20233707.0001

MARLBOROUGH RESORT

MARLBOROUGH, NY

PREPARED FOR:
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engineering architecture

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1.0 INTRODUCTION

The Applicant, Marlborough Resort LLC, is proposing to expand an existing recreational resort located at 626 Lattintown Rd, Marlboro, NY in Ulster County to be known as Marlborough Resort (Project). The total site consisting of 152.5 acres is located in the rural agricultural district and is made up of tax parcels: 102.4-3-8.8.320; 102.4-2-12;102.4-2-13;102.4-2-29. The St. Hubert's Lodge and Club is currently the existing onsite use.

The Project proposes to develop and expand on the current hospitality use of the property by re-purposing several of the existing structures and renovating the existing lodge. In addition, several new buildings will be constructed to provide sleeping accommodations, recreational amenities, and other hospitality services. The Project will include a hotel and spa, guest cabins, dining rooms, a bar, a distillery and tasting room, small event center, farm market and barbecue, pavilions, recreation space, restroom buildings, staff dorms, a welcome center, and various accessory storage buildings. The Project will also include utility improvements including water extension, a water storage tank, sanitary sewer collection system, a packaged wastewater treatment plant, solar arrays, and green infrastructure. Together, these buildings and improvements make up the proposed resort hotel use. The plan includes surface parking spaces throughout the property in support of the resort hotel use. A small accessory structure will be removed and replaced in the same footprint by an addition. Small accessory structures that are no longer needed will be removed. The Project is planned to be constructed in three phases, as detailed in the associated plan set.

This report analyzes water demand and resulting pressure at points around the site in the context of the Town of Marlborough distribution system. The Project will include a water distribution system and storage tank on site to serve the resort. The report also includes discussion of the sanitary sewer loading, collection system and on-site packaged wastewater treatment plant.

See Appendix A - Figure 1 for the Project Location figure.

2.0 EXISTING CONDITIONS

2.1 Land Coverage

The site is bordered by Lattintown Road to the west, beyond which is a row of residences and agricultural land. To the east of the site is Ridge Road, which is residential along the site's property line. The site consists of wetlands, forest, agricultural land, wooded areas, existing structures, a gravel parking lot and water features. Water features make up approximately 3 acres of the site. Lattintown Creek runs through the property, contributing to a series of ponds just east of the creek. There is also a large irregular shaped pond on the southeast corner of the site. The western two-thirds of the site consist of forests (49 acres across the site) and state wetlands (30.5 acres).

An existing long and paved internal road off Lattintown Road leads to the existing lodge and club onsite. This entire area is lawn with scattered trees and impervious pavement. There are many dirt and gravel walking trails throughout the site as well.

2.2 Wetlands / Creeks

The site was reviewed for the existence of federal and state regulated wetlands within the property boundaries. Federal wetlands were researched using the National Wetlands Inventory (NWI) using an online U.S. Fish and Wildlife website search. State regulated wetlands were researched using the NYSDEC's online Environmental Resource Mapper website. Review of the mapping indicates there are state wetlands and federal wetlands on site. Refer to Appendix B for the federal and state regulated wetlands mapping.

2.3 NYSDEC Environmental Resources

The NYSDEC Environmental Resource Mapper is an interactive mapping application that can be used to identify some of New York State's natural resources and environmental features that are state protected, or of conservation concern. It displays generalized locations of animals and plants that are rare in New York, including those listed as Endangered or Threatened. Significant natural communities, such as rare or high-quality forests, wetlands, and other habitat types along with New York's streams, rivers, lakes, and ponds and water quality classifications are also displayed. According to this database, there are no rare and endangered animals in the vicinity of the project. There are natural communities near the project site but are not on site.

See Appendix C for the Environmental Resources Map.

2.4 Floodplain

According to FEMA's National Flood Hazard FIRMette Mapper, the entire site is outside of any flood zone per community panel no. 36111C0790E dated 09/25/2009. Refer to Appendix D for a floodplain map of the site and the FIRM panel.

2.5 State Historic Preservation Office Review

The site was reviewed for the presence of archeological sensitive areas using online GIS tools found at the NYS Historic Preservation Office (SHPO). The Cultural Resource Information System mapping of the area found no archeo-sensitive areas within the project site. Refer to Appendix E for the archeologically sensitive areas map.

2.6 Soils

Soils within the project area were reviewed for their hydrologic soil group in accordance with the USDA's NRCS Soil Survey. The soil groups present on site are summarized below and the soils map can be found in Appendix F:

Table 1: *Hydrologic Soil Group Table*

Soil symbol	Soil Name	Slopes	Soil Group
BgC	Bath gravelly silt loam	8 to 15%	C
At	Atherton silt loam	8 to 15%	B/D
Pa	Palms muck	n/a	A/D
BgD	Bath gravelly silt loam	15-25%	C
CnB	Chenango gravelly silt loam	3 to 8%	A
VoB	Volusia gravelly silt loam	3 to 8%	D
HgC	Hoosic gravelly loam	rolling	A
Cd	Canandaigua silt loam	till substratum	C/D
LY	Lyons-Atherton complex, very stony	n/a	C/D
BHE	Bath very stony soils	steep	C
VoC	Volusia gravelly silt loam	8 to 15%	D
VSB	Volusia channery silt loam	0 to 8%	D
MdB	Mardin gravelly silt loam	3 to 8%	D
CnC	Chenango gravelly silt loam	8 to 15%	A
CgB	Castile gravelly silt loam	3 to 8%	A/D
MgB	Mardin-Nassau complex	3 to 8%	D
CF	Cut and Fill land	n/a	B
BnC	Bath-Nassau complex	8 to 25%	C

3.0 EXISTING WATER SYSTEM

It is the Applicant's intent to foster a public-private partnership and connect to the Town of Marlborough water system to supply water for the Project. An analysis was completed to determine that the proposed Project can be served without impacting the existing water system.

3.1 Town of Marlborough Water System

The Town of Marlborough water system services the entire Town of Marlborough and Hamlet of Milton. The existing public water system is sourced by the New York City Delaware Aqueduct, owned and operated by the New York City Department of Environmental Protection. The Aqueduct originates at the Roundout Reservoir in the Catskill Mountains. While the Marlborough Water District has its own tap to the Aqueduct, it currently uses an interconnection with the Town of Newburgh to receive water from their tap of the Aqueduct. During Aqueduct shutdowns, water is sourced from Chadwick Lake in Newburgh and filtered at the Chadwick Lake Filter Plant.

The Town owns and operates two standpipe steel storage tanks to store treated water with a volume of 400,000 gallons each, a total of 800,000 gallons. The Marlborough Tank is located on Western Avenue near the intersection of Villa di Leonardo. The Milton Tank is located off Walnut Lane near the intersection of Milton Turnpike and east of Mills Place. Both tanks have a 40-foot diameter and height of 50-feet and are located at a base elevation of 435' above mean sea level (amsl) with an overflow elevation of 484'.

The Water System Facility Evaluation Report for the Town of Marlborough, Ulster County, New York, prepared by Maser Consulting, P.A in November 2003, details the existing water system components along with a hydraulic analysis. At the existing point of connection to the Town of Newburgh, a pressure regulating valve (PRV) is in place to maintain a water system pressure between 80 and 90 psi. Due to the high operating pressure and the varied topography throughout the service area, there are a total of eight (8) PRVs throughout the system.

Over the course of 2019-2022, the average production for the year was as follows:

Table 2: *Historic Water Production*

Year	Average Daily Production (gal)	Maximum Day Production (gal)	Available Daily Capacity (gal)	Remaining Daily Capacity (gal) [Less Max Day]	Potential Available Daily Capacity (gal)	Potential Remaining Capacity (gal) [Less Max Day]
2019	522,322	798,000	800,000	2,000	1,000,000	202,000
2020	532,436	750,000	800,000	50,000	1,000,000	250,000
2021	537,345	750,000	800,000	50,000	1,000,000	250,000
2022	541,664	940,000*	800,000	-140,000	1,000,000	60,000
2023	514,520	690,000	800,000	110,000	1,000,000	310,000

*This maximum daily usage appeared much larger than any other month's data and could be an outlier attributed to repair or maintenance operations.

Water consumption data for 2023, provided by the Town, is included in Appendix G.

3.2 Marlborough – Newburgh Intermunicipal Agreement

Per the 2016 Inter-Municipal Agreement (IMA) between the Town of Newburgh and the Town of Marlborough, Marlborough has an allowable daily water capacity of 800,000 gallons per day (GPD). The agreement has an option to increase the acquired capacity from 800,000 to 1,000,000 GPD, if Newburgh possesses excess to treat water at the existing plant.

Based on the 2023 historical flows, there is capacity within the Town of Marlborough's existing agreement with Newburgh to serve additional water demands. As the following sections describe, the Project's water demand is below the current remaining daily capacity without needing to execute the option to increase capacity from Newburgh. As such, the Applicant is requesting to enter the Town water district without executing the IMA option.

4.0 PROPOSED WATER DEMAND ANALYSIS

4.1 Hydrant Flow Test

In order to determine available flow and pressure, a hydrant flow test was completed along Ridge Road, east of the proposed project on May 15, 2024. The hydrant flow test data, where P_{st} = static pressure, P_{res} = residual pressure, Q_{ob} = observed flow rate and Q_{20} = flow rate calculated at 20 psi, is displayed below and provided in Appendix H.

Flow Test Hydrant at 268 Ridge Road
Elevation=± 478 ft
Date of Test: 05/15/2024

P_{res} = 70 psi
Q_{ob} = 750 gpm

Residual Hydrant at 250 Ridge Road
Elevation=± 463 ft
Date of Test: 05/15/2016

P_{st} = 88 psi
P_{res} = 70 psi
Q_{20} = 1,537 gpm

4.2 Domestic and Pool Water Demand

Based on the proposed programing, the anticipated water demand was calculated with the use of up to date, water-saving fixtures to promote sustainability throughout the project. Per the 2014 NYSDEC New York Design Standards for Intermediate Sized Wastewater Treatment Systems and NYSDOH Title 6-1.29 Swimming Pool Design Standards, the anticipated new water demand for the proposed development is outlined as follows:

Table 3: *Anticipated Average Daily Water Demand*

	Type of Use	Unit	Unit Quantity	Hydraulic Loading Rate w/ Credit (gpd/unit)	Average Daily Water Demand (gpd)
PHASE 1	Welcome Building	Per Employee	1	12	12
	Entry Cottage (Existing Cabin)	Per Bedroom	1	110	110
	Renovated Main Lodge - 2 Guestrooms	Per Bedroom	2	110	220
	Renovated Main Lodge - Private Dining/Winter Terrace	Per Seat	6	28	168
	Renovated Main Lodge - Bar	Per Seat	15	16	240
	Renovated Main Lodge - Lounge	Per Seat	15	16	240
	Orangerie (Small Events Center)	Per Seat	100	8	800
	Cabin Bar	Per Seat	17	16	272
	Clubhouse Dining Room 1	Per Seat	102	28	2,856
	Farm Market & Barbeque	Per Seat	15	28	420
	Pond Cabin (Existing)	Per Bedroom	1	110	110
	Spa - Pool	Total Pool Volume	1	65,040	65,040**
	Spa - Other Amenities	Patrons	215	16	3,440
	Spa - Employees	Employees	31	12	372
	Events Center	Per 10 SF	220	8	6,160
	Hotel	Per Sleeping Unit	28	110	3,080
	Walled Garden			0	-
	Back of House Operation (Existing Yoga Building)			0	-
	Walled Garden	Per Seat	25	35	875
	Pond Pavilion (Serving Tennis Courts)	Per Person	64	4	256
	Tree House - 2 Guestroom Cabins (1 Bedroom ea.)	Per Bedroom	22	220	4,840
	Tree House - 1 Guestroom Cabins (1 Bedroom ea.)	Per Bedroom	8	110	880
	Animal Planet - Petting Zoo (Barn)	Per Employee	3	36	108
	Staff Dorm & Locker Room	Per Person	35	75	2,625
PHASE 2	Hillside – 2 Guestroom Cabins (2 Bedrooms ea.)	Per Bedroom	15	220	3,300
	1-Guest, 5-Bedroom Cabins	Per Bedroom	8	550	4,400
	Orchard 2-Guestroom Cabins	Per Bedroom	8	220	1,760
PHASE 3	Clubhouse Dining Room 2	Per Seat	100	35	3,500
	Orchard Pond Pavilion				
	Orchard Pond Pavilion	Per Person	64	4	256
	Distillery			0	5,000
	TOTAL AVERAGE DAILY DEMAND				**46,300**

Notes:
1. Hydraulic Loading Rates from Table B-3 of NYS Design Standards for Wastewater Treatment Systems (2014) unless otherwise noted below.
2. NYSDEC allows for up to 20% reduction in flows for installations equipped with certified water-saving plumbing fixtures. Where appliable, the listed Hydraulic Loading Rates account for this credit.
3. The pool filling peak hourly flow (GPD) is indicated by a (**) in the average daily water demand column.

Table 4: *Scenario Based Domestic Water Demand*

Scenario	Demand (GPD | gpm)
Total Average Daily Demand	46,300 GPD (32 gpm)
Maximum Daily Demand (Factor of 2)	93,496 GPD (65 gpm)
Peak Demand (Factor of 4) – with pool	249,152 GPD (173 gpm)
Peak Demand (Factor of 4) – without pool	184,112 GPD (128 gpm)

For design purposes, the anticipated average daily demand of the development was assumed to be 46,300 GPD. The average daily demand utilizes a probable quantity of 215 patrons utilizing the spa and its various amenities. The maximum daily demand was calculated using a peak factor of 2.0 and full utilization of the spa (243 patrons) and its amenities including a maximum of 96 spa treatments per day. Conservatively, the hourly peak demand, which includes the pool filing flow and a maximum of 12 spa treatments per hour, was calculated using a factor of 4.0. Pool filling is also not anticipated to be a daily occurrence and will only take place during off-peak hours.

The average and maximum daily demands are within the Town's available capacity based on the 2023 water consumption data provided. It is important to note that the demand rates are quantified utilizing NYSDEC standards for wastewater, which are known to be conservative. As such, the Project's water demands could be met without needing to execute the option to increase capacity from Town of Newburgh.

4.3 Fire Protection Demand

The Guide for Determination of Needed Fire Flow prepared by ISO provides a method to determine needed fire flows for buildings based upon the type of construction, occupancy, exposure and location. In accordance with the Building Code of New York State, buildings requiring fire protection and suppression systems shall comply with the New York State Fire Code Chapter 9 "Fire Protection Systems."

It should be noted that ISO does not determine needed fire flows for buildings provided with automatic fire suppression systems compliant with applicable NFPA Standards. Installation of automatic fire suppression systems in a building can also significantly reduce the demand for fire flow.

Where provisions of the code require that a building or portion thereof be equipped throughout with an automatic sprinkler system, commercial systems shall comply with NFPA13 except as provided for in the Building Code. Automatic sprinkler systems, where required for residential buildings, shall comply with NFPA 13R.

It has been preliminarily determined that there will be no unconditioned commercial spaces, therefore the required sprinkler demand per NFPA13 is 250 gpm along with an additional 250 gpm hose stream allowance at the closest upstream hydrant for a total of 500 gpm for a 60-minute duration. Per NFPA 13R, the residential buildings would require a sprinkler demand of approximately 90 gpm for 30 minutes.

Fire suppression systems will be designed by the building's mechanical/plumbing consulting engineer or fire protection expert. It is the responsibility of the fire protection or mechanical engineering consultant to verify the adequacy of the water supply to provide the required flow and pressure for the proposed fire suppression system(s). Design of such installations and determination of actual flow and pressure requirements is beyond the scope of this report.

To enhance life safety through the project, fire hydrants are provided throughout the road corridors at a maximum spacing of 400 feet. Needed fire flows for one- and two-family dwellings not exceeding two stories in height can be estimated using recommended values presented in Chapter 7 of ISO Guide for Determination of Needed Fire Flow. The needed fire flows recommended by ISO for such structures are based on the distance between the buildings; Based on the minimum provided distance of 30 feet between buildings, the needed fire flow is estimated to be 500 gpm for a duration of 1 hour.

5.0 PROPOSED WATER DISTRIBUTION SYSTEM

5.1 Connection to Existing Water System

Water is proposed to be supplied to the Project via an 8-inch connection to the existing 12-inch ductile iron pipe water main on Ridge Road. The water service connection will be designed and installed per the Town's requirements. Connection to the existing 12-inch ductile iron pipe will be completed under the observation of Town personnel using a wet tap and valve.

Once the tap is completed, an 8-inch water main will be extended into the property. A master meter with remote readout will be located within a concrete vault at the entrance to the site. Water meter and backflow prevention devices shall be selected following the Town's standards and will remain privately owned and operated.

5.2 Pipe Sizing and Material

After the meter, the water main will transition to an 8-inch PVC C900 water main which will be installed along the proposed project roadways to provide service to the proposed uses. All valves, bends, tees, crosses and dead ends shall be provided with mechanical joint connections and restrained with Megalug mechanical joint restraints. A concrete thrust block shall be placed behind all tee fittings. Water mains will be generally installed with a minimum earthen cover of five (5) feet using conventional open cut trenching method, in accordance with OSHA standards.

The main will first serve the proposed distillery and staff house located at the base of the site. Then it will be routed up to the Clubhouse Dining Room 2 and the water storage tank. The tank will provide reserve fire flow and ensure adequate water pressure for the site. The tank draw line will serve the proposed guest cabins and guest houses (Phase 2), Animal Planet, proposed treehouse cabins (Phase 1), as well as the entire resort area (furthest west) which includes a lodge, spa, hotel, gym, an events center, dining rooms, and wastewater treatment plant. Blowoff hydrants are proposed at the end of the turnarounds of the cabins and guest houses.

There will be approximately 12,621 linear feet of water main on site. Once constructed, the internal water main and its appurtenances will remain private.

5.3 Hydrants, Valves & Appurtenances

Main isolation valves will be installed at all water main intersections and at a maximum spacing of 800 feet between valves. Hydrants will be installed throughout the distribution system at all road intersections, dead end lines and all high points, and will be spaced at intervals not exceeding 400 feet. Thirty-nine (39) dedicated fire hydrants are proposed.

5.4 Water Service Connections

Each building will be served by a water service tapped from the proposed internal 8-inch water distribution main. Where applicable, the water service will split inside the building to a domestic and fire protection service line. The proposed water services will be constructed in accordance with the latest AWWA standards and specifications. Where applicable for the hazard class, a backflow prevention device will be installed within the building.

5.5 Water Storage Tank

While there is adequate available water pressure and demand from the Town system to serve the project, an onsite water storage tank is proposed to ensure average daily demand redundancy and/or fire protection for the resort without impacting offsite conditions.

After preliminary discussions with the Town, the Applicant proposed that at their sole cost and expense, they will construct a standpipe water storage tank as a public-private partnership with the Town of Marlborough Water District to meet the needs of the proposed project and benefit the Town. The tank would be zoned to supply a portion for the proposed project and the remaining capacity will be available to benefit the Town of Marlborough Water District. If it is determined by the Town of Marlborough that such a capital project is not in the best interest of the Town of Marlborough, the Applicant will alternatively make a payment, which monies shall be used by the Town of Marlborough under its sole discretion. Such payment shall be due and payable prior to the issuance of a temporary certificate of occupancy or a permanent certificate of occupancy for the proposed first phase of the project.

The following two approaches for the water storage tank are currently proposed for discussion and selection:

5.5.1 Base Option – 50,000-Gallon Water Storage Tank to Serve Project

Based on the guidelines established in the Recommended Standards for Water Works, Parts 7 (10 State Standards, latest edition), the sizing of a water storage tank should meet domestic demands and if provided, fire flow demands. If the source has sufficient capacity to supplement peak demands on the system, the provided storage capacity may be reduced. As the Project is not a public water supply and the Town has adequate capacity to serve the Project, storage is being proposed as a benefit as opposed to a requirement, and the sizing has been reduced to provide emergency/standby storage equal to the average daily demand, approximately 50,000 gallons. This approach avoids excess storage capacity and promotes water turnover to maintain water quality.

The water storage tank shall be an Aquastore® glass-fused-to-steel bolted together tank as manufactured by CST Industries. The dimensions of the tank have been selected in order to provide a low-profile structure that will be minimally visible. The top of the storage tank will be below surrounding tree cover. The tank elevation will provide enough water pressure throughout the project site as required by the Recommended Standards for Water Works 2012 Edition, Sections 7.3.1 and 8.2.1. The existing (pre-construction) ground elevation where the tank will be located is approximately 585 feet amsl, which is at a higher elevation than the proposed Project.

The base of the tank will be designed to rest on competent subgrade. The tank has an actual capacity of 53,058 gallons (nominal capacity of 56,000 gallons), with the following dimensions: 12-inch freeboard, 22-foot diameter (nominal), and 19-foot sidewall height (nominal).

The site will be secured by an 8-foot-high chain link fence with a cantilevered sliding gate and padlock. Site perimeter lighting will consist of floodlight fixtures mounted on pole controlled by motion sensor/timer/photocell.

The tank site is to be provided with 120V electrical service (underground). The proposed storage tank can generally be described as follows:

- The materials, design, fabrication, and erection of the bolt together tank shall conform to AWWA Standard for Factory-Coated Bolted Steel Tanks for Water Storage ANSI/AWWA D103 (latest edition).
- Tank coating system shall conform to ANSI/AWWA D103 (latest edition).
- All materials in contact with stored water shall meet ANSI/NSF Additives Standard No. 61 (NSF/ANSI, 2016).
- The tank shall be designed to support the following loadings at a minimum:
  - Dead load consisting of the estimated weight of all permanently imposed loads.
  - Live load consisting of the weight of all the liquid (assuming a water specific gravity of 1.0) when the reservoir is filled to overflowing.
  - Foundation loads: Resulting soil pressure shall not exceed the allowable soil bearing capacity.
  - Wind and snow loads shall comply with ASCE Standard 7-02.
  - Earthquake seismic design shall comply with AWWA D103.
- Tank floor shall be reinforced concrete with an embedded glass-coated steel starter sheet.
- Tank shell and dome shall rest on a concrete ring wall foundation and footings designed for available soil bearing strength. The foundation shall bear on a minimum of 8-inch of crushed stone.
- The spread footing shall be designed to resist all overturning forces. The bottom of the spread footing shall be frost protected by placing it at a minimum of 4 feet below the lowest adjacent ground surface exposed to freezing.
- Subgrade shall be protected from freezing during construction.
- The ring foundation walls shall be backfilled with crushed stone and the material compacted to 95% of the maximum dry density as defined by ASTM D 1557.
- Soils at the bearing surface or within the zone of influence shall not be disturbed. The zone of influence is defined as a line drawn outward and downward from the lower edge of the footing at a 1 Horizontal:1 Vertical (1H:1V) slope.
- The roof dome structure shall be constructed of non-corrugated triangular aluminum panels interlock in a manner to form a clear span 3D space truss.
- The atmospheric tank shall be equipped with the following appurtenances:
  - Fabricated 30-inch by 30-inch aluminum roof access hatch provided with lockable hasp.
  - Gravity roof vent constructed of aluminum with #25 mesh insect screen.
  - External overflow pipe shall be 12 inches in diameter, Schedule 80 PVC or Aluminum, with an overflow weir structure, terminating 24 inches above the ground surface and discharging over a drainage inlet structure (catch basin with discharge to grade away from the tank) or riprap stone.
  - Exterior aluminum tank ladder with galvanized steel safety cage and step-off platforms shall be provided.

- Hinged, lockable entry device shall be installed on the ladder cage such as a cage gate or similar mechanism to restrict unauthorized access.
- Access door (shell manhole) with a minimum diameter of 24 inches shall be provided; the cover plate shall be supported by a davit.

The water storage tank and appurtenances, especially the overflow and vent pipes, shall be designed to prevent freezing, which will interfere with proper functioning. A passive cathodic protection system specifically designed for use with glass-lined tanks shall be supplied by the tank manufacturer. Two separate 8-inch diameter inlet/outlet pipes shall be installed through the tank floor; pipe will be provided with a removable bolted silt stop.

The tank will be provided with a submersible vortex tank mixer to improve water circulation and water quality. The tank will be equipped with a liquid level pressure transducer or ultrasonic device to provide tank level information. A telemetry system shall automatically collect and transmit tank site data to a programmable logic controller (PLC).

5.5.2 Alternative Option – Combined Water Storage Tank to Serve Project and Town

Based on the guidelines established in the NYCRR, Title 10, Part 5, Subpart 5-1, NYSDOH, and the Recommended Standards for Water Works, Parts 7 and 8, the sizing of water storage tanks for public water supplies would include: (a) an operational storage of 1.5 times the average daily demand, (b) the required Needed Fire Flow (NFF) for a given duration, and (c) an emergency/standby storage equal to the average daily demand.

Based on the Water System Facility Evaluation Report (Maser 2003), the existing storage tanks do not effectively serve all parts of the service area, specifically those located at higher elevations up to 550'. The Report made various recommendations for improvements to the system including a new storage tank, PRV adjustments, additional interconnections, extensions and water main looping. The Report recommended a minimum water storage tank capacity of 500,000 gallons based upon either "average daily flow (0.5 mg) or a maximum fire demand of 2,000 gallons per minute (gpm) for a two (2) hour duration (0.24 mg), plus 50% ADF (.25 mg) or a total of 0.49 mg." This quantity, however, represents both the Marlborough and Milton service areas. To appropriately size a new tank for the Town, the existing and/or potential service area(s) to be placed on the new tank would need to be clearly defined to determine the respective average daily demands. During preliminary discussions with the Town, half of the Report's proposed volume or 250,000 gallons was used as the benchmark for Town dedicated capacity within a new tank. One of the Report's proposed locations for a new storage tank was the Project site. To effectively serve the Marlborough and Milton service areas, the tank's Hydraulic Grade Line (HGL) would need to be at or above the HGL at Ridge Road and surrounding areas, along with sufficient operating storage. Per the Hydrant Flow Test Figure in Appendix J, the finished grade along Ridge Road at the entrance to the site is +/-464 feet. The static pressure measured during the hydrant flow test was 88 psi, which equates to an HGL elevation of 666' at this location.

The Project's proposed tank location is at base elevation 585'. In order to maintain the needed HGL to serve the Town, the new tank would need to have an operating range of a minimum of 666', making the tank at least 81 feet high and higher in order to supply a suitable operating range during domestic conditions.

The Project's programming has been designed to preserve the site's existing aesthetics and viewsheds. As such, the dimensions of the water storage tank were assessed to provide a low-profile structure that would be minimally visible to the public. A water storage tank with a total capacity of 300,000 gallons, consisting of a dedicated 250,000 gallons for the Town and 50,000 gallons for the Project, was sized to have a diameter of 70-feet and a height of 12 – 19 feet maximum. At this height and the HGL at Ridge Road, the tank would not be able to supply water to the Town during typical domestic demand conditions at the current system pressure. The system pressure would need to decrease by a

minimum of 27 psi to be at the needed HGL. It is anticipated that the storage tank may only be effective during a fire flow condition where the system pressures drop significantly within the network. Other modifications such as additional PRVs may also reduce system pressures in certain zones to be able to benefit from the tank.

In accordance with the Recommended Standards for Water Works, storage tanks are recommended to be designed to ensure water age does not exceed five days. This ensures water quality does not degrade from concerns such as decreased disinfectant residuals, increased microbial growth, increased water age and unsatisfactory taste and odor. It will be key to design and size the tank to store a quantity that will be effectively utilized to maintain water quality for all end users. The combined water storage tank approach may create excess storage capacity that won't be guaranteed to turn over water frequently enough to preserve water quality at acceptable levels.

5.6 Water System Pressure

The water supply system will be designed and operated to maintain a minimum residual pressure of 20 psi at ground level at all points throughout the Project's distribution system under all conditions of flow including fire flow. The average day demand, maximum day demand and fire flow under peak hourly demand scenarios were simulated to assess the minimum available pressure and the maximum available fire flow while maintaining a minimum 20 psi residual pressure. The normal working pressures in the distribution system will be kept between 35 and 100 psi at ground level. The area to be served by the proposed water distribution system has surface elevations ranging from 400 to 590 feet amsl. As a result, the water distribution system will be designed to incorporate distinct pressure zones to accommodate this wide range of elevations within the Project.

A hydraulic model utilizing WaterCAD version V8I of the project's proposed water demands has been developed to analyze working pressures and available fire flows within the system. As the distribution system is proposed to be fed off the storage tank, a booster pump will be needed to increase pressures to acceptable ranges at the Club House Dining Room 2 and the Orchard guest houses and guestrooms. PRV(s) will be added to select location(s) throughout the system to reduce pressures to the 35-100 psi range.

Once a water storage tank alternative is selected, the detailed design of the booster pump will be finalized. Additionally, coordination with a fire protection engineer will be commenced to design the interconnection between the water main from Ridge Road, the tank and other ancillary appurtenances in order to achieve adequate fire flow at all structures.

5.7 Disinfection & Testing

Once installation of the underground water pipe network is deemed substantially complete for performance testing, all water mains shall be pressure tested and leakage tested in accordance with the applicable AWWA standards.

All new water mains shall be disinfected in accordance with AWWA Standard C651 "Standard for Disinfection of Water Mains" (latest edition). Bacteriological sampling shall be completed in accordance with AWWA Standards and the Ulster County Department of Health. Only upon successful bacteriological sampling results are achieved with a certification of completed work be prepared and submitted.

5.8 Design Standards

The proposed water system improvements have been designed in accordance with application standards and guidelines including the Recommended Standards for Water Works (Ten States Standards), American Water Works Association (AWWA) standards, New York State Department of Health and Town of Marlborough standard specifications and details.

6.0 PROJECTED WASTEWATER GENERATION

6.1 Hydraulic Loading

Based on the current programing, the following wastewater flows were calculated in accordance with the 2014 NYSDEC New York Design Standards for Intermediate Sized Wastewater Treatment Systems and NYSDOH Title 6-1.29 Swimming Pool Design Standards.

These hydraulic loading rates take into consideration the use of up to date, water saving fixtures to promote sustainability throughout the project.

Table 5: *Total Sanitary Demand*

	Type of Use	Unit	Unit Quantity	Hydraulic Loading Rate w/ Credit (gpd/unit)	Average Daily Wastewater Flow (gpd)
PHASE 1	Welcome Building	Per Employee	1	12	12
	Entry Cottage (Existing Cabin)	Per Bedroom	1	110	110
	Renovated Main Lodge - 2 Guestrooms	Per Bedroom	2	110	220
	Renovated Main Lodge - Private Dining/Winter Terrace	Per Seat	6	28	168
	Renovated Main Lodge - Bar	Per Seat	15	16	240
	Renovated Main Lodge - Lounge	Per Seat	15	16	240
	Orangerie (Small Events Center)	Per Seat	100	8	800
	Cabin Bar	Per Seat	17	16	272
	Clubhouse Dining Room 1	Per Seat	102	28	2,856
	Farm Market & Barbeque	Per Seat	15	28	420
	Pond Cabin (Existing)	Per Bedroom	1	110	110
	Spa - Pool	Total Pool Volume	1	65,040	65,040**
	Spa - Other Amenities	Patrons	215	16	3,440
	Spa - Employees	Employees	31	12	372
	Events Center	Per 10 SF	220	8	6,160
	Hotel	Per Sleeping Unit	28	110	3,080
	Walled Garden			0	-
	Back of House Operation (Existing Yoga Building)			0	-
	Walled Garden	Per Seat	25	35	875
	Pond Pavilion (Serving Tennis Courts)	Per Person	64	4	256
	Tree House - 2 Guestroom Cabins (1 Bedroom ea.)	Per Bedroom	22	220	4,840
	Tree House - 1 Guestroom Cabins (1 Bedroom ea.)	Per Bedroom	8	110	880
	Animal Planet - Petting Zoo (Barn)	Per Employee	3	36	108
	Staff Dorm & Locker Room	Per Person	35	75	2,625
PHASE 2	Hillside – 2 Guestroom Cabins (2 Bedrooms ea.)	Per Bedroom	15	220	3,300
	1-Guest, 5-Bedroom Cabins	Per Bedroom	8	550	4,400
	Orchard 2-Guestroom Cabins	Per Bedroom	8	220	1,760
PHASE 3	Clubhouse Dining Room 2 (360 Restaurant)	Per Seat	100	35	3,500
	Orchard Pond Pavilion				
	Orchard Pond Pavilion	Per Person	64	4	256
	Distillery			0	5,000
	TOTAL				**46,300**

Notes:
1. Hydraulic Loading Rates from Table B-3 of NYS Design Standards for Wastewater Treatment Systems (2014) unless otherwise noted below.
2. NYSDEC allows for up to 20% reduction in flows for installations equipped with certified water-saving plumbing fixtures. Where appliable, the listed Hydraulic Loading Rates account for this credit.
3. The pool filling peak hourly wastewater flow (gpd) is indicated by a (**) in the average daily wastewater flow column.

Table 6: *Scenario Based Design Wastewater Flow*

Scenario	Demand (GPD | gpm)
Total Average Daily Flow	46,300 GPD (32 gpm)
Maximum Daily Flow (Factor of 2)	93,496 GPD (65 gpm)
Peak Flow (Factor of 4)	184,112 GPD (128 gpm)

For design purposes, the anticipated average daily flow of the development was assumed to be 46,300 gpd. The average daily flow utilizes a probable quantity of 215 patrons utilizing the spa and its various amenities. The maximum daily flow was calculated using a peak factor of 2.0 and full utilization of the spa and its amenities including a maximum of 96 spa treatments per day. Conservatively, the hourly peak demand includes a maximum of 12 spa treatments per hour and was calculated using a factor of 4.0. Pool water will not be discharged to the wastewater treatment plant.

A detailed breakdown of the wastewater generated in the spa is provided in Appendix I.

6.2 Pool Water

A specific draining and cleaning protocol for the pools will be submitted to Ulster County Department of Health for approval. This protocol will be based on maintaining pool water chemistry and quality within regulated ranges with the use of advanced chemical controllers equipped with data logging and alarm capabilities as well as regular manual confirmation of the pool water parameters. Pool draining and cleaning will be proposed to occur when the pool water parameters have reached pre-determined levels requiring fresh water. This protocol will significantly reduce water usage and maintain safe water.

When the pools are drained, the water will be dechlorinated and discharged to the porous pavement. A dichlorination system will be designed to bring chlorine levels to acceptable minimum levels and then discharged at determined rates with the use of a flow restrictor.

7.0 PROPOSED SANITARY SEWER COLLECTION SYSTEM DESIGN

The proposed internal sanitary sewer collection system will include a combination of gravity and pressure pipes.

7.1 Gravity System

There is approximately 10,249 linear feet of 8-inch diameter PVC SDR 35 gravity pipe and approximately eighty-four (84) precast concrete manholes. All pipes shall be sloped to provide a flushing and self-cleaning velocity of 3 ft/sec. Manning's equation was used to calculate pipe capacity of the gravity sewers for this project and compared to the flow anticipated from the project to ensure the system will have ample capacity.

Table 7: *Sanitary Lateral Pipe Capacity Check Using Manning's Equation*

Proposed Pipe	Manning's Maximum Flow Capacity	Proposed Peak Flow	Allowable capacity > Peak Flow
8" Sanitary Sewer Pipe	$Q= A\ (1.49/n)\ (A/P)^{2/3}\ S^{.5}$ $Q= 0.35\ (1.49/.009)\ ((0.35)/(2.09))^{2/3}(.40)^{.5}$ $Q= 1.11\ ft^3/sec = 500\ gpm$	173 GPM	Yes

A=Flow Area (sf) n=Manning's Roughness Coefficient (unitless) P=wetted perimeter (ft) (for maximum flow this equals the pipe circumference = 2πR) S=slope of channel (ft/ft)

Based on the table above, the sanitary sewer system can handle the proposed flows. All pipes including building sewers and the collection pipe shall have watertight joints and be installed per pipe manufacturer's requirements and ASTMS standards.

7.2 Pressure System

Due to the difference in elevation, four (4) pump stations and 2,471 linear feet of 4-inch diameter HDPE DR11 sanitary sewer force main will be used to convey sewage from lower elevation areas towards the onsite wastewater treatment plant. Each pump station will have adequate capacity for the peak hourly flow.

There will be three Smith & Loveless Everlast Series package above grade pump stations serving large sections of the system and one smaller effluent pump station to serve the pond pavilion.

7.3 Smith & Loveless Packaged Pump Station

The pump station will be directly mounted on a 6-foot diameter precast concrete wet well. The pumps, valves, ancillary mechanical equipment and controls will be mounted on top of the wet well and enclosed within a hinged tip-up, insulated fiberglass enclosure on a ½-inch thick Duro-Last stainless-steel baseplate. Shut-off valves, check valves, pressure gauges, mechanical equipment and all controls will be accessible for operation and maintenance from aboveground. Access to the wet well will be provided by an aluminum manway cover.

A ventilating blower and louvers will be mounted on the hood enclosure for maximum cooling. The pump station is also equipped with a thermostat and internal wiring. A heater will be provided to keep the enclosure within the operating range required for the electronics and to prevent condensation.

These sanitary pump stations will also be provided with the Quicksmart touchscreen pump station controller, a central control panel mounted inside the enclosure. The controller will manage alarms, wet well level set points, and pump station functions. Maintenance logs, recommended operation and maintenance instructions and troubleshooting support are available on this system as well. NEMA rated motor starters, automatic pumping level controls, totalizing run time meters, phase monitor, time delay relay, 5 kVA transformer, and transducer signal splitter are also provided.

The pump station will be equipped with telemetry and audio/visual alarms in case of emergency. The Sensaphone Sentinel cellular-based modem will have the capability to relay the following pump station alarms to the contracted operator or to a 24-hour on-call service:

- Pump failure
- High water level

- Low water level
- Loss of power
- Enclosure Intrusion
- Communication link failure
- Standby generator fault alarms

The pump station will be powered from the site's main electrical distribution to be designed by others. The main electric service panel will be sized to accommodate the electrical loads for the vacuum-primed pumps, controls, heater and blower. Service panel will include one weather-proof 120V dual GFCI receptacle. All outdoor electrical and control equipment will be installed in weatherproof NEMA 4X rated enclosures. All electrical equipment serving the pump station will be designed in accordance with the National Electric Code (NEC).

Standby power to the pump station will be provided by a dedicated standby generator. The standby generator will be equipped with an automatic transfer switch to ensure continuous operation of the pump station in the event of a utility power outage.

The pump station, generator and all appurtenances will be enclosed and shielded from view. Cut sheets of the proposed pump station are provided in Appendix J.

7.3.1 Pump Station 1 – Distillery

This Smith & Loveless package will be Series EV1000 equipped with two (2) model 4B3B close-coupled vacuum-primed non-clog pumps with an impeller size of 11 inches and a duty point of 80 gpm at 131 ft of total dynamic head (TDH). Each pump will be powered by a 15 HP/230V/3 phase/1,760 RPM motor. Each pump shall have a shutoff and check valve on the discharge side of the pump. The wet well will be 6-foot diameter and 8.5-feet deep.

The pump impeller shall be an enclosed two-port type made of close-grained cast-iron and shall be balanced. The eye of the impeller as well as the ports shall be large enough to permit the passage of a 3-inch diameter sphere. The impeller shall be keyed with a stainless-steel key and secured to the motor shaft by a stainless-steel cap screw equipped with a suitable self-locking device. The impeller shall not be screwed or pinned to the motor pump shaft and shall be readily removable without the use of special tools. To prevent the buildup of stringy materials, grit and other foreign particles around the pump shaft, all impellers less than full diameter shall be trimmed inside the impeller shrouds. The shrouds shall remain full diameter so that close minimum clearance from shrouds to volute is maintained. Both the end of the shaft and the bore of the impeller shall be tapered to permit easy removal of the impeller from the shaft.

7.3.2 Pump Station 2 – Road B Intersection

This Smith & Loveless package will be Series EV1000 equipped with two (2) model 4B2X*1 close-coupled vacuum-primed non-clog pumps with an impeller size of 8-3/4-inches and a duty point of 100 gpm at 22 ft of total dynamic head (TDH). The impeller shall be Smith & Loveless X-Peller designed specifically for high volumes of trash pumping applications. Each pump will be powered by a 2 HP/230V/3 phase/875 RPM motor. Each pump shall have a shutoff and check valve on the discharge side of the pump. The wet well will be 6-foot diameter and 9.5-feet deep.

The pump impeller shall be an X-Peller super clog resistant mono-port impeller, made of close-grained cast-iron and shall be in dynamic balance when pumping wastewater. The dynamic balance shall be obtained without the use of balance weights or liquid filled chambers. The impeller shall be designed to allow for the trimming of the impeller to meet design condition changes without altering the balance. The eye of the impeller as well as the port shall be large enough to permit the passage of a 3-inch diameter sphere. To further prevent clogging, the impeller port shall have a minimum area of 10.6 in^2. The impeller shall be keyed with a stainless-steel key and secured to the motor shaft by a stainless-steel cap screw equipped with a suitable self-locking device. The impeller shall not be screwed or pinned to the motor pump shaft and shall be readily removable without the use of special tools. To prevent the buildup of stringy materials, grit and other foreign particles around the pump shaft, all impellers less than full diameter shall be trimmed inside the impeller shrouds. The shrouds shall remain full diameter so that close minimum clearance from shrouds to volute is maintained. Both the end of the shaft and the bore of the impeller shall be tapered to permit easy removal of the impeller from the shaft.

7.3.3 Pump Station 3 – WWTP Influent Pump Station

This Smith & Loveless package will be Series EV1000 equipped with two (2) model 4B2X*1 close-coupled vacuum-primed non-clog pumps with an impeller size of 8-3/4-inches and a duty point of 100 gpm at 8 feett of total dynamic head (TDH). The impeller shall be Smith & Loveless X-Peller designed specifically for high volumes of trash pumping applications. Each pump will be powered by a 2 HP/230V/3 phase/875 RPM motor. Each pump shall have a shutoff and check valve on the discharge side of the pump. The wet well will be 6-foot diameter and 9.5-feet deep.

The pump impeller shall be an X-Peller super clog resistant mono-port impeller, made of close-grained cast-iron and shall be in dynamic balance when pumping wastewater. The dynamic balance shall be obtained without the use of balance weights or liquid filled chambers. The impeller shall be designed to allow for the trimming of the impeller to meet design condition changes without altering the balance. The eye of the impeller as well as the port shall be large enough to permit the passage of a 3-inch diameter sphere. To further prevent clogging, the impeller port shall have a minimum area of 10.6 in^2. The impeller shall be keyed with a stainless-steel key and secured to the motor shaft by a stainless-steel cap screw equipped with a suitable self-locking device. The impeller shall not be screwed or pinned to the motor pump shaft and shall be readily removable without the use of special tools. To prevent the buildup of stringy materials, grit and other foreign particles around the pump shaft, all impellers less than full diameter shall be trimmed inside the impeller shrouds. The shrouds shall remain full diameter so that close minimum clearance from shrouds to volute is maintained. Both the end of the shaft and the bore of the impeller shall be tapered to permit easy removal of the impeller from the shaft.

7.3.4 Pump Station Generator

Natural gas standby generators with automatic transfer switches are proposed to be installed to ensure uninterrupted operation of the pump station in the event of a utility power outage. The standby generator will be located next to the pump station in a fenced area.

Pump Station 1 will require a 45 to 50 KW natural gas generator. Pump Stations 2 and 3 will require a 12 to 15 KW natural gas generator or a minimum 25 KW commercial unit. The basis of design for the standby generators will be a Cummins 60 Hz, 120/208V 3 phase generator sized to power the pumps with staggered starts including all ancillary pump station equipment such as the control panel, level switches, heater and cooling fan. The generator will be housed in a sound-attenuated acoustically designed weather protective enclosure with a low noise factory engineered exhaust system.

The generator will be equipped with a temperature rise alternator, stop switch, single circuit breakers, low coolant level shutdown, annunciator, and standalone 12V battery charger. An automatic transfer switch will be provided.

Standby equipment will be regularly exercised at full loads.

7.4 Force Main

Each pump station will convey sanitary sewage via a 4-inch diameter HDPE DR-11 sewer force main. The force main will be installed with a minimum of 5 feet of cover. The 4-inch sewer force main will provide a minimum cleaning velocity of 2 feet/second at the pump's duty point.

The force main conveying wastewater from the project location will be designed to minimize friction loss and maintain a cleansing velocity of 3 ft/sec. Air relief valves will be provided at high points to prevent air trapping within the force main. To support future maintenance, cleanouts will be provided approximately every 500-1,000 feet or in accordance with local flushing companies' capabilities. Cleanouts shall be located at all major changes in direction and shall include an isolating valve with a capped T or Y fitting on either side of the valve to allow for bidirectional maintenance.

7.5 Grease Trap

A 2,000-gallon external grease trap is proposed to be installed on the dedicated 4-inch building sewer lateral to intercept grease and solids from the kitchen/food preparation areas. The sizing of the external grease trap is based on Table D-1 of the NYSDEC Design Standards for Intermediate-Sized Wastewater Treatment Systems, March 2014 assuming a 4-inch building sewer lateral.

An effluent sampling manhole with a minimum internal 6-inch drop will be installed downstream of the grease trap to facilitate sampling of the effluent coming out of the grease trap.

7.6 Testing

Once installation of the underground sanitary sewer collection system is considered substantially complete for performance testing, hydrostatic and air tests shall be performed on all pipes. All manholes shall be pressure tested in accordance with the applicable standards.

7.7 Design Standards

The proposed internal sanitary sewer collection system has been designed per application standards and guidelines including the Recommended Standards for Wastewater (Ten States Standards) and NYSDEC Intermediate Standards for Wastewater Systems.

8.0 PROPOSED ON SITE WASTEWATER TREATMENT PLANT

8.1 Basis of Design

The onsite wastewater treatment plant will be a package plant, consisting of the following treatment units:

- Primary Settlement Tank;
- Coarse Screening Septic Filters;
- Equalization Tank;
- Automatic Backwashing Filters;

- Sludge Tank;
- Aeration Tank;
- MBR Treatment Building;
- Membrane Bioreactors;
- UV units;
- Blower/Chemical Building.

The wastewater generated is expected to be of medium strength. This type of wastewater is discharged from typical residential fixtures such as toilets, sinks, bathtubs and washing machines generated by water using tasks like attending to personal hygiene, preparation of food and cleaning. Medium strength wastewater generated by mass food preparation/service, and linen service is also expected by the project. The expected influent wastewater is typically characterized by the following concentration ranges:

Table 8: *Design Criteria of Influent*

Parameter	Value	Units
Chemical Oxygen Demand (COD)(assumed)	550	mg/L
Biochemical Oxygen Demand- 5 day (BOD_5)	275	mg/L
Total Suspended Solids (TSS)	300	mg/L
Volatile Suspended Solids (VSS)(assumed)	237	mg/L
Total Kjeldahl Nitrogen (TKN)	65	mg/L
Ammonia Nitrogen (NH4-NI)(assumed)	45.5	mg/L
Total Phosphorus (TP)	10	mg/L
Fat, Oil, Grease (FOG)(assumed)	100	mg/L
Water Temperature	50	°F
Alkalinity (assumed)	200	mg/L
pH	6.5-8.5	

The discharge quality objectives of the effluent are summarized in the table below:

Table 9: *Effluent Discharge Objectives*

Parameter	Objective	Units
Biochemical Oxygen Demand- 5 day (BOD_5)	5	mg/L
Total Suspended Solids (TSS)	5	mg/L
Fecal coliform (FC) (30 Day Mean)	100	CFU/ 100 mL
Ammonia (NH_3)	1	mg/L
pH	6-9	

8.2 Primary Settlement Tank

The primary settlement tank (PST) consists of two sections divided by a baffle wall with 4-inch circular openings. In the first section, flow is allowed to equalize and settle, unmixed and unaerated. The baffle wall reduces turbulence which increases settling of solid particles. The second section contains septic filters. The second section is equipped with a 54-inch x 54-inch lockable access hatch to access and remove the septic filters.

Aluminum chlorohydrate will be injected into the PST to improve the coagulation of solids, which will increase TSS and BOD removal efficiencies, as well as reduce the total phosphorus concentration.

The PST will be equipped with a high-level float switch which will activate the alarm during a high-level condition that may be caused by clogged septic filters.

8.2.1 Septic Filters

Coarse screening septic filters are to be located inside the second section of the PST after the baffle wall. These filter cartridges are made up of filter plates that are locked together with five ribs and two sections with 1/8-inch openings throughout their structure. Each filter is sized to handle flow at the design head pressure. The filters will prevent larger debris from reaching the equalization (EQ) tank and fine screen automatic backwashing filters. The combined settling and filtration will decrease the TSS and BOD.

8.3 Influent Flow Equalization

The screened wastewater will discharge into an EQ tank where it will be temporarily stored prior to secondary treatment. The EQ tank will ensure the wastewater is treated at a steady flowrate over a 24-hour period. The EQ tank will be a precast concrete tank which includes two (2) submersible duty/stand-by sewage pumps, 9-inch cap course bubble air diffusers for oxygen transfer and mixing requirements, associated piping, guide rail assemblies, shutoff valves, check valves, controls, appurtenances, and an access ladder. The equalization tank will have two (2) hinged and lockable aluminum access hatches.

Equalization basin capacities will be sufficient to effectively reduce expected flows and load variations over a 24-hour period. The peak hourly flow will be dampened by the storage capacity of the EQ tank.

The controls for the EQ tank will utilize one duty pump unless the operator switches wastewater flow to the standby pump. The controls for the flow equalization tank will be designed to run the duty pump on every successive pumping cycle until the operator switches to the standby pump. In the event of a pump failure, the remaining functional pump will take over all pumping cycles until the failed pump is reinstated.

The operation of the EQ pumps will be controlled by the level transmitter located in the aeration tank, and float switches used as secondary back up should the level transducer fail. The level transducer located in the EQ tank will control the frequency of power to be delivered to the permeate pumps through VFDs to maintain a steady flow. The function of each controller is described below:

- EQ Level Transducer: This level transducer will display the tank level in the EQ tank as a percentage. Alarm set points will be configured to notify the operator of low-low and high-high water levels. Furthermore, as the wastewater level in the EQ tank increases, the power being supplied to the permeate pump VFD's will also increase. There will also be a filtration mode and standby mode level settings programmed into the PLC which will dictate whether filtration occurs.

- EQ Low-low Float: This float will turn off the duty EQ pump and will activate an alarm signal when the float switch is in the extended position should the level transducer fail.
- EQ Low Float: This float will initiate standby mode when the float switch is in the extended position should the level transducer fail.
- EQ High Float: This float will initiate filtration mode when the float switch is in the tilted position should the level transducer fail.
- EQ High-high Float: The high-level float switch will activate the alarm when the float switch is tilted, turning on the standby EQ pump if there is room in the aeration basin should the level transducer or duty pump fail.
- Aeration Tank Low-low Level Float: This float is used to shut off the MBR feed pumps and permeate pumps, will turn on the duty EQ pump if possible and will activate an alarm signal when the float switch is in the extended position.
- Aeration Tank Low Level Float: This float will turn on the duty EQ pump when the float switch is in the extended position.
- Aeration Tank High Level Float: This float will turn off the EQ pump when the float switch is in the tilted position.
- Aeration Tank High-high Level Float: This float will activate an alarm signal when the float switch is in the titled position and turn off the EQ pumps until the alarm is acknowledged or the system returns to normal.

8.4 Influent Flow Equalization

The EQ pumps are sized to start efficiently during maximum monthly flow conditions and run continuously for peak hourly flow conditions based on the expected flows of the full build. The PLC will record the EQ pump cycles and run times to monitor pump usage.

The operator will be able to adjust the floats in the aeration tank based on actual flow conditions. The EQ pump discharge isolation valves and strainer inlet valves are not to be throttled as the Automatic Backwashing Filters (strainers) require proper backwashing of the strainers.

8.5 Automatic Backwashing Filters (Strainers)

The Membrane Bioreactor (MBR) building will contain automatic duty/stand-by backwashing inline filters (ABF), connected in parallel, each with a 1,500-micron screen. These strainers will filter particulates greater than 1.5-mm and fibrous material from the wastewater before being discharged to the aeration basin. The solids will be collected on the screen and will be flushed and drained into the sludge tank.

8.6 Chemical Addition

8.6.1 Coagulant Addition

A 50% solution of aluminum chlorohydrate (ACH) will be injected into the PST Tank to coagulate solids, which will improve TSS and BOD removal efficiencies, as well as phosphorus removal. The system responsible is a (1) chemical metering system, complete with two (2) duty/stand-by chemical metering pumps and a storage tote. Phosphorus is removed by chemical precipitation and subsequent coagulation. The chemical metering system will be located inside the blower/chemical building.

The pumps will be installed with associated foot valves, check valves, and tubing. The chemical metering pumps are sized to be able to dose sufficient chemical at the maximum monthly flow. The duty chemical metering pump will add aluminum chlorohydrate continuously over a 24-hour period but will turn off if both MBR trains are in standby mode. The operator will be able to adjust the chemical flowrate based on actual site conditions.

8.6.2 Alkalinity Addition

A 25% solution of sodium hydroxide will be injected into the aeration tank to provide enough alkalinity for complete nitrification to take place to meet the ammonia effluent objectives. This system is a (1) chemical metering system, complete with two (2) duty/stand-by chemical metering pumps, and a storage drum. The chemical metering system will be located inside the blower/chemical building.

The pumps will be installed with associated foot valves and tubing. The chemical metering pumps are sized to be able to dose sufficient chemical at the maximum monthly flow. The duty chemical metering pump will add sodium hydroxide continuously over a 24-hour period but will turn off if both MBR trains are in standby mode.
The operator will be able to and should adjust the chemical flowrate based on actual site conditions.

8.7 Secondary Treatment

The activated sludge process is used for BOD, TSS, and ammonia removal. In this design an aeration basin and membrane bioreactor will be used to achieve secondary treatment.

8.7.1 Aeration Basin

The aeration basin or tank will be a precast concrete tank. Two (2) positive displacement blowers will be installed to supply air to the aeration basin. The aeration basin will be equipped with a fine bubble air diffusion grid. The working capacity of the aeration basin and minimum freeboard will be designed per the Ten State Standard Recommendations for Wastewater Facilities.

The aeration tank will receive screened wastewater and returned activated sludge (RAS) via a 3-inch HDPE DR17 discharge pipe and a 6-inch SDR35 RAS gravity line with a slope of 1% to ensure a gravity flow of greater than 2 ft/s respectively. The RAS overflow pipe connects the MBR tanks from both MBR trains to the aeration tank. The aeration tank will be equipped with controls, appurtenances, and an access ladder. There will be two (2) concrete risers with a hinged and lockable aluminum access hatch to access the MBR feed pumps.

The aeration tank is equipped with two (2) submersible MBR feed pumps, one for each MBR treatment tank. Each MBR feed pump will feed its corresponding MBR tank. The MBR feed pumps will be installed with isolation valves, check valves, associated piping, guiderail systems, and an access ladder.

The aeration tank will also be installed with Fine Bubble Diffusers for oxygen transfer and mixing requirements. One (1) duty and one (1) standby aeration blower will be designated for the aeration basin, each capable of maintaining a dissolved oxygen concentration of 2.0 mg/L. The aeration blowers are positive displacement with a 2-inch diameter discharge connecting to 3-inch stainless-steel pipe. The motor is rated for continuous operation with a minimum motor speed of 1337 RPM. The blowers will be installed with VFDs, isolation valves, check valves, and associated piping.

Each MBR feed pump is designed to feed mixed liquor to its MBR train and allow for a 4:1 RAS overflow ratio. There is one feed pump per MBR tank. In the event of a pump failure, the operating MBR train is designed to be able to handle the entirety of the peak daily flow (PDF), as well as the peak hourly flow (PHF) up to a 4-hour period. A level transducer located in the MBR tanks will initiate the corresponding MBR feed pump to turn on should the water level drop below the desired setpoint. This ensures the membranes are always submerged underwater.

8.7.2 Controls

To maintain the dissolved oxygen concentration at 2.0 mg/L, a dissolved oxygen probe will determine the frequency of power to be delivered to the aeration blowers through VFDs. Under normal operation, the blowers will only alternate duty when initiated by the operator. In the event of a blower failure, the remaining functional blower will take over all blower cycles until the failed blower is reinstated. The function of each controller is described below:

- MBR Tank Level Transducer: will display the tank level in each MBR tank as a percentage. If in standby mode and the water level drops by 10%, the corresponding MBR feed pump for that MBR train will turn on to prevent the membrane cassettes from being exposed to air. If the water level drops by 10% during filtration mode, the permeate pump will stop, and wait for the minimum water level in the corresponding membrane tank to be reinstated. The standby MBR train would take over. An alarm signal will occur in either case and the water level setpoint can be adjusted to ensure proper operation.
- Aeration Tank Low-low Level Float: used to shut off the MBR feed, and permeate pumps, will activate an alarm signal when the float switch is in the extended position.
- Aeration Tank Low Level Float: will turn on the EQ pump when the float switch is in the extended position.
- Aeration Tank High Level Float: will turn off the EQ pump when the float switch is in the tilted position.
- Aeration Tank High-high Level Float: will activate an alarm signal when the float switch is in the tilted position and turn off the EQ pumps until the alarm is acknowledged or the system returns to normal.
- Aeration Tank Dissolved Oxygen Probe: will measure the dissolved oxygen in real time. As the dissolved oxygen drifts further away from the 2.0 mg/L setpoint, the PLC will send a signal to the blower's VFDs to either increase or decrease frequency of power to increase or decrease the air flow output. Note that only one DO probe will control the aeration blowers VFD speeds at any given time.

8.7.3 Pump Cycle Settings

The MBR feed pumps are designed to have a pumping capacity 5 times that of the maximum monthly flow (MMF). The pumps will operate continuously during filtration mode to maintain an RAS ratio of 4:1. During standby mode, the MBR feed pumps will operate for 5 minutes every 60 minutes to flush the membranes. The MBR feed pumps are also designed to ensure they can hydraulically handle one half of the peak hourly flow. The PLC will record the MBR feed pump cycles and run times to monitor pump usage.

8.8 Tertiary Treatment

Tertiary treatment will be achieved by the use of the MBR. The design effluent will have 5 mg/L BOD5 and 5 mg/L TSS. The membrane bioreactor will contain fibreplate. Fibreplate is a technology which shares the advantages of hollow-fibre and flat-sheet technologies, creating a highly effective ultrafiltration membrane. It has the lowest energy costs, the highest filtration rates for peak demands, and the unique operational robustness to recover in-situ from any plant upsets. Each membrane module consists of 16 sheets made from polyvinylidene fluoride (PVDF) with a nominal pore size of 0.04 microns. The Fibreplate design allows for higher sustained fluxes and higher throughput per unit volume. Permeate is pulled through the pores of the membrane, while suspended particulates remain inside the MBR tank and recirculate back to aeration basin. The space between the membranes sheets is kept clear, reducing the potential for

sludging. The membranes sheets are potted into vertical headers to form modules with unobstructed, open flow paths to avoid solids and debris accumulation. Modules are connected to form a membrane cassette, and typically one cassette is installed per membrane tank.

The tertiary treatment process will consist of two (2) stainless steel MBR tanks, complete with two (2) centrifugal recirculation pumps, two (2) centrifugal permeate pumps, membrane modules, an air scouring blower, diffuser plates, ball valves, check valves, actuated ball valves, access hatches, controls, flowmeter and appurtenances. Fibracast Fibreplate FPM500 membranes shall be used with a surface area of 500 ft^2 with an operating flux of 10 gallons/ft^2/day (GFD) at 50 ºF, and an average operating pressure of -2.5 psi. The maximum membrane flux of this unit is 20 GFD at 50ºF and can be sustained up to a maximum of 4 hours, with a maximum transmembrane pressure of -8 psi. Therefore, each membrane cassette will sustain a peak daily flow of 86,000 GPD/tank continuously, and a peak hourly flow of 172,000 GPD/tank up to a 4-hour period.

8.8.1 Membrane Train

Under normal operating conditions, a relax cycle is to be performed on the membranes at a predetermined rate. In a relax cycle, the membranes are air scoured and the MBR feed pump flushes the tank, while the permeate pump is off. If a higher level of cleaning is required, a backpulse cycle can be performed on the membranes. In a backpulse cycle, clean water is forced backwards through the membranes modules to dislodge solids that may have clogged the pores. This can improve membrane performance and the longevity of membrane cassettes. The downtime required for relaxing or backpulsing is accounted for in the operating flux parameters. Therefore, two (2) MBR trains, each equipped with eighteen (18) Fibreplate FPM500 membrane modules are required to have redundancy to sustain peak daily flow continuously, and the peak hourly flow up to a 4-hour period.

The accumulating mixed liquor suspended solids (MLSS) in the membrane tanks will be removed via waste activated sludge (WAS) lines, complete with actuated valves. A timer which is programmed into the PLC will determine the duration and frequency of wasting. Operators will be able to adjust these times as required. Level transducers will be installed in the membrane tanks to monitor the water level to ensure the membranes are always submerged.

The permeate pump for each MBR tank will be controlled by a VFD. The pump will be installed with isolation valves, and associated piping. A pressure sensor will be installed on the suction side of each pump to monitor the transmembrane pressure for the corresponding MBR Tank. An electronic flowmeter will be installed on the discharge side of each pump to measure and record the instantaneous and total daily flow for each membrane train.
To minimize solids accumulation in the membranes, each tank will contain an air scouring blower. The air scouring blowers are Gardner Denver positive displacement blower, model SBL-2L with a 7.5 HP/460V motor, and 2-inch diameter discharge connecting to 3-inch stainless-steel pipe and transition to CPVC. The motor is rated for continuous operation with a minimum motor speed of 1337 RPM. The blower will be installed with a VFD, isolation valves, check valves, and associated piping. Being installed with a VFD, the air scouring blower can be adjusted manually to increase or decrease the air flowrate. A pressure transducer will be installed on each airline to ensure proper operation. A stainless-steel diffuser plate will be placed under each row of membrane modules to diffuse the air inside the MBR tanks.

A recirculation pump to further clean a row/stack of membrane module is added to each MBR tank. The pump will be installed with isolation valves, and associated piping. An electronic flowmeter will be installed on the discharge side of each pump to measure the instantaneous flowrate to the corresponding membrane tank.

A backpulse cycle will utilize collected potable water from the backpulse tank to clean sludge and debris off the membranes. During a backpulse cycle, the permeate pump will turn off, actuated valves will switch the system from filtration mode to backpulse mode, and the duty backpulse pump will then activate. The clean water will be capable of dislodging any solids that may have clogged the pores and remove sludge stuck between the membrane sheets. The backpulse pump is a centrifugal pump which will be connected to a VFD to allow for flow control. The backpulse pumps will be installed with isolation valves, check valves, associated piping and guiderail systems. A pressure sensor will be installed on the discharge side of the pump to monitor the backpulse pressure. An electronic flowmeter will be installed on the discharge side of the pump to measure the instantaneous flowrate during a backpulse cycle.

8.8.2 Controls

There are four (4) tertiary treatment cycles: filtration mode, relax mode, backpulse mode, and standby mode. In filtration mode, the MBR feed pump, recirculation pump, and air scouring blower are in operation while the permeate pump pulls water through the membranes for treatment. In relax mode, the MBR feed pump, recirculation pump, and air scouring blower are in operation but the permeate pump is off to rest the membranes. In backpulse mode, the air scouring blower, MBR feed pump, and recirculation pump are in operation while the backpulse pump forces clean water back through the membranes. In standby mode, the air scouring blower, MBR feed pump, and recirculation pump turn on intermittently to flush the membranes. The controls for the tertiary treatment are designed to be fully automated using pressure transducers, flowmeters, and timers.

The timer will initiate a backpulse or relax cycle every 5 minutes, for a duration of 30 seconds to relax or clean the membranes respectively. A flow meter will be installed on each permeate discharge pipe, each air scouring pipe, and the combined backpulse discharge pipe. The PLC will record the instantaneous flowrate and totalize the flow for each treatment cycle for each train. In the event of a pump or blower failure, the system will initiate an alarm signal and the MBR train will move into standby mode (with consideration for the equipment that is malfunctioning). A level transducer in the MBR tanks will turn off the permeate pump if the water level drops below the desired setpoint. This will ensure the membranes are always submerged underwater. A pressure transducer located on each permeate suction line will measure the transmembrane pressure. A pressure transducer located on each air scouring discharge line will measure the air pressure going into each MBR tank. The same pressure transducer located on the permeate suction lines will be used to measure the backpulse pressure during a backpulse. The function of each controller is described below:

- MBR Tank Level Transducer: will display the tank level in each MBR tank as a percentage. If in standby mode and the water level drops by 10%, the corresponding MBR feed pump for that MBR Train will turn on to prevent the membrane cassette from being exposed to air. If the water level drops by 10% during filtration mode, the permeate pumps will stop and wait for the minimum water level in the corresponding membrane tank to be reinstated. The standby MBR train would take over. An alarm signal will occur in either case and the water level setpoint can be adjusted to ensure proper operation.
- Transmembrane Pressure (TMP) Transducer: will display the transmembrane pressure in the suction line for each permeate pump to monitor the condition of the membrane modules. The TMPs should operate between 0 to -8 psi during filtration mode. If the TMPs exceed -8 psi during filtration mode, the system will switch the duty/standby MBR trains and commence a sodium hypochlorite clean in place on the corresponding MBR train. Only one MBR train can conduct a clean in place at any given time so that the other MBR trains can still produce effluent at the full rated capacity. If the TMPs do not recover to above -8.0 psi after a clean in place, then the MBR train will go into standby mode until the problem can be rectified.

- Backpulse Pressure Transducer: The backpulse pressure transducers are the same pressure transducers used on the permeate suction lines. During a backpulse they will display the backpulse pressure to monitor the condition of the membrane modules. The backpulse pressure should operate between 0 to 2.5 psi during a backpulse or clean in place. If the TMPs exceed 3.0 psi during a backpulse or clean in place cycle, that MBR train will go into standby mode until the problem can be rectified.
- Air Scour Pressure Transducer: This will display the air pressure produced by each air scouring blower on their designed air pipe. If the air pressure rises above the high pressure setpoint, or lowers below the low pressure setpoint, that MBR train will go into standby mode and activate an alarm signal.
- Permeate Flowmeter: A designated flowmeter will measure the instantaneous effluent flowrate from the corresponding membrane train. Permeate pump VFD speed target is controlled by the water level in the EQ tank as mentioned above. The flowmeters will tabulate a total daily effluent flow for each MBR train. If the instantaneous flowrate goes above the high flowrate setpoint it will activate an alarm signal. If the flowrate drops below the low instantaneous flowrate setpoint, the permeate pump will turn off and initiate an air ejection cycle. If after an air ejection cycle, the flow stays below the low flowrate setpoint, the corresponding MBR train will go into standby mode and activate an alarm signal.
- Backpulse Flowmeter: This will measure the instantaneous backpulse flowrate, control the backpulse pump VFD setpoint, and tabulate a total daily backpulse flow for each MBR train. If the flowrate goes above the high flowrate setpoint or below the low flowrate setpoint, backpulsing or clean in place will cease and activate an alarm signal.
- MBR Feed Flowmeter: This will measure the instantaneous flowrate of the MBR Feed pump. If the flowrate rises above the high flowrate setpoint, an alarm signal will activate. If the flowrate drops below the low flowrate setpoint, the MBR train will go into standby mode and activate an alarm signal.

8.8.3 Pump Cycle Settings

The permeate pump is required to have a net pumping capacity equal to the peak hourly flow. Fibreplate membranes require a relax or backpulse cycle every 5 minutes for a duration of 30 seconds. In the event of a pump failure, the corresponding MBR train will go into standby mode until the failed pump is reinstated and the standby MBR train will take over all functions.

Each permeate pump will be equipped with a VFD and will be controlled by the water level in the equalization tank. As the level in the equalization tank changes, so will the power being supplied to the permeate pump motor. Operators will be able to adjust this scaling as required.

The backpulse pump is required to have a pumping capacity to produce a flux of 8.5 gallons/ft2/day (GFD). In the event of a pump failure, the standby backpulse pump will take over all duty requirements. Each backpulse pump will be equipped with a VFD and will be controlled by the backpulse flowmeter. Operators will be able to adjust this scaling as required.

An individual row/stack of membrane modules is required to have a flushing flowrate between 30-50 GPM. Any shortfall will be made up through the recirculation pumps. In the event of a pump failure, that MBR train will go into standby mode until the failed pump is reinstated.

8.8.4 Sodium Hypochlorite Clean in Place (CIP)

The clean in place process is meant to disinfect and remove accumulated sludge on the membranes to

maintain permeability. A 12% solution of sodium hypochlorite will be utilized. The system includes one (1) chemical metering system, two (2) chemical metering pumps, and a 55-gallon storage tank. The chemical metering system will be located inside the MBR building.

The pump will be installed with associated foot valves, check valves and tubing. This will push the solution deep inside the membrane modules for a thorough cleaning. During the CIP cycle, no effluent will discharge from said MBR train, and therefore only one MBR train will be able to perform a CIP at any given time. If the water level in the backpulse tank is insufficient at the start of a CIP, it will not commence. The operator will be able to and should adjust the chemical flowrate based on actual site conditions.

8.9 Citric Acid Clean in Place (CIP)

A citric acid CIP is performed to remove scaling that may accumulate on the membranes. Citric Acid CIPs should only occur after Sodium Hypochlorite CIPs for proper effectiveness. Two filtration cycles must occur between the end of a Sodium Hypochlorite CIP and the start of a citric acid CIP. Citric acid is to be added manually by the operator to the backpulse tank, prior to the commencement of a citric acid CIP. During the CIP cycle, no effluent will discharge from said MBR train, and therefore only one MBR train will be able to perform a CIP at any given time. If the water level in the backpulse tank is insufficient at the start of a CIP, it will not commence.

8.10 UV Disinfection for Each Membrane Train

Three (3) Viqua K+ units shall be provided and piped in parallel for redundancy. The UV units will be used as a backup to the membranes to meet the proposed fecal coliform objectives should a tear occur. The UV unit will alarm should the UV dosage drop below a set level. These units provide disinfection against waterborne pathogens, including Giardia, Cryptosporidium, and most viruses.

8.11 Sludge Tank

The waste sludge generated by the end of the treatment train shall be wasted into one (1) precast concrete sludge storage tank, complete with one (1) submersible air lift pump, associated piping, shutoff valves, controls, appurtenances, and an access ladder. The sludge tank will be supplied with one (1) concrete riser with a hinged and lockable aluminum access hatch.

As previously mentioned, excess solids will be automatically wasted from the MBR tanks to the sludge tank with actuated valves and a timer. This waste, plus the raw water used for backwashing the strainers will be sent to the sludge tank. A decant air lift pump will be used to transfer supernatant back to the EQ tank for reprocessing. The pump is connected to 2-inch S80 PVC discharge piping, which then discharges the supernatant to a 4-inch SDR35 gravity discharge with 1% slope, connecting to the EQ Tank.

8.11.1 Controls

The operation of the decant air lift pump will be controlled by a timer and one (1) float switch. The low-low level float will prevent the decant pump from turning on. The operator will be required to use a sludge judge to determine the optimal decant pump height, and runtime frequency and duration to transfer only supernatant to the EQ tank. The function of each controller is described below:

- Sludge Tank Low-Low Level Float: When this switch is in the extended position, it will turn off the decant air lift pump timer. When this switch is in the tilted position, it will turn on the decant air lift pump timer.
- Sludge Tank High-High Level Float: When this switch is tilted, it will notify the operator with an alarm signal that the tank is full and prevent wasting of the MBR tanks or strainers from occurring.

- Decant Air Pump Pressure Transmitter: A pressure transmitter will measure the instantaneous line pressure of the air delivered to the air lift pump. The pressure transmitter will ensure a minimum pressure of 10 psig is delivered to provide the suction lift required.

8.11.2 Pump Cycle Settings

The decant air lift pump is designed to transfer the maximum volume of supernatant in a reasonable amount of time. The decant air lift pump will only run when the water level is above the minimum required submergence for operation. The design conditions allow for a submergence ratio of 0.4 to 0.6 (ratio of static head to length of delivery pipe). At lower levels of submergence, the flowrate of the airlift pump will be decreased. The Sludge Tank Low-Low level float will be set at a suitable height to meet this minimum submergence ratio. The PLC will record the decant cycles and run times of the air pumps to monitor usage.

8.11.3 Effluent Flow Metering

A flow meter will be installed on each permeate discharge pipe between the permeate pumps and the UV units to measure the effluent flowrate from each MBR train. The flowmeter will display instantaneous flows and record the total effluent flow per day per train.

8.12 Discharge Location

Following UV disinfection, treated effluent will be pumped to the proposed outfall. The outfall shall be located at a location along the onsite stream. A vermin proof screen will cap the end of the outfall pipe outfall.

8.13 Effluent Flow Metering

An insertion-style magmeter flow sensor with a 4-20 mA signal output for remote flow monitoring will be installed on the common discharge pipe header between the permeate pumps and the UV units in the MBR building. The flowmeter will record instantaneous flows processed by the MBR train and record the total flow per day per cycle. The plant PLC will have the ability to monitor and track flows and totalize and log the flows from the flowmeter.

8.14 Standby Power

A dedicated on-site standby generator equipped with an automatic transfer switch will provide backup power to ensure continuous operation of the sewage treatment plant in the event of a power outage. The standby generator will have sufficient capacity to power all pumps and ancillary equipment including control panels.

The standby generator will be powered by a diesel engine. The diesel- powered generator will be provided with a fuel subbase tank with enough capacity to run the generator for 24 hours continuously at full loads. The subbase tank is a dual wall tank with secondary containment and provided with a leak detection alarm.

The generator will be housed in a sound-attenuated acoustically designed weather protective enclosure with a low noise critical grade exhaust silencer. The generator will be equipped with the following features and accessories: run-off-auto switch, running time meter, critical-grade exhaust silencer, block heater, automatic battery charger, generator alarm status panel, oil pressure gauge, high temperature and low oil pressure shutdown. An automatic transfer switch will be provided.

The generator provides contacts for interconnection with the central control panel. The central control panel will notify the operator with a generator fault alarm and message. The generator has an LCD screen with detailed info on faults.

Standby equipment will be regularly exercised at full loads.

8.15 Site Protection

The WWTP will only be accessible to the operators via a locked access gate. All of the WWTP buildings will be locked and will be inaccessible through other means as there are no windows or other exterior features that provide a means of entrance. All buried tanks shall be secured with a lockable cover. The generator panels shall also be locked.

8.16 Water Service Connection

Water service connection to the treatment plant will consist of a 4-inch curb stop, 4-inch type K copper service line and a curb box. The new curb box will be installed on the shoulder of the main roadway along the edge of paved access drive to the wastewater treatment plant.

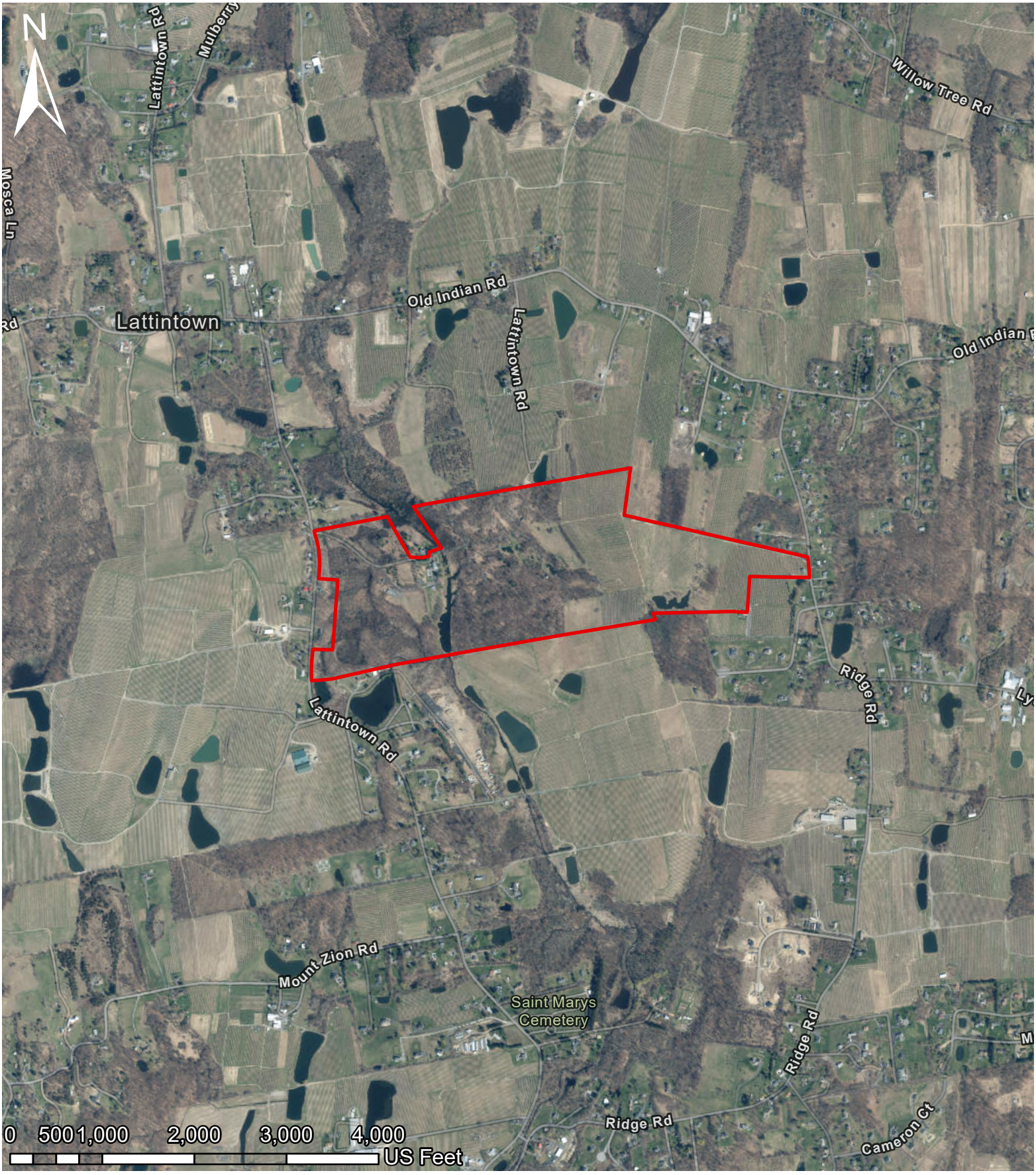
A water meter and reduced pressure zone (RPZ) assembly will be provided. The RPZ shall conform to ASSE Standard 1013, AWWA C-511 and USC specifications manual for Cross Connection Control and shall be listed as an acceptable device in the State Department of Health, Environmental Health Manual PWS-14. The RPZ assembly with atmospheric vent shall be provided with quarter turn ball valves on inlet side and outlet side, and four test cocks and an air gap. Assembly is rated for a working pressure of 150 psi.

8.17 Operation and Maintenance

The operation, monitoring and maintenance of the on-site wastewater treatment plant will be performed by and under the direct supervision of a New York State licensed wastewater operator contracted by the owner of the facilities. The minimum wastewater operator certification grades required to operate this WWTP facility will be determined by the NYSDEC based on its design flow, type of treatment and operational complexity. Prior to completion of the construction of the wastewater treatment plant facility, the Contractor should assemble and compile an Operation and Maintenance (O&M) Manual, complete with list of major equipment suppliers and copies of approved shop drawings, installation manuals, operation and maintenance manuals for major equipment and components.

APPENDICES

APPENDIX A: LOCATION MAP



Legend

Project Area

Marlborough Resort Location Map

Maps created by: Passero Associates GIS
CRS: NAD83 State Plane New York East
Municipality: Hamlet of Marlborough
Source: Ulster County GIS

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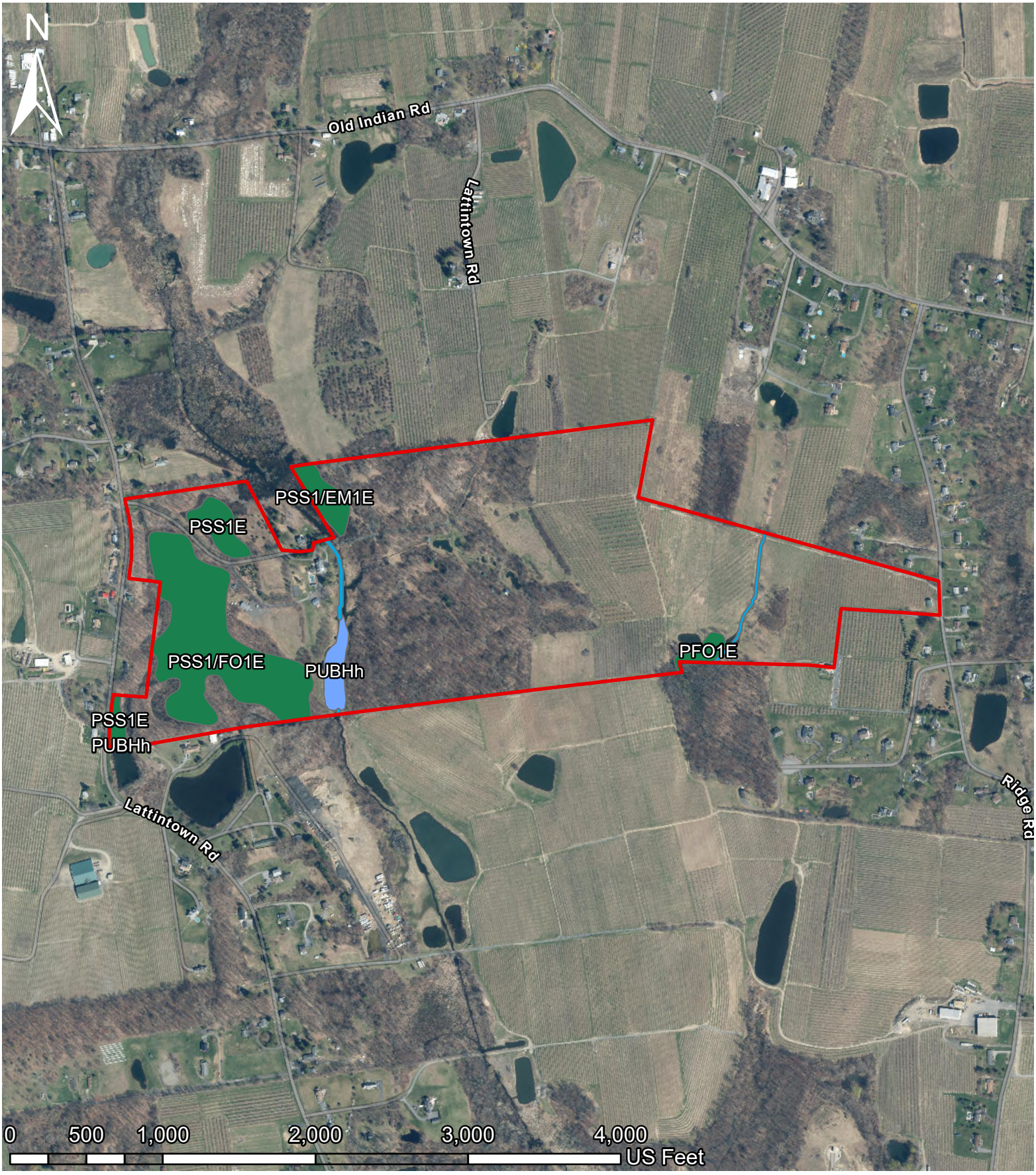
Service Credits:

New York State, Maxar, Esri Community Maps Contributors, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

Date: 4/25/2024

APPENDIX B: WETLAND MAPPING



Legend

Wetlands

- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Riverine

USFWS National Wetlands Inventory

Maps created by: Passero Associates GIS
CRS: NAD83 State Plane New York East
Municipality: Hamlet of Marlborough
Source: U.S. Fish and Wildlife Service

PASSERO architecture engineering

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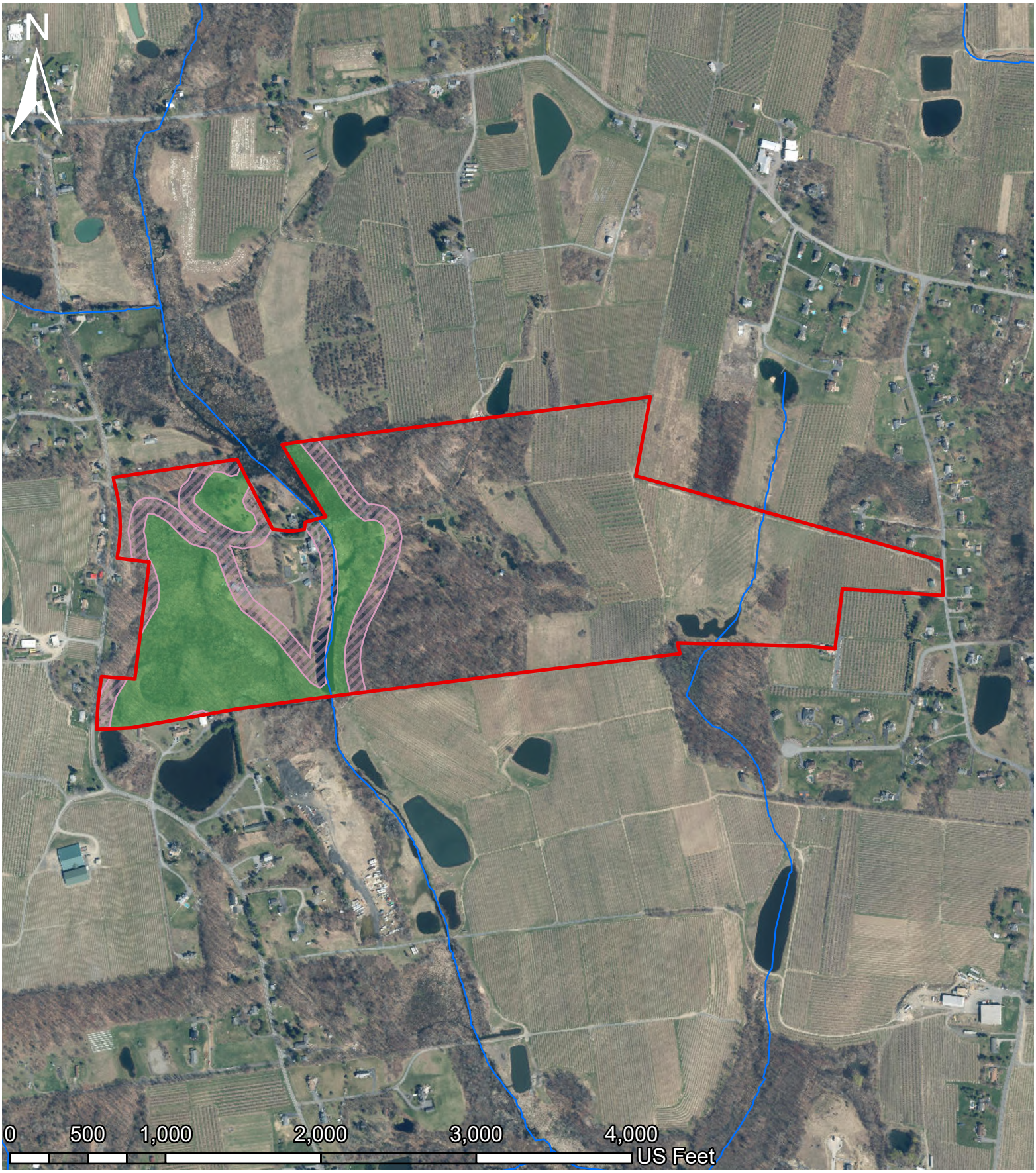
Date: 4/25/2024

APPENDIX C: NYSDEC ENVIRONMENTAL RESOURCE MAPPER



Legend

- Significant Natural Communities
- Rare Plants & Animals
- NYSDEC Wetlands
- 100ft Buffer
- Water Classifications for Rivers & Streams

Environmental Resource Map

Maps created by: Passero Associates GIS
CRS: NAD83 State Plane New York East
Municipality: Hamlet of Marlborough
Source: Environmental Resource Mapper

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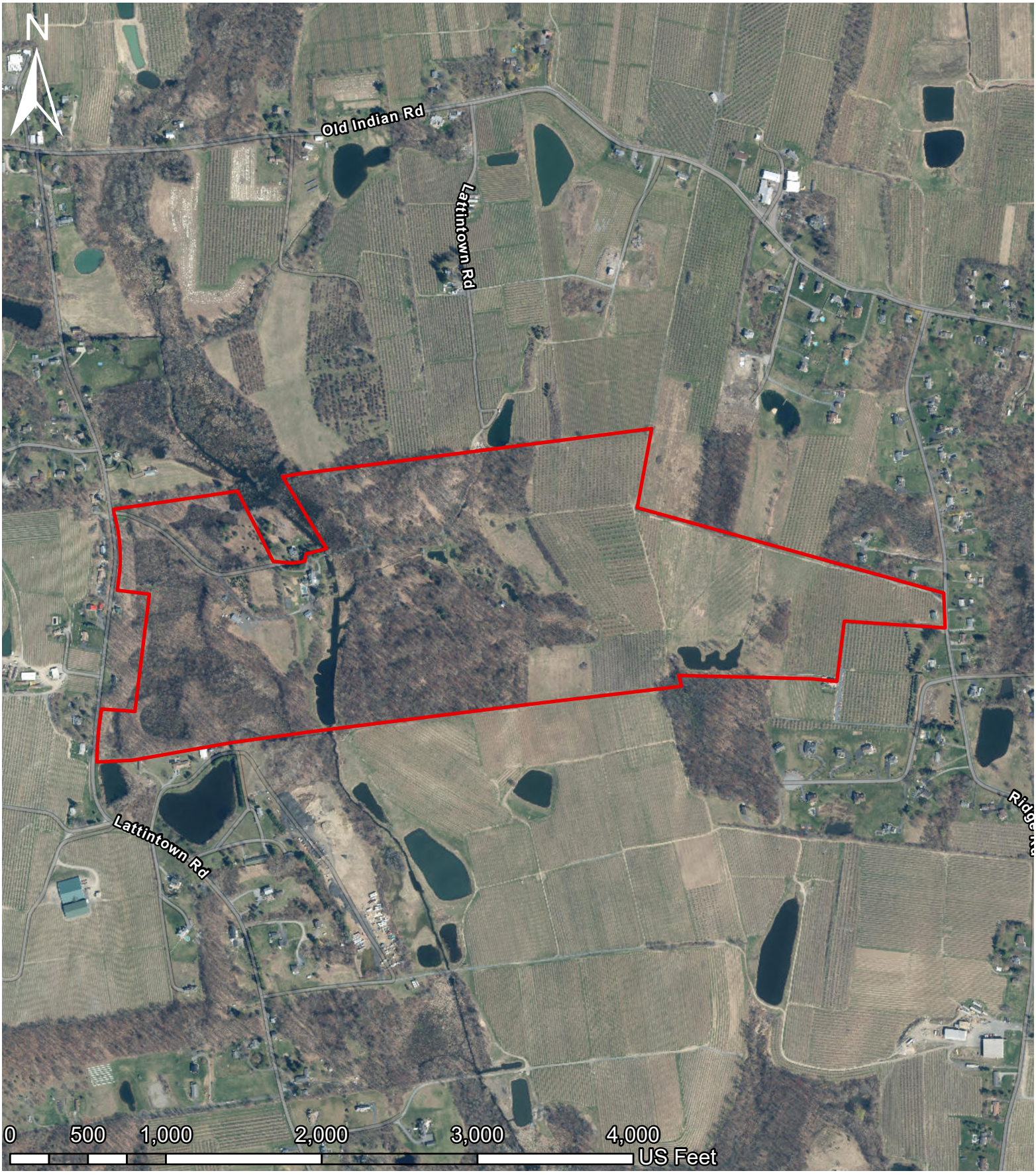
Service Credits:
New York State, Maxar

Date: 4/25/2024

APPENDIX D: FEMA MAPPING



Legend

- 0.2% Annual Chance Flood Hazard
- 1% Annual Chance Flood Hazard
- Future Conditions 1% Annual Chance Flood Hazard
- Regulatory Floodway
- Area with Reduced Risk Due to Levee
- Special Floodway

FEMA Flood Areas Map

Maps created by: Passero Associates GIS
CRS: NAD83 State Plane New York East
Municipality: Hamlet of Marlborough
Source: FEMA

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architecture engineering

Service Credits:

New York State, Maxar, Esri Community Maps Contributors, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

Date: 4/25/2024

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 18. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC–3, #9202
1315 East–West Highway
Silver Spring, MD 20910–3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713–3242,** or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was derived from digital orthophotography provided by the NY Office of Cyber Security & Critical Infrastructure Coordination from photography dated April 2004.

This map reflects more detailed and up–to–date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data)* may reflect stream channel distances that differ from what is shown on this map.

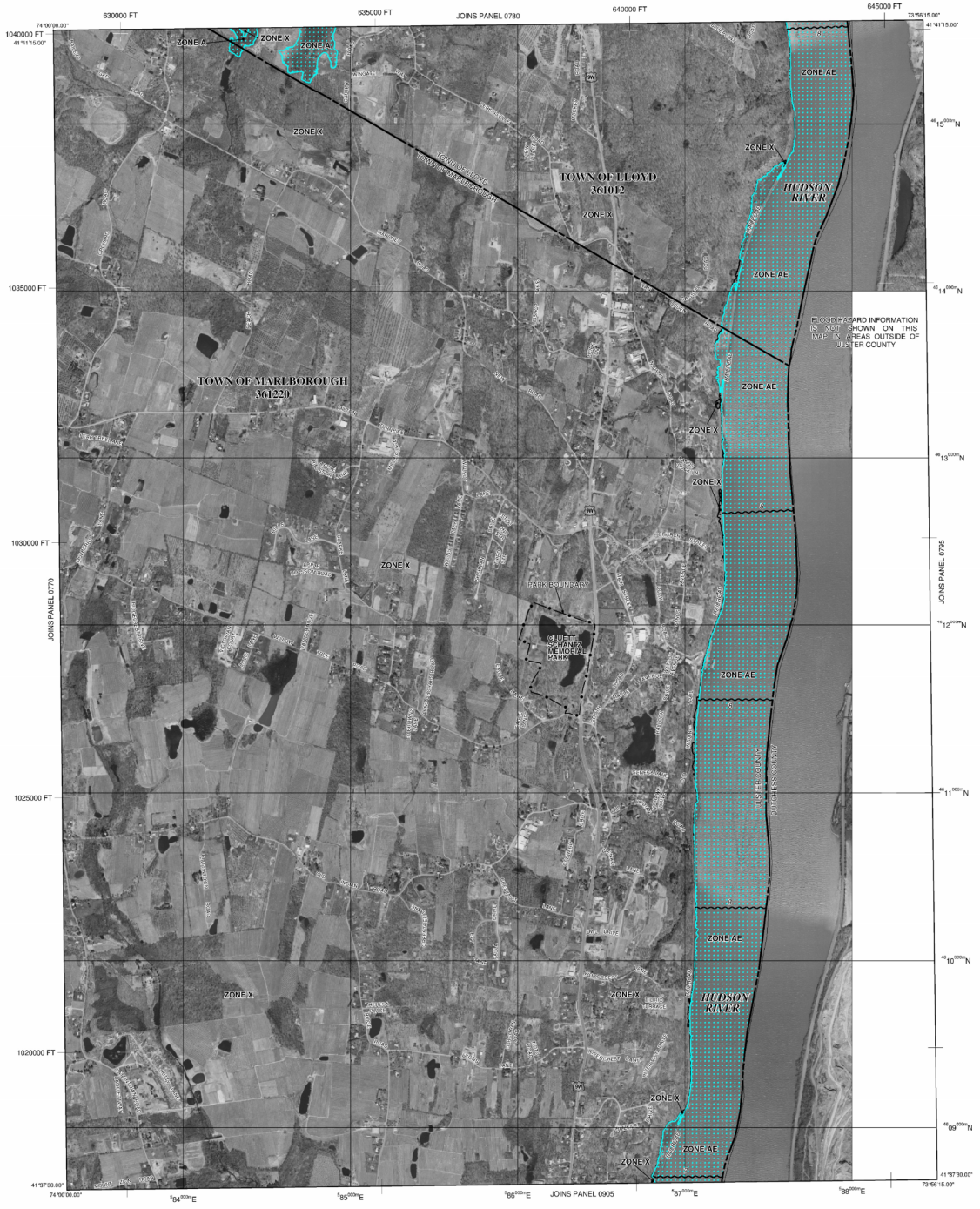
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de–annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1–800–358–9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, *a Flood Insurance Study report,* and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1–800–358–9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1–877–FEMA MAP** (1–877–336–2627) or visit the FEMA website at http://www.fema.gov/.

This digital FIRM was produced through a unique cooperative partnership between the New York State Department of Environmental Conservation (NYSDEC) and FEMA. As part of the effort, NYSDEC has joined in a Cooperative Technical Partnership agreement to produce and maintain FEMA's digital FIRM.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary
0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different base flood elevations, flood depths or flood velocities.
513 Base Flood Elevation line and value; elevation in feet*
(EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A Cross section line
23 — 23 Transect line
97°07'30", 32°22'30" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN 1000-meter Universal Transverse Mercator grid values, zone 18
6000000 FT 5000-foot grid ticks: New York State Plane coordinate system, east zone (FIPSZONE 3101), Transverse Mercator
DX5510 Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
September 25, 2009
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1–800–638–6620.

MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0790E

FIRM
FLOOD INSURANCE RATE MAP

ULSTER COUNTY, NEW YORK
(ALL JURISDICTIONS)

PANEL 790 OF 910
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

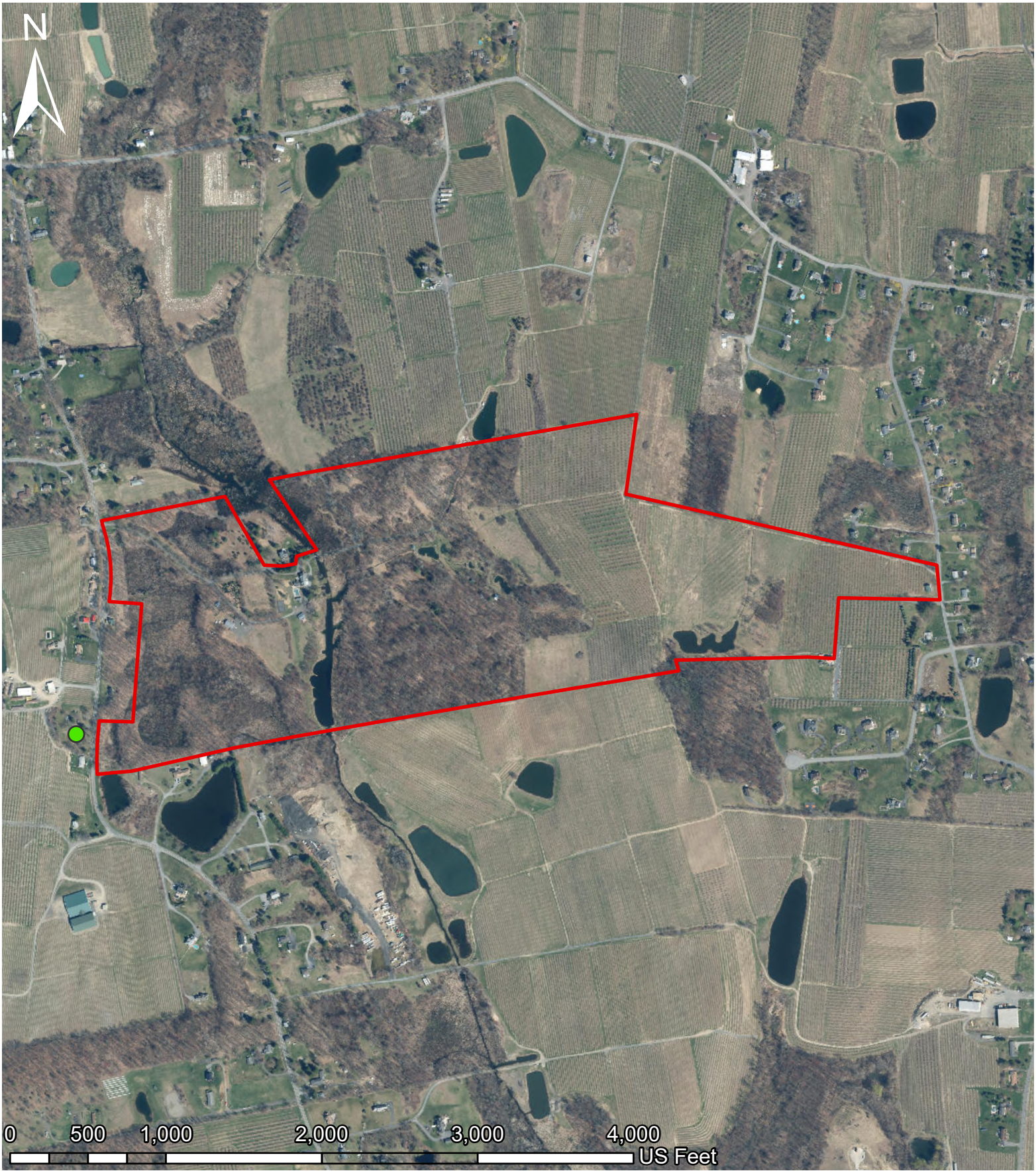
COMMUNITY	NUMBER	PANEL	SUFFIX
LLOYD, TOWN OF	361012	0790	E
MARLBOROUGH, TOWN OF	361220	0790	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
36111C0790E
EFFECTIVE DATE
SEPTEMBER 25, 2009

Federal Emergency Management Agency

APPENDIX E: ARCHAEOLOGICAL SENSITIVE AREAS MAP



Legend

- Project Area
- Historic Sites

Eligible Historic Sites

- Eligible
- Listed

Archeological Sensitive Areas

Maps created by: Passero Associates GIS
CRS: NAD83 State Plane New York East
Municipality: Hamlet of Marlborough
Source: Cultural Resource Information System

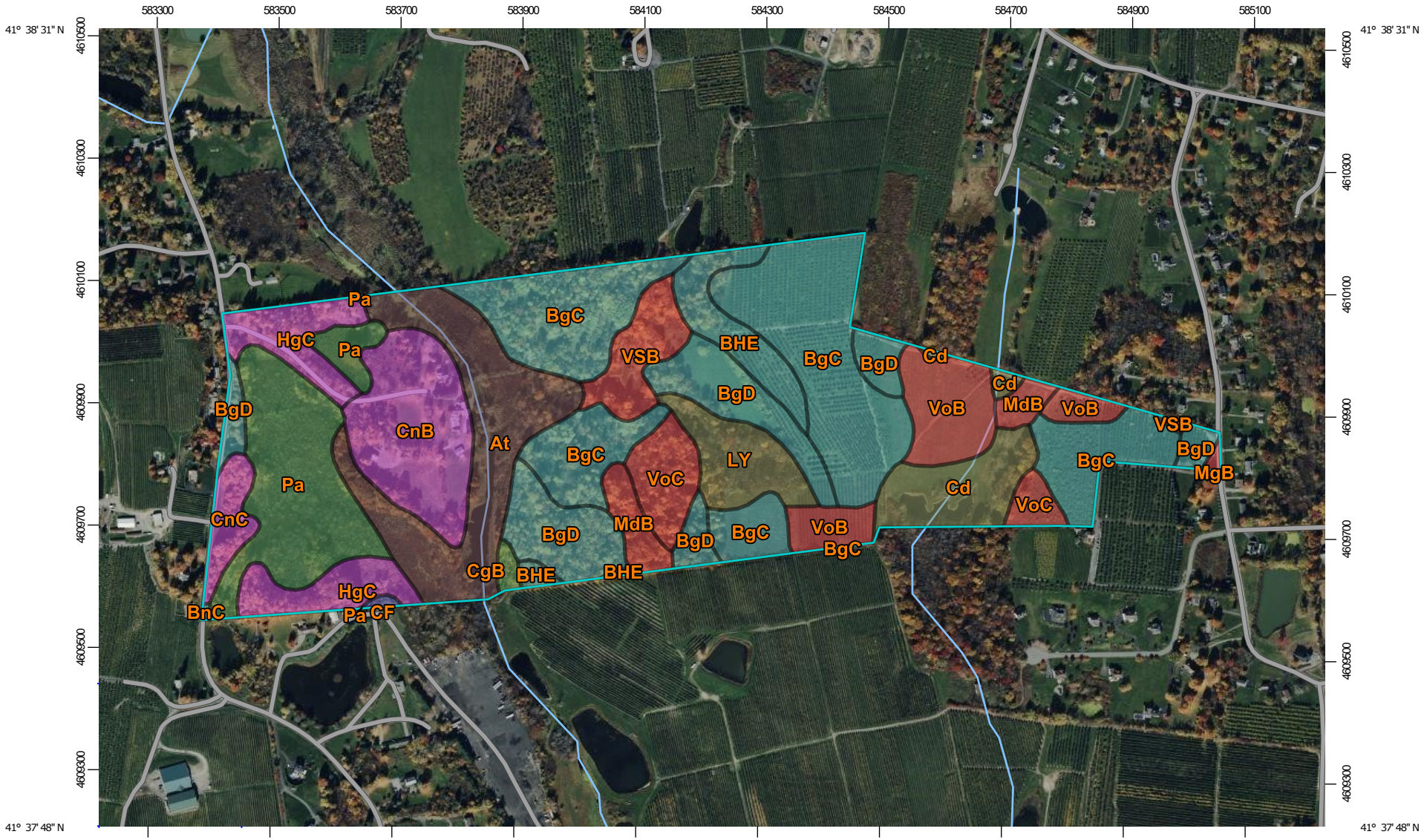
PASSERO
architecture engineering

Service Credits:
New York State, Maxar

Date: 4/25/2024

APPENDIX F: SOILS MAP

Hydrologic Soil Group—Ulster County, New York
(MALBOROUGH RESORT)



Map Scale: 1:9,200 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 400 800 1600 2400

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Lines

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Points

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Ulster County, New York
Survey Area Data: Version 22, Sep 5, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 21, 2022—Oct 27, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
At	Atherton silt loam	B/D	17.9	11.0%
BgC	Bath gravelly silt loam, 8 to 15 percent slopes	C	41.4	25.4%
BgD	Bath gravelly silt loam, 15 to 25 percent slopes	C	17.0	10.4%
BHE	Bath very stony soils, steep	C	5.8	3.6%
BnC	Bath-Nassau complex, 8 to 25 percent slopes	C	0.1	0.0%
Cd	Canandaigua silt loam, till substratum	C/D	7.4	4.6%
CF	Cut and fill land	B	0.2	0.1%
CgB	Castile gravelly silt loam, 3 to 8 percent slopes	A/D	0.6	0.4%
CnB	Chenango gravelly silt loam, 3 to 8 percent slopes	A	12.8	7.9%
CnC	Chenango gravelly silt loam, 8 to 15 percent slopes	A	2.8	1.7%
HgC	Hoosic gravelly loam, rolling	A	9.4	5.8%
LY	Lyons-Atherton complex, very stony	C/D	6.0	3.7%
MdB	Mardin gravelly silt loam, 3 to 8 percent slopes	D	3.7	2.3%
MgB	Mardin-Nassau complex, 3 to 8 percent slopes	D	0.2	0.1%
Pa	Palms muck	A/D	17.2	10.5%
VoB	Volusia gravelly silt loam, 3 to 8 percent slopes	D	9.8	6.0%
VoC	Volusia gravelly silt loam, 8 to 15 percent slopes	D	5.8	3.5%
VSB	Volusia channery silt loam, 0 to 8 percent slopes, very stony	D	5.0	3.1%
Totals for Area of Interest			**163.3**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX G: 2023 TOWN WATER CONSUMPTION DATA

+

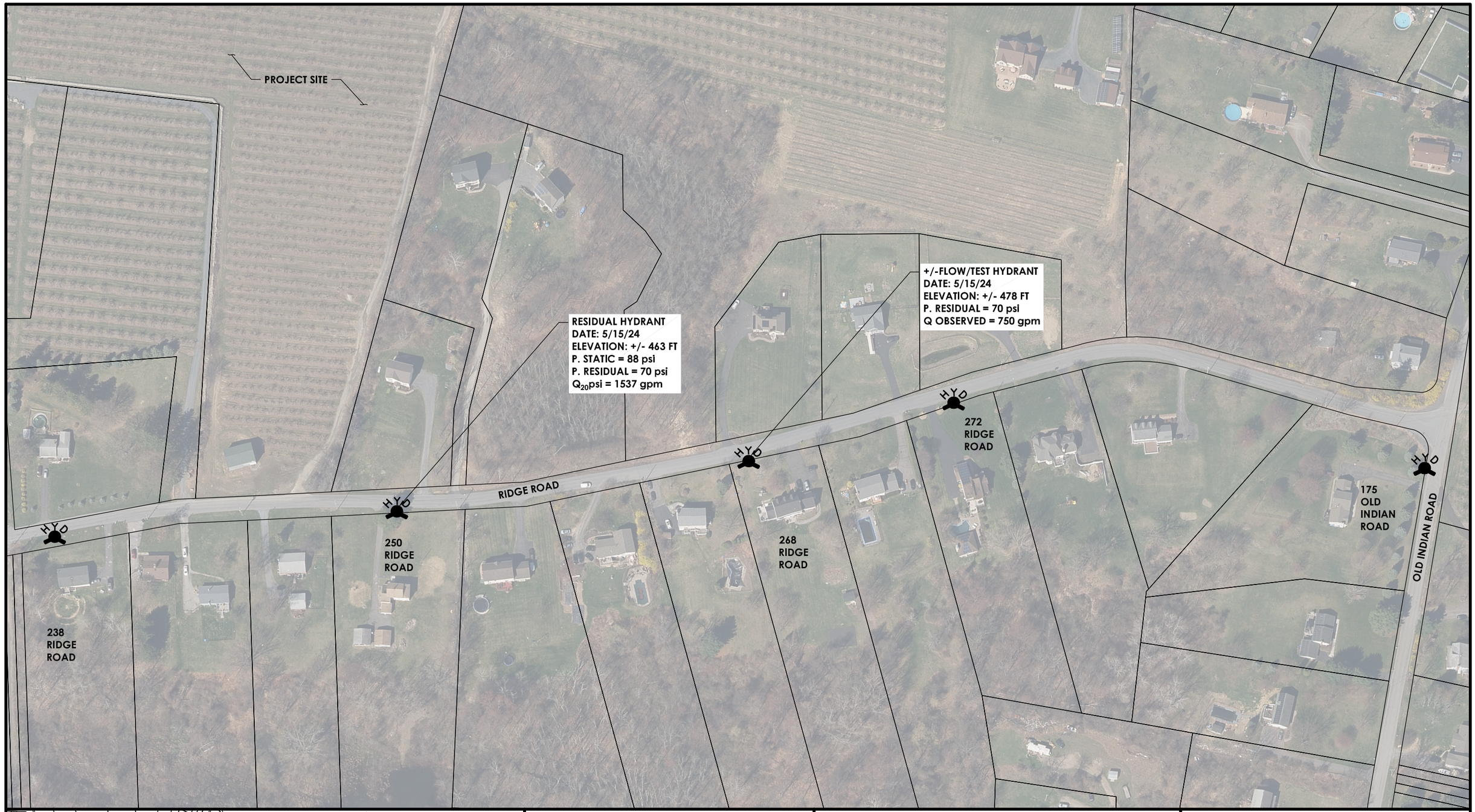
Water Consumption 2023

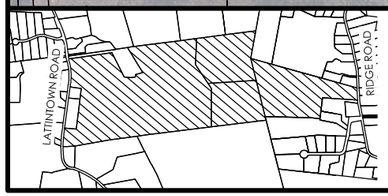
Total for the Month:

January	15,666,000	Avg. Daily Flow	505,354	Max flow	610,000
February	14,097,000	" " "	503,464	" "	615,000
March	15,753,000	" " "	508,161	" "	585,000
April	15,255,000	" " "	508,515	" "	620,000
May	17,317,000	" " "	558,635	" "	650,000
June	17,304,000	" " "	576,302	" "	690,000
July	15;022,000	" " "	484,607	" "	545,000
August	16,446,000	" " "	530,525	" "	615,000
September	16,156,000	" " "	538,533	" "	565,000
October	15,883,000	" " "	502,677	" "	620,000
November	15,186,000	" " "	506,700	" "	670,000
December	13,715,000	" " "	442,000	" "	598,000
Annual Usage		187,800,000	514,520		605,750

15,650,000 Average Monthly Usage

APPENDIX H: HYDRANT FLOW TEST DATA





VILLAGE of MARLBORO

FIRE FLOW TEST FIGURE

MARLBOROUGH RESORT
626 LATTINTOWN ROAD
255 RIDGE ROAD
MARLBORO, NY 12542

Drawn By: AL

Date: 5/24/24

PASSERO ASSOCIATES
engineering architecture
242 West Main Street, Suite 100
Rochester, NY 14614

Client:
MARLBOROUGH RESORT, LLC
100 RING RD WEST, RM 101
GARDEN CITY, NY 11530

Project Number: 20233707.0001

Scale: 1"=150'

Sheet No: 1

APPENDIX I: RESORT SPA – WASTEWATER FLOWS

PASSERO
engineering architecture

Marlborough Resort Spa

Type of Use	Length	Width	Depth	Volume (CF)	Volume (Gallons)	SF Usage by Patrons	Unit	Unit Quantity	Hydraulic Loading Rate (gpd/unit)[1]	Water Saving Credit (%)[2]	Hydraulic Loading Rate w/ Credit (gpd/unit)	Average Daily Wasterwater Flow (gpd)	+Treatment Room Maximum Daily Wasterwater Flow (gpd)	+Treatment Room Peak Hourly Flow Wasterwater Flow (gpd)
Lap Pool	55	20	4	4400	32,912									
Outdoor Pool	32.67	10.6	3.5	1212.057	9,066									
Indoor Pool	12	19.8	3.5	831.6	6,220									
Hot Pool	11.5	16.5	3.5	664.125	4,968									
Cold Plunge Pool	11.5	4	3.5	161	1,204									
Jets Pool	13	16.5	3.5	750.75	5,616									
Salt Pool	11.5	23.5	2.5	675.625	5,054									
TOTAL POOL VOLUME					**65,040**									**65,040**
Pool						50	Patrons	75	20	20%	16		2,400	4,800
Spa							Patrons	58	20	20%	16		1,856	3,712
Gymnasium						50	Patrons	51	20	20%	16		1,632	3,264
Yoga						50	Patrons	11	20	20%	16		352	704
Treatment Rooms						1/Each	Patrons	48	20	20%	16		1,536	192
Lockers						50	Patrons	27						
AVERAGE PATRONS/DAY								243						
REALISTIC AVERAGE PATRONS/DAY								215			16	**3,440**	**7,776**	**12,672**
Lifeguard							Each	2	15	20%	12	24	48	96
Receptionist							Each	3	15	20%	12	36	72	144
Locker Attendant							Each	2	15	20%	12	24	48	96
Juice Bar Employees							Each	2	15	20%	12	24	48	96
Maintenance							Each	2	15	20%	12	24	48	96
Gym Instructor							Each	3	15	20%	12	36	72	144
Masseur							Each	15	15	20%	12	180	360	720
Treatment Room Receptionist							Each	2	15	20%	12	24	48	96
TOTAL STAFF								31				**372**	**744**	**1,488**
Total												**3,812**	**8,520**	**14,160**

Notes:
1. Hydraulic Loading Rates from Table B-3 of NYS Design Standards for Wastewater Treatment Systems (2014) unless otherwise noted below.
2. NYSDEC allows for up to 20% reduction in flows for installations equipped with certified water-saving plumbing fixtures.
3. Pool volume will be dichlorinated and then discharged to porous pavement.

Average Daily Flow:	**3,812 gpd** **3 gpm**

Max Day Peak Factor: 2

Max Daily Flow:	**8,520 gpd** **6 gpm**

Hourly Peak Factor: 4

Peak Hourly Flow:	**14,160 gpd** **10 gpm**

APPENDIX J: PUMP STATION CUT SHEETS

Smith & Loveless Inc.

EVERLAST™

Wet Well Mounted Pump Stations

Built for You. Built for Life.

EVERLAST™

Wet Well Mounted Pump Stations

Advanced Pumping Technology
Innovative Pumps, Components & Controls

New Station & Enclosure Designs
Redesigned Looks with a New Color Scheme

Simplified System Selection
Streamlined Standard Packages

Lowest Life-Cycle Costs
Backed by Industry-Leading Warranty Protection

Smith & Loveless Inc.'s above-ground wastewater pumping stations pave the way for end-users to reap the benefits of robust construction, operator-safe maintenance and single-source solutions. The result is efficient pump station performance, long service life and realized savings—verified by decades of successful installations.

S&L's next generation **EVERLAST™** Wet Well Mounted Pump Stations perfectly embody this philosophy. Featuring the top S&L innovations, new looks and enclosures, convenient package options, and leading warranty protection, **EVERLAST™** is designed to provide you a long, successful pumping life.

HIGHEST EFFICIENCY.
New STAR ONE™ S&L Non-Clog Pumps Add 3-5%

SAFEST O&M.
No Confined Space Entry; Operator Ease

MOST RELIABLE.
Anti-Clog Solutions; Easy to Maintain

LONGEST LIFE.
Durable Equipment; Decades of Service

Smith & Loveless Inc.

Visit SmithandLoveless.com/Pumping

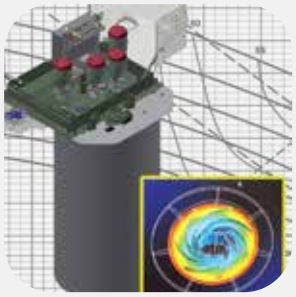
EVERLAST™ Wet Well Mounted Pump Station Specifications

Individual Pumps:	4"-12" / 100-300 mm
Piping:	4"-30" / 100-750 mm
Power (Ind. Pump):	1.5-300 Hp / 1.1-225 kW
Max. Ind. Pump Capacity:	5,000 gpm / 350 lps
Max. Ind. TDH Capacity:	255 ft. / 78 m
Wet Well Diameters:	4-12 ft. / 1.2-3.6 m

- 2, 3 or 4-Pump Designs Parallel or Series Operation
- Multiple Control Options PLCs to Relay Logic
- Multiple Alarms
- Concrete or Steel Wet Wells
- Cold Climate Packages
- Multiple Enclosure Types Above-Ground/ Partial-Bury

S&L Total Life-Cycle Support

Engineering and Design



S&L provides total support with 3-D Modeling and CAD drawings, computational fluid dynamics (CFD) analysis, finite analysis, specification support, product demonstrations, and other value-added technical services.

Manufacturing and Testing

S&L pump stations are factory-built and assembled, and tested to Hydraulic Institute standards in state-of-the-art facilities that replicate actual field conditions. Our customers are invited to witness testing at our factory.

Delivery, Installation and Startup

Upon delivery, simply connect suction and discharge piping and electrical connections, and secure the baseplate to the wet well. The process is typically completed within a few hours. S&L startup assistance is available.

After Market Parts and Services

S&L's After Market & Field Service groups completely support you through the life of your system with factory-certified parts and retrofits, service inspections and contracts, technical phone assistance, O&M training, and continuing education.

10 YEAR WARRANTY PROTECTION

Industry-Leading Pump Station Warranty Protection

EVERLAST™ Series 1000-5000 pump stations offer the industry's longest service life and warranty protection, including 10-year protection for various pump, baseplate and enclosure equipment. The **DURO-LAST**® stainless steel baseplate option comes with 25-year protection. Rest easy knowing your station is designed to offer service life for a generation or longer.

The Wet Well Mounted Advantage

Above-Ground Access from Simple Vacuum-Priming

Robust, yet simple S&L Vacuum-Priming delivers the benefits of above-ground, operator-safe pumping. When wet well levels rise, the innovative **WaveStart**™ Prime Sensing System achieves prime in 60 seconds under standard conditions, maintaining it indefinitely. Employing **Multi-Variable Sensing**™ with minimal connections, the system virtually eliminates O&M tasks associated with older priming systems, utilizes far less energy than self-priming pumps, and operates efficiently in applications with rags, strings, wipes, films, flushables and other debris.

featuring WaveStart Prime Sensing

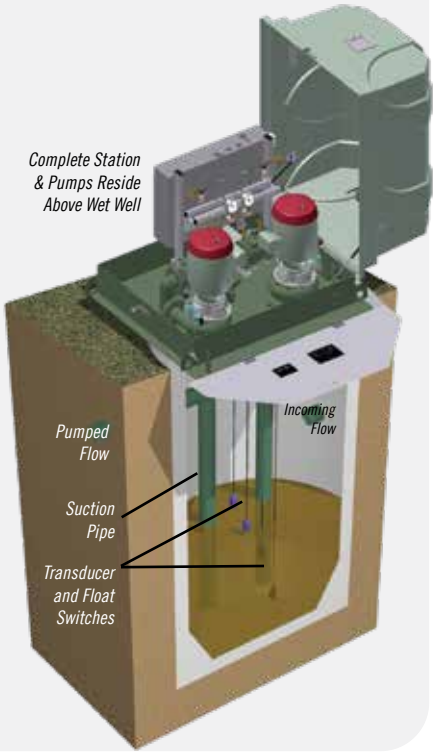
No Confined Space Entry for Routine O&M

Offering the safest pump station access on the market, S&L **EVERLAST**™ Wet Well Mounted Pump Stations are inspected and maintained without the requirements typically associated with confined space entry, like harnesses, gas monitoring equipment, and multiple personnel.

OPERATOR SAFE

Paves the Way for the Lowest Life-Cycle Costs

One operator is able to inspect S&L stations. Maintenance tasks like pulling an entire pump or changing out a pump seal or impeller can be completed without costly outside contractors or pump maintenance centers. This results in significant savings in parts and labor costs over the life of the system.



S&L Pumps & Impellers

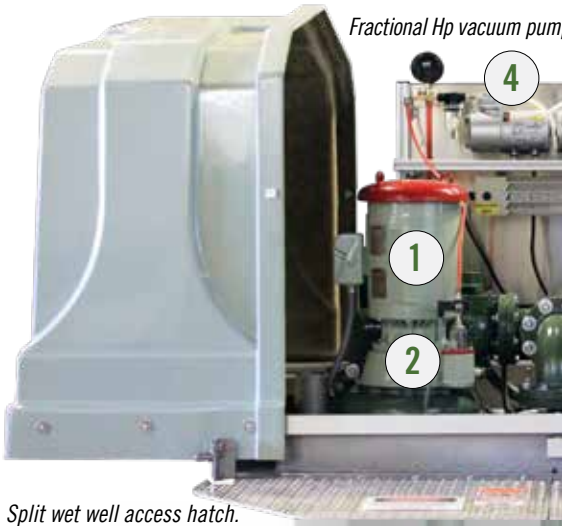
1 STAR ONE™ S&L Non-Clog Pumps

Our vertical, close-coupled **STAR ONE**™ S&L Non-Clog Pump design meets the highest of standards that promote superior efficiency, durability and ease of maintenance, including the 10 States Standard for 3" (76 mm) solids. Its rugged design, featuring exclusive oversized, stainless steel pump shafts and bearings, will typically deliver service for more than 20 years with basic care. The **STAR ONE**™ construction streamlines access to the volute, impeller and seal merely by removing four to eight cap screws from the connecting motor adapter on the station base in just a few minutes without any spillage.

STAR ONE™ *S&L Non-Clog Pumps offer industry-leading wire-to-water pump efficiencies and service-life while effectively handling problem flushables.*

2 X-PELLER® Impeller

Specifically designed for applications with high volumes of consumer flushables, the **X-PELLER**® Impeller has been proven to effectively expel high volumes of consumer stringy materials, including flushable wipes, rags and other unusual trashy items, because of its mono-port design. Designed to pass 3" (76 mm) solids, the **X-PELLER**® eliminates clogging and the need to pull pumps to unbind the impeller. Fully trimmable to the user's specific pumping conditions, it even works well in low flow conditions. Optional. *For more see Bulletin 612.*

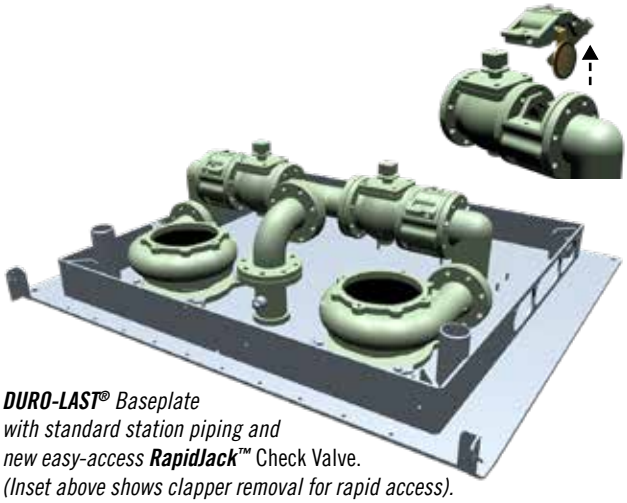


Fractional Hp vacuum pump

Split wet well access hatch.

Level controls

Station



DURO-LAST® *Baseplate with standard station piping and new easy-access* ***RapidJack***™ Check Valve. *(Inset above shows clapper removal for rapid access).*

3 RapidJack™ Quick-Clean Check Valve

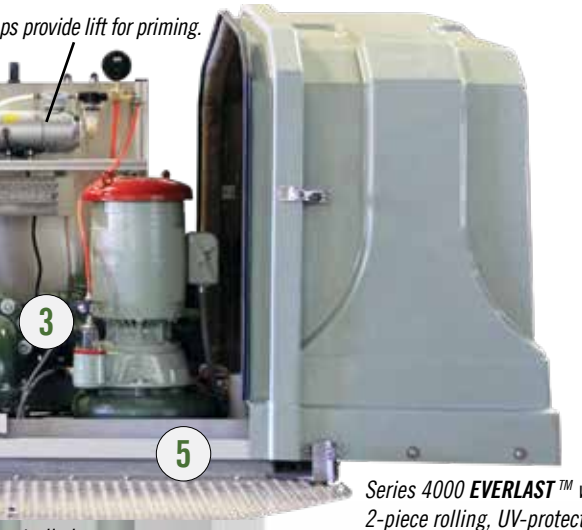
Revolutionizing wafer check valve maintenance, the optional **RapidJack**™ Quick-Clean Check Valve is easily removed and replaced using 4 bolts in less than 15 minutes. Its unique design allows the clapper system to be removed while the valve body remains in the piping. Simply remove the obstruction, reinsert the **RapidJack**™ clapper system and the four bolts! *See Bulletin 635.*

Controls & Accessories

EVERLAST™

4 QUICK SMART™ System Controls

Delivering simplified operation yet powerful pump station control, **QUICKSMART**™ PLC Station Controls provide unparalleled ability to monitor and adjust all of your pump station functions. The user-friendly, graphical touchscreen makes control modifications, screen navigation and viewing of pump station status easier and smarter than ever. Features include a push-notification maintenance log and I/O Status (digital and analog) screen. *Available in all models except Series 1000 & 2000. See Bulletin 660.*



not all shown.

*Series 4000 **EVERLAST**™ with 2-piece rolling, UV-protected enclosure.*

STATION COMM™

Remote Communication

Remotely monitor critical alarms and control a variety of pump station functions via simple cell phone text messaging commands with **STATIONCOMM**™. Send simultaneous service messages to as many as ten different users. *See Bulletin 685.*

Force Main Sync

By combining **QUICKSMART**™ PLC controls with Variable Frequency Drives (VFDs) and smart sensors, the **Force Main Sync** system option ensures that multiple pump stations in a single force main achieve optimal energy efficiency and cost-saving pump performance. *Contact S&L for application.*

Assembly

5 DURO-LAST

Stainless Steel Baseplate

The rugged **DURO-LAST**® 3/8" or 1/2" (9.5 or 12.7 mm) baseplate option, backed by full 25-year warranty, is available in 316 and/or lean duplex series 2100 stainless steel. It features a Pitting Resistance Equivalent Number of 24.0 or greater. **DURO-LAST**® is glass bead blasted to remove surface contamination and passivated to provide a uniform finish. *See Bulletin 641.*

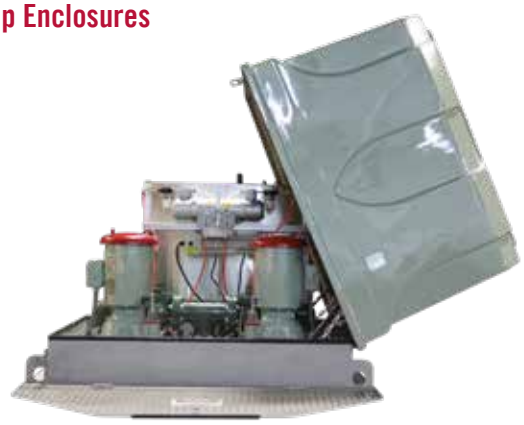
+ Additional Station Features

- **Multiple Enclosure Options** (incl. pre-fab buildings)
- **Station Advanced Warning System** (standard S3000 / 4000)
- **Submersible Transducer & Back-Up Floats** (std.)
- **NEMA 4X Stainless Steel Panels** (optional)
- **ShadeAide® HMI Protector** (optional)
- **Wet Well Mounted Fall Protection** (optional)

Featured Duplex Pumping System Models

Series 1000 & 3000

Tip-Up Enclosures



1000: Packaged Station
Hinged One-Piece Enclosure
3/8" (9.5 mm) Baseplate
Relay Logic controls

3000: Packaged Station
Hinged One-Piece Enclosure
1/2" (12.7 mm) Baseplate
QUICKSMART™ PLC controls

Series 2000 & 4000

2-Piece Sliding Enclosures

2000: Packaged Station
Two-Piece Sliding Enclosure
3/8" (9.5 mm) Baseplate
Relay Logic controls

4000: Packaged Station
Two-Piece Sliding Enclosure
1/2" (12.7 mm) Baseplate
QUICKSMART™ PLC controls

Rectangular Recessed

Earth-Insulated with Dual Hatch Entry

RR: Packaged Station
Ground-Level, Dual Hatch
Allows for Deeper Wet Well
Maintains Low Profile
Relay Logic or **QUICKSMART**™

Flows	Up to 1,300 GPM (82 lps)
TDH	Up to 158' (48 m)
Power	1.5 - 50 Hp (1.1 - 37 kW)
Piping	4" - 6" piping (100 - 150 mm)

+ ADD EVERLAST™ Series 1000 - 5000 Supplemental Packages

Station Monitoring Package

Advanced pump station status monitoring features including digital flow rate
*Avail. only with **QUICKSMART**™*

Enhanced Alarm Package

Enhanced alarm notifications including intrusion, operator assist, low water alarm, and other water level alarms

Building Enclosure Package

Skid-mounted pumping system configurations inside one of many climate controlled pre-fab or site-built buildings

Cold Weather Package

Insulated versions of standard S&L enclosures combined with additional heating and vacuum release systems

Specialized Pumping System Models

EVERLAST™

Series 5000
Higher Capacity Duplex

5000: Packaged Station Two-Piece Hinged Enclosure; Higher Capacity Duplex Pumping Accomodates Larger S&L Pumps

Series Hi-Head
Pumps in Series Operation

SHH: Packaged Station Multiple Enclosure Options; Higher Head Pumping with 4 S&L Pumps in Series Arrangement

Triplex
Higher Capacity & Flex

TRIPLEX: Packaged Station Two-Piece Hinged Enclosure; Higher Capacity Pumping Provides Design Flex with 3 S&L Pumps

CAPSULAR®
Highest Capacity WWMPS

CAP: Packaged Large-Capacity WWMPS; Pre-Fabricated Building 2-6 S&L Pumps (in Parallel or Series)

	5000	Hi-Head	Triplex	CAPSULAR®
Flows	Up to 3,000 GPM (189 lps)	Up to 1,300 GPM (82 lps)	Up to 2,600 GPM (164 lps)	Up to 12,500 GPM (788 lps)
TDH	Up to 255' (78 m)	Up to 316' (96 m)	Up to 158' (48 m)	Up to 350' (107 m)
Power	1.5 - 200 Hp (1.1 - 149 kW)	1.5 - 50 Hp (1.1 - 37 kW)	1.5 - 50 Hp (1.1 - 37 kW)	1.5 - 300 Hp (1.1 - 223 kW)
Piping	4" - 10" piping (100 - 250 mm)	4" - 6" piping (100 - 150 mm)	4" - 6" piping (100 - 150 mm)	4" - 30" piping (100 - 750 mm)

+ ADD Premium S&L Feature Options For Any Station Model

XPELLER®

Exclusive S&L single-port impeller design proven to prevent pump clogging; effectively expels high volumes of consumer flushables

RapidJack™

NEW! S&L check valve design that simplifies valve access and any unclogging in just minutes

LAST

Popular station baseplate upgrade made of 316 and/or lean duplex series 2100 stainless steel. Backed by 25-year warranty protection

StationComm™

Remotely receive updates, monitor and control pump station functions via cell phone text messaging direct with your station

Built for the Lowest Total Cost of Ownership.

Compare vs. Submersibles & Self-Primers

Highest Efficiency

The S&L Non-Clog Pump with custom-trimmed impellers and premium efficient motors deliver the highest wire-to-wire efficiencies. Vacuum-priming uses much less energy than self-primers.

Safest O&M

All mechanical equipment is instantly accessible without confined space entry, eliminating extra gear and personnel for O&M. No oil-filled mechanical seals, adjustable parts, or spillage.

Most Reliable

S&L Non-Clog Pumps are always designed for 3" (76 mm) solids handling per the 10 States Standard.

Lowest Total Costs

EVERLAST™ pump stations offer the longest service life (25+ years) and proven 50% savings vs. submersibles. Our seals offer longer average service life than typical submersible pumps.

Smith & Loveless Inc.
www.SmithandLoveless.com

Phone: (913) 888-5201
Fax: (913) 888-2173

14040 Santa Fe Trail Dr.,
Lenexa, KS USA 66215-1284