



March 15, 2016

Mr. Ronald Rosen, Chairman
Shrewsbury Zoning Board of Appeals
Town of Shrewsbury, Town Hall
100 Maple Avenue
Shrewsbury, MA 01545

Subject: Pointe at Hills Farm Peer Review for the Water Service
Shrewsbury, Massachusetts

Dear Mr. Rosen:

As requested, Tata & Howard, Inc. has performed a review of the water infrastructure and service in the Comprehensive Permit Application and supplemental material submitted by Smart Growth Design for the Pointe at Hills Farm properties. The project includes two sites with multifamily dwellings. Based on the Site Plans prepared by Water Design Associates, Inc. dated November 6, 2015 the first site (Phase 1), located at 440 Hartford Turnpike, includes five three story buildings with a total of 180 one, two, and three bedroom apartments. The second site (Phase 2), located at 526 Hartford Turnpike, includes two three story buildings and one four story building with a total of 100 one, two, and three bedroom apartments. As part of this Peer Review we have reviewed the Site Plans prepared by Water Design Associates, Inc. dated November 6, 2015, the water usage estimates presented in the New Sewer Service Evaluation for the Pointe at Hills Farm Development prepared by AECOM Technical Services, Inc., dated August 2015, and the Preliminary Water Study prepared by Onsite Engineering, Inc., dated March 1, 2016.

In addition, the Peer Review includes an evaluation of the proposed water service in relation to the existing water distribution system. This evaluation utilizes the Town's hydraulic model to determine potential impacts to the distribution system and reviews the potential impacts the estimated domestic water usage would have on the Town's existing and projected water distribution system demands and on the capacity requirements set forth in the Town's most recent Water Management Act Permit.

Determination of Flow

At the time of this review, an estimate of water usage for the development was discussed in the AECOM evaluation and reviewed as part of Onsite Engineering's Preliminary Water Study. AECOM used two methods to estimate the anticipated wastewater flows. It appears that at the time of the New Sewer Service Evaluation, the final design of the

properties was not complete. To be conservative, AECOM used an estimate of 300 units. The overall distribution between one, two, and three bedroom units is similar to the numbers presented in the design drawings. The first method utilized Massachusetts Title 5. This method resulted in a total daily flow of approximately 54,450 gallons per day (gpd). The second method utilized and TR-16 Guides for the Design of Wastewater Treatment Works. TR-16 states that existing wastewater flow and/or consumption data, when available, should be used as a basis for sewer design. Water usage records from two similar developments in Shrewsbury were used to estimate a total daily flow of approximately 42,300 gpd. This is based on an estimated usage of 141 gpd per unit. Based on the Town's Rules and Regulation for the Installation and Connection for Building Sewers and for the Use of Public Sewers, the TR-16 estimated flow from the development was used for all further analysis.

Between the completion of the AECOM evaluation and the Onsite Engineering evaluation, the number of units has continued to change. Onsite Engineering utilized a total of 248 units and the estimated usage of 141 gpd per unit to propose an estimated total daily usage of 35,000 gpd for both phases. It is our understanding that the number of buildings and units are still being finalized. An updated Site Plan with the most recent number of units was not included in this study. As a result, we have used the 300 units considered in the AECOM evaluation to be conservative in our evaluation.

We agree that using flows from similar developments is a good estimation of the anticipated water usage. The Massachusetts Department of Conservation and Recreation (DCR) develops water needs forecasts for public water suppliers using the Water Resources Commission's Policy for Developing Water Needs Forecasts for Public Water Suppliers and Communities and Methodology for Implementation. The Water Resources Commission uses performance standards which includes a maximum residential consumption is 65 gallons per capita day (gpcd). Based on the data collected during the 2010 US Census, the average household size for renter occupied units in Shrewsbury is 1.98 people per unit. Using the 300 units considered in the AECOM New Sewer Service Evaluation, the anticipated population within the development is approximately 594 people. Using the 65 gpcd, the anticipated daily water usage in the development is approximately 38,600 gpd. Because the water usage estimated based on similar developments within Shrewsbury is slightly higher than this estimated usage, we agree that the 42,300 gpd is a conservative estimate for water use for the proposed development.

Site Plans

Based on the preliminary water main configuration presented by the proponent in the Site Plans, we offer the following comments and recommendations.

1. The plans indicate that the water main pipe and fittings shall be plastic pipe. The Shrewsbury Water & Sewer Department would prefer the use of Class 53 ductile iron water mains.
2. The plans indicate that water services shall be pressure rated plastic or copper service piping as required by the Shrewsbury Water & Sewer Department. The Shrewsbury Water & Sewer Department standard is plastic pipe rated at 200 psi for all water services.
3. The plans do not indicate the proposed water main diameter. The water mains should be a minimum of 8-inch diameter throughout the development.
4. The plans indicate that the water main servicing Phase 1 of the development will tie into the Hartford Turnpike and Stoney Hill Road water mains. The call outs on the plans reference each will be tied in with a triple gate. However, the Stoney Hill Road connection only shows two valves. This should be modified to show the triple gate configuration. Also, the plans do not indicate the existing water main material or size. This will dictate the size gate valve needed. Stoney Hill Road is an 8-inch diameter PVC water main and there is a 12-inch diameter asbestos cement water main on Hartford Turnpike. Please indicate the existing water main materials and diameters on the plans. Appropriate fittings will be needed to connect to these water mains.
5. The plans indicate that the water main servicing Phase 2 of the development will tie into the Hartford Turnpike and Stoney Hill Road water mains. The Stoney Hill Road connection shows two new gates and one existing gate. The condition of the existing gate will need to be verified with the Water & Sewer Department. The Water & Sewer Department may require a replacement gate valve at this location. Also, the plans do not indicate the existing water main material or size. Stoney Hill Road is 8-inch PVC water main and the water main on Hartford Turnpike is a 12-inch vinyl lined asbestos cement water main. Please indicate the existing water main materials and diameters on the plans. Appropriate fittings will be needed to connect to these water mains.
6. The existing Shrewsbury water system has three service areas, each with a different operating hydraulic gradeline. Phase 1 is located in the Low Service Area. The boundary between the Low Service Area and the Reduced High Service Area is separate by a closed gate valve on Hartford Turnpike in the vicinity of the proposed tie in on Hartford Turnpike. The location of the isolation valve will have to be verified in the field and the tie in must be located on the west side of the isolation valve so that proposed water infrastructure in Phase 1 is served by the Low Service Area. Phase 2 is served entirely by the Reduced High Service Area.

7. In general, fire hydrants should be placed at an interval of approximately 500 feet and isolation valves at an interval of 1,000 feet, in accordance with standard waterworks practice. Currently, the fire hydrants and isolation valves are placed to meet these intervals. However, upon review of the hydrant locations in Phase 1, it appears that Buildings 1, 2, 3, and 5 each have two hydrants located at two corners of the building. Building No. 4 only has one hydrant located at a corner. We recommend an additional hydrant be located near Station 7+00. Final hydrant locations should be approved by the Shrewsbury Water and Fire Departments. Also, while there is not more than 1,000 feet between isolation valves, we recommend additional valves throughout Phase 1 to allow for isolated shut downs if necessary in the future.
8. The water service to each building is shown as a single service line that splits to provide domestic and fire service. There is no indication of the size of the water services or the water main going to each building. The service size for the domestic service should be verified by the Water & Sewer Department and information on the fire service size and requirements should be submitted for review. Currently, each building service is shown with either a gate valve or water shut off prior to the split between the domestic and fire service. We recommend modifications to the piping configuration to allow for isolating the domestic and fire protection services for servicing or repairs in the future.

Hydrant Flow Tests

Three hydrant flow tests were performed in the area of the proposed developments on February 3, 2016. One was performed in the Low Service Area near Phase 1 and two were performed in the Reduced High Service Area near Phase 2. The results of the hydrant flow tests were considered in the hydraulic model of the existing Shrewsbury water distribution system. Also, system operating conditions such as water level in the water storage tank, booster pump station operating flow rates, and flow from the water treatment facility were obtained from the Water & Sewer Department when not provided by Onsite Engineering. The model results matched the field results for Test No. 1. The observed pressure drop between static and flowing conditions for Test No. 2 and 3 were higher in the field than expected based on the hydraulic model. There are several reasons for the model and field results to be different. One reason would be if the water main diameters were incorrect in the hydraulic model. All water main diameters were verified with the Water & Sewer Department. Another reason could be the hydraulic condition of the existing water mains. The water mains feeding this area in the Reduced High Service Area are mostly Asbestos Cement and PVC. These water mains typically retain their hydraulic capacity and are not as susceptible to internal corrosion. We do not feel as though the condition of the mains is the cause of the pressure decrease. Another reason for the unexpected results would be a hydraulic restriction such as a closed or partially closed valve in the area. Valves would have to be checked in the field to determine if there are any restrictions caused by closed or partially closed valves. Conditions in the

model were adjusted to match the field results for all hydraulic simulations involving the proposed development.

Hydraulic Evaluation

Tata & Howard conducted hydraulic simulations using the model of the existing Shrewsbury water distribution system. The model was updated to include the proposed approximately 1,950 linear feet of 8-inch diameter water main that will tie into existing water mains on Stoney Hill Road and Hartford Turnpike for Phase 1 and approximately 1,100 linear feet of 8-inch diameter water main that will tie into existing water mains on Stoney Hill Road and Hartford Turnpike for Phase 2. The highest elevation shown in Phase 1 is approximately 478 feet above mean seal level (MSL) at the street level and the highest elevation shown in Phase 2 is approximately 516 feet above MSL at the street level.

Based on estimates by AECOM, the estimated average daily demand (ADD) for the project is approximately 42,300 gpd. Phase 1 represents approximately two thirds of the demand or 28,200 gpd and the remaining 14,100 gpd is for Phase 2. As discussed in the April 2012 Water Distribution System Study Update by Tata & Howard, the typical maximum day demand (MDD) to ADD peaking factor for the Shrewsbury system is approximately 1.60. Using this factor, the estimated MDD is 67,700 gpd for the development with approximately 45,100 gpd for Phase 1 and approximately 22,600 gpd for Phase 2.

The model simulations were run at the estimated MDD for the Shrewsbury system. The tanks were set at 5 feet below overflow elevation and all sources were online. The results of the simulations show that the static pressure at street level is approximately 45 pounds per square inch (psi) at the highest street elevation in Phase 1 and approximately 65 psi at the highest street elevation in Phase 2. These pressures match the estimated static pressures reported in the Preliminary Water Study. The pressure at these point is adequate as per the Massachusetts Department of Environmental Protection (MassDEP) published Guidelines for Public Water Systems which recommends a pressure of 35 psi to 60 psi during normal flow conditions. The proposed domestic demands do not appear to have an impact on static pressures within the area.

Based on the results of the hydrant flow tests, Onsite Engineering estimated an available fire flow within Phase 1 of 810 gpm while maintaining 20 psi and 1,400 gpm while maintaining 20 psi in Phase 2. These estimates were based on system conditions at the time of the flow tests. It is recommended that a distribution system provide a minimum pressure of 20 psi at ground level throughout the system under MDD. Information obtained from the hydraulic model indicates that an estimated available fire flow of approximately 750 gpm will be available in Phase 1 while maintaining 20 psi throughout the distribution system under MDD conditions and approximately 1,200 gpm will be

available in Phase 2 while maintaining 20 psi throughout the distribution system under MDD conditions.

Information on flows and pressures required for the proposed fire protection systems for each phase were not provided at the time of this evaluation. Based on our experience with buildings of similar size and material, these flows may not be adequate in the event of a fire. The Preliminary Water Study references the Insurance Services Office (ISO) Guide for Determination of Needed Fire Flows (Edition 05-2998) as stating that a needed fire flow of 1,000 gpm at 20 psi can be used for residential occupancies up to and including four stories in height with an automatic fire sprinkler system. This value was used in Onsite Engineering's evaluation of the system. The ISO Guide for Determination of Needed Fire Flow (Edition 06-2014) references a minimum needed fire flow of 1,000 gpm. The recommended fire flow for these buildings would need to be determined during the design of the fire protection system.

The Preliminary Water Study recommends considering connecting Phase 1 to the Reduced High Service Area. To do this, all of Stoney Hill Road would also need to be served from the Reduced High Service Area. Based on the hydraulic model, the estimated available fire flow while maintaining 20 psi in the system would be 1,200 gpm if Phase 1 was included in the Reduced High Service Area. Once the fire protection system has been designed by a Fire Protection Engineer, the requirements of the system should be reviewed using the hydraulic model to determine if distribution system improvements are necessary to provide the recommended available fire flow.

If all of Stoney Hill Road were supplied by the Reduced High Service Area, static pressures along Stoney Hill Road, Deer Run Drive, Thistle Hill Drive, and Quail Hollow Drive would experience an increase in static pressure of approximately 40 psi. The static pressures along these roads would be between 100 and 135 psi. The highest pressures would be observed on Stoney Hill Road near Deer Run Drive, on Deer Run Drive, and Quail Hollow Drive. An upper limiting pressure of 120 psi is generally recommended, as older fittings in the system are generally rated at 125 to 150 psi. The MassDEP published Guidelines for Public Water Systems recommends that pressure reducing devices be utilized on mains or on individual services lines when static pressures exceed 100 psi. Pressure above this level can result in increased water use from fixtures and also increased leakage throughout the distribution system. Also, plumbing code states that water heaters in homes can be affected when pressures exceed 80 psi.

As discussed previously, Phase 1 and Phase 2 are proposed in two different service areas. The system valve separating the two service areas is located on Hartford Turnpike between Phase 1 and Phase 2. Currently, the water main on Hartford Turnpike in the Reduced High Service Area that serves Phase 2 is vinyl lined asbestos cement water main. Vinyl lining was only used in the industry for a short period of time. It had been

found that the vinyl can leach perchloroethylene (PCE) into drinking water and thus the lining was discontinued. The Water & Sewer Department currently monitors the water main and occasionally utilizes a bleeder at this location. The existing water services on Hartford Turnpike are generally commercial and industrial. The vinyl lining is less of a concern for these types of services. However, this type of lining needs to be taken into consideration if the proposed Phase 2 project moves forward or if consideration is given to include Phase 1 in the Reduced High Service Area. Based on system records, there is approximately 2,900 linear feet of asbestos cement water main with the vinyl lining between South Street and 464 Hartford Turnpike. We recommend replacement of this water main to eliminate any concerns associated with the vinyl lining.

Water Management Act Permit

The Town of Shrewsbury was issued a Final Modified Water Management Act (WMA) Permit in July 2015. The WMA permit increased the Town's daily average withdrawal volume to 4.17 million gallons per day (mgd), with provisions to increase to 4.35 mgd if certain conditions are met. From 2010 through 2014, Shrewsbury's daily average withdrawal volume ranged from 3.50 mgd to 3.70 mgd. As a condition of the permit, the Town must implement mitigation measures once water withdrawals exceed a baseline withdrawal volume of 3.91 mgd. A Mitigation Plan was developed and issued with the WMA Permit. The Mitigation Plan was designed to offset increased water use over the baseline.

The development's proposed average daily flow of 42,300 gpd or 0.042 mgd will increase the ADD to approximately 3.74 mgd. While the proposed average daily flow from both phases at the Pointe at Hills Farm development will not result in Shrewsbury exceeding their baseline demand or their permitted daily average withdrawal volume, the Town must consider future impacts this development will have on the Town's ability to supply other potential future developments. Based on the Stormwater Management Summary for the Pointe at Hills Farms completed by Waterman Design Associates, Inc. dated November 2015, the stormwater management system has been designed to meet Stormwater Management Standards. The stormwater runoff from both phases will be collected and treated on site and discharged to either the proposed surface detention basin or one of several subsurface infiltration systems located throughout the site. The Town may be able to utilize the stormwater management practices as mitigation credit.

The WMA Permit also has a maximum daily withdrawal rate of 7.8 mgd. This is the maximum amount of water Shrewsbury can pump from the existing sources on any single day. From 2010 through 2014, the MDD for Shrewsbury has ranged from 5.20 mgd to 5.69 mgd. The development's estimated maximum day demand of 67,700 gpd or 0.068 mgd for both phases would increase the Town's MDD to approximately 5.76 mgd. This is well below the Town's maximum daily withdrawal rate.

Mr. Ronald Rosen
Chairman

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We appreciate the opportunity to assist you on this important matter. If you have any questions regarding this letter, please contact our office.

Sincerely,

TATA & HOWARD, INC.



Paul B. Howard, P.E.
Senior Vice President