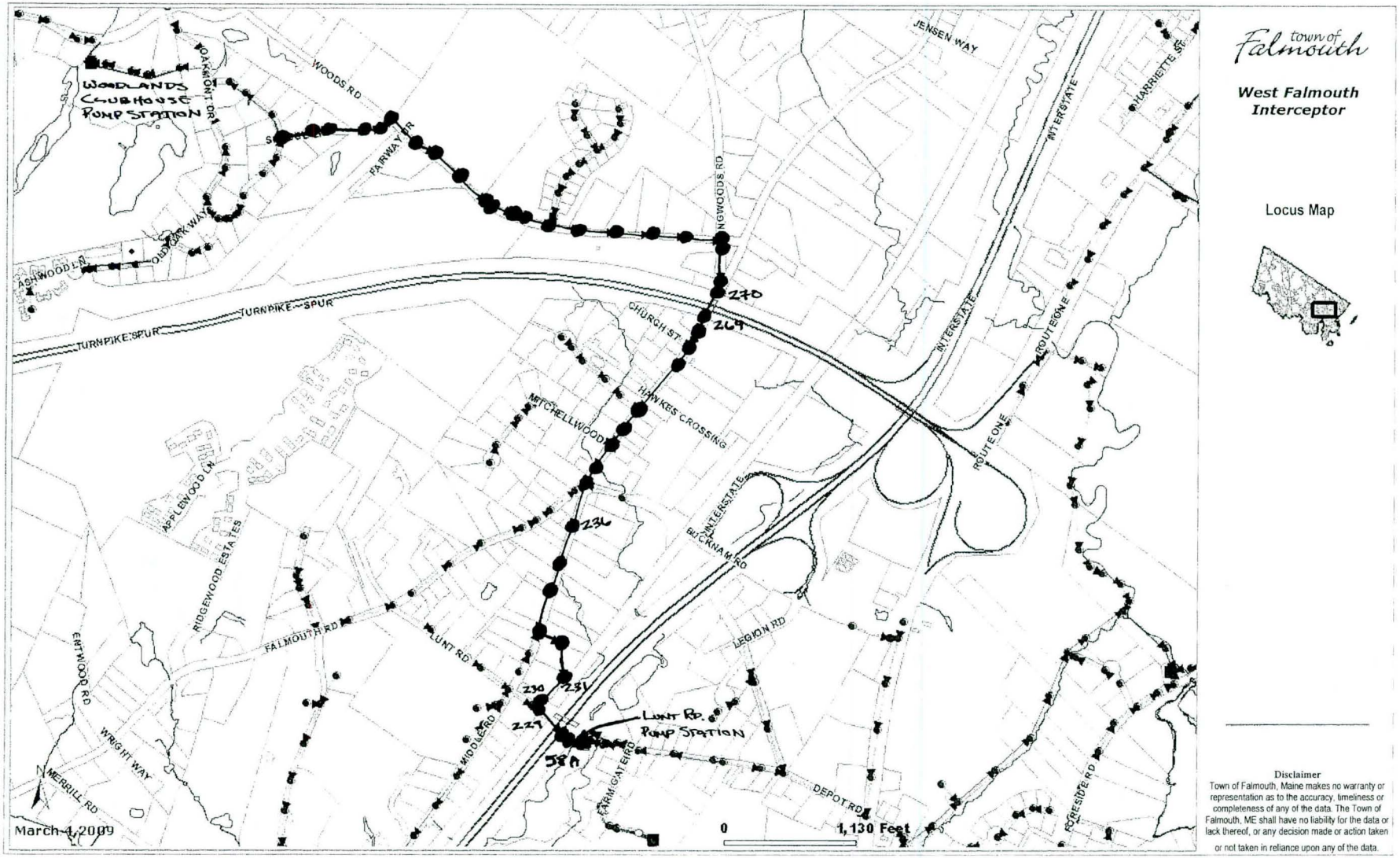
Interceptor	Source	Flows (CFS)	Flow to MH No.	Starting HGL Inv
Rt. 88				Future pump on elevation (0.50)
	From Cumberland[2]	2.77	102	
	Hedgerow Drive PS	0.25	101	
	Private Homes (10)[3]	0.02	101	
	Baysite Drive PS	0.24	100	
	Private Homes (15)[3]	0.03	99	
	Private Homes (30)[3]	0.07	98	
	Private Homes (15)[3]	0.03	97	
	Private Homes (40)[3]	0.09	97	
	Private Homes (20)[3]	0.04	90	
	Private Homes (75)[3]	0.17	88	
	Private Homes (20)[3]	0.04	87	
	Handy Boat PS	1.19	86	

Interceptor	Source	Flows (CFS)	Flow to MH No.	Starting HGL Inv
Rt. 88 (con't.)	Private Homes (15)[3]	0.03	82	
	Private Homes (10)[3]	0.02	76	
Foreside				See Note 1
	Underwood Road PS	0.31	135	
	Private Homes (10)[3]	0.02	134	
	Private Homes (15)[3]	0.03	132	
	Private Homes (15)[3]	0.03	131	
	Private Homes (20)[3]	0.04	125	
	Private Homes (10)[3]	0.02	121	
	Private Homes (10)[3]	0.02	120	
	Private Homes (15)[3]	0.03	119	
	Private Homes (10)[3]	0.02	117	
	Private Homes (20)[3]	0.04	112A	
	Private Homes (5)[3]	0.01	102	
Mackworth Point (Lower Rt. 1)				Pipe Crown
	Private Homes (15)[3]	0.03	17	
	Private Homes (20)[3]	0.04	19	
	Private Homes (20)[3]	0.04	20	
	Private Homes (30)[3]	0.07	21	
	Private Homes (30)[3]	0.07	22	
	Private Homes (15)[3]	0.03	23	
	Private Homes (25)[3]	0.06	25	
	Private Homes (25)[3]	0.06	26	
	Private Homes (30)[3]	0.07	28	
	Private Homes (110)[3]	0.25	29	
	Mackworth Island PS	0.45	29	
West Falmouth				Pump on elevation (12.25)
	Clubhouse PS	0.53	72	
	Private Homes (25)[3]	0.06	277	
	Private Homes (10)[3]	0.02	270	
	Private Homes (25)[3]	0.06	241	

Interceptor	Source	Flows (CFS)	Flow to MH No.	Starting HGL Inv
West Falmouth (cont.)	Police Station	0.01	238	
	Private Homes (40)[3]	0.09	238	
	Private Homes (10)[3]	0.02	233	
	Middle Road PS	0.26	229	
	Max. School Flow	0.28[4]	229	
Woodlands Club[5]	Pinehurst Lane PS	0.38	8	Max. water level of wet well/overflow tanks (127.3)
	Private Homes (10)[3]	0.02	6	
	Private Homes (5)[3]	0.01	5	
Exit 52	N/A	--	--	See Note 1
Middle Road	Private Homes (5)[3]	0.01	26	High water alarm (9.0)
	Private Homes (40)[3]	0.09	28	
	Private Homes (10)[3]	0.02	30	
	Private Homes (15)[3]	0.03	32	
	Private Homes (10)[3]	0.02	33	
	Private Homes (10)[3]	0.02	52B	
	Private Homes (35)[3]	0.07	52D	

Notes:

1. Assumed starting HGL elevation as the normal flow level of the pipe.
2. Cumberland owns 1.79 MGD of the total capacity for this interceptor. This value was used for modeling.
3. Assumed a peak flow of 1 gpm/home.
4. Assumption based on 1,000 students and faculty at 30 gpd per capita over an 8 hour day with a peaking factor of 2.
5. Additional capacity as noted will submerge the final section of pipe flowing into the wet well. This last section is well below the rest of the sewer line and does not appear to have any services flowing into it.


town of Falmouth
West Falmouth Interceptor
Locus Map
WOODLANDS CLUBHOUSE PUMP STATION
WOODS RD
FAIRWAY DR
OAKMONT DR
OLD OAK WAY
ASHWOOD LN
TURNPIKE SPUR
TURNPIKE SPUR
NGWOODS RD
JENSEN WAY
INTERSTATE
HARRIETTE ST
ROUTE ONE
ROUTE ONE
CHURCH ST
HAWKES CROSSING
MITCHELLWOOD
INTERSTATE
BUCKNAM RD
ASPLENWOOD LN
RIDGEWOOD ESTATES
FALMOUTH RD
LUNT RD
LEGION RD
EMTWOOD RD
WRIGHT WAY
MERRILL RD
MIDDLE RD
FARMGATE RD
DEPOT RD
FORESIDE RD
270
269
236
230
231
229
LUNT RD. PUMP STATION
38A
March 4, 2009
0
1,130 Feet
Disclaimer
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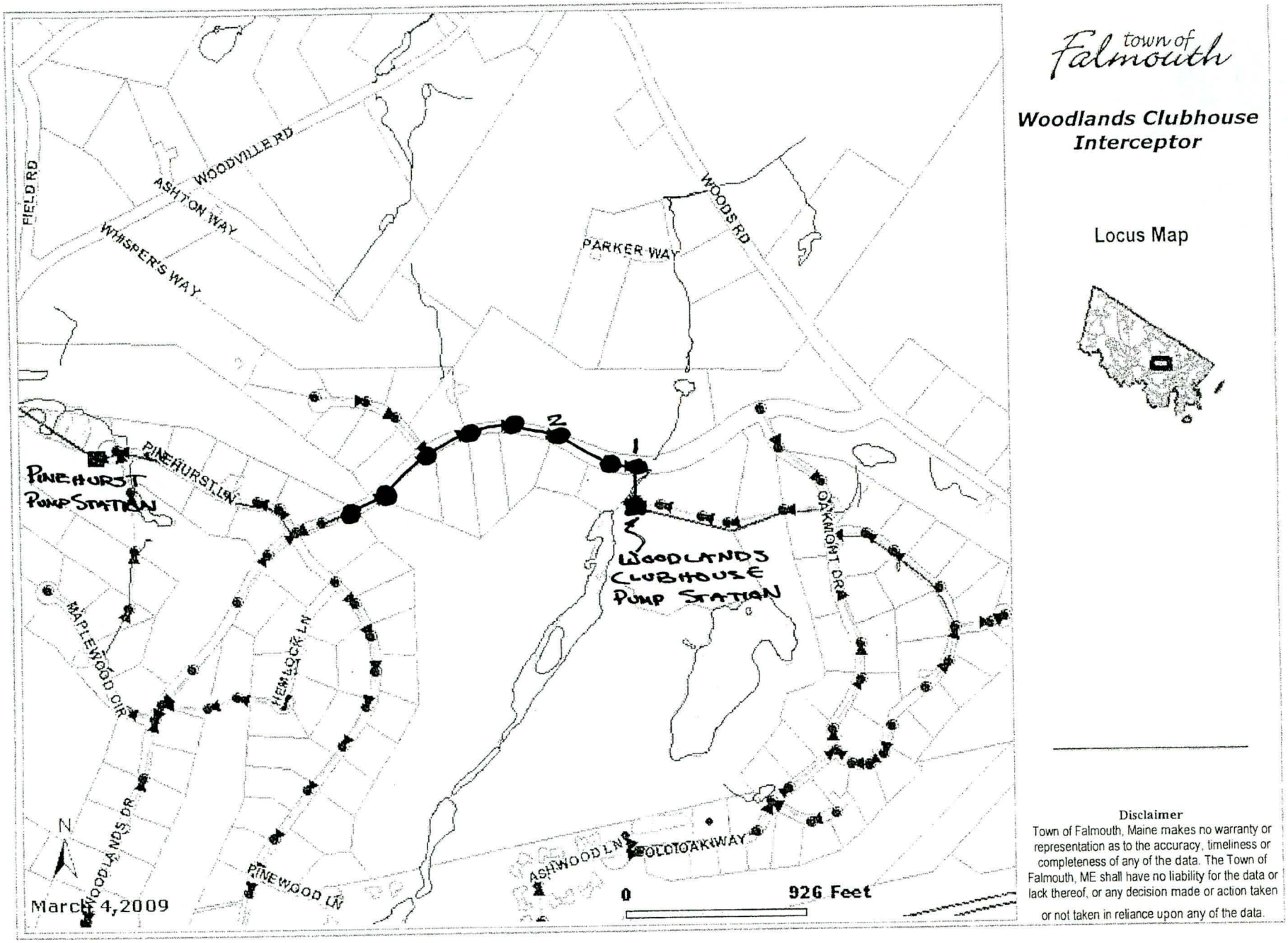
town of Falmouth
Woodlands Clubhouse Interceptor
Locus Map
FIELD RD
WOODVILLE RD
ASHTON WAY
WHISPER'S WAY
PARKER WAY
WOODS RD
PINEHURST LN
PINEHURST PUMP STATION
WOODLANDS CLUBHOUSE PUMP STATION
OAKMONT DR
MAPLEWOOD CIR
HEMLOCK LN
WOODLANDS DR
PINEWOOD LN
ASHWOOD LN
OLDTOAKWAY
1
2
N
March 4, 2009
0
926 Feet
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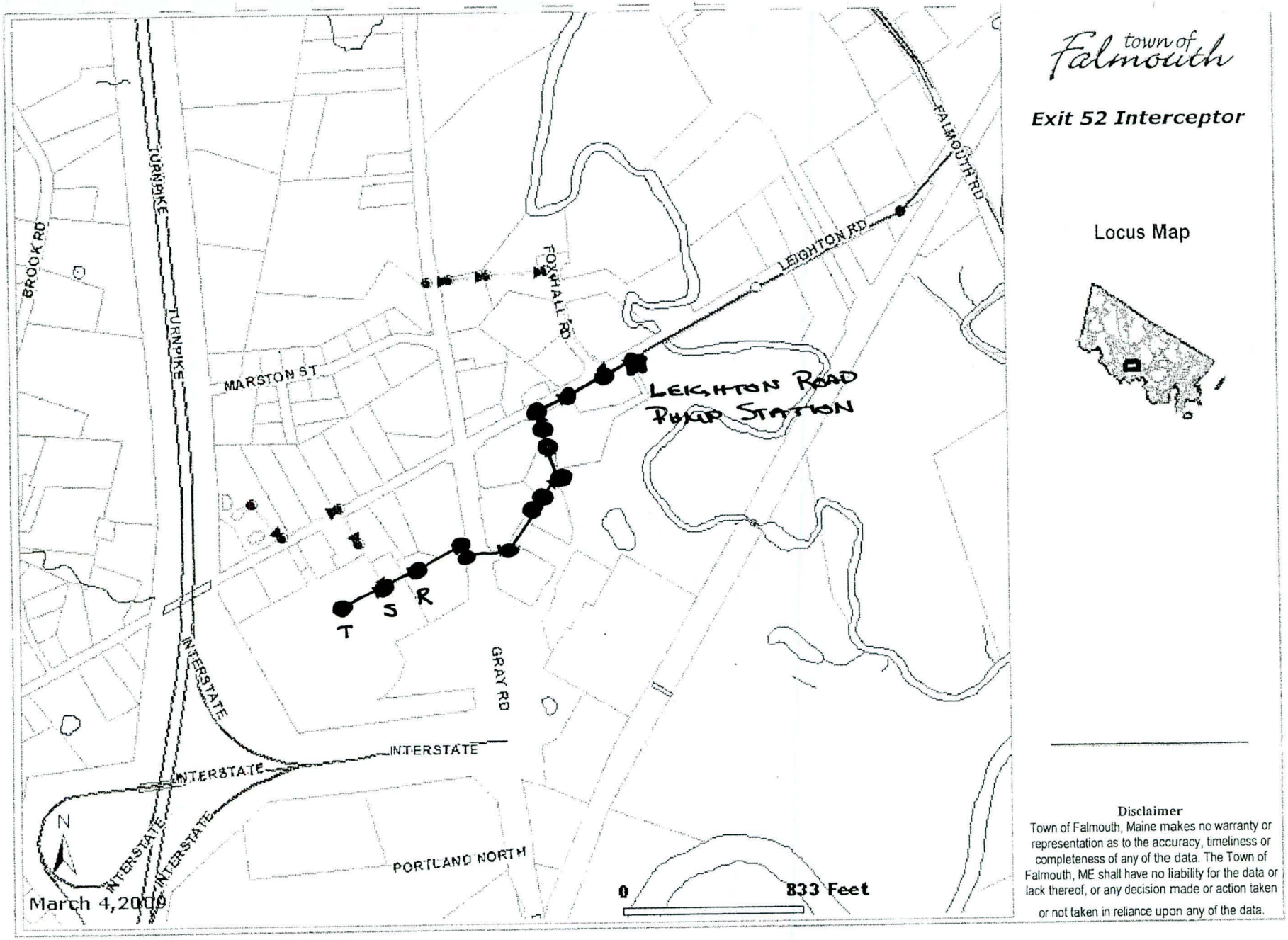
town of Falmouth
Exit 52 Interceptor
Locus Map
BROOK RD
TURNPIKE
TURNPIKE
MARSTON ST
FOXHALL RD
LEIGHTON RD
FALMOUTH RD
LEIGHTON ROAD PUMP STATION
T
S
R
GRAY RD
INTERSTATE
INTERSTATE
INTERSTATE
INTERSTATE
INTERSTATE
PORTLAND NORTH
N
0
833 Feet
March 4,2009
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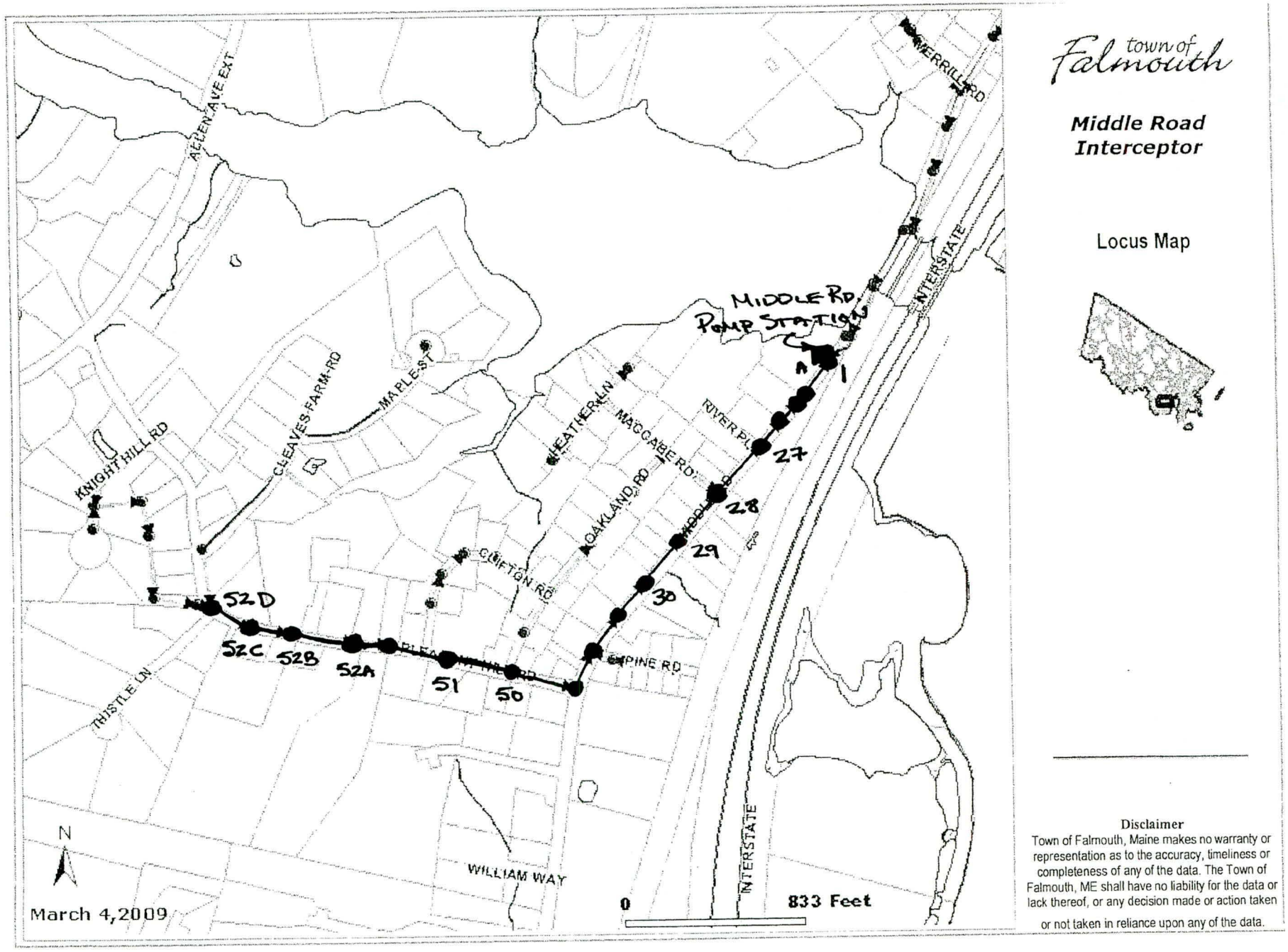
town of Falmouth
Middle Road Interceptor
Locus Map
MERRILL RD
ALLEN AVE EXT
MIDDLE RD. PUMP STATION
INTERSTATE
MAPLE ST
CLEAVES FARM RD
KNIGHT HILL RD
HEATHER LN
MAGGABE RD
OAKLAND RD
CLIFTON RD
PINE RD
THISTLE LN
WILLIAM WAY
INTERSTATE
1
27
28
29
30
50
51
52A
52B
52C
52D
N
March 4,2009
0
833 Feet
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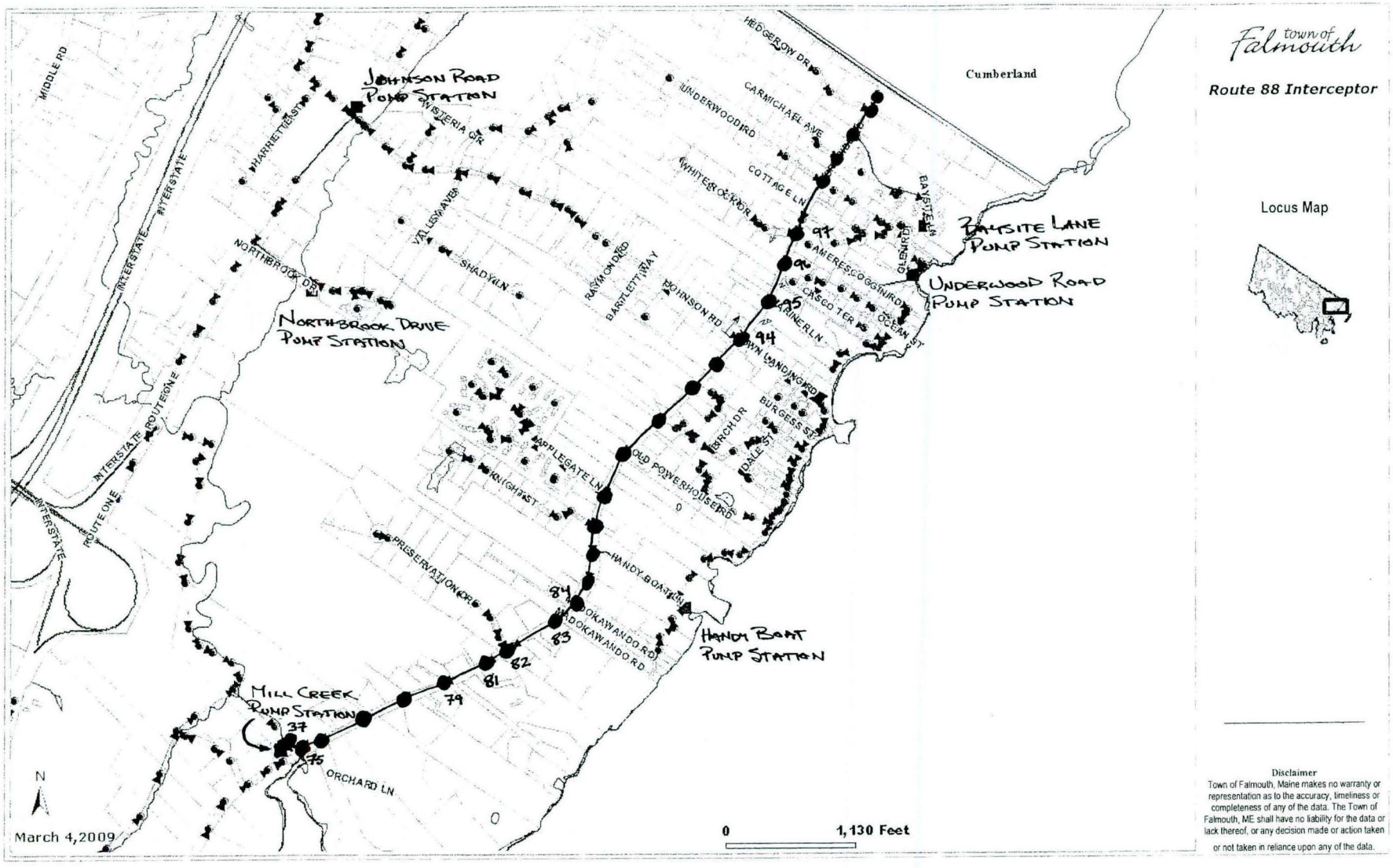
town of Falmouth
Route 88 Interceptor
Locus Map
Cumberland
JOHNSON ROAD PUMP STATION
NORTHBROOK DRIVE PUMP STATION
MILL CREEK PUMP STATION
HANDY BOAT PUMP STATION
BAYSITE LANE PUMP STATION
UNDERWOOD ROAD PUMP STATION
MIDDLE RD
INTERSTATE
ROUTE ONE
HEDGEROW DRIVE
CARMICHAEL AVE
UNDERWOOD RD
COTTAGE LN
WHITEROCK DR
WISTERIA DR
HARRIETT ST
VALLEY VIEW
SHADY LN
NORTHBROOK DR
RAYMOND RD
BARTLETT WAY
JOHNSON RD
AMERESCOGGIN RD
CASCO TER
OCEAN ST
GLENN RD
BAYSITE LN
MARINER LN
TOWN LANDING RD
BURGESS ST
BIRCH DR
DALE ST
APPLEGATE LN
OLD POWERHOUSE RD
KNIGHT ST
PRESERVATION DR
HANDY BOAT DR
MEDOKAWANDO RD
ORCHARD LN
94
95
96
97
79
81
82
83
84
37
75
N
March 4,2009
0
1,130 Feet
Disclaimer
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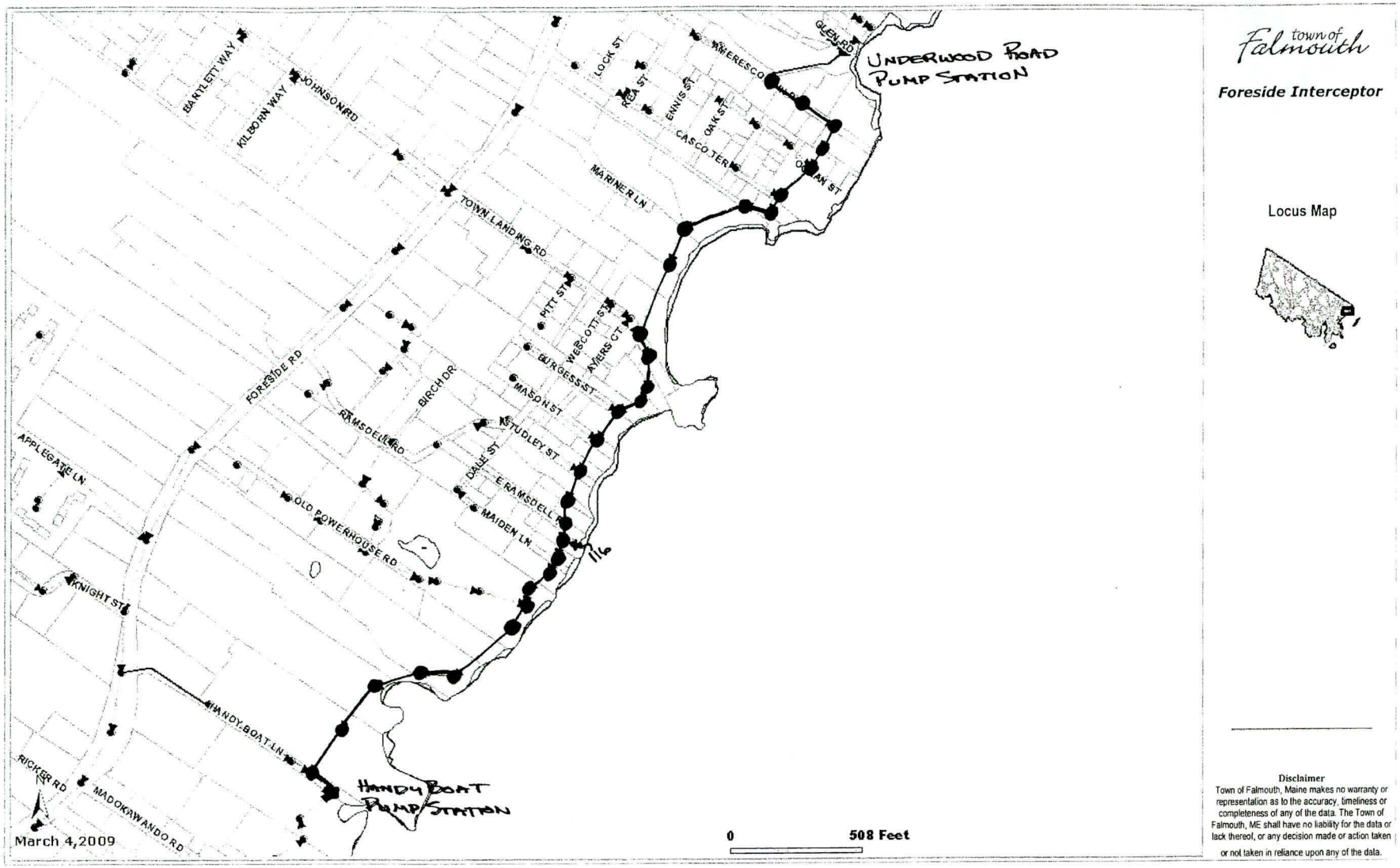

town of Falmouth

Foreside Interceptor

Locus Map

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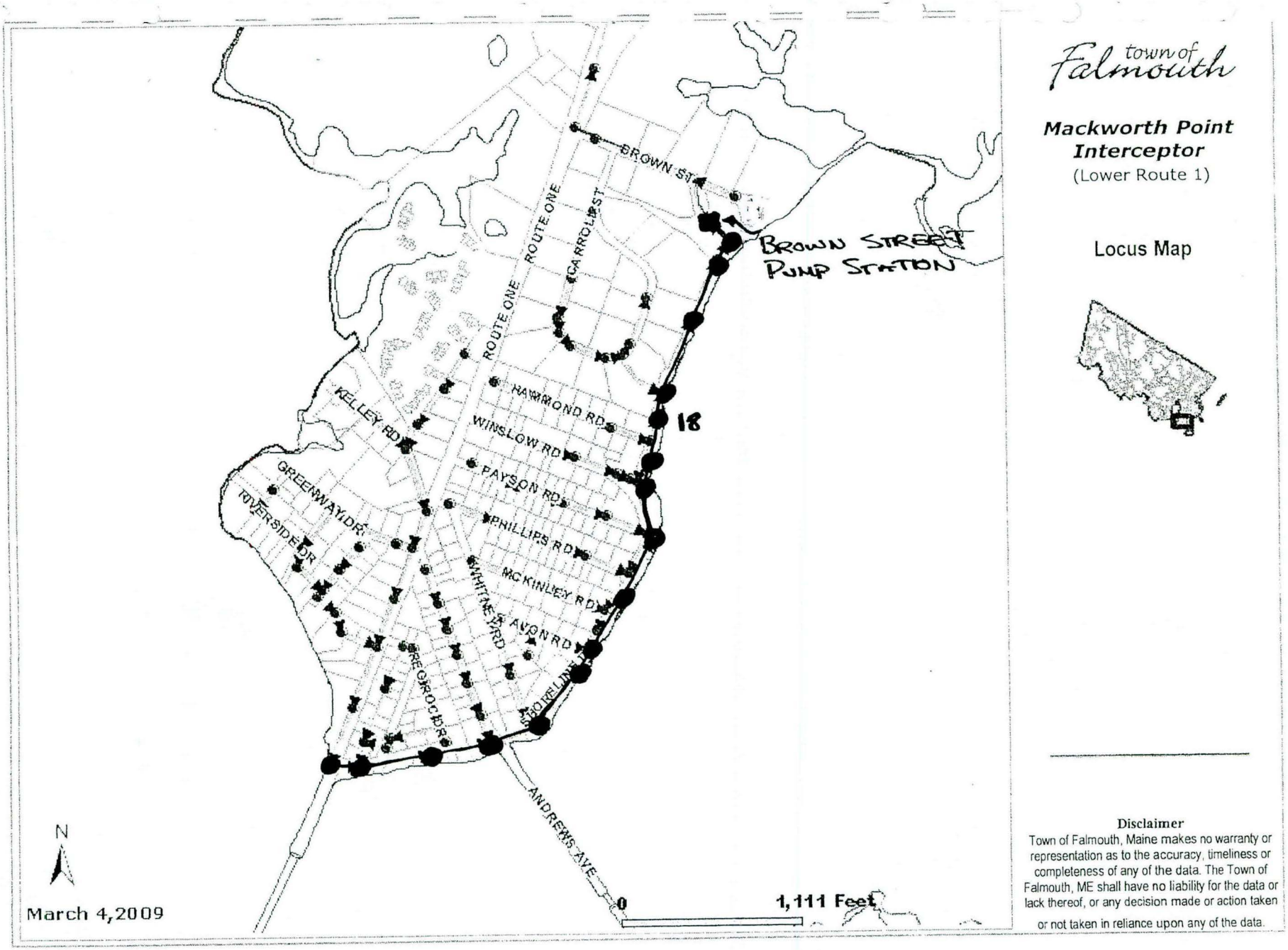
town of Falmouth
Mackworth Point Interceptor
(Lower Route 1)
Locus Map
BROWN ST
BROWN STREET PUMP STATION
ROUTE ONE
CARROLL ST
HAMMOND RD
WINSLOW RD
PAYSON RD
PHILLIPS RD
MCKINLEY RD
AVON RD
KELLEY RD
GREENWAY DR
RIVERSIDE DR
WHITNEY RD
GREGROCE DR
ROTELLINI
ANDREWS AVE
18
N
March 4,2009
0
1,111 Feet
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Wastewater Treatment Facility
Sewer Pump Station
Air Release Manhole
Clean Out Manhole
Sewer Manhole

Sewer Force Main
Sewer Gravity Main
Interceptor Modeled

Natural Drainange
Wetland

Town Boundary

Source:
Aerial imagery provided by MEGIS. Road data from ESRI.
All other data provided by the town of Falmouth, ME.

0 1,000 2,000 Feet

Comprehensive Pump Station Assessment
Town of Falmouth, Maine
Wastewater Collection System

PROJ NO: 11371A | DATE: Apr 2009 | FIGURE: 1-1

WRIGHT-PIERCE
Engineering a Better Environment

WRIGHT-PIERCE

Engineering a Better Environment