

**REPORT**

**PARE Project No. 08176.01**

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# **WATER SYSTEM MASTER PLAN**

**FOR THE  
TOWN OF SOUTHBOROUGH  
WATER DEPARTMENT  
Southborough, MA**

**SUBMITTED FEBRUARY 2009**

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## EXECUTIVE SUMMARY

The Southborough Water Department recently engaged Pare Corporation (PARE) to prepare a Water System Master Plan in order to provide an overview of their water system's performance, identify system deficiencies, and provide an evaluation of potential system improvements.

The Town has a population of approximately 9,350 people, of which approximately 93 percent are connected to the water distribution system. 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 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 operates at a HGL of 515 ft MSL and is served by the Boland Pump Station and the Tara Road storage tank. There are four pressure-reducing valves in the system that transfers water from the High Service Area to the Low Service Area during periods of peak demand in the Low Service Area.

Based on water system meter records for the years 2005 - 2007, as well as pump station meter records and storage tank charts, average daily water demand in the system is approximately 1.09 million gallons per day (MGD). The maximum day demand over that same time period was 2.76 MGD, and the peak hour demand was 5.65 MGD. Residential water demand is approximately 300 gallons per day (gpd) per service connection and non-residential water demand is approximately 500 gpd/acre (gross lot area).

Future system water demand was estimated by conducting a limited build-out evaluation of the Town. PARE utilized existing water consumption rates established for residential customers (300 gpd/service connection) and non-residential customers (500 gpd/acre) to project future water demand. Based on our build-out evaluation, residential water demand could increase by as much as 219,000 gpd and non-residential water demand could increase by as much as 214,000 gpd.



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The total future average daily water demand is estimated to be 1.52 MGD, or 40 percent more than the current average day demand.

The Town's existing hydraulic model was updated in general accordance with American Water Works Association (AWWA) Document M32 – *Distribution Network Analysis for Water Utilities*. The model was used to evaluate system performance. In addition, *Recommended Standards for Water Works (Ten States)* was utilized as a guideline in performing the system evaluation. Ten States recommends that system pressure range from 35-90 psi during normal operating conditions and never below 20 psi during emergency conditions. Both AWWA and Ten States recommend that a water system be capable of supplying the maximum day demand with the largest pump in each pump station off-line.

It appears as though the Town's system operates generally within the recommended pressure of 35-90 psi. The only areas of Town that are below 35-psi on a regular basis are those areas in the vicinity of the Oak Hill and Tara Road storage tanks. There do not appear to be any areas of Town that operate at a pressure below 20 psi on a regular basis. There are some fairly sizable areas of Town that operate above 90 psi, particularly around the Sudbury Reservoir and the Hopkinton town-line. The highest pressure in Town is approximately 125 psi and is located at the base of the Sudbury Reservoir dam. At build-out, system pressures are not anticipated to change significantly from what they are now (less than 1 psi change over current system pressure).

The Town appears to have a deficit in pump capacity in the Low Service Area; however, pump capacity in the High Service Area appears to be adequate, although marginal. Pump capacity in the Low Service Area is approximately 0.79 MGD, while the maximum day demand in the Low Service Area is 1.3 MGD, a deficit of approximately 0.51 MGD. Pump capacity in the High Service Area is 1.58 MGD, while the maximum day demand in the High Service Area is 1.46 MGD. At build-out, the deficit in pump capacity in the Low Service Area is anticipated to increase from 0.51 MGD to 1.01 MGD. At build-out, the High Service Area is anticipated to have a deficit in pump capacity of 0.47 MGD.

The useable storage capacity in the system is approximately 0.98 MG. If we assume storage should be able to provide the maximum day demand and a fire event (refer to PARE's January



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28, 2008 Water Tank Siting Research Report), an appropriate amount of storage would be approximately 4.0 MG, a deficit of approximately 3.02 MG. Future storage requirements in the system are anticipated to be approximately 5.0 MG, or 4.0 MG more than what is currently available.

The available fire flow in the system ranges from 625 gpm to more than 5,000 gpm, with 290 out of 328 system nodes in the hydraulic model that have an available fire flow over 1,000 gpm. While fire flow appears to be generally adequate for a primarily residential system like Southborough, there are six locations that Insurance Services Offices, Inc (ISO) has determined require exceptionally high fire flows, up to 3,500 gpm. Those locations include:

1. Marlborough Road at St. Marks School;
2. Trottier School;
3. Mary E. Finn School;
4. Highland Street at Parkerville Road;
5. Mt. Vickery Road at Cordaville Road; and
6. Oregon Road at Woodland Road.

Of these six locations, the required fire flow, as determined in the hydraulic model, is only available at three – Marlborough Road, Highland Street, and Oregon Road. Adequate fire flow is unavailable at the Finn School, the Trottier School, and the Cordaville Road/Mt. Vickery Road.

PARE reviewed the system for critical pipe segments, or segments that provide the sole sources of water to large areas of Town, or that provide a critical path for fire flow. While not currently causing significant adverse impact on the system, there are certain critical pipes that may be undersized or that do not have significant redundancy. Provided below is a list of system pipes that appear to be critical and are either undersized or do not have substantial redundancy.

1. The 12-inch water main along the access road to the Hosmer Station (1,100 lf);
2. The 12-inch water main on Main Street between Northborough and Deerfoot Roads (4,200 lf);
3. The 12-inch water main on Sears Road (3,600 lf);
4. The 12-inch water main on Rt. 9 between Crystal Pond and Deerfoot Roads (1,800 lf);



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5. The 12-inch water main that crosses under I-495 on Main Street (400 lf);
  6. The 6-inch water main on Rt. 9 between Brook Lane and Oak Hill Road (1,900 lf); and
  7. The 8-inch water main that crosses under I-90 at Woodland Road (300 lf).

To address the existing system deficiencies, PARE has three recommendations;

1. Institute a capital improvements program to address the immediate and long-term needs of the system;
2. Perform an evaluation of the Town's flushing program to address water quality concerns in the winter (this could also include the development of a unidirectional flushing program); and
3. Evaluate whether it is more cost effective to construct a new storage facility in the vicinity of Cordaville Road and Mt. Vickery Road to address the inadequate fire flow in this area, or if it is more cost effective to pursue localized upgrades to facilities in this area for the purpose of reducing the fire flow requirement.

The capital improvements program should have the dual purpose of addressing the immediate needs of the distribution system as well as addressing the system's long-term needs. The program should prioritize capital improvements based on which improvements would provide the maximum benefit for the least cost and which ones would address the most critical system deficiencies. At a minimum, the capital improvements should include the following;

- Install a new 12-inch water main between Presidential Drive and Fisher Road;
- Install a new 12-inch water main along the access road to the Hosmer Pump Station;
- Develop a town-wide SCADA system;
- Upgrade existing PRVs and vaults;
- Upgrade the Boland Pump Station;
- Install a new 12-inch water main on Flagg Road between Lovers Lane and Strawberry Hill Road;
- Install a new 12-inch water main on Main Street under I-495;
- Upgrade Hosmer Pump Station;
- Upgrade system storage in the High Service Area;
- Upgrade system storage in the Low Service Area;



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- Install a new 8-inch water main on Woodland Road at the I-90 Crossing;
  - Install a new 12-inch water main on Rt. 9 between Crystal Pond and Deerfoot Roads; and
  - Install parallel 12-inch and 8-inch water mains on Rt. 9 between Willow Street and Winter Street.

It is noted that upgrading the existing PRVs between the High and Low Service Areas, in addition to installing a new SCADA system, could have a substantial benefit to the Town. The PRVs would allow water to be shared from the High Service Area to the Low Service Area, which would increase available fire flow to the Finn School and the Cordaville Road business district. This would also allow the Town to focus their resources on upgrading system storage and pump capacity in the High Service Area, which would effectively increase the water available to the Low Service Area. The Town could then make upgrading storage and pump capacity in the Low Service Area a long-term improvement rather than a critical short-term need.

PARE recommends that the Town perform an evaluation of their flushing program in order to identify the most effective means of circulating water in the southern half of Town by the Hopkinton town-line and along the western half of Rt. 9. The Town could also use this as an opportunity to create a unidirectional flushing (UDF) program, which would optimize the flushing program town-wide, not just in areas of elevated water age.

Finally, PARE recommends that the Town conduct a cost-benefit analysis to identify the most practical means of attaining adequate fire flow in the area of Cordaville and Mt. Vickery Roads. This analysis should consider which is more cost effective; a new storage facility in the vicinity of the DPW Garage or localized improvements to structures in the area that could reduce the overall needed fire flow. PARE recommends that the Town work with the Fire Department and consult with ISO on ways to reduce the needed fire flow in this area.

