

*Map, Plan, and Report*  
**Wawarsing Water District**

Town of Wawarsing  
Ulster County, New York



Prepared for:

Town of Wawarsing  
108 Canal Street  
Ellenville, NY 12428

DRAFT: December 21, 2018

REVISED: May 24, 2019

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## 1.0 INTRODUCTION

The purpose of this Map, Plan, and Report is to present data and information to the Town of Wawarsing relative to a proposed new Water District (WD) serviced by a water supply from three newly installed wells. The properties in the proposed WD are currently served by individual water supplies in both individual residential and commercial properties. The proposed service area matches an area delineated by the New York City Department of Environmental Protection (NYCDEP) where USGS studies and NYCDEP suggested the presence of leakage from the buried NYCDEP aqueduct passing west to east under the Town of Wawarsing near the Vernooy Kill Creek and Lippman Park may influence individual well production. The water district can be provided reliable potable water via the recently installed wells, treated and then distributed through the proposed water system network described herein.

This Map, Plan, and Report includes:

- Description of the proposed Town water district;
- estimate of the existing and projected water demands for the Wawarsing Water District (WWD);
- description of the proposed water system infrastructure;
- opinion of probable construction cost;
- evaluation of the future debt retirement; and
- estimated operation and maintenance and usage cost.

This report follows the criteria outlined in both the Recommended Standards for Water Works (WSCGL, 2012) and the Guide for Determination of Needed Fire Flow (ISO, 2008). It includes data obtained from the wellfield hydrogeologic report (in press) and interviews with the former operator of the adjacent Napanoch and Kerhonkson water districts as well as current Town officials.

## 2.0 EXISTING CONDITIONS

### 2.1 Town of Wawarsing Geography and Demographics

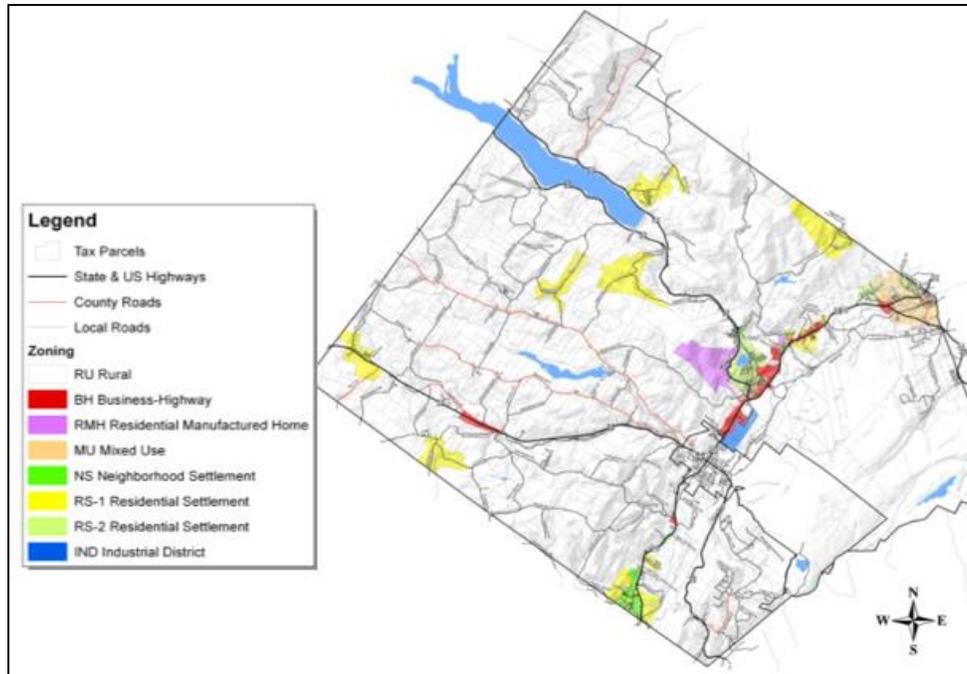
The Town of Wawarsing is in the southwest corner of Ulster County, New York, within the Lower Non-Tidal portion of the Roundout watershed (UCPD, 2009; RCWC, 2010) [only a small portion drains to the Wallkill watershed (Fairweather & Shepstone, 2006, p. 26)]. It is composed by the Village of Ellenville and the hamlets of Napanoch, Wawarsing, and Kerhonkson. It is mostly located in the Rondout valley with a total area of 133.9 square miles and elevations that range between 400 feet to 300 feet above sea level (though, higher elevations might be found to the east). Refer to Figure A-1 in Appendix A.

As of 2011, the land cover was distributed as follows (Mickelson & Church, 2018, pp. 19-20): 79% forest, 5% developed, 4% agricultural, 6% wetlands, 3% scrub/shrubs, 2% open water, and 1% grassland/herbaceous. The land use has a varied pattern throughout the town, wherein the majority of the town's land is composed of residential (37.9%) and vacant lands (37.6%) (Fairweather & Shepstone, 2006, p. 29). Figures 1 and 2 represent the land use and zoning maps, respectively.



**Figure 1.** Town of Wawarsing land use map  
(Fairweather & Shepstone, 2006, p. 31)

According to the U.S. Census Bureau (2010), the Town of Wawarsing population is 13,157 and has a median household income of \$46,672 (in 2016 dollars). With respect to the living arrangements, the town has approximately 4,487 households with an average of 2.47 persons per household for the period 2012-2016. Also, 87% of the population lives in households while 13% of residents are in group quarters. From the water consumption<sup>1</sup> point of view, it is noteworthy to point out that, in average, 48% of the town's households were built before 1960 (45% in Kerhonkson, 58% in Napanoch, and 41% in the rest of Wawarsing) (Fairweather & Shepstone, 2006, pp. 14-17).



**Figure 2.** Town of Wawarsing zoning map  
(Town of Wawarsing Building Department, 2014)

## 2.2 Town of Wawarsing Water Districts

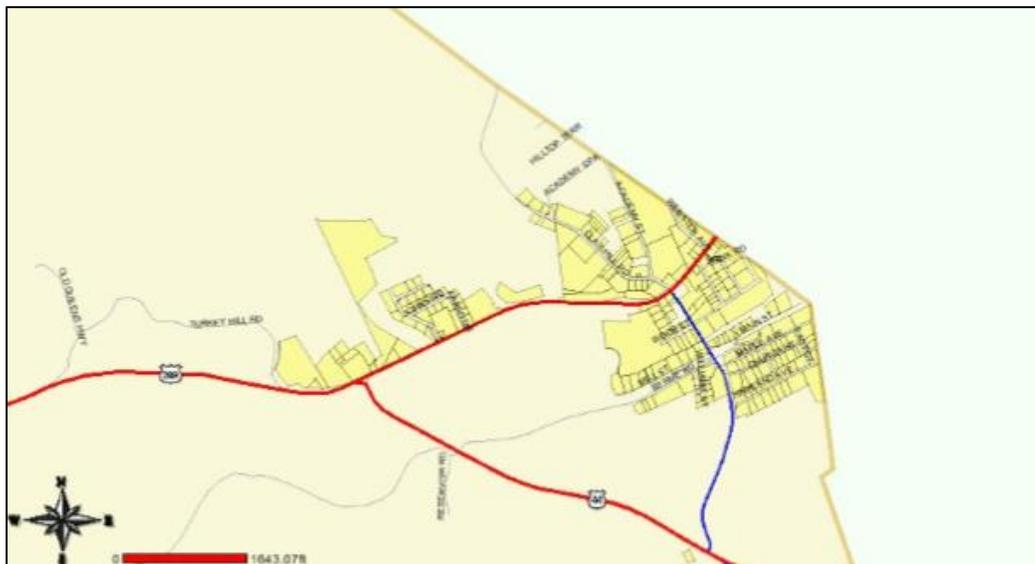
As per UCDOH (2017), in Ulster County, drinking water is supplied by 145 public water systems that fall into the category of either *Community Water System (CWS)* or *Non-Transient Non-Community Water System (NTCNWS)*, all of which use groundwater as their water source (typically, not fluorinated; except for the Marlborough Water District). In the Town of Wawarsing, there are two main sources of drinking water; the water districts of Kerhonkson and Napanoch. Also, the Village of Ellenville, which has its own public water system, supplies a small area of the southern part of the town (Fairweather & Shepstone, 2006, p. 32-34) in emergency situations.

<sup>1</sup> Typical residential hydraulic loading rates are: 10 gpd for post 1994 plumbing code fixtures; 130 gpd for pre 1994 fixtures; and 150 gpd for pre 1980 fixtures (Table B-3, page B-16, Design Standards for Intermediate-Sized Wastewater Treatment Systems [https://www.dec.ny.gov/docs/water\\_pdf/2014designstd.pdf](https://www.dec.ny.gov/docs/water_pdf/2014designstd.pdf)).

### 2.2.1 Kerhonkson Water District (KWD)

The KWD is an older water district originally established as a private water system. In 1965, the Town of Wawarsing purchased the water district from the private owners. It serves approximately 243 customers (T. Moza, personal communication, Oct. 17, 2018), which are mainly residential and two (2) restaurants (no significant commercial or industrial users). For water source, the KWD relies on two (2) groundwater wells: one well is located at the end of Hilltop Terrace (geographical coordinates 41°46'47.22"N; 74°18'18.13"W), of which it has been reported that the supply has elevated mineral content; the second one is located on a parcel just off Route 44/55 near the Kerhonkson reservoir (geographical coordinates 41°45'58.39"N; 74°18'8.87"W). The well near Route 44/55 is the main supply source for the District. Figure A-2 in Appendix A shows the location of the two wells and the property's parcel ID number within which they are situated. Appendix C compiles the detailed information of the property's tax ID information.

The approximate current average water daily production is 80,000 gallons per day (gpd) (T. Moza, personal communication, Oct 17, 2018). The water is treated at the wellhead inside a small building where the only unit process carried out is disinfection (chlorination). For the period July 2017–September 2017, the New York Department of Health – Bureau of Public Water Supply Protection reported that the KWD complied with the federal health-based drinking water standards (EWG-Kerhonkson, n.d.). However, the well on Hilltop Terrace has water quality issues (elevated mineral content). After treatment, water is pumped and stored into two (2) steel standpipe water storage tanks: 400,000-gal and 100,000-gal (Fairweather & Shepstone, 2006, p. 32). The old water distribution mains (wooden, AC, and CI pipes) were recently replaced with new 10-inch PVC C-900 pipes. Figure 3 shows the parcels served by the KWD.



**Figure 3.** Area covered by the Kerhonkson Water System  
(Fairweather & Shepstone, 2006, p. 33)

### **2.2.2 Napanoch Water District (NWD)**

The NWD uses groundwater as its source of water. The well field consists of five (5) bedrock wells with depths of 300 feet and a net reported capacity of 200 gallons per minute (gpm), which are on the west side of Route 55A near Nappy Lane Northwest of the Hamlet of Napanoch (geographical coordinates 41°45'12.04"N; 74°23'0.34"W). Figure A-2 in Appendix A shows the location of the wells and the property's parcel ID number within which they are situated. Appendix C compiles the detailed information of the property's tax ID information.

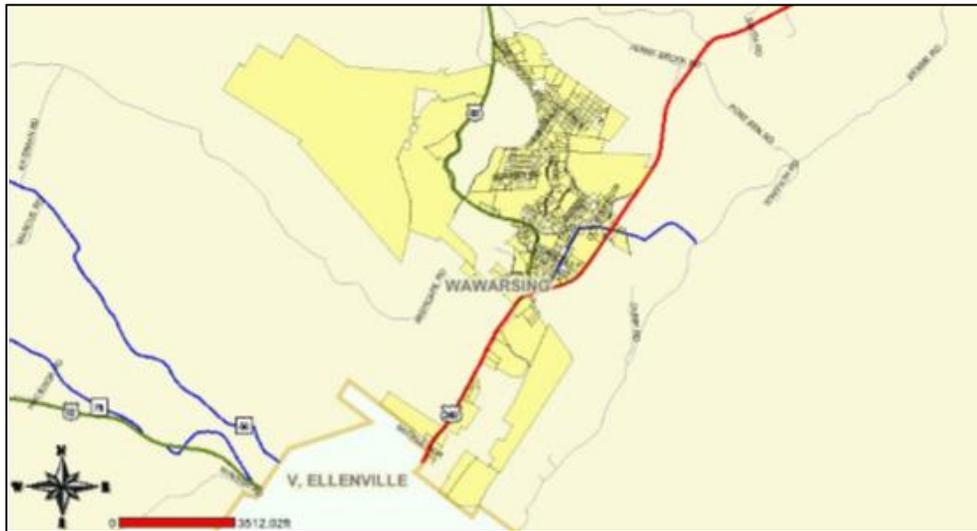
The NWD's approximate, current average daily flow rate is 125,000 gpd and includes approximately 447 connections, of which 73 continue to use their own wells (T. Moza, personal communication, Oct 17, 2018). The groundwater was historically treated inside two (2) small buildings located at the well field. Treatment consisted only of two unit processes: chlorination for disinfection and addition of soda ash for corrosion control. For the period Jul 2017–Sep 2017, the New York Department of Health – Bureau of Public Water Supply Protection reported that the NWD complied with the federal health-based drinking water standards (EWG-Napanoch, n.d.). However, because the water has elevated levels of iron and manganese, the Town recently constructed an additional treatment plant to reduce these concentrations to required levels. This plant, designed by Brinnier & Larios, is located at the well field.

The treated water is then conveyed to a 750,000-gal Natgun concrete tank for storage via 12-inch DIP (CL52) water main. The tank was built in 2001 and is located approximately 1,000 feet north of the well field. Access to the tank is via dirt road the water treatment buildings. There is no gate or fence around the tank. The water distribution system is composed of:

- A *primary water distribution system* that consists of a 12-inch DIP (CL52) water main, which runs from the well field to Route 55, then along Route 55 in both directions (south towards Main street and north towards Continental Road). From the intersection of Route 55 and Continental Road, the 12-inch main then proceeds southeast under Continental Road all the way to Old State Route 209 in the hamlet of Napanoch.
- A *secondary water distribution system* that consists of smaller diameter mains (8 inches and 6 inches) connected to the 12-inch main. Segments of the secondary distribution system are either looped or dead-end lines.
- *Water service lines*, which are 1-inch Type K Copper.

Water usage is primarily from residential users and a few commercial/retail businesses within and nearby the hamlet of Napanoch. There are no industrial water users in the district (there are two (2) closed factories on Aluminum Drive just south of North Main Street). The district uses badger meters equipped with Badger Orion Automatic Radio Read system. Figure 4 shows the parcels served by the NWD. Lastly, there is also an emergency water interconnection between

the NWD and the Village of Ellenville water system, which is strictly for emergency situations (the connection is designed with metering in both directions).



**Figure 4.** Area covered by the Napanoch Water System  
(Fairweather & Shepstone, 2006, p. 32)

Table 1 compiles the information of the two above-mentioned water districts.

**Table 1.** Summary of information on Napanoch and Kerhonkson Water Districts

Item	Water District	
	Napanoch	Kerhonkson
Owner	Local government	Local government
Type	Community water system	Community water system
Facility Registry System (FRS) Identifier	110017627246	110013275712
N° of connections served	447 (73 of which are on their own wells)	243
Year built	All new system built in 2001.	Gradually built since the turn of the 20 <sup>th</sup> century. In 1965, was taken over by Town.
N° of wells	Five (5) 300-foot deep bedrock wells.	Relies on two (2) groundwater wells.
Well capacity	Reported capacity of 220 gpm.	
Water treatment plant	Location of well fields	Off Route 55 near Nappy Lane, north of the hamlet of Napanoch.
		Parcel ID: 83.1-2-1.200. Geog. Coord.: 41°45'15.58"N; 74°23'17.34"W
		Parcel ID: 76.13-2-22 (Well on Hilltop Terrace). Geog. Coord.: 41°46'47.22"N; 74°18'18.13"W.
		Parcel ID: 76.3-2-30 (Well near Kerhonkson reservoir). Geog. Coord.: 41°45'58.39"N; 74°18'8.87"W.

Item	Water District		
	Napanoch	Kerhonkson	
Location of plant	Building at well field.	At each well site.	
Plant capacity	Average daily production: 125,000 gpd.	Average daily production: 80,000 gpd.	
Treatment	Chlorination for disinfection, addition of soda ash for corrosion control, and filtration to remove iron and manganese.	Water from each well is treated at the well head inside a small building. Treatment consists only of chlorination for disinfection.	
N° of business connections	Some small business using similar to residential. <i>ShopRite</i> and new <i>Walmart</i> (not yet open).	Two (2) restaurants and one (1) undertaker.	
N° of industry connections	Two (2) closed factories on Aluminum Drive.	None.	
Other information	Demand buildout potential remains within the district due to 73 residents remaining on private wells, approx. 28 acres of vacant/undeveloped land near the airport. The existing Napanoch Gravel Pit site off Route 55 is for sale. Properties have commercial re-development.	Demand build out potential remains within the district due to undeveloped land within the district boundaries.	
Supply	Pump stations	One (1) not used. It can connect to Ellenville water supply in emergency.	
	PRV	Two (2).	
	Type of pipe	All Class 52 cement lined DIP.	Various: AC, CI, some were replaced with PVC C-900 pipe.
	Service connections	K Copper mostly 1 inch.	
	Type of hydrants	Clow Medallion.	
Storage	Tanks	One (1) 750,000-gal tank (Natgun concrete) connected via 12-inch DIP to the water main. Gravity fed system.	There are two (2) distribution water storage tanks (steel standpipes): 400,000-gal and 100,000-gal. A tank is located at each well site. Gravity fed system.
Water meters	Type	Badger equipped with Badger Orion Automatic Radio Read system.	Badger Meters.

### 3.0 PROPOSED WAWARSING WATER DISTRICT

The proposed Wawarsing Water District lies approximately between the existing Napanoch and Kerhonkson Water Districts (Figure B-1 in Appendix B), where it will provide water to existing homes and businesses east and west of Route 209. Interconnections with the Napanoch and Kerhonkson Water Districts are recommended for resiliency. The proposed source of water for the Wawarsing Water District is a wellfield developed for this project in the broad field east of Napanoch within the property identified with Tax Parcel ID 83.3-1-3.110 (Figure A-2 in Appendix A).

### **3.1 Water Supply Source**

#### **3.1.1 General Wellfield Site Description**

During June and August 2018, The Chazen Companies (Chazen) directed installation and testing of three candidate public water system wells for the proposed Wawarsing water district. The wells are situated on property owned by New York State and managed by the NYS Department of Corrections and Community Supervision (DOCCS). The wells lie within the property referenced before, approximately 250 feet west of the Rondout Creek in the field east of the Walmart Supercenter and Ricke Len's, on Route 209 (approximate geographical coordinates 41° 44' 25.21" N; 74° 22' 2.28" W) (Figure A-2 in Appendix A). The Ellenville (Joseph Resnick) Airport is located south of the wells and private properties and Institution Road is located to the north. The Ulster County and NYS Eastern correctional facilities are situated east of the Rondout Creek and across the creek from the wells.

While seeking water source for the proposed Wawarsing Water District, an extensive soil boring program was completed on this site, as well as other properties. Priority consideration was given to well locations likely to contain saturated sand and gravel capable of supporting estimated peak daily demands exceeding 200 gpm. Candidate locations also needed to be sufficiently north or south from the aquifer areas which USGS studies and the NYCDEP had suggested might be affected by known leaks from the buried NYCDEP aqueduct, passing west to east under the Town of Wawarsing near the Vernooy Kill Creek and Lippman Park.

A boring program conducted in the currently-proposed wellfield area identified buried contours of a historic bedrock river valley under the broad valley. Sediments in most locations were less than 50 feet thick. However, in the location of the installed test wells, the sediments were as much as 240 feet in thickness. In borings advanced around the installed test wells, the first 100 feet of valley sediments consist predominantly of silty sand while at depths reaching 170 feet below grade. Select borings encountered coarse sand and gravel horizons judged suitable for installation of test well screens.

Three wells were sequentially installed in these deep sediments at this wellfield location, as discussed further below.

#### **3.1.2 Verified Yield**

Three adjoining 8-inch diameter wells, PW-1, PW-2, and PW-3, have been installed in the proposed wellfield area, each with a depth at approximately 170 feet below field elevation, and each with a well screen approximately 8 feet long installed at the base of the well. The well designs and locations were approved in advance with the Ulster County Department of Health (UCDOH). The pumping test protocols were also approved in advance with both the UCDOH and the New York State Department of Environmental Conservation (NYSDEC).

Two dual-well pumping tests were conducted. The first test was conducted using wells PW-1 and PW-2, discharging a combined flow of 243 gpm, with PW-2 providing the higher contributing yield. The second test confirmed available site yield using PW-3 instead of well PW-2, ensuring source redundancy and its availability as a back-up well, as required under New York State Department of Health (NYSDOH) regulations for public water supply wells. The 243 gpm yield was selected to evaluate peak demand anticipated by the proposed new water district and interconnections with the Napanoch and Kerhonkson Water Districts.

Analysis of water level data from each test projects that these groundwater withdrawal rates can be sustained during a 180-day drought period with a water column remaining above all well screens. The nearest known active wells are approximately 3,200 feet to the northwest, providing water to the Eastern and Ulster Correctional facilities. The water levels in these production wells were monitored during both Wawarsing pumping tests and revealed no water level influences. Homes and businesses nearer to the site, along Route 209 and Institution Road lie within the Napanoch Water District.

### 3.1.3 Verified Quality

Water samples from these wells were collected for analyses required by NYSDOH for community water supply wells. Results indicate the water is of good quality, requiring treatment only to control manganese and iron, and routine disinfection (Appendix D). Microscopic Particulate Analysis (MPA) results indicate the wellfield water quality is not directly influenced by surface water quality from the nearby Rondout Creek.

## 3.2 Proposed Service Area

The proposed water district is located in between the existing districts, mainly along Route 209. Its boundaries were originally established by the NYCDEP (Figure B-1 in Appendix B). Table 2 shows the approximate area and perimeter of the proposed water district.

**Table 2.** Area and perimeter of the proposed water district

<b>Service area</b>	<b>Area (acres)</b>	<b>Perimeter (miles)</b>
WWD	683.30	8.70

The full water district encompasses a total of 278 parcels, some of which are only partially within the district boundaries. The properties in the proposed WWD fall into one of the following six groups/categories (Table 3):

*Residential:* 1 Family Residential, 1 Family with Apartment, 2 Family, Apartment, Residential Multiple, Manufacturing Housing, Manufacturing Housing Park, Residential with Commercial Use, and Seasonal Residential.

*Commercial:* Fuel Storage and Distribution Facilities, Converted Residential, Auto Body, > 1 Use Some Building, 1 Use Some Building, Mini-Warehouse/Self-Service Storage, Truck Terminal, and Inn Lodge.

*Rural:* Rural Residential and Agriculture, Rural Residential and Recreation, and Rural Residential.

*Community Service:* Police and Fire Protection, Cemetery, Religious, Correctional, Highway Garage, and Recreational Facilities.

*Vacant:* Rural Vacant > 10 Acres, Rural Vacant < 10 Acres, Public Utility Vacant, Vacant Commercial, Vacant Rural, Vacant with Improvements, and Residential Vacant Land.

*Recreation and Entertainment:* Parks.

**Table 3.** Property type categories

Property Type	Number of Parcels	% of Total
Residential	157	56.5
Commercial	13	4.7
Rural	4	1.4
Community Service	12	4.3
Vacant	89	32.0
Recreation & Entertainment	3	1.1
<b>TOTAL</b>	<b>278</b>	<b>100.0</b>

Ulster County Parcel Viewer does not show information on Parcel 75.3-2-8.100.

Table 4 provides specific information on the property class, within the seven groups, the parcels' property class, count, and acreage, which mostly accounts for residential and rural type. Figure B-2 (Appendix B) shows the parcels that form part of the proposed WWD. Appendix C has the detailed information of each parcel, which was obtained from the Ulster County Parcel Viewer (UCIS, n.d). From Tables 2 and 4, it can be observed that the acreage between the proposed service area along Route 209, and the total acreage of engaged parcels, which in some locations extends beyond the district boundary, is approximately 857.85 acres. These excluded acres were not included in the original district boundary delineated by NYCDEP to focus District benefits and costs precisely on areas identified as requiring public water (due to aqueduct tunnel conditions). The focused district boundary avoids burdening owners of the outlying acreage with unwarranted benefit use charges.

**Table 4.** Summary of property classes within the proposed Wawarsing Water District

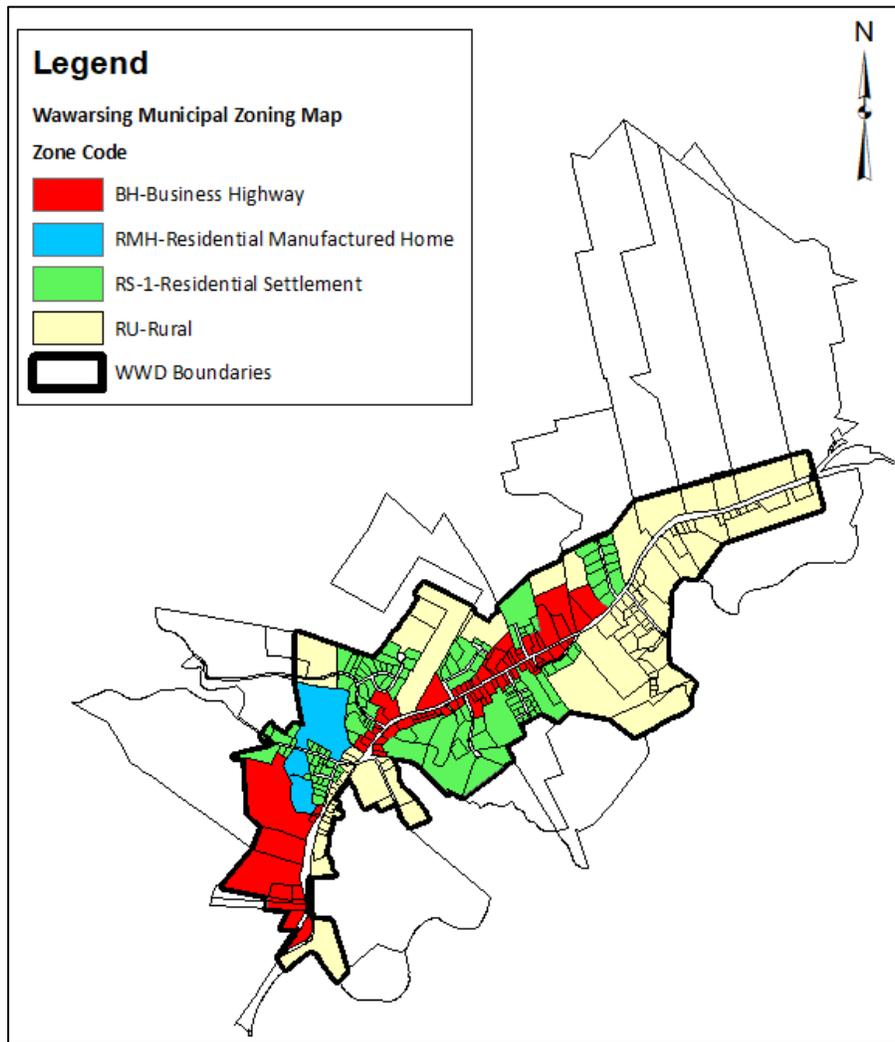
Property class	Along Route 209				TOTAL	
	East side		West side		Count	Acres
	Count	Acres	Count	Acres		
1 family res	43	51.84	77	72.33	<b>120</b>	<b>124.17</b>
1 family w/ apt	1	2.7	1	2.3	<b>2</b>	<b>5.00</b>
2 family	1	0.28	3	0.94	<b>4</b>	<b>1.22</b>
Apartment			2	4.73	<b>2</b>	<b>4.73</b>
Res multiple	6	20.4	6	151.9	<b>12</b>	<b>172.3</b>
Res vac land	35	21.05	10	14.03	<b>45</b>	<b>35.08</b>
Res w/ comm use	3	9.92	2	18.5	<b>5</b>	<b>28.42</b>
Converted res	2	3.42	2	6.65	<b>4</b>	<b>10.07</b>
Seasonal res			2	1.04	<b>2</b>	<b>1.04</b>
Rural vac > 10	4	141.5	1	15.7	<b>5</b>	<b>157.20</b>
Rural vac < 10	8	10.62	16	47.5	<b>24</b>	<b>58.12</b>
Rural res & ag	1	109.2			<b>1</b>	<b>109.20</b>
Rural res & rec	2	32.6			<b>2</b>	<b>32.6</b>
Rural res			1	148	<b>1</b>	<b>148</b>
Vac w/ imprv	5	4.71	4	7.4	<b>9</b>	<b>12.11</b>
Vac comm	2	1.14	3	8.81	<b>5</b>	<b>9.95</b>
Vac rural					<b>0</b>	<b>0.00</b>
Fuel Store & Dist	1	1.4			<b>1</b>	<b>1.40</b>
Auto body	1	0.9			<b>1</b>	<b>0.90</b>
Mfg housing	5	0.0341			<b>5</b>	<b>0.0341</b>
Mfg housing pk	2	11.1	3	32.69	<b>5</b>	<b>43.79</b>
Polic/fire	2	5.7			<b>2</b>	<b>5.70</b>
Pub Util Vac	1	41.9			<b>1</b>	<b>41.90</b>
Cemetery	2	4.1	1	9.2	<b>3</b>	<b>13.3</b>
> 1 use som bld	1	0.53			<b>1</b>	<b>0.53</b>
1 use som bld	1	0.52			<b>1</b>	<b>0.52</b>
Religious	2	9.86	1	1.1	<b>3</b>	<b>10.96</b>
Mini Whse Self Sto			1	0.34	<b>1</b>	<b>0.34</b>
Other storage			1	0.53	<b>1</b>	<b>0.53</b>
Park			3	96.3	<b>3</b>	<b>96.3</b>
Truck Terminal			1	5.1	<b>1</b>	<b>5.10</b>
Correctional			2	291	<b>2</b>	<b>291.00</b>
Highway gar			2	26.11	<b>2</b>	<b>26.11</b>
Inn lodge			1	93.53	<b>1</b>	<b>93.53</b>
Rec facility					<b>0</b>	<b>0.00</b>
Null			1		<b>1</b>	<b>0.00</b>
<b>TOTAL</b>	<b>131</b>	<b>485.42</b>	<b>147</b>	<b>1055.73</b>	<b>278</b>	<b>1541.15</b>

Note: acreage total values were rounded to two decimal places. Parcels denoted as "Null" were counted. However, they were not included in the total acreage estimation as the information was missing. See Appendix C for further comments on this. Detailed information on property type classification codes may be found at: <https://www.tax.ny.gov/research/property/assess/manuals/prclas.htm>

### 3.2.1 Build-out Analysis

As shown in Table 3, the WWD is comprised of 278 parcels, mainly along Route 209. Considering the Town of Wawarsing Zoning Map (Figure 5), the 278 parcels within the proposed water district

fall into 4 zoning districts. Each district has the same minimum lot size requirements regardless of on-site versus off-site water supply.



**Figure 5. Town of Wawarsing Municipal Zoning Map**

The estimation of the current and future water demand for the proposed district was based on a buildout analysis of the service area map, which followed these assumptions: (a) to only consider the portion of the properties located within the proposed district, (b) to remove built-out parcels on the existing zoning map as well as those properties not considered to be developable as they are either municipal or state-owned lands (including the 3 cemeteries and 31 properties purchased by Ulster County and the NYCDEP), (c) to subtract all areas of parcels that are within the FEMA 100-year floodplain (with A zone designations on the Flood Hazard Boundary Map, FHBM), (d) to deduct 75% of the wet area of developable parcels containing water or federal wetlands to approximate the zoning regulations, and (e) not considering the portion of the parcels having slopes greater than 15% as development in such areas may negatively impact environmentally sensitive areas (TUCPC, 2007, p. 24, 34-35; Mickelson and Church, 2018, p. 17).

The areas having slopes less than 15% were further analyzed by dividing their total area by 1-acre (43,560 square feet) to determine the probable number of lots possible for the parcel. Only five lots were determined to have less development potential due to slopes than they would otherwise have.

For final determinations of possible dwelling units, the net available area for each parcel was divided by the minimum lot size allowed and rounded down to whole numbers. If a lot already had development that number was reduced by one. For lots that would yield over five new units, the number was reduced by 20% (rounded to the nearest whole number) to account for the likely need for internal roadways and utilities. In the BH district, the amount of potential commercial development was evaluated using an assumed Floor Area Ratio (FAR) of 30% on the net buildable area per parcel (UCPB, 2017, p. 31), less existing development. Table 5 summarizes the build-out analysis results. A maximum of 5 potential benefit units were assigned to parcels that are partially within the water district boundaries. A summary of the existing and potential benefit units estimated for each parcel within the WWD can be seen in Appendix E.

**Table 5. Build-out analysis summary**

Zone Code	Minimum Lot Size (ft <sup>2</sup> )	Number of Parcels	Benefit Units		
			Existing	Potential	TOTAL
Rural (RU)	120,000	83	72	42	114
Residential Settlement (RS-1)	80,000	120	100	24	124
Residential Manufactured House (RMH)	40,000	3	3	12	15
Business Highway (BH)	40,000	72	66	4	70
<b>TOTAL</b>		<b>278.0</b>	<b>241.0</b>	<b>82.0</b>	<b>323.0</b>

### **3.2.1 Greater Catskills Flood Remediation – “Buyout Program”**

The Town of Wawarsing, Ulster County, and the NYCDEP entered into an agreement to purchase selective homes that were identified through the analysis of that program. As a result of the purchasing of homes, the Owner agreed to a no-build clause as part of the purchase. Therefore, properties that have entered into the program will not be able to have structures. These homes should be excluded from water demand estimations.

### **3.2.2 Water Demand Estimation**

To simplify the water demand estimation, parcels were placed into two (2) categories (single family residential and commercial). For commercial, the total acreage (in sq. ft.) of the Business Highway (BH) Zone Code was estimated. The water demand estimates –immediate and future– were carried out having in mind that the build-out analysis is a theoretical maximum development achievable given a certain set of assumptions and typically overstates development potential (Table 6). Therefore, the actual water usage will likely be less than the maximum

estimate herein. For comparison purposes, both Design Standard and a local comparable water use (Napanoch Water District) metrics were used to develop the shown range of projected daily water usage values. Demands have been adjusted for the removal of buyout parcels.

**Table 6.** Estimated water usage (average day)

WD	Land Use	Existing	Potential	Total	Metric	Projected Daily Water Usage (gpd)
Wawarsing Water District	Single Family Residential [Dwelling Units (3 bdr, typical)], includes developable rural area	241	82	323	225 gpd/du <sup>(1)</sup>	72,675
					330 gpd/du <sup>(2)</sup>	106,590
	Commercial (square feet, SF)	577,000		577,000	0.08 gpd/SF <sup>(3)</sup>	46,160
<b>TOTAL</b>						<b>118,835 – 152,750<sup>(4), (5)</sup></b>

- (1) Typical average daily water usage for a residential dwelling in the Napanoch Water District is 225 gpd. Source: Napanoch Water District – Production well test data evaluation (CDM, July 24, 2000).
- (2) Typical loading rate from Table B-3 of the 2014 Design Standards for Intermediate-Sized Wastewater Treatment Systems ([https://www.dec.ny.gov/docs/water\\_pdf/2014designstd.pdf](https://www.dec.ny.gov/docs/water_pdf/2014designstd.pdf)). The loading rate for single family residences is 110-gpd per bedroom for homes with post-1994 plumbing code fixtures. The loading rate presented is based on a 3-bedroom house.
- (3) Typical loading rate from Table B-3 of the 2014 Design Standards for Intermediate-Sized Wastewater Treatment Systems ([https://www.dec.ny.gov/docs/water\\_pdf/2014designstd.pdf](https://www.dec.ny.gov/docs/water_pdf/2014designstd.pdf)) for shopping center/grocery store/department store with a 20% reduction for use of water saving plumbing fixtures as recommended by the same document (Part B.6.b Design flow, Method 1, page B-15).
- (4) Peak Day demand is normally twice average day unless negotiated separately with Department of Health based on local data or other experience. Thus, peak day demand for the proposed Wawarsing Water District is in the range of 258,370 – 335,8760 gpd.
- (5) Expressed as gallons-per-minute, average daily demand estimate is 90 to 117 gpm, peaking to 180 to 234 gpm.

## 4.0 WATER SYSTEM DESIGN

### 4.1 Water Treatment System

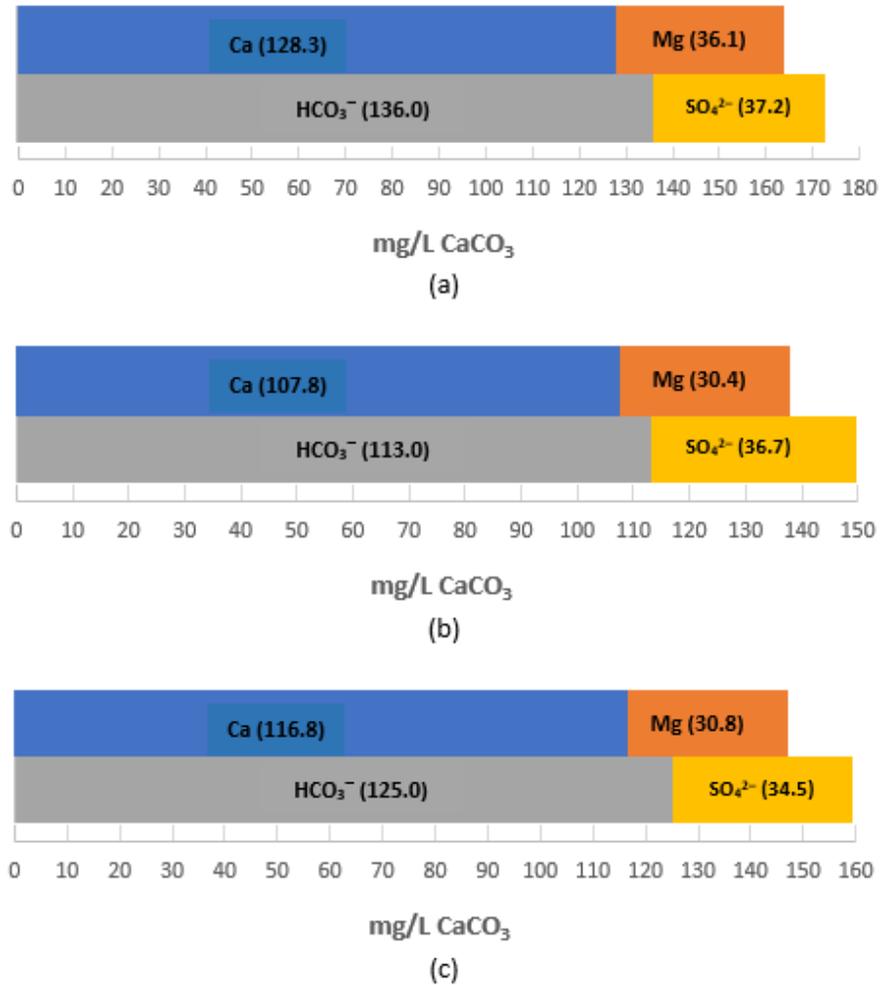
In general, the three production wells (PW) water quality lab results reported that parameters are below maximum contaminant levels (MCL), except for manganese (Appendix D). Table 7 summarizes select parameters of interest to the proposed water treatment program. The water source quality data otherwise showed: (a) low turbidity, (b) absent *E. coli* and total coliforms, (c) hardness concentration of a hard water, (d) manganese above MCL and SMCL, and (e) a negative LSI value close to zero.

**Table 7.** Summary of relevant water quality parameters in PWs

Parameter	Production Well (PW)			Comments
	PW-1	PW-2	PW-3	
pH	7.90	7.99	7.94	Within the acceptable range of 6.5 to 9.5.
Alkalinity (mg/L as CaCO <sub>3</sub> )	136	113	125	Based on the pH values, most of the alkalinity is in the form of the ion bicarbonate (HCO <sub>3</sub> <sup>-</sup> ).
Hardness (mg/L as CaCO <sub>3</sub> )	164	138	147	Hard water (120 to 180 mg/L). The hardness values are computed by adding the Ca and Mg concentrations expressed in mg/L as CaCO <sub>3</sub> . Based on the results of pH, Alkalinity, Ca, and Mg concentrations, it is concluded that most of the hardness present is temporary (carbonate hardness). See Figure 6.

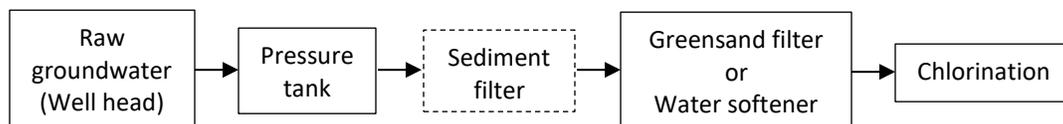
Parameter	Production Well (PW)			Comments
	PW-1	PW-2	PW-3	
Ca (mg/L)	51.3 (128.3)	43.1 (107.8)	46.7 (116.8)	Value in parentheses is the concentration in mg/L as CaCO <sub>3</sub> .
Mg (mg/L)	8.66 (36.1)	7.3 (30.4)	7.39 (30.8)	Value in parentheses is the concentration in mg/L as CaCO <sub>3</sub> .
Sulfate (SO <sub>4</sub> <sup>2-</sup> ) (mg/L)	35.7 (37.2)	35.2 (36.7)	33.1 (34.5)	Value in parentheses is the concentration in mg/L as CaCO <sub>3</sub> .
Chloride (Cl <sup>-</sup> ) (mg/L)	9.1 (12.8)	16.9 (23.8)	12.0 (16.9)	Value in parentheses is the concentration in mg/L as CaCO <sub>3</sub> .
				For drinking water, the maximum concentration level set by EPA is 500 mg/L.
TDS (mg/L)	230	200	200	Certain components of TDS, such as chlorides, sulfates, magnesium, calcium, and carbonates, affect corrosion or encrustation in water-distribution systems. High TDS levels (> 500 mg/L) result in excessive scaling in water pipes, water heaters, boilers, and household appliances such as kettles and steam irons. The palatability of drinking water has been considered excellent if TDS < 300 mg/L. Water with extremely low concentrations of TDS may also be unacceptable because of its flat, insipid taste <sup>(1)</sup> .
Langelier Saturation Index (LSI)	-0.096	-0.162	-0.134	Negative LSI: water tend to be aggressive/corrosive. Despite having a negative LSI, reported values are near zero, which indicates that treatment is not required (None/Mild corrosion range).
Fe (mg/L)	0.037	0.022	0.021	<b>MCL for Fe and Mn is 0.3 mg/L.</b> If iron and manganese are present, the total concentration of both should not exceed 0.5 mg/L. Higher levels may be allowed by the State when justified by the supplier of water <sup>(2)</sup> . Mn is slightly above MCL. However, the combined Fe and Mn is below 0.5 mg/L.
Mn (mg/L)	0.368	0.308	0.315	Manganese is above <b>secondary maximum contaminant level (SMCL) of 0.05 mg/L.</b> SMCLs are not federally enforced <sup>(3)</sup> . Manganese may cause corrosion and staining, and gives water undesirable odor, taste, and color (black to brown).
Combined Fe & Mn (mg/L)	0.405	0.330	0.336	
Na (mg/L)	11.8	8.93	10.6	For individuals on a very low sodium diet (500 mg/day), EPA recommends that drinking-water sodium not exceed 20 mg/L. In order to avoid adverse effects on taste, <b>EPA recommends that sodium concentrations in drinking water not exceed 30 to 60 mg/L</b> , a threshold for taste-sensitive segments of the population <sup>(4)</sup> .
Turbidity (NTU)	0.27	< 0.20	< 0.20	
<i>E. coli</i>	Absent	Absent	Absent	
Total Coliforms	Absent	Absent	Absent	

<sup>(1)</sup> WHO (2016); <sup>(2)</sup> NYS-DOH (n.d, p. 75); <sup>(3)</sup> U.S.-EPA (n.d.); <sup>(4)</sup> U.S.-EPA (2003)



**Figure 6.** Hardness bar charts  
(a) PW-1, (b) PW-2, and (c) PW-3

Based on the results in Table 7, it is recommended to design a water treatment system capable of both removing manganese and hardness and providing disinfection. For this, a greensand filter or a water softener, and chlorination should be used (Figure 7). A sediment filter shall be installed if a water softener is to be part of the water treatment system. A treatment building would be constructed, likely behind or replacing an existing structure near the intersection of Route 209 and Institution Road, to treat raw water prior to distribution.



**Figure 7.** Proposed water treatment system layout

#### 4.4.1 Water Treatment Plant Facility Location

The water treatment plant (WTP) facility will be constructed on a property located on Institution Road (approximate geographical coordinates 41°44'35.42"N; 74°22'2.03"W). The property is identified with the Tax Parcel ID # 83.1-1-23 (also referred to as the Brown property). The facility will be built on an area of approximately 20,000 ft<sup>2</sup>, which represents 8.6% of the total property area (233,500 ft<sup>2</sup>) (Appendix F). In addition to the main building, the facility will be provided of access roads (on Institution Road and to the well field), security fencing, treatment system, storage tank (subsurface, preferable), and other components necessary for the proper operation of the WTP.

#### 4.2 Water Storage Tank

Based on the guidelines established in both the *NYCRR, Title 10, Part 5, Subpart 5-1.33 [items (b)(10) and (f)]* (NYS-DOH, n.d., pp. 31-32) and the *Recommended Standards for Water Works, Parts 7 (Subpart 7.0.1) and 8 (Subpart 8.2.3)* (GL-UMRBS, 2012, pp. 107 & 116), the sizing of the water storage tank followed these guidelines: (a) an operational storage of 1.5 the average daily demand<sup>2</sup>, (b) a fire flow rate of 750 gpm for 2 hours (Table 8) as the Town of Wawarsing is mostly rural, and (c) an emergency/standby storage equal to the average daily demand. Table 9 compiles the storage needs for the proposed Wawarsing Water District for two different average daily water demands previously assumed in Section 3.2.2.

An available location of suitable elevation for the tank consists of Town property located on Route 209 where the Town of Wawarsing Highway Garage currently operates, identified with the Tax Parcel ID 83.6-4-1 (approximate geographical coordinates 41°45'23.05"N; 74°21'53.40"W). The final tank style and exact location on the property would be determined during the project’s design stage/phase.

**Table 8.** Fire flow criteria

Distance between Bldgs. (ft)	Needed Fire Flow (gpm)	Fire flow durations
> 100	500	
31 to 100	750	• Less than 3,000 gpm: 2 h duration.
11 to 30	1,000	• 3,000 to 3,500 gpm: 3 h duration.
≤ 10	1,500	• Greater than 3,500 gpm: 4 h duration.

Source: ISO (2008, p. 24)

<sup>2</sup> Peak-day demand is assumed to be twice the average daily demand. For the operational (equalization) storage, it was assumed that corresponded to the 25% of the peak-day demand, which accounts for 1.5 times the average daily demand.

**Table 9.** Theoretical storage capacity of the proposed WWD

Storage criteria	Wawarsing Water District	
	With an Avg. Daily Water Demand of 118,835 gpd <sup>(1)</sup>	With an Avg. Daily Water Demand of 152,750 gpd <sup>(1)</sup>
Operational storage	178,253	229,125
Fire flow storage <sup>(2)</sup>	90,000	90,000
Emergency/Standby storage	118,835	152,750
<b>TOTAL (gal)</b>	<b>387,088</b>	<b>471,875</b>

Notes: <sup>(1)</sup> Value taken from Table 6; <sup>(2)</sup> Volume = (Fire Flow Rate)(Duration)

### 4.3 Water Distribution

#### 4.3.1 Proposed Distribution System Piping

The water distribution network may consist of: (a) 10-inch High-density polyethylene (HDPE) for the main water line along Route 209 and its corresponding connection to the water storage tank (this 10-inch water main could be potentially reduced to 8-inch, if supported by modeling and related system demands), (b) 8-inch HDPE pipe along Port Ben Road. will extend only up to the water district boundaries, (c) 8- or 6-inch HDPE for alternate/secondary roads to both feed the different parcels within the boundaries of the proposed water district and connect to the existing water districts of Napanoch and Kerhonkson, (d) hydrants (each 600 feet), (e) 3-way shutoff valves, and (f) 1-inch pipes for property service. Table 10 summarizes the information of the type and diameter of pipes to be placed in each road. Figure B-1 (Appendix B) shows the pipes' alignment at each street/road.

**Table 10.** Description of pipes and alignment for the proposed WWD

Pipe type and diameter	Road/Street name	Roadway Inventory	Additional
10-inch HDPE	Route 209	NY State road inventory	
	Meadow Ln.	Wawarsing local highway inventory (Res. # 55)	
8-inch HDPE	Port Ben Rd.	Wawarsing local highway inventory	
	Foordmore Rd.	Wawarsing local highway inventory	
	Deer Run Ln.	Unknown (possibly a private road)	
	Edward Ln.	Unknown (possibly a private road)	
	Fox Hill Rd.	Wawarsing local highway inventory	
	George Young Blvd		
	Smith Rd. II	Wawarsing local highway inventory	
	Carpenter Ln.	Unknown (possibly a private road)	
	Geary Dr.	Unknown (possibly a private road)	
	7 Maples Dr.	Unknown (possibly a private road)	
Jenny Brook Rd.	Wawarsing local highway inventory		

- Hydrants @ 600 ft.
- 3-way shutoff valves.
- 1-inch pipe property service.

Pipe type and diameter	Road/Street name	Roadway Inventory	Additional
6-inch HDPE	Stephens Rd.	Wawarsing local highway inventory	
	Thomkins Trail	Unknown (possibly a private road)	
	Kager Ln.	Unknown (possibly a private road)	
	Kings Hwy.	Wawarsing local highway inventory	
	Smith Rd.	Wawarsing local highway inventory	
	Unknown street (south of Smith Rd.)		
	Joshua Ave.	Unknown (possibly a private road)	
	Unknown street (Between Smith Rd. & Joshua Ave.)		
	Kelsey Ln.	Wawarsing local highway inventory	
	Cozy Ln.	Unknown (possibly a private road)	
	Vernoroy Dr.	Wawarsing local highway inventory	
	Lundy Rd.	Wawarsing local highway inventory	
	Piper Ln.	Wawarsing local highway inventory	
	Old Rt. 209	Wawarsing local highway inventory	
	Old Rt. 209	Wawarsing local highway inventory	

### 4.3.2 WWD Connection to Neighboring Water Districts

#### WWD Connection to KWD

Interconnection to the KWD will consist of the installation of approximately 8,245 LF of 8-inch water mains along Route 209 from the western end of the WWD (approximate geographical coordinates 41°46'17.24"N; 74°19'43.00"W) to a location just east of Pearl Street in Kerhonkson (approximate geographical coordinates 41°46'28.35"N; 74°17'57.98"W). Two options are proposed for the pipe alignment (Figure 8): (a) along Route 209 and (b) along Turkey Hill Road and then along Route 209. An above ground or below grade metering structure will be provided at a convenient location along this transmission main allowing for water metering in both directions. The structure will include appropriate isolation valves.

#### WWD Connection to NWD

Given that the water treatment facility will be constructed on a located off Institution Road near Route 209 (previously described in Section 4.4.1), it would be more convenient to connect to the existing water main on Institution Road just east of Route 209 (approximate geographical location 41°44'35.92"N; 74°22'1.17"W) (Figure 9). The WWD Well Field is located within the property identified with Tax Parcel ID #83.3-1-.110 (approximate geographical coordinates 41°44'25.30"N; 74°22'2.56"W), which is approximately 1,100 LF away from Institution Road. An above ground or below grade metering structure will be provided on the connection line allowing for water metering in both directions. The structure will include appropriate isolation valves.

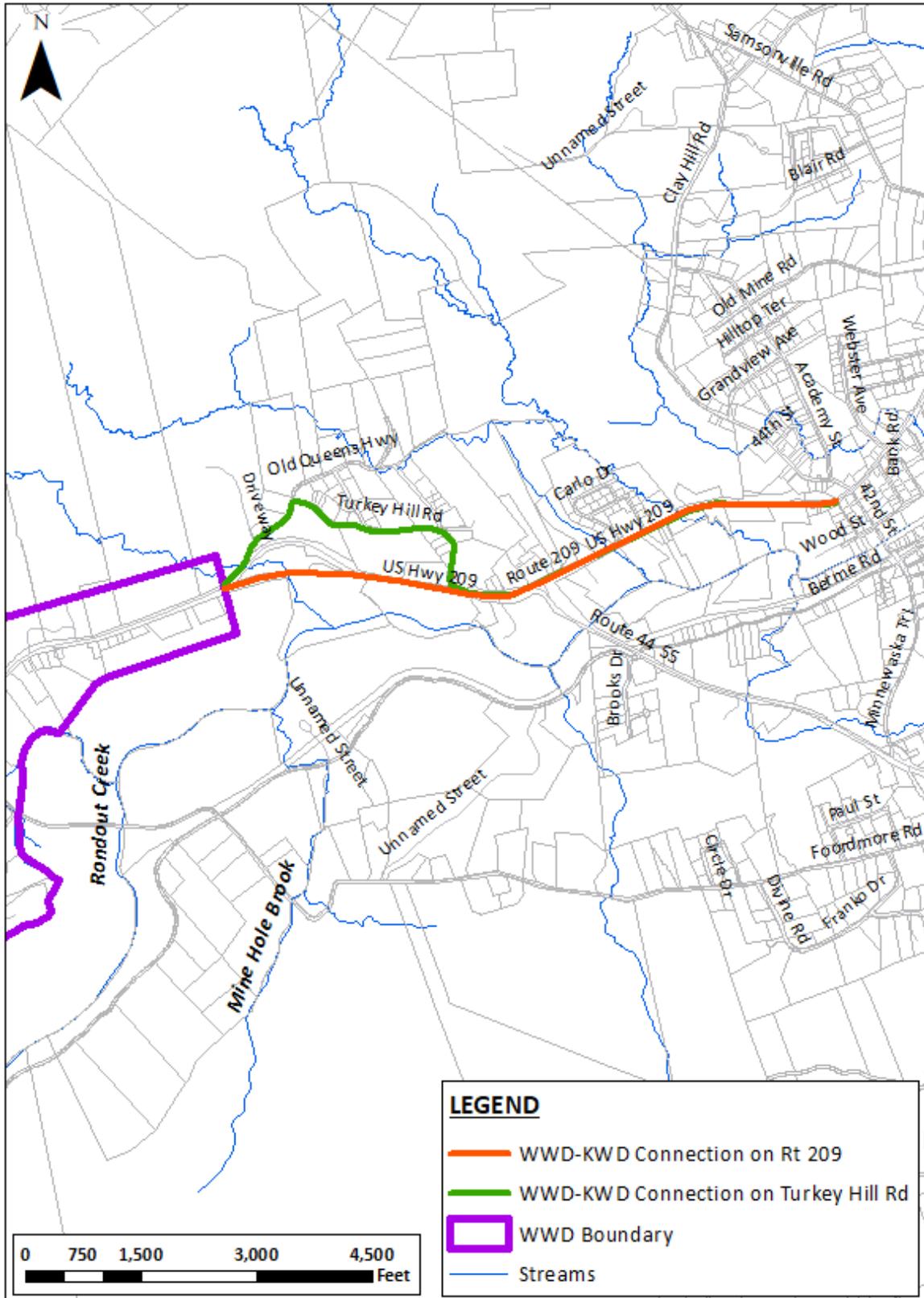


Figure 8. WWD proposed connection to KWD

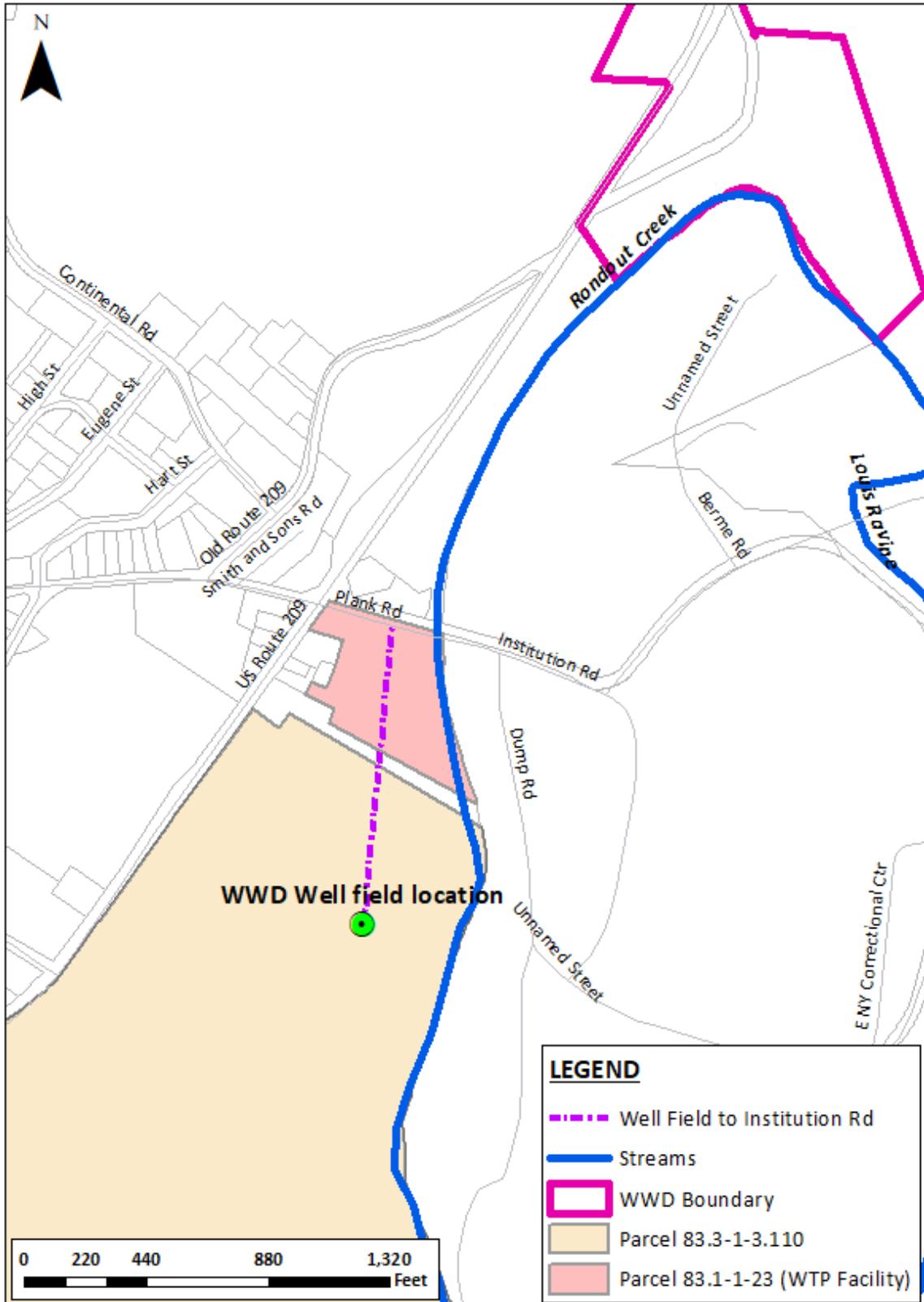


Figure 9. WWD proposed connection to NWD

#### **4.4 Property Easements**

The proposed distribution alignment requires placement of the distribution network within State right-of-way (ROW), Town ROW, and private roads. The Town will need to seek and obtain easements for the placement of the water distribution network.

#### **4.5 Alternative Water System Designs**

Prior to identifying a new water source and having to design and construct a new water treatment facility, the alternative consideration of extending the two existing water districts was considered. The Napanoch Water District currently provides limited water capacity to the District. Due to the poor water quality and limited district well capacities of the water district, use of the Napanoch Water District as an alternate source for the new Wawarsing Water District is not feasible. The Kerhonkson Water District provides service to the District and is challenged with water supply for any potential build out. The District, mostly residential, is already using the majority of the District capacity. Therefore, extending the District is not feasible. Similar with both water districts, the public well supplies are not sufficient for expanded demands. Consequently, a new water source was established. Chazen also investigated the option of extending a raw waterline from the new water (well fields) to one of the existing water districts treatment plants. However, the estimated cost of running at least 1.5 miles of raw water line and upgrading a water treatment plant for additional capacity is significantly more than the estimated cost of constructing a new treatment facility.

#### **4.6 Connection to Neighboring Water Systems**

Interconnections to the Napanoch and Kerhonkson Water Districts are recommended for community and source resiliency and may allow for phased construction of the water storage tank, if desired.

#### **4.7 Water Service Connections**

The project scope is proposing complete water service and connections for occupied parcels within the WWD. It is assumed that each service connection will consist of a 1-inch service connection to the structure plumbed into the existing house water service and full disengagement from the existing well, with well abandonment offered at discretion of the property owner. It is common that when a water district is established, (a) the service often stops at the property line and (b) future services are only installed at the time of need and not necessarily at the time of construction. In this instance, service will be brought fully to each existing occupied structure, but vacant parcels would have service connection installed to the ROW only. The Town will need to seek temporary construction easements.

Future connections, completed after the construction of the project, will be the responsibility of the property owner.

## 5.0 OPINION OF PROBABLE COSTS

Preliminary cost estimates associated with the WWD formation included only construction of the distribution network within the water district boundaries, plus a 20% construction contingency. A full cost estimate was developed based on unit price analysis of all design and permitting activities, treatment facilities and equipment, storage, connections to individual homes, and other factors necessary for the proposed WWD and its connections to the neighboring water districts of Napanoch and Kerhonkson. The cost opinions are based upon the current project understanding and have been developed using 2018 construction budgeting values.

Subsequent changes in the project scope or time frame may change project costs. Since there is no control over the costs of labor and materials or competitive bidding and market conditions, the opinion of probable construction costs is made on the basis of past experience and limited available data. These opinions represent our best judgment as a consultant familiar with the construction industry. However, there is no guarantee that proposals, bids or construction costs will not vary from the opinion of probable costs.

The comprehensive estimate is \$21,011,324. Options to provide interconnections with the adjacent water districts are estimated to add \$605,100, which increases the comprehensive estimate to \$21,616,424. A summary of the cost estimated is provided in Table 11.

**Table 11.** Summary of cost estimate for the WWD

Project Summary	Comprehensive updated Estimate
Div. 00-Procurement & Contracting Reqs	\$918,564
Construction - Distribution Network	\$8,534,915
Construction - Water Treatment Plant	\$2,225,150
Construction - Water Storage	\$1,290,850
Design/Geotech/Survey/Permitting	\$1,704,627
Construction Management	\$1,415,370
Contingency	\$2,784,914
Escalation	\$2,136,934
<b>SUB-TOTAL</b>	<b>\$21,011,324</b>
<b>Additional options</b>	
Napanoch Water District Inter-Connection	\$30,600
Kerhonkson Water District Inter-Connection	\$439,500
Pressure Reducing Valve/Zones	\$135,000
<b>SUB-TOTAL</b>	<b>\$605,100</b>
<b>TOTAL</b>	<b>\$21,616,424</b>

## 6.0 DEBT RETIREMENT

### 6.1 Ad Valorem

Construction costs of this WWD will be fully provided by the NYCDEP as part of the agreement with the Town. Thus, there will be no debt retirement component for the design and construction of the water district. The annual user cost estimation is based solely on the anticipated operation and maintenance costs associated with the proposed WWD. See Section 7.0 Annual User Cost Analysis

For this District, similar to the adjacent Napanoch and Kerhonkson Districts, should this District establish debt, this district will retire debt using an Ad valorem methodology. An Ad valorem process provides a prorated fair share of debt responsibility. Should the District ever create debt needing retirement, each parcel is then responsible for the assessed value of the individual property as part of the entire District valuation as per Equation 1.

$$\text{Parcel debt retirement \%} = \frac{\text{Parcel valuation}}{\text{District valuation}} \quad \text{Eq. (1)}$$

Vacant parcels or parcels that have entered into the Buyout Program are included in the District valuation as well as the individual parcel debt retirement responsibility.

## 7.0 ANNUAL USER COST ANALYSIS

Given that the WWD will be a new water district with no current/existing information on the cost of water rates, the water fees of the adjacent water district of Napanoch (

Table 12) were used as a comparable reference for estimating the water charges of the proposed WWD. The Napanoch Water District and the proposed WWD have similar numbers of service connections and customer classifications (residential and commercial), according to the build-out analysis and the water demand estimation described in Sections 3.2.1 and 3.2.2, respectively. The following customer classes were not included in this analysis: (a) outside user (no information available), (b) senior residents (currently, no information available), and (c) commercial with water consumption over 500,000 gallons after the first 5,000 gallons (pricing will be made on a case-by-case basis). These rates may be modestly higher than those suitable for the WWD since the NWD treatment system includes iron and manganese filtration. Water fees for the Kerhonkson Waste District are also noted below; in district rates are comparable to NWD rates.

**Table 12. Water charges of Napanoch and Kerhonkson Water Districts**

Customer class	Water District	
	Napanoch	Kerhonkson
Residential	\$70.00 for the first 5,000 gal.; \$2.00 per 1,000 gal. over 5,000	
Commercial	\$140.00 for the first 5,000 gal.; \$3.00 per 1,000 gal. over 5,000, \$2.75 per 1,000 gal. over 500,000	
Senior resident (65 and older with income of \$22,500/yr. or less)	\$2.00 per 1,000 gal.	
Outside users	\$87.50 for the first 5,000 gal.; \$2.50 per 1,000 gal. over 5,000 gal.	\$76.25 for the first 5,000 gal.; \$2.50 per 1,000 gal. over 5,000
In district users		\$62.50 for the first 5,000 gal.; \$2.00 per 1,000 gal. over 5,000

Source: (T. Moza, personal communication, Oct 17, 2018)

Based on Table 12 values, Table 13 shows the likely WWD water charges for residential and commercial users. The residential quarterly water demand was estimated based on two different water demand rates, 225 gpd/unit and 330 gpd/unit. For the calculation of the commercial quarterly water demand, a water demand rate of 905.1 gpd/unit was used. This value was estimated based on the water demand of 46,160 gpd for the existing commercial units shown in the current water use estimates in Section 3.2.2 (Table 6).

**Table 13. Water charges of the proposed Wawarsing Water District**

Customer Class (Meter Size)	Quarterly demand (gal)	Fixed Fees/Charges (\$/quarterly for the first 5,000 gal)	Usage Fees/Charges (\$/1,000 gal. for over 5,000 gal)	Quarterly cost per unit (\$/quarter/unit)	
Residential (1-inch)	Single family (3 Bdr) at 225 gpd	20,531.25	70.00	2.00	101.10
	Single family (3 Bdr) at 330 gpd	30,112.50	70.00	2.00	120.30
Commercial (1-inch)	82,590.20	140.00	3.00	372.80	

The annual rate would be less than NYS Office of the State Comptroller maximum amount of \$898.00 cost for 2019 (ONYSO, 2019) for a typical one or two-family home.

Vacant parcels or parcels that have entered the Buyout Program are not responsible for usage fees.

The Town may change user fees and responsibilities following Special District regulations through actions set forth by the Town Board.

## 8.0 REQUIRED APPROVALS AND OTHER ACTIONS

- Submission of this *Map, Plan, and Report* to the Town Board, followed by a Public Hearing, receipt of revised *Map, Plan, and Report* based upon public hearing comments.
- Final review and acceptance of the *Map, Plan, and Report*.
- Complete State Environmental Quality Review Act (SEQR) review and determination.
- Agreement(s) for possible shared municipal service with the hamlets of Napanoch and Kerhonkson.
- Approval of a Highway Work Permit for Work on Town Roads – Town of Wawarsing Highway Department and NYSDOT.
- Property acquisition and mapping, including Easements or Fee Title for private lands necessary for construction of proposed infrastructure.
- Modify existing agreements with neighboring water districts and develop Memorandum of Understanding (MOU) for emergency connections.
- NYSDEC – Water Withdrawal Permit.
- Bonding for required Project Costs.
- Field studies required for New York's State Historic Preservation Office (SHPO), wetland and ecological permitting.
- Survey, and Construction drawings and specifications for construction prepared by the Engineer.
- Town and Planning Board approvals for water treatment building, water pipe installation.
- Submission of permit applications for Water Supply Application, SHPO, wetlands and ecology.
- Approval of engineering plans and specifications by the County/New York State Department of Health.
- Statement of no archeological impact by the New York State Office of Parks, Recreation, and Historic Preservation.
- Agreement for use of wells with NYSDOCS.

## 9.0 CONCLUSION

Chazen has completed an investigation and analysis for the design and construction of a new water district for the Town of Wawarsing.

The proposed WWD has a total area of 683.3 square miles, which includes 278 parcels, primarily residential (56.5%) and vacant (32.0%); the rest is comprised of commercial, rural, community service, and recreation and entertainment. The proposed WWD has 241 existing units and 82 potential build-out units for a total of 323 units.

An adequate water supply was identified from three wells (PW-1, PW-2, and PW-3) within the property identified with Tax Parcel ID 83.3-1-3.110. Pumping tests conducted confirmed source

redundancy and availability with a back-up well with combined flow of 243 gpm, sufficient to meet peak daily demand for the envisioned district.

Lab results showed that the water source has, overall, good quality. Manganese was the only parameter above the State's established MCLs. Thus, the recommended water treatment system shall, at least, remove the excess concentration (manganese) and provide disinfection.

The proposed WWD considers installing water service into each occupied structure in the WWD. Future connections to the water district could be installed at the time of need.

The comprehensive project cost is \$21,616,424, which includes the interconnections to Napanoch and Kerhonkson water districts for community resilience and potentially for storage tank construction phasing.

A preliminary water fee estimation made based on both the existing residential and commercial units and the water fees of the neighboring water districts suggests that quarterly water prices in the WWD for Residential Single Family (3 bedroom) unit will be \$101.10 or \$120.30, depending on the daily water demand assumed for the unit. For Commercial use, the price will be \$372.80 per unit. However, the final fees will be determined by the Town Board.

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## Appendix A. Location Maps

# Appendix B. Proposed Wawarsing Water District Map

## **Appendix C. Parcels' Detailed Information**

## **Appendix D. Report Well Lab Testing Results**

## **Appendix E. WWD Benefit Units Summary**

## **Appendix F. Water Treatment Plant Facility Location**