TATA & HOWARD

May 13, 2015

Ms. Nan Balmer, Town Administrator
Office of the Town Administrator
41 Cochituate Road
Wayland, MA 01778

Subject: Feasibility Study for Potable Water Supply
River's Edge Development
T&H Job No. 4007

Dear Ms. Balmer:

Tata & Howard, Inc. is pleased to provide the feasibility study for potable water supply to the proposed River's Edge Development located at 484-490 Boston Post Road in Wayland, Massachusetts. The study was conducted to estimate the available flow and pressure in the vicinity of the proposed development and determine the adequacy of the existing water supply to meet the demands of the proposed development. As stated in our agreement, this study does not include the use of the hydraulic model or development of recommendations for system improvements to increase the flow rate and pressure to meet fire flow recommendations. The developer will be responsible for hiring a qualified fire protection engineer to determine the recommended fire flow for the River's Edge Development.

During the course of this project, the undersigned served as Project Officer, Ms. Amanda Cavaliere, served as Project Manager, Mr. Ryan Cain, P.E. served as Senior Project Engineer, Ms. Patricia Kelliher served as Assistant Project Engineer, and Ms. Karen Gracey, P.E. provided technical reviews. At this time, we wish to express our appreciation to the Town of Wayland for their participation in this study and for their help in collecting information and data. Should you have any questions, please contact us.

Sincerely,

TATA & HOWARD, INC.

Jack O'Connell, P.E.
Senior Vice President

cc: Mr. Sarkis Sarkisian - Wayland Town Planner
Ms. Elizabeth Doucette, MCPPO – Wayland Financial Research/Analyst

Tata & Howard
67 Forest Street | Marlborough, MA 01752
T: 508-303-9400 | F: 508-303-9500
www.tataandhoward.com

Other Offices
MA | NH | CT | ME | VT | AZ

TABLE OF CONTENTS

Letter of Transmittal

LIST OF TABLES

LIST OF FIGURES

Appendices

Appendix A –Flow Test Locus Map

SECTION 1 - EXECUTIVE SUMMARY

1.1 General

Tata & Howard, Inc. was retained by the Town of Wayland (Town) to complete a feasibility study for potable water supply to the proposed River's Edge Development located at 484-490 Boston Post Road. The intent of the study is to estimate the water usage for the proposed River's Edge Development and identify any potential impacts on the Town's water supply based on existing flow conditions and projected demands over the next 20 years. Potential improvements to the distribution system were not evaluated as part of this study as the Department of Public Works is in the process of updating the 2007 Capital Efficiency Plan™ (CEP) this year. Therefore, we recommend the developer coordinate with the Wayland Water Department regarding the update of the CEP anticipated to be completed by Winter 2015 for potential recommended improvements that may be required to meet the proposed demands.

The study includes estimating the projected maximum day water demand for the proposed River's Edge Development, available flow and pressure in the vicinity of the proposed development, and projected demands for the water distribution system based on historical use and population trends. In accordance with Town Bylaw, Chapter 191 Lawn Irrigation Systems, areas greater than 15,000 square feet (sf) cannot be serviced by an irrigation system connected to the public water supply. It has been anticipated that the property area to be irrigated would be greater than 15,000 sf. Therefore, an irrigation component was not included in the projected water demand estimate for the proposed River's Edge Development.

Additionally, the study includes a supply evaluation based on current registered and permitted volumes compared to existing and projected demands under the existing Water Management Act Permit. The Massachusetts Department of Environmental Protection (MassDEP) is currently in the process of renewing the Town's existing Water Management Act (WMA) permit, which has the potential to significantly impact the current average allowable withdrawal and limit the amount of available water supply. Once the WMA permit is renewed, the Town will re-evaluate the available supply based on the new WMA permit compared to existing and projected demands.

SECTION 2 – Existing System Conditions

2.1 Existing Flow Conditions

A fire flow test was conducted on April 20, 2015 by the Town's Water Department staff and Tata & Howard at the nearest hydrant on Boston Post Road in the vicinity of the proposed River's Edge Development, located at 484-490 Boston Post Road. This flow test was conducted to determine the available fire flow and pressure at this location based on the existing conditions of the water distribution system. The data obtained during the fire flow test included a static and residual pressure reading, and measurement of flow from the hydrant. The location of the test is depicted on the locus map attached in Appendix A.

Table No. 2-1
Fire Flow Test Results

Location of Flowing Hydrant	Flowing Hydrant Static Pressure (psi)	Residual Hydrant Static Pressure (psi)	Residual Hydrant Residual Pressure (psi)	Observed Flow (gpm)	Estimated Flow at 20 psi (gpm)
End of Water Main on Boston Post Road	104	114	98	1,275	3,300

At the time of the fire flow test, the water level in the Reeves Hill Tank was approximately 357 feet above mean sea level and the Baldwin Pond Treatment Facility was operating at a rate of 1,260 gallons per minute (gpm). Based on the flow test results, the estimated available fire flow at the nearest hydrant on Boston Post Road while maintaining a pressure of 20 pounds per square inch (psi) at the residual hydrant is 3,300 gpm.

2.2 Estimated Available Flow

The static pressure at the flowing hydrant was 104 psi. Based on elevation data provided by the Office of Geographic Information (MassGIS), the ground elevation at the existing hydrant on Boston Post Road is approximately 127 feet above mean sea level. The observed static pressures represent system operating conditions at the time of the flow test. The water level in the tanks varies under normal operating conditions. Operating ranges and system static pressures can vary over time due to seasonal changes, the requirements of the water distribution system, and different daily demand patterns. This can result in lower static pressures in the system.

At the system conditions of the flow test, the estimated static pressure at ground level for a future hydrant on Boston Post Road at the entrance to the proposed River's Edge Development is 101 psi. In general, MassDEP guidelines recommend a minimum pressure of 35 psi at ground level during average day, maximum day, and peak hour demand conditions.

The pressure and available flow at each hydrant is dependent on the elevation of the hydrant and the head loss due to friction in the pipe. It is assumed that a hydrant would be located at the

entrance of the proposed development approximately 2,800 linear feet from the existing water distribution system. This hydrant was evaluated for available flow with a proposed 8-inch diameter water main. By using the proposed hydrant elevation and the length, diameter, and material of the proposed water main, it is estimated that the proposed hydrant at the entrance of the proposed River's Edge Development will have an estimated available flow of 1,950 gpm while maintaining 20 psi.

The needed fire flow for the proposed River's Edge Development was not estimated or evaluated as part of this study. The developer is responsible for hiring a qualified fire protection engineer to determine the recommended fire flow for the River's Edge Development. Prior to constructing the proposed development, the Town should discuss the needed flows for the proposed fire suppression system and a needed fire flow on the street with the Wayland Fire Department.

SECTION 3 - Population

3.1 General

For the purposes of evaluating the water needs of a community, several parameters are typically reviewed to better understand the demands of a distribution system. These parameters are defined in the sections below and are presented with their existing and projected demand estimates.

3.2 Population Projections

Because population has a direct correlation to water consumption, population projections from various sources through the year 2035 were reviewed to reflect actual and planned growth within the Town. The following section reviews historical population data and presents an estimated future population based on available information from the Town.

According to the United States Census, the Town of Wayland has experienced fluctuating population changes ranging from approximately -0.8 percent to 10.3 percent per year from 1980 through 2010 with an overall growth of approximately 6.8 percent. The population recorded during each decennial census has been plotted in Figure No. 3-1. According to the US Census, the population in the Town was approximately 13,000 people in 2010.

The US Census Bureau also estimated the annual population changes between 2000 and 2013. The census estimated annual population has also been included in Figure No. 3-1. From 2000 through 2006, there was an overall decrease in population of approximately 2.7 percent. From 2006 through 2013, there was an overall increase in population of approximately 5.6 percent. The average growth rate per year was approximately 0.2 percent. The population projections forecasted by the organizations described below used the US Census estimated populations.

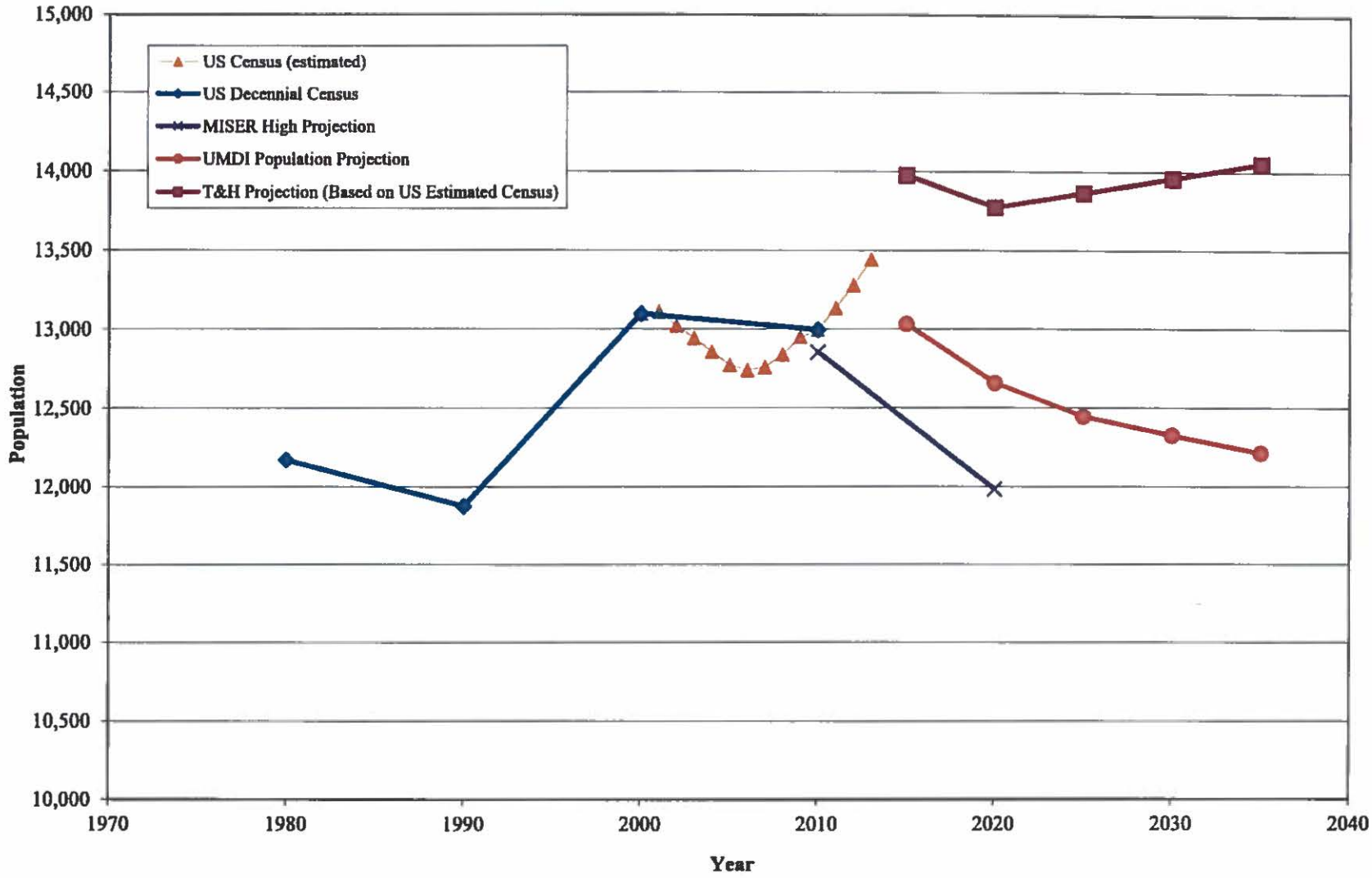
Population projection data collected from the Massachusetts Institute for Social and Economic Research (MISER) has also been included in Figure No. 3-1. MISER used three different growth rates between 0.3 and 0.9 percent to estimate projections through 2020. Based on the MISER; low, middle, and high projections, the estimated 2020 populations are 9,700, 10,700, and 11,900, respectively. MISER last developed projections in 2003 based on U.S. Census data for 2000. These projections do not reflect the shift in economic and social trends that has taken place since 2000, and are likely no longer valid.

Population projection data was also collected from the University of Massachusetts Donahue Institute (UMDI) included in Figure No. 3-1. The projections are provided in 5-year intervals from 2015 through 2035. Based on UMDI, the estimated 2035 population is approximately 12,200.

Based on the estimated populations from 2000 to 2013 presented by the U.S. Census and the proposal of several developments in Town, it was determined that the decrease in population presented by both MISER and UMDI do not accurately represent the Town's projected population. Therefore, population projections for this study were determined by utilizing the trends of the U.S. Estimated Census. This trend anticipates a slow growth over the next twenty years. The estimated 2035 population for the Town is 14,050. This population projection

includes the addition of the proposed River's Edge Development. Based on 2000 U.S. Census Data, the average household size in the Town of Wayland was 2.80. Assuming 190 units with an average of 2.80 people per unit, the total number of people in the proposed River's Edge Development would be 532. The historic and projected population of the Town is presented on Figure No. 3-1.

Figure No. 3-1
Historic and Projected Populations



SECTION 4 – SYSTEM SUPPLY & DEMANDS

4.1 Water System Demands

The Massachusetts Department of Conservation and Recreation (DCR) follows specific guidelines when projecting the water usage for communities in conjunction with the MassDEP Water Management Act (WMA) program. It is important to note that the DCR has a key role in the water management approval process and demand projections are required to be approved by DCR before MassDEP will approve development of a new water supply source or authorize the withdrawal of additional volume from existing sources.

The DCR is in the process of preparing demand projections for the Town of Wayland. However, they were not available at the time of this study. Therefore, future demands were calculated based on the population projections presented in Section 3.2. DCR demand projections include future developments previously approved by the local Planning Department. Therefore, since this development has not been designed or approved, it is recommended that the Planning Department coordinate with the Water Department regarding this development and other potential developments requiring significant amounts of water so DCR can include the developments in the demand projections prior to being finalized.

Based on recent developments, the Massachusetts Water Resource Commission (MWRC) has adopted new Water Management Standards for all registered and permitted withdrawals. The policy includes performance standards and conditions for all registered and permitted public water suppliers in the following areas:

- Maximum residential consumption of 65 gallons per capita per day (gpcd).
- Maximum of 10 percent unaccounted-for water.

Because the timing for construction of the River's Edge development is unknown, projected demands were estimated based on DCR guidelines including 10 percent unaccounted for water and 65 gpcd and using current trends.

Average Day Demand

Average day demand (ADD) is the total water supplied to a community in one year divided by 365 days. This term is commonly expressed in million gallons per day (mgd). This demand includes all water used for domestic (residential), commercial, and municipal purposes. The municipal component includes water used for system maintenance such as water main flushing and fire flows. In addition, the ADD includes unaccounted-for water attributed to unmetered water uses and system leakage. According to the 2014 Annual Statistical Report (ASR), the raw water ADD supplied for the system was 1.33 mgd.

The following criteria were used to develop the ADD for the design year 2035:

Criteria following DCR guidelines:

- Residential consumption of 65 gpcd
- Year 2035 service population of 14,050, which includes the proposed River's Edge Development of 532 people.

- Commercial usage remains the same at 5% of the total usage
- Municipal usage remains the same at 2% of the total usage
- Maximum of 10 percent unaccounted for water

Criteria following current trends:

- Residential consumption of 75 gpcd
- Year 2035 service population of 14,050, which includes the proposed River's Edge Development of 532 people.
- Commercial usage remains the same at 5% of the total usage
- Municipal usage remains the same at 2% of the total usage
- Maximum of 20 percent unaccounted for water

The estimated ADD for the design year 2035 based on the above criteria is approximately 1.10 mgd following DCR guidelines and approximately 1.44 mgd following current trends, as shown in Table No. 4-1.

Summer Average Day Demand

MassDEP guidelines recommend that a system consider a projected summer ADD (SADD). The current SADD is estimated by averaging demands from the three maximum months for the past five years. Based on available data between 2010 and 2014, the SADD ranged from 1.50 mgd to 1.87 mgd. The SADD peaking factor is determined by dividing the SADD by the annual ADD for each of the past five years. These peaking factors are averaged to estimate the future summer peaking factor. Based on the 2010 through 2014 monthly demand data, the average summer peaking factor is 1.28. Based on the projected ADD of 1.10 mgd using DCR guidelines, the estimated 2035 SADD is approximately 1.41 mgd and based on the projected ADD of 1.44 mgd using current trends, the estimated 2035 SADD is approximately 1.85 mgd.

Maximum Day Demand

Maximum day demand (MDD) is the maximum one-day (24-hour) total quantity of water supplied during a one-year period. This term is typically expressed in mgd.

The projected MDD can be estimated by the MDD/ADD ratio. The MDD/ADD ratio provides a relationship between the two demands which can be used to estimate future demands. As shown on Table No. 4-1, the raw water MDD for 2014 was 2.84 mgd. Upon comparison of the MDD to the ADD, the ratio for 2014 was 2.14. The resulting projected MDD for year 2035 is estimated to be 2.36 mgd based on the projected 2035 ADD of 1.10 mgd using DCR guidelines and 3.09 mgd based on the projected 2035 ADD of 1.44 using current trends.

Table No. 4-1
Current and Projected Water Use

Year	ADD (mgd)	SADD (mgd)	Peaking Factor (SADD/ADD)	MDD (mgd)	Peaking Factor (MDD/ADD)
2014	1.33	1.67	1.28	2.84	2.14
2035 (DCR Guidelines)	1.10	1.41	1.28	2.36	2.14
2035 (Current Trends)	1.44	1.85	1.28	3.09	2.14

4.2 Available vs. Needed Flows

In accordance with standard waterworks practices and current MassDEP guidelines, the supply sources of a water system must be capable of meeting maximum day demand conditions with all supplies online and summer average day demand conditions with the largest source out of service. Additionally, the sources should be permitted or registered to withdraw volumes adequate to meet ADD. In this section, the permitted or registered volumes of the existing supply sources were analyzed to determine the availability of surplus supply for the addition of the River's Edge Development.

In 1987, the WMA program was implemented by MassDEP to regulate withdrawal of water from the State's watershed basins. Under this program, all new sources withdrawing more than 100,000 gallons per day (gpd) and existing sources exceeding their registered withdrawal volume by 100,000 gpd are required to obtain a withdrawal permit under the WMA. When first implemented, the registered withdrawal volume for a public water system was based on that system's historical pumping rate of the water supply source(s) between 1981 and 1985. Permits can be renewed and amended as system demands increase and additional supply sources are utilized. The WMA program considers the need for the withdrawal, the impact of the withdrawal on other hydraulically connected water suppliers, the environmental impacts of the withdrawal and the water available in the river basin or subbasin (the basin safe yield) prior to issuing a permit. It is important to note that the basin safe yield is different from the safe yield of a supply. In accordance with the WMA permit application instructions, the basin safe yield is the total water available to be withdrawn from a river basin or subbasin, whereas the safe yield of a well is the volume of water the well is capable of pumping under the most severe pumping and recharge conditions that can be realistically anticipated.

The Wayland system is currently authorized to withdraw an average daily volume of 1.77 mgd through its WMA permit and registration. However, MassDEP is currently in the process of renewing the existing permit to include revisions to the WMA regulations, which are intended to manage water withdrawals throughout the Commonwealth to ensure an appropriate balance among competing long-term water needs of communities and the preservation of water resources and aquatic ecosystems. The revisions to the regulations implement a framework to establish a methodology for relating impacts to the aquatic resources to natural manmade conditions, including the withdrawal of water. The allowable volume the Town is authorized to withdraw

from the Concord River Basin could change due to the new regulations, therefore, impacting the available water supply.

Current permit and registered authorized withdrawal volumes and maximum approved pumping rates were obtained from the 2014 ASR. Table No. 4-2 outlines the Approved Withdrawal Rates for each supply.

Table No. 4-2
Supply Summary

Name of Supply	Approved Withdrawal Rate (MGD)
Campbell Well	0.600
Chamberlain Well	0.828
Happy Hollow Well No. 1	0.648
Happy Hollow Well No. 2	0.763
Meadowview Well	Offline
Baldwin Pond Well No. 1*	1.51
Baldwin Pond Well No. 2*	
Baldwin Pond Well No. 3*	

* Baldwin Pond WMA permit maximum approved pump rate is 1.51 mgd from all three sources combined.

According to the 2014 ASR, the Wayland ADD was 1.33 mgd, the MDD was 2.84 mgd, and the SADD was 1.67 mgd. The system's total combined approved withdrawal rate of all active supply sources is 4.35 mgd. The Meadowview Well is currently offline and will remain offline indefinitely. Therefore, the pumping rate for Meadowview Well has not been included in the calculations. Compared to the 2.84 mgd MDD in 2014, a surplus of 1.51 mgd is estimated. The Baldwin Pond Water Treatment Facility is Wayland's largest source. Therefore, the maximum pumping rate with the largest source offline is 2.84 mgd. Compared to the SADD of 1.67 mgd in 2014, a surplus of 1.17 mgd is estimated.

The proposed River's Edge Development is still in the planning stages. Therefore, since the timing of construction for River's Edge Development is unknown at this time, projected demands using current trends were used to evaluate the adequacy of the supply sources. The projected 2035 ADD, MDD, and SADD using current trends are 1.44 mgd, 3.09 mgd, and 1.85 mgd, respectively. Compared to the projected 2035 MDD of 3.09 mgd, a surplus of 1.26 mgd is estimated. If the largest source was offline, a surplus of 0.99 mgd is estimated compared to the projected 2035 SADD using current trends of 1.85 mgd.

Table No. 4-3 outlines the system's ADD, MDD, and SADD for 2014 and projected 2035 compared to the WMA registered or permitted volumes and maximum approved daily pumping volumes. According to the recent demand data, Wayland currently does not exceed their registered or permitted volumes or exceed their maximum approved daily pumping volumes. The surplus of water for existing and projected demand conditions makes it feasible to supply water to the proposed River's Edge Development. It is recommended that the Town re-evaluate

the available supply compared to projected demands once the WMA permit is renewed and finalized.

Table No. 4-3
Current and Projected Demand Summary (Current Trends)

Year	ADD (mgd)	WMA Permitted/ Registered Volume (mgd)	SADD (mgd)	MDD (mgd)	Maximum Approved Daily Pumping Volume (mgd)	Difference Between MDD and Authorized Withdrawal (mgd)	Maximum Approved Daily Pumping Volume with Largest Source Offline (mgd)
2014	1.33	1.77	1.67	2.84	4.35	+1.51	+1.17
2035	1.44	1.77	1.85	3.09	4.35	+1.26	+0.99

SECTION 5 – Conclusions

5.1 General

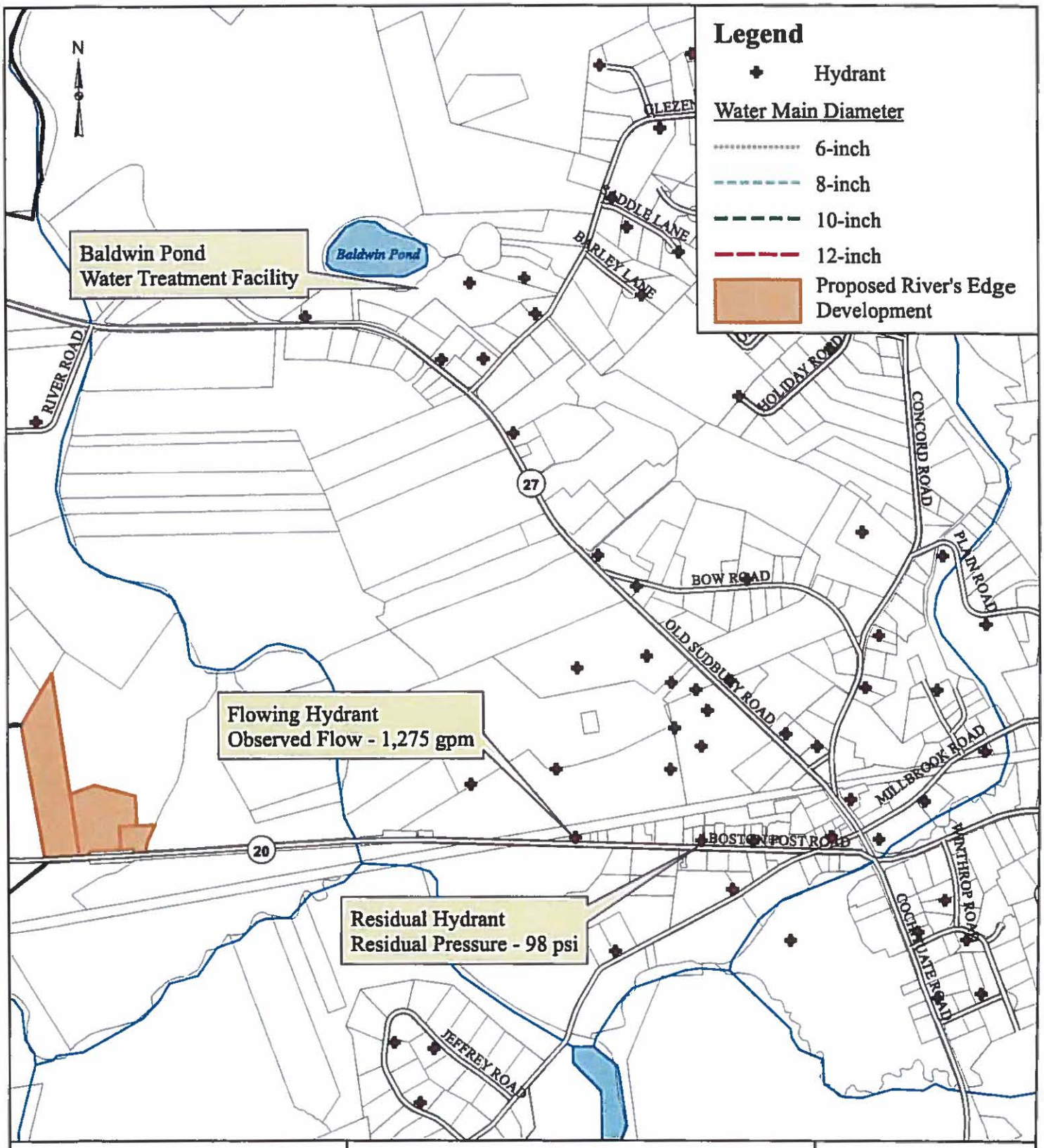
This study was conducted to calculate the current estimated available flow and pressure in the vicinity of the proposed site and determine the feasibility for potable water supply to the proposed River's Edge Development based on existing flow conditions and projected demands versus current system supply conditions. By using the hydrant elevation and the length, diameter, and material of the proposed water main, it is estimated that the proposed hydrant at the entrance of the proposed River's Edge Development will have an estimated available flow of 1,950 gpm while maintaining 20 psi. Based on existing supply conditions, a surplus is estimated compared to existing flow conditions and projected system demands. The surplus of water for existing and projected demand conditions makes it feasible to supply water to the proposed River's Edge Development under the current WMA permit.

It is recommended that the Planning Department coordinate with the Water Department regarding this development and other potential developments requiring significant amounts of water so DCR can include the estimates in their demand projections prior to being finalized. It is also recommended that the Town re-evaluate the available supply compared to projected demands once the WMA permit has been renewed and demand projections are updated by DCR to determine the impacts, if any, on the available supply for the proposed River's Edge Development and any other potential developments in the preliminary planning stages.

Potential improvements to the distribution system were not evaluated as part of this study. The land for the River's Edge Development currently is owned by the Town and has not been purchased by a developer. At the time the land is purchased, we recommend the Town request a subdivision review be conducted to analyze and provide comments to the developer's water main design plans, determine water use fees, and conduct a hydraulic analysis. The Town is currently updating their CEP anticipated to be completed by December 2015. The CEP includes a hydraulic analysis of the Town's distribution system using WaterGEMS modeling software. The model can be used to determine potential recommended improvements that may be required to meet the proposed demands and fire flow requirements for the proposed fire suppression system and a needed fire flow on the street as recommended by the Wayland Fire Department. Tata & Howard will provide a cost estimate to the Town for a subdivision review, at the time the land is purchased by a developer, upon request.

APPENDIX A

TATA & HOWARD



TATA & HOWARD

Date: May 2015
Approximate Scale: 1" = 1,000'

Flow Test Locus Map
Feasibility Study for Potable Water Suppy

River's Edge Development
Wayland, Massachusests

Figure No.

1