



*Water, Wastewater and Stormwater Specialists*

March 1, 2016

Mr. Fran Zarette, P.E.  
Smart Growth Design, LLC  
625 South Street  
Shrewsbury, MA 01545

Re: Preliminary Water Study  
The Pointe at Hills Farm, Shrewsbury, MA

Dear Mr. Zarette:

In accordance with our Agreement, Onsite Engineering has completed hydrant flow testing and a preliminary water study for the proposed Pointe at Hills Farm project located in Shrewsbury, Massachusetts. As part of this study we reviewed plans of the project prepared by Waterman Design Associates, Inc. with the latest revision date of November 6, 2015, as well as the Town's existing water system map and water system Capital Efficiency Plan™ dated March 2014.

The proposed development consists of two residential properties located between the western (Phase 1) and eastern (Phase 2) intersections of Stoney Hill Road and Route 20. Phase 1 located at 440 Hartford Turnpike consists of five 3-story apartment buildings (156 dwelling units), four 6-bay parking garages and a 1-1/2 story clubhouse. Phase 2 located at 526 Hartford Turnpike consists of a series of 3-story buildings (92 dwelling units) containing an internal clubhouse. Approximately 45% of the units will be 1-bedroom, 45% will be 2-bedroom and 10% will be 3-bedroom units. The estimated demand associated with the development based on an estimated sewer use of 141 gpd per unit (as identified in the "New Sewer Service Evaluation" by AECOM dated August 2015) is 35,000 gallons per day (gpd). The proposed water main for both phases loops through the property connecting on Hartford Turnpike (Route 20) and Stoney Hill Road. Upon review of the water system map, it appears that the two phases of the project as currently configured would be served by different service areas: Phase I would connect to the low service area (LSA), whereas Phase II would connect to the reduced high service area (RHSA).

### **HYDRANT FLOW TESTS**

In order to obtain current and relevant flow and pressure data in the vicinity of the project, three (3) hydrant flow tests were conducted by Onsite Engineering personnel with the assistance of Shrewsbury Water Department staff on February 3, 2016. The flow test record sheets are provided in Attachment 1 and the results are summarized below:

#### **Test 1 – Stoney Hill Road near Phase 1 entrance. Water flow occurred at 9:08 am.**

The flowing hydrant was located approximately 300 feet off Hartford Turnpike at the west entrance to Stoney Hill Road. The estimated ground elevation at the flow hydrant is 421 feet. The residual hydrant was located at 131 Stoney Hill Road at an estimated elevation of 403 feet. The static pressure of the residual hydrant was 78 psi. Both hydrants are located off an 8-inch diameter PVC main installed in approximately 1995 and are designated within the low pressure service area. The flow recorded was 856 gpm at a residual pressure of 50 psi. The equivalent estimated flow at 20 psi is 1,270 gpm.

**Test 2 – Stoney Hill Road near Phase 2 entrance. Water flow occurred at 9:53 am.**

The flowing hydrant was located at 5 Stoney Hill Road approximately 400 feet off Hartford Turnpike at the east entrance to Stoney Hill Road. The estimated ground elevation at the flow hydrant is 499 feet. The residual hydrant was located at the intersection of Stoney Hill Road and Pheasant Hill Road at an estimated elevation of 480 feet. The static pressure of the residual hydrant was 82 psi. Both hydrants are located off an 8-inch diameter polyvinyl chloride (PVC) main installed in approximately 1995 and are designated within the reduced high pressure service area. The flow recorded was 950 gpm at a residual pressure of 47 psi. The equivalent estimated flow at 20 psi is 1,294 gpm.

**Test 3 – 464/525 Hartford Turnpike (Route 20). Water flow occurred at 10:38 am.**

The flowing hydrant was located at 464 Hartford Turnpike in front of YRC Freight and is the last hydrant located in the reduced high pressure service area. The estimated ground elevation at the flow hydrant is 496 feet. The residual hydrant was located at 525 Hartford Turnpike (near the intersection with Stoney Hill Road) at an estimated elevation of 514 feet. The static pressure of the residual hydrant was 68 psi. Both hydrants are located off a 12-inch diameter vinyl lined asbestos concrete (AC) main located on Hartford Turnpike and are designated within the reduced high pressure service area. The flow recorded was 1,151 gpm at a residual pressure of 46 psi. The equivalent estimated flow at 20 psi is 1,755 gpm.

The water levels in the storage tanks at the time of the flow tests as provided by the Water Department are summarized below:

Tank/ Service Area	Tank Height (ft)/ Overflow Elevation	Operating Level during Hydrant Flow Tests		Hydraulic Gradeline during Hydrant Flow Tests
		9:00 AM	11:00 AM	
Oak Street (LSA)	37.5 598 ft	25.1	22.5	583 – 585.6
Hillside Drive (LSA)	48.5 596 ft	39.0	36.6	584.1 - 586.5
Temple Hill (RHSA)	35.0 680 ft	28.6	28.8	673.6 – 673.8

**FLOW AND PRESSURE EVALUATION**

The static pressures recorded in the field correspond with the hydraulic gradelines based on the tank levels at the time of the flow tests with an allowance for pipe losses. Specifically, the hydraulic gradeline from Test 1 (in the LSA) was 583 feet and from Tests 2 and 3 (in the RHSA) were 669 feet and 671 feet, respectively. Calculations were also completed to estimate the static pressure at the proposed points of connection and at the highest elevation of the project site(s).

The results of the calculations indicate that under Phase 1 the static pressure at the point of connection on Stoney Hill Road (elev. 421 feet) is 70 psi, the static pressure at the point of connection on Hartford Turnpike (elev. 460 ft) is 53 psi, and the static pressure at the highest ground elevation (elev. 478 ft) is

approximately 46 psi. Under Phase 2 the static pressure at the point of connection on Stoney Hill Road (elev. 499 ft) is 74 psi, the static pressure at the point of connection on Hartford Turnpike (elev. 507 ft) is estimated at 70 psi, and the static pressure at the highest ground elevation (elev. 516 ft) is approximately 66 psi. Generally, the normal working pressures in a water system under static conditions should range between 60 and 80 psi, with a minimum pressure of 35 psi; therefore the calculated static pressures under both phases appear to meet this criterion. Under Phase 1 the pressures at the point of connection on Hartford Turnpike and at the high point are at the lower end of the recommended range.

It is our understanding that because the project is still in the preliminary design phase, a Fire Protection Engineer has not been contracted to design the automatic fire sprinkler system for the buildings. Therefore, the actual fire flow requirement is not yet known. However, in accordance with ISO's *Guide for Determination of Needed Fire Flows* (Edition 05-2008), "where residential occupancies up to and including four stories in height are protected with an automatic fire sprinkler system installed in accordance with NFPA 13R, *Standard for the Installation of Sprinkler Systems in residential Occupancies up to and including Four Stories in Height*, a reduction in fire flow may be appropriate." The Guide goes on to specify that a needed fire flow of 1,000 gpm at 20 psi can be used for these residential occupancies. Additional calculations were completed using the Hazen-Williams flow equation and pipe C-values reported in the Capital Efficiency Plan™ to determine if this fire flow requirement could be met under both phases of the project.

As stated previously, the estimated available fire flow at the entrance to Phase 1 off Stoney Hill Road is 1,270 gpm at 20 psi. Based on this data, the estimated available fire flow at the high point of Phase 1 (elev. 478 ft), located approximately 1,000 ft from the connection point on Stoney Hill Road, is 1,000 gpm at 8 psi or 810 gpm at 20 psi. Therefore, it does not appear to meet the 1,000 gpm at 20 psi requirement. It is likely that additional flow would be available from the connection on Route 20, as it is closer to the high point of the project and is a 12-inch diameter main. Unfortunately, without hydrant flow test data from the low service area on Route 20, the estimated available fire flow cannot be calculated. However, the Town may be able to utilize the existing hydraulic model to estimate the available fire flow from the connection on Route 20. An alternative solution may be to connect Phase 1 to the reduced high service area instead. Based on hydrant test #3 results, the estimated available fire flow at the high point of Phase 1 if connected to the reduced high service area is 1,000 gpm at 54 psi or 1,500 gpm at 20 psi.

The estimated available fire flows at the entrances to Phase 2 off Stoney Hill Road and Hartford Turnpike are 1,294 gpm at 20 psi and 1,755 gpm at 20 psi, respectively. Based on the hydrant test #3 results, the estimated available fire flow at the high point of Phase 2 (elev. 516 ft), located approximately 500 ft from the connection point on Hartford Turnpike, is 1,000 gpm at 43 psi or 1,400 gpm at 20 psi. Therefore, the 1,000 gpm at 20 psi requirement can be met.

### **RECOMMENDATIONS AND CONCLUSIONS**

Based upon our review of the water system information and the proposed layout, it is our opinion that both phases of the project can be adequately serviced by the existing water system. It is our understanding that the Town has an existing water model that could be utilized to model the proposed project and the available fire flow to both phases of the project under various scenarios. We recommend that consideration be given to connecting Phase 1 to the reduced high service area rather than the low service area to provide better flows under a fire condition. The Town previously expanded the reduced high service area under a similar scenario to accommodate a fire flow requirement on Commerce Road. By expanding the service area, the

Capital Efficiency Plan™ stated that a fire flow requirement of 2,500 gpm at 20 psi could be met at this location.

In accordance with our Agreement, this evaluation is based on the hydrant flow test data obtained on February 3, 2016 and an estimated needed fire flow requirement for a typical apartment complex equipped with an automatic fire sprinkler system. Once the flow and pressure needs of the automatic fire sprinkler system are determined by a Fire Protection Engineer, the calculations may need to be revisited. Our evaluation also does not include pressure losses between the proposed 8-inch main servicing the development and the proposed individual buildings or pressure losses within the proposed buildings. These pressure losses are typically identified and addressed during the design of the building plumbing systems.

We appreciate the opportunity to work with you on this important project. If you have any questions or require additional information, please feel free to contact me directly at 978-660-2752.

Sincerely,

Onsite Engineering, Inc.



Susan Hunnewell, P.E.  
Vice President - Director of Water Engineering

Attachments – Hydrant Flow Data Sheets

Cc: Wayne Belec, Waterman Design Associates  
Town of Shrewsbury

# Hydrant Flow Test Report

Test Date 2/3/2016

Test Time 9:00 am

## Location

The Pointe at Hills Farm, Shrewsbury, MA

## Tested by

Onsite Engineering - Susan Hunnewell, P.E. and Paul Ruszala, P.E.

## Notes

Flow Test 1 - Low Pressure Zone. Flow hydrant at entry to Stoney Hill Road; Read hydrant at 131 Stoney Hill Road.

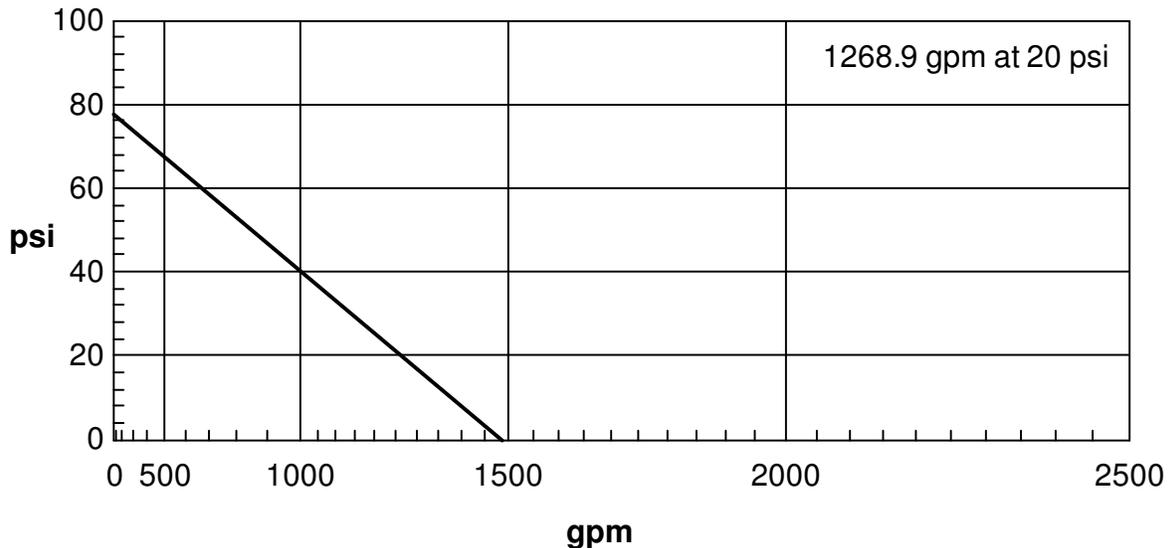
## Read Hydrant

78 psi **static pressure**  
50 psi **residual pressure**  
403 ft **hydrant elevation**

## Flow Hydrant(s)

Outlet	Elev	Size	C	Pitot Pressure	Flow
#1	421	2.5	0.9	26	856 gpm

## Flow Graph



# Hydrant Flow Test Report

Test Date 2/3/2016

Test Time 9:50 am

## Location

The Pointe at Hills Farm, Shrewsbury, MA

## Tested by

Onsite Engineering - Susan Hunnewell, P.E. and Paul Ruzala, P.E.

## Notes

Flow Test 2 - Reduced High Pressure Zone. Flow hydrant at 5 Stoney Hill Road; Read hydrant at Stoney Hill Road/Pheasant Hill.

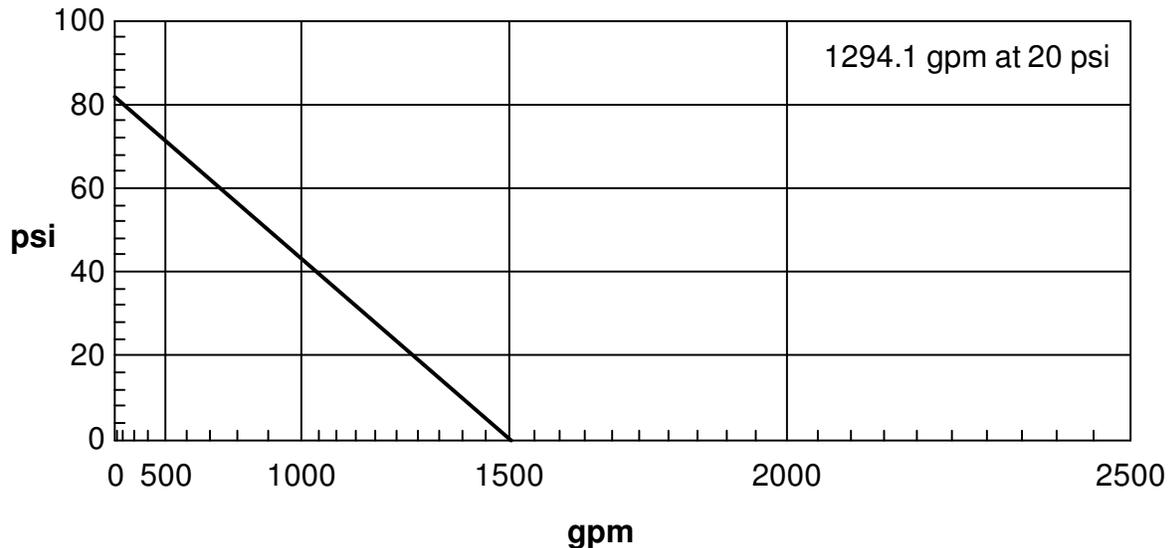
## Read Hydrant

82 psi **static pressure**  
47 psi **residual pressure**  
480 ft **hydrant elevation**

## Flow Hydrant(s)

Outlet	Elev	Size	C	Pitot Pressure	Flow
#1	499	2.5	0.9	32	950 gpm

## Flow Graph



# Hydrant Flow Test Report

Test Date 2/3/2016

Test Time 10:30 am

## Location

The Pointe at Hills Farm, Shrewsbury, MA

## Tested by

Onsite Engineering - Susan Hunnewell, P.E. and Paul Ruzala, P.E.

## Notes

Flow Test 3 - Reduced High Pressure Zone. Flow hydrant at 464 Hartford Turnpike/Rte 20 (YRC Freight); Read hydrant at 525 Hartford Turnpike/Rte 20

## Read Hydrant

68 psi **static pressure**  
46 psi **residual pressure**  
514 ft **hydrant elevation**

## Flow Hydrant(s)

Outlet	Elev	Size	C	Pitot Pressure	Flow
#1	496	2.5	0.9	47	1151 gpm

## Flow Graph

