INSITE
ENGINEERING, SURVEYING & LANDSCAPE ARCHITECTURE, P.C.

WATER & WASTEWATER ENGINEERING REPORT

For

West End Lofts
City of Beacon, New York

June 27, 2017

Prepared By

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1.0 INTRODUCTION

The West End Lofts project is located on a parcel between Beekman Street and Wolcott Avenue, immediately south of the Beacon City Hall property. The subject property is located in the City's Linkage District and is identified as Tax Map No. 5954-26-688931. The applicant, Kearney Realty & Development Group wishes to construct three buildings containing 98 apartments. The project will also require subdivision approval to arrange the final property lines with the City, and place Buildings 1 and 2 on one lot, and Building 3 on a second lot. All buildings are proposed to be three (3) stories from the front and four (4) stories from the rear.

The building breakdown of the proposed development of the site consists of the following:

1. Building #1, 28 Total Units, (14, 1-bedroom / 14, 2-bedroom).

2. Building #2, 45 Total Units, (31, 1-bedroom / 14, 2-bedroom).

3. Building #3, 25 Total Units, (11, 1-bedroom / 14, 2-bedroom).

The project is located in the City of Beacon Water and Sewer area. Water will be provided by three (3) proposed individual water service line connections to the existing 12" water main in Wolcott Avenue. Sewer will be provided with 6" service connections to a proposed 8" onsite sewer main. The onsite sewer main is proposed to connect to the existing 8" sewer in Beekman Street.

2.0 PROJECT DESIGN FLOWS AND ANTICIPATED FLOWS

Design maximum daily wastewater flows for the proposed project, West End Lofts, are based on the hydraulic loading rates given in the New York State Department of Environmental Conservation (NYSDEC) publication **Design Standards for Intermediate Sized Wastewater Treatment Works – 2014** (DEC 14). The design maximum daily water use is a conservative design flow on which the water infrastructure will be designed. This value does not represent the average daily flow which is expected to be substantially less.

The following table calculates the hydraulic loading rates and the design flow rates (gallons per day or gpd) for the proposed project.

Table 1: West End Lofts Project Design Maximum Daily Flow Rate

Proposed Use	Hydraulic Loading Rate	Design Maximum Daily Flow (gpd)
56 – One Bedroom Apartments	110 gpd/dwelling	6,160
42 –Two Bedroom Apartments	220 gpd/dwelling	9,240
Total		**15,400**

The anticipated design average daily flows for the project are expected to be significantly less than the design maximum daily design flow. The design maximum daily flows represent conservative flows to ensure that the proposed sewer infrastructure is designed with an ample factor of safety. The anticipated average daily flows are based on occupancy rates and measured data for water use. Statistical data (obtained from **Rutgers University, Center for Urban Policy Research**, **Residential Demographic Multipliers**, June 2006) for the average number of occupants in rental units (based on number of bedrooms) was used to calculate the expected number of residents anticipated for the project as shown in the table below. Data from the American Water Works Association (AWWA) shows that the average in home water use is 69 gpd per person. This number is reduced to 45 gpd per person when water saving fixtures are used, which is the case for this project.

Table 2: Design Average Daily Flow

Proposed Use	Occupancy Rate	Total Anticipated Residents	Water Use Per Resident (gpd)	Water Use (gpd)
56 – One Bedroom Apartments	1.6 people/unit	90	45	4,050
42 –Two Bedroom Apartments	2.3 people/unit	97	45	4,365
Total Anticipated Water Use (gpd)				**8,415**

As demonstrated above, through the use of water saving fixtures as required by current building code, a design maximum flow of 15,400 gpd is proposed for the project, while the design average daily flows are anticipated to be substantially less 8,415 gpd.

The peak hourly flow is calculated using a peaking factor that is based on the population of the subject project. A peaking factor of four will be used for the project based on Figure 1 from Recommended Standards for Wastewater Facilities.

Peak Hourly Domestic Flow

15,400 gpd ÷ (24 hr/day) ÷ (60 min/hr) = 10.7 gallons per minute (gpm)

Peak Hourly Flow = 10.7 gpm x 4 = 42.8 gpm

Although the anticipated flows (design average daily flow) for the project are lower than the design maximum daily flows, the design maximum daily flows are used for the design of the system. This provides an additional factor of safety in the proposed design.

The requirements for fire sprinkler systems were preliminarily established for the project. The three residential buildings are required to have fire sprinklers. The fire sprinkler designer has provided that the sprinkler demand for the residential buildings is 300 gpm at 50 psi was provided by the building design team for this report. This results in a peak fire sprinkler and domestic combined flow of;

Peak Fire Sprinkler and Domestic Combined Flow

42.8 gpm + 300 gpm = **342.8 gpm = 343 gpm**

3.0 PROPOSED WATER CONNECTION TO THE CITY OF BEACON SYSTEM

3.1 System Characteristics

Based on review of existing system with the City of Beacon Water and Sewer Department there is an existing 12” main in Wolcott Ave that passes along the subject project’s frontage.

3.2 Proposed Water Service Connection

The existing watermain which the project proposes to connect to is located in Wolcott Ave which bounds the project site to the east. As previously discussed, based on available mapping subsequent discussions with the City of Beacon Water and Sewer Department the existing watermain is 12-inch diameter pipe. The project proposes three (3) 6” DIP service line connections to the existing 12” main in Wolcott Ave will be provided for each building. This service lines will be combined fire and domestic services for each of the residential buildings.

One (1) centrally located fire hydrant is proposed throughout the proposed development. All hydrants will be manufactured by Mueller as required by the City.

Restrained joint connections will be provided at all pipe bends. Upon completion of the water service installation pressure testing, disinfection, and flushing will be performed in accordance with AWWA standards.

Recommended Standards for Water Works (RSWW) recommends that the normal working pressure not be below 35 psi, and both the RSWW and the American Water Works Association (AWWA) M 31 recommend that a minimum of 20 psi be maintained at all points in the water distribution system during fire flows.

Flow testing on the existing watermain in Wolcott Ave was performed and witnessed by the City on April 4, 2017. The hydrant at the corner of Wolcott Ave and Beacon St was flowed and the residual was measured at the next hydrant to the north, in front of the Fire Department Building, immediately across from City Hall. A static pressure of 84 psi was measured at the residual hydrant and during the flow test a residual pressure of 70 psi was witnessed with a flow of 1405 gpm.

3.2.1 Static Pressures

The static pressure at the first-floor elevation (FFE) will be calculated by comparing the approximate elevation of the tested hydrant to the elevation of the first floor of the building:

Static Pressure at Residual Hydrant (SPH)	= 84 psi
Elevation of Residual Pressure Hydrant	= 135' ±
First Floor Elevation of Highest Building (FFE):	= 142' ±
Static Head Change = Hydrant Elevation - FFE = 135 - 142 =	= -7' ±
Static Pressure Change (SPC) = Static Head Change / 2.31 ft/psi	
SPCB = -7' / 2.31 ft/psi =	= -3 psi
Static Pressure at FFE = SPH + SPCB = 84 psi + (-3 psi) =	= 81 psi

3.2.2 Residual Pressure – Peak Combined Flow

The equation below is taken from AWWA M17. The equation is used to calculate flow available at different pressures or differences in the residual pressure that would result from different flow rates. Here the equation is used to calculate the residual pressure at the observation hydrant for the peak combined flow, using the pressures and flow rates measured during the flow test. The proposed water service lines will be sized for the peak combined flow to 343 gpm (300 gpm sprinkler flow and 43 gpm domestic flow).

$$Q_R = Q_F * h_r^{0.54} / h_f^{0.54}$$

Where:

- Q_R = peak combined flow (343 gpm)
- Q_F = flow from hydrant during test (1405 gpm)
- h_r = the difference in pressure between the static pressure measured at the observation hydrant and the residual pressure at the total combined flow
- h_f = the difference between the static pressure and residual pressure measured at the observation hydrant during the flow test, (14 psi)

$$343 \text{ gpm} = 1405 \text{ gpm} * h_r^{0.54} / 14\text{psi}^{0.54}$$

$$h_r = 1 \text{ psi}$$

The results in a residual pressure of 83 psi at the residual pressure hydrant.

Next the frictional head loss must be calculated for the main from the tested hydrant to the service connection. As shown in the attached calculations in Appendix A head loss of 1 ft (1 psi) for the peak combined flow is calculated.

Next calculate the frictional loss for the water service line at the peak combined flow of 343 gpm. As shown in the attached calculations a head loss of 2 ft (1 psi) is calculated in the service line. This results in a calculated pressure of:

84 psi – loss in main – loss in service line, + Static Pressure Change

84 psi – 1 psi – 2 psi + (-1 psi) = 80 psi

Based on the calculated residual pressures at the observation hydrants used for the flow testing and the head loss calculations included in Appendix A there is adequate pressure and flow available in the existing watermains to meet the 35 psi minimum pressure per RSWW recommendations.

3.2.3 Onsite Fire Flow at Proposed Hydrant

As shown in the fire flow test figure attached to this report, the hydrant that was flowed during the test is at a similar elevation and approximately 200 feet from the proposed onsite hydrant. Based on the results of the flow test similar flows (1400 gpm +/-) and pressures (70 psi +/-) can be anticipated at the onsite hydrant.

4.0 PROPOSED WASTEWATER CONNECTION TO THE CITY OF BEACON SYSTEM

Centralized sanitary sewer service for the West End Lofts will be provided via connection to the gravity sewer system located west of the project site adjacent to Beekman Street.

Onsite sewer service lines will collect wastewater flows from all three (3) buildings and connect to an existing sewer manhole on the east side of Beekman Street. Wastewater flow from each building will be conveyed by 6" PVC SDR 35 sewer service lines. The service connections will be installed with a minimum slope of ¼" per foot slope meeting the requirements of DEC14. The sewer service lines are proposed to connect to a proposed 8" PVC SDR sewer main onsite that ultimately connects to the existing sewer main in Beekman Street. All PVC pipe will contain rubber push on gaskets at pipe connections. Cleanouts will be provided on each sewer service connection just outside of each building. Upon installation of the sewer mains will be tested with low pressure air tests in conformance with ASTM F1417-92 and the sewer manholes shall be vacuum tested in conformance with ASTM 1244-02, per the notes on the project plans.

The site plan depicts the sanitary sewer system connections for the subject project including the locations of the existing sewer mains, manholes, and sewer services from a survey prepared at the time of the construction of Beacon City Hall. The elevations associated with the existing system will be verified prior to the final design of the connection to the existing sewer. The onsite sanitary sewer system will be designed in accordance with City of Beacon and Dutchess County Department of Health (DCDOH) requirements and is subject to their respective approvals.

It is understood that the City Sewer collection system down gradient of the proposed project flows to an existing pump station at the end of West Main Street, near the Metro North Train Station. In conversations with the Planning Board Engineer it is understood that the City will require their independent consulting engineer to assess the proposed flows from the subject project and the impact on the existing pump station with respect to capacity to the overall City system.

Appendix A

Water Headloss Calculations

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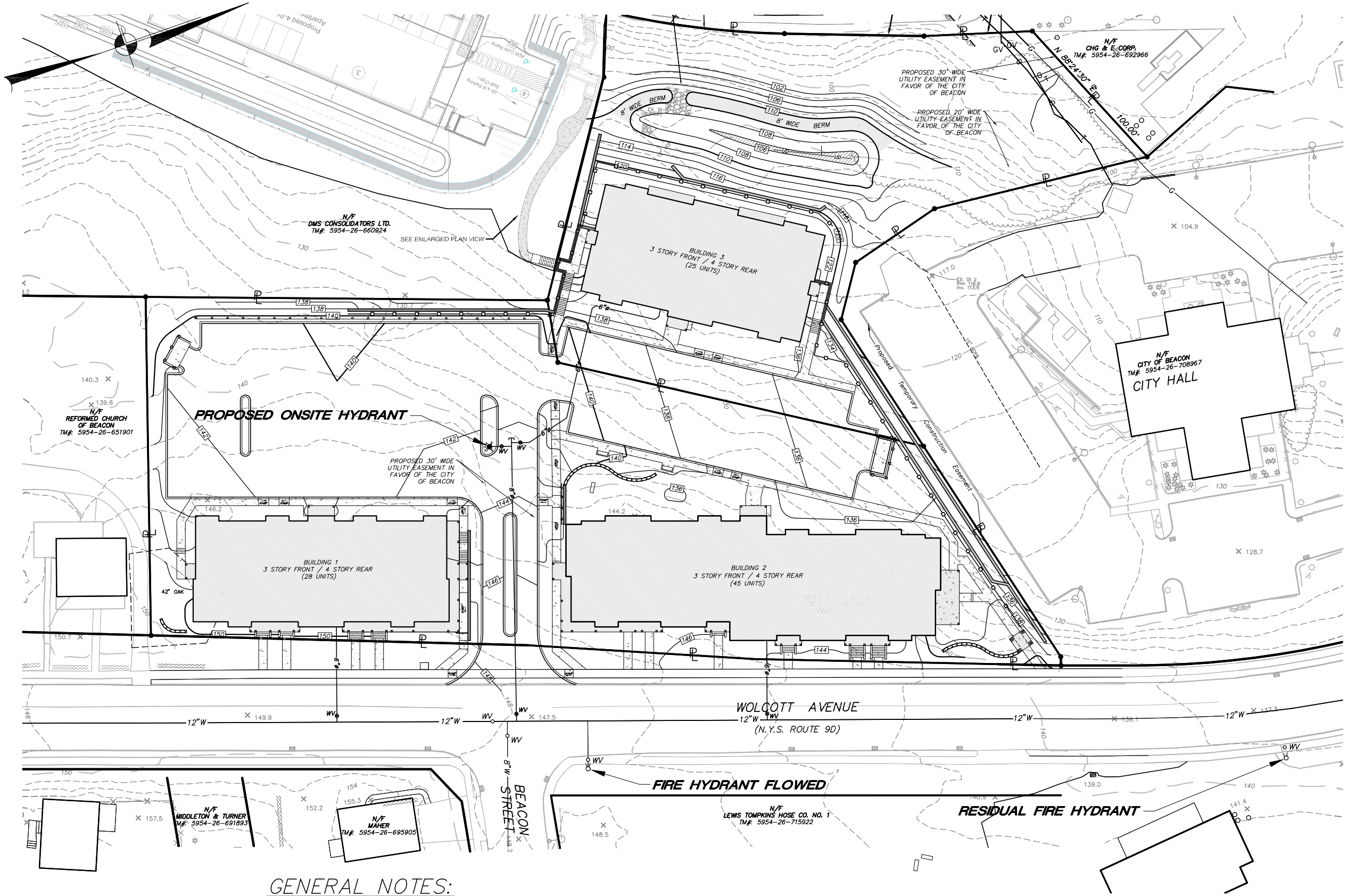
West End Lofts
Head Loss Calculations

Head Loss in Water Main from Residual Pressure Hydrant to Service line.

C	110		Roughness coefficient for ductile iron pipe
d	8	in	Diameter of water main
L	165	ft	Length of water main
Q	343	gpm	Flow Rate
V	2.2	ft/s	Velocity
L_e	35	ft	Equivalent length to account for losses in valves and bends
L_t	180	ft	Total Length = L + L_e
HL	1	ft	HL = $\frac{10.44(L_t)(Q^{1.85})}{(C^{1.85})(d^{4.87})}$

Head Loss in Service Line

C	110		Roughness coefficient for ductile iron pipe
d	6	in	Diameter of water service line
L	130	ft	Length of water service line
Q	343	gpm	Flow Rate
V	3.9	ft/s	Velocity
L_e	35	ft	Equivalent length to account for losses in valves and bends
L_t	165	ft	Total Length = L + L_e
HL	2	ft	HL = $\frac{10.44(L_t)(Q^{1.85})}{(C^{1.85})(d^{4.87})}$



GENERAL NOTES:

1. Property line shown hereon is based on contract of sale and requires a lot line realignment with the city parcel to the north.
2. Topography shown hereon is based upon aerial photography dated April 14, 2003 and is photogrametrically compiled. Elevations shown hereon conform to the North American Vertical Datum of 1988 (N.A.V.D, 1988) as derived by GPS observation. The contour interval is 2'.
3. Flow testing on the existing watermain in Wolcott Ave was performed and witnessed by the City on April 4, 2017. The hydrant at the corner of Wolcott Ave and Beacon St was flowed and the residual was measured at the next hydrant to the north, in front of the Fire Department Building, immediately across from City Hall. A static pressure of 84 psi was measured at the residual hydrant and during the flow test a residual pressure of 70 psi was witnessed with a flow of 1405 gpm

60 0 30 60

(IN FEET)
1 inch = 60 ft.

DATE:	5-30-2017
SCALE:	1" = 60'
PROJECT NO.:	16226.100
FIGURE:	1

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DRAWING: HYDRANT FLOW TEST FIGURE

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