
SECTION 1.0

INTRODUCTION AND BACKGROUND

The Southborough Water Department recently engaged Pare Corporation (PARE) to prepare a Water System Master Plan. The purpose of the Plan is to provide an overview of water system performance, identify system deficiencies, and provide an evaluation of potential system improvements to ensure consistent high quality service to the existing and future customer base.

The following sections of this Plan will provide the following information:

- System history;
- System description;
- PARE's recent update of the Town's computerized hydraulic model;
- PARE's evaluation of the existing system;
- PARE's build-out analysis of the water distribution system, and
- Possible future capital improvements for the system.

1.1 SYSTEM OVERVIEW

The Town of Southborough owns and operates a water distribution system that serves a population of approximately 9,350 people. The Town is characterized by low-density residential development in the north and medium density residential development in the south. While the Town is primarily residential in nature, some dense commercial development exists along the Boston Worcester Turnpike (Rt. 9). Of the Town's current population, approximately 93 percent is connected to the distribution system.

Over the last three years, system-wide consumption averaged approximately 1 million gallons per day (MGD) and increased to approximately 2.8 MGD in the summer. The Town's current sole source of supply is the Massachusetts Water Resource Authority (MWRA) via two connections to the Hultman Aqueduct, one connection to the Metrowest Water Supply Tunnel, and one direct connection to the John J. Carroll Water Treatment Plant. Existing customers are served by three water storage tanks, two pump stations, and 86 miles of transmission and distribution piping.

The system is operated as two distinct pressure zones, referred to as the High Service Area and the Low Service Area. The boundary between the High and Low Service Areas runs generally



north-south along Rt. 85 from the Marlborough town-line to I-90. From I-90, the boundary runs roughly east-west from Rt. 85 to the Westborough town-line. The eastern half of Town and locations south of I-90 are in the Low Service Area. The remaining area north of I-90 and west of Cordaville Road is in the High Service Area (refer to Appendix A – Water System Map).

The Low Service Area encompasses approximately 55 percent of the overall Town by area, and 60 percent of the population. The Low Service Area operates at a hydraulic grade line (HGL) of 493 ft mean sea level (MSL) and is served by the Hosmer Pump Station and the Oak Hill and Clear Hill storage tanks.

The High Service Area encompasses approximately 45 percent of the overall Town by area, and 40 percent of the population. The High Service Area operates at an HGL of 515 ft MSL and is served by the Boland Pump Station and the Tara Road storage tank.

The following sections provide a detailed description of the system's primary components.

1.1.1 *Supply Sources*

The Town of Southborough obtains all of its water supply by direct connection to the MWRA's Hultman Aqueduct, Metrowest Water Supply Tunnel (MWWST), and John J. Carroll Treatment Plant. The Hultman Aqueduct and the MWWST are also connected to the John J. Carroll Treatment Plant and transport water from the Plant in Marlborough to the Norumbega storage facility in Weston. The Town currently has a ten-year contract with MWRA that expires at the end of 2016. As of the date of this report (2009), the Town is allowed to purchase up to 450 million gallons per year (MGY), not to exceed 3.6 MGD on a single day. The average annual limit will increase to 475 MGY in 2011. The maximum daily limit will increase to 3.9 MGD in 2014. The average annual and maximum daily limit will remain at 475 MGY and 3.9 MGD, respectively, until 2016. A copy of the MWRA Water Use Agreement is provided as Appendix B.

Hultman Aqueduct

Southborough has two connections to the Hultman Aqueduct, one at the Boland Station and one at the Hosmer Station. At the Hosmer Station in the Low Service Area, the aqueduct is reported to be a 14-ft diameter concreted pressure duct. The depth of the aqueduct ranges from 250 to 300 feet below grade. The connection is made through a vertical shaft, referred to as Shaft



No.3, approximately 150 feet north of the station. Inside the shaft is a 20-inch cast iron pipe that connects directly to the aqueduct. Outside the shaft, the 20-inch pipe reduces down to a 16-inch pipe, and maintains that diameter until it enters the station.

At the Boland Station, the Hultman Aqueduct is reported to be a 12.5-ft diameter duct and is relatively shallow compared to its depth at the Hosmer Station. The aqueduct itself is higher than surrounding grade; however, soil is mounded around the aqueduct to maintain a consistent burial depth of approximately 4 ft. The connection is made via a 16-inch pipe that connects directly to the aqueduct. Between the station and the aqueduct the 16-inch pipe reduces down to a 12-inch pipe until it enters the station. The connection to the aqueduct is made approximately 50 ft north of the station.

Metrowest Water Supply Tunnel

The Town of Southborough's connection to the MWWST at the Hosmer Station was made in 2003. The MWWST is a 14-ft diameter concrete pressure pipe that ranges in depth from 200 to 500 ft below grade. The connection is made approximately 500 feet south of the station at a vertical shaft above the tunnel. The connection is made via a 24-inch diameter pipe that connects to the 16-inch pipe behind the Station, the same pipe that connects to the Hultman Aqueduct.

John J. Carroll Water Treatment Plant

While the water in the Hultman Aqueduct and the MWWST originates at the John J. Carroll Water Treatment Plant (Plant), the Town of Southborough also has a direct connection to the Plant. The Boland Station is connected to the Plant via 6,000 ft of 24-inch ductile iron water main. The 24-inch pipe is connected to the 16-inch pipe between the Hultman Aqueduct and the Station.

1.1.2 *Pump Stations*

The Town of Southborough operates two booster pump stations. The purpose of each station is to increase the HGL of the MWRA supply to the HGL of the Southborough system. The following two sections describe each of the pump stations. Table 1-1 provides an overview of the pumps in each station.



Thomas J. Boland Pump Station

The Thomas J. Boland Pump Station (Boland) is located off Northborough Road in the northwest section of Town. Boland was constructed in 1960. The station supplies water to the High Service Area and fills the Tara Road Tank. The pumping system in Boland is comprised of two 50 HP horizontal split-case centrifugal pumps, each rated at 550 gpm at 275 ft of head. The station also has a 1,000-gpm gasoline powered emergency backup pump inside the station. The fuel source for that pump is a buried storage tank behind the station. Southborough personnel report that the gasoline powered pump is not automated and that in the event of a power outage the pump needs to be started manually. The incoming HGL of the MWRA supply, as measured in the station, ranges from 295 to 303 ft. The MWRA uses the Boston City Base (BCB) datum when measuring their HGL, which is 5.65 ft lower than the US Geological Survey's MSL, which is the datum that Southborough uses to measure their HGL. Therefore, the HGL of the incoming supply, as measured relative to MSL, is 5.65 ft lower than reported in the station, or in this case 289 to 297 ft MSL.

Arthur L. Hosmer Pump Station

The Arthur L. Hosmer Station (Hosmer) is located off of Boston Road in the northeast corner of Town, adjacent to the Sudbury Reservoir. Hosmer was constructed in 1977. The station supplies water to the Low Service Area and fills the Oak Hill and Clear Hill Tanks. The pumping system in Hosmer is comprised of two horizontal split-case centrifugal pumps – one rated for 650 gpm at 250 ft of head, and one rated for 550 gpm at 250 ft of head. In addition, the station is equipped with a propane-fired engine that, when connected to the 650-gpm pump, acts as an emergency backup pump in the station. The fuel source for that pump is an aboveground steel storage tank outside the station. The propane engine is normally disconnected from the 650-gpm pump. In the event of a power failure, Southborough personnel must physically connect the engine drive to the pump shaft and manually start the engine. The incoming HGL of the MWRA supply, as measured in the station, ranges from 291 to 303 ft BCB, or 285 to 297 ft MSL.



TABLE 1-1: Southborough Distribution Pumps						
Station	Flow	Head	Horse Power	Pump Manufacturer	Motor Manufacturer	Date Installed
<i>Boland</i>						
No.1	550 gpm	275 ft	50 HP	Gould	GE	1961
No.2	550 gpm	275 ft	50 HP	Gould	GE	1961
Auxiliary	1,000 gpm	unknown	unknown	unknown	WA Kraft	1961
<i>Hosmer</i>						
No.1	650 gpm	250 ft	60 HP	unknown	Marathon	1977
No.2	550 gpm	250 ft	40 HP	unknown	Marathon	1977
Auxiliary	NA	NA	60 HP	unknown	unknown	1977

1.1.3 Tanks

The Town of Southborough has three water storage tanks, the Tara Road Tank (Fiddler's Green), the Oak Hill Tank, and the Clear Hill Tank. The Tara Road Tank is located in the High Service Area of Town, while the Oak Hill Tank and the Clear Hill Tank are both located in the Low Service Area of Town. The following table describes the three water storage tanks.

TABLE 1-2: Southborough System Storage Tanks			
	Tara Road (Fiddler's Green)	Clear Hill	Oak Hill
Nominal Size	1.300 MG	0.460 MG	0.275 MG
Diameter	67 ft	40 ft	25 ft
Base Elevation	467 ft	451 ft	418 ft
Overflow Elevation	515.0 ft	493.3 ft	492.7 ft
Operating Range	503.0 to 510.0 ft	482.0 to 488.0 ft	482.0 to 488.0 ft
Style	Standpipe	Standpipe	Standpipe
Year Built	1960	1930	1930
Location	Tara Road	Overlook Drive	Oak Hill Road
Condition*	Very Good	Good	Good

* Condition provided in tank inspection reports prepared by Underwater Solutions Inc.

The most recent tank inspection reports are provided as Appendix C.



1.1.4 *Transmission and Distribution Mains*

The Town of Southborough's water distribution system is made up of approximately 86 miles of water main, ranging in size from 6-inches to 12-inches in diameter. In addition, there are short sections of 16 and 24-inch pipe that feed both pump stations from the MWRA system. Table 1-3 provides a relative breakdown of the piping size as a percentage of the total. Typical pipe material in the system includes ductile iron (DI), unlined cast iron (CI), cement-lined CI, polyvinyl chloride (PVC), and asbestos cement.

TABLE 1-3: Distribution Piping	
Size	% of System
6-inch	11
8-inch	51
10-inch	8
12-inch	29
> 12-inch	<1

1.1.5 *Pressure-Reducing Valves*

The Town of Southborough's water system has four pressure-reducing valves (PRVs) that, when working properly, transfer water from the High Service Area to the Low Service Area during times of peak water demand. The PRVs were manufactured by Golden Anderson Industries, Inc. and installed over a two-year period around 1990. Each PRV is located within an underground concrete vault with interior dimensions 8 ft by 8 ft, and a 7-ft ceiling height. The Town is currently undergoing a PRV evaluation and replacement program to determine if they are working properly and if replacement is warranted. In addition, the PRV vaults are prone to flooding due to leakage of interior piping and groundwater intrusion. The PRV evaluation is being performed concurrently with the preparation of this Plan.

The following sections describe each of the PRVs.

Ledge Hill Road PRV

The Ledge Hill Road PRV vault is located within a landscaped area to the northwest of the intersection of Marlboro Road (Rt. 85) and Ledge Hill Road. The PRV is 12-inches in size,



and the interior piping is 12-inch DI. This represents the northern most PRV in the Town of Southborough.

Town Square PRV

The Town Square PRV vault is located in a grassed area within the VFW Memorial Park between Main Street and Common Street. The PRV is 10-inches in size, and the interior piping is 10-inch DI. Flooding within this vault is more significant than at the other three PRV vaults.

Mount Vickery Road PRV

The Mount Vickery Road PRV vault is located in a grassed area to the northwest of the intersection of Cordaville Road (Rt. 85) and Mount Vickery Road. The PRV is 6-inches in size, and the interior piping is 6-inch DI.

Parkerville Road PRV

The Parkerville Road PRV is located in a grassed area to the northeast of the intersection of Parkerville Road and Richards Road, adjacent to the Finn School. The PRV is 8-inches, and the interior piping is 8-inch DI. This represents the southern most PRV in the Town of Southborough.

1.2 SYSTEM HISTORY

Provided below is a brief timeline of the development of the Southborough water supply system.

1898 The Fayville Dam is completed, producing several reservoirs, primary of which is the Sudbury Reservoir. The Sudbury Reservoir is the primary water supply for the Town of Southborough until 1962.

1908 The Wachusett Reservoir in Clinton and Boylston is completed. The Wachusett Reservoir, which was created by the Metropolitan Water District to serve the growing population of Boston, is currently one of two reservoirs that provide water to Boston and Towns west of Boston, including Southborough. The Wachusett Reservoir is currently operated by the Massachusetts Water Resources Authority (MWRA), but the land around the Reservoir is owned and maintained by the



Massachusetts Department of Conservation and Recreation (MA DCR).

- 1930 The Oak Hill standpipe is completed. The Oak Hill Standpipe is a 0.275 MG storage tank on Oak Hill Road that is still in use today.
- 1930 The Clear Hill standpipe is completed. The Clear Hill Standpipe is a 0.46 MG storage tank on Overlook Drive that is still in use today.
- 1930 The Atwood Elevated Tank is completed. The Atwood Elevated Tank was a 150,000-gallon elevated tank on Atwood Street that was demolished in 1990.
- 1941 The Hultman Aqueduct is completed. The Hultman Aqueduct is one of two aqueducts that transport water from the Wachusett Reservoir to the Norumbega Reservoir in Weston. The Hultman Aqueduct also has a branch that feeds the Weston Reservoir.
- 1946 The Quabbin Reservoir is completed. The Quabbin Reservoir is the primary water supply for the City of Boston. Like the Wachusett Reservoir, the Quabbin is operated by the MWRA, but the land around the Reservoir is owned and maintained by the MA DCR. The Quabbin Reservoir flows by gravity to the Wachusett Reservoir through the Quabbin Aqueduct.
- 1959 A report prepared by Whitman and Howard recommended that the Town abandon the Sudbury Reservoir due to poor water quality. The report suggested that that the Town construct a pumping station adjacent to Hultman Aqueduct and make a connection to the aqueduct at Shaft No. 3.
- 1960 The Tara Road Tank, also referred to as Fiddler's Green Reservoir, is completed. The reservoir, which is a 1.3 MG standpipe, was built with a higher overflow elevation than the other tanks in the system in order to better serve the higher elevations around Tara Road. When the tank was constructed, there were plans to construct a booster pump station to serve the higher tank, which would effectively create a new pressure zone in Town. However, the booster pump station was never constructed. As a result, the tank was operated with only ± 26 feet of water in it



order to match the overflow elevations of the other system water tanks.

- 1962 The Thomas J. Boland Pump Station is completed. The Boland Station, which is still in service today, originally pumped water solely from the Hultman Aqueduct, but now pumps from the Hultman Aqueduct and from a direct connection to the John J. Carroll Treatment Plant. It is noted that this is not the pump station that Whitman and Howard recommended in 1959; this station is located on the opposite side of Town.
- 1977 The Arthur L. Hosmer Pump Station is completed. This is the pump station recommended by Whitman and Howard in their 1959 report. The Hosmer Station originally pumped solely from the Hultman Aqueduct from Shaft No.3, but now pumps from both the Hultman Aqueduct and the Metrowest Water Supply Tunnel. The Hosmer Station is still in service today and is the sole source of supply for the Low Service Area in Town.
- 1978 The Town acquires the property on Fairview Hill for future tank site.
- 1988 A report prepared by Whitman and Howard recommended that the Town create two pressure zones, which are now the High Service Area and a Low Service Area. The report recommends that the High Service Area be served by the Tara Road Tank, which has an overflow elevation of 515 ft MSL, but has been operating since its construction at an HGL of approximately 493 ft MSL.
- 1990 The Atwood Tank is demolished. The tank is no longer considered cost effective to maintain.
- 1990 The Town installs four pressure-reducing valves over a two-year period. The pressure reducing valves effectively divide the Town into two service areas, the High Service Area and the Low Service Area, as recommended in Whitman and Howard's 1988 report. The pressure reducing valves are intended to transfer water from the High Service Area to the Low Service Area in times of peak water demand.



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- 1993 The water main between the Hosmer Pump Station and the Oak Hill standpipe is upgraded from 8-inches to 12-inches.
- 1997 The MWRA and the Town install water mains along Sears Road, Valley Road, Bigelow Road, Pinehill Road, Johnson Road, and Main Street.
- 2003 The Metrowest Water Supply Tunnel (MWWST) is completed. The MWWST is the second of two aqueducts that bring water from the Wachusett Reservoir to the Norumbega Reservoir (the Hultman Aqueduct being the first). The Town makes a connection to the MWWST near the Hosmer Station that provides a second source of supply to the station.

