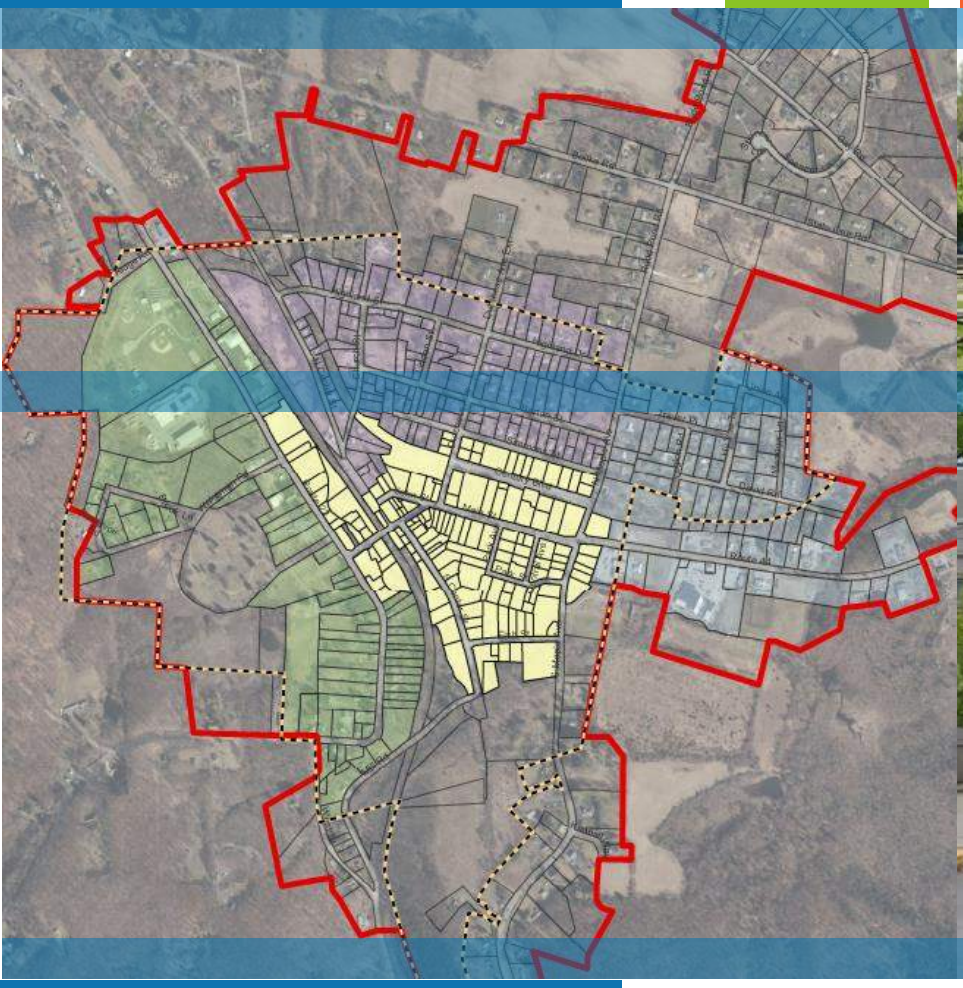

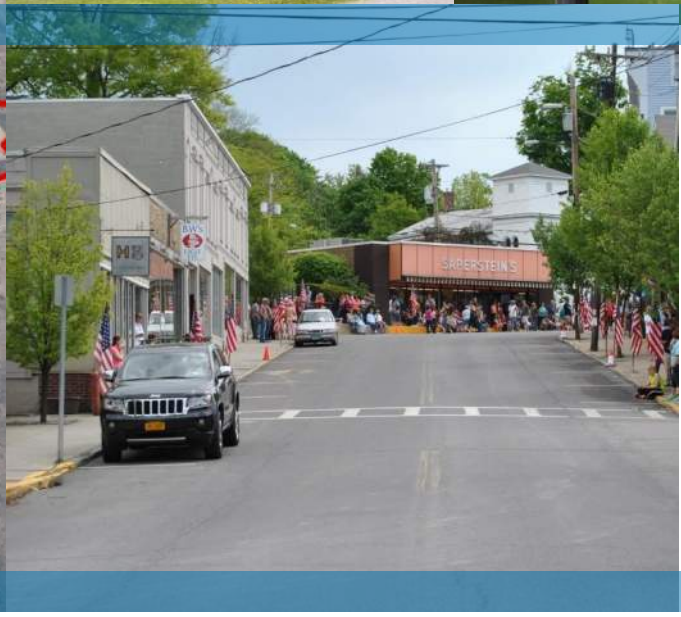

Millerton Wastewater Preliminary Engineering Report

Village of Millerton

March 2020
REVISED June 2020
REVISED April 2022
REVISED April 2024
REVISED July 2025

CWSR# C3-5339-02-00
EPG# 76549

STATE OF NEW YORK
ERIN K. MOORE
084665
LICENSED PROFESSIONAL ENGINEER

Tighe&Bond

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**Revised July 2025*

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M1784-009
July 17, 2025

Jennifer Najdek, Mayor
Village of Millerton
21 Dutchess Avenue
Millerton, NY 12546

Re: **Updated Wastewater Feasibility Evaluation**

Dear Mayor Najdek:

Tighe & Bond, whose services are provided in New York by T&B Engineering and Landscape Architecture, PC (Tighe & Bond), is pleased to submit our updated Wastewater Feasibility Evaluation Report for the Village of Millerton. This report has been revised from its original March 2020 date, revision of June 2020, revision of April 2022, and revision of April 2024.

Executive Summary

Tighe & Bond has evaluated various wastewater collection, treatment, and water resource recovery return options to determine a viable solution for the Village. The enclosed report summarizes our evaluation including a prioritization of service areas, a discussion of conventional and alternative wastewater systems, identification of alternatives, a summary of the recommended alternative, and anticipated costs for implementing and maintaining these improvements.

The results of the wastewater survey revealed problems with individual wastewater systems throughout the Village and that there is a desire amongst survey respondents for a Village wastewater system. The wastewater evaluation presented in the attached report considered reported wastewater problems, lot sizes, lot density, depth to restrictive layers, and the Village comprehensive plan goals to determine the need for a wastewater system and to prioritize certain areas of the Village.

Alternatives Analysis

Based on the community feedback, it was determined that the proposed service area should incorporate parts of each sub-area with the primary focus on serving the Village General Business District, commercial areas along Route 22, and the Town of North East Boulevard District along Route 44. The anticipated sewer district is shown in Figure A.9 of the report.

The alternatives and costs comparisons presented in this report are based on the proposed sewer district and the estimated average day design flow of 70,000 gpd as discussed in Section 5.1 of the report. Based on the alternative development discussed in Sections 4 and 5 of the enclosed report, four alternatives were identified for consideration including:

- Alternative No. 1 – No-Action
- Alternative No. 2 – STEP Collection System with Biofiltration Resource Recovery System and Groundwater Return at the Mill Street Site
- Alternative No. 3 – STEP Collection System with Membrane Bioreactor Resource Recovery System and Surface Return to Webatuck Creek at the Mill Street Site
- Alternative No. 4 – STEP Collection System with Biofiltration Resource Recovery System and Surface Return to Webatuck Creek at the Mill Street Site

We have recommended a project that includes construction of a septic tank effluent collection system for the proposed sewer district, a resource recovery system at the Mill Street site treatment and surface resource recovery system sized to treat and recover 70,000 gpd at the Mill Street property and Webatuck Creek, respectively.

Recommended Alternative

The no-action alternative (Alternative No. 1) was not recommended because it would not address issues with existing septic systems and it would fail to promote growth of business development in the proposed district. Therefore, a life cycle cost analysis was performed for Alternative No. 2, Alternative No. 3, and Alternative No. 4 and is summarized in Table E.1 below.

Table E.1
Life Cycle Cost Analysis Summary

	Alt. No. 2	Alt. No. 3	Alt. No. 4
Capital Costs	$10,726,000	$10,008,000	$10,406,000
Annual O&M Costs	$116,200	$201,000	$146,000
Present Worth of O&M Costs	$2,820,000	$4,880,000	$3,550,000
Present Worth of Salvage Value	$1,150,000	$890,000	$1,080,000
Net Present Value	**$14,812,000**	**$15,979,000**	**$15,182,000**
		Planning Period	20 years
		Inflation Rate	2.30%
		Discount Rate	0.30%

Although the capital construction costs for Alternative No. 2 are more than Alternative No. 3 and Alternative No. 4, the lower annual operation and maintenance costs associated with Alternative No. 2 ultimately result in a lower life cycle cost. However, Alternative No. 2 is no longer feasible due to the inability to acquire the vacant parcel resulting in insufficient area for a groundwater recovery system at the Mill Street site. Alternative No. 4 has the second lowest life cycle cost analysis. Several non-monetary considerations such as public perception, visual impacts, simplified operation and maintenance, and ease of expandability also favor Alternative No. 4 and therefore, Alternative No. 4 is the recommended alternative.

Opinion of Probable Costs

There are several financial grant or low-interest loan programs available which may assist the Village with funding this project such as the Clean Water State Revolving Fund. The enclosed engineering report has been prepared in anticipation of pursuit of a low-interest loan or grant. Table E.2 on the following page provides the conceptual opinion of probable cost for implementation of Alternative No. 4 in a format that is consistent with funding agency requirements.

Table E.2
Recommended Alternative Costs

Item	Cost[1]
1. Construction Costs	$9,476,000
2. Engineering Costs	
a. Design	$736,000
b. Construction	$1,137,000
3. Other Expenses	
a. Local Counsel	$71,000
b. Bond Counsel	$118,000
c. Work Force	$0
d. Financial Services	$0
e. Miscellaneous	$0
4. Equipment	$0
5. Land Acquisition	$0
6. Project Contingency (20%)	$2,292,000
7. Total Project Costs	**$13,830,000**
8. Less Other Sources of Financing	
a. Dutchess County MIG	-$200,000
b. CPF Grant	-$959,752
c. IMG Grant	-$5,082,099
9. Project Costs to be Financed	$7,588,149

[1]Costs presented are in 2025 dollars

Next Steps

It is recommended that the Village use the enclosed engineering report to apply for additional financial assistance for funding the design and construction of the recommended alternative. In addition, we also recommended the following:

- Apply for financial assistance for funding the design and construction of the recommended alternative.
- Collect and analyze updated flow information for the service area following completion of the water meter replacement project.
- Complete necessary engineering and design tasks for the recommended alternative including a site survey and parcel investigations.
- Obtain easements for sewer mains not passing through a parcel being served and permanent easements necessary for system maintenance.
- Obtain necessary permits including a SPDES permit and construction permits where sewer mains cross state roads.
- Construction will be awarded and commence following receipt of reasonable bids.
- Testing and start-up will begin as construction nears completion and service connections are made.

We understand that installation of a new wastewater collection and treatment system is a complex and costly undertaking, but we hope that this report will meet the Village's goal of understanding the options available for implementing a wastewater system and we look forward to assisting the Village with the next steps in the process.

Funding Agency Comments

Comments on the revised April 2024 Wastewater Feasibility Evaluation report were received on February 10, 2025. Modifications to the report to address these comments were made in this July 2025 revision of the report but did not impact the report conclusions which are summarized in this letter.

Please contact Erin Moore at 845-516-5835 if you have any questions regarding this report.

Very truly yours,
T&B Engineering and Landscape Architecture, PC

Erin K. Moore, PE, BCEE
Senior Project Manager

Section 1
Project Planning

1.1 Introduction

This report presents a wastewater preliminary engineering report performed for the Village of Millerton, New York. This evaluation has been performed to determine whether a municipal wastewater disposal system is needed within the Village and, if it is determined to be necessary, the most appropriate and cost-effective means of wastewater collection and disposal for the Village.

The need for community wastewater collection and treatment systems is constantly evolving. Historically, initial efforts were focused on collection and disposal and were driven by the need to reduce human disease. That era was followed by a focus on the elimination of water pollution effects, allowing native marine organisms to return to normal growth patterns and allowing full human recreational use. Currently, community wastewater collection and treatment systems have begun to redefine wastewater as a valuable resource. As such, when proposing alternatives for addressing wastewater needs this document uses the term "water resource recovery and return systems". This modern terminology embraces the concept that water is the most valuable resource in the world.

The Village is currently served by individual (residential/commercial) subsurface wastewater disposal systems (primarily septic tanks with leachfields) and is un-sewered. The study area boundary for this evaluation is the water service area which encompasses portions of the Town of North East and the entire Village of Millerton. The study area boundary is shown in Figure A.1.

The following tasks were performed as part of this evaluation and are described in the Sections that follow:

1. Service Area Delineation
2. Wastewater Flow Estimates
3. Evaluation of Collection, Treatment, and Disposal Alternatives
4. Cost Estimates for the Developed Alternatives
5. Recommendations & Implementation Procedures

Tighe & Bond, who provides services in New York through T&B Engineering and Landscape Architecture, PC (Tighe & Bond), has been engaged by the Village of Millerton to prepare this Engineering Report in a format consistent with NYS Environmental Facility Corporation (EFC) New York State Clean Water Revolving Fund Engineering Report guidelines and the United States Department of Agriculture (USDA) preliminary engineering report guidelines per RUS Bulletin 1780-2.

1.2 Previous Planning Efforts

Prior planning efforts for the Village of Millerton were reviewed as part of this evaluation to obtain background information and previous approaches. The following documents were reviewed or referenced as part of this effort and are described in this report Section:

- *Preliminary Engineering Report for Millerton Central Sewer District Village of Millerton and Town of North East, C.T. Male Associates, P.C., 2009*
- *Groundwater Resource Report, Dutchess County Aquifer Recharge Rates & Sustainable Septic System Density Recommendations, The Chazen Companies, 2006*
- *Town of North East & Village of Millerton Comprehensive Plan, Dutchess County Department of Planning and Development, 1992*
- *Town of North East / Village of Millerton Comprehensive Plan, 2019*

Preliminary Engineering Report Millerton Central Sewer District (2009)

This document is a preliminary engineering report for the establishment of a sewer district for the Village of Millerton. The report provides general cost estimates for several potential services areas as well as construction costs for the recommended wastewater treatment system. The Preliminary Engineering Report recommended a wastewater collection system consisting of conventional gravity sewers and grinder pumps which would deliver the raw wastewater to a steel packaged extended air activated sludge plant capable of treating 80,000 gallons-per-day (gpd).

While the C.T. Male report does provide costs for several conventional treatment scenarios, potential service areas were based only upon zoning and use analysis completed by the Joint Committee; no formal wastewater needs analysis was completed. Additionally, the report focused on conventional wastewater collection and treatment systems and did not consider alternative technologies which could present substantial cost savings for the Village.

Groundwater Resource Report (2006)

The Groundwater Resource Report was intended to provide updated understandings of aquifer recharge rates as well as provide updated guidance for sustainable densities of septic systems throughout Dutchess County, NY. The septic system density analysis is relevant to this report and provides general guidance for the minimum densities of onsite septic systems in the Village.

The Groundwater Resource Report recommended the minimum average parcel sizes for traditional onsite septic design (septic tank and leachfield) between 1.2 and 1.4 acres per system where hydrologic soil group (HSG) Type A is present, between 1.6 and 1.9 acres per system where HSG Type B is present, between 3.0 and 3.5 acres per system where HSG Type C is present, and as much as 5.4 to 6.2 acres where HSG Type D is present.

Comprehensive Plan (1992 & 2019)

The 1992 Comprehensive Plan discusses the Town and Village goals and objectives which are described in greater detail in Section 3.2.3 of this report. The 1992 Comprehensive Plan recognized ongoing issues with septic systems in the Village and established a goal to further investigate the need for a centralized sewage disposal system which would primarily serve the Village of Millerton and a portion of the surrounding areas (the water supply area).

The joint Comprehensive Plan between the Town of North East and the Village of Millerton was updated and adopted in 2019. One of the capital improvement projects identified in the 2019 Comprehensive Plan to meet the economic vibrancy goal is to plan and construct a public sewer system for the Village and areas adjacent to the Village.

1.3 Site Information

1.3.1 Location & Population Trends

The Village of Millerton is in the northeastern corner of Dutchess County within the Town of North East, near the border of Connecticut. The Village of Millerton lies within the Long-Island Sound Watershed. The Village is approximately 1.0 square mile including residential and commercial uses. The entire study area is approximately 1.7 square miles. Figure A.1 shows the Village of Millerton boundary and the study area boundary.

The Town of North East had a total population of 2,971 at the time of the 2020 census. The population of the Village of Millerton according to the 2020 census was 921, representing approximately 31% of the Town population. The Town of North East and the Village of Millerton had populations of 3,037 and 956, respectively at the time of the 2010 census. The most recent population estimate for the Town of North East was 2,957 and for the Village of Millerton it was 871 according to the American Community Survey (ACS) 2021 population estimates.

While there are no formal population projections for the Village of Millerton or Town of North East, the census data and population estimates from 2010 through 2021 indicate a relatively stable population. Based on previous trends, the population in the planning area is expected to remain relatively stable over the 20-year planning period.

1.3.2 Geologic & Topographic Conditions

The study area is composed mainly of silty loam soils of two main soil types, Stockbridge silt loam and Copake gravelly silt loam. Stockbridge silt loam, of which most of the study area is composed, consists of very deep, well drained soils formed from calcareous loamy till. They are somewhat level to moderately steep soils on till plains, smooth hills, and low ridges, with slope ranges from 3 to 25 percent. Permeability ranges from moderate in the surface layer and subsoil to moderately slow or slow in the substratum. The Stockbridge soils are generally HSG Type C or D.

Copake gravelly silt loam, which is present in the center of the study area, consists of well drained soils formed from loamy mantled stratified drift and glacial outwash. They are nearly level to steep soils on outwash plains and terraces with slope ranges from 0 to 30 percent. Permeability ranges from moderate to moderately rapid in the surface layer and subsoil and from rapid to very rapid in the substratum. The Copake soils are generally HSG Type A or B. Figure A.2 identifies all soil types located in the study area.

Bedrock in the study area is Wappinger Limestone which is a light to medium gray, banded travertine. Depth to bedrock is commonly more than 6 feet. The National Resource Conservation Service (NRCS) Soils Report for the study area is attached in Appendix B.

A brief description of each of the primary soil types found in the study area is below:

Cu, Cx - Copake fine sandy loam consists of well drained soils formed in loamy mantled stratified drift and glacial outwash. The soils are moderately deep to stratified sand and gravel and are very deep to bedrock. They are nearly level to very steep soils on outwash plains, terraces, kames, eskers, and moraines. Permeability is moderate or moderately rapid in the surface layer and subsoil, and rapid or very rapid in the substratum.

Sk, Sm - Stockbridge loam consists of very deep, well drained soils formed in loamy calcareous till. They are somewhat level to moderately steep soils on till plains, smooth hills, low ridges and drumloidal landforms. Slope ranges from 3 to 25 percent. Permeability is moderate in the surface layer and subsoil and moderately slow or slow in the substratum.

Gs - Georgia loam consists of very deep, moderately well drained soils on glaciated uplands. They formed in loamy till. Permeability is moderate in the solum and slow in the substratum. Saturated hydraulic conductivity is moderately high or high in the solum and moderately low or moderately high in the substratum. Slope ranges from 0 to 60 percent.

Mn - Massena silt loam consists of very deep, somewhat poorly drained or poorly drained soils on uplands. They are nearly level to strongly sloping soils that formed in till dominated by siliceous rock with some limestone. Slope ranges from 0 to 15 percent.

Nw, Nx - Nassau channery silt loam consists of shallow, somewhat excessively drained soils formed in till. They are nearly level to very steep soils on bedrock controlled, glacially modified landforms. Bedrock is at a depth of 10 to 20 inches. Slope ranges from 0 to 70 percent.
Dw – Dutchess cardigan complex consists of well drained soils formed from phyllite, slate, schist, and shale. They are slightly sloping to steep soils. Slope ranges from 5 to 20 percent. Bedrock is at a depth of 20 to 40 inches.

Most of the topography in the study area is relatively level (0-15% slope). However, the steepness of the topography increases towards the south and northwest sides of the study area. Figure A.3 shows the topography in and around the study area.

1.3.3 Environmental Resources & Floodplain

The study area was found to be within the New York State Department of Environmental Conservation (NYSDEC) rare plants and rare animals check zone as shown on their Environmental Resource Mapping tool, Figure 1.1 below. The locations shown in the Environmental Resource Mapper Rare Plants and Rare Animals layer are not precise locations. Rather, they show those generalized areas where NY Natural Heritage has information in its databases regarding rare animals and/or rare plants. These generalized areas show the vicinity of actual, confirmed observations and collections of rare animals and rare plants. The precise locations are not provided by this tool.

Webatuck Creek flows generally north to south through the Village of Millerton. The Kelsey Brook flows generally east to west through the Village to its confluence with the Webatuck Creek just south of South Center Street. An unnamed tributary also flows into Webatuck Creek from the west. All streams within the study area are Class C waterbodies as defined by the NYSDEC, and Webatuck Creek is also noted as trout waters.

As shown on Figure 1.1, there are NYSDEC regulated freshwater wetlands within the study area and a registered natural community to the north. The natural community is noted as an Appalachian oak-hickory forest at Alander Mountain. The specific species of rare plants and/or rare animals that are in this vicinity are not provided by the Environmental Resource Mapper Tool.

Figure A.4 identifies the U.S. Fish and Wildlife National Wetlands Inventory (NWI) wetlands; much of the NWI wetlands overlap with the NYSDEC regulated wetlands shown on Figure 1.1.

The 100- and 500-year flood zones as delineated by the Federal Emergency Management Agency (FEMA) are shown on Figure A.4. The mapped flood zones are adjacent to Webatuck Creek and Kelsey Brook. As shown on Figure A.4, portions of the study area are within or adjacent to the flood zones.

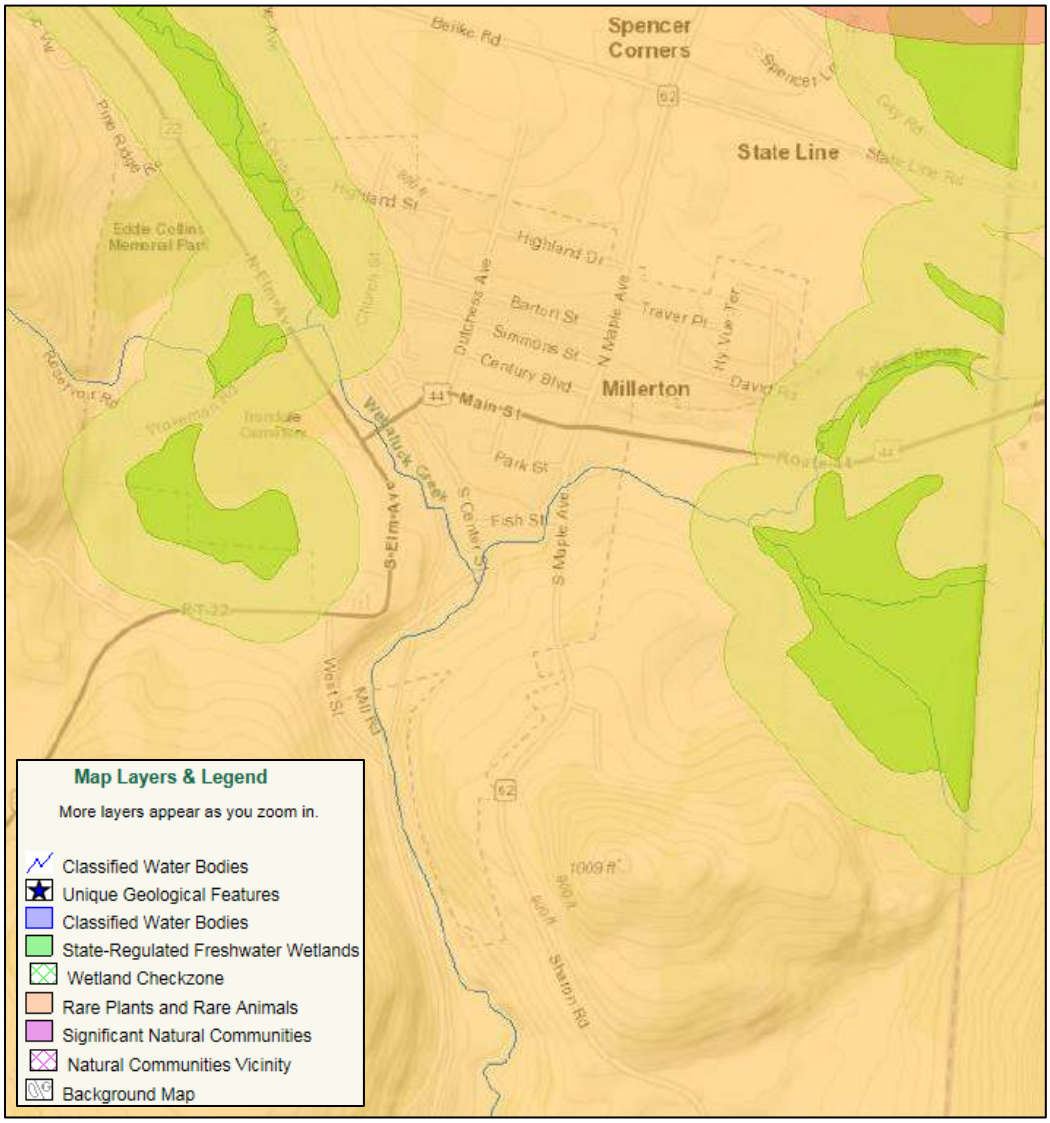

FIGURE 1.1
Village of Millerton NYSDEC Environmental Resources Mapper

*Revised July 2025

1.3.4 Land Use/Zoning

The Village of Millerton makes up most of the study area; the parcels within the Village boundary fall under the Village of Millerton zoning districts. Figure A.5 shows the zoning districts for the Village of Millerton. The parcels within each of the zoning districts in the Village and the minimum lot sizes for each district are summarized below:

Low Density Residential (R1A)

- Includes areas to the far south and far west of the Village.
- Minimum lot size is 1 acre.

Medium Density Residential (R20,000)

- Comprises large areas to the north, south, and west parts of the Village.
- Minimum lot size varies depending on availability of sewer service.

High Density Residential (R10,000)

- Includes the developed area between South Center Street and Route 62.
- Minimum lot size varies depending on availability of sewer service.

General Business District (GB)

- Includes the lots along Main Street.
- Minimum lot coverage must be 30% of the land area. No minimum lot sizes.

Planned Residential/Business District

- Includes a small group of lots along Route 22.
- Minimum lot coverage must be 30% of the land area. No minimum lot sizes.

Limited Business District

- Includes an area towards the north side of the Village along Route 22.
- Minimum lot size is 1 acre.

Highway Business Districts I (HB-I)

- Includes four lots near the intersection of Main Street and Maple Avenue.
- Minimum lot sizes are 1 acre.

Land Conservancy District (LC)

- Includes lots along Webatuck Creek and several larger lots in the northeast section of the Village.
- Minimum lot size is 1 acre.

Industrial District (M)

- One large industrial parcel off Route 22 occupied by Arnoff Moving and Storage.
- Minimum lot size is 3 acres.

The remaining parcels in the study area (outside the Village boundary) fall under the Town of North East zoning districts. A map of the zoning districts for the Town of North East is attached in Appendix C. The parcels within each of the Town zoning districts in the study area and the minimum lot sizes for each district are summarized below:

Agricultural (A5A)

- Generally, to the west of the Village of Millerton.
- Minimum lot size is 5 acres.

Boulevard Districts

- Generally, to the east of the Village of Millerton along Route 44.
- No minimum lot sizes.

Highway Business III (HBIII)

- Generally, to the north of the Village of Millerton along Route 22 and Route 60.
- Minimum lot size is 1 acre.

Land Conservation (LC)

- Primarily along Webatuck Creek.
- Minimum lot size is 1 acre.

Medium Density Residential (R20000)

- Includes areas to the north and east of the Village of Millerton.
- Minimum lot size varies depending on availability of sewer service.

Very Low Density Residential (R3A)

- Includes areas to the south of the Village of Millerton.
- Minimum lot size is 3 acres.

1.3.5 Environmental Justice Areas

The Village of Millerton nor the Town of North East (shaded yellow) was not found to be in a Potential Environmental Justice Area (PEJA) as indicated (in purple shading) by the NYS DECinfo Locator mapping presented in Figure 1.2, below.

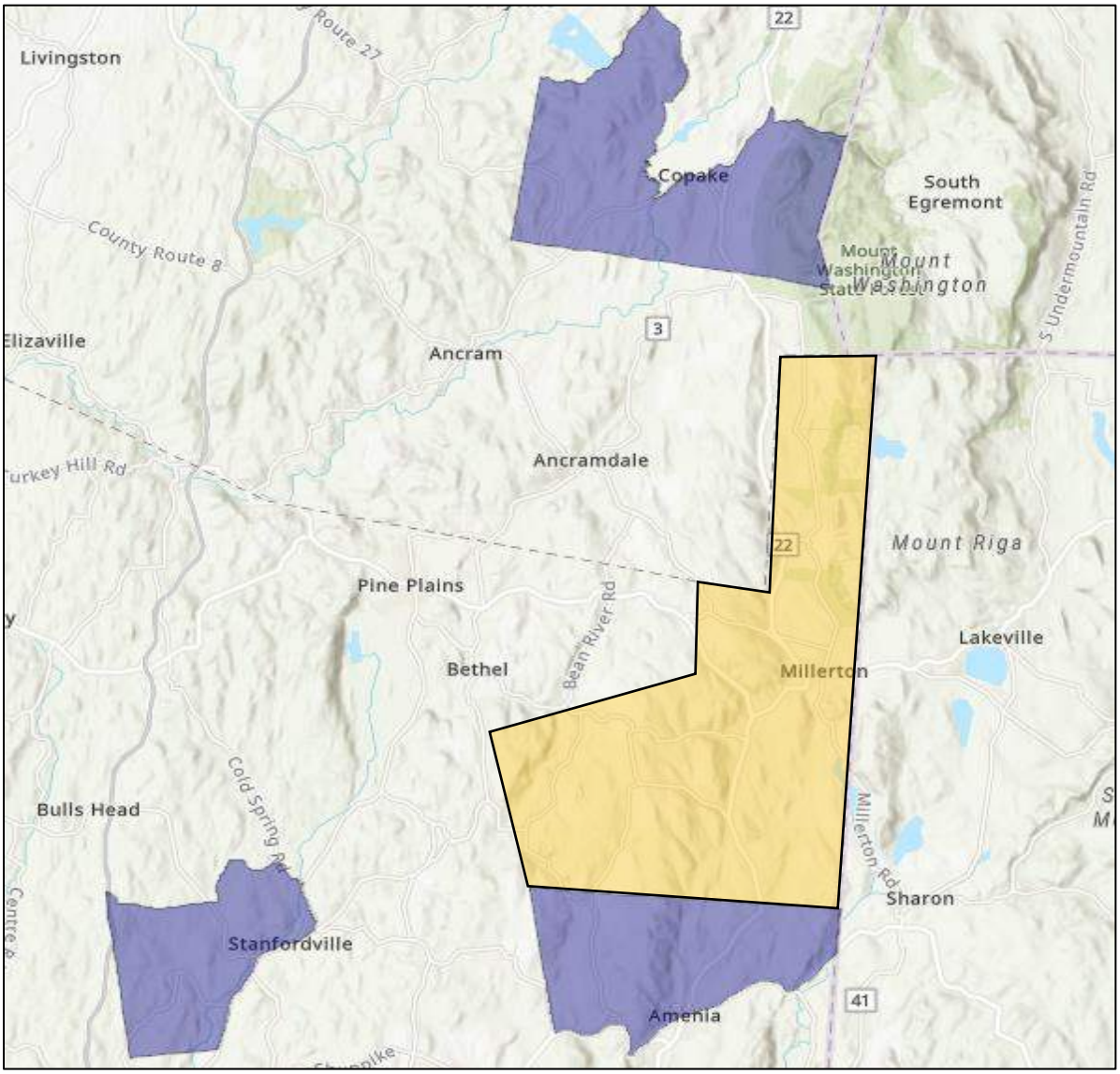

FIGURE 1.2
Millerton/North East Area Environmental Justice Areas

1.4 Community Engagement

The Village of Millerton and Town of North East have taken several steps to engage the community regarding the implementation and feasibility of a new sewer system. Below is a timeline which illustrates the actions already taken, as well as the planned approach to continuously involve the community and encourage civic participation throughout the project.

- 2018 – Village of Millerton sends out 478 wastewater surveys to businesses and homeowners in the Village and Town to collect input from community members regarding their need and desire for a sewer system. The Village of Millerton hired Tighe & Bond to perform the wastewater feasibility evaluation.

- 2019 – Several public meetings and workshops were held to discuss updates to the Town of North East & Village of Millerton Comprehensive Plan. These discussions included the feasibility of creating and funding a sewer system. The comprehensive plan was adopted in November 2019 and includes a capital improvement project to provide a public sewer system serving the Village and immediate surrounding areas in the Town.
- 2019 – Village of Millerton met with Tighe & Bond several times to discuss progress on the wastewater feasibility evaluation, discuss district delineation, review results of the study, and prepare for public presentations.
- 2020 – Presentations of the wastewater feasibility evaluation were held for the draft report and the final report. The presentations were a joint effort between the Village, Town, and Tighe & Bond. The presentations were given to the public to explain the results, recommendations, financial impacts, and next steps. The meeting was held for the stakeholders in the proposed sewer district and the public and many of the property and business owners attended the meeting, provided feedback, and asked questions regarding the proposed sewer district.
- 2021/2022 – The Village of Millerton, Town of North East, and Tighe & Bond worked together to update the preliminary engineering report in 2021 and 2022. This included revisions to the service area delineation, flow estimate, and treatment and disposal system approach as the property that was originally intended for the system could not be acquired. During this process, the Village contacted parcel owners to gauge their interest in connecting to the system – the feedback from the property owners was used to revise the service area delineation. Several meetings and presentations were held during the revision process and to present the final revisions including public meetings on August 2, 2021, October 25, 2021, March 7, 2022, March 21, 2022, June 6, 2022, October 11, 2022, and November 28, 2022.
- 2022 – Tighe & Bond worked with the Village of Millerton and Town of North East to develop a Map & Plan for the Village and a Map, Plan, and Report for the Town of North East. These documents were critical steps to define the service areas and move towards the next steps in the project.
- August 2, 2022 – The Village received a $200,000 Dutchess County Municipal Investment Grant (MIG) for preliminary engineering.*
- January 9, 2023 – The Village of Millerton Village Board approved a resolution to accept the Map and Plan for the Village Sewer System
- January 23, 2023 – The Village of Millerton as Lead Agency completed the State Environmental Quality Review Act (SEQR) process for the project. The Village Board adopted a negative declaration finding that the proposed action would not result in any significant adverse environmental impacts and that a draft environmental impact statement would not be prepared.
- March 29, 2023 – A public presentation regarding the Town Map, Plan & Report was completed.
- June 20, 2023 – A public hearing for the formation of the Town of North East Sewer District was held.
- July 2023 – The Qualifications Based Selection Process for Wastewater System Design Engineering was completed and an engineering contract for Preliminary Design was awarded.*

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- 2023 – Intermunicipal agreement between the Village of Millerton and Town of North East developed.*
- 2024 - The Village and Town have received a $5,082,099 Intermunicipal Grant (IMG) and a $959,752 Congressionally Directed spending Community Project Funding Grant (CPF)*
- 2024 – The Village and Town advanced the preliminary design phase which included house-to-house inspections of the properties in the service area, surveying, and geotechnical investigations.*
- Ongoing – The Village/Town Wastewater committee have engaged directly via in person or telephone meetings with most parcel owners that would be impacted by the project and/or located in the proposed service area.
- Ongoing– The Village of Millerton & Town of North East intend to continue to update the public regularly regarding the status of this wastewater project and the funding and revenue strategies.
- Ongoing – The Millerton News, an independently owned community weekly newspaper covering both Millerton and North East has regularly run articles on the project starting in 2020.

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Section 2
Need for Project*

The Village of Millerton identified issues with septic systems in the Village over three decades ago. The Village does not currently have a public wastewater collection or treatment system although there is relatively dense development in the Village center and commercial areas in the Town of North East. Most of the parcels are served by individual subsurface septic tanks and leachfields while some have even older disposal systems such as seepage pits or cesspools. Some of these older systems are generally regarded as outdated and no longer allowed in new construction.

The 1992 Comprehensive Plan identified the need to evaluate the feasibility of various sewage management options and, more recently, the 2019 Comprehensive Plan listed the construction of a public sewer system as one of the capital improvement projects necessary to meet the economic vibrancy goal. Construction of the sewer system is expected to allow for expansion of businesses and encourage growth within the sewer district thus limiting urban sprawl, which will help achieve another goal of the Comprehensive Plan which is to preserve the rural character of the Town.

As discussed later in this report, a survey was administered by the Village as part of this study. The survey included 105 respondents and identified the threat that the lack of sewer infrastructure imposes on the protection of natural resources and on controlled infrastructure growth. The survey also confirmed that there are wastewater disposal problems in the Village most likely due to site specific and localized conditions and that there are a significant number of property owners who feel that wastewater improvements are necessary for the Village.

In speaking with residents and business owners in the Village and Town, several community members have expressed that expansion of their business or residential housing is limited due to their septic system capacity. Businesses could expand or upgrade their existing systems to meet the required capacity; however, the expansion or replacement of their existing onsite septic system is often not feasible due to the relatively small parcel sizes and since they are required to have enough space for a 100% reserve area for any new or renovated system.

A central sewer system would make it easier and more attractive for businesses to expand and would allow lot sizes to be smaller in the sewer district which would allow for greater density and number of businesses. It would also allow for mixed-uses such as apartments to be built above storefronts which would otherwise be futile without providing a public wastewater system as the small existing lots are not able to support the larger flow demands.

A community wastewater system would provide several benefits, including:

- Replace outdated septic systems
- Allow existing businesses to reach their full capacity
- Encourage additional growth and new businesses in service area
- Allow for multi-use buildings
- Provide environmental protection by replacing failing or outdated septic systems
- Promote sustainable community development that benefits all residents
- Encourage capital investments in-Town

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Section 3
Wastewater Disposal Needs Analysis

3.1 General

The first component of this study is the evaluation of the need for wastewater disposal improvements in the study area. A sewer district can be delineated once the need for wastewater disposal is determined. The Village is currently served by individual subsurface wastewater disposal systems (including septic tanks with seepage pits, leachfields, or sand filters) and wastewater storage tanks (i.e. tight tanks) which are pumped on a regular basis.

From review of previous documentation and reports discussed in Section 1.2, it appears likely that failing wastewater disposal systems and properties with no on-site disposal methods are a serious issue of concern to the Village and are strong encouragements for forming a sewer district. Although previous reports have used zoning and use methodologies for the basis of service area delineation, this evaluation utilized several additional steps to determine the correct delineation for a potential sewer district. Wastewater disposal need was determined by several methods, including:

- Evaluation of the results of a wastewater survey distributed to each business/resident served in the Village of Millerton water district;
- Evaluation of site conditions that may indicate constraints to individual onsite wastewater disposal systems including soil type, shallow depth to groundwater or bedrock, parcel size, and parcel density;
- Evaluation of existing land use and zoning constraints, and;
- Evaluation of comprehensive plan goals and priorities which may impact the need for wastewater treatment improvements.

For the purposes of this evaluation, the study area has been divided into eight sub-areas as shown in Figure A.6. The sub-areas were created based upon zoning, similar use characteristics, geographical features, and constructability considerations. The sub-areas have been delineated for comparison purposes and to help identify the areas of highest priority. The portions of the study area not included in one of the eight sub-areas were excluded due to their large parcel sizes, low parcel density, and/or geographic isolation. The eight sub-areas are:

- Main Street: based around the center of the Village including most of Main Street and all of Century Boulevard. The west border of this sub-area is Webatuck Creek.
- Main North: includes the portion of the study area to the north of Simmons Street, bordered to the west by North Center Street, to the east by North Maple Avenue, and to the north by Highland Street.
- Main East: includes mostly commercial parcels to the east of North Maple Avenue along Route 44. Most of this sub-area is outside of the Village boundary.
- Main South: includes the high density residential areas immediately south of the Main Street sub-area. The area is bordered on the south by Fish Street.

- Main West: includes eleven mixed use parcels around the intersection of Main Street and Route 22.
- Route 22 North: includes a mix use of planned residential parcels and limited business parcels along Route 22.
- Route 22 South: mostly includes medium density residential parcels along Route 22, Mill Road, and West Street.
- Travers Place: Includes the residential neighborhood off Travers Place on the far east side of the Village.

3.2 Determining and Prioritizing Need

3.2.1 Wastewater Survey

Questionnaire surveys were mailed to each of the 478 water service users in the study area and the Village of Millerton. The surveys requested information about each individual's on-site wastewater disposal system and related residence information. This survey was intended to evaluate homeowners' and business owner's experiences and the perceived need for wastewater disposal improvements such as new sewers, within their individual neighborhoods, or anywhere in the Village. The survey also included areas for comments on the needs of wastewater improvements in the Village. In addition, the survey inquired about groundwater conditions in basements to collect information about neighborhoods with groundwater problems, which can lead to failing wastewater systems. A cover letter from the Village was also attached with each survey. A copy of the wastewater survey questionnaire and cover letter are included in Appendix D.

A total of 105 surveys were returned, representing a 22% response rate overall.

The responses for each sub-area are provided in Table 3.1. The total percent response rate shown in Table 3.1 is less than 22% because only 434 of the 652 parcels in the study area are included in the sub-areas.

TABLE 3.1 – Survey Response Summary by Sub-area

Sub-Area	Number of Parcels	Number Responding	% Responding
Main Street	82	15	18%
Main North	132	26	20%
Main East	21	1	5%
Main South	57	12	21%
Main West	11	1	9%
Route 22 North	34	4	12%
Route 22 South	37	6	16%
Travers Place	60	13	22%
TOTAL:	**434**	**78**	**18%**

The results of the wastewater questionnaire survey are discussed below:

Out of all of the responses, 8% reported problems with their wastewater disposal system. These problems included failing leachfields, frequent pumping, and frequent back-ups. Table 3.2 summarizes the location of the respondents reporting problems. The remaining 93% did not report any problems with their wastewater disposal system. Figure A.7 shows the parcels where issues were reported.

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TABLE 3.2 – Reported Wastewater Disposal Problems by Sub-area

Sub-Area	Number Reporting	% Reporting WW Problems	Problem Streets
Main Street	1	7%	Main Street
Main North	1	4%	North Center Street
Main East	0	0%	-
Main South	2	17%	S Center St
Main West	0	0%	-
Route 22 North	1	25%	Brook Lane
Route 22 South	1	17%	Mill Road
Travers Place	0	0%	-

Of the 105 respondents, 40% felt that a wastewater treatment system is required for the Village; 45% felt no treatment system was required, and 15% were unsure. Of the 40% who felt a treatment system is needed, 3% felt the entire Village requires a treatment system, 12% felt a wastewater system should be constructed for the Business District, 19% felt a wastewater system should be constructed at the highway garage, 5% felt the wastewater system should be constructed outside of town, 40% were unsure, and 21% did not answer. However, it appears that the question concerning the service area was misinterpreted by most respondents. The question was intended to ask what area they believe should be serviced by a sewage system, not where, specifically, a wastewater treatment system should be constructed. Therefore, the responses to this particular question are not being considered as part of this evaluation.

A total of 24% of respondents reported having problems with water in their basements. Of the 24% who reported problems with water in their basement, 4% reported that problems occur every day, 68% reported that problems occur during rain events, and 28% reported that problems occur during the Spring. Figure A.7 shows parcels where basement water problems were reported.

As previously noted, comments on wastewater disposal needs were solicited in the survey. These are not quantifiable by percentage as not every respondent chose to comment. In general, those who had wastewater problems or felt the Village needs additional wastewater treatment systems, made comments supporting a wastewater treatment project. One comment was received expressing that the cost of the system should only be paid for by those who would be serviced by the system. No other respondents who opposed the system provided comments.

The overall indication that the wastewater survey results provide is that:

- There was a significant number of respondents who felt wastewater improvements were necessary for the Village (40%).
- Generally, the Village of Millerton has isolated wastewater disposal problems most likely due to site specific and localized conditions.
- The majority of basement water problems were reported in the developed residential areas.

3.2.2 Site Conditions

Several site conditions can contribute to poor wastewater disposal systems. Some of which include:

- Small Lot Sizes
- High Parcel Density
- Poor Soil Conditions
- High Groundwater Levels
- Shallow Depth to Bedrock
- Inappropriate/Heavy Usage

Lot Sizes and Density

To provide adequate space for a septic tank, soil adsorption system, and reserve area, as well as sufficient room for a building and setback requirements, a minimum lot size is typically required. As discussed in Section 1.2 of this report, review of the Groundwater Resource Report indicated a recommended minimum lot size between 1.2 - 1.4 acres for HSG Type A soils and 1.6 – 1.9 acres for Type B soils. For the purpose of this evaluation, a parcel size of less than 1 acre was considered inadequate for onsite waste disposal.

In the Village, separation distances between wells and septic systems are not an issue as there is a public water system. Parcels less than 1 acre may have difficulty conforming to the New York State Department of Health (DOH) regulations. The DOH regulations include:

- Minimum distance from septic tank to building 10 feet
- Minimum distance from leachfield to building 20 feet
- Minimum distance from leachfield to the street 10 feet
- Minimum distance from leachfield to adjacent property line 10 feet
- Minimum distance from leachfield to well 100 feet

In many cases, the building takes up a significant portion of the parcel, leaving very little area for an adequate wastewater disposal system. Table 3.3 provides the percentage of lots within each sub-area that are less than 1 acre in size.

Parcel size is typically related to parcel density. Highly developed areas usually have small lot sizes spaced closely together. These areas are not well suited for onsite disposal systems simply due to limited space. The average lot density for each sub-area was computed for comparison purposes and is summarized in Table 3.4. As shown in Table 3.4, the average lot density is greatest in the Main Street sub-area and second greatest in the Main South sub-area. Main North also has a relatively high lot density and the Main East, Main West, and Route 22 North sub-areas have the lowest relative lot densities.

TABLE 3.3 – Parcels Less than 1 Acre

Sub-Area	% Lots less than 1 Acre
Main Street	96%
Main North	97%
Main East	62%
Main South	95%
Main West	91%
Route 22 North	59%
Route 22 South	81%
Travers Place	83%

TABLE 3.4 – Average Lot Density

Sub-Area	Density (Lots/Acre)
Main Street	3.2
Main North	2.2
Main East	0.8
Main South	2.7
Main West	0.8
Route 22 North	0.6
Route 22 South	1.7
Travers Place	1.5

Poor Soil Conditions

When soils are 'tight' and have percolation rates greater than 60 minutes/inch, wastewater disposal fields are much more likely to fail and create surface ponding or clogging problems. In general, the soils in the study area are well drained Copake and Stockbridge soils and are not likely to have excessive percolation rates. As long as percolation rates are in accordance with NYS DOH Standards, and considering there is a public water supply, these soils should be appropriate for wastewater disposal adsorption fields. In general, there are no large groups of parcels that appear to be significantly affected by poor soils. The HSG soil types for the study area are shown in Figure A.2.

High Groundwater or Shallow Bedrock

The vertical separation to seasonal high ground water is an additional important requirement in siting subsurface disposal systems. A minimum depth of 4 feet between the bottom of the leachfield to groundwater is required per NYS DOH regulations. There are isolated portions of the study area where the depth to groundwater is less than 4 feet. One of the largest of the areas is around the Millerton Recreation Park and may explain some of the septic system and basement issues reported in that area. A significant portion of the study area along Gay Road also has high groundwater levels, however this portion of the study area is not included in the sub-areas and had no reported basement problems. No other sub-area besides Main East has areas of shallow depth to groundwater (see Figure A.2).

The surveys distributed to the Village also inquired about flooded basements and inquired as to when the flooding occurred. Parcels that reported basement flooding problems are highlighted on Figure A.7. Table 3.5 displays the basement flooding reports for each sub-area.

TABLE 3.5 – Reported Basement Flooding Problems

Sub-Area	% Reporting Problem (All causes)	% Reporting Problem (Seasonal only)
Main Street	27%	13%
Main North	31%	12%
Main East	0%	0%
Main South	25%	0%
Main West	0%	0%
Route 22 North	50%	25%
Route 22 South	17%	0%
Travers Place	15%	8%

It is important to note that several respondents noted that rain appeared to cause water to enter their basement. This is not typically considered an indicator of a high ground water table, rather, it indicates that the basement walls may be improperly sealed or the house improperly guttered. Respondents who indicated flooding is a problem that occurs typically in the spring and during snowmelt are more likely to have their basements affected by a high water table.

Although there are areas of groundwater impacting basements, the results of the survey indicate few problems with failing leachfields in these areas. It is likely that seasonal groundwater in these areas is high enough to impact a basement which extends 6 feet into the ground, but not high enough to significantly affect disposal fields. It should be made clear that individual wastewater disposal systems contribute very little to groundwater and have almost no influence on groundwater elevation. Installation of a wastewater collection system would have no effect on seasonal basement flooding. Discharge of sump pumps to a wastewater collection system is also prohibited.

In addition to ground water levels, the vertical separation to bedrock is an important requirement in siting subsurface disposal systems. A minimum depth to bedrock of 4 feet is required per NYS DOH regulations. There are small isolated portions of the study area where bedrock can be found shallower than 4 feet according to the NRCS soil type designations for the area. This may explain some reported basement water problems, particularly for a series of reported problems in the Route 22 South sub-area along Mill Street. There are no other areas of shallow bedrock within the boundaries of the sub-areas.

3.2.3 Village Priorities

The comprehensive plan, a joint plan for the Town of North East and the Village of Millerton, provides goals and recommendations regarding the following topics:

- Rural Character
- Agriculture
- Environment
- Maintain Village Center
- Encourage Limited Growth
- Promote Housing Alternatives
- Supply of Clean Drinking Water
- Provide Sound Disposal of Wastes
- Transportation
- Historic Conservation
- Recreation

In review of the comprehensive plan, wastewater disposal improvements are believed to impact the above items in the following manner as discussed in Table 3.6:

TABLE 3.6 – Comprehensive Plan Goals & Wastewater Disposal Impacts

Item	Brief Description of Goals	Impact
Rural Character/ Development	- Encourage high quality in new development - Discourage high density development - Provide designated areas for commercial development	A wastewater treatment system may encourage development in previously undeveloped areas, which may oppose the goals to prevent development in these areas.
Agriculture	- Support more efficient land use - Protect agricultural operations - Cooperate with local land trusts - Maintain significant areas of prime agricultural land	A wastewater treatment system is not expected to affect agriculture or agricultural activities.
Maintain Village Center	- Encourage the location of community facilities in the Village - Discourage development outside the Village	A wastewater treatment system is expected to have positive impacts for maintaining the development within the Village.
Environment	- Control and provide for proper disposal of wastes - Protect surface and groundwater resources - Protect natural drainage areas - Limit erosion and sedimentation	An improved wastewater treatment system should have positive impacts on protecting water resources.
Encourage Limited Growth	- Encourage the expansion of employment opportunities - Encourage small businesses - Encourage the development of light industry	A wastewater treatment system is expected to encourage limited growth in the Village.
Promote Housing Alternatives	- Encourage access for all residents - Encourage housing for people of all ages - Concentrate relatively dense housing to the Village area	A wastewater treatment system is expected to encourage housing alternatives.
Supply of Clean Drinking Water	- Pursue the development of a centralized water system - Ensure protection of surface and groundwater resources	A centralized wastewater treatment system is expected to further protect the water supply system.

TABLE 3.6 Continued - Comprehensive Plan Goals & Wastewater Disposal Impacts

Item	Brief Description of Goals	Impact
Provide Sound Disposal of Wastes	- Pursue the development of a centralized sewage disposal system. - Ensure protection of surface and groundwater resources.	The goal of this evaluation is to identify the level of wastewater treatment required. An improved wastewater treatment system is expected to improve the health of local groundwater resources.
Transportation	- Encourage public transportation that would serve the Town and Village - Ensure adequate off-street parking is provided. - Encouraged planned pedestrian walkways and bikeways.	A wastewater treatment system is expected to have no specific impact on transportation goals.
Historic Conservation	- Designate historic sites and districts - Identify and protect scenic roads	A wastewater treatment system is expected to have no specific impact on historical goals.
Recreation	- Encourage the use and improvements of all community facilities - Encourage public access to lakes and streams	A wastewater treatment system discharging directly to Webatuck Creek may been seen negatively.

Based upon the results of Table 3.6, the following Table 3.7 summarizes the Village goals that a wastewater treatment system may impact, and whether the impact is negative or positive. Note that the "Provide Sound Disposal of Wastes" is a Comprehensive Plan goal, and the goal of this report is to determine the level of wastewater treatment necessary to meet that goal, therefore it is not included in Table 3.7 as being influenced positively or negatively.

TABLE 3.7 – Wastewater Treatment Impacts

Issue	Treatment System Impact	Comments
- Rural Character/Dev., - Maintain Village Center, - Encourage Limited Growth	Positive	Intelligent delineation of a sewer district will encourage limited development in the Village Center by meeting the needs of high sewer demand business while not facilitating unneeded expansion of residential areas.
- Environment, - Drinking Water	Positive	Removal of old and unmaintained on-site disposal systems will aid in protection of local water sources.
- Recreation	Negative	A wastewater treatment system discharging to Webatuck Creek may been seen negatively by some members of the community who rely on the water way for recreation activities.

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3.2.4 Summary

The items described in the Sections above were used to develop a priority of wastewater treatment needs. To create a wastewater treatment needs priority ranking, each of the sub-areas were given a 0-7 ranking per each issue which affects wastewater treatment, 7 being the highest need, and 0 being the lowest. Table 3.8 summarizes the results.

TABLE 3.8 – Wastewater Needs Ranking

Sub-Area	WW Problems	Small Lots	Lot Density	High GW	Shallow BD	Village Goals	Total
Main Street	5	6	7	5	6	7	**36**
Main North	4	7	5	6	6	2	**30**
Main East	3	1	2	1	6	6	**19**
Main South	6	5	6	4	6	3	**30**
Main West	3	4	2	1	6	4	**20**
Route 22 North	7	0	1	7	6	5	**26**
Route 22 South	6	2	4	3	7	1	**23**
Travers Place	3	3	3	2	6	0	**17**

Wastewater Problems

Refer to Table 3.2. The Route 22 North sub-area had the highest reported percentage of problems followed by Main South, Route 22 South, Main Street, and Main North. The Main East sub-area, Main West, Route 22 North, and Travers Place had no reported wastewater problems.

Small Lots

Refer to Table 3.3. The Main North sub-area has the highest percentage of lots less than 1 acre, followed by Main Street, Main South, Main West, Travers Place, Route 22 South, Main East, and the Route 22 North sub-area.

Lot Density

The Main Street sub-area has the highest lot density by far. Main South and Main North also have high lot densities. The remaining sub-areas were ranked accordingly as shown in Table 3.4.

High Groundwater

The sub-areas were ranked based on the percent of reported basement flooding problems as summarized in Table 3.5. Route 22 North had the highest percentage of reported basement flooding problems. The Main Street, Main North, Travers Place, and Main South sub-areas also had basement flooding problems. The other two sub-areas had no reported basement flooding problems.

Shallow Bedrock

Refer to Figure A.2. Only two rankings were appointed to this category since only the Main South sub-area has areas where the depth to a restrictive bedrock layer was less than four feet.

Village Goals

The Village goals were merged into a single category. A potential sewer district in any of the sub-areas is expected to benefit the environment, therefore each sub-area was primarily ranked based on the development/limited growth goals for each sub-area. Main Street was ranked as the highest need for wastewater improvements because development in this area is encouraged per the Comprehensive Plan. The Main East sub-area was ranked second highest followed by Route 22 North based on land use and zoning types. Main North, Main South, and Travers Place were all ranked lower in this category because they are primarily residential areas where expansion and development are discouraged to maintain rural character.

3.3 Service Area Prioritization

The wastewater needs analysis identified the Main Street area as the area with the greatest need for wastewater improvements. Main South ranked the second highest followed by Main North and Route 22 North. Table 3.9 summarizes the sub-areas from highest priority to lowest priority based on the wastewater needs analysis.

TABLE 3.9 – Priority of Sub-Areas

Priority No.	Sub-Area
1	Main Street
2	Main South
3	Main North
4	Route 22 North
5	Route 22 South
6	Main West
7	Main East
8	Travers Place

The rankings in Table 3.9 can be used to prioritize wastewater service areas.

3.4 Wastewater Flows and Loads*

3.4.1 Wastewater Flow Estimates

The 2009 report by C.T. Male Associates, P.C. titled "Preliminary Engineering Report for Millerton Central Sewer District" cited a required treatment capability of 80,000 gpd for their recommended sewer district area. The basis of this calculated flow rate was determined by the Equivalent Dwelling Unit (EDU) method. The EDU method uses a typical single-family house in the district and compares it to all other parcels in the district to assign them an appropriate EDU based on the expected wastewater flow. The sum of all EDUs equates to the total design flow for the district. EDU counts were performed by the Dutchess County Water and Wastewater Authority (DCWWA) in 2018 for the parcels included in the 2009 report. A single EDU was equated to 250 gpd.

A revised wastewater design flow estimate was developed for the newly proposed sub-areas utilizing the EDU method by adapting the EDU methodology and assignments from the 2009 Report to the newly delineated service areas. The parcels that did not have an assigned EDU from the 2009 report were assigned an EDU based on the water usage (if reliable data was available), zoning designation, and/or publicly available property information.

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Additionally, historical drinking water production data and flow meter readings were provided by the Village of Millerton and were used for comparison of the estimated wastewater flows. There are 376 metered users in the water district, with 64 of those being non-residential users.* Flow meter readings for several months were provided and reviewed as part of this evaluation. However, upon review, only 55% of the parcels in the sub-areas had reviewable flow meter data and the data available had significant inconsistencies with typical anticipated water demand and the overall water system production, resulting is very low usage per EDU that was unsuitable to assess per parcel demand.* This is considered an inadequate portion of users and therefore the flow meter readings were not used for flow estimating purposes.

In lieu of flow meter readings, the daily total water consumption data for the Village of Millerton Water District for the years 2017 - 2022 was provided.* A summary of the average daily water usage during this time is provided in Table 3.10.

TABLE 3.10 – Village of Millerton Water Use Summary (2017 – 2024)*

	2017	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Average Daily Flow (gpd)	116,000	122,000	123,000	147,000	157,000	169,000	138,000	120,000
2017-2024 Average Daily Flow (gpd)								**136,500**

As shown in Table 3.10, the average daily flow for the entire Millerton Water District from 2017 to 2024 was approximately 136,500 gpd and in total, there are 936 EDUs for the entire Water District. This equates to a flow of approximately 146 gpd per EDU which suggests that the previously used value of 250 gpd is overly conservative. However, using a 146 gpd/EDU approach may underestimate the flows from high use facilities since it takes the entire Water District into account. Therefore, applying the 136,500 gpd to the proposed wastewater service area only (671 EDUs) results in a flow rate of 204 gpd/EDU. To be conservative, flow estimates for the proposed wastewater service areas have been determined using a flow rate of 215 gpd/EDU.*

A water meter replacement project for the Village of Millerton is currently underway. During this project, all of the existing water meters will be replaced with new meters. As of June 2025, water meters have been installed for approximately 66% of parcels in the proposed wastewater service area. Water usage data for these parcels from June 2023 through June 2025 was reviewed and flow per EDU calculated based on the EDU assignments provided in Appendix E. For the June 2023-June 2024 period for all metered parcels the flow rate was 94 gpd/EDU, for residential only parcels for the same period the flow rate was 122 gpd/EDU. For the June 2024-June 2025 period for all metered parcels the flow rate was 106 gpd/EDU, for residential only parcels for the same period the flow rate was 153 gpd/EDU. These flow rates are much less than calculated using the total water consumption data in Table 3.10 above; the variance is most likely attributable to losses in the water system rather than a sudden decrease in water usage by users. As the water meter replacement project is ongoing and metered data is not available for all parcels in the proposed wastewater service area, the flow conservative rate based on calculated total water consumption data with an added safety factor has been used (215 gpd).*

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The resulting flow estimates calculated using the EDU method for each sub-area are summarized in Table 3.11. The EDU assignments for each parcel are in Appendix E.

TABLE 3.11 – Wastewater Flow Estimates Using the EDU Method

Sub-Area	Residential EDUs	Commercial EDUs	Total EDUs	Estimated Wastewater Flow (gpd)
Main Street	40	91	131	29,000
Main North	67	153	220	48,000
Main East	1	30	31	7,000
Main South	74	12	86	19,000
Main West	9	7	16	4,000
Route 22 North	23	40	63	14,000
Route 22 South	57	2	59	13,000
Travers Place	49	17	66	15,000
TOTAL	**319**	**352**	**671**	**149,000**

Table 3.11 assumes the same flow per EDU for both residential and non-residential users. There are a total of 81 non-residential users and the majority are office spaces or retail spaces where usage does not typically exceed that of residential users. There are 25 non-residential users with activities such as food preparation where the usage would be expected to exceed that of residential users. As the basis for the flow per EDU is the overall system usage, the higher flow from these users is captured in the average flow calculation and, if anything, this produces a more conservative flow estimate for the other non-residential users. Section B.6.b of the 2014 Design Standards does not state that separate flow estimates for non-residential users should be determined, only that water usage data should be from "existing and similar facilities", which is met through the use of the overall system water usage data.*

As noted above, a water meter replacement project for the Village of Millerton is currently underway. During this project, all of the existing water meters will be replaced with new meters. Once the new meters are installed, precise flow estimates can be obtained on a parcel by parcel basis. For the purpose of this report, the EDU flow estimates have been used. However, it is anticipated that actual flows for each sub-area will be less than the EDU method flow estimates and thus it is recommended that the flow estimates presented in this report are re-evaluated following completion of the flow meter replacement project and prior to final design of a wastewater system.

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Peak Flow Considerations

Several peak flows should also be considered when discussing the design flows of wastewater treatment systems including the anticipated peak hourly flow and the anticipated peak daily flow. Figure 3.1 provides the 10 States Standards (10 SS) peak hour peaking factor computational methodology. Assuming the entire wastewater service areas serve 90% of the Village population (a population of approximately 900, see Section 1.3.1), the peak hour peaking factor is 3.8. Applying the total estimated average daily flow of 149,000 gpd produces a peak hourly flow of up to 566,000 gpd if all sub-areas were serviced. Note that as the service area increases, the peaking factor is predicted to decrease. This calculation does not account for inflow and infiltration (I&I), which would not be expected for a newly constructed sewer system, regardless.

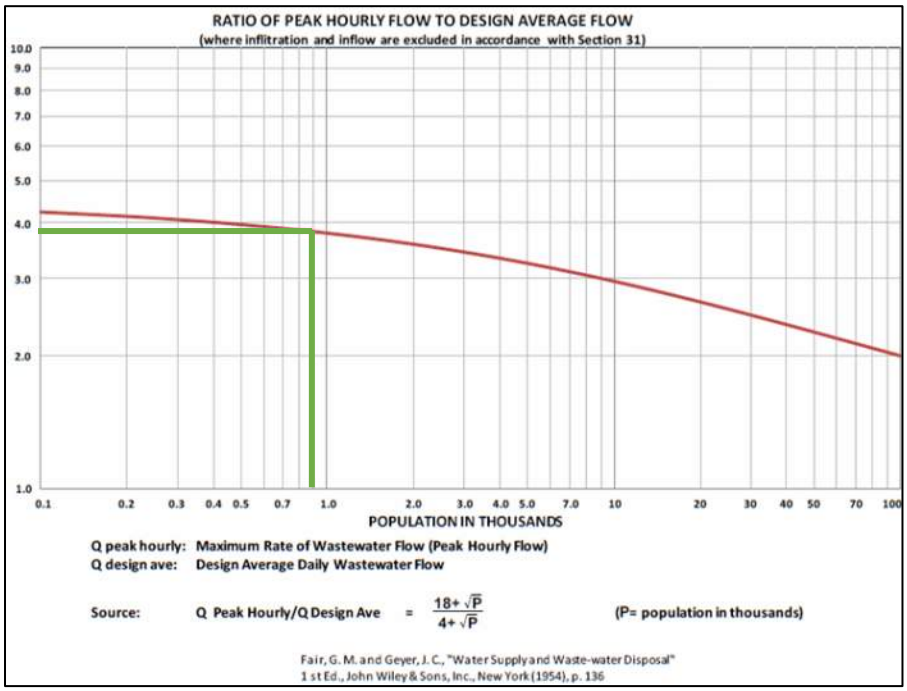

FIGURE 3.1
Ten States Standards Peak Hour Factor Calculation

Figure 3.2 below provides the American Society of Civil Engineers (ASCE) Manual of Practice No. 9 Sewer Design and Construction (MOP 9) daily peaking factor curves. The estimated average daily flow of 149,000 gpd produces a maximum day peaking factor of approximately 2.8, which results in a peak daily flow of 417,000 gpd if all sub-areas were serviced.

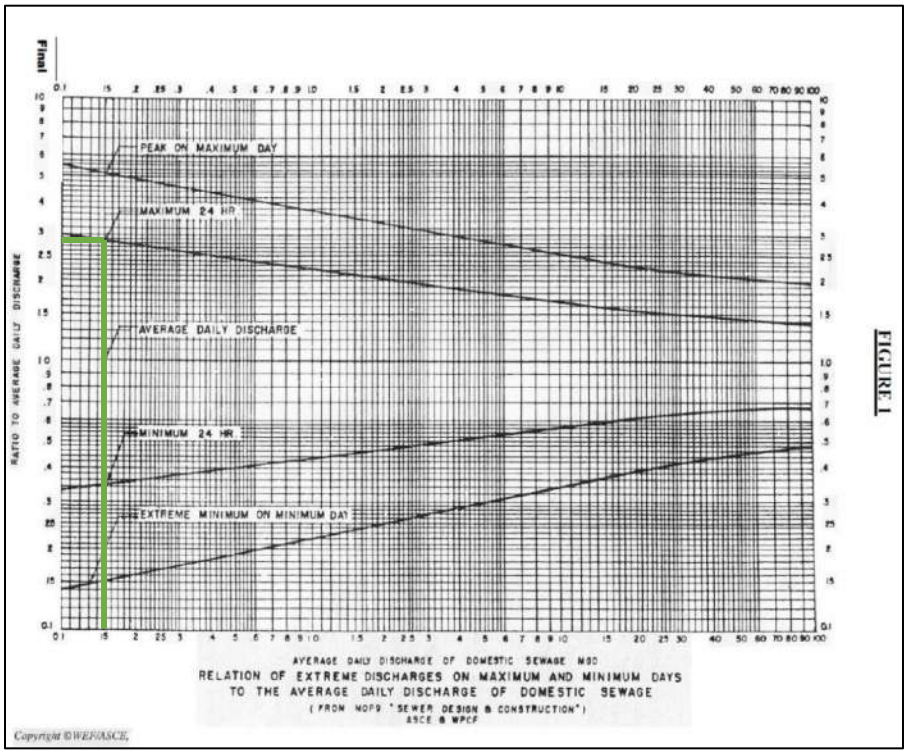

FIGURE 3.2
MOP 9 Daily Peaking Factor Calculation

A summary of the anticipated design flows if all sub-areas were serviced is provided in Table 3.12. It should be noted that the daily peaking factor calculation is intended for conventional treatment systems that may be subject to I&I. A newly installed system will be subject to minimal I&I and therefore would have a much lower peak day flow.

TABLE 3.12 – Anticipated Design Flows for Entire System

Average Daily Flow (gpd)	149,000
Peak Daily Flow (gpd)	417,000
Peak Hourly Flow (gpd)	566,000

3.4.2 Future Flows and Loads*

The design wastewater constituents should be based upon the service area at its full potential. Additional residential and commercial development and high demand businesses such as restaurants in the service area may increase the daily average flows. Additionally, and although this would be a new system, typical practice also accounts for inflow and infiltration as well as prohibited flows into the wastewater system.

For this application, future flows will be considered the other parcels within the water district but outside of the delineated sub-areas as defined in Section 3.1 and shown in Figure A.6. There are 209 parcels outside of the sub-areas, which are mostly residential, consisting of 133 single family, multi-family, or apartment units, 23 commercial units, and 53 vacant parcels. Refer to Appendix E for the EDUs for each parcel; total EDUs for the parcels outside of the sub-areas is 234. The estimated average daily flow for the expanded service using the EDU method is 234 EDUs x 215 gpd/EDU = 51,000 gpd. Applying the

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same peaking factors discussed in Section 3.4.1 to the expanded service area results in an additional peak hour flow of 194,000 gpd and an additional peak daily flow of 143,000 gpd. The anticipated flows for the expanded service area are summarized in Table 3.13.

TABLE 3.13 – Expanded Service Area Anticipated Flows

Average Daily Flow (gpd)	51,000
Peak Daily Flow (gpd)	143,000
Peak Hourly Flow (gpd)	194,000

3.4.3 Discharge Limits

The discharge limits of a new wastewater treatment system will depend on the type of disposal system selected. Generally, subsurface disposal systems do not have as many discharge limitations as a more conventional municipal wastewater treatment plant (WWTP) discharging to a surface water. In New York State, a WWTP discharging to a surface water body or to the subsurface at flows over 1,000 gpd is subject to a NYSDEC State Pollutant Discharge Elimination Permit (SPDES). A new WWTP discharging to a non-intermittent stream such as Webatuck Creek at a flow of 50,000 gpd, for example, would generally be expected to meet the following discharge limits summarized in Table 3.14.

TABLE 3.14 – Anticipated Discharge Limits for Surface Disposal

Wastewater Component	Effluent
pH	6.5 – 8.5 s.u.
Ultimate Oxygen Demand (UOD):	
June 1 – October 31	16 mg/L
November 1 – May 31	27 mg/L
Dissolved Oxygen	7.0 mg/L
Total Suspended Solids (TSS):	
Summer	10.0 mg/L
Winter	15.0 mg/L
Settleable Solids	0.3 ml/L
Total Ammonia Nitrogen (TAN):	
June 1 – October 31	1.24 mg/L
November 1 – May 31	1.81 mg/L
Total Residual Chlorine	0.03 ug/L
Coliforms:	
30 Day Consecutive Geometric Mean	200 mg/L
7 Day Consecutive Geometric Mean	400 mg/L

Conversation with NYSDEC Region 3 indicated that there has typically been no SPDES monitoring limits established for subsurface wastewater disposal regarding many of the constituents typically measured for surface disposal. However, groundwater monitoring will be required by the NYSDEC for discharges to the subsurface for flows greater than 30,000 gpd with an applicable Nitrite limit (as N) of 10 mg/L. Additionally, similar projects have been subject to a Nitrate limit after treatment and prior to disposal of 20 mg/L.

The surface disposal limits presented in Table 3.14 and the subsurface disposal limits for Nitrite and Nitrate presented above have been assumed for the alternative analysis presented herein. Final conversations with the NYSDEC would be required to establish effluent limits during design of a wastewater treatment system based on the selected

treatment and disposal method and verified design flows for the selected service area. As well, these limits may be changed based on the full technical and water quality review of the SPDES application by NYSDEC.*

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Section 4
Alternatives Considered*

4.1 Individual Onsite Wastewater Systems

In portions of the study area, primarily undeveloped areas or large parcels, continued use of individual homeowner septic systems may be appropriate and cost-effective. For example, the areas around Gay Road had no reported wastewater problems and the lot sizes are generally larger. The limited amount of problems in these areas coupled with sufficient sub-surface conditions can support continued use of properly maintained individual septic systems.

The cost to replace a conventional homeowner septic system in its entirety, (septic tank, distribution box, and leachfield) can vary significantly, typically ranging from $5,000 to $20,000, but can be greater depending on family size and site conditions.

The septic system problems identified in the study area can, in many cases, be attributed to small property lots, although small areas of poor soils and shallow groundwater or bedrock may also cause these problems. Where these difficult site conditions exist, continued use of conventional septic systems (septic tanks, distribution boxes, and leachfields) is not expected to provide effective, trouble-free wastewater treatment and would likely require that residents modify use of the property to accommodate their septic systems.

However, upgrades to the individual septic systems may be effective in addressing the isolated problems currently experienced in some of these areas. For example, where septic system failures are the result of high groundwater alone, construction of a "mounded" leachfield, set at a sufficient elevation above the high groundwater level, may mitigate the septic system problems experienced. Again, this is a provided example, since no homeowner reported any leachfield failures resulting from high groundwater.

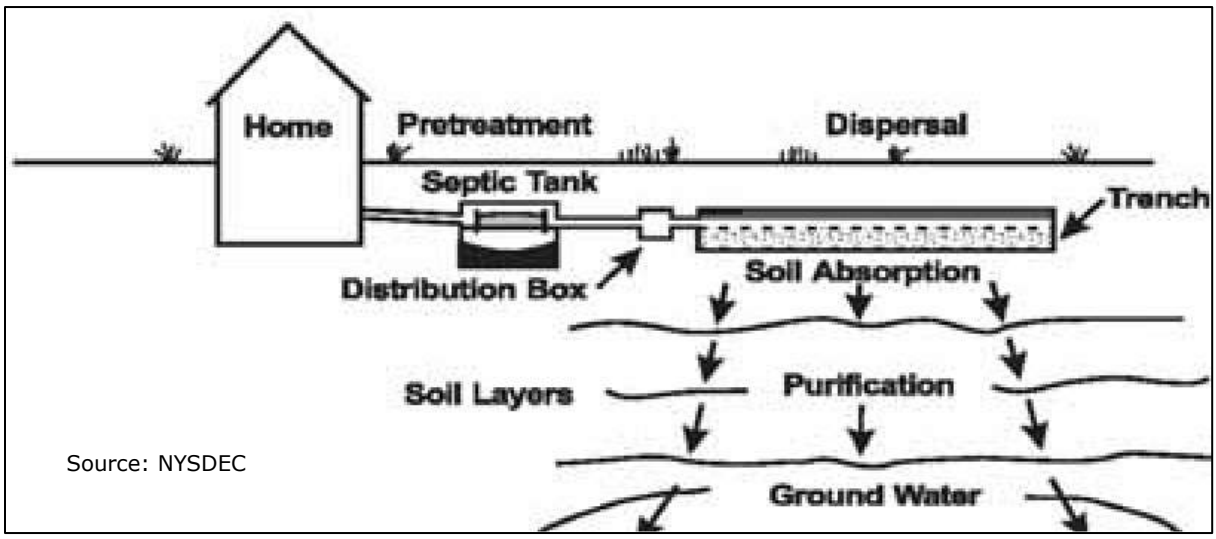

FIGURE 4.1
Typical Residential Wastewater Treatment System

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It is important to note that although siting wastewater disposal fields in areas of very high groundwater (< 2' from the ground surface) is not appropriate, due to the likelihood of the groundwater to surcharge the disposal system causing its failure, individual wastewater disposal fields are not a significant cause of elevated groundwater. In comparison with the effects of precipitation, infiltration, and runoff, wastewater contributes minimally to groundwater elevation.

Alternative technologies for sub-surface wastewater disposal are often considered to upgrade failing septic systems in areas that cannot accommodate conventional systems. Alternative treatment systems provide additions or modifications to one or more of the components of a conventional system, while providing at least an equivalent degree of environmental and public protection. These technologies are generally better at removing solids and other pollutants from wastewater before discharging to the soil absorption system (leachfield), which typically increases the life of the soil absorption system and may make it possible to overcome difficult site conditions.

Most of the alternative onsite treatment systems such as an aerobic treatment system, require mechanical equipment (blowers and/or pumps) to operate effectively and, as a result, require more frequent maintenance than a conventional septic system. Typically, a licensed operator will need to perform annual or biannual maintenance.

The construction cost of a typical alternative individual household septic system is approximately $30,000-$40,000. However, this cost can vary significantly, depending on family size and site conditions, similar to a conventional septic system. The annual operation and maintenance cost of this biological treatment system, including sampling, testing, reporting, electricity, and facility maintenance, is estimated at approximately $1,000 per year.

On parcels with small lot sizes and reported wastewater problems, upgrades to septic systems are not expected to be effective in correcting current wastewater disposal problems due to the lack of area for an individual treatment system. Because upgrades to individual septic systems alone are not expected to be sufficient for the entire Village, other wastewater system improvements have been considered in the following Sections.

4.2 Wastewater Collection Systems

A wastewater system consists of three components; the collection system, the treatment system, and the disposal system. Each component of a wastewater system has several different methods and technologies available. The relevant collection system methods for the Village of Millerton are discussed below and the treatment and disposal options are discussed in the Sections to follow.

4.2.1 Conventional Gravity and Pumped Collection Systems

A conventional collection system consists of PVC piping installed by an open trench method. This involves removing pavement or sod on the ground surface, excavating to depths of 5 – 12 feet (typically, but can be deeper) installing crushed stone bedding, installing rigid PVC pipe, and backfilling and repairing the disturbed surface. Gravity piping must be installed carefully to maintain a constant downward slope. Access for inspection and cleaning is by pre-cast concrete manholes spaced approximately every 250 feet. Generally, the smallest gravity main is no less than 8-inches with a minimum slope of 0.4%.

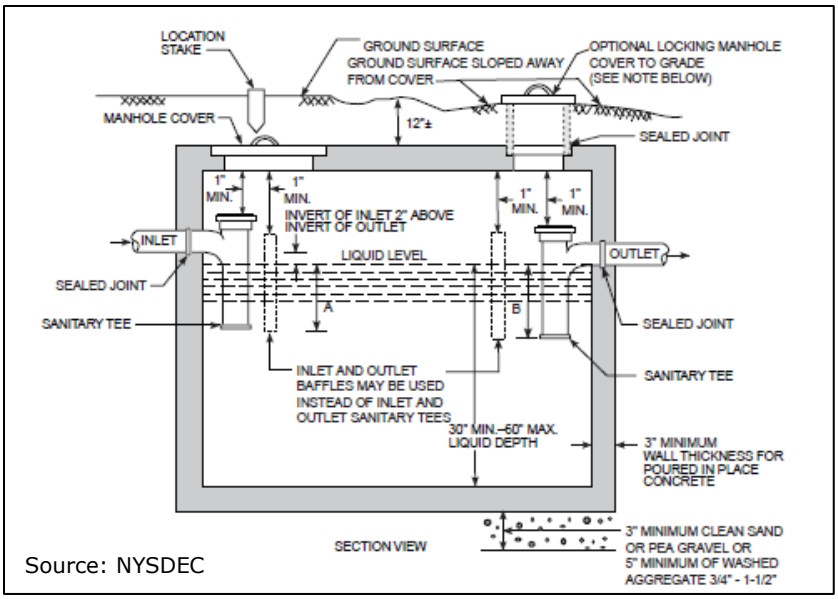
Gravity systems are appropriate when there is sufficient grade to ensure required pipe slopes. However, since maintaining slope is vital to these systems, open trench construction is necessary. Open trench construction in shallow cross-country routes with sufficient space and only requiring loaming and seeding for repair can be very cost effective. Open trench construction through well trafficked paved areas can have expensive restoration costs.

Where site conditions and topography do not allow for conveyance to the treatment site, gravity piping will discharge to a pump station. Conventional pump stations typically consist of a pre-cast concrete wet well with two submersible wastewater pumps. Pump stations discharge to a smaller diameter forcemain. The minimum sanitary forcemain diameter is typically 4-inches and the pumps must maintain a flow velocity of 2 fps. Sanitary forcemains must have clean out structures every 400 – 500 feet and may require air release structures at high points.

Rather than pumping stations, grinder pumps may be used to convey untreated wastewater directly from a buildings sewer into the collection system. This option requires a grinder pump at each household but is often a good option if site conditions and topography don't allow for gravity lines.

4.2.2 Alternative Collection Systems

A significant difference between conventional and alternative collection systems is the use of septic tanks. Septic tanks are typically plastic or concrete tanks which detain raw wastewater discharge from a building service. The tank is baffled which allows solids to settle to the bottom of the tank, and floatable material to form a scum layer at the top of the tank. Waste in the tank are decomposed by aerobic digestion. Wastewater leaving the tank (septic tank effluent) is of improved quality as solids remain within the septic tank. Septic tanks must be pumped regularly (typically every 3 – 7 years) or solids will build up in the tank and discharge in the effluent. A typical septic tank schematic is shown in Figure 4.2.



Source: NYSDEC

FIGURE 4.2
Typical Septic Tank

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While conventional wastewater collection systems convey raw wastewater, alternative collection systems typically convey septic tank effluent. Septic tank effluent alternatives include both gravity and pressure collection systems, including:

Septic Tank Effluent Gravity Systems

Septic tank effluent gravity systems (STEG) use small diameter gravity collector lines to convey septic tank effluent to a treatment location. These gravity lines have a minimum diameter of 4-inches and no minimum slope but typically have a minimum velocity of 0.5 fps. Gravity lines have the advantage of not requiring any power to operate and will continue to provide appropriate wastewater service even in cases of electricity outages.

Septic Tank Effluent Pumps

Low pressure sewers consist of smaller diameter forcemains through which sewer flow is pumped. Septic tank effluent pumps (STEP) force wastewater through the main regardless of pipe slope. Low pressure sewers can be installed by conventional open trench methods, but smaller diameter piping can also be installed by directional drilling. Directional drilling utilizes exit and entry pits, and access for service connections, but does not disturb the ground surface over the entire pipe length, significantly reducing restoration costs. The minimum diameter for low pressure sewer piping is 2-inches and there are no minimum slope requirements. Individual effluent service lateral lines may be as small as 1.25" in diameter. Similar to conventional sanitary sewer forcemains, low pressure sewers must have regular clean out structures every 500 to 1,000 feet and will require air release valves at high points. Effluent pumps will be sized for parcel flow, typically 50 gpm minimum for residential homes, and two pumps will be provided at each septic tank for redundancy. Septic tanks and effluent pumps will be located on each parcel, except where space is limited multiple parcels may discharge to a single septic tank.

A schematic of STEG and STEP systems is shown in Figure 4.3.

FIGURE 4.3
Typical STEG and STEP System Schematic

4.3 Wastewater Treatment Systems

4.3.1 Conventional Treatment Systems

Many larger communities have "conventional" wastewater treatment systems which generally consist of the following components:

- Primary treatment for the removal of solids;
- Secondary treatment which typically consists of biological treatment for the removal of additional contaminates;
- Tertiary treatment for further removal of contaminants by biological, chemical, or physical means;
- Disinfection by chemical treatment or by UV light, and;
- Return to a surface water body.

Since most wastewater treatment systems were built for large municipalities, extensive centralized systems were justifiable due to the significant flows requiring treatment and the site constraints faced by densely developed communities. However, a conventional system may not be the best match for a smaller, rural community such as Millerton.

There is strong interest in many smaller communities about alternative technologies for wastewater treatment; however, considering the significant cost burden it takes a small community to implement any wastewater treatment system, there is a tendency to utilize the 'tried and true' approach of a conventional system. Unfortunately, a conventional system has energy, economic, and environmental impacts that place additional cost burdens on small communities.

One of the most significant disadvantages of a conventional wastewater treatment system for small communities is solids handling. Conventional wastewater treatment systems typically consist of screening for large solids removal, comminutors, large above ground settling basins to remove the remaining solids, pumps to remove the collected solids, digesters to further break down sludge or mechanical dewatering devices and then loading facilities for trucking to conventional landfills. These components are generally expensive to build and operate especially at a small scale. From a technical standpoint, sludge removal, collection, and disposal are one of the most significant challenges to any wastewater treatment system. When considering the economic scale of small community systems, successfully addressing sludge management is vital.

For proper operation, conventional wastewater treatment facilities require a full time licensed operator and generally at least one other trained staff member. Due to the size of the Village, associated costs, and staffing requirements of a conventional wastewater treatment system, an alternative treatment system is recommended for the Village of Millerton in leu of a conventional wastewater treatment system.

4.3.2 Water Resource Recovery Systems

Water Resource Recover Systems are alternative treatment systems that typically include:

- Use of individual septic tanks for solids removal and primary treatment;
- Use of several treatment locations for one community;
- Packaged modular secondary/tertiary biological treatment units located at a regional location near denser development/neighborhoods, and;
- Subsurface disposal systems.

FIGURE 4.4
Alternative Treatment System in Dix Hills, NY

4.3.3 Treatment System Comparison

There are several differences between the conventional treatment systems and water resource recovery (WRR) treatment systems. The significant differences include:

- Sludge Management
- Piping Costs
- Operation & Maintenance

As discussed in Section 4.3.1, one of the most challenging aspects of a conventional wastewater treatment system is solids handling. However, with many WRRS treatment systems, solids removal occurs at each parcel or a combination of a few parcels. This allows typical residential septic tank pumpers and haulers to handle solids removal and disposal. Typically, the community is responsible for all maintenance of septic tanks, ensuring that efficient solids removal is occurring.

By removing solids before the wastewater is conveyed to a treatment location, a wastewater collection system can be sized at a smaller diameter, lowering installation costs. For instance, gravity lines can be reduced to 4-inches where an 8-inch diameter is normally required, and pressure lines can be reduced to 2-inches where 4-inches would normally be required.

However, septic tank effluent systems that utilize pumping may be difficult to manage during power outages. Frequently, a home with no municipal wastewater services has no municipal water service either. Thus, if a power outage occurs, the well is without power, as well as the wastewater system pump. If a home has a generator, it typically will be sized to accommodate the well pump, as well as the wastewater pump, also avoiding a conflict. However, if a home that has municipal water service, which typically remains unaffected by power outage, also has septic wastewater pumps as part of an alternative collection system, there may be a continued source of wastewater, with no means of wastewater pumping during a power outage.

If a sustained power outage lasted for several days, the municipality would need to pump each septic tank into the collection system. For a conventional collection system, this would require simply providing emergency power at a central pump station, rather than requiring service at many individual systems. Both conventional and alternative systems that utilize gravity collection avoid these problems. All treatment systems, conventional and alternative, require emergency power at the main treatment location.

In general, conventional wastewater treatment facilities are treating higher flows, and have more complex treatment systems due to on-site sludge management. For proper operation, conventional wastewater treatment facilities require a full-time licensed operator and generally at least one other trained staff member. WRR systems typically treat smaller flows and have simpler treatment systems; thus, staffing is usually part time.

Due to the size of the potential service district, the anticipated daily flows, the status of septic systems in the Village, and relative costs, further consideration of WRR systems is appropriate for the Village. Additional information regarding alternative treatment technologies have been presented in the following Section.

4.3.4 Water Resource Recovery Technologies

A water resource recovery system accomplishes treatment in two locations; primary treatment occurs in the on-site septic tanks, and secondary treatment which occurs at a site where the flow has been collected.

Treatment efficiency for small systems is generally characterized by their efficiency at removal of organic constituents and solids. The most commonly used parameter to define the organic strength of municipal wastewater is biochemical oxygen demand (BOD). BOD is the quantity of dissolved oxygen utilized by microorganisms in the aerobic oxidation of the organic matter in wastewater over a period of time. The depletion of dissolved oxygen in wastewater is directly related to the amount of organic matter present in the wastewater.

The quantity of solids in wastewater is typically expressed as total suspended solids (TSS). Suspended solids are those removable by filtration or settling. Wastewater may also have quantities of dissolved solids, which require additional treatment for removal.

Another parameter used to gauge the strength of wastewater is nitrogen. Common forms of nitrogen are ammonia, nitrite, and nitrate. Large quantities of nitrogen in wastewater returned to a water body can cause growth of algae. Ammonia is considered a serious water pollutant as it is toxic to fish. Nitrate can easily pass through the soil to the groundwater, where it can accumulate to high levels over time, potentially contaminating drinking water sources.

Typically, a permit for subsurface wastewater discharge for flows above 1,000 gpd will have limitations set for nitrogen. Typical individual disposal system absorption fields remove little or no nitrogen from the septic tank effluent. Primary treatment by a traditional septic tank is effective at removing quantities of BOD and TSS and some nitrogen species. Table 4.1 below provides typical septic tank influent and effluent concentrations.

TABLE 4.1 – Typical Septic Tank Influent & Effluent Concentrations

Parameter	Influent Concentration	Effluent Concentration
BOD	350 mg/l	150 mg/L
TSS	400 mg/l	60 mg/L
TKN	300 mg/l	60 mg/L
NH_3-N	70 mg/l	50 mg/L
FOG	150 mg/l	20 mg/L

There are many suitable water resource recovery technologies available for wastewater treatment. However, there are minimum criteria that each system must meet, including:

- Ability to meet regulatory effluent limits, and;
- NYSDEC Region 3 familiarity with the system and past approval.

WRR system technologies that have not been previously approved by the NYSDEC for a community application will have a much longer review period and have a significant chance of delaying project schedule. Therefore, for the purpose of this evaluation, technologies that have not been previously installed for a community application were eliminated from further consideration.

Table 4.2 summarizes the treatment systems that were considered for Millerton but were not analyzed.

TABLE 4.2 – Treatment Systems Not Analyzed

Treatment System	Reason(s) Not Considered
Conventional Activated Sludge WWTP	• Complexity • Inappropriate size • Construction costs • Staffing requirements • O&M requirements
Packaged Steel WWTP	• Complexity • Longevity concerns • O&M requirements

Cluster Treatment Systems	• Few locations available for clusters
Alternative Individual Onsite Treatment Systems	• O&M requirements and costs • Does not address concerns with reserve area

Two of the most appropriate WRR technologies for the Village of Millerton investigated as part of this report include:

- Membrane Bioreactor Treatment System - Ovivo microBLOX
- Biofiltration Treatment Systems - Orenco AdvanTex

Membrane Bioreactor System - Ovivo microBLOX

Membrane bioreactors (MBR) combine biological oxidation of the activated sludge process with membrane separation. MBR systems treat wastewater through aerobic digestion and membrane filtration. This allows both to occur in a single unit operation and eliminates the need for large settling tanks required in a conventional treatment system. Air is introduced into the tank housing the membranes which provides oxygen for the biological process, mixes the tank, and scours the membranes to reduce fouling.

The Ovivo microBLOX MBR is a packaged system designed to be simple to operate and with options ranging from initial solids removal through disinfection. The packaged system includes a small waste activated sludge holding tank (WAS), however, this can be increased to store additional sludge or a separate sludge holding tank is often constructed to reduce the frequency of sludge removal. The MBR system would require construction of a building to properly winterize the MBR units and other components. Effluent pH control and dissolved oxygen systems would also be required to meet the anticipated effluent parameter limits for surface discharge. In addition, an equalization tank can be added to the system to equalize the influent flows and loadings. A standard Ovivo microBLOX packaged unit is shown in Figure 4.5.

FIGURE 4.5
Ovivo MicroBLOX System

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Ovivo has single unit systems capable of treating average flows of up to 150,000 gpd and multi-unit systems capable of treating flows of up to 500,000 gpd. Figure 4.6 shows the simplified process flow diagram for a single Ovivo microBLOX system and Table 4.3 shows the typical reported effluent quality achieved with Ovivo's microBLOX systems:

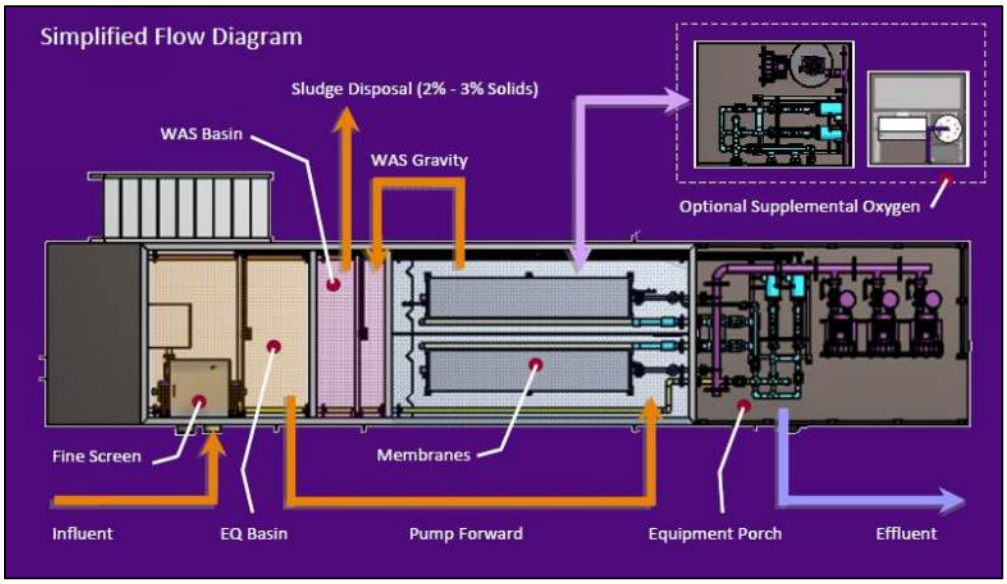

FIGURE 4.6
Ovivo MicroBLOX Simplified Process Flow Diagram

TABLE 4.3 – Ovivo MicroBLOX Typical Effluent Concentrations

Parameter	Effluent
BOD_5	<2 mg/L
Total Nitrogen (TN)	<3 mg/L
Ammonia (NH_3)	<0.3 mg/L
Total Phosphorus (TP)	< 0.03 mg/L
Fecal Coliform	< 2.2 CFU/100 mL
Total Suspended Solids (TSS)	< 2 mg/L

For an average day flow of 75,000 gpd, a dual-tank system with one tank for the MBR and one tank dedicated to flow equalization and WAS storage would be required to treat the flows and meet the effluent requirements. Approximately 4,500 square feet of building space to house the units would be required. Additional membranes and the addition of a supplemental oxygen system could be added to the system to achieve a greater treatment capacity should the wastewater service area be expanded. Supplemental information about the Ovivo microBLOX units can be found in Appendix F.

The Ovivo microBLOX packaged systems have been installed in over 200 applications across the country including over 40 units in Massachusetts. A similar system was approved and installed within NYSDEC Region 3 at the Storm King School in Cornwall.

Biofiltration Systems - Orenco AdvanTex

The Orenco AdvanTex Wastewater Treatment System is a packed bed biofiltration system that uses lightweight synthetic textile to treat septic tank effluent. The textile media has a high porosity and large surface area for microbial attachment and high loading rates. The septic tank effluent is sprayed onto the textile media and percolates down where it is filtered and treated by microorganisms that populate the textile. There are several AdvanTex models available, which range in size and flow capacity. An image of the AdvanTex AX-Max treatment units prior to backfill is shown in Figure 4.7.

FIGURE 4.7
Orenco's AdvanTex Units (AX-Max Models Shown)

Primary tankage is supplied to receive the influent flow and provides two functions including equalization and acting as pre-anoxic tanks. Pumps are installed in the primary tankage which distribute the flow to the biofiltration treatment units. The wastewater percolates down through the media where it is filtered, cleaned, and nitrified by the naturally occurring microorganisms that populate the media. Aeration is provided at each of the treatment units and after passing through the media, the treated effluent flows out of the units to a final effluent tank for a subsurface disposal system. The treated effluent typically enters a second stage for polishing for surface disposal systems. In either scenario, the flow from the effluent tank is dispersed by gravity or is pumped to the disposal location. A calibrated portion of the treated wastewater is also sent back to the pre-anoxic tanks to pass through the system again. A post anoxic tank is typically incorporated into surface disposal systems for denitrification between the first and second stages. Figure 4.8 represents a simplified system layout for the Orenco AdvanTex System for a subsurface disposal system.

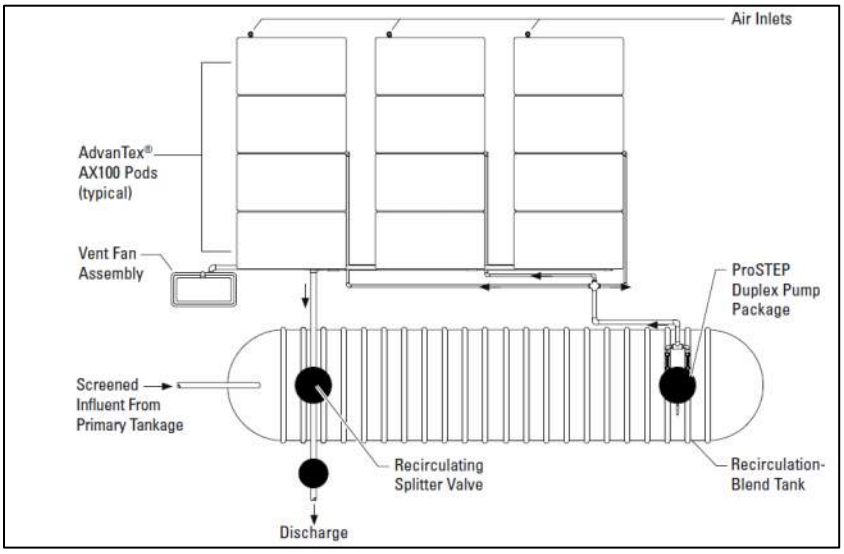

FIGURE 4.8
Typical Orenco AdvanTex System Layout for Subsurface Disposal

Table 4.4 shows the typical reported effluent quality achieved with the Orenco AdvanTex System:

TABLE 4.4 – Orenco Treatment System Typical Effluent Concentrations

Parameter	Effluent
BOD_5	< 15 mg/L
Total Nitrogen (TN)	< 20 mg/L
Ammonia (NH_3)	N/A
Total Phosphorus (TP)	N/A
Fecal Coliform	N/A
Total Suspended Solids (TSS)	< 20 mg/L

An Orenco treatment system sized for 75,000 gpd with a subsurface disposal system would consist of approximately one influent equalization/pre-anoxic tank, ten treatment tanks, one effluent tank, and the associated pumps, equipment, and controls.

An Orenco treatment system sized for 75,000 gpd with a surface disposal system would consist of approximately one influent equalization tank/pre-anoxic tank, ten stage 1 treatment tanks, one post anoxic tank, one effluent tank, five stage 2 treatment tanks, and the associated pumps, equipment, and controls. These systems are NSF/ANSI Schedule 40 approved for residential wastewater treatment systems. More information on the Orenco AdvanTex systems can be found in Appendix F.

The Orenco AdvanTex Systems are installed in over 75 residential applications and in several municipal locations in New York including the communities of:

- Hyde Park – 120 Service Connections – 30,000 gpd – Surface Return
- Hillsdale - 73 Service Connections – 35,000 gpd, - Subsurface Return

- East Schodack – 23 Service Connections – 7,500 gpd – Surface Return
- Schodack Landing – 75 Service Connections – 20,000 gpd – Surface Return
- Bethlehem – 23 Service Connections – 7,500 gpd – Surface Return

4.4 Water Resource Recovery Return

Two alternatives exist for water resource recovery return of the treated effluent;

- Return to a surface water body, or;
- Return to groundwater.

4.4.1 Return to Surface Water

The method of a conventional community wastewater treatment facility that can also be utilized by alternative water resource recovery systems is to return to a surface water body, which was historically accomplished by piping the treated wastewater effluent to a concrete headwall, where it flows by gravity into the surface water. For the Village of Millerton, the surface water body for water resource return is Webatuck Creek.

Return to surface water requires disinfection, which can be accomplished two ways; by chemical means, or by UV light. Chemical disinfection requires multiple sets of pumps for chlorination and dechlorination chemicals, on-site storage of these chemicals which can be hazardous to employees and the environment, delivery of monthly chemical supplies through local streets, frequent water testing to ensure effectiveness of disinfection, and subsequent removal of disinfection chemicals.

UV disinfection is accomplished by exposing the treated wastewater to very high doses of ultraviolet light. It does not require the use of chemicals but is a system higher in capital costs and has significant energy usage impacts. UV disinfection also requires frequent water quality testing. Both disinfection methods would require the construction of a building to house the processes, an additional capital cost.

4.4.2 Return to Groundwater

There are several different options for water resource return to groundwater. The most widely used conventional groundwater systems include absorption fields (leachfields) which can be configured as trenches or beds. Other methods include drip dispersal systems or gravelless geotextile sand filters, which may also be applicable for the Village of Millerton. All three options are discussed in the following sub-sections.

Absorption Fields

Water resource return to groundwater is typically accomplished using absorption fields, especially for smaller systems. However, absorption fields can also be used for larger systems if the space is available. There are generally two types of absorption fields; absorption trenches and absorption beds. The trench is the most common and preferred of the two options and consists of a trench or series of trenches in which a perforated PVC pipe is placed in a bed of gravel or synthetic aggregate. Sewage is delivered to the PVC pipes by gravity, pressure, or by dosing and seeps slowly out of the perforated PVC pipe, into the aggregate, and finally into the soil. A typical trench absorption field utilizing perforated PVC pipe and gravel aggregate is shown in Figure 4.9.

FIGURE 4.9
Typical Trench Absorption Field Under Construction

In lieu of perforated PVC pipes, infiltration chambers can also be used in trenches. Infiltration chambers are similar to conventional trench absorption fields except that the perforated PVC pipes are replaced with high-density polyethylene arches that interlock to form a continuous drainage area with a much greater storage volume than a PVC pipe-in-gravel system. The infiltration chambers have an open bottom which allows the sewage to seep into the ground. With the infiltration chambers, sewage has more time to percolate slowly and effectively, ensuring greater strength, performance, and longevity. Using infiltration chambers in lieu of perforated PVC pipes may allow for a smaller drainage field size compared to pipe-in-gravel trenches. Infiltration chambers can also be installed without an aggregate if soil conditions allow. However, aggregates are typically used regardless for best practice, particularly for higher flow systems. Infiltration chambers can be gravity fed or pressurized.

Absorption beds (also referred to as seepage beds) are similar to trenches in that they also utilize perforated PVC pipes or infiltration chambers and an aggregate. The difference between absorption trenches and absorption beds is that for beds there is no native soil that separates the rows of PVC pipes or infiltration chambers; rather, the pipes or chambers are all placed in a common bed of aggregate. Trenches are preferred over beds because beds have very little sidewall area and lower oxygen transfer. Beds are also better suited for pressure systems and for flat sites in order to minimize the potential groundwater mounding and/or down gradient seepage. A bed absorption field utilizing infiltration chambers and gravel aggregate is shown in Figure 4.10.

FIGURE 4.10
Seepage Bed with Infiltration Chambers Under Construction

When absorption fields are used for treatment (such as with conventional septic tanks and leachfields), it is anticipated that microorganisms in the soil assist in removal of any remaining organic matter, solids, and nutrients. When absorption fields are used after secondary treatment, they are primarily intended for return of the treated effluent into the ground. In this case, a 33% increase in application rate is allowed when a "Responsible Management Entity" owns the treatment system such as a municipality (Appendix 75-A.6(6)(ii)(d)). Therefore, it has been assumed for the remainder of this report that the Village of Millerton would qualify as a responsible management entity and that a 33% increase in application rate would be appropriate, provided that secondary treatment is supplied.

In general, the subsurface return of treated effluent avoids the significant costs and maintenance concerns associated with disinfection. Subsurface return is considered by regulators as having lower environmental impacts, as it allows recharge of the water table rather than return to a surface water body where it is immediately removed from the watershed. The absorption fields also have no visual impact on the surrounding community. Additionally, subsurface return allows for much less licensed operator involvement and water quality testing. However, subsurface return requires significant area for the disposal field, which may not be available within every community.

Drip Dispersal Systems

Subsurface drip dispersal technologies apply recovered water to the root zone using perforated small diameter piping or porous diffusers, typically placed 6 to 12 inches below the soil surface (minimum of 18 inches in cold climates such as New York). This technology has been successfully used in the northeast for several years and has been accepted as a reliable method of wastewater disposal. Drip dispersal systems are often used in areas where marginal or shallow soils are found. Figure 4.11 shows a typical drip dispersal system under construction.

FIGURE 4.11
Drip Dispersal System Before Backfill

Drip dispersal subsurface systems consist of a pre-treatment unit, a pump tank, filtration system, subsurface drip tubing, and a controller. Primary settling or septic tank treatment is the minimum level of pre-treatment necessary for a drip dispersal system. Additional pre-treatment to remove specific pollutants, such as FOG, which may adversely impact the soil or receiving environment or foul the drip dispersal system may be necessary.

For drip dispersal systems, the pump tank stores effluent until the controller turns on the pump to dose pre-treated wastewater through a filtering system into the soil. The filtration system removes solids from the effluent and flushes them back to the pretreatment device. Drip tubing is placed directly into the soil without the use of trenches. The system relies on specially designed emitters to apply effluent uniformly.

Drip tubing is typically placed approximately 2' apart in the landscape so emitters are on a grid pattern within the existing landscape. Drip lines are buried relatively shallow so the soil can provide treatment, landscape plants can use the nutrients and water, and the system can maximize evaporation. A typical drip dispersal layout is shown in Figure 4.12.

A benefit of the drip dispersal systems is that they require minimum backfill compared to traditional leachfields thus cutting down on excavation costs for installation. Drip dispersal systems also have controls which allow for monitoring of the system performance. The drip dispersal system allows the water to very slowly disperse into the ground over a larger area and does not require gravel placement.

One of the disadvantages of a drip dispersal system compared to a standard absorption field is that they are more maintenance heavy. The drip dispersal system needs to be monitored, cleaned, and filters changed on a regular basis for efficient operation. There is also greater risk associated with a drip dispersal system if the dispersal tubing becomes fouled due to a failed filter, or lack of maintenance.

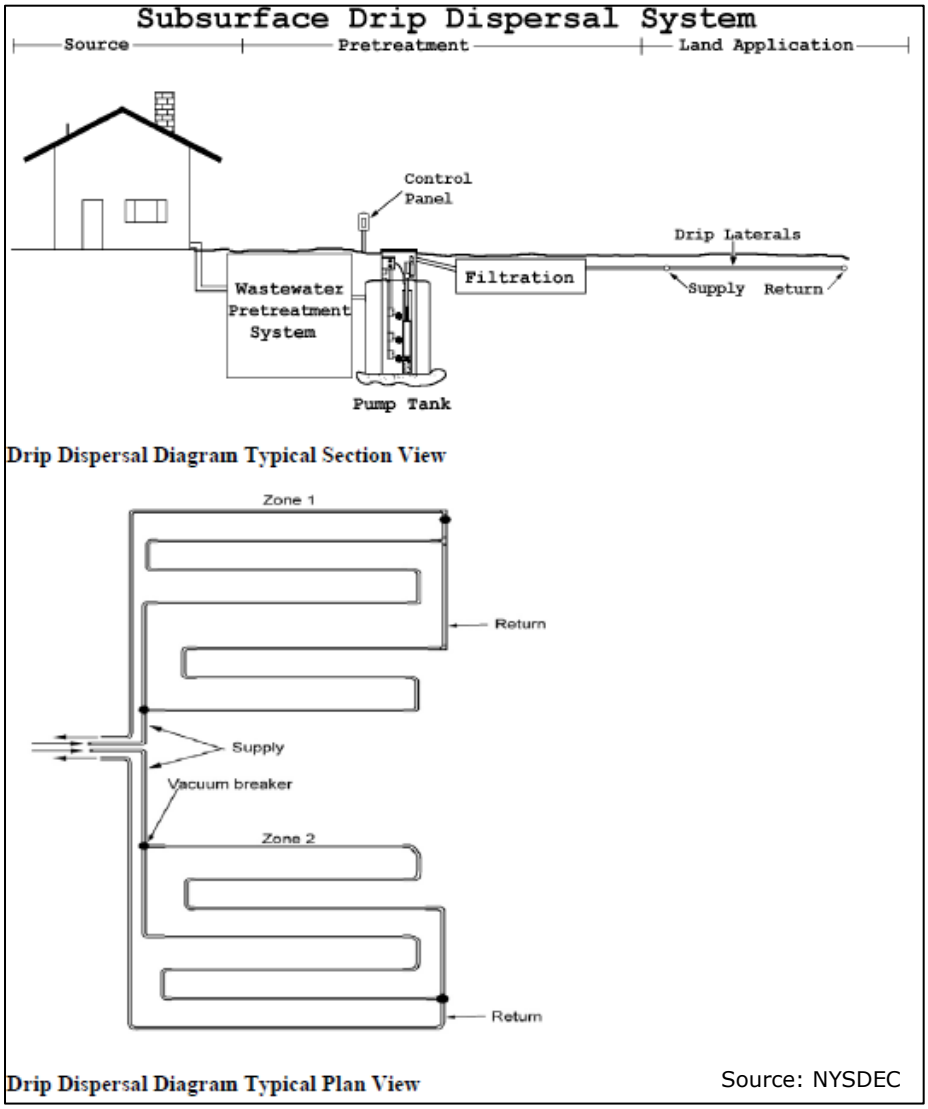

FIGURE 4.12
Typical Drip Dispersal System

Similar to conventional absorption fields, drip dispersal requires a significant area for the disposal field. The design of drip dispersal fields must meet the same design standards as a conventional absorption field. Therefore, there is no distinct advantage of a drip dispersal system in terms of reduced field area compared to a conventional absorption field. The advantage for using a drip dispersal field comes when a particular site has marginal soils, a shallow depth to a restrictive layer, or high groundwater. If a site does not have one of these conditions, then a conventional absorption field is preferred.

Gravelless Geotextile Sand Filters

The use of gravelless absorption systems is becoming more common as the technology is easier to install compared to more traditional absorption fields and also provides distinct advantages at certain sites. There are several types of gravelless absorption systems including open-bottom gravelless chambers/galleys, gravelless media-wrapped corrugated pipe sand-lined systems, and gravelless geotextile sand filters.

Gravelless geotextile sand filters (GGSF) are similar to conventional absorption trench systems but consist of a geotextile wrapped "unit" surrounded by system sand instead of a single pipe surrounded by gravel aggregate. There are several manufacturers of GGSF products which vary slightly from one manufacturer to the next, but each generally consists of a perforated pipe surrounded by or placed on top of a synthetic aggregate or media which is then contained around the diameter of the pipe or covered by a geotextile fabric. The unit(s) are placed in a 4 foot wide trench and are surrounded by 6 inches of system sand below and on the sides of the unit(s).

In accordance with NYSDEC design standards, a trench bottom sizing criteria of 6 square feet per linear foot of trench may be used for the design of GGSF systems provided that the GGSF product has an overall unit width of 3 feet, a storage capacity of 12 gallons per linear foot, and six inches of system sand is installed below and on the sides of the unit(s). The GGSF systems must have a minimum of 4 foot edge-to-edge trench separation. An example of a gravelless geotextile sand filter trench system (manufactured by Infiltrator) is shown in Figure 4.13.

FIGURE 4.13
Gravelless Geotextile Sand Filter Trench System (by Infiltrator)

4.5 Potential Treatment System Locations

Determining the correct siting for a wastewater treatment system is challenging. However, the use of alternative treatment technologies, with their low visual, audio, and odor impact, allow for a much greater number of sites to be considered.

4.5.1 Initial Parcel Screening

For the purpose of this evaluation, only parcels owned by the Village of Millerton were considered for potential wastewater treatment system sites. The potential wastewater treatment system sites which are owned by the Village are shown in Figure A.8. As shown in Figure A.8, there are 11 parcels owned by the Village. Six of the parcels were eliminated based on initial review as indicated below in Table 4.5.

TABLE 4.5 – Potential Locations and Initial Parcel Screenings

Parcel	Location	Status
1	North of Millerton Recreation Park	Eliminated, slopes greater than 15%
2	Millerton Recreation Park	Eliminated, recreation park
3	Off Highland Street	Eliminated, village water tower
4	Dutchess Ave & Simmons St	Eliminated, village offices/police
5	Main St & Dutchess Ave	Eliminated, village park on Main St
6	Near Irondale Cemetery	Eliminated, wetlands
7	Town Highway Garage	Potential Site
8 - 11	Mill Street Site	Potential Site

After initial screening, there are two remaining sites which are potentially suitable for an alternative wastewater treatment system. They are referred to as the Town Garage Site and the Mill Street Site for the remainder of this report. Figure 4.14 shows the two site options with an overlay of the flood zones and wetlands and Figure 4.15 shows the topography at each of the sites. Each of the two sites are described in further detail below:

Town Garage Site

The Town Garage Site is 1.1 acres and is at the corner of South Center Street and Mill Street. The Village has indicated that the town garage will be relocating, and the property will be turned over to the Village of Millerton. The lot is bordered to the west by Webatuck Creek and is mostly within the 100-year flood zone as shown in Figure 4.14 except for the northernmost part of the parcel. The lot is cleared and contains one large building that is currently used by the Town Highway Department. There are residential properties bordering the north, east, and west sides of the property. The site is mostly level but slopes down slightly from north to south. The Webatuck Creek runs along the western property border. The property is in the high density residential and land conservation zoning districts.

Mill Street Site

The Mill Street Site is a cluster of four parcels owned by the Village of Millerton on the south side of Mill Street. The total size of the Mill Street Site is 8.9 acres. Current access to the property is at the corner of South Center Street and Mill Street. Village staff have indicated that there is also a right-of-way to the property off South Maple Avenue that is overgrown and no longer used. The location of the right-of-way is shown approximately on Figures 4.14 and 4.15.

The Webatuck Creek runs along the north side of the site. The north half of the lot is wooded and rises up steeply to the south from Webatuck Creek. The south half of the lot is mostly cleared, overgrown pasture which slopes down to the northwest towards Webatuck Creek. The lots are primarily medium density residential zoning districts, however portions of the lots along Webatuck Creek are in the land conservation zone.

Overall, the Mill Street site is relatively isolated from nearby residential houses; the closest of which is off Maple Avenue. As with the Town Garage Site, the north portion of the Mill Street Site is within the 100-year flood zone as shown on Figure 4.14.

One benefit of the Mill Street site is that there is a large vacant parcel immediately to the south. This parcel is 27.7 acres and has access from Sharon Road. Approximately 5 acres of this parcel is already cleared. This lot also generally slopes down to the northwest towards Webatuck Creek.

Given the potential need for treatment capacity, the Village initiated preliminary conversations regarding parcel acquisition with the owner of the vacant parcel. It was determined by all parties that a suitable path may exist for future Village ownership of the vacant parcel, and therefore the alternative analysis may base its assumptions on the Village acquiring the vacant parcel, or portions thereof.

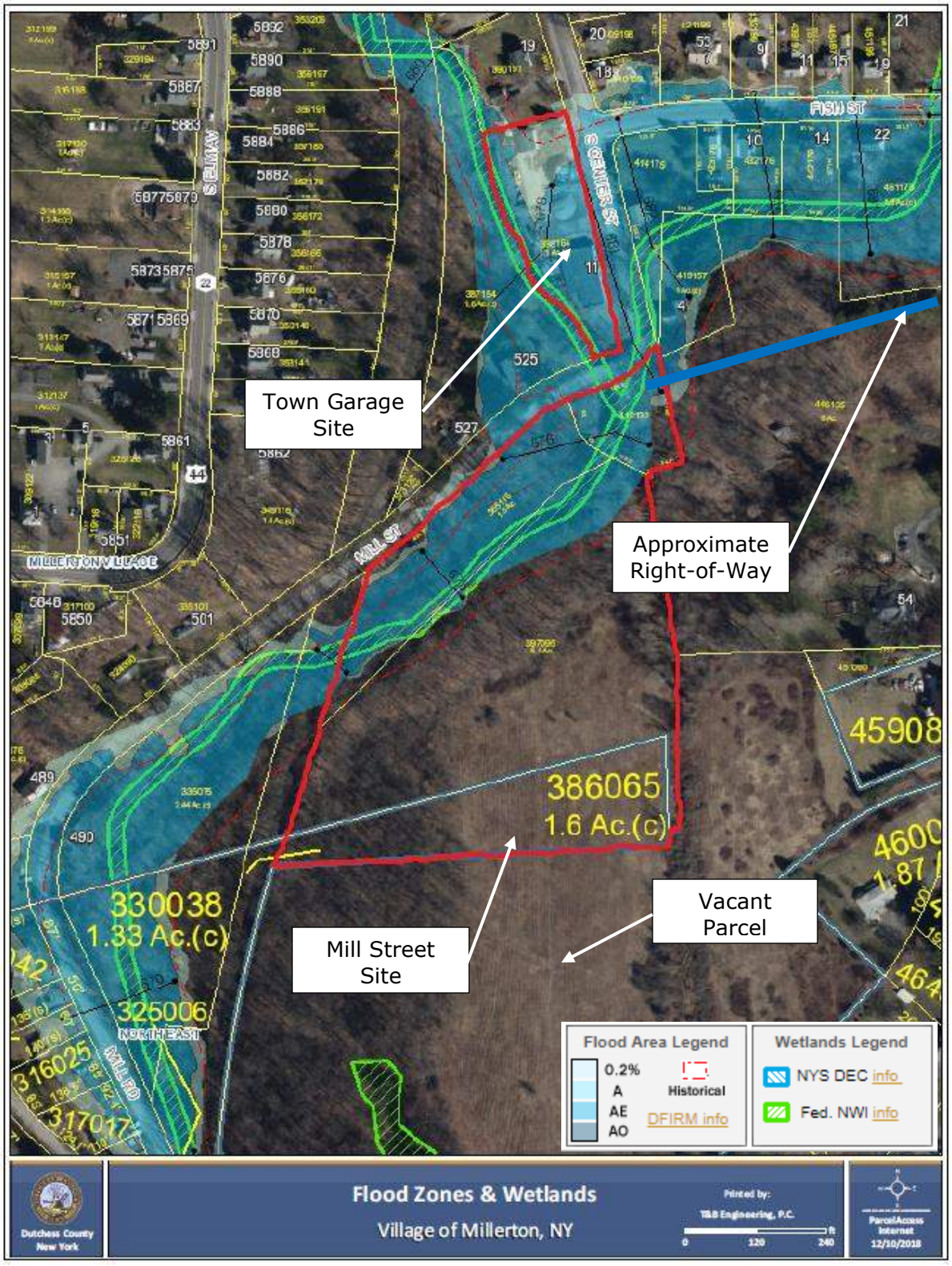

FIGURE 4.14
Potential Wastewater Treatment Sites – Flood Zones

*Revised July 2025

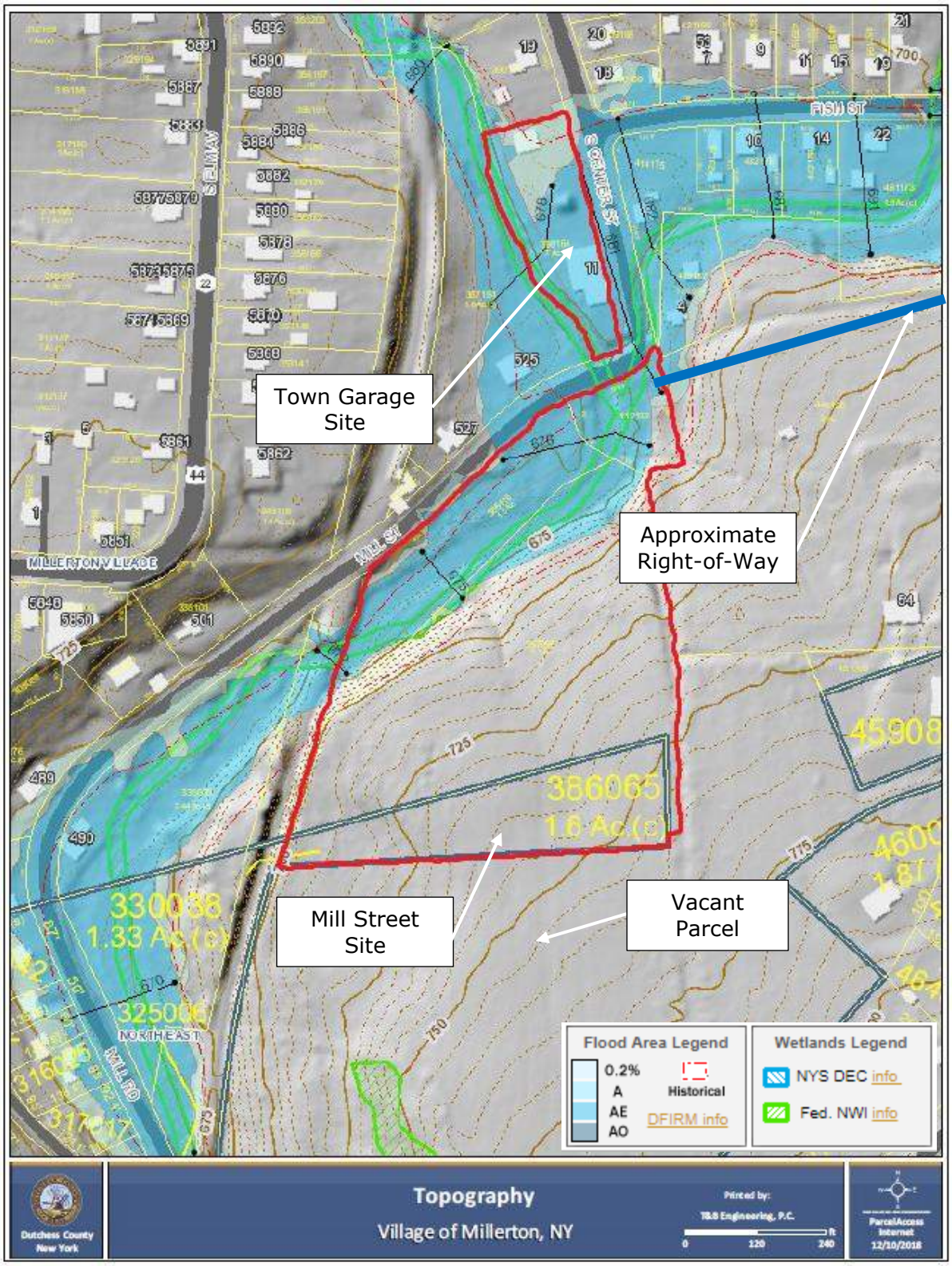

FIGURE 4.15
Potential Wastewater Treatment Sites – Topography

*Revised July 2025

4.5.2 Additional Parcel Considerations

The New York State Department of Environmental Conservation outlines considerations in selecting sites for wastewater treatment systems in order to minimize potential adverse impacts. These criteria provided the basis for the secondary screenings as discussed in the following sub-sections.

Separation Distances

Table 4.6 provides the recommended separation distances that should be maintained between treatment facilities and dwellings or property lines to provide some attenuation of airborne nuisances such as aerosols, pathogens, odors, and noise as provided by the NYSDEC *Design Standards for Intermediate Sized Wastewater Treatment Systems, 2014*.

TABLE 4.6 – Recommended Separation Distances

Treatment Type	Radial Distance to Existing Downwind Dwellings	Distance to Property Line from Treatment Unit
Wastewater Treatment Process Open to the Atmosphere e.g. Open Sand Filter, and Oxidation Ditches	400 feet	350 feet
Wastewater Treatment Processes Enclosed in a Building, and Buried or Covered Sand Filters	200 feet	150 feet
Facultative and Aerated Lagoons	1,000 feet	800 feet
Effluent Recharge Bed	750 feet	550 feet

Using Table 4.6 as a guideline, a minimum distance between the nearest dwelling unit and the water resource recovery system of 200 feet is desirable. Additionally, the treatment system should be a minimum of 150 feet from the property line. Maintaining either of these distances at the Town Garage Site is not feasible. However, maintaining both recommended separation distances at the Mill Street Site is attainable.

Zoning and Other Land Use Restrictions

The Town Garage Site is approximately 60% within the land conservation zoning district and 40% within the high density residential zoning district. Development is discouraged in the land conservation zone per the Comprehensive Plan. However, public utility installations are permitted in these areas according to the Village of Millerton zoning code.

The Mill Street Site is mostly within the medium density residential zoning district besides portions of the lot along Webatuck Creek which are in the land conservation zoning district. However, this section of the lot is steep and would not be utilized for a wastewater treatment system and is therefore not expected to be a restriction. The vacant parcel to be obtained by the Village is zoned as low density residential.

Topography

Areas with unsuitable topography were eliminated in the initial screening. Of the remaining sites, the Town Garage Site has nearly flat slopes and topography is therefore not expected to be an issue. The Mill Street Site is relatively steep along Webatuck Creek but the cleared area of the site (approximately 5 acres) has a slope of 5-10%. This slope is within the acceptable range per NYSDEC design standards for certain subsurface disposal systems.

Area for Future Expansion

A larger parcel is preferable to allow for expansion, should the entire Village be added to the sewer system and to control and maximize the buffer areas between adjacent property owners. Unfortunately, none of the lots surrounding the Town Garage Site would be available for future expansion.

Direction of Prevailing Wind

Prevailing winds in the Village are from the west. However, prevailing wind direction is a more significant consideration for larger traditional wastewater treatment plants with open tanks and sludge and septage processing. It is assumed that odors will be minimal for either of the proposed alternative treatment technologies and will be adequately addressed by the separation buffer criteria discussed previously in this Section.

Flood Considerations and Accessibility

Wastewater treatment systems and disposal areas should be located above the 100-year flood plain. Additionally, the NYSDEC *Design Standards for Wastewater Treatment Works*, requires that all treatment and disposal systems be located to minimize or eliminate flood damage. This is of greatest concern for the Town Garage Site since nearly all of the site is within the 100-year floodplain (see Figure 4.14). In order to protect the area of the site from flooding, the area would need to be filled to elevate the treatment system or built with all structures above the 100-year floodplain level. Access to the site during a flood would also need to be provided.

In accordance with 6 NYCRR Part 502 – Floodplain Management Criteria For State Projects, paragraph (15); in riverine situations, no project (including fill) shall be undertaken unless it is demonstrated that the cumulative effect of the proposed project, when combined with all other existing and anticipated development, will not increase the existing water surface elevation of the base flood more than one foot at any point. Provided, the provisions of this paragraph shall not apply to any project being undertaken on a site where there is less than one square mile of drainage area for the watercourse involved above such site, and where the administrator has not provided final flood base elevations on a city, town or village's flood insurance rate map (FIRM). The flood base elevation across the Town Garage Site is 681 feet as shown on the Village's FIRM (attached in Appendix G).

The Flood Insurance Study for Dutchess County indicates that "The area between the floodway and the 1% annual chance floodplain boundaries (100-year flood) is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water surface elevation of the 1% annual chance flood by more than 1.0 foot at any point." This is accompanied by the following Figure 4.16.

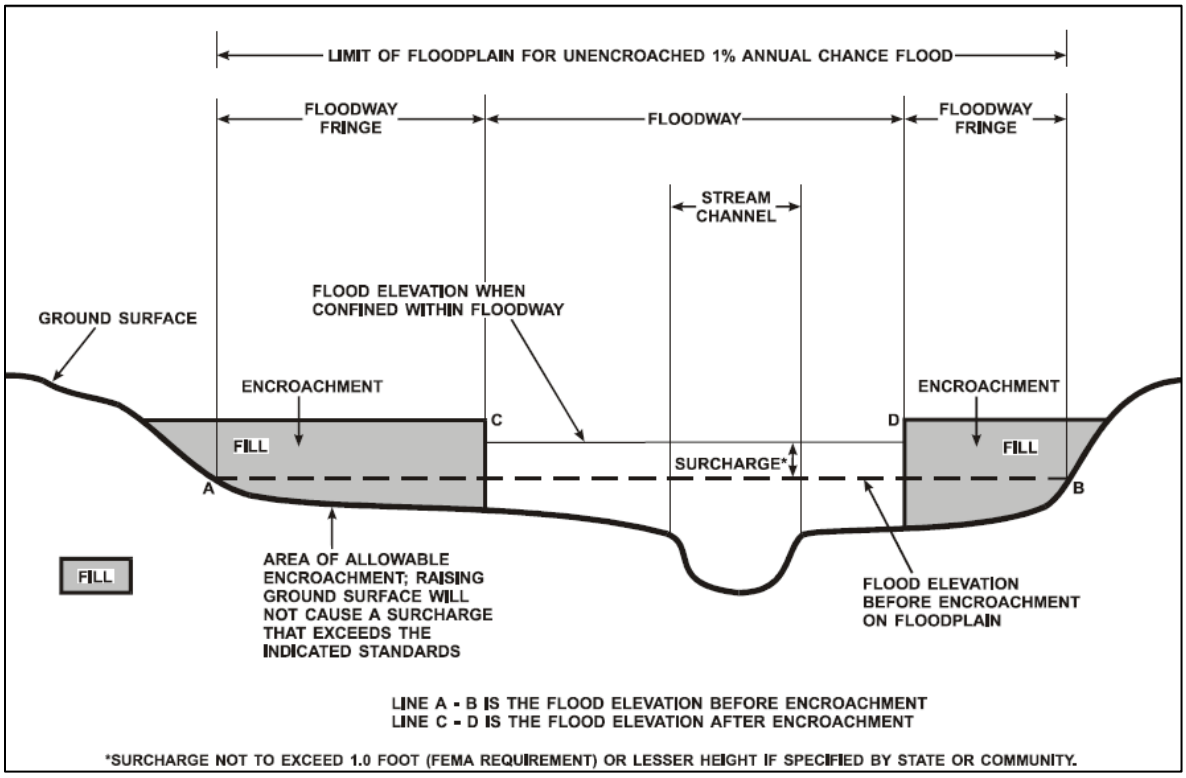

FIGURE 4.16
Floodway Fringe and Floodway Guidance

Thus, to utilize the available portion of the Town Garage site, the site could be filled to an acceptable level such that the treatment system would be above the 100-year flood elevation, while not causing a significant increase in flood elevation. A modeling study would need to be completed to demonstrate that the improvements to the site would not adversely affect the surrounding properties or raise the base flood level by more than 1 foot. A subsurface disposal system is not recommended for this site due to its position relative to the flood plain and the limited space.

While the higher elevation area on the Mill Street Site is well above the 100-year floodplain, the access to the site at the corner of South Center Street and Mill Street would be cut off during a 100-year flood event. Therefore, the right-of-way from South Maple Lane would need to be used as a secondary access route during a flood event. However, due to the flood elevations, a right-of-way line adjustment would likely be necessary in order to keep the right-of-way out of the 100-year flood zone. The approximate location of the right-of-way and anticipated lot line adjustments are shown in Figure 4.17.

However, if the vacant parcel was acquired, permanent access to the Mill Street site from Sharon Road could be provided which would have no flood restrictions and void the need for the right-of-way and lot line adjustments.

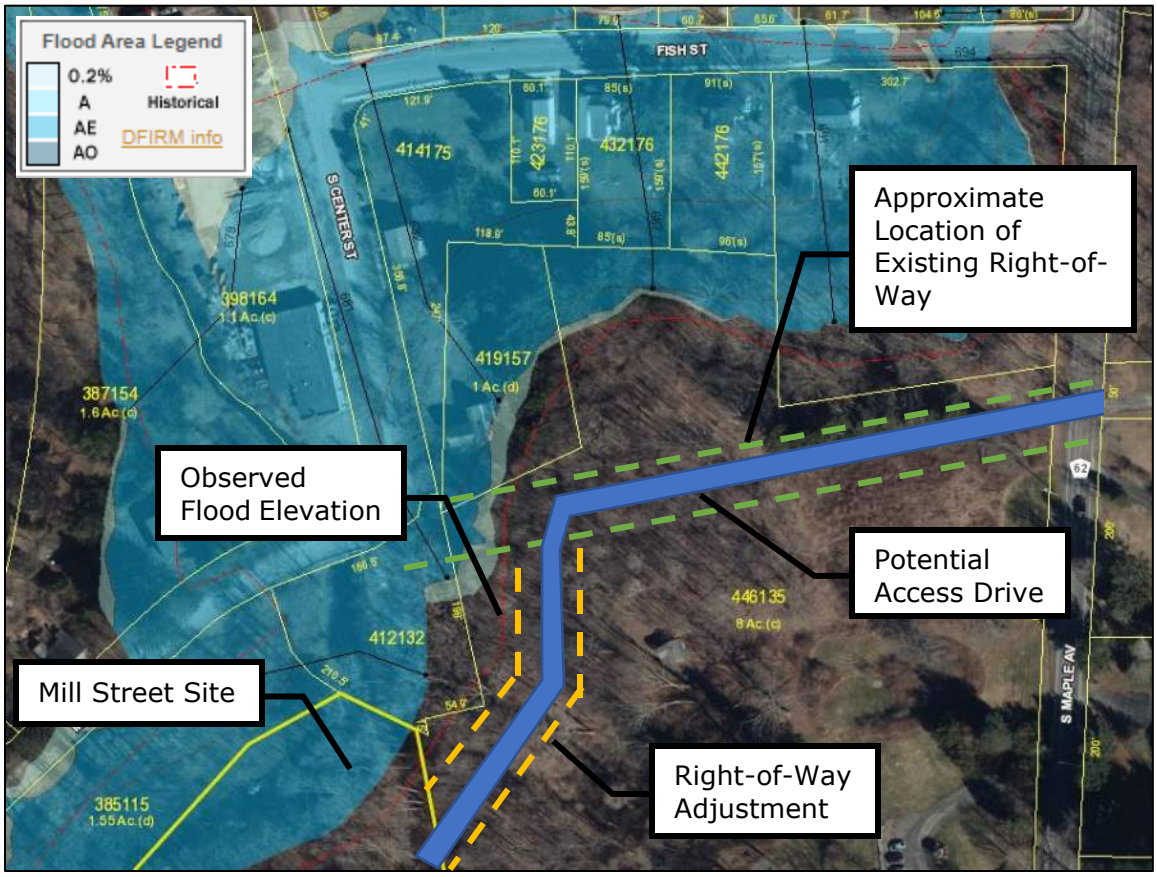

FIGURE 4.17
Approximate Right-of-Way Location at the Mill Street Site

Geologic Considerations

The geology of the area is shown on Figures A.2. The soil type at the Town Garage Site is Copake gravelly silt loam, which is a well-drained, HSG Type A soil. Depth to a restrictive layer is reportedly more than 80 inches. The soil type at the Mill Street Site is mostly Stockbridge silt loam, which is a moderately well-drained, HSG Type C soil. Depth to a restrictive layer is reportedly more than 80 inches. Shallow bedrock is not expected to be an issue at ether location.

The Village is in seismic design category C.

Protection of Groundwater

As a regulatory minimum, groundwater return systems are required to be located 100 feet from groundwater wells. This is not expected to be a problem for the Mill Street Site and is not relevant to the Town Garage Site because a return to groundwater system would not be feasible at that location.

The separation to seasonal high ground water is an additional important requirement in siting subsurface return to groundwater systems. A minimum vertical separation distance of 4 feet is required. Areas with suspected high groundwater levels are shown in Figure A.2. As shown, high groundwater is not expected to affect either site and no basement problems were reported near either of the sites.

*Revised July 2025

Adjacent Systems

All occupied parcels in the Village contain groundwater disposal systems or holding tanks. In addition, there are subsurface drainage returns in various areas of the Village. Consideration should be given in siting any new subsurface disposal systems so that adjacent systems are not impacted.

Conveyance Distance

The cost of installing a collection system from the site to the treatment area is directly related to the length of sewer lines required. Sites which require longer conveyance distances are less favorable then potential sites closer to the center of the service area as long as those sites are not in conflict with the items discussed above. The Mill Street Site would require approximately 1,500 more feet of force main compared to the Town Garage Site.

4.5.3 Return to Groundwater System Potential

Soils suitable for groundwater return systems must be sufficiently permeable to allow effluent to be returned to groundwater. The commonly used empirical measure is the percolation test that measures the rate of water drop in minutes per inch in a small percolation test hole.

For return to groundwater systems, soils must have a percolation rate of less than 120 minutes/inch and preferably less than 60 minutes per inch; especially for larger systems. DEC standards tabulate the allowable application for subsurface return in gallons per day per square foot for a range of percolation rates. The required system size and cost therefore is proportional to the percolation rate. Soils with a percolation rate of over 60 minutes per inch need to be 6 times larger than systems with a soil percolation rate of 1 minute per inch. Very coarse sands and gravels may have percolation rates of less than 1 minute per inch. In this case, DEC standards require additional treatment (beyond septic tanks) because the effluent moves too rapidly through the soil to be treated.

On-site investigations at the Mill Street Site were completed on October 26th, 2018. The detailed results of the on-site investigation can be found in Appendix H. A total of six deep tests and three percolation tests were completed in the cleared area at the Mill Street Site (see map included in Appendix H). In general, the soils were found to be silty loam to a depth of approximately 90 inches. The percolation rates ranged from 6 minutes to 11 minutes with an average percolation rate of approximately 8 minutes per inch. No percolation tests have been completed at the vacant parcel.

Based upon the percolation rate and NYSDEC Design Standards, an application rate of 0.9 gallons/day/square foot is appropriate for the Mill Street Site (8-10 mpi). However, as discussed in Section 4.4.2, NYSDOH may allow a 33% increase in application rate for treatment systems that are owned by a responsible management entity provided that secondary treatment is supplied prior to recovered water return to groundwater. Therefore, an application rate of 1.2 gallons/day/square foot has been used to estimate the return potential for the Mill Street Site.

The following list provides the assumptions/constraints that were made regarding the preliminary calculation of the maximum potential water return capacity at the Mill Street Site:

1. The vacant parcel will be obtained and can be utilized for groundwater return
2. The vacant parcel has similar percolation rates as the Mill Street Site (8 mpi)
3. Secondary treatment will be provided prior to disposal
4. The Village is considered a responsible management entity
5. The allowable application rate will be 1.2 gpd/square foot (includes 33% increase)
6. Approximately 6 acres of the site is suitable for absorption fields (excluding the area for the treatment system and accounting for approximate setback requirements)
7. Trench dimensions are in accordance with NYSDEC design standards

Table 4.7 provides the approximate maximum wastewater disposal capacity of the Mill Street Site with the assumptions stated above and with a conventional trench absorption system, with a drip dispersal system, and with a GGSF absorption system.

TABLE 4.7 – Estimated Return to Groundwater Capacity at the Mill Street Site

Disposal System	Available Trench Length (ft)	Trench Sizing Criteria (ft^2/ft)	Available Absorption Area (ft^2)	Application Rate (gpd/ft^2)	Potential Disposal Capacity (gpd)
Conventional Trench	33,500	2.0	67,000	1.2	80,000
Drip Dispersal	-	-	67,000	1.2	80,000
GGSF	25,300	6.0	151,800	1.2	182,000

As shown in Table 4.7, the total potential capacity of the Mill Street Site varies based on the type of system used. The GGSF system provides a significant advantage over the conventional trench system regarding disposal capacity at the site. Using the GGSF, the approximate maximum potential disposal capacity at the Mill Street Site is 182,000 gpd (including the vacant parcel). However, if the vacant parcel was not obtained by the Village, the total potential disposal capacity of the site using the GGSF system would only be about 60,000 gpd. It should be noted that this calculation assumes that the 33% increase in application rate would be granted by the NYS Department of Health and that the vacant parcel has the same percolation rates as the Mill Street Site.

If the increased application rate was not allowed by the NYS Department of Health, the total potential disposal capacity of the Mill Street Site and vacant parcel would be reduced to 137,000 gpd and 45,000 gpd if the vacant parcel was not acquired (0.9 gpd/square foot application rate) using a GGSF disposal system. Therefore, it is critical that the Village acquire the vacant parcel, or portions thereof in order to consider subsurface disposal. Additional percolation tests should be conducted at the vacant parcel prior to the Village acquiring the property.

4.5.4 Return to Surface Water Locations*

In general, recovered water return to surface water is the less desirable option as the SPDES permit discharge levels are much more significant compared to a subsurface disposal system. In addition, return to surface water does not have the benefits of local aquifer recharge as recovered water immediately leaves the watershed.

If a surface return system was used at either of the two sites, both would utilize the Webatuck Creek. Based upon the NYSDEC classification of Webatuck Creek, it is anticipated that recovered water parameters would be held to the levels discussed in Section 3.4.3. A submerged discharge within the Webatuck Creek is preferred to a free discharge due to the visual and environmental impacts of a free discharge. Actual type and components of the surface return will be determined during final design.*

An acceptable return for a treatment system at the Town Garage Site would likely be towards the south side of the site near the confluence of Kelsey Brook and upstream of the Mill Street Bridge (Location No. 1). The return would be across from a neighboring property which is likely to be seen negatively by the residents. Although there is one residential property adjacent to the return location, the stream then continues approximately 1,500 feet before passing the next residence.

Surface water return at the Mill Street Site would also returned to Webatuck Creek. The treatment system water return at the Mill Street Site would need to be piped down the hill and return in Webatuck Creek downstream of the Mill Street Bridge (Location No. 2). This return location is not directly adjacent to any residents and the closest downstream resident is approximately 1,100 feet. Therefore, the Mill Street Site is the preferred site for surface disposal due to its isolation from nearby residences as compared to the Town Garage Site. Figure 4.18 shows the potential surface return locations.

FIGURE 4.18*
Potential Surface Return Locations

*Revised July 2025

Section 5
Alternative Analysis

5.1 Proposed District & Alternative Development

Preliminary findings based on the wastewater needs analysis, estimated flows, and disposal options were discussed with the Village of Millerton and the Town of North East in 2020 and 2021 following the first revisions of this Preliminary Engineering Report. The Village of Millerton and Town of North East solicited feedback from residents and business owners in the study area in 2021 and 2022 regarding the proposed sewer district. This Report and this Section have been updated based on the recent feedback provided by the Village and the Town.

Based on the community feedback, it was determined that the proposed service area should incorporate parts of each sub-area with the primary focus on serving the Village General Business District, commercial areas along Route 22, and the Town of North East Boulevard District along Route 44. The anticipated sewer district is shown in Figure A.9.

Table 5.1 summarizes the average day design flow for the anticipated sewer district shown in Figure A.9. The anticipated flow contribution from each municipality is shown in Table 5.1. The base flow for the Village and the Town is based on the EDU methodology with one EDU equivalent to 215 gpd as discussed in Section 3.4.1. A Village future flow contribution of 25% of the base flow and a Town future flow contribution of 75% of the base flow has been added to the average day design flow to account for potential future flow contributions in each municipality. The future flow contributions are approximate based on the vacant land and potential build-out/expansion in each area.

TABLE 5.1 – Millerton Anticipated Sewer District Design Flow Summary

Contribution	No. of Res EDUs	No. of Com. EDUs	Total No. of EDUs	Total Flow (GPD)
Village Base Flow[1]	86	128	214	46,100
Village Future Flow[2]	-	-	-	11,500
Town Base Flow[1]	1	32	33	7,100
Town Future Flow[3]	-	-	-	5,300
			Average Day Design Flow	**70,000**

[1]Based on 1 EDU equivalent to 215 gpd

[2]Future flow for Village calculated as 25% of the Village base flow

[3]Future flow for Town calculated as 75% of the Town base flow

A summary of the developed alternatives for wastewater collection, treatment, and disposal are discussed in the following Sections. The alternatives and costs comparisons presented in this report are based on the anticipated sewer district shown in Figure A.9 and the estimated average day design flow of 70,000 gpd as shown in Table 5.1. Expansion of the sewer district and/or future increases in average day flows greater than those presented above will increase the size and cost of the collection and treatment system.

5.1.1 Individual Onsite Wastewater Treatment Systems

The use of individual, alternative, onsite wastewater treatment systems was dismissed since upgrades to individual septic systems alone were not expected to be sufficient for the parcels in the anticipated sewer district. Alternative onsite, decentralized wastewater treatment systems also require mechanical equipment that have high up-front costs as well as associated operation and maintenance costs. Additionally, most of the proposed district has small lot sizes which have limited area for onsite alternative treatment systems. Therefore, alternative onsite wastewater treatment system improvements were not considered for the proposed sewer district. Use of conventional septic systems and leachfields for those parcels not included in the district will are appropriate and will continue.

5.1.2 Wastewater Collection Systems*

Two types of collection systems were discussed in Section 4.2 including conventional gravity/pumped systems and alternative septic tank effluent systems. An alternative collection system where sludge is addressed at individual septic tanks is recommended for the proposed service area. An alternative collection system will not only reduce the construction costs compared to a conventional collection system but, will also reduce the O&M costs associated with the water resource recovery system since solids handling is addressed by individual septic tanks.

As previously discussed, there are two acceptable collection system methodologies for septic tank effluent systems; gravity and pumped (STEG and STEP). Gravity systems require appropriate topography. A low spot between South Center Street and Route 22 would prohibit gravity flow for approximately eleven parcels along Railroad Plaza back to the intersection of Main Street and South Center Street (refer to Figure 5.1). However, a gravity line for the parcels along Railroad Plaza could be routed along the rail trail and back out onto South Center Street to meet the required slopes. Alternatively, the eleven parcels could use a STEP system to pump the flow along Main Street up to the intersection with South Center Street.

A high spot running north/south across Main Street would require excavation in excess of 20 feet to allow for a continuous slope from North Maple Avenue along Main Street towards South Center Street. To avoid the extensive excavations, sewer mains would be routed along South Maple Avenue across Fish Street to the intersection of South Center Street. However, this requires a bridge crossing on Fish Street.

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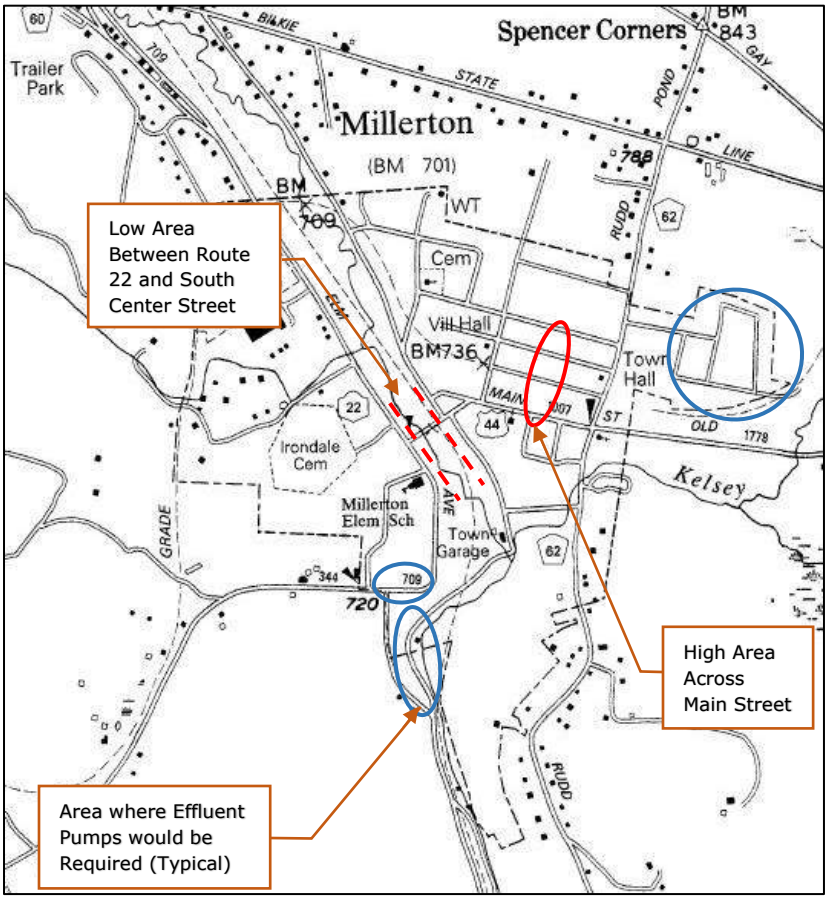

FIGURE 5.1
Village of Millerton Topography Impacting Gravity Flow

Most of the wastewater from the service area could flow by gravity, however, certain lots will require a STEP system based on local topography, the details of which have not been thoroughly reviewed during this evaluation. Areas where effluent pumps are anticipated are shown in Figure 5.1 (note that these areas are outside of the proposed district). However, more areas requiring STEP systems would likely be identified during a detailed collection system evaluation and design.

If a STEG system is used, a central pump station located near the intersection of South Center Street and Fish Street (the Garage Site) will be required to pump the wastewater up to the Mill Street Site. A central pump station adds maintenance, nuisances, and significant costs. In addition, STEG systems require manholes at junction points which also add construction costs and additional maintenance. For these reasons, a comprehensive STEP type collection system is the recommended collection system approach for the Village of Millerton.

Figure A.10 provides a preliminary collection system layout for the proposed service area. The northern section of the collection system begins at the Millerton Recreation Park from which the service lateral crosses Rte. 22/N Elm Ave and ties into the STEP sewer on the northeast side of the road. The STEP sewer then proceeds southerly along Rte. 22 to parcel #5924 where an easement will cross the Webatuck Creek, Railroad Plaza, and Harlem Valley Rail Trail to connect to John St., then east on Century Blvd. to parcel #97 Main St.

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where the sewer crosses Rte. 44 and combines with the eastern section of the collection system. The eastern section begins at the NY/CT border and conveys flows along the south side of Rte. 44 to parcel #108 Rte. 44 where it combines with the northern section of the collection system. Flow from parcels on the north side of Rte. 44 is collected in two separate pipe segments that cross Rte. 44 to combine with the sewer on the south side of the road. The combined northern and eastern sections of sewer then parallel Main St. through easements and crosses Central Ave. and Park Ave. to reach S Center St., which the sewer then runs south along to Mill St. where the sewer continues cross-country to the proposed Mill Street Site for treatment.*

Septic tanks will be located on each parcel connected to the system, except for the Main St./S Center St. area where due to the building density multiple parcels flow will be combined in a few septic tanks where space is available. As much as possible, existing septic tanks in good condition and of appropriate size will be reused. On parcels that require new septic tanks, those tanks will be located as close as feasible to existing tank locations to reduce new piping needed to connect to buildings. Each septic tank will include a redundant effluent pump system on the parcel. No additional pump stations will be required in the collection system to convey flow to the treatment site.*

5.1.3 Wastewater Treatment Systems

Of the treatment systems reviewed in Section 4.3, a conventional wastewater treatment system was not recommended due to the size of the Village and the associated costs and staffing requirements of a conventional WWTP. Therefore, two water resource recovery treatment technologies were discussed; a membrane bioreactor treatment system (Ovivo microBLOX), and a biofiltration treatment system (Orenco's AdvanTex). The Orenco treatment system varies slightly based on the return type and therefore it is discussed relevant to both surface and groundwater resource recovery.

Both water resource recovery systems meet the minimum treatment system criteria:

- Ability to reach effluent limits, and;
- NYSDEC Region 3 familiarity with the system and past approval for community systems.

To evaluate the systems, the following items have been considered:

- Ease of Operation
- Operation and Maintenance Considerations
- Footprint

Ease of Operation

Each of the systems require a different degree of operation. Generally speaking, the Ovivo MBR system is more complicated than the Orenco AdvanTex system. Both systems use a similar biological process for treatment and use similar components including pumps, media filters, and blowers. However, the Ovivo system has more pumps and controllers in comparison to the Orenco System. Both systems have automated controls which can be viewed remotely to check on the status of the systems. Additional tankage, pumps, and equipment will be required for the Orenco treatment system for surface return compared to the same system for groundwater return.

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The Ovivo System is primarily a single treatment tank, versus multiple units in the Orenco System. However, by having multiple treatment tanks, the Orenco system could easily have one unit out of service, while still treating wastewater flow. Since the Ovivo MBR system has only one unit, there is no ability to maintain flow, although there should be sufficient storage in preceding tankage to hold flow while short-term maintenance activities occur, given a certain time period.

Each system has similar maintenance requirements regarding textile/membrane replacement, and periodic textile filter cleaning or replacement. Maintenance of the Orenco system will be less labor intensive for cleaning and/or replacement of the textile media in comparison with the Ovivo system which requires a building crane to remove and install the membranes. The Ovivo membranes require regular backwashing which is an automated process. The Ovivo MBR system will also generate significantly more sludge than the Orenco AdvanTex system which will result in more frequent sludge removal.

Operation & Maintenance Considerations

Although both systems use similar technologies, the degree of anticipated operation and maintenance activities for each system is different. The Orenco system for groundwater return can, for the most part, be left alone, however, it is anticipated that approximately 3 hours per week will be required for checking and monitoring the system compared to 10 hours per week for the Ovivo system and 7 hours a week for the Orenco system with surface return. Sludge generation for the Ovivo system is significantly more and is estimated that sludge will need to be hauled off site twice a month. The Orenco tanks will only need to be emptied every couple of years or as needed based on regular monitoring of the sludge levels.

Footprint

It is anticipated that the AdvanTex treatment units and primary tankage for groundwater and surface water return would take up approximately 10,000 square feet and 14,000 square feet, respectively. The Ovivo tanks are approximately 9'W x 45'L X 12'H and would require approximately a 4,500 square foot building to house the units. A comparison of the two treatment systems is tabulated in Table 5.2.

TABLE 5.2 – Treatment System Comparison

Ease of Operation

AdvanTex	Ovivo
- Packed Bed Biofiltration	- Membrane Bioreactor
- Multiple Treatment Units	- Single Treatment Unit
- No building required	- Building required

Operation & Maintenance Considerations

AdvanTex	Ovivo
- Less sludge build-up	- Greater sludge removal
- Less frequent media maintenance	- More difficult media maintenance
- Remote control available	- Remote control available

Footprint

AdvanTex	Ovivo
- Larger footprint (10k -14k sq ft)	- Smaller Footprint (4.5k sq ft)
- Shallow installation	- Requires concrete slab and building

From a review of both technologies, it appears that either is well suited to address the Village's needs. As discussed in Section 4.3.4, multiple communities in New York State have successfully utilized the Orenco AdvanTex technology including continued effluent quality exceeding the NYSDEC SPDES permit limits. MBR systems have also been used successfully for small communities, and Ovivo has over 200 microBLOX MBR systems in operation across the country, many of which are in New England and New York. Since both technologies appear to be applicable for meeting the needs of the Village, both treatment technologies will be considered in the alternative analysis.

5.1.4 Recovered Water Return Systems

Two alternatives exist for return of recovered water; return to a surface water body, or return to the groundwater. As mentioned in Section 4.4, surface return will have more stringent SPDES permit limits than groundwater return, thus requiring a larger, more costly recovery system, higher operation and maintenance skill and expense, and the

potential for negative public perception. However, the total footprint will be much smaller, allowing for a much larger treatment flow rate per square foot.

Surface return is the only disposal option for the Town Garage Site. The Mill Street site can return of up to 182,000 gpd to the subsurface with a GGSF system if the adjacent vacant parcel is acquired which would be more than large enough to support the estimated flows for the proposed sewer district.

Table 5.3 compares both disposal methods.

TABLE 5.3 – Recovered Water Return Comparison

Surface Return	Subsurface Return
Water Quality	
- Stream Water Quality - Dissolved oxygen level essential for maintaining fish populations impacted by BOD, nitrogen and phosphorus - Potential route for public exposure to treated effluent	- Groundwater Quality - Nitrates untreated by soil and accumulate in groundwater, potentially lowering aquifer water quality - No direct public exposure route
Public Perception	
- Negative public perception in regard to public impacts and environmental health concerns	- Less controversial method, no observable return location, generally more positive public perception regarding public health impacts
Footprint	
- Small return area	- Large return area
Permitting	
- Higher level of treatment required	- Lower level of treatment required
Expandability	
- Greater potential for expansion	- Lower potential for expansion
Operation & Maintenance	
- Minimal amount of operation and maintenance for return piping - Will require regular sampling	- Greater operation and maintenance depending on subsurface technology used - Periodic groundwater monitoring

As shown in Table 5.3, each return method has advantages and disadvantages. Fortunately, both options are feasible for the Village of Millerton and therefore both methods of recovered water return are considered in the alternative analysis.

5.1.5 Water Resource Recovery System Sites

As discussed in Section 4.5, the Mill Street site is the only site available at this time that is suitable for groundwater return. The Town Garage site has inadequate area available for groundwater return and is also within the 100-year flood zone. There would be enough room for consideration of an MBR system at the Garage Site with surface return. However, due to its proximity to residential neighbors and its location within the 100-year flood zone, this treatment site has not been considered. Therefore, the Mill Street site is the recommended site for construction of a water resource recovery and/or return system.

5.1.6 Definition of Alternatives

Based upon the results of the evaluation and the recommendations discussed above, four alternatives have been considered regarding implementation of a water resource recovery collection, treatment, and return system for the Village of Millerton. The alternatives include:

- Alternative No. 1 – No-Action
- Alternative No. 2 – STEP Collection System with Biofiltration Resource Recovery System and Groundwater Return at the Mill Street Site
- Alternative No. 3 – STEP Collection System with Membrane Bioreactor Resource Recovery System and Surface Return to Webatuck Creek at the Mill Street Site
- Alternative No. 4 – STEP Collection System with Biofiltration Resource Recovery System and Surface Return to Webatuck Creek at the Mill Street Site

5.2 Alternative No. 1: No-Action

The no-action alternative means that no centralized wastewater collection, treatment, or return system would be implemented in the Village of Millerton. In this scenario, the existing individual wastewater treatment systems and storage tanks would remain in use. This option does not address the isolated wastewater return issues and leaves the responsibility of fixing these issues on the homeowners. Faulty septic systems and leachfields may remain in place due to homeowners lack of maintenance or financial inability to repair their own system. Faulty septic systems may also adversely affect the quality of local water ways and nearby residential water supplies.

Additionally, the no-action alternative does not address locations where local conditions such as high bedrock, high groundwater, poor soils, parcel density, or inadequate space limit the effectiveness of traditional septic systems. Another disadvantage of the no-action alternative is that certain high demand facilities such as restaurants may be unable to expand due to limited wastewater capacity. The no-action alternative does not address the desire of the 40% of wastewater survey respondents who felt that a centralized wastewater treatment system is required for the Village.

An advantage of the no-action alternative is that there is no large construction cost; all septic tank pumping costs, maintenance costs, and repair costs will remain the responsibility of the property owners. This will prevent a potential tax burden for those Village residents who would not be serviced by the wastewater treatment system yet may still see an increase in their contribution for funding of the construction and maintenance.

Another advantage of the no-action alternative is that there will be no direct surface water return and no disruption of traffic which is likely to occur during construction of a new sewage collection system.

5.3 Alternative No. 2: Biofiltration with Absorption Field

Alternative No. 2 consists of the following:

1. Construction of a STEP collection system for the proposed service area;
2. Installation of the Orenco AdvanTex biofiltration system for secondary treatment of the septic tank effluent at the Mill Street Site sized to treat an average daily flow of 75,000 gpd for the proposed service area, and;
3. Construction of a subsurface return system at the Mill Street Site sized for an average daily flow of 75,000 gpd for the service area.

A preliminary layout of the water resource recovery system and absorption fields for Alternative No. 2 is shown in Figure 5.2. Note that Figure 5.2 assumes that the vacant parcel would be acquired by the Village and used for the recovery and return system.

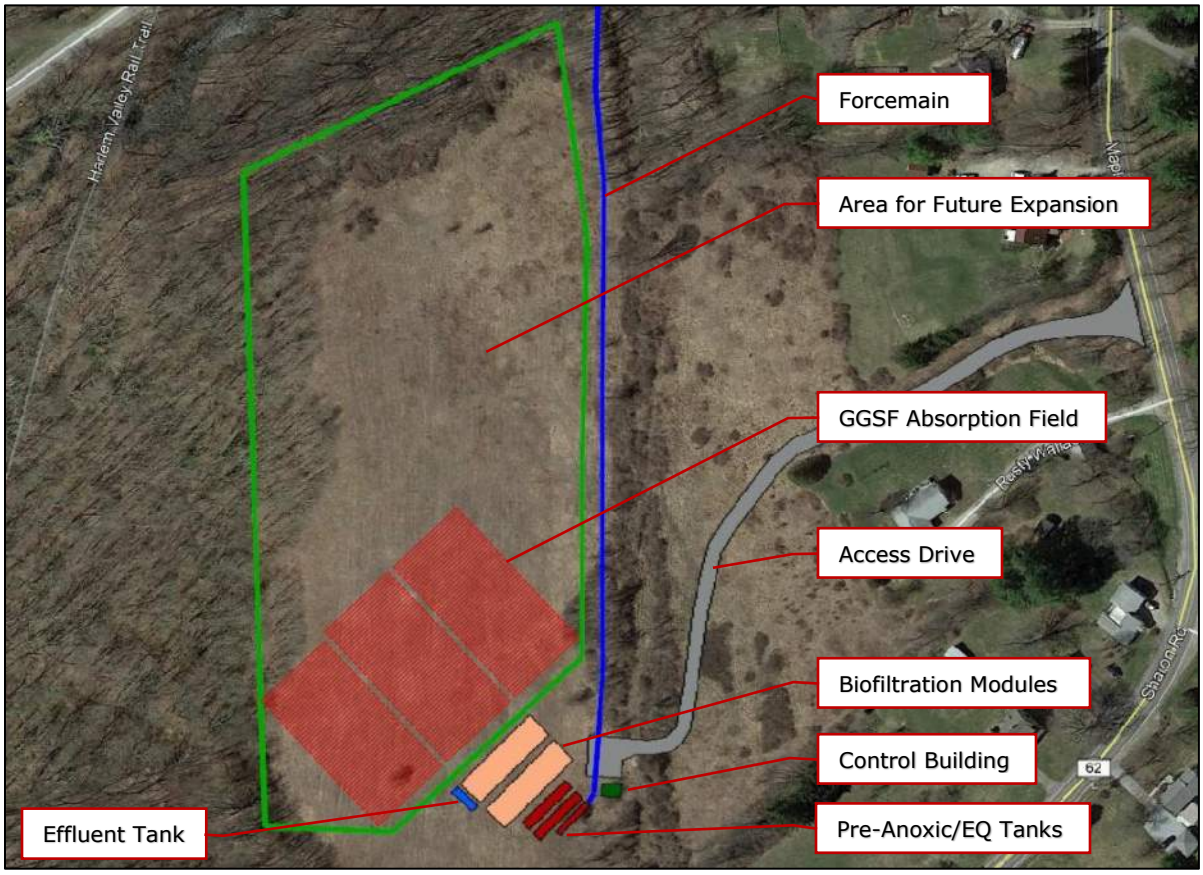

FIGURE 5.2
Preliminary Layout of Alternative No. 2

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If a biofiltration resource recovery system with subsurface return at the Mill Street Site was pursued, then the system components will consist of:

- Influent Flow Meter
- Pre-Anoxic/EQ Tanks
- Orenco AdvanTex AX-Max Biofiltration Treatment Modules
- Treated Wastewater Effluent Tank
- Effluent Flow Meter
- Control Building
- GGSF Absorption Fields
- Groundwater Monitoring Wells

Site work for Alternative No. 2 would include construction of an access road from Sharon Road, brush hogging and clearing, excavation and grading for the absorption fields, excavation for the buried piping, tanks, and treatment units, and security fencing around the treatment units. After the absorption fields are installed the area would be seeded and mulched and would be mowed at least a few times a year for maintenance. There would be minimal visual impact once construction is complete for the nearby residences as almost all equipment would be below grade.

5.4 Alternative No. 3: MBR with Surface Return

Alternative No. 3 consists of the following:

1. Construction of a STEP collection system for the proposed service area;
2. Installation of the Ovivo microBLOX MBR system for secondary treatment of septic tank effluent at the Mill Street Site sized to treat an average daily flow of 75,000 gpd for the service area;
3. Construction of a building for the MBR treatment system, and;
4. Installation of surface return piping to Webatuck Creek.

A preliminary layout of the treatment system and return location for Alternative No. 3 is shown in Figure 5.3. If an MBR system with surface return at the Mill Street Site was pursued, then the system components will consist of:

- Metal Building for the MBR System
- Influent Flow Meter (in building)
- Ovivo microBLOX Tank split for EQ and WAS Storage
- Ovivo microBLOX Treatment Unit with UV Treatment
- Ovivo microBLOX Supplementary Oxygen Unit
- Effluent Flow Meter
- Surface Return to Webatuck Creek

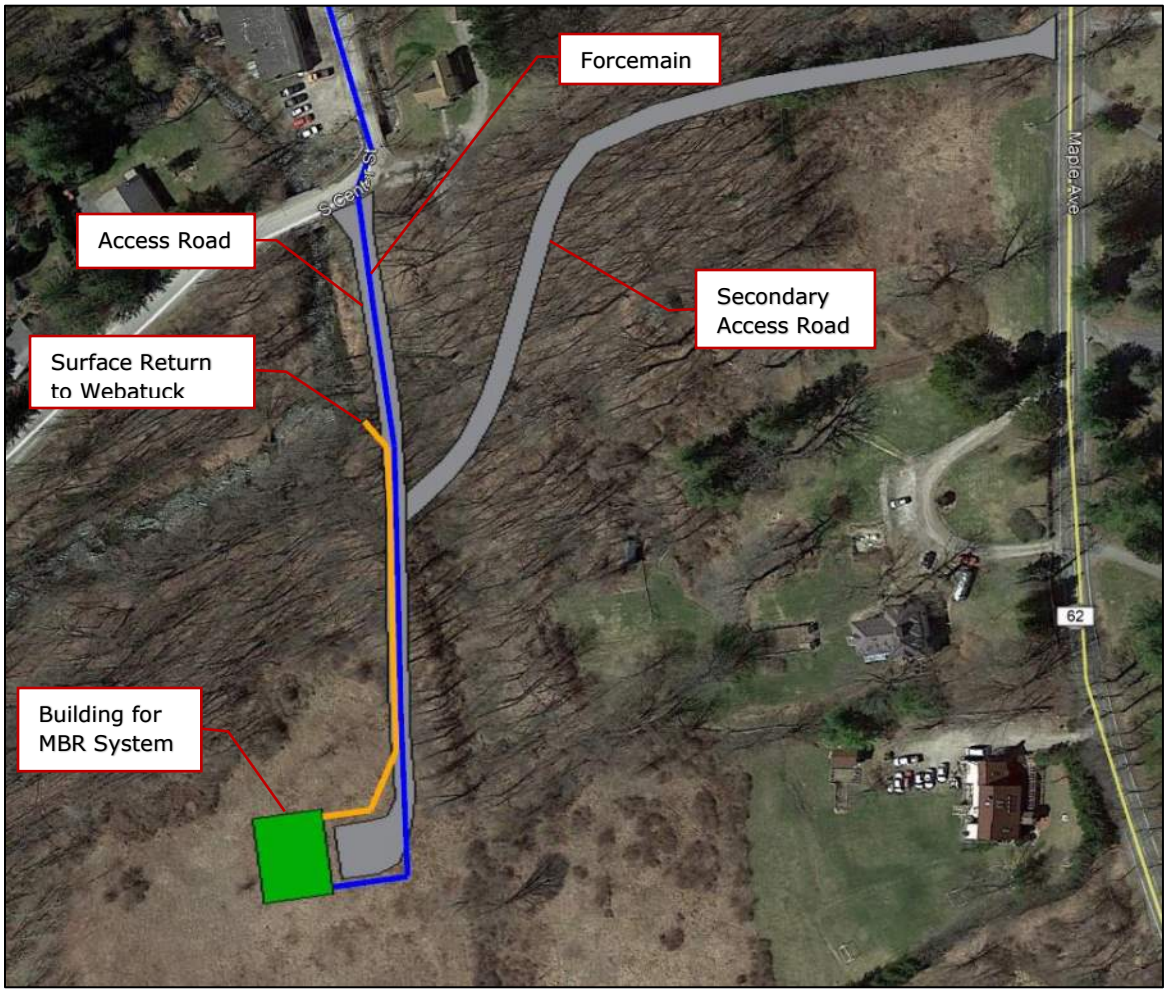

FIGURE 5.3
Preliminary Layout of Alternative No. 3

Site work for Alternative No. 3 would include clearing and construction of an access road from the Corner of Mill Street and South Center Street to the treatment system building at the Mill Street Site and/or the secondary access road through the right-of-way off Sharon Road. The forcemain would be installed up the hill to the metal building that would house the MBR system. The MBR system will require excavation and grading for a concrete slab for the building. The building will be approximately 4,500 square feet and will require 18' of height for proper clearances above the MBR treatment units.

The MBR system will require a 208V, 3 phase electric service for the pumps and blowers. Minimal site clearing will be required for this alternative. The return piping would be routed back down along the primary access road to Webatuck Creek. The return would discharge downstream of the South Center Street Bridge as shown in Figure 5.3.

This alternative does not require acquisition of the vacant parcel because there is enough room for the MBR system on the parcels that the Village currently owns including the required property line setbacks. However, the Village may need to consider purchasing a portion of the vacant parcel if a right-of-way or lot-line adjustment is infeasible for the secondary access road.

5.5 Alternative No. 4: Biofiltration with Surface Return

Alternative No. 4 consists of the following:

1. Construction of a STEP collection system for the proposed service area;
2. Installation of the Orenco AdvanTex biofiltration system for secondary treatment of the septic tank effluent at the Mill Street Site sized to treat an average daily flow of 75,000 gpd for the proposed service area;
3. Installation of UV disinfection system and effluent flow monitoring, and;
4. Installation of surface return piping and return to Webatuck Creek.

A preliminary layout of the water resource recovery system and return location for Alternative No. 4 is shown in Figure 5.4.

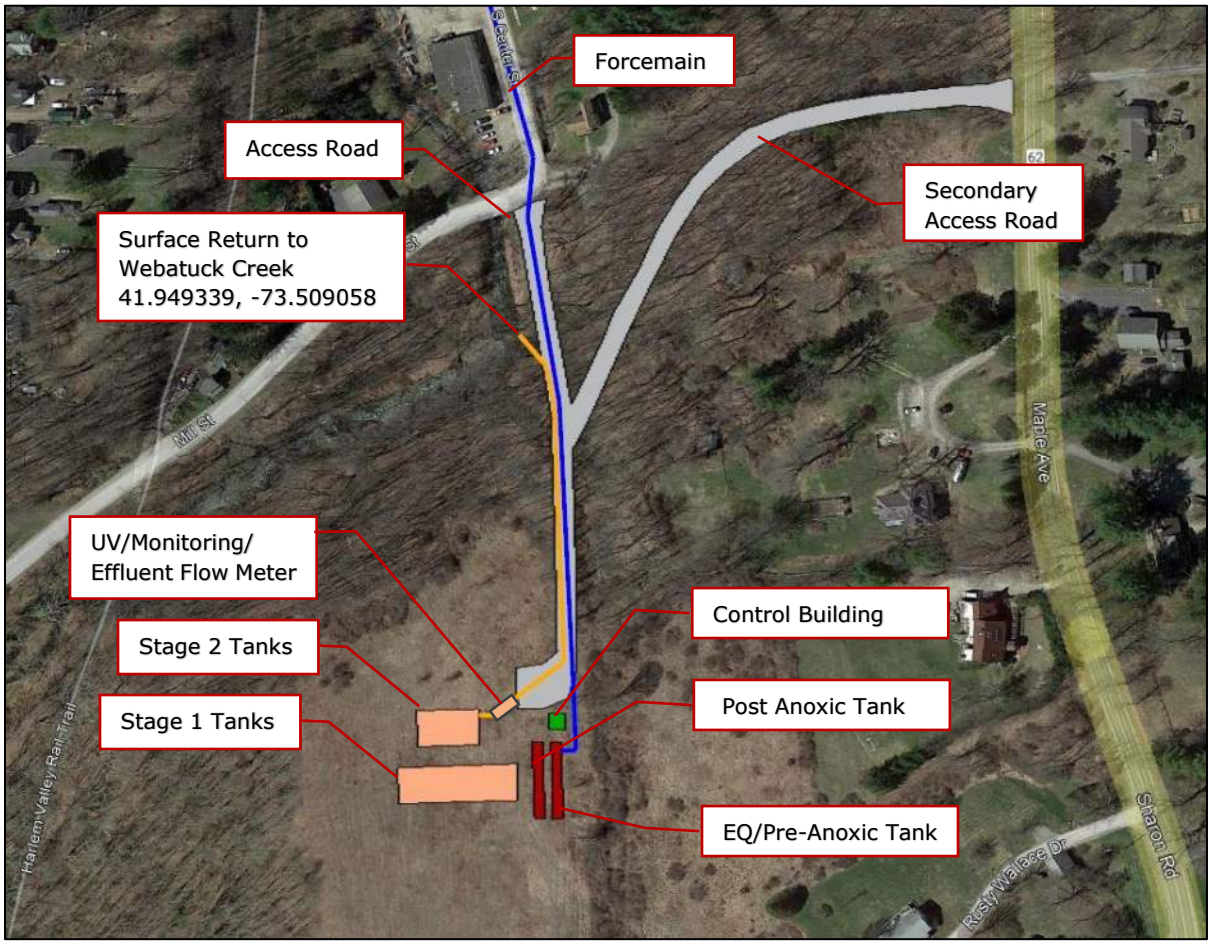

FIGURE 5.4*
Preliminary Layout of Alternative No. 4

If a biofiltration treatment system with surface return at the Mill Street Site was pursued, then the system components will consist of:

- Influent Flow Meter

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- Pre-Anoxic/EQ Tanks
- Orenco AdvanTex AX-Max Stage 1 Treatment Modules
- Orenco AdvanTex AX-Max Stage 2 Treatment Modules
- Post Anoxic Tank with Carbon Addition
- Disinfection
- Effluent Flow Meter
- Control Building
- Surface return to Webatuck Creek
- Aeration within surface return piping*

Site work for Alternative No. 4 would include clearing and construction of an access road from the Corner of Mill Street and South Center Street to the treatment system location at the Mill Street Site and/or the secondary access road through the right-of-way off Sharon Road. The forcemain would be installed up the hill to the treatment system. The Orenco treatment system will require excavation and for installation of the buried tanks. A small control building would be located adjacent to the treatment system.

Minimal site clearing will be required for this alternative. The surface return piping would be routed back down along the primary access road to Webatuck Creek. The return piping would return downstream of the South Center Street Bridge as shown in Figure 5.4. If during final design it is determined that effluent aeration is required for DO levels, the surface return piping has several drops which will be designed to address aeration, such that additional aeration systems will not be needed.

This alternative does not require acquisition of the vacant parcel because there is enough room for the treatment system on the parcels that the Village currently owns including the required property line setbacks. However, the Village may need to consider purchasing a portion of the vacant parcel if a right-of-way or lot-line adjustment is infeasible for the secondary access road.

The Orenco AdvanTex Systems are installed in over 75 residential applications and in several municipal locations with surface discharges in New York including the communities of:

- Hyde Park – 120 Service Connections – 60,000 gpd – Surface Return
- East Schodack – 23 Service Connections – 7,500 gpd – Surface Return
- Schodack Landing – 75 Service Connections – 20,000 gpd – Surface Return
- Bethlehem – 23 Service Connections – 7,500 gpd – Surface Return
- Kensington Woods – 84 Service Connections – 35,500 gpd – Surface Return

5.6 Alternative Cost Comparison

5.6.1 Cost Estimate Approach*

Conceptual construction cost estimates have been prepared for each of the three construction alternatives and include the following components:

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1. **Construction Cost:** The budgetary cost estimates are based on Class 3 level construction cost estimates, as defined by the Association for the Advancement of Cost Engineering (AACE) International Recommended Practices and Standards. According to AACE International Recommended Practices and Standards, the estimate class designators are labeled Class 1, 2, 3, 4, and 5, where a Class 5 estimate is based on the lowest level of project definition and a Class 1 estimate is closest to full project definition and maturity. The end usage for a Class 3 estimate is budget authorization, appropriation, and initial cost control. The expected accuracy range of a Class 3 estimate is between +30% and -20%. The level of project definition for a Class 3 estimate is between 10% and 40%. The costs include overhead and profit, equipment costs, demolition/removal of existing equipment, temporary provisions (if applicable), facilities and bypasses (if necessary, to complete the work), and costs regarding installation and start-up of improvements. This cost also includes a contractor general conditions cost factor of 15% of the construction subtotal. The costs are based upon recently completed project bid forms, quotes from equipment manufacturers/vendors, and data contained in R.S. Means Construction Cost Data.

2. **Engineering (20%):** A 20% cost factor has been applied for engineering fees. The 20% for engineering fees can be broken down further as: Engineering Design (8%) and Construction Administration (12%).

3. **Contingency (20%):** A 20% contingency has been applied to the estimated total project costscosts. For a Class 3 estimate, AACE International Recommended Practices and Standards recommends a contingency of 20%.*

4. **Total Project Costs:** The total project costs are the sum of the construction costs, property acquisition (if applicable), engineering, and the contingency costs.

5.6.2 Alternative Cost Estimates*

Capital Costs

The capital cost to the Village for the no-action alternative is $0. However, as described previously, if an individual system fails, cost to replace with an engineered system is estimated to be up to $40,000 per parcel.

Tables 5.4, 5.5 and 5.6 present the summarized construction cost estimates for Alternative No. 2, Alternative No. 3, and Alternative No. 4, respectively. These cost estimates include the cost for the collection, treatment, and disposal systems. The detailed construction cost estimates for each alternative are provided in Appendix I.

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TABLE 5.4 - Alternative No. 2 Preliminary Cost Estimate*

Component	Estimated Cost
STEP Collection System	$4,739,000
Site Work	$36,000
Electrical Service	$21,000
Biofiltration Resource Recovery System	$2,719,000
GGSF Absorption Field	$1,140,000
Construction Subtotal	$8,655,000
Property Acquisition	$283,000
Contingency (20%)	$1,788,000
Total Estimated Construction Cost	**$10,726,000**

TABLE 5.5 - Alternative No. 3 Preliminary Cost Estimate*

Component	Estimated Cost
STEP Collection System	$4,739,000
Site Work	$83,000
Electrical Service	$21,000
MBR Resource Recovery System	$3,441,000
Surface Return	$56,000
Construction Subtotal	$8,340,000
Property Acquisition	$0
Contingency (20%)	$1,668,000
Total Estimated Construction Cost	**$10,008,000**

TABLE 5.6 - Alternative No. 4 Preliminary Cost Estimate*

Component	Estimated Cost
STEP Collection System	$4,739,000
Site Work	$83,000
Electrical Service	$21,000
Biofiltration Resource Recovery System	$3,773,000
Surface Return	$56,000
Construction Subtotal	$8,672,000
Property Acquisition	$0
Contingency (20%)	$1,734,000
Total Estimated Construction Cost	**$10,406,000**

As shown in Tables 5.4, 5.5, and 5.6, Alternative No. 3 is anticipated to have the lowest capital construction cost.

Operation and Maintenance Costs

If the No Action Alternative is selected, costs for maintenance and repairs of existing septic systems will remain the cost of the individual property owners including costs for repair or replacement of failing systems. Tables 5.7, 5.8, and 5.9 present the summarized annual operation and maintenance (O&M) cost estimates for Alternative No. 2, Alternative No. 3, and Alternative No. 4, respectively. These cost estimates include the annual operation and maintenance costs for the collection, treatment, and disposal systems as well as administrative costs, short-term assets, and a 20% contingency. The detailed O&M cost estimates for each alternative are provided in Appendix I.

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TABLE 5.7 - Alternative No. 2 Annual O&M Cost Estimate

Component	Estimated Cost
STEP Collection System	$46,700
Biofiltration Resource Recovery System	$35,700
GGSF Absorption Field	$1,900
Annual O&M Subtotal	$84,300
Contingency (20%)	$16,900
Administration, Billing, & Accounting	$15,000
Total Estimated Annual O&M Cost	**$116,200**

TABLE 5.8 - Alternative No. 3 Annual O&M Cost Estimate

Component	Estimated Cost
STEP Collection System	$46,700
MBR Resource Recovery System	$106,900
Surface Return	$1,000
Annual O&M Subtotal	$154,600
Contingency (20%)	$31,000
Administration, Billing, & Accounting	$15,000
Total Estimated Annual O&M Cost	**$201,000**

TABLE 5.9 - Alternative No. 4 Annual O&M Cost Estimate

Component	Estimated Cost
STEP Collection System	$46,700
Biofiltration Resource Recovery System	$61,400
Surface Return	$1,000
Annual O&M Subtotal	$109,100
Contingency (20%)	$21,900
Administration, Billing, & Accounting	$15,000
Total Estimated Annual O&M Cost	**$146,000**

As shown in Tables 5.7, 5.8, and 5.9, Alternative No. 2 is anticipated to have the lowest annual operation and maintenance costs.

5.6.3 Life Cycle Cost Analysis*

A life cycle cost analysis was utilized to better compare the alternatives to determine the most cost-effective alternative, rather than just the alternative with the lowest capital cost. The net present value was calculated for each alternative as the capital cost (which includes construction and non-construction costs such as land acquisition and engineering) plus the present worth of the uniform series of annual O&M, minus the present worth of the salvage value of the system. This was calculated for a planning period of 20 years with a 2.3% inflation rate and a 0.3% discount rate taken from Appendix C of OMB Circular A-94. The net present value for each alternative is presented in Table 5.10.

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TABLE 5.10 - Life Cycle Cost Analysis Summary*

	Alt. No. 2	Alt. No. 3	Alt. No. 4
Capital Costs	$10,726,000	$10,008,000	$10,406,000
Annual O&M Costs	$116,200	$201,000	$146,000
Present Worth of O&M Costs	$2,820,000	$4,880,000	$3,550,000
Present Worth of Salvage Value	$1,150,000	$890,000	$1,080,000
Net Present Value	**$14,812,000**	**$15,979,000**	**$15,182,000**
		Planning Period	20 years
		Inflation Rate	2.30%
		Discount Rate	0.30%

Although the capital costs for Alternative No. 3 and Alternative No. 4 are less, the lower O&M costs for Alternative No. 2 ultimately results in a lower life cycle cost for Alternative No. 2 as shown in Table 5.10.

5.7 Non-Monetary Considerations

Non-monetary factors such as environmental impacts, land requirements, constructability concerns, sustainability considerations, potential for service interruption, availability for future expansion, public perception, operation and maintenance requirements, and regulator familiarity should also be considered for each alternative. Each of these items are briefly discussed in this Section.

Environmental Impacts

As discussed, the surface return options presented in Alternative No. 3 and Alternative No. 4 have the most direct impact on the water quality of Webatuck Creek. In comparison, the groundwater system recommended for Alternative No. 2 would have no direct environmental impact on Webatuck Creek. The no-action alternative is very likely to have environmental impacts if existing systems are to remain and are not functioning properly. There are no other anticipated environmental impacts.

Land Requirements

Alternative No. 2 requires the procurement of the vacant parcel adjacent to the Town owned parcel. However, Alternative No. 3 and Alternative No. 4 do not require land procurement since both treatment systems can fit within the existing Town owned property.

Procurement of a right-of-way or a lot line adjustment will be required for Alternative No. 3 and No. 4 for the secondary access road. Easements will also be required for the collection system and access easements will be required for the Village to access each parcel's STEG/STEP tank for operation and maintenance purposes.

Constructability Concerns

Each of the alternatives has their own unique constructability challenges. Alternative No. 2 has a constructability challenge for installation of the absorption field trenches parallel to the site contours. Alternative No. 3 and No. 4 have constructability challenges

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associated with the site clearing and construction of an access roadway along a relatively steep slope.

Sustainability Considerations

Sustainable utility management practices are important to consider when creating a new sewer district. Each alternative is utilizing a STEP collection system which is a closed system and thus there is much less chance for inflow and infiltration compared to a conventional collection system. Alternatives No. 2 with subsurface discharge are generally expected to be more energy efficient than Alterative No. 3 and Alternative No. 4 with the surface discharge. This is because the treatment system has less components, and thus there are less pumps, blowers, and there is no UV system which consumes a large amount of electricity. The operational simplicity of Alternative No. 2 compared to Alternative No. 3 and 4 in turn reduces the amount of operator visits, time and fuel driving back and forth, sending samples to the lab, etc. which, although minimal, helps to reduce the carbon footprint of the system.

There is minimal installation of non-porous surfaces for each alternative and thus stormwater management should be easily obtained. Green infrastructure can be incorporated where practical during the final design of the selected system.

Potential for Service Interruption

Each alternative has the potential for service interruption. However, the design of each treatment system would include an emergency back-up generator to ensure continuous operation even during a power failure event. However, power failure events for parcels with STEP systems (all alternatives) will mean temporary service interruptions for those parcels until electrical service is restored.

Availability for Future Expansion

Having area available for expansion of the sewer system is a very important consideration. Each of the alternatives has a STEP collection system which can be easily expanded.

One of the most important non-monetary considerations is the ability for the treatment system to expand for future wastewater flows. Alternative No. 2 is somewhat restricted in this manner as the subsurface is only capable of returning a fixed amount of flow based on the available area at the site (up to 182,000 gpd, see Section 4.5.3).

The MBR system and surface return alternative could be expanded in the future to meet average day flows of up to 125,000 gpd by adding a supplemental oxygen system and additional membranes. However, if flows are in excess of 125,000 gpd, an additional treatment unit will need to be added which will require an expansion of the metal building or construction of a second building to house the additional treatment units. This is an important consideration if the Village desires to expand the service area in the future.

The Orenco biofiltration system (Alternative No. 4) can also be expanded to meet future flows if needed. The Orenco system is modular and therefore additional tanks can be added to the system to allow for treatment of additional flow.

Public Perception

Nuisances such as odors and noise are commonly associated with wastewater treatment systems. While none of the proposed alternatives are expected to cause significant noise

or odor pollution, the MBR alternative is likely to be louder due to a greater number of pumps and blowers associated with the system. However, the building should significantly reduce the amount of noise emanating from the MBR system. No noise or odor concerns are expected with the AdvanTex biofiltration systems.

Public perception of the surface water return to Webatuck Creek will be seen negatively by members of the community. Residents have previously voiced concern to a surface water return. In addition, the MBR system will require a building which may be considered aesthetically unappealing for the neighbors within sight distance of the facility. This can be reduced with strategic placement and landscaping if required.

The components for Alternative No. 2 and Alternative No. 4 are primarily below grade and therefore are not expected to cause any negative public perceptions. However, Alternative No. 2 does require installation of an access road between two residences off Sharon Road and will require weekly inspection of the site by operators.

Operation and Maintenance Requirements

Each of the alternatives require a different degree of operation and maintenance. For the STEP system, maintenance primarily includes pumping out the tanks every 3-5 years (same as typical septic tanks). At a minimum, a yearly check on each of the septic tanks is also good practice to make sure there are no obvious issues. Effluent filters should be cleaned/replaced on a regular basis and STEP tank pumps will need to be replaced after approximately 20 years. It is anticipated that emergency maintenance for STEP tanks will periodically be required.

The Orenco AdvanTex treatment systems for Alternative No. 2 and Alternative No. 4 have similar operation and maintenance requirements. However, the Orenco treatment system for Alternative No. 4 will require more frequent operation and maintenance since there are additional tanks and components associated with the surface return treatment system. This means more pumps and blowers to maintain and eventually more media that will need to be replaced. Alternative No. 4 will require more frequent operational check-ins including daily compliance sampling as compared to Alternative No. 2. Generally, the MBR system (Alternative No. 3) requires a more operation and maintenance than the Orenco AdvanTex treatment system.

Besides maintenance for the effluent dosing pumps, there is practically no maintenance associated with the GGSF disposal system (Alternative No. 2). Maintenance of the surface return (Alternative No. 3 and 4) will consist of regular inspections of the surface return and periodic cleaning.

Regulator Familiarity

Regulator familiarity with the treatment system will help expedite regulatory review of the project. Treatment system technologies that have not been previously approved by the NYSDEC Region 3 for a community application will have a much longer review period and have a significant chance of delaying project schedule. The Orenco treatment systems have been installed for several community applications including a 30,000 gpd system in Hyde Park and a 35,000 gpd system in Hillsdale (Alternative No. 2 and 4). NYSDEC Region 3 is also familiar with the MBR systems (Alternative No. 3).

A summary of the non-monetary considerations for each alternative is shown in Table 5.11.

TABLE 5.11 – Non-Monetary Considerations

Item	Alt No. 1	Alt. No. 2	Alt. No. 3	Alt. No. 4
Environmental Impacts	- Failing or unmaintained leachfields remain	- Secondary treatment provided - Minimal groundwater impacts	- Direct Return to Webatuck Creek	- Return to Webatuck Creek
Land Requirements	- None	- Need to acquire vacant parcel	- None	- None
Constructability Concerns	- None	- GGSF system install on sloped site	- Secondary access road	- Secondary access road
Sustainability Considerations	- None	- More energy efficient	- Least energy efficient	- Less energy efficient
Potential for Service Interruption	- Potential for septic systems to fail	- Service interruption for STEP Tanks	- Service interruption for STEP Tanks	- Service interruption for STEP Tanks
Availability for Future Expansion	- Limited expansion available on small parcels	- Limited future expansion for disposal system	- Potential for expansion	- Most easily expandable – modular system
Public Perception	- Negative	- Subsurface return, positive	- Surface return, negative	- Surface return, negative

Operation and Maintenance Requirements	-	O&M remains the responsibility of property owners	-	Least O&M	-	Most O&M	-	Less O&M
Regulator Familiarity	-	Familiar	-	Familiar	-	Familiar	-	Familiar
Village Goals	-	Limits the amount of flow from businesses	-	Increases expandability of businesses	-	Increases expandability of businesses	-	Increases expandability of businesses
Existing Issues	-	Does not address existing WW issues	-	Addresses existing WW issues	-	Addresses existing WW issues	-	Addresses existing WW issues

Section 6
Recommended Alternative

Due to the reported wastewater problems in the Village, the public's desire to install a centralized wastewater treatment system, the goals of the comprehensive plan, and the site constraints in the Village which limit the performance of traditional septic systems, the Village is encouraged to consider Alternative No. 2, Alternative No. 3, or Alternative No. 4.

6.1 Summary of Recommended Alternative

Based on the results of the alternatives analysis and the non-monetary considerations discussed in Section 5, Alternative No. 2 is the apparent best alternative and was recommended in previous revisions of this report. However, although preliminary conversations with the owner of the vacant parcel suggested that a suitable path may exist for Village ownership of the vacant parcel, further conversations between the Village and the parcel owner in late 2021 concluded that the Village will not be able to acquire the vacant parcel at this time. Therefore, Alternative No. 2 is no longer feasible since there is insufficient area for a groundwater return system on the Mill Street property alone.

Since Alternative No. 2 is no longer feasible, Alternative No. 4 is the recommended alternative. The basis for selection of Alternative No. 4 is as follows:

- Alternative No. 2 is not feasible (vacant parcel cannot be acquired)
- Second lowest life cycle costs
- Reduced operation and maintenance complexity and frequency compared to MBR
- Minimal visual impacts
- Greater public perception (tanks are mostly buried)
- Ease of future expansion
- Meets Village goals
- Will allow growth of businesses within the Village

Implementation of Alternative No. 4 will consist of the following:

1. Construction of a STEP collection system for the proposed sewer district. The proposed sewer district primarily covers the Village General Business District, the commercial areas along Route 22, and the Town of North East Boulevard District along Route 44 (see Figure A.9 for a map of the proposed sewer district);
2. Installation of the Orenco AdvanTex biofiltration system for secondary treatment of the septic tank effluent wastewater at the Mill Street Site sized to treat an average daily flow of 70,000 gpd for the service area, and;
3. Construction of surface return piping to Webatuck Creek for the treated effluent.

6.2 Project Costs*

There are several financial grant or low-interest loan programs available which may assist the Village with funding this project such as the Clean Water State Revolving Fund (CWSRF) or the USDA Rural Development program. This engineering report has been prepared in anticipation of pursuit of a low-interest loan or grant. Table 6.1 below provides the conceptual opinion of probable cost for implementation of Alternative No. 4 in a format that is consistent with USDA Rural Development requirements.

TABLE 6.1 - Recommended Project Costs*

Item	Cost[1]
1. Construction Costs	$9,476,000
2. Engineering Costs	
a. Design	$736,000
b. Construction	$1,137,000
3. Other Expenses	
a. Local Counsel	$71,000
b. Bond Counsel	$118,000
c. Work Force	$0
d. Financial Services	$0
e. Miscellaneous	$0
4. Equipment	$0
5. Land Acquisition	$0
6. Project Contingency (20%)	$2,292,000
7. Total Project Costs	**$13,830,000**
8. Less Other Sources of Financing	
a. Dutchess County MIG	-$200,000
b. CPF Grant	-$959,752
c. IMG Grant	-$5,082,099
9. Project Costs to be Financed	$7,588,149

[1]Costs presented are in 2025 dollars

6.3 Annual Operating Budget

6.3.1 Income

There is no existing income for sewer services since there is no existing municipal sewer system. Sewer use fees for the proposed system will fund construction and annual O&M costs. Refer to Section 6.3.3 for debt repayments.

6.3.2 Annual O&M Costs

As discussed in Section 5.6.2, the estimated annual O&M cost for the proposed system is $146,000 (see Table 5.9). The annual O&M cost estimate includes the annual operation and maintenance costs for the collection, treatment, and disposal systems as well as administrative costs, short-term assets, and a 20% contingency. The detailed O&M cost estimate for Alternative No. 4 can be found in Appendix I.

*Revised July 2025

6.3.3 Dept Repayment & User Fees*

Sewer Use costs have been developed using a Benefit Unit approach presented in Appendix L.

6.3.4 Reserves

It is anticipated that debt service reserves will be accounted for in future Village and Town budgets. Short lived assets are tabulated in Table 6.2, below.

TABLE 6.2 - Short Lived Assets

Description	Cost
1-5 Years	
STEP Tank Float Switches	$11,700
STEP Tank Effluent Filters	$19,500
Biofiltration System Pump Float Switches	$1,050
UV Bulbs and Sleeves	$9,600
5-10 Years	
Office Computer	$2,000
Biofiltration System Spray Nozzles	$9,000
UV Bulbs and Sleeves	$9,600
10-15 Years	
Influent Flow Meter	$5,500
Effluent Flow Meter	$5,500
UV Bulbs and Sleeves	$9,600
Fans	$12,000
Control Building Lights	$500
Control Building HVAC	$7,500
Sewer District Truck	$70,000
Total	**$173,050**

6.4 Project Implementation & Schedule*

The following are the next steps for project implementation of the recommended alternative:

1. Secure Additional Project Funding - As indicated in this report, the cost of the proposed system is substantial. It is recommended that this report is used to apply for financial assistance for funding the design and construction of the recommended alternative. This report has been modified for the USDA Rural Development application. The Village plans to continue pursuing WQIP in 2025.
2. Engineering & Design:
    a. Preliminary Engineering – A $200,000 Municipal Innovation Grant has been secured to fund a portion of preliminary design. The QBS process has been utilized to select an engineer and an engineering contract has been executed. The Preliminary Design is now mostly complete and included:
        i. Site Survey - A topographic and boundary survey of the treatment and disposal site conducted by the engineering consultant.

*Revised July 2025

ii. Collection System Survey – A survey of the collection system to locate existing utilities and prevent conflicts with the utilities during construction of the new collection system.

iii. Soil Testing – Geotechnical information collected at the treatment system site and in the collection system and will be used for final design of the collection and treatment system components.

iv. Parcel Investigations – A parcel by parcel survey completed to determine the type and location of the existing wastewater treatment systems in order to determine the appropriate connection points and locations for the new STEP tanks.

b. Final Engineering – As noted above a wastewater design engineer has been selected through the QBS process, final engineering will include design and construction administration and observation for construction of the collection, water resource recovery, and return systems. The Village recently received a $959,752 Congressionally Directed Spending Community Project Funding Grant which will be used to fund the final design phase.

i. Service Area Flow Confirmation – Following the completion of the water meter replacement project, the measured flows for the proposed sewer district should be compared to the estimated flows. As discussed in Section 3.4.1, it is anticipated that actual flows will be less than the estimated flows based on the water production data available.

ii. Permitting – the engineering consultant will assist the Village with obtaining a SPDES permit for the system. Permits will be required for construction of the sewer mains where the sewer mains cross state roads. A Protections of Water Permit will be required for stream crossings and the outfall through NYSDEC. A permit for the outfall will also be required through the Army Corp of Engineers. A SWPPP for Construction Phase activities will also be developed.

iii. Design Phases– Design of the collection, treatment, and disposal system will advance in stages including 30%, 60%, and 100% (permit set) design phases. The engineering consultant will have discussions with regulators during the design including the NYSDEC and the Dutchess County Department of Behavioral and Community Health. Design modifications may be required depending on discussions with regulators.

iv. Contract Documents - Contract documents appropriate for permitting and construction will be developed and will consist of drawings and specifications for each phase of the design process.

v. Regulatory Review – It is anticipated that the NYSDEC and the Dutchess County Department of Behavioral and Community Health will need to review and approve the 100% design prior to bidding.

vi. Bidding – The project will go out to public bid after receiving approval.

vii. Construction Administration & Observation – The engineering consultant will provide construction administration and observation services.

3. Construction – Construction will be awarded and commence following receipt of reasonable bids. It is anticipated that the construction project will be split into two prime contracts: general construction and electrical construction per Wick's Law. The sequence of construction would likely start with installation of the water resource recovery and return systems, installation of the sewer mains, and then making the service connections to each user.
4. Testing and Start-up – Testing and start-up will begin as construction nears completion and service connections are made.

The anticipated project schedule is attached as Appendix M.

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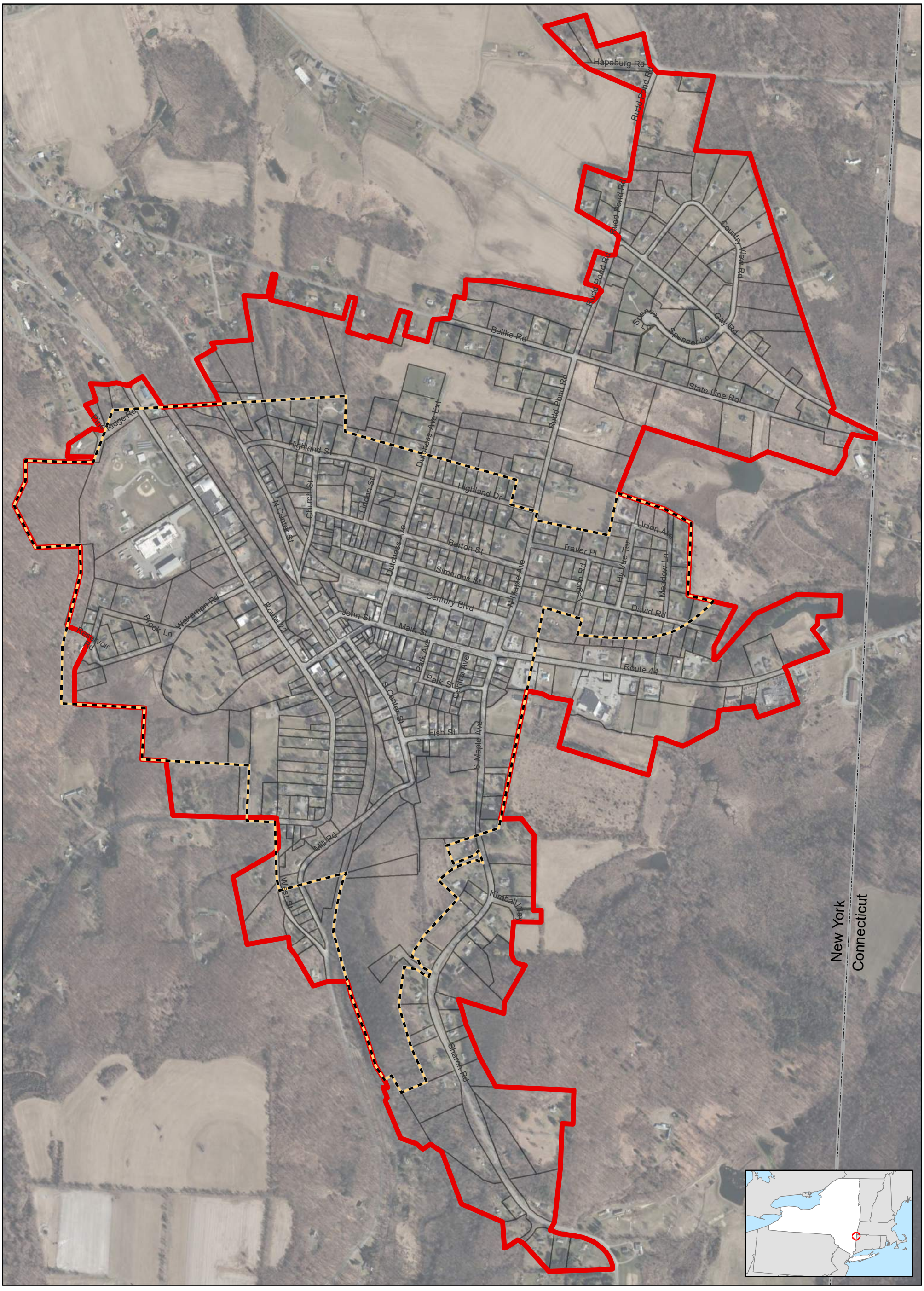
APPENDIX A



Legend

- Study Area Boundary (Water District)
- Village Boundary
- Parcel Boundary

Tighe&Bond
Engineers | Environmental Specialists
Services provided in New York by T&B Engineering, P.C.

1. Ortho provided by dhses.ny.gov (2016).
2. Parcel lines are approximate.
3. Resource data provided by NYSGIS clearinghouse (gis.ny.gov)

1 in = 800 ft

0 400 800

Feet

N

Figure A.1
Study Area Boundary

Village of Millerton
Wastewater Feasibility Evaluation

March 2020

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M-1784

SkB
MnA
SkC
GsA
Hapeburg Rd
SkB
GsA
Rudd Pond Rd
SkC
GsA
SkB
GsB
Rudd Pond Rd
Country View Rd
GsB
SkC
Su
SkB
MnA
GsB
Beilke Rd
Spencer Ln
Spencer Ln
Gay Rd
Ha
W
SkB
Wy
DwD
CuD
Pine Ridge Rd
Pg
SkC
SmC
Rudd Pond Rd
SkC
State Line Rd
MnA
CuB
CuB
Su
SkB
NwD
Highland St
Dutchess Ave Ext
Highland Dr
GfB
GfB
Su
SkC
Union Ave
Traver Pl
Barton St
Hy-Vue Ter
Meadow Ln
SkB
CwA
W
NwD
Wy
Simmons St
Dutchess Ave
N Maple Ave
Legion Rd
Century Blvd
David Rd
CuB
Brook Ln
Wakeman Rd
Route 22
John St
CxB
Main St
Park Ave
Park St
Central Ave
CuA
Route 44
CuA
Wy
Ue
Ur
Wy
CuC
NwD
CuB
S Center St
Fish St
S Maple Ave
Cc
SkC
Wy
CuA
SkC
Mill Rd
SkB
SkD
West St
NxE
Kimball Way
SkC
SkC
NwD
NxE
SkD
Sharon Rd
DwD
Ff
DwC
DwD
SkB
GsB
New York
Connecticut

Legend

- Study Area Boundary
- Village Boundary
- Parcel Boundary
- Drainage Types A or B
- Drainage Types C or D
- Depth to Groundwater < 4'
- Depth to Bedrock < 4'

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1. Ortho provided by dhses.ny.gov (2016).
2. Parcel lines are approximate.
3. Resource data provided by NYSGIS clearinghouse (gis.ny.gov)
4. Soil drainage types provided by USDA Natural Resources Conservation Service.

1 in = 800 ft

0 400 800

Feet

N

Figure A.2
Soil Types & Restrictions

Village of Millerton
Wastewater Feasibility Evaluation

March 2020

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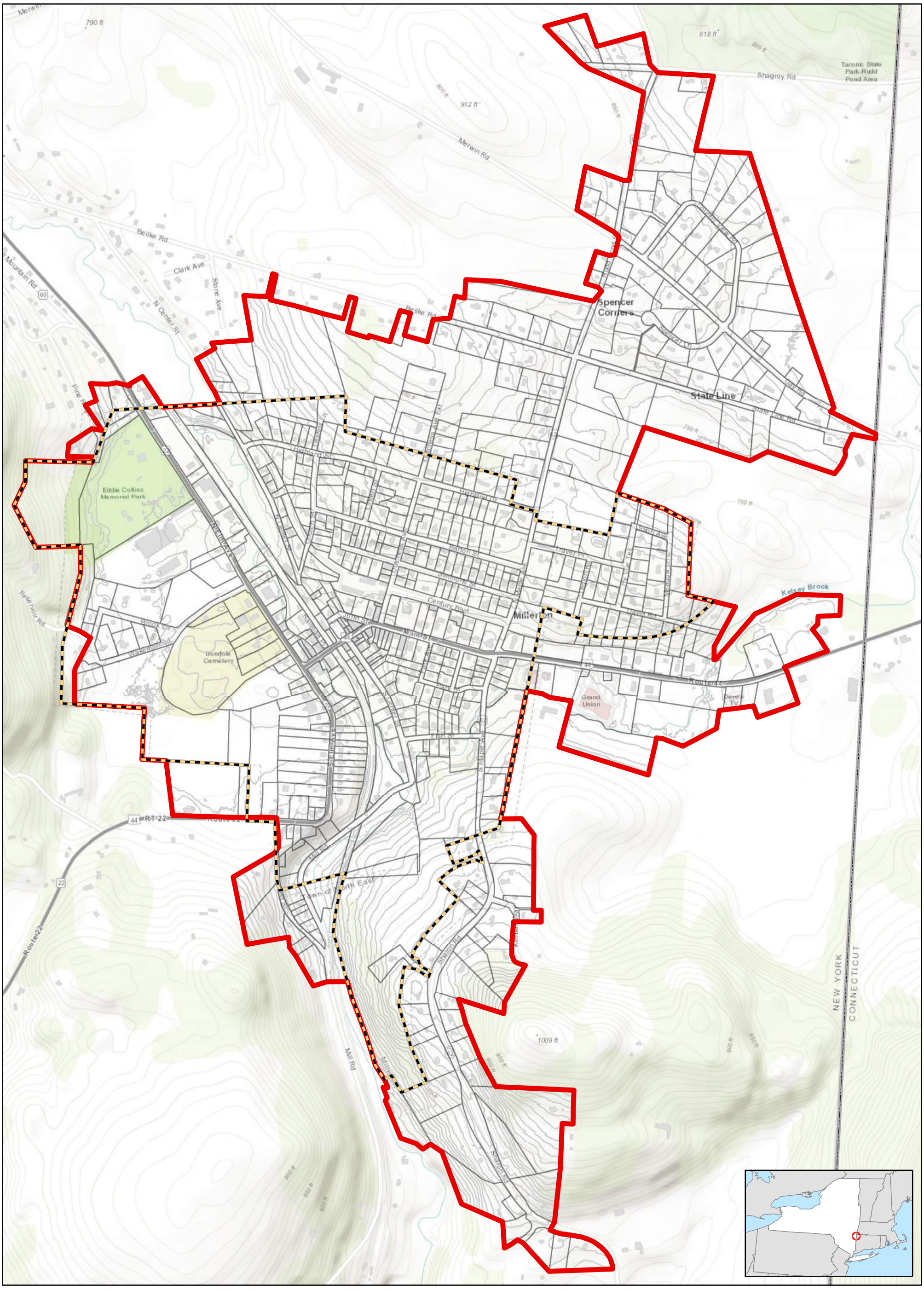

Legend

- Study Area Boundary
- Village Boundary
- Parcel Boundary

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1. Ortho provided by dhses.ny.gov (2016).
2. Parcel lines are approximate.
3. Resource data provided by NYSGIS clearinghouse (gis.ny.gov)
4. Topography provided by ESRI.

1 in = 800 ft

0 400 800

Feet

N

Figure A.3
Topography

Village of Millerton
Wastewater Feasibility Evaluation

March 2020

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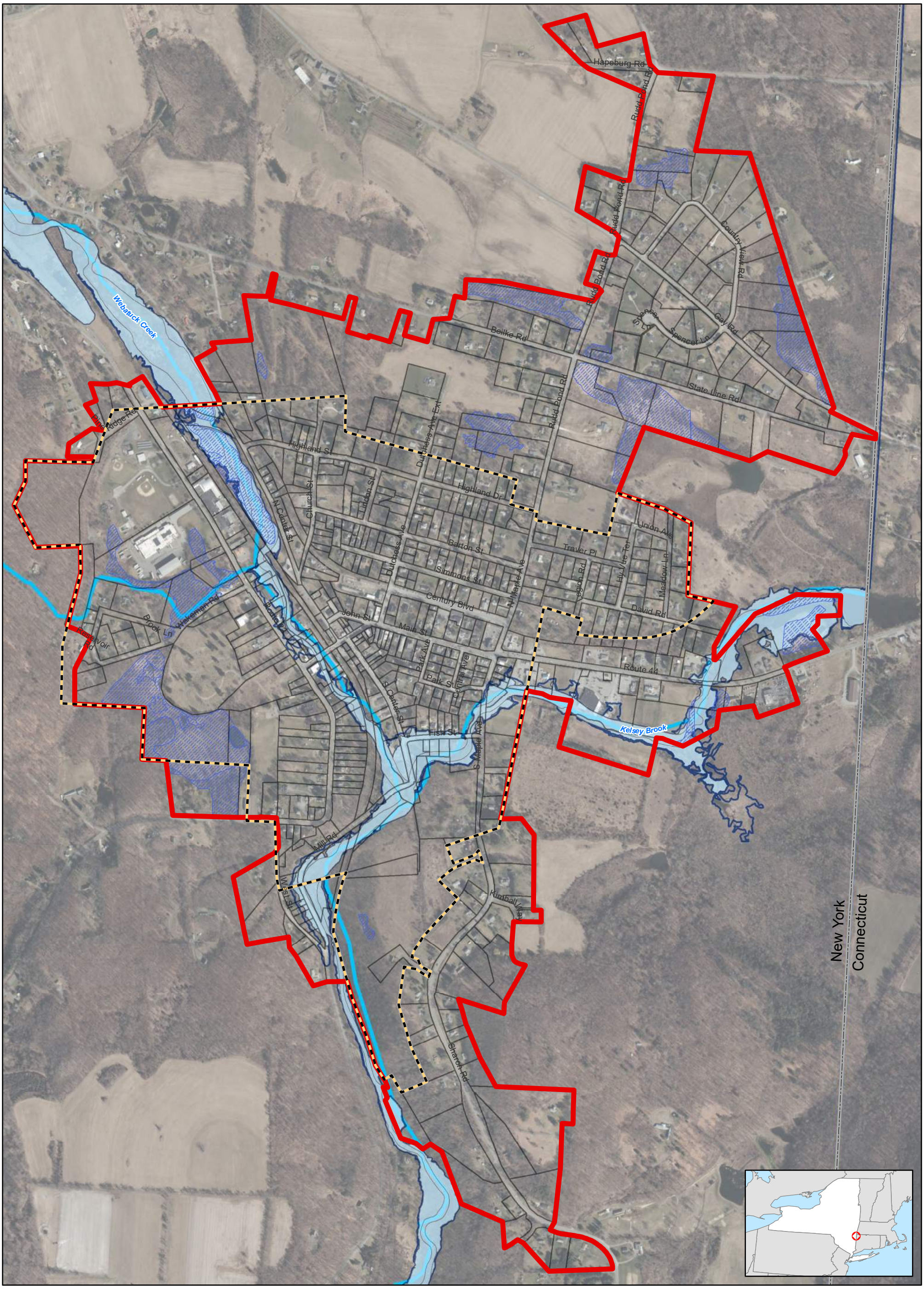
M-1784



Legend

- Study Area Boundary
- Village Boundary
- Parcel Boundary
- Stream / River
- 100-Year Flood Zone
- 500-Year Flood Zone
- NWI Wetlands

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1. Ortho provided by dhses.ny.gov (2016).
2. Parcel lines are approximate.
3. Resource data provided by NYSGIS clearinghouse (gis.ny.gov)
4. Flood zone delineation provided by FEMA.
5. NWI wetlands provided by U.S. Fish & Wildlife Service.

1 in = 800 ft

0 400 800

Feet

N

Figure A.4
Hydrography

Village of Millerton
Wastewater Feasibility Evaluation

March 2020

J:\M\M1784 Millerton\004 - Wastewater Evaluation\Documents\Reports\GIS\MillertonNY_FigureA.4.mxd

M-1784

Hapeburg Rd
Rudd Pond Rd
Rudd Pond Rd
Rudd Pond Rd
Country View Rd
Spencer Ln
Spencer Ln
Gay Rd
Beilke Rd
State Line Rd
Rudd Pond Rd
Dutchess Ave Ext
Pine Ridge Rd
R20000
Highland St
R20000
R20000
Highland Dr
R20000
Union Ave
Traver Pl
R20000
Ivy Vue Ter
Meadow Ln
Legion Rd
R20000
R20000
R20000
David Rd
R20000
R20000
Century Blvd
R20000
LC
LB
LC
LB
M
LC
R1A
R1A
R1A
LC
PRB
PRB
PRB
Route 22
Brook Ln
Wakeman Rd
Reservoir Rd
GB
GB
GB
GB
GB
GB
GB
John St
Main St
HBI
HBI
Route 44
R10000
R10000
R10000
R10000
R20000
R20000
R20000
R20000
LC
LC
LC
Fish St
Park St
Park Ave
S Center St
S Maple Ave
N Maple Ave
N Central St
Church St
Liddon St
Simmons St
Barton St
Mill Rd
West St
Kimball Way
Sharon Rd
R1A
New York
Connecticut

Legend

- Study Area Boundary
- Village Boundary
- Parcel Boundary
- GB, General Business
- HBI, Highway Business I
- LB, Limited Business
- LC, Land Conservation
- M, Industry
- PRB, Planned Residential Business
- R10000, High Density Residential
- R1A, Low Density Residential
- R20000, Medium Density Residential

1 in = 800 ft

0 400 800

Feet

N

1. Ortho provided by dhses.ny.gov (2016).
2. Parcel lines are approximate.
3. Resource data provided by NYSGIS clearinghouse (gis.ny.gov)
4. Zoning district classifications provided by the Village of Millerton.

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Figure A.5
Zoning Districts

Village of Millerton
Wastewater Feasibility Evaluation

March 2020

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M-1784

Hapeburg Rd
Rudd Pond Rd
Rudd Pond Rd
Rudd Pond Rd
Country View Rd
Spencer Ln
Spencer Ln
Gay Rd
Beilke Rd
State Line Rd
Rudd Pond Rd
Pine Ridge Rd
Highland St
Duchess Ave Ext
Highland Dr
N Central St
Church St
Eddon St
Duchess Ave
Barton St
Simmons St
N Maple Ave
Century Blvd
Union Ave
Traver Pl
Union Rd
Hy Vue Ter
Meadow Ln
David Rd
John St
Main St
Route 22
Park Ave
Park St
Central Ave
S Center St
Fish St
S Maple Ave
Route 44
Reservoir Rd
Brook Ln
Wakeman Rd
Mill Rd
West St
Kimball View
Sharon Rd
New York
Connecticut

Legend

- Study Area Boundary
- Village Boundary
- Parcel Boundary
- Main Street
- Main North
- Travers Place
- Main East
- Main South
- Route 22 South
- Main West
- Route 22 North

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1. Ortho provided by dhses.ny.gov (2016).
2. Parcel lines are approximate.
3. Resource data provided by NYSGIS clearinghouse (gis.ny.gov).

1 in = 800 ft

0 400 800

Feet

N

Figure A.6
Sub-Areas

Village of Millerton
Wastewater Feasibility Evaluation

March 2020

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M-1784

Legend

Study Area Boundary
Village Boundary
Parcel Boundary
Parcels w/ Septic Problems
Parcels w/ Basement Problems
Parcels w/ Septic and Basement Problems

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1. Ortho provided by dhses.ny.gov (2016).
2. Parcel lines are approximate.
3. Wastewater survey results provided by the Village of Millerton.

1 in = 800 ft
0 400 800
Feet

N

Figure A.7
WW Survey Results

Village of Millerton
Wastewater Feasibility Evaluation

March 2020

J:\M\M1784 Millerton\004 - Wastewater Evaluation\Documents\Reports\GIS\MillertonNY_FigureA.7.mxd

M-1784

Parcel 1
Parcel 2
Parcel 3
Parcel 4
Parcel 5
Parcel 7
Parcels 8-12
Parcel 6
Hapeburg Rd
Rudd Pond Rd
Courtney View Rd
Gay Rd
Spencer Ln
Beilke Rd
State Line Rd
Plass Ridge Rd
Highland St
Dutchess Ave Ext
Highland Dr
N Central St
Church St
Linden St
Dutchess Ave
Barton St
Traver Pl
Union Ave
Meadow Ln
Hy-Vue Ter
Legion Rd
Simmons St
N Maple Ave
Century Blvd
David Rd
John St
Main St
Route 22
Wakeman Rd
Brook Ln
Reservoir Rd
Park Ave
Central Ave
Park St
Route 44
S Center St
Fish St
S Maple Ave
Mill Rd
West St
Kimball View
Sharon Rd
New York
Connecticut

Legend

Study Area Boundary
Potential Wastewater Treatment Site
Village Boundary
Parcel Boundary

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1. Ortho provided by dhses.ny.gov (2016).
2. Parcel lines are approximate.
3. Resource data provided by NYS GIS clearinghouse (gis.ny.gov).

1 in = 800 ft
0 400 800
Feet

N

Figure A.8
Potential Sites

Village of Millerton
Wastewater Feasibility Evaluation

March 2020

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M-1784

FIGURE A.9
PROPOSED
SEWER DISTRICT

LEGEND

- Sewer District
- Parcel Boundary
- Village Boundary
- Town Boundary

LOCUS MAP

0 300 600

Feet

1:7,200

NOTES

Ortho provided by its.ny.gov (2020).

Village of Millerton
Wastewater
Feasibility Evaluation
Millerton, New York

April 2022

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M-1784

FIGURE A.10
PROPOSED COLLECTION SYSTEM

LEGEND

- Sewer District
- Parcel Boundary
- Village Boundary
- Town Boundary
- Collection System

LOCUS MAP

0 300 600
Feet
1:7,200

NOTES

Ortho provided by its.ny.gov (2020).

Village of Millerton
Wastewater
Feasibility Evaluation
Millerton, New York

April 2022

Tighe&Bond

V:\Projects\M\M1784\MilltertonWW_DistrictFormation\MilltertonNY_ProposedSewerDistricLandscape.mxd, [Exported By: kjw, 4/13/2022, 3:54:39 PM]

M-1784

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APPENDIX B

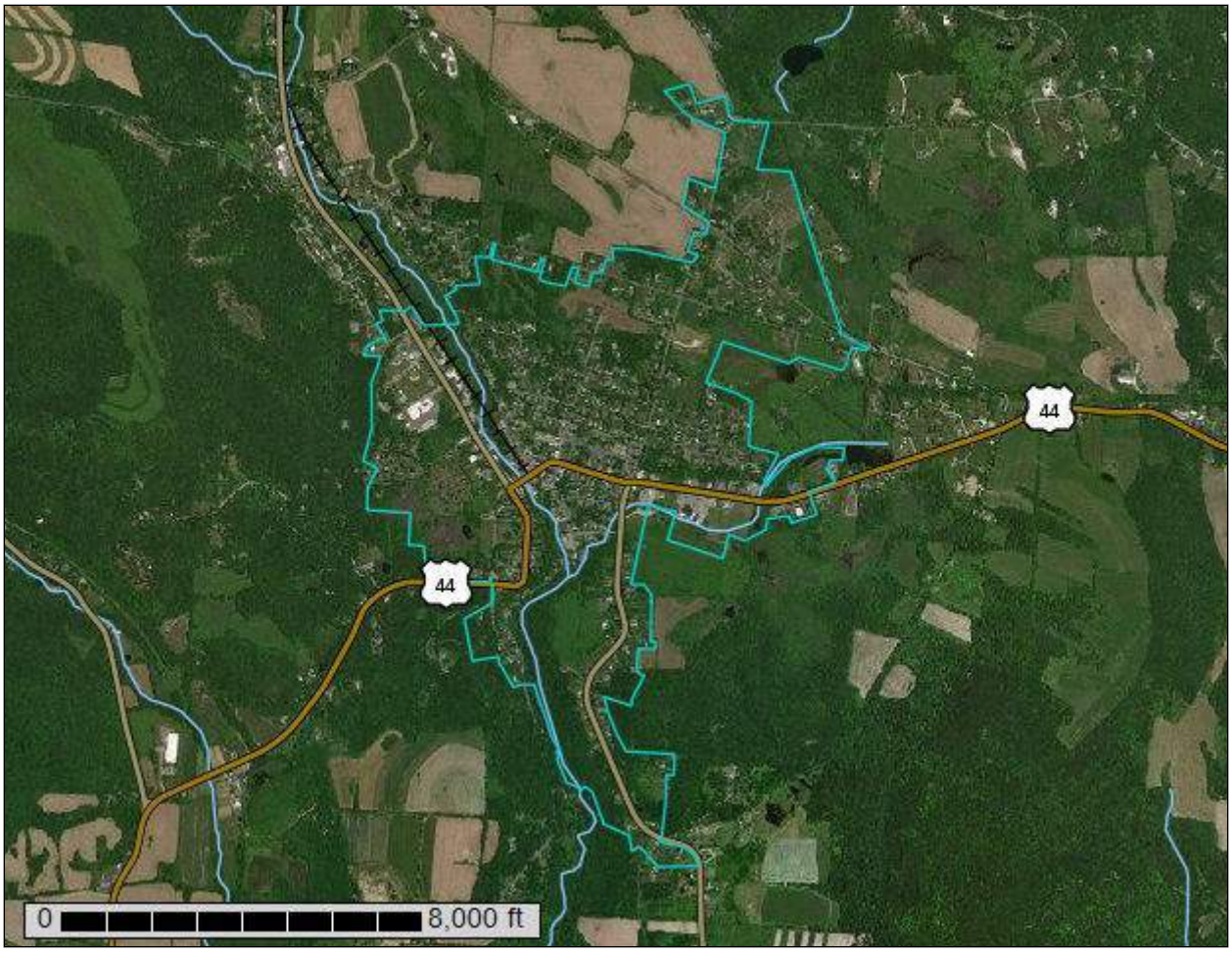
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Dutchess County, New York



April 23, 2018

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

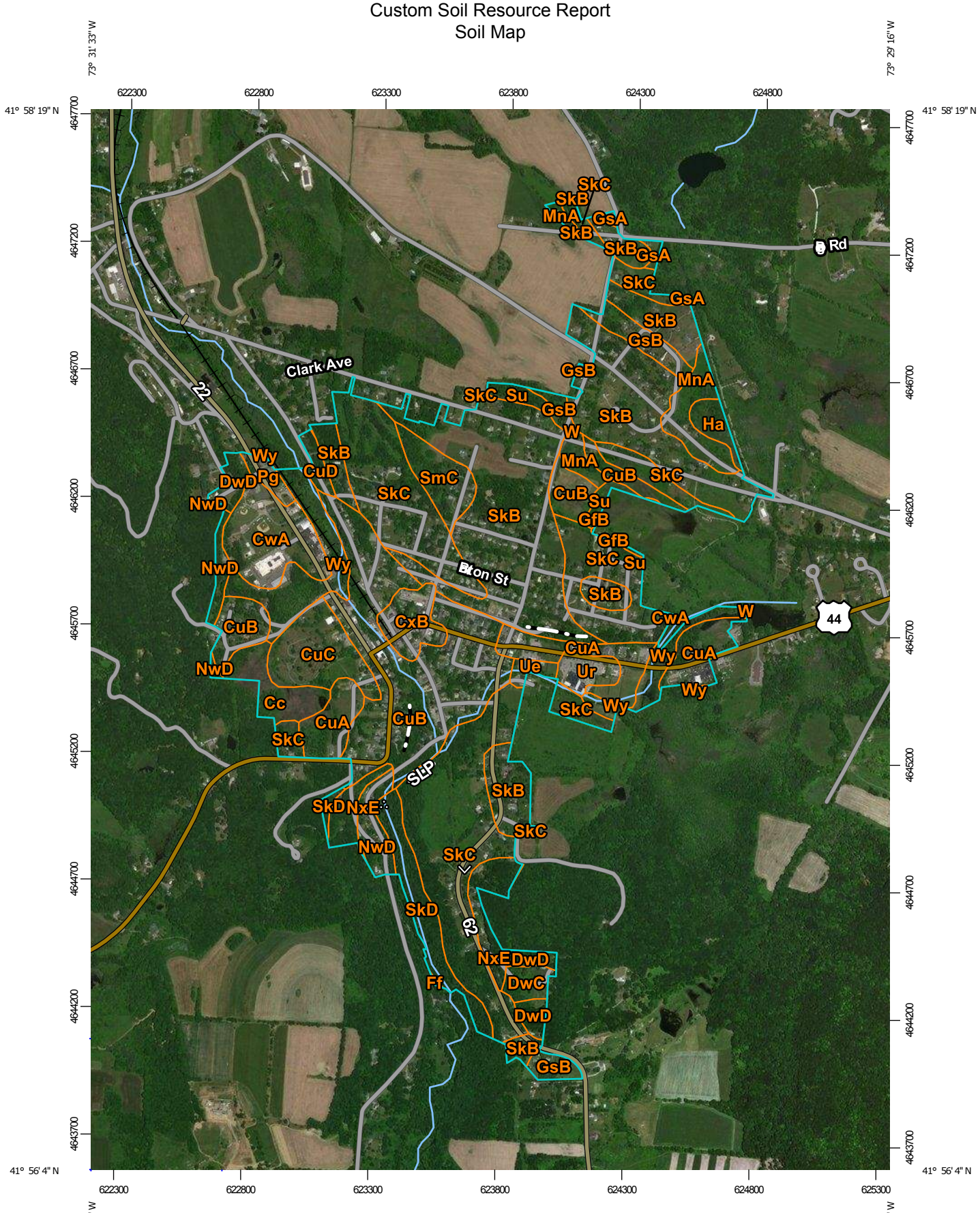
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:20,300 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 300 600 1200 1800

Feet: 0 500 1000 2000 3000

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 Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

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 1:24,000.

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: Dutchess County, New York
Survey Area Data: Version 14, Oct 8, 2017

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

Date(s) aerial images were photographed: Jul 2, 2015—Oct 5, 2016

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Cc	Catden muck, 0 to 2 percent slopes	14.2	1.8%
CuA	Copake gravelly silt loam, nearly level	41.0	5.2%
CuB	Copake gravelly silt loam, undulating	113.8	14.5%
CuC	Copake gravelly silt loam, rolling	23.9	3.0%
CuD	Copake gravelly silt loam, hilly	3.8	0.5%
CwA	Copake channery silt loam, fan, 0 to 3 percent slopes	28.3	3.6%
CxB	Copake-Urban land complex, undulating	12.6	1.6%
DwC	Dutchess-Cardigan complex, rolling, rocky	5.7	0.7%
DwD	Dutchess-Cardigan complex, hilly, rocky	11.6	1.5%
Ff	Fluvaquents-Udifluvents complex, frequently flooded	0.2	0.0%
GfB	Galway-Farmington complex, undulating, rocky	0.1	0.0%
GsA	Georgia silt loam, 0 to 3 percent slopes	1.8	0.2%
GsB	Georgia silt loam, 3 to 8 percent slopes	16.1	2.0%
Ha	Halsey mucky silt loam	5.6	0.7%
MnA	Massena silt loam, 0 to 3 percent slopes	19.6	2.5%
NwD	Nassau-Cardigan complex, hilly, very rocky	14.4	1.8%
NxE	Nassau-Rock outcrop complex, steep	18.5	2.3%
Pg	Pawling silt loam	4.5	0.6%
SkB	Stockbridge silt loam, 3 to 8 percent slopes	192.0	24.4%
SkC	Stockbridge silt loam, 8 to 15 percent slopes	172.3	21.9%
SkD	Stockbridge silt loam, 15 to 25 percent slopes	20.6	2.6%
SmC	Stockbridge-Farmington complex, rolling, rocky	14.1	1.8%
Su	Sun silt loam	6.8	0.9%
Ue	Udorthents, wet substratum	3.2	0.4%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Ur	Urban land	7.6	1.0%
W	Water	0.3	0.0%
Wy	Wayland silt loam	34.4	4.4%
Totals for Area of Interest		**786.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Dutchess County, New York

Cc—Catden muck, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2t2qk
Elevation: 0 to 1,430 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Catden and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Catden

Setting

Landform: Fens, kettles, marshes, swamps, bogs, depressions, depressions, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed herbaceous organic material and/or highly decomposed woody organic material

Typical profile

Oa1 - 0 to 2 inches: muck
Oa2 - 2 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Percent of area covered with surface fragments: 0.0 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water storage in profile: Very high (about 26.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Canandaigua

Percent of map unit: 5 percent

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Natchaug

Percent of map unit: 5 percent
Landform: Depressions, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Alden

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Timakwa

Percent of map unit: 5 percent
Landform: Swamps
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Hydric soil rating: Yes

CuA—Copake gravelly silt loam, nearly level

Map Unit Setting

National map unit symbol: 9rf9
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Copake and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Copake

Setting

Landform: Outwash plains, terraces, deltas
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: gravelly silt loam
H2 - 6 to 36 inches: gravelly loam
H3 - 36 to 80 inches: stratified very gravelly coarse sand to gravelly loamy fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Hoosic

Percent of map unit: 10 percent
Hydric soil rating: No

Halsey

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Fredon

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

CuB—Copake gravelly silt loam, undulating

Map Unit Setting

National map unit symbol: 9rfb
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Copake and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Copake

Setting

Landform: Terraces, deltas, outwash plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: gravelly silt loam
H2 - 6 to 36 inches: gravelly loam
H3 - 36 to 80 inches: stratified very gravelly coarse sand to gravelly loamy fine sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Hoosic
Percent of map unit: 10 percent
Hydric soil rating: No

Fredon
Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Halsey
Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

CuC—Copake gravelly silt loam, rolling

Map Unit Setting
National map unit symbol: 9rfc
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Copake and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Copake

Setting
Landform: Deltas, outwash plains, terraces
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy over calcareous sandy and gravelly glaciofluvial deposits

Typical profile
H1 - 0 to 6 inches: gravelly silt loam
H2 - 6 to 36 inches: gravelly loam
H3 - 36 to 80 inches: stratified very gravelly coarse sand to gravelly loamy fine sand

Properties and qualities
Slope: 5 to 16 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 6.3 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Hoosic
Percent of map unit: 10 percent
Hydric soil rating: No

Fredon
Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

Halsey
Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: Yes

CuD—Copake gravelly silt loam, hilly

Map Unit Setting
National map unit symbol: 9rfd
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition
Copake and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Copake

Setting
Landform: Deltas, outwash plains, terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Riser
Down-slope shape: Convex

Across-slope shape: Convex
Parent material: Loamy over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: gravelly silt loam
H2 - 6 to 36 inches: gravelly loam
H3 - 36 to 80 inches: stratified very gravelly coarse sand to gravelly loamy fine sand

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Hoosic

Percent of map unit: 10 percent
Hydric soil rating: No

Fredon

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

CwA—Copake channery silt loam, fan, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 9rfg
Elevation: 300 to 850 feet
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Copake, fan, and similar soils: 80 percent
Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Copake, Fan

Setting

Landform: Terraces, deltas, outwash plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: channery silt loam
H2 - 6 to 36 inches: channery loam
H3 - 36 to 80 inches: stratified very gravelly coarse sand to gravelly loamy fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 36 to 72 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Hoosic

Percent of map unit: 10 percent
Hydric soil rating: No

Fredon

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Halsey

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

CxB—Copake-Urban land complex, undulating

Map Unit Setting

National map unit symbol: 9rfj
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Copake and similar soils: 40 percent
Urban land: 35 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Copake

Setting

Landform: Deltas, outwash plains, terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: gravelly silt loam
H2 - 6 to 36 inches: gravelly loam
H3 - 36 to 80 inches: stratified very gravelly coarse sand to gravelly loamy fine sand

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Hydric soil rating: No

Description of Urban Land

Typical profile

H1 - 0 to 6 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Udorthents

Percent of map unit: 10 percent
Hydric soil rating: No

Fredon

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Hoosic

Percent of map unit: 5 percent
Hydric soil rating: No

Halsey

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

DwC—Dutchess-Cardigan complex, rolling, rocky

Map Unit Setting

National map unit symbol: 9rfp
Elevation: 50 to 1,000 feet
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Dutchess and similar soils: 40 percent
Cardigan and similar soils: 30 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dutchess

Setting

Landform: Ridges, hills

Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till derived mainly from phyllite, slate, schist, and shale

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 28 inches: silt loam
H3 - 28 to 86 inches: channery silt loam

Properties and qualities

Slope: 5 to 16 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Cardigan

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till or colluvium derived from phyllite, slate, shale, and schist

Typical profile

H1 - 0 to 8 inches: channery silt loam
H2 - 8 to 20 inches: channery loam
H3 - 20 to 30 inches: channery silt loam
H4 - 30 to 34 inches: unweathered bedrock

Properties and qualities

Slope: 5 to 16 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Georgia
Percent of map unit: 10 percent
Hydric soil rating: No

Massena
Percent of map unit: 9 percent
Hydric soil rating: No

Nassau
Percent of map unit: 9 percent
Hydric soil rating: No

Rock outcrop
Percent of map unit: 1 percent
Hydric soil rating: Unranked

Sun
Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

DwD—Dutchess-Cardigan complex, hilly, rocky

Map Unit Setting
National map unit symbol: 9rfq
Elevation: 50 to 1,000 feet
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition
Dutchess and similar soils: 40 percent
Cardigan and similar soils: 30 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dutchess

Setting
Landform: Ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Parent material: Loamy till derived mainly from phyllite, slate, schist, and shale

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 28 inches: silt loam
H3 - 28 to 86 inches: channery silt loam

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Cardigan

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till or colluvium derived from phyllite, slate, shale, and schist

Typical profile

H1 - 0 to 8 inches: channery silt loam
H2 - 8 to 20 inches: channery loam
H3 - 20 to 30 inches: channery silt loam
H4 - 30 to 34 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Sun
Percent of map unit: 10 percent
Landform: Depressions
Hydric soil rating: Yes

Nassau
Percent of map unit: 9 percent
Hydric soil rating: No

Georgia
Percent of map unit: 5 percent
Hydric soil rating: No

Massena
Percent of map unit: 5 percent
Hydric soil rating: No

Rock outcrop
Percent of map unit: 1 percent
Hydric soil rating: Unranked

Ff—Fluvaquents-Udifluvents complex, frequently flooded

Map Unit Setting
National map unit symbol: 9rfy
Elevation: 100 to 3,000 feet
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition
Fluvaquents and similar soils: 50 percent
Udifluvents and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fluvaquents

Setting
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Alluvium with highly variable texture

Typical profile

H1 - 0 to 5 inches: gravelly silt loam
H2 - 5 to 70 inches: very gravelly silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 19.98 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

Description of Udifluvents

Setting

Landform: Flood plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium with a wide range of texture

Typical profile

H1 - 0 to 4 inches: gravelly loam
H2 - 4 to 70 inches: very gravelly loam

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 19.98 in/hr)
Depth to water table: About 24 to 72 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Linlithgo
Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: No

Wayland
Percent of map unit: 2 percent
Landform: Flood plains
Hydric soil rating: Yes

Wappinger
Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: No

Pawling
Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: No

Carlisle
Percent of map unit: 1 percent
Landform: Marshes, swamps
Hydric soil rating: Yes

Palms
Percent of map unit: 1 percent
Landform: Marshes, swamps
Hydric soil rating: Yes

Hoosic, fan
Percent of map unit: 1 percent
Hydric soil rating: No

Copake, fan
Percent of map unit: 1 percent
Hydric soil rating: No

GfB—Galway-Farmington complex, undulating, rocky

Map Unit Setting
National map unit symbol: 9rg0
Elevation: 100 to 1,000 feet
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Galway and similar soils: 40 percent
Farmington and similar soils: 30 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Galway

Setting

Landform: Benches, ridges, till plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous loamy till

Typical profile

H1 - 0 to 6 inches: gravelly loam
H2 - 6 to 30 inches: gravelly loam
H3 - 30 to 31 inches: gravelly loam
H4 - 31 to 35 inches: unweathered bedrock

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 25 percent
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Farmington

Setting

Landform: Till plains, benches, ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till or congeliturbate derived from limestone, dolomite, shale, and sandstone, and in many places mixed with wind and water deposits

Typical profile

H1 - 0 to 7 inches: loam
H2 - 7 to 15 inches: very fine sandy loam
H3 - 15 to 19 inches: unweathered bedrock

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Georgia

Percent of map unit: 10 percent
Hydric soil rating: No

Stockbridge

Percent of map unit: 10 percent
Hydric soil rating: No

Massena

Percent of map unit: 8 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 1 percent
Hydric soil rating: Unranked

Sun

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

GsA—Georgia silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 9rg5
Elevation: 90 to 1,000 feet
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Georgia and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Georgia

Setting

Landform: Hills, till plains, drumlinoid ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Loamy till derived mainly from limestone, shale, or slate

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 27 inches: loam
H3 - 27 to 80 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Massena

Percent of map unit: 5 percent
Hydric soil rating: No

Stockbridge

Percent of map unit: 5 percent
Hydric soil rating: No

Charlton

Percent of map unit: 3 percent
Hydric soil rating: No

Dutchess

Percent of map unit: 3 percent
Hydric soil rating: No

Sun

Percent of map unit: 2 percent
Landform: Depressions

Hydric soil rating: Yes

Punsit

Percent of map unit: 2 percent
Hydric soil rating: No

GsB—Georgia silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9rg6
Elevation: 90 to 1,000 feet
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Georgia and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Georgia

Setting

Landform: Drumlinoid ridges, hills, till plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Loamy till derived mainly from limestone, shale, or slate

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 27 inches: loam
H3 - 27 to 80 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C

Hydric soil rating: No

Minor Components

Charlton
Percent of map unit: 5 percent
Hydric soil rating: No

Massena
Percent of map unit: 5 percent
Hydric soil rating: No

Stockbridge
Percent of map unit: 5 percent
Hydric soil rating: No

Dutchess
Percent of map unit: 3 percent
Hydric soil rating: No

Pittstown
Percent of map unit: 2 percent
Hydric soil rating: No

Ha—Halsey mucky silt loam

Map Unit Setting
National map unit symbol: 9rg8
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition
Halsey and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Halsey

Setting
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy glaciofluvial deposits over sandy and gravelly glaciofluvial deposits

Typical profile
H1 - 0 to 9 inches: mucky silt loam
H2 - 9 to 33 inches: gravelly loam

H3 - 33 to 60 inches: stratified very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Fredon

Percent of map unit: 10 percent
Landform: Depressions
Hydric soil rating: No

Palms

Percent of map unit: 5 percent
Landform: Marshes, swamps
Hydric soil rating: Yes

Carlisle

Percent of map unit: 5 percent
Landform: Marshes, swamps
Hydric soil rating: Yes

MnA—Massena silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 9rh9
Elevation: 100 to 1,000 feet
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Massena and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Massena

Setting

Landform: Hills, till plains, drumlinoid ridges
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till dominated by siliceous rocks with varying proportions of limestone

Typical profile

H1 - 0 to 7 inches: silt loam
H2 - 7 to 33 inches: loam
H3 - 33 to 72 inches: fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 12 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Moderate (about 7.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Sun

Percent of map unit: 10 percent
Landform: Depressions
Hydric soil rating: Yes

Georgia

Percent of map unit: 5 percent
Hydric soil rating: No

Punsit

Percent of map unit: 5 percent
Hydric soil rating: No

NwD—Nassau-Cardigan complex, hilly, very rocky

Map Unit Setting

National map unit symbol: 9rhf
Elevation: 600 to 1,800 feet
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Nassau and similar soils: 45 percent
Cardigan and similar soils: 30 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nassau

Setting

Landform: Benches, ridges, till plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Channery loamy till derived mainly from local slate or shale

Typical profile

H1 - 0 to 5 inches: channery silt loam
H2 - 5 to 16 inches: very channery silt loam
H3 - 16 to 20 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Cardigan

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till or colluvium derived from phyllite, slate, shale, and schist

Typical profile

H1 - 0 to 8 inches: channery silt loam
H2 - 8 to 20 inches: channery loam
H3 - 20 to 30 inches: channery silt loam
H4 - 30 to 34 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Dutchess

Percent of map unit: 10 percent
Hydric soil rating: No

Sun

Percent of map unit: 10 percent
Landform: Depressions
Hydric soil rating: Yes

Rock outcrop

Percent of map unit: 5 percent
Hydric soil rating: Unranked

NxE—Nassau-Rock outcrop complex, steep

Map Unit Setting

National map unit symbol: 9rhg
Elevation: 600 to 1,800 feet
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Nassau and similar soils: 45 percent
Rock outcrop: 30 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nassau

Setting

Landform: Benches, ridges, till plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Channery loamy till derived mainly from local slate or shale

Typical profile

H1 - 0 to 5 inches: channery silt loam
H2 - 5 to 16 inches: very channery silt loam
H3 - 16 to 20 inches: unweathered bedrock

Properties and qualities

Slope: 25 to 45 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Rock Outcrop

Typical profile

H1 - 0 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 25 to 45 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydric soil rating: Unranked

Minor Components

Cardigan

Percent of map unit: 10 percent
Hydric soil rating: No

Dutchess

Percent of map unit: 10 percent
Hydric soil rating: No

Sun

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Pg—Pawling silt loam

Map Unit Setting

National map unit symbol: 9rhk
Elevation: 50 to 500 feet
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Pawling and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pawling

Setting

Landform: Flood plains

Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Loamy over sandy and gravelly alluvium

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 33 inches: silt loam
H3 - 33 to 72 inches: very gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Available water storage in profile: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: No

Minor Components

Linlithgo

Percent of map unit: 10 percent
Hydric soil rating: No

Wayland

Percent of map unit: 5 percent
Landform: Flood plains
Hydric soil rating: Yes

Wappinger

Percent of map unit: 5 percent
Hydric soil rating: No

SkB—Stockbridge silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9rhv
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Stockbridge and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stockbridge

Setting

Landform: Till plains, drumlinoid ridges, hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous loamy till

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 23 inches: silt loam
H3 - 23 to 80 inches: silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Georgia

Percent of map unit: 5 percent
Hydric soil rating: No

Galway

Percent of map unit: 4 percent
Hydric soil rating: No

Massena

Percent of map unit: 4 percent
Hydric soil rating: No

Charlton

Percent of map unit: 3 percent
Hydric soil rating: No

Bernardston

Percent of map unit: 2 percent

Hydric soil rating: No

Farmington

Percent of map unit: 1 percent
Hydric soil rating: No

Sun

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

SkC—Stockbridge silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 9rhw
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Stockbridge and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stockbridge

Setting

Landform: Hills, till plains, drumlinoid ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous loamy till

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 23 inches: silt loam
H3 - 23 to 80 inches: silt loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Georgia

Percent of map unit: 5 percent
Hydric soil rating: No

Galway

Percent of map unit: 4 percent
Hydric soil rating: No

Massena

Percent of map unit: 4 percent
Hydric soil rating: No

Charlton

Percent of map unit: 3 percent
Hydric soil rating: No

Bernardston

Percent of map unit: 2 percent
Hydric soil rating: No

Farmington

Percent of map unit: 1 percent
Hydric soil rating: No

Sun

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

SkD—Stockbridge silt loam, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 9rhx
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Stockbridge and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stockbridge

Setting

Landform: Hills, till plains, drumlinoid ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous loamy till

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 23 inches: silt loam
H3 - 23 to 80 inches: silt loam

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Bernardston

Percent of map unit: 5 percent
Hydric soil rating: No

Charlton

Percent of map unit: 5 percent
Hydric soil rating: No

Galway

Percent of map unit: 4 percent
Hydric soil rating: No

Georgia

Percent of map unit: 4 percent
Hydric soil rating: No

Farmington

Percent of map unit: 1 percent
Hydric soil rating: No

Sun

Percent of map unit: 1 percent
Landform: Depressions

Hydric soil rating: Yes

SmC—Stockbridge-Farmington complex, rolling, rocky

Map Unit Setting

National map unit symbol: 9rj0
Elevation: 100 to 900 feet
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Stockbridge and similar soils: 50 percent
Farmington and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stockbridge

Setting

Landform: Drumlinoid ridges, hills, till plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous loamy till

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 23 inches: silt loam
H3 - 23 to 80 inches: silt loam

Properties and qualities

Slope: 5 to 16 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Farmington

Setting

Landform: Benches, ridges, till plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till or congeliturbate derived from limestone, dolomite, shale, and sandstone, and in many places mixed with wind and water deposits

Typical profile

H1 - 0 to 7 inches: loam
H2 - 7 to 15 inches: very fine sandy loam
H3 - 15 to 19 inches: unweathered bedrock

Properties and qualities

Slope: 5 to 16 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Galway

Percent of map unit: 10 percent
Hydric soil rating: No

Georgia

Percent of map unit: 5 percent
Hydric soil rating: No

Massena

Percent of map unit: 3 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 1 percent
Hydric soil rating: Unranked

Sun

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Su—Sun silt loam

Map Unit Setting

National map unit symbol: 9rj3
Elevation: 600 to 1,800 feet
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sun and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sun

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy till derived primarily from limestone and sandstone, with a component of schist, shale, or granitic rocks in some areas

Typical profile

H1 - 0 to 4 inches: silt loam
H2 - 4 to 22 inches: loam
H3 - 22 to 80 inches: gravelly loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Minor Components

Canandaigua
Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Massena
Percent of map unit: 5 percent
Hydric soil rating: No

Palms
Percent of map unit: 5 percent
Landform: Marshes, swamps
Hydric soil rating: Yes

Sun, stony
Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Ue—Udorthents, wet substratum

Map Unit Setting
National map unit symbol: 9rj8
Elevation: 50 to 2,400 feet
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition
Udorthents, wet substratum, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Wet Substratum

Typical profile
H1 - 0 to 4 inches: gravelly loam
H2 - 4 to 72 inches: very gravelly loam

Properties and qualities
Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 5.95 in/hr)
Depth to water table: About 12 to 36 inches
Frequency of flooding: None
Frequency of ponding: None

Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Low (about 5.5 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Udorthents, smoothed
Percent of map unit: 10 percent
Hydric soil rating: No

Urban land
Percent of map unit: 5 percent
Hydric soil rating: Unranked

Unnamed soils, undisturbed
Percent of map unit: 4 percent
Hydric soil rating: Unranked

Rock outcrop
Percent of map unit: 1 percent
Hydric soil rating: Unranked

Ur—Urban land

Map Unit Setting
National map unit symbol: 9rjb
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition
Urban land: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Typical profile
H1 - 0 to 6 inches: variable

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Udorthents, smoothed
Percent of map unit: 5 percent
Hydric soil rating: No

Udorthents, wet substratum
Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed soils, undisturbed
Percent of map unit: 1 percent
Hydric soil rating: Unranked

Rock outcrop
Percent of map unit: 1 percent
Hydric soil rating: Unranked

W—Water

Map Unit Setting
National map unit symbol: 9rjc
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition
Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Wy—Wayland silt loam

Map Unit Setting
National map unit symbol: 9rjf
Elevation: 200 to 1,500 feet
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition
Wayland and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wayland

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Silty and clayey alluvium washed from uplands that contain some calcareous drift

Typical profile

H1 - 0 to 9 inches: silt loam
H2 - 9 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Calcium carbonate, maximum in profile: 1 percent
Available water storage in profile: High (about 11.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Minor Components

Pawling

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: No

Linlithgo

Percent of map unit: 5 percent
Hydric soil rating: No

Fluvaquents

Percent of map unit: 3 percent
Landform: Flood plains
Hydric soil rating: Yes

Palms

Percent of map unit: 3 percent
Landform: Marshes, swamps
Hydric soil rating: Yes

Carlisle

Percent of map unit: 2 percent
Landform: Marshes, swamps
Hydric soil rating: Yes

Udifluvents

Percent of map unit: 2 percent
Hydric soil rating: No

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

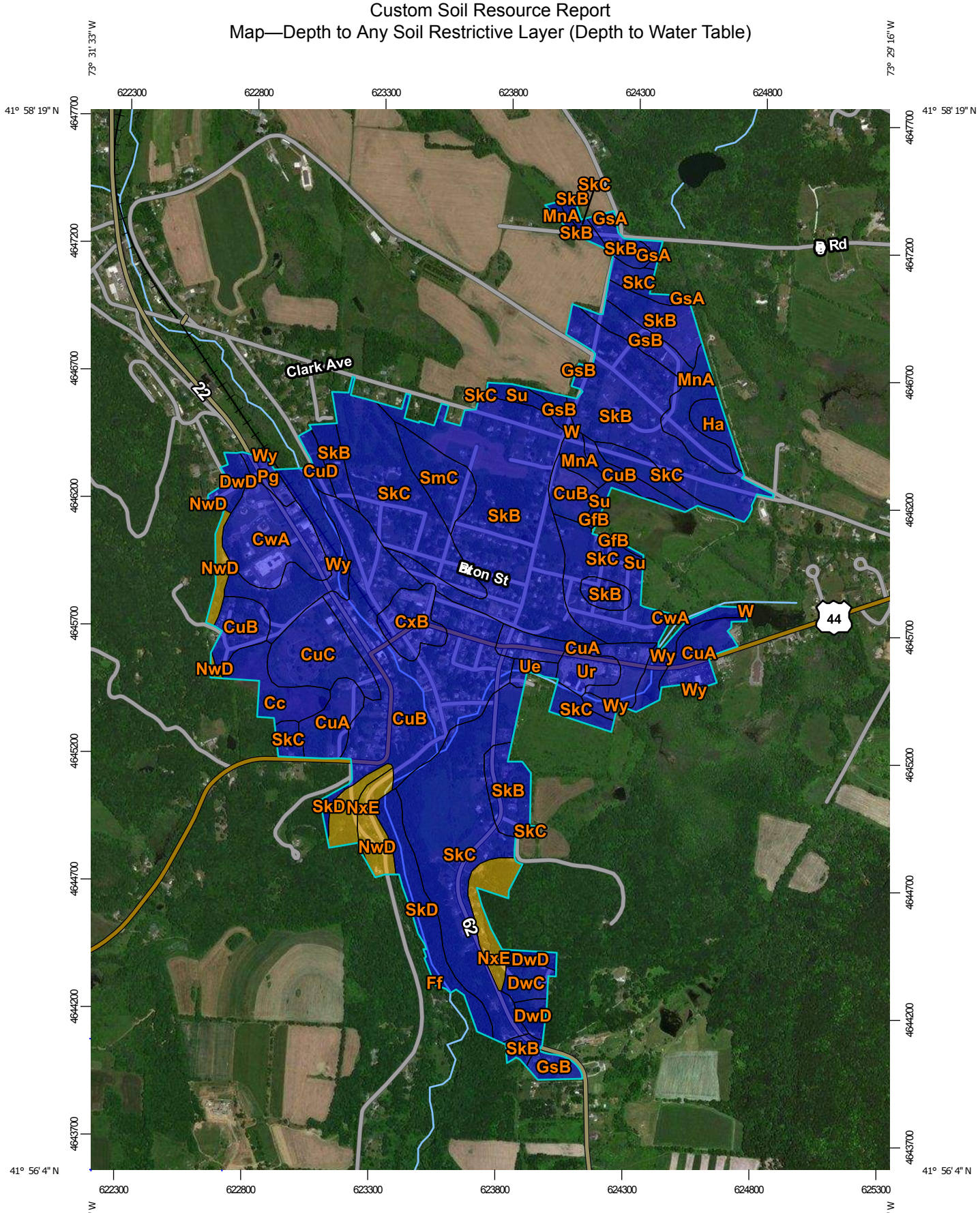
Depth to Any Soil Restrictive Layer (Depth to Water Table)

A "restrictive layer" is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers.

This theme presents the depth to any type of restrictive layer that is described for each map unit. If more than one type of restrictive layer is described for an individual soil type, the depth to the shallowest one is presented. If no restrictive layer is described in a map unit, it is represented by the "> 200" depth class.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Map—Depth to Any Soil Restrictive Layer (Depth to Water Table)



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Soil Rating Lines

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Soil Rating Points

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- 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 1:24,000.

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: Dutchess County, New York
Survey Area Data: Version 14, Oct 8, 2017

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

Date(s) aerial images were photographed: Jul 2, 2015—Oct 5, 2016

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.

Table—Depth to Any Soil Restrictive Layer (Depth to Water Table)

Map unit symbol	Map unit name	Rating (centimeters)	Acres in AOI	Percent of AOI
Cc	Catden muck, 0 to 2 percent slopes	>200	14.2	1.8%
CuA	Copake gravelly silt loam, nearly level	>200	41.0	5.2%
CuB	Copake gravelly silt loam, undulating	>200	113.8	14.5%
CuC	Copake gravelly silt loam, rolling	>200	23.9	3.0%
CuD	Copake gravelly silt loam, hilly	>200	3.8	0.5%
CwA	Copake channery silt loam, fan, 0 to 3 percent slopes	>200	28.3	3.6%
CxB	Copake-Urban land complex, undulating	>200	12.6	1.6%
DwC	Dutchess-Cardigan complex, rolling, rocky	>200	5.7	0.7%
DwD	Dutchess-Cardigan complex, hilly, rocky	>200	11.6	1.5%
Ff	Fluvaquents-Udifluvents complex, frequently flooded	>200	0.2	0.0%
GfB	Galway-Farmington complex, undulating, rocky	79	0.1	0.0%
GsA	Georgia silt loam, 0 to 3 percent slopes	>200	1.8	0.2%
GsB	Georgia silt loam, 3 to 8 percent slopes	>200	16.1	2.0%
Ha	Halsey mucky silt loam	>200	5.6	0.7%
MnA	Massena silt loam, 0 to 3 percent slopes	>200	19.6	2.5%
NwD	Nassau-Cardigan complex, hilly, very rocky	41	14.4	1.8%
NxE	Nassau-Rock outcrop complex, steep	41	18.5	2.3%
Pg	Pawling silt loam	>200	4.5	0.6%
SkB	Stockbridge silt loam, 3 to 8 percent slopes	>200	192.0	24.4%
SkC	Stockbridge silt loam, 8 to 15 percent slopes	>200	172.3	21.9%
SkD	Stockbridge silt loam, 15 to 25 percent slopes	>200	20.6	2.6%

Map unit symbol	Map unit name	Rating (centimeters)	Acres in AOI	Percent of AOI
SmC	Stockbridge-Farmington complex, rolling, rocky	>200	14.1	1.8%
Su	Sun silt loam	>200	6.8	0.9%
Ue	Udorthents, wet substratum	>200	3.2	0.4%
Ur	Urban land	>200	7.6	1.0%
W	Water	>200	0.3	0.0%
Wy	Wayland silt loam	>200	34.4	4.4%
Totals for Area of Interest			**786.9**	**100.0%**

Rating Options—Depth to Any Soil Restrictive Layer (Depth to Water Table)

Units of Measure: centimeters

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Interpret Nulls as Zero: No

Water Features

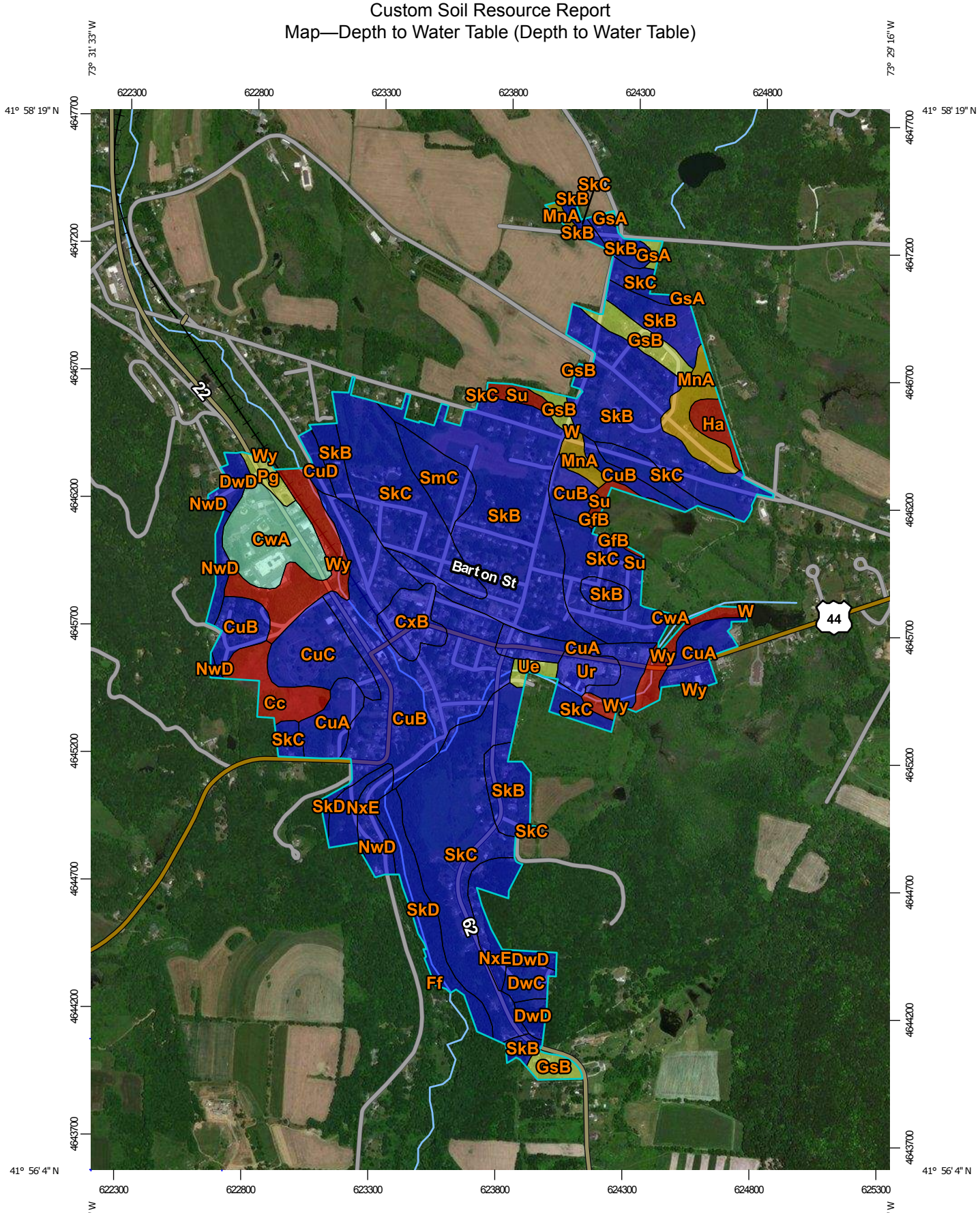
Water Features include ponding frequency, flooding frequency, and depth to water table.

Depth to Water Table (Depth to Water Table)

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Map—Depth to Water Table (Depth to Water Table)



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Soil Rating Lines

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Soil Rating Points

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- 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 1:24,000.

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: Dutchess County, New York
Survey Area Data: Version 14, Oct 8, 2017

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

Date(s) aerial images were photographed: Jul 2, 2015—Oct 5, 2016

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.

Table—Depth to Water Table (Depth to Water Table)

Map unit symbol	Map unit name	Rating (centimeters)	Acres in AOI	Percent of AOI
Cc	Catden muck, 0 to 2 percent slopes	0	14.2	1.8%
CuA	Copake gravelly silt loam, nearly level	>200	41.0	5.2%
CuB	Copake gravelly silt loam, undulating	>200	113.8	14.5%
CuC	Copake gravelly silt loam, rolling	>200	23.9	3.0%
CuD	Copake gravelly silt loam, hilly	>200	3.8	0.5%
CwA	Copake channery silt loam, fan, 0 to 3 percent slopes	137	28.3	3.6%
CxB	Copake-Urban land complex, undulating	>200	12.6	1.6%
DwC	Dutchess-Cardigan complex, rolling, rocky	>200	5.7	0.7%
DwD	Dutchess-Cardigan complex, hilly, rocky	>200	11.6	1.5%
Ff	Fluvaquents-Udifluvents complex, frequently flooded	0	0.2	0.0%
GfB	Galway-Farmington complex, undulating, rocky	>200	0.1	0.0%
GsA	Georgia silt loam, 0 to 3 percent slopes	69	1.8	0.2%
GsB	Georgia silt loam, 3 to 8 percent slopes	69	16.1	2.0%
Ha	Halsey mucky silt loam	8	5.6	0.7%
MnA	Massena silt loam, 0 to 3 percent slopes	38	19.6	2.5%
NwD	Nassau-Cardigan complex, hilly, very rocky	>200	14.4	1.8%
NxE	Nassau-Rock outcrop complex, steep	>200	18.5	2.3%
Pg	Pawling silt loam	54	4.5	0.6%
SkB	Stockbridge silt loam, 3 to 8 percent slopes	>200	192.0	24.4%
SkC	Stockbridge silt loam, 8 to 15 percent slopes	>200	172.3	21.9%
SkD	Stockbridge silt loam, 15 to 25 percent slopes	>200	20.6	2.6%
SmC	Stockbridge-Farmington complex, rolling, rocky	>200	14.1	1.8%

Map unit symbol	Map unit name	Rating (centimeters)	Acres in AOI	Percent of AOI
Su	Sun silt loam	0	6.8	0.9%
Ue	Udorthents, wet substratum	61	3.2	0.4%
Ur	Urban land	>200	7.6	1.0%
W	Water	>200	0.3	0.0%
Wy	Wayland silt loam	0	34.4	4.4%
Totals for Area of Interest			**786.9**	**100.0%**

Rating Options—Depth to Water Table (Depth to Water Table)

Units of Measure: centimeters

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Interpret Nulls as Zero: No

Beginning Month: January

Ending Month: December

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APPENDIX C

Town of North East Zoning Map

Legend

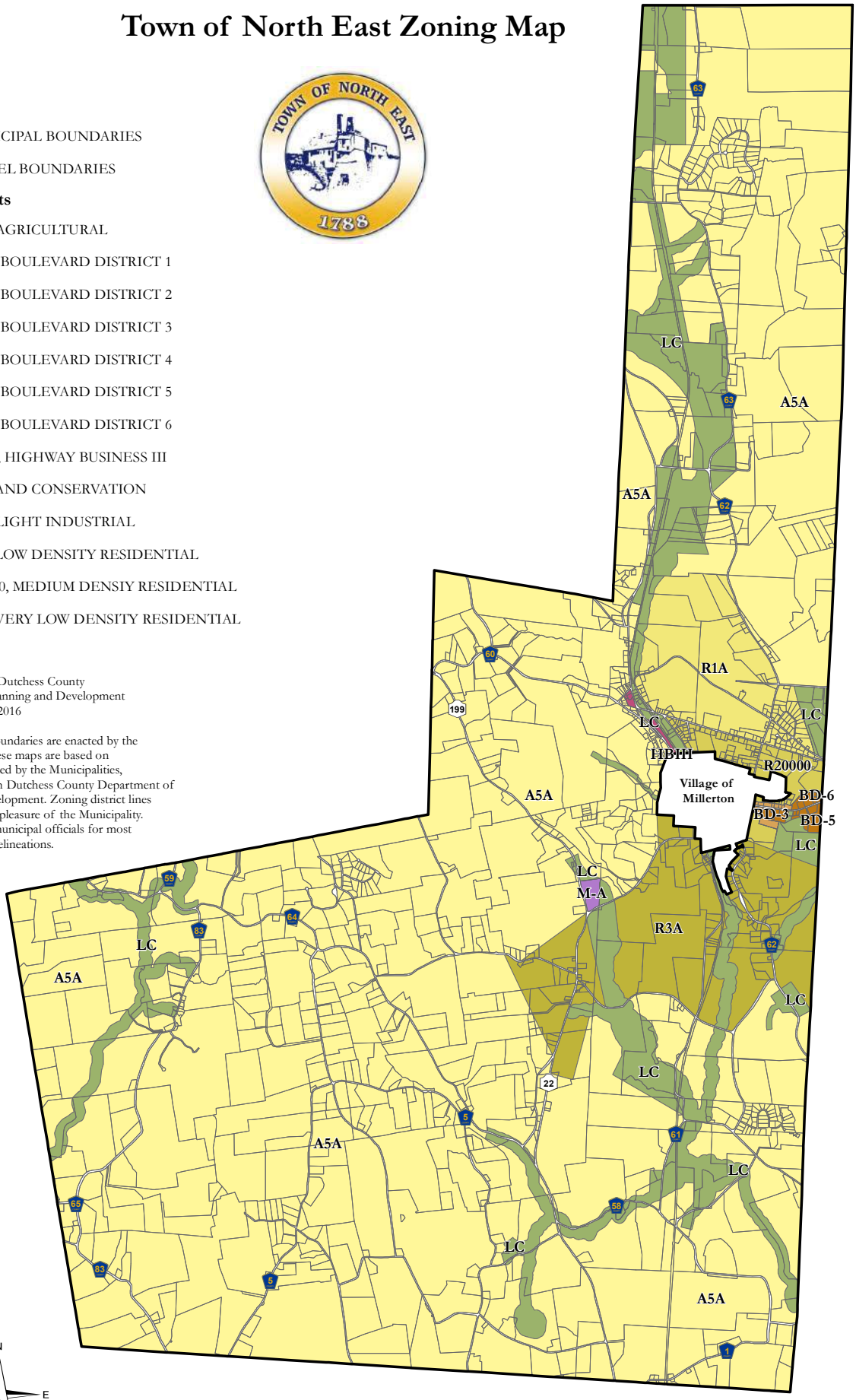
- MUNICIPAL BOUNDARIES
- PARCEL BOUNDARIES

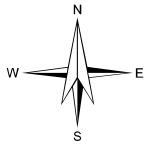
Zone Districts

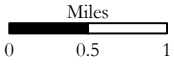
- A5A, AGRICULTURAL
- BD-1, BOULEVARD DISTRICT 1
- BD-2, BOULEVARD DISTRICT 2
- BD-3, BOULEVARD DISTRICT 3
- BD-4, BOULEVARD DISTRICT 4
- BD-5, BOULEVARD DISTRICT 5
- BD-6, BOULEVARD DISTRICT 6
- HBIII, HIGHWAY BUSINESS III
- LC, LAND CONSERVATION
- M-A, LIGHT INDUSTRIAL
- R1A, LOW DENSITY RESIDENTIAL
- R20000, MEDIUM DENSIY RESIDENTIAL
- R3A, VERY LOW DENSITY RESIDENTIAL

Map Prepared By Dutchess County
Department of Planning and Development
Issued: Februrary 2016

Zoning District boundaries are enacted by the Municipalities. These maps are based on information supplied by the Municipalities, per agreement with Dutchess County Department of Planning and Development. Zoning district lines are updated at the pleasure of the Municipality. Check with local municipal officials for most recent boundary delineations.







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APPENDIX D

Village of Millerton Wastewater Survey

Dear Village Resident:

The Village of Millerton is collecting data to evaluate the wastewater conditions within the Village.

Why is the Village collecting data?

While most Village residents have municipal drinking water (treated drinking water is provided to a parcel through underground piping) wastewater is disposed of by individual on-site systems that use biology in the soil to treat wastewater before it reaches the groundwater aquifer. While some of these systems are working well, others have needed costly repairs and upgrades. The intent of this data collection is to:

1) Understand where residents have experienced problems with their systems
2) Understand where other conditions exist (such as high groundwater) which may impact wastewater conditions

What will this data be used for?

The Village has received an Engineering Planning Grant through the New York State Department of Environmental Conservation Environmental Facilities Corporation. This grant will be used to prepare a study that will:

1) Determine the need for wastewater improvements within the Village
2) Recommend needed improvements and suggest alternatives for achieving those recommendations
3) Provide estimated costs to implement improvements

To accomplish this we need your help in providing some important information about your wastewater conditions. Please fill out the attached form and return to the Village by:

1. Mail: Village of Millerton
PO Box 528
Millerton, NY 12546
2. Email: clerk@villageofmillerton.com
3. Drop off: Millerton Village Hall, 21 Dutchess Avenue Mon. – Fri., 9am – 4pm

If you have any questions about this survey, or need assistance filling out the forms, please contact Stephany Eisermann, Village of Millerton Clerk, (518) 789-4489.

Thank you for your help.

File: J:\M\M1784 Millerton\004 - Wastewater Evaluation\Documents\Survey\survey cover letter.doc

Village of Millerton Wastewater Disposal Survey

Property Owner/Commercial Name: _____

Property Address: _____

Property is:

☐ Residential ☐ Commercial ☐ Vacant Lot - No building - No Wastewater System

Do you have any problems with your wastewater disposal system (generally septic tank and leachfield)?

☐ Yes ☐ No

If your answer was yes, please indicate the type of problem:

☐ Must pump septic tank frequently _____ times per year

☐ Toilet/sink back-ups

☐ Leachfield failing, ponding on the surface

☐ Other: _____

Do you feel there is a need for a wastewater treatment system somewhere in the Village?

☐ Yes ☐ No

If your answer was yes, please indicate where: _____

Do you have any problems with water in your basement?

☐ Yes ☐ No

If your answer was yes, please indicate how often:

☐ Every day

☐ Whenever it rains

☐ Only in spring

☐ Other: _____

Do you have a sump pump in your basement?

☐ Yes ☐ No

If your answer was yes, please indicate how often it runs:

☐ Every day

☐ Whenever it rains

☐ Only in spring

☐ Other: _____

Other Comments:

_____

_____

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APPENDIX E

PROPOSED MILLERTON SEWER DISTRICT

BENEFIT ASSESSMENT METHODOLOGY (BU)
EQUIVALENT DWELLING UNIT METHODOLOGY (EDU)

1 BU = 25 GPD
10 BU = 1 EDU = 1x SINGLE FAMILY RESIDENCE

DEVELOPED LAND (Use the higher of either LAND USE/WATER USE or ACREAGE)

LAND USE/WATER USE	BU/EDU
RESIDENTIAL	
FIRST DWELLING UNIT	10/1
EACH ADDITIONAL DWELLING UNIT	8/1
COMMERCIAL/INSTITUTIONAL:	
FIRST 250 GPD WATER USAGE	10/1
EACH ADDITIONAL 100 GPD	4/0.4
ADDITIONAL APARTMENT DWELLING:	
FIRST 125 GPD WATER USAGE	5/0.5
EACH ADDITIONAL 125 GPD	5/0.5
ACREAGE	
FIRST 2 ACRES	10/0
EACH ADDITIONAL WHOLE ACRE	2/0

UNDEVELOPED LAND

FIRST 2 ACRES	8/0
EACH ADDITIONAL WHOLE ACRE	2/0

Adapted from *Preliminary Engineering Report for Millerton Central Sewer District Village of Millerton and Town of North East,* by C.T. Male Associates, P.C., 2009.

Parcel No.	Residential EDUs	Commercial EDUs	Total EDUs
7271-14-304308-0000	1	0	1
7271-14-353308-0000	1	0	1
7271-14-343309-0000	3	0	3
7271-14-336299-0000	0	3	3
7271-14-352290-0000	0	3	3
7271-14-353282-0000	0	1	1
7271-14-388335-0000	1	0	1
7271-14-364304-0000	0	2	2
7271-14-413332-0000	1	0	1
7271-14-353292-0000	0	1	1
7271-14-458315-0000	1	0	1
7271-14-380297-0000	0	2	2
7271-14-403334-0000	1	0	1
7271-14-438320-0000	1	0	1
7271-14-311291-0000	0	1	1
7271-14-374300-0000	0	1	1
7271-14-386330-0000	3	2	5
7271-14-449317-0000	1	0	1
7271-14-341303-0000	0	1	1
7271-14-425324-0000	0	1	1
7271-14-348289-0000	0	2	2
7271-14-355284-0000	0	1	1
7271-14-444319-0000	1	0	1
7271-14-401327-0000	0	1	1
7271-14-389340-0000	0	1	1
7271-14-381305-0000	0	1	1
7271-14-332290-0000	0	1	1
7271-14-360287-0000	0	3	3
7271-14-410324-0000	0	1	1
7271-14-381260-0000	4	0	4
7271-14-352267-0000	0	3	3
7271-14-364277-0000	0	2	2
7271-14-487305-0000	0	1	1
7271-14-323272-0000	0	2	2
7271-14-340276-0000	0	1	1
7271-14-357260-0000	0	1	1
7271-14-351260-0000	0	2	2
7271-14-479308-0000	0	1	1
7271-14-391272-0000	1	0	1
7271-14-360274-0000	0	1	1
7271-14-327266-0000	0	2	2
7271-14-382253-0000	1	0	1
7271-14-402267-0000	0	3	3

Parcel No.	Residential EDUs	Commercial EDUs	Total EDUs
7271-14-385274-0000	0	3	3
7271-14-382277-0000	0	2	2
7271-14-364272-0000	1	1	2
7271-14-409265-0000	0	2	2
7271-14-387273-0000	0	1	1
7271-14-317278-0000	0	2	2
7271-14-346284-0000	0	2	2
7271-14-375264-0000	0	1	1
7271-14-419263-0000	1	0	1
7271-14-364326-0000	0	2	2
7271-14-498306-0000	0	1	1
7271-14-378278-0000	1	1	2
7271-14-370276-0000	0	2	2
7271-14-495298-0000	0	1	1
7271-15-504270-0000	0	1	1
7271-14-367268-0000	0	1	1
7271-14-470316-0000	1	0	1
7271-14-362253-0000	2	1	3
7271-14-483274-0000	0	1	1
7271-14-459275-0000	0	1	1
7271-14-462287-0000	0	1	1
7271-14-431301-0000	0	1	1
7271-14-408296-0000	0	1	1
7271-14-451293-0000	0	1	1
7271-14-374279-0000	0	2	2
7271-14-379254-0000	2	0	2
7271-14-437286-0000	0	2	2
7271-14-396269-0000	1	0	1
7271-18-365247-0000	0	2	2
7271-14-420293-0000	1	0	1
7271-14-448280-0000	4	2	6
7271-14-428288-0000	1	1	2
7271-14-392291-0000	0	0	0
7271-14-472278-0000	1	0	1
7271-14-395303-0000	0	2	2
7271-14-333251-0000	0	1	1
7271-14-339254-0000	0	1	1
7271-18-342244-0000	1	0	1
7271-18-351232-0000	2	0	2
7271-00-612237-0000	0	1	1
7271-00-715245-0000	0	2	2
7271-00-646248-0000	1	0	1
7271-00-622253-0000	0	1	1

Parcel No.	Residential EDUs	Commercial EDUs	Total EDUs
7271-00-610232-0000	0	2	2
7271-00-632250-0000	0	1	1
7271-00-682247-0000	0	2	2
7271-00-658247-0000	0	1	1
7271-00-596259-0000	0	1	1
7271-00-564263-0000	0	0	0
7271-00-578242-0000	0	1	1
7271-00-701220-0000	0	2	2
7271-00-715223-0000	0	2	2
7271-00-664222-0000	0	0	0
7271-00-623228-0000	0	1	1
7271-00-739225-0000	0	2	2
7271-00-552232-0000	0	0	0
7271-00-585220-0000	0	3	3
7271-00-534237-0000	0	4	4
7271-00-524328-0000	0	4	4
7271-19-509241-0000	0	1	1
7271-15-518268-0000	0	1	1
7271-14-397393-0000	1	0	1
7271-14-382386-0000	0	2	2
7271-14-362429-0000	2	1	3
7271-14-383402-0000	0	2	2
7271-14-361373-0000	0	3	3
7271-14-346435-0000	0	2	2
7271-14-329378-0000	0	2	2
7271-14-344380-0000	3	0	3
7271-14-337380-0000	0	3	3
7271-14-388408-0000	1	0	1
7271-14-353376-0000	1	0	1
7271-14-403400-0000	1	0	1
7271-14-328311-0000	0	2	2
7271-14-357363-0000	0	1	1
7271-14-447343-0000	2	0	2
7271-14-378338-0000	1	1	2
7271-14-471342-0000	1	0	1
7271-15-506328-0000	0	1	1
7271-14-485337-0000	0	1	1
7271-14-317310-0000	0	2	2
7271-14-407347-0000	1	2	3
7271-14-381357-0000	0	1	1
7271-14-318328-0000	0	2	2
7271-14-409354-0000	0	2	2
7271-14-335328-0000	0	1	1

Parcel No.	Residential EDUs	Commercial EDUs	Total EDUs
7271-14-393364-0000	0	0	0
7271-14-352366-0000	0	3	3
7271-14-411360-0000	0	1	1
7271-14-476334-0000	1	0	1
7271-14-468332-0000	1	0	1
7271-14-364367-0000	0	2	2
7271-14-331356-0000	0	2	2
7271-14-330364-0000	0	2	2
7271-14-441351-0000	1	0	1
7271-14-420347-0000	1	0	1
7271-14-390354-0000	0	1	1
7271-14-491330-0000	0	1	1
7271-14-369341-0000	0	1	1
7271-14-422357-0000	1	0	1
7271-14-431347-0000	0	1	1
7271-14-438341-0000	1	0	1
7271-14-319337-0000	2	0	2
7271-14-383367-0000	0	2	2
7271-14-319323-0000	2	0	2
7271-14-482327-0000	0	1	1
7271-14-331371-0000	0	2	2
7271-14-323346-0000	0	2	2
7271-14-355346-0000	0	1	1
7271-14-343367-0000	3	0	3
7271-14-369365-0000	0	1	1
7271-14-454341-0000	0	1	1
7271-14-361343-0000	0	3	3
7271-14-376363-0000	0	1	1
7271-14-359391-0000	0	1	1
7271-14-333435-0000	0	1	1
7271-14-347403-0000	0	2	2
7271-14-353401-0000	1	0	1
7271-14-364402-0000	0	2	2
7271-14-338427-0000	0	3	3
7271-14-366391-0000	0	2	2
7271-14-338418-0000	0	3	3
7271-14-374425-0000	0	1	1
7271-14-329384-0000	0	2	2
7271-14-364415-0000	0	2	2
7271-14-430429-0000	1	1	2
7271-14-438426-0000	1	0	1
7271-15-503336-0000	0	1	1
7271-14-495410-0000	0	1	1

Parcel No.	Residential EDUs	Commercial EDUs	Total EDUs
7271-14-498325-0000	0	1	1
7271-14-457421-0000	0	1	1
7271-15-505321-0000	0	1	1
7271-14-397381-0000	1	0	1
7271-14-398415-0000	1	0	1
7271-14-465420-0000	1	0	1
7271-14-462338-0000	0	1	1
7271-14-481415-0000	0	1	1
7271-14-447424-0000	2	0	2
7271-14-314426-0000	0	1	1
7271-14-466392-0000	1	0	1
7271-14-274440-0000	1	2	3
7271-14-416379-0000	1	0	1
7271-14-496385-0000	0	1	1
7271-14-443376-0000	1	0	1
7271-14-302430-0000	1	0	1
7271-14-278425-0000	1	2	3
7271-14-431407-0000	0	1	1
7271-14-425376-0000	0	1	1
7271-14-452373-0000	0	1	1
7271-14-261411-0000	0	1	1
7271-14-472390-0000	1	0	1
7271-14-452396-0000	0	1	1
7271-14-296396-0000	1	0	1
7271-14-311437-0000	0	1	1
7271-14-298380-0000	1	0	1
7271-14-301372-0000	1	0	1
7271-14-285422-0000	0	7	7
7271-14-293406-0000	0	1	1
7271-14-460371-0000	0	1	1
7271-15-500360-0000	0	1	1
7271-14-428398-0000	1	1	2
7271-14-290440-0000	0	7	7
7271-14-444398-0000	1	0	1
7271-15-507374-0000	0	1	1
7271-14-288415-0000	0	7	7
7271-14-308401-0000	1	0	1
7271-15-511380-0000	0	1	1
7271-14-478389-0000	2	0	2
7271-14-487386-0000	0	1	1
7271-14-318436-0000	0	2	2
7271-14-424390-0000	1	0	1
7271-14-471367-0000	1	0	1

Parcel No.	Residential EDUs	Commercial EDUs	Total EDUs
7271-14-459395-0000	0	1	1
7271-14-316374-0000	0	2	2
7271-14-312393-0000	0	1	1
7271-00-515404-0000	1	0	1
7271-00-408450-0000	1	0	1
7271-14-279466-0000	1	2	3
7271-14-299463-0000	1	0	1
7271-14-288465-0000	0	7	7
7271-14-307460-0000	1	0	1
7271-14-335457-0000	0	1	1
7271-14-320456-0000	2	0	2
7271-14-350452-0000	0	2	2
7271-14-370446-0000	0	2	2
7271-14-386442-0000	3	2	5
7271-18-461244-0000	2	0	2
7271-18-384204-0000	2	2	4
7271-14-445261-0000	2	0	2
7271-18-455219-0000	1	0	1
7271-18-390191-0000	1	0	1
7271-14-451260-0000	0	1	1
7271-14-433256-0000	1	0	1
7271-18-429240-0000	2	0	2
7271-18-448220-0000	1	0	1
7271-18-486224-0000	1	0	1
7271-18-493239-0000	1	0	1
7271-18-450209-0000	1	0	1
7271-18-445197-0000	1	0	1
7271-18-491233-0000	1	0	1
7271-18-441236-0000	1	0	1
7271-18-473241-0000	1	0	1
7271-18-495245-0000	0	1	1
7271-14-477253-0000	2	0	2
7271-14-436264-0000	2	2	4
7271-18-374232-0000	1	0	1
7271-18-458236-0000	1	0	1
7271-18-475246-0000	1	0	1
7271-18-472235-0000	1	0	1
7271-18-467222-0000	1	0	1
7271-14-464254-0000	1	0	1
7271-18-465209-0000	1	0	1
7271-18-451196-0000	1	0	1
7271-14-498253-0000	0	1	1
7271-18-409244-0000	1	0	1

Parcel No.	Residential EDUs	Commercial EDUs	Total EDUs
7271-18-434223-0000	4	0	4
7271-18-432199-0000	1	0	1
7271-14-446252-0000	2	0	2
7271-18-405219-0000	2	0	2
7271-18-441218-0000	3	0	3
7271-18-390238-0000	1	0	1
7271-18-439197-0000	1	0	1
7271-18-380216-0000	0	1	1
7271-18-414175-0000	1	0	1
7271-18-431248-0000	1	0	1
7271-18-418227-0000	3	0	3
7271-18-419157-0000	1	0	1
7271-18-425223-0000	1	0	1
7271-18-398164-0000	0	2	2
7271-18-423176-0000	1	0	1
7271-18-409198-0000	1	0	1
7271-18-407207-0000	1	0	1
7271-18-394229-0000	4	0	4
7271-18-421199-0000	3	0	3
7271-18-410189-0000	1	0	1
7271-18-388247-0000	2	2	4
7271-18-442176-0000	1	0	1
7271-14-406252-0000	1	2	3
7271-18-444244-0000	1	0	1
7271-18-407237-0000	2	0	2
7271-18-432176-0000	2	0	2
7271-18-433215-0000	0	0	0
7271-18-461173-0000	1	0	1
7271-18-470194-0000	1	0	1
7271-14-311262-0000	0	1	1
7271-18-311229-0000	1	0	1
7271-18-309235-0000	1	0	1
7271-14-319267-0000	2	0	2
7271-18-308219-0000	1	0	1
7271-14-315265-0000	0	2	2
7271-18-277227-0000	0	0	0
7271-14-297252-0000	1	0	1
7271-18-279173-0000	0	3	3
7271-18-328242-0000	0	1	1
7271-18-339222-0000	1	0	1
7271-18-336229-0000	2	0	2
7271-13-217424-0000	0	2	2
7271-14-296285-0000	1	0	1

Parcel No.	Residential EDUs	Commercial EDUs	Total EDUs
7271-14-253364-0000	0	2	2
7271-14-290303-0000	0	7	7
7271-14-285318-0000	0	7	7
7271-14-263351-0000	0	1	1
7271-14-293292-0000	0	1	1
7271-14-305275-0000	1	0	1
7271-13-245381-0000	0	2	2
7271-14-300280-0000	1	0	1
7271-13-228407-0000	0	2	2
7271-14-268277-0000	1	0	1
7271-14-277327-0000	1	2	3
7271-14-255290-0000	0	3	3
7271-14-273269-0000	1	2	3
7271-14-277259-0000	1	2	3
7271-14-258306-0000	0	1	1
7271-14-273334-0000	1	2	3
7271-13-199451-0000	0	2	2
7271-13-234295-0000	1	0	1
7271-13-177277-0000	1	0	1
7271-13-118283-0000	1	0	1
7271-13-135268-0000	1	0	1
7271-13-167277-0000	1	0	1
7271-13-122295-0000	1	0	1
7271-13-145286-0000	1	0	1
7271-13-153272-0000	1	0	1
7271-17-121238-0000	1	0	1
7271-13-164304-0000	2	0	2
7271-13-129310-0000	1	0	1
7271-13-210316-0000	0	2	2
7271-13-157422-0000	0	2	2
7271-13-239337-0000	2	0	2
7271-13-173354-0000	0	2	2
7271-13-230350-0000	1	0	1
7271-18-317180-0000	1	0	1
7271-18-316188-0000	1	0	1
7271-18-309122-0000	4	0	4
7271-18-335101-0000	1	0	1
7271-18-329194-0000	1	0	1
7271-18-295122-0000	1	0	1
7271-18-322116-0000	1	0	1
7271-18-305076-0000	1	0	1
7271-18-314168-0000	2	0	2
7271-18-295093-0000	1	0	1

Parcel No.	Residential EDUs	Commercial EDUs	Total EDUs
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7271-18-313147-0000	2	0	2
7271-18-324090-0000	1	0	1
7271-18-301099-0000	1	0	1
7271-18-317100-0000	0	1	1
7271-18-308088-0000	4	0	4
7271-18-312137-0000	3	0	3
7271-18-307099-0000	4	0	4
7271-18-319116-0000	1	0	1
7271-18-294074-0000	3	0	3
7271-18-315157-0000	2	0	2
7271-18-312199-0000	1	0	1
7271-18-349116-0000	0	1	1
7271-18-325126-0000	1	0	1
7271-18-283128-0000	3	0	3
7271-18-300054-0000	1	0	1
7271-18-350214-0000	2	0	2
7271-18-357179-0000	1	0	1
7271-18-353206-0000	1	0	1
7271-18-357185-0000	3	0	3
7271-18-353148-0000	1	0	1
7271-18-356172-0000	1	0	1
7271-18-355160-0000	1	0	1
7271-18-356197-0000	1	0	1
7271-18-344218-0000	1	0	1
7271-18-353141-0000	1	0	1
7271-18-356166-0000	1	0	1
7271-18-356191-0000	1	0	1
7271-00-688294-0000	0	2	2
7271-00-642269-0000	0	1	1
7271-00-599270-0000	0	1	1
7271-00-569274-0000	0	1	1
7271-00-590270-0000	0	3	3
7271-00-679269-0000	0	1	1
7271-00-548287-0000	0	4	4
7271-00-626267-0000	0	1	1
7271-00-580273-0000	0	1	1
7271-00-648272-0000	1	0	1
7271-00-612268-0000	0	1	1
7271-00-663270-0000	0	1	1
7271-15-656344-0000	1	0	1
7271-15-612306-0000	1	0	1
7271-15-635339-0000	1	0	1

Parcel No.	Residential EDUs	Commercial EDUs	Total EDUs
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7271-15-544338-0000	1	0	1
7271-15-574318-0000	1	0	1
7271-15-524324-0000	1	0	1
7271-15-632317-0000	1	0	1
7271-15-616328-0000	1	0	1
7271-15-597331-0000	1	0	1
7271-15-521312-0000	1	0	1
7271-15-593314-0000	1	0	1
7271-15-584316-0000	1	0	1
7271-15-637360-0000	1	0	1
7271-15-614317-0000	1	0	1
7271-15-533364-0000	1	0	1
7271-15-631302-0000	1	0	1
7271-15-618339-0000	1	0	1
7271-15-620350-0000	1	0	1
7271-15-563337-0000	1	0	1
7271-15-588332-0000	1	0	1
7271-15-554340-0000	1	0	1
7271-15-578335-0000	1	0	1
7271-15-600356-0000	1	0	1
7271-15-529342-0000	1	0	1
7271-15-655330-0000	1	0	1
7271-15-554364-0000	1	0	1
7271-15-547304-0000	1	0	1
7271-15-582288-0000	1	0	1
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7271-15-673301-0000	1	0	1
7271-15-612284-0000	1	0	1
7271-15-651283-0000	1	0	1
7271-15-549314-0000	1	0	1
7271-15-572294-0000	1	0	1
7271-15-552323-0000	1	0	1
7271-15-592287-0000	1	0	1
7271-15-535374-0000	1	0	1
7271-15-518292-0000	1	0	1
7271-15-627282-0000	1	0	1
7271-15-643283-0000	1	0	1
7271-15-602285-0000	1	0	1
7271-15-639380-0000	1	0	1
7271-15-626384-0000	1	0	1
7271-15-606390-0000	1	0	1

Parcel No.	Residential EDUs	Commercial EDUs	Total EDUs
7271-15-603371-0000	1	0	1
7271-15-618388-0000	1	0	1
7271-18-498217-0000	0	2	2
7271-18-363242-0000	0	0	0

Tighe&Bond

APPENDIX F

Ovivo microBLOX
Membrane Bioreactor Treatment System

microBLOX™

RTO (Ready-to-Operate) Enviroquip® MBR Systems

Key Features & Benefits

- Complete, Ready-to-Operate MBR System
- High solids operation
- Gravity filtration
- Simple, single-stage process
- Few moving parts
- Small footprint
- Easily located, deployable

How we create value

- Guaranteed to meet most stringent nutrient limits
- 25 % - 50 % lower total installed cost
- > 5x less waste solids hauling
- 12 week delivery (2 weeks for submittals)
- Highest reuse quality effluent
- All replacement parts in stock (72hr delivery)
- Comprehensive service plans available

microBLOX™

microBLOX™ Membrane Bioreactor (MBR) Systems are fully functional solutions to wastewater treatment problems and are ideally suited for a wide range of applications, including, but not limited to: housing developments, state parks, rest areas, isolated communities, military camps, shopping malls, golf courses, resorts, casinos, sewer mining (scalping), some industrial and more.

microBLOX™ technology was designed and engineered to be extremely simple to operate and optimize. This single-stage process uses one set of blowers to provide mixing, air scouring and process oxygen. For higher strength waste, concentrated oxygen can be efficiently added to the process on an as needed basis. Each System can be guaranteed to meet the most stringent nutrient limits and online monitoring is available for ammonia, nitrates and phosphorus in the effluent.

Backed by one of the largest water companies in the world, Ovivo, microBLOX™ Systems are built on the experience of Enviroquip® MBR Systems and our over 130 operating plants in the US and 330 plants worldwide.

62,500 GPD microBLOX plant is easily installed and ready-to-operate

Why microBLOX™?

- **Lowest Total Cost of Ownership**
  Total installed and operating costs can be lower than all other comparable technologies.
- **The Most Space Efficient**
  At higher flow and/or pollutant loading, microBLOX™ can treat more waste than any other technology in a given footprint (maximum unit capacity up to 62,500 gpd).
- **Most Reliable**
  Considered Best Available Technology (BAT), microBLOX™ Systems are guaranteed to meet the most stringent nutrient limits and to produce the highest, reuse quality effluent over a broad range of operating conditions.
- **Single Source Responsibility**
  There is only one number to call for technical support, parts or service (with parts delivery in 72 hrs).
- **Built for Operators by Operators**
  All components are accessible; no electrical components are located in mixed liquor. Full remote monitoring capabilities using easily configurable phone application.

microBLOX™ Range

Standard Systems

Each microBLOX™ comes equipped as a fully functioning, ready-to-operate MBR system, including:

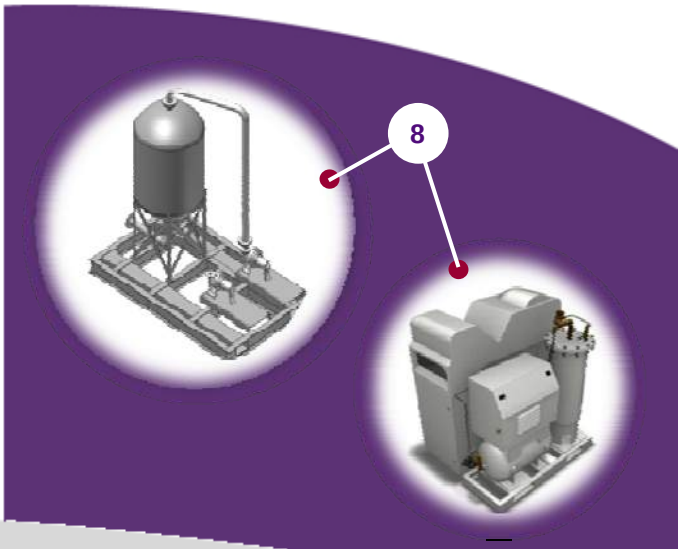
- Fine screening (1)
- Integrated, tested process tankage (2)
- Equalization Zone (3)
- WAS Zone (4)
- Submerged membrane units by KUBOTA®(5)
- Pre-wired, factory tested equipment (6)
- Remote monitoring controls

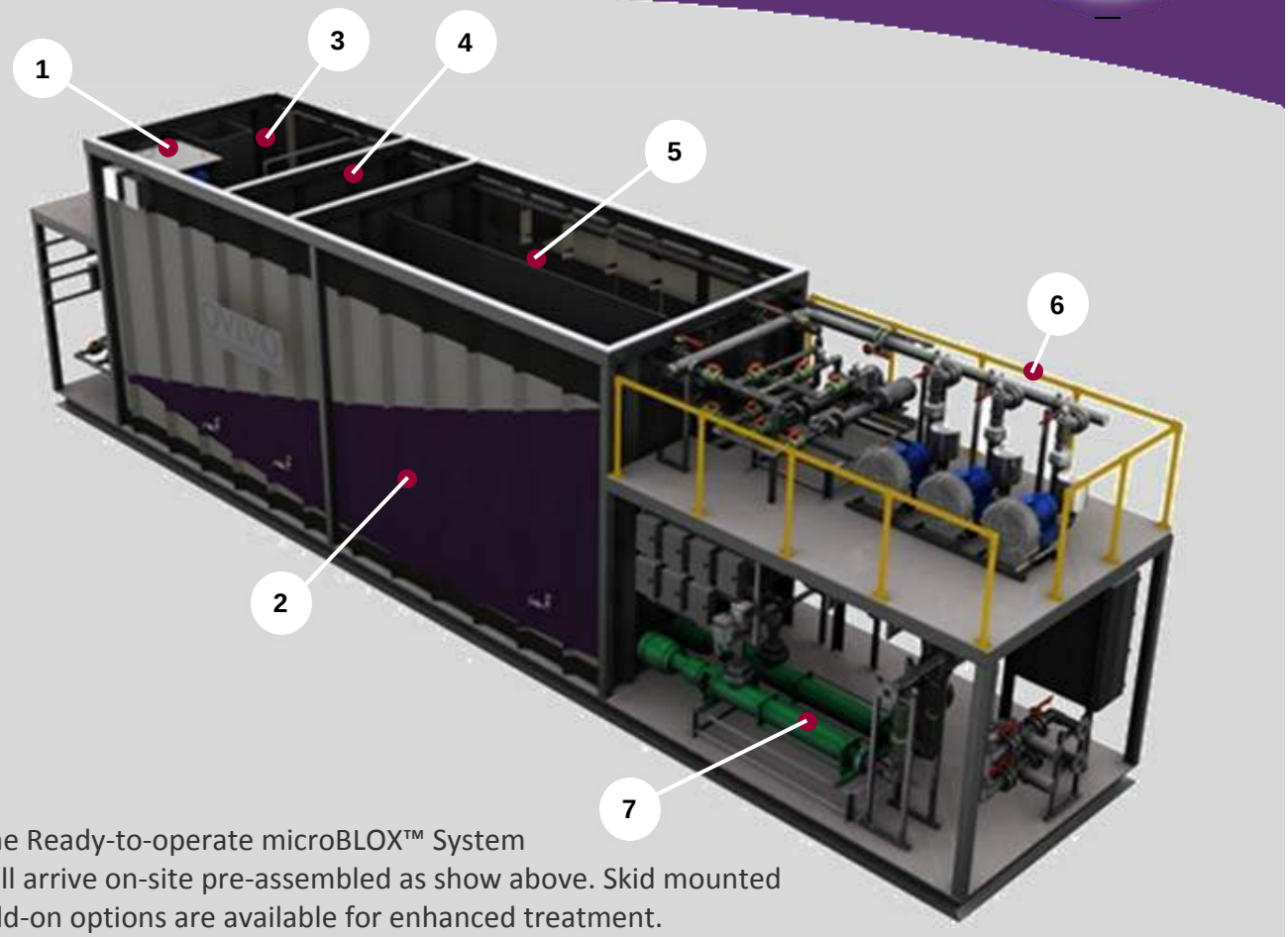
Options

Several options are available to tailor the capabilities of each microBLOX™ System to meet specific project needs including:

- Online nutrient monitoring
- Winterization packages
- Chemical dosing (add. carbon, pH, coagulants)
- Permeate disinfection
- Permeate pumping (7)
- Concentrated oxygen delivery systems (8)

Treated Effluent Quality		
Parameters	**Typical Values**	**Achievable Values**
BOD_5	< 2.0 mg/l	Non Detectable
Total Nitrogen (TN)	< 10.0 mg/l	< 3.0 mg/l
Ammonia (NH_3)	< 1.0 mg/l	< 0.3 mg/l
Phosphorus (TP)	< 1.0 mg/l	< 0.03 mg/l
Fecal Coliform	< 2.2 CFU/100 ml	Non Detectable
TSS	< 2.0 mg/l	Non Detectable





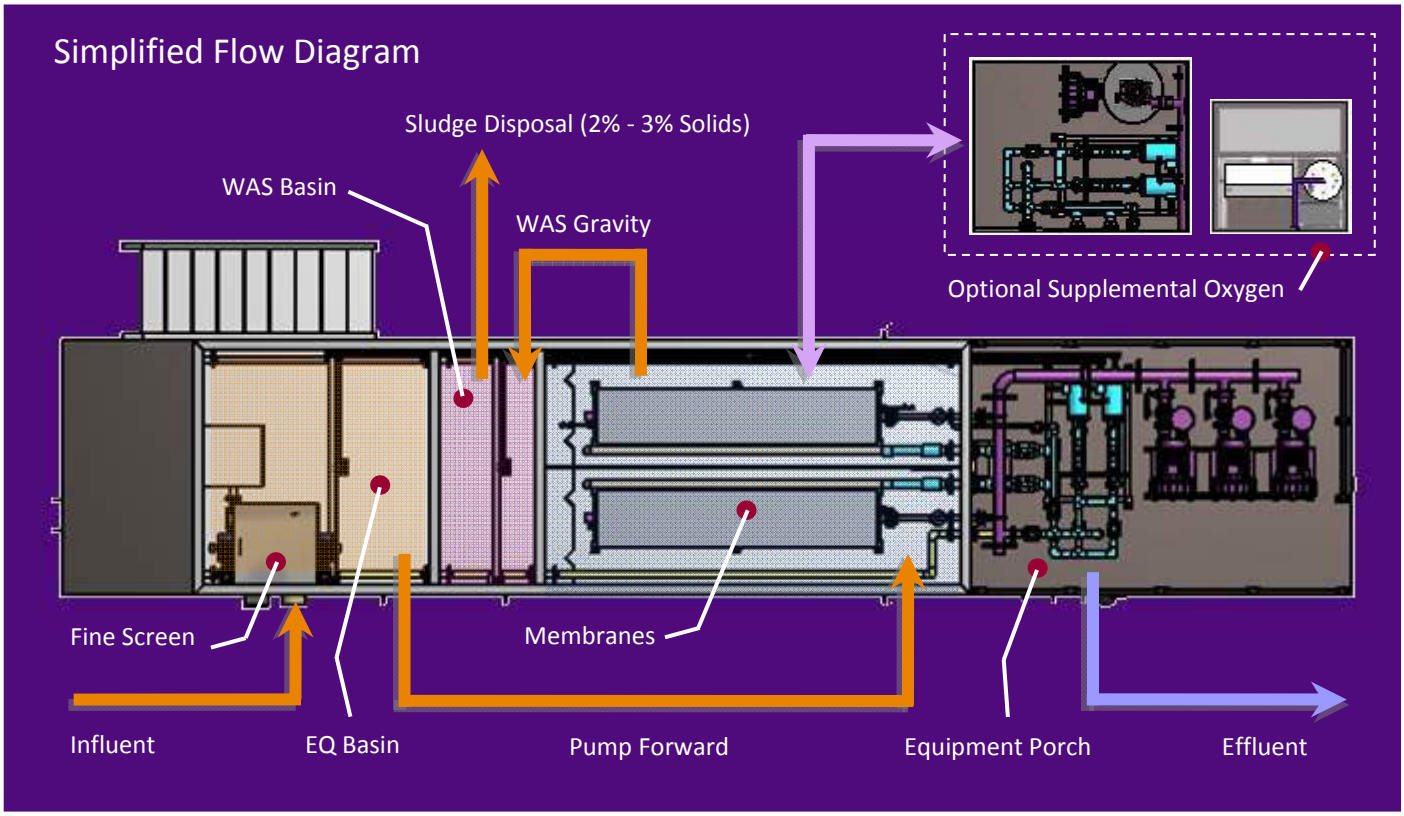
The Ready-to-operate microBLOX™ System will arrive on-site pre-assembled as show above. Skid mounted add-on options are available for enhanced treatment.

The Process

A microBLOX™ System can be configured to run in flow-through or batch modes depending on site conditions and treatment goals. As shown above, influent (raw wastewater) is screened before filling a dedicated Equalization Zone. Equalized wastewater is then pumped into a single-stage MBR process designed to operate over a range of dissolved oxygen conditions to achieve nutrient removal targets. For smaller, municipal applications, process oxygen is delivered exclusively by membrane aeration. Biologically treated wastewater is then gravity filtered (or pumped) using KUBOTA membranes to produce reuse quality effluent with only one tank; there is no recycle, no mechanical mixing and no fine bubble diffusers.

For higher strength wastes (e.g. light industrial or commercial), or to increase hydraulic throughput, options are available using various oxygen concentrator technologies. Oxygen makeup and delivery systems are completely skid mounted and easy to setup requiring only a few field connections. The onboard controls system is equipped with programming necessary for seamless integration.

Unlike other MBR Systems, a microBLOX™ System integrates solids thickening into the biological process to keep waste solids handling costs down and to improve overall reliability. As necessary, partially digested, thickened solids are wasted to an integral Waste Activated Sludge (WAS) Storage Zone. WAS can be stored at 2% - 3% solids, which can reduce hauling frequencies by more than 5 times that of conventional (package) technologies using sedimentation for solid/liquid separation.



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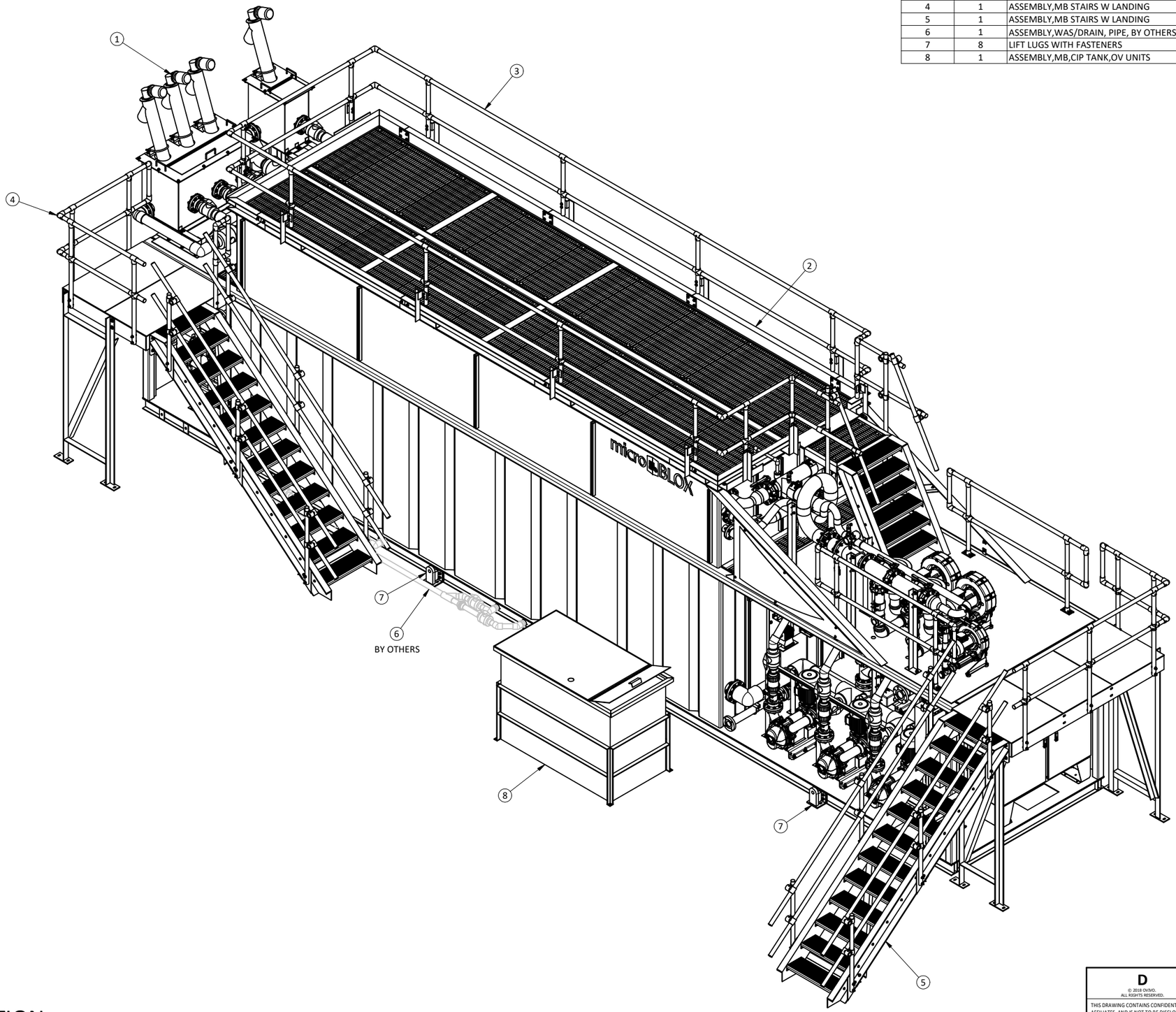
ITEM	QTY	DESCRIPTION	MATERIAL	PART NUMBER	TOTAL WEIGHT
1	1	ASSEMBLY,MB,V3,65K-GPD,TANK,SHIPPED		V3 65K GPD-1-300	45365.975
2	1	ASSY,ALUM CHANNEL FOR COVER MOUNT,V3		234-688	289.135
3	1	ASSEMBLY,MB-V3,TANK TOP HANDRAIL		234-646	559.605
4	1	ASSEMBLY,MB STAIRS W LANDING		234-659	821.434
5	1	ASSEMBLY,MB STAIRS W LANDING		234-660	929.319
6	1	ASSEMBLY,WAS/DRAIN, PIPE, BY OTHERS		BY OTHERS	55.645
7	8	LIFT LUGS WITH FASTENERS		234-185	283.310
8	1	ASSEMBLY,MB,CIP TANK,OV UNITS		234-521	481.337



NOT FOR CONSTRUCTION
FINAL DESIGN MAY VARY

ID #	SALES M-V3 65K GPD-01
QUANTITY	
MATERIAL	SEE BOM
FINISH	SEE BOM
COST CLASS	
WEIGHT	48785.8 lbmass

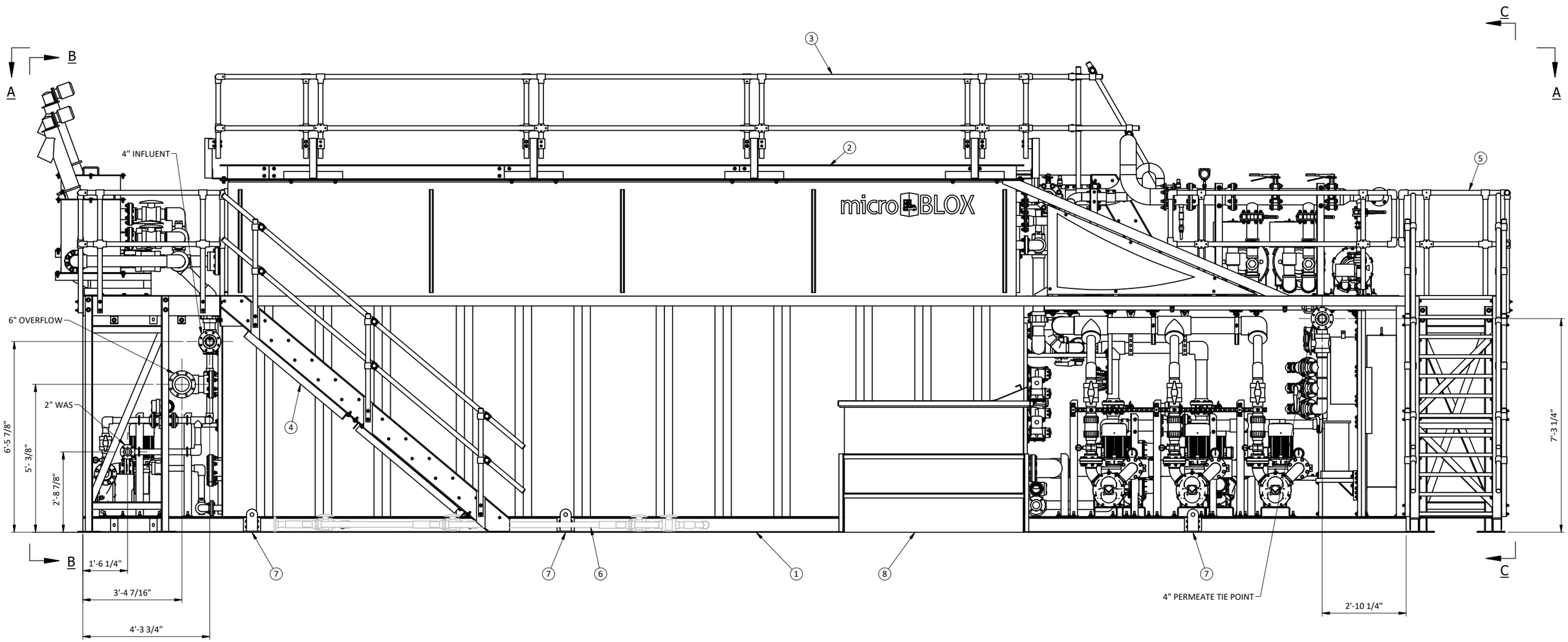
D

THIRD ANGLE PROJECTION

OVIVO
Worldwide Experts in Water Treatment

ASSEMBLY,MB,V3,65K-GPD,INSTALL,FIELD

REF. FROM		DO NOT SCALE PRINTS			
DATE (mm/dd/yyyy)	8/13/2019	WORKMANSHIP STANDARD ES0001 APPLIES			
DRAWN	RD	ORIGINAL S.O.	DWG. NO.	SALES M-V3 65K GPD-01	SHEET 1 OF 6 / REV A
CHECK'D	DV				



NOT FOR CONSTRUCTION

FINAL DESIGN MAY VARY

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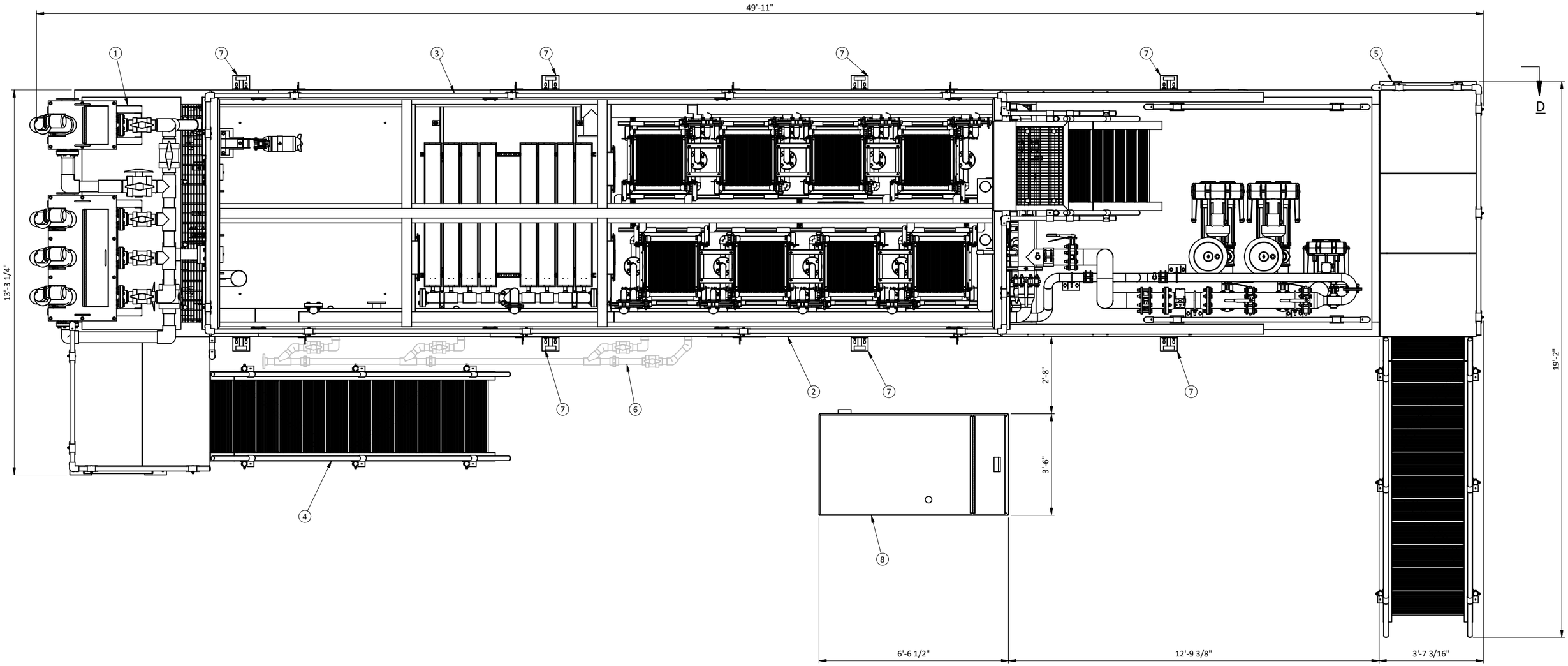
D	DO NOT SCALE PRINTS	DWG. NO.	SALES M-V3 65K GPD-01	SHEET 2 OF 6	REV A

WORKMANSHIP STANDARD ES0001 APPLIES



VIEW A-A
(GRATING TURNED OFF FOR CLARITY)

NOT FOR CONSTRUCTION
FINAL DESIGN MAY VARY

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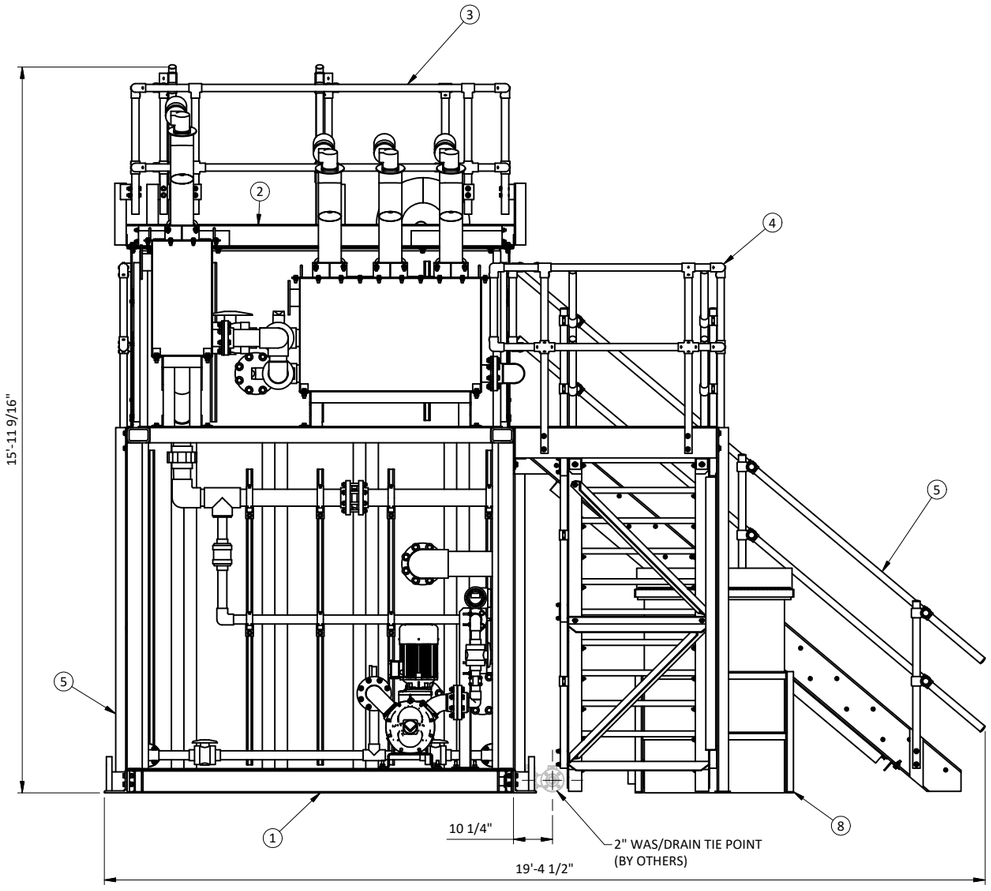
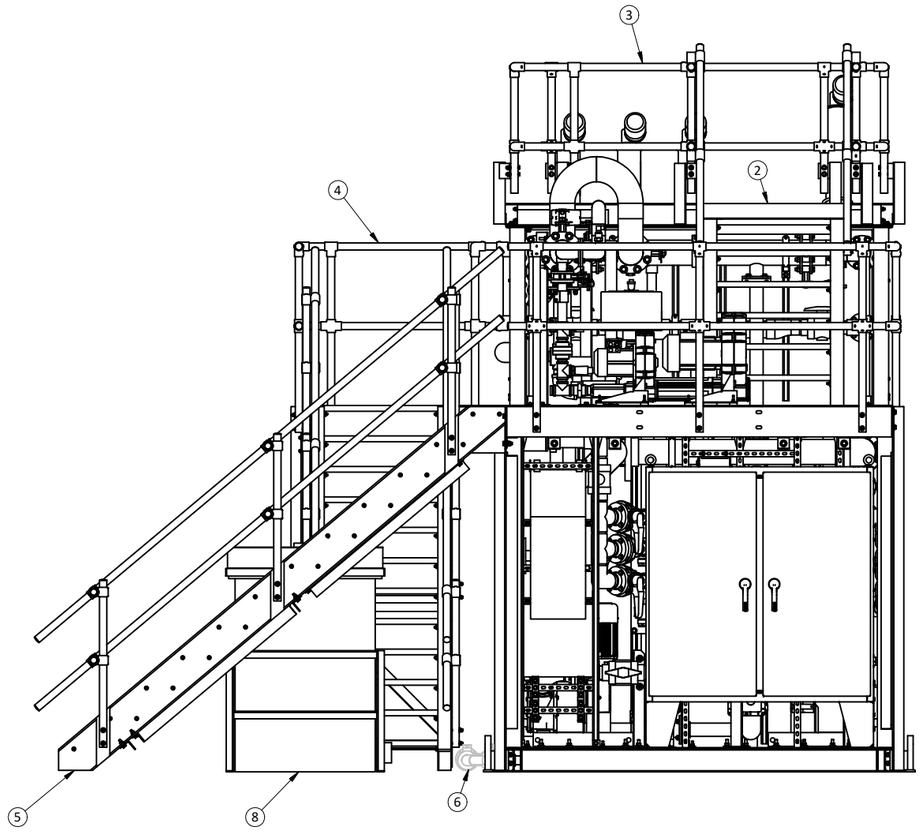
D	DO NOT SCALE PRINTS	DWG. NO.	SALES M-V3 65K GPD-01	SHEET 3 OF 6 / REV A

WORKMANSHIP STANDARD ES0001 APPLIES



VIEW B-B



VIEW C-C

NOT FOR CONSTRUCTION
FINAL DESIGN MAY VARY

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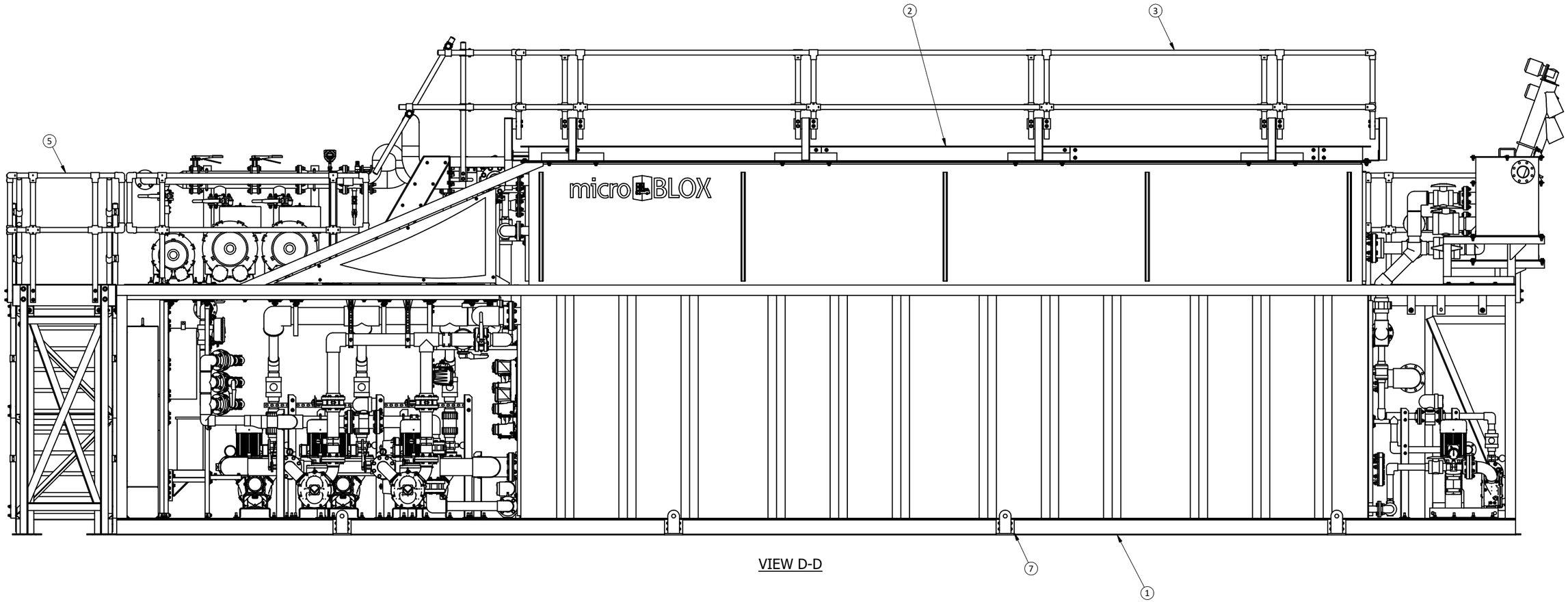
D	DO NOT SCALE PRINTS	DWG. NO.	SALES M-V3 65K GPD-01	SHEET 4 OF 6	REV A

WORKMANSHIP STANDARD ES0001 APPLIES



VIEW D-D

NOT FOR CONSTRUCTION
FINAL DESIGN MAY VARY

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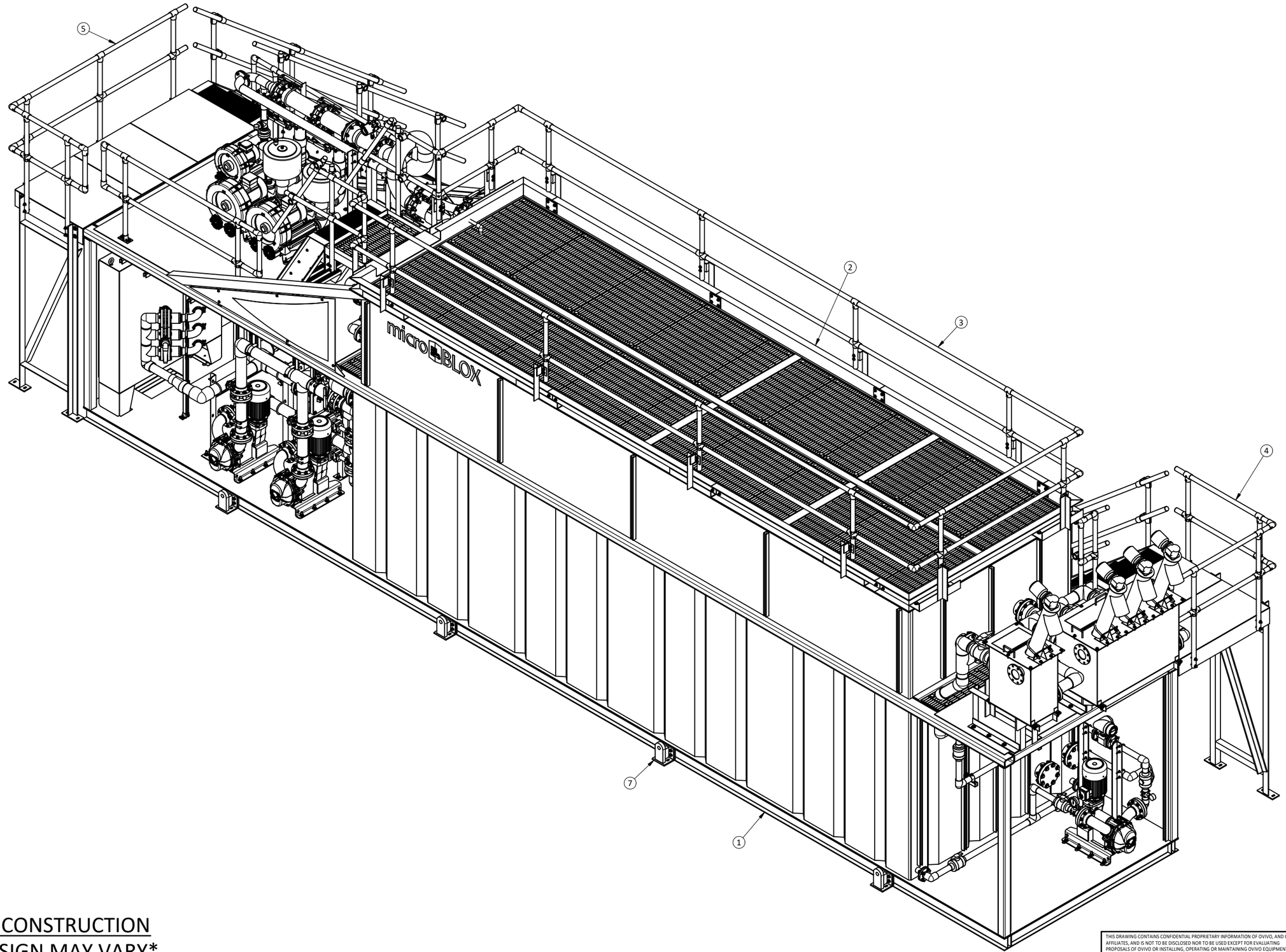
D	DO NOT SCALE PRINTS	DWG. NO.	SALES M-V3 65K GPD-01	SHEET 5 OF 6	REV A

WORKMANSHIP STANDARD ES0001 APPLIES



NOT FOR CONSTRUCTION
FINAL DESIGN MAY VARY

OVIVO
Worldwide Experts in Water Treatment

D	DO NOT SCALE PRINTS	DWG. NO.	SALES M-V3 65K GPD-01	SHEET 6 OF 6	REV A

WORKMANSHIP STANDARD ES0001 APPLIES

Orenco AdvanTex System – Example Installations in New York

- Hyde Park – 120 Service Connections – 30,000 gpd – Surface Return
- Hillsdale – 73 Service Connections – 50,000 gpd – Subsurface Return
- East Schodack – 23 Service Connections – 7,500 gpd – Surface Return
- Schodack Landing – 75 Service Connections – 20,000 gpd – Surface Return
- Bethlehem – 23 Service Connections – 7,500 gpd – Surface Return
- Kensington Woods – 160 Service Connections – 35,500 gpd – Surface Return

Orenco AdvanTex AX-Max
Biofiltration Treatment System

AdvanTex® Treatment Systems

AX-Max™

Manufactured by Orenco Systems®, Inc.

This full-sized AdvanTex® AX-Max™ wastewater system was installed at a 50-site campground in the LaPine State Park, LaPine, Oregon, to handle design flows of 7,500 gpd (28.4 m³/day).

Decentralized Wastewater Treatment for Commercial Properties and Communities

Applications:

- Municipal systems
- Subdivisions, apartments
- Golf course developments, resorts
- Manufactured home parks
- Parks, RV parks, campgrounds
- Schools, churches, businesses
- Rest areas, truck stops

Orenco® SYSTEMS

814 Airway Avenue, Sutherlin, Oregon, USA 97479
Toll-Free: 800-348-9843 • +1-541-459-4449 • www.orenco.com

AdvanTex® AX-Max™ Treatment System

Reliable, Energy-Efficient Wastewater Treatment Everywhere!

The Yakama Nations Housing Authority in Washington state added five AdvanTex® AX-Max units (background) to its ten AdvanTex AX-100 units, increasing the capacity of its wastewater system by 50%. Photo courtesy of Fextex Systems, Inc.

For more than 15 years, Orenco's AdvanTex® Treatment Systems have been providing reliable, energy-efficient wastewater treatment inside and outside the urban core. AdvanTex textile filter technology has been winning awards and coming out on top in field trials and demo projects, all over the world.

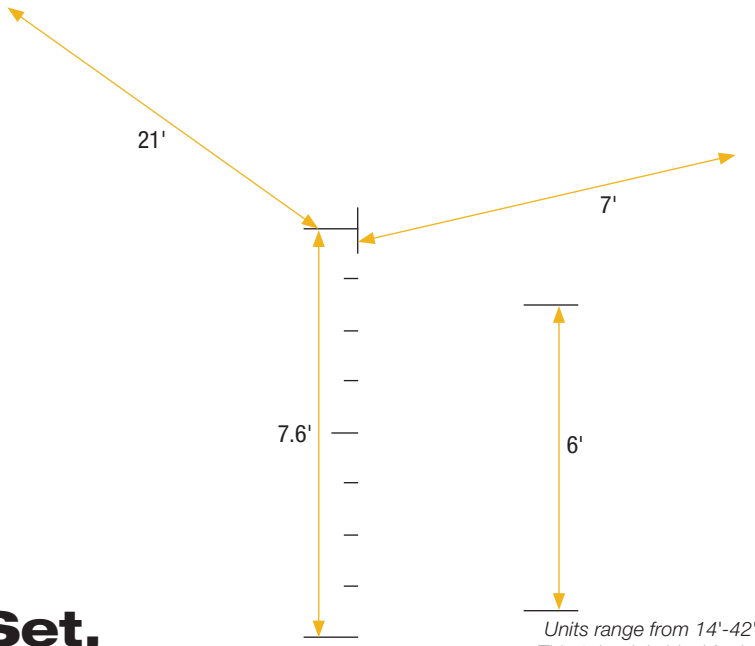
Orenco's newest product in the AdvanTex line is the AX-Max™: a completely-integrated, fully-plumbed, and compact wastewater treatment plant that's ideal for commercial properties and communities. It's also ideal for projects with strict discharge limits, limited budgets, and part-time operators.

A Sustainable Solution for Wastewater Treatment

Like all AdvanTex Treatment Systems, the AX-Max is a recirculating media filter that produces outstanding effluent quality suitable for reuse, with significant nutrient-removal. AX-Max systems are highly energy-efficient, using less than 2 kWh per 1000 treated gallons (3.785 m^3). And they require minimal O&M compared to conventional technologies. Consequently, AdvanTex can earn LEED credits for your projects.

A full-sized AX-Max unit can be configured as a plug & play wastewater treatment system capable of handling up to 15,000 gpd (56.8 m^3/day) design flow when receiving primary-treated effluent. Alternately, a similar unit can be configured as a 5,000 gpd (18.9 m^3/day) system capable of processing raw sewage.

AdvanTex® AX-Max™ Treatment System



Units range from 14'-42' in length. This 21' unit is ideal for lower flows.

Set, Plumb, Wire, and Go

The AX-Max is pre-plumbed and easy to install, so AX-Max projects can meet the tightest deadlines. The entire system — including treatment, recirculation, and discharge — is built inside an insulated fiberglass tank that ranges from 14-42 feet (4.3-12.8 m) in length. AX-Max units can be installed above-ground — for maximum versatility in temporary or variable-flow situations — or in-ground. They can also be installed individually or in multi-tank arrays, treating up to 1 MGD (3,800 m^3/day).

For Every Climate and Condition

AX-Max systems provide excellent treatment anywhere, and they have been installed all over the world. For example, AX-Max systems have been installed at Malibu's famous beach parks and New Zealand's Glendhu Bay campground. Several more were installed in Soyo, Africa, to serve a new hospital and school. Other AX-Max systems have been installed on top of Alaska's frozen tundra and St. Lucia's volcanic rock. Still more have been installed in mining camps from Alberta to Texas and, in the Midwest, at a U.S. Department of Defense demo site.

Benefits

- Containerized, fully-plumbed
- Capable of meeting stringent permit limits
  - ~ Reuse-quality effluent
  - ~ Significant reductions in ammonia, total nitrogen
- Compact and versatile
- Above-ground or in-ground installation
- Easy to set
- Simple to operate
- Low energy usage: <2 kWh per 1000 treated gal. (<2 kWh per 3.785 m^3)*

  ** When treating domestic waste*

Textile Treatment Media

The treatment medium is a uniform, engineered textile. AdvanTex textile is easy to clean and allows loading rates as high as 50 gpd/ft^2 (2000 L/day/m^2) with primary-treated influent.

Effluent Distribution

High-quality, low-horsepower pumps micro-dose the treatment media at regular intervals, and proprietary spin nozzles efficiently distribute the effluent, optimizing treatment.

Telemetry Controls

Orenco's telemetry-enabled control panels use a dedicated phone line or ethernet connection, ensuring 24/7 monitoring and real-time remote control.

AdvanTex® AX-Max™ Treatment System

Carefully Engineered by Orenco

Orenco Systems has been researching, designing, manufacturing, and selling leading-edge products for small-scale wastewater treatment systems since 1981. The company has grown to become an industry leader, with about 300 employees and 300 points of distribution in North America, Australasia, Europe, Africa, and Southwest Asia. Our systems have been installed in more than 70 countries around the world.

Orenco maintains an environmental lab and employs dozens of civil, electrical, mechanical, and manufacturing engineers, as well as wastewater treatment system operators. Orenco's technologies are based on sound scientific principles of chemistry, biology, mechanical structure, and hydraulics. As a result, our research appears in numerous publications and our engineers are regularly asked to give workshops and trainings.

Powered by Franklin Electric

Orenco SYSTEMS

814 Airway Avenue
Sutherlin, OR 97479 USA

T: 800-348-9843
T: 541-459-4449
F: 541-459-2884

www.orenco.com

ABR-ATX-MAX-1
Rev. 1.5, © 03/17
Orenco Systems®, Inc.

Project Summary

Installation photos courtesy of BioSolutions, Inc.

Point Dume State Beach and Preserve, Southern California

In spring, 2011, Los Angeles County needed to quickly upgrade restrooms at Malibu's Point Dume State Beach in time for the long — and busy — Memorial Day weekend. The county's engineer specified three AX-Max units, one for each restroom, and all three were installed in a matter of days. The small footprint of this configuration saved the county valuable space for visitor parking. After disinfection, the treated effluent is dispersed right into the sand. Point Dume is part of a large-scale upgrade of L.A. County beach parks, virtually all of which include AdvanTex Treatment Systems of various sizes and configurations.

Fully Supported by Orenco

AdvanTex Treatment Systems are part of a comprehensive program that includes ...

- Designer, installer, and operator training
- Design assistance, technical specifications, and plan reviews
- Installation and operation manuals
- Lifetime technical support

Distributed by:

Orenco® SYSTEMS *Technical Data Sheet*

AdvanTex® AX-Max Treatment Systems

Applications

Orenco's AdvanTex® AX-Max is a complete, fully-plumbed, AdvanTex Wastewater Treatment Plant for residential, commercial, municipal, and mobile applications with medium-to-large-flows and permits requiring secondary treatment or better. It can be used as a stand-alone unit or in multi-unit arrays under adverse conditions in a wide range of environments. The AX-Max is ideal for:

- Small sites and poor soils
- At-grade or above-grade installations
- Mobile and temporary installations
- Disaster response sanitation
- Remote locations
- Extreme hot or cold climates

General

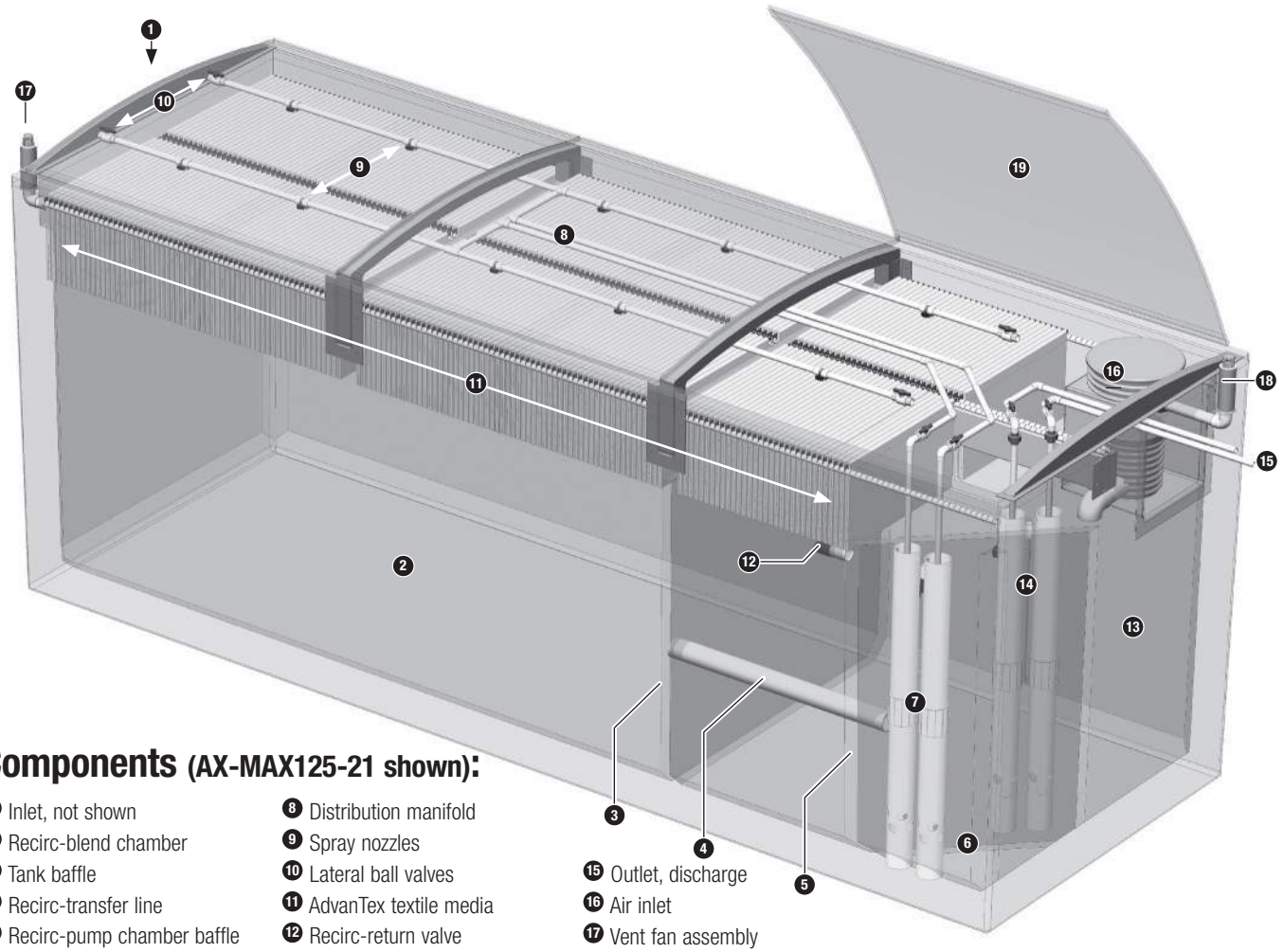
The AX-Max is a modular system that can be preceded by primary treatment or configured to incorporate primary, secondary, and tertiary wastewater treatment before reuse or dispersal.

The heart of the AX-Max system is the AdvanTex Recirculating Treatment Tank, a sturdy, watertight, corrosion-proof fiberglass tank that includes the same dependable, textile treatment media found in all AdvanTex products.

Standard Models

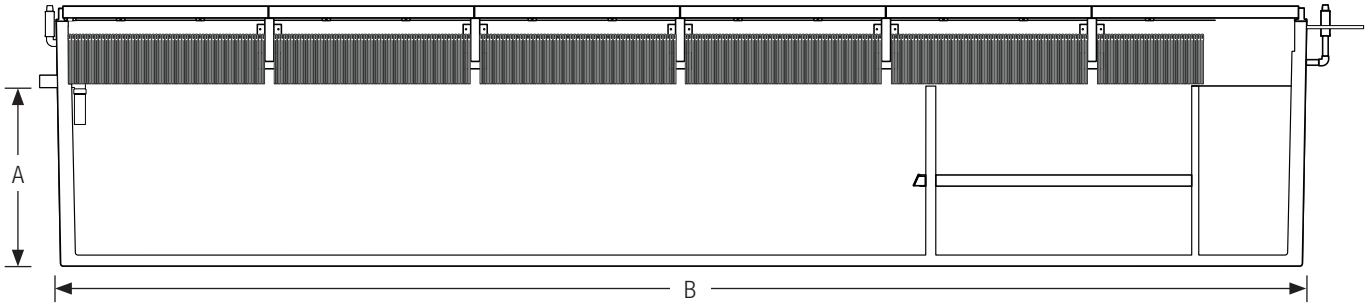
AX-MAX100-14, AX-MAX150-21, AX-MAX200-28, AX-MAX250-35, AX-MAX300-42 (Standard models without pump systems.)

AX-MAX075-14, AX-MAX125-21, AX-MAX175-28, AX-MAX225-35, AX-MAX275-42 (Standard models with pump systems.)

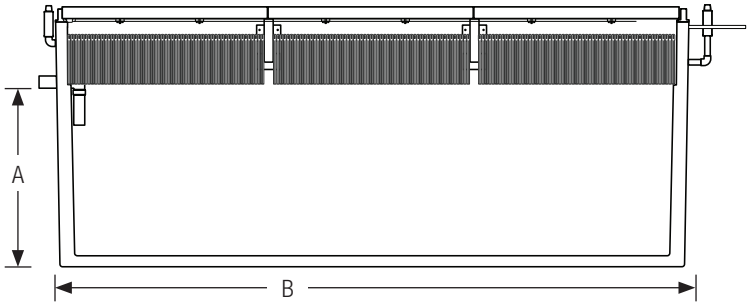


Components (AX-MAX125-21 shown):

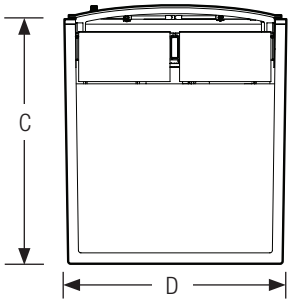
1. Inlet, not shown
2. Recirc-blend chamber
3. Tank baffle
4. Recirc-transfer line
5. Recirc-pump chamber baffle
6. Recirc-pump chamber
7. Recirc pumping assembly
8. Distribution manifold
9. Spray nozzles
10. Lateral ball valves
11. AdvanTex textile media
12. Recirc-return valve
13. Recirc-filtrate chamber
14. Discharge pumping assembly
15. Outlet, discharge
16. Air inlet
17. Vent fan assembly
18. Air outlet
19. Hinged lid, typical



AdvanTex AX-MAX275-42, side view



AdvanTex AX-MAX150-21, side view



AdvanTex AX-MAX, end view (all models)

Specifications

Nominal Dimensions*

Model	AX-MAX100-14	AX-MAX150-21	AX-MAX200-28	AX-MAX250-35	AX-MAX300-42
A, ft (m)	variable	variable	variable	variable	variable
B, ft (m)	14.0 (4.2)	21.0 (6.4)	28.0 (8.5)	35.0 (10.7)	42.0 (12.8)
C, ft (m)	7.6 (2.3)	7.6 (2.3)	7.6 (2.3)	7.6 (2.3)	7.6 (2.3)
D, ft (m)	7.5 (2.3)	7.5 (2.3)	7.5 (2.3)	7.5 (2.3)	7.5 (2.3)
Footprint, ft^2 (m^2)	112.0 (10.4)	168.0 (15.6)	224.0 (20.8)	280.0 (26.0)	336.0 (31.2)
Model	**AX-MAX075-14**	**AX-MAX125-21**	**AX-MAX175-28**	**AX-MAX225-35**	**AX-MAX275-42**
A, ft (m)	5.7 (1.7)	5.7 (1.7)	5.7 (1.7)	5.7 (1.7)	5.7 (1.7)
B, ft (m)	14.0 (4.2)	21.0 (6.4)	28.0 (8.5)	35.0 (10.7)	42.0 (12.8)
C, ft (m)	7.6 (2.3)	7.6 (2.3)	7.6 (2.3)	7.6 (2.3)	7.6 (2.3)
D, ft (m)	7.5 (2.3)	7.5 (2.3)	7.5 (2.3)	7.5 (2.3)	7.5 (2.3)
Footprint, ft^2 (m^2)	112.0 (10.4)	168.0 (15.6)	224.0 (20.8)	280.0 (26.0)	336.0 (31.2)

**See AdvanTex® AX-Max Treatment System drawings for exact dimensions and specific treatment configurations.*

Orenco Systems® Inc. , 814 Airway Ave., Sutherlin, OR 97479 USA • 800-348-9843 • 541-459-4449 • www.orenco.com

Tighe&Bond

APPENDIX G

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 NAD 83, GRS80 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, Maryland 20910-3182
(301) 713-3242

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 New York State Office of Cyber Security & Critical Infrastructure Coordination. This information was produced as one-foot and two-foot resolution natural color orthoimagery from photography dated April 2006.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. 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. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

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.

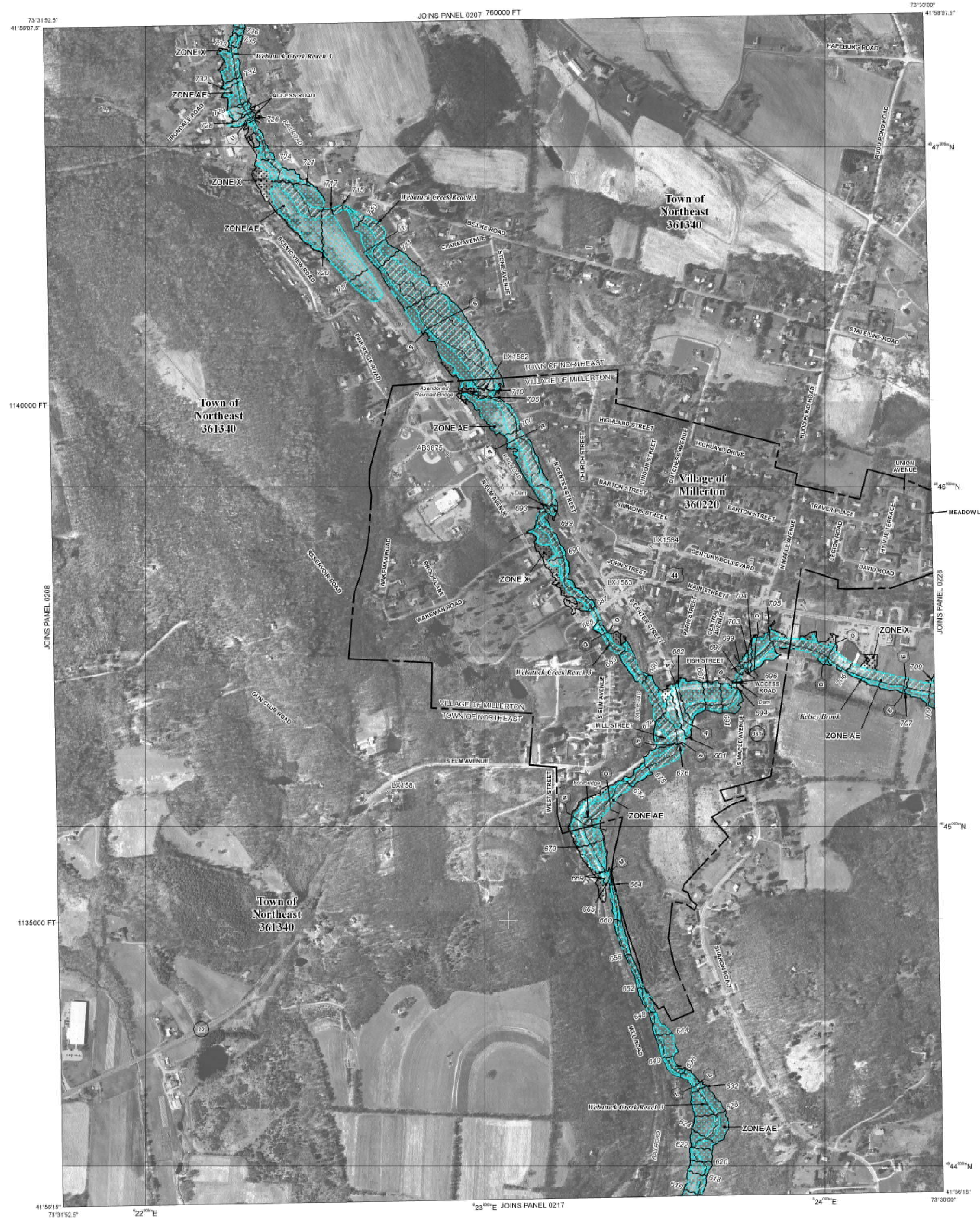
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which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

For information on available products associated with this FIRM, visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange (FMIX) at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

CTP Cooperating Technical Partners

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 SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual 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 Area Zones and 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

(A)——(A)	Cross section line
3——3	Limited detail cross section line
(23)- - - -(23)	Transect line
87°07'45", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
76°N	1000-meter Universal Transverse Mercator grid values, zone 18
600000 FT	5000-foot grid values: New York State Plane coordinate system, East zone (FIPSZONE 3101), Transverse Mercator projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
May 2, 2012

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.

N

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0209E

FIRM

FLOOD INSURANCE RATE MAP

for DUTCHESS COUNTY, NEW YORK
(ALL JURISDICTIONS)

CONTAINS:

COMMUNITY	NUMBER
MILLERTON, VILLAGE OF	360220
NORTHEAST, TOWN OF	361340

PANEL 209 OF 602
MAP SUFFIX: E
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

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
36027C0209E

EFFECTIVE DATE
MAY 2, 2012

Federal Emergency Management Agency

Tighe&Bond

APPENDIX H

Tighe&Bond
Engineers | Environmental Specialists
Services provided in New York by T&B Engineering, P.C.

Project/Site Information

M1784-004 Wastwater Evlauation
Mill Road
Millerton, New York 12546

Test Pit No. **TP-1**
Page No. 1 of 6
File No.
Checked By:

T&B Rep.	R. Morrison	Contractor	Village of Millerton DPW			Date	10/12/18
		Operator	Cole Lawrence			Ground Elev.	Unkown
Weather		Make		Model		Time Started	9:00 AM
		Capacity		Reach	ft.	Time Completed	2:00 PM

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0	0" - 2" Organic Debris	N/A		M		
	2" - 94" Silt Loam, Brown-Grey color, Gravel 10-15%, Cobbles 5%					
1'	Roots to a depth of 37"			M		
2'						
3'						
4'						
5'						
6'						
7'						
8'						
9'						
10'						
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1. Inconsistent lenses of redox features found typically around cobles. Redox features were as high as 38" but very sparatic in formation
2. Purple maganese marks found in soil matrix
3. Bedrock not encountered
4. No topsoil noted.
5. Water weeping in test pit while digging and was left open to see how high ground water would stabilize at.

Test Pit Plan

Volume = _____ cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
4	47"

Tighe&Bond
Engineers | Environmental Specialists
Services provided in New York by T&B Engineering, P.C.

Project/Site Information

M1784-004 Wastwater Evlauation
Mill Road
Millerton, New York 12546

Test Pit No. **TP-2**
Page No. 2 of 6
File No.
Checked By:

T&B Rep.	R. Morrison	Contractor	Village of Millerton DPW			Date	10/12/18
		Operator	Cole Lawrence			Ground Elev.	Unkown
Weather		Make		Model		Time Started	9:00 AM
		Capacity		Reach	ft.	Time Completed	2:00 PM

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0	0" - 1" Organic Debris	N/A		M		
1'	1" - 95" Silt Loam, Brown-Grey color, Gravel 5-10%, Cobbles 5%			M		
2'	Roots to a depth of 40"					
3'						
4'						
5'						
6'						
7'						
8'						
9'						
10'						
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1. Inconsistent lenses of redox features found typically around cobles. Redox features were as high as 20" but very sparatic in formation.
2. Purple maganese marks found in soil matrixs
3. Bedrock not encountered
4. No topsoil layer noted.
5. Water weeping in test pit. Was not left open to equalize.

Test Pit Plan

Volume = _____ cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
0	51"

Tighe&Bond
Engineers | Environmental Specialists
Services provided in New York by T&B Engineering, P.C.

Project/Site Information

M1784-004 Wastwater Evlauation
Mill Road
Millerton, New York 12546

Test Pit No. **TP-3**
Page No. 3 of 6
File No.
Checked By:

T&B Rep.	R. Morrison	Contractor	Village of Millerton DPW			Date	10/12/18
		Operator	Cole Lawrence			Ground Elev.	Unkown
Weather		Make		Model		Time Started	9:00 AM
		Capacity		Reach	ft.	Time Completed	2:00 PM

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0	0" - 2" Organic Debris	N/A		M		
	2" - 96" Silt Loam, Brown-Grey color, Gravel 10-15%, Cobbles 5%					
1'	Roots to a depth of 20"			M		
2'						
3'						
4'						
5'						
6'						
7'						
8'						
9'						
10'						
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1. Inconsistent lenses of redox features found typically around cobles. Redox features were as high as 51" but very sparatic in formation.
2. Bedrock not encountered
3. No topsoil layer noted.
4. No groundwater encountered.

Test Pit Plan

Volume = _____ cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
N/A	N/A

J:\M\M1784 Millerton\004 - Wastewater Evaluation\Data\Soils\Testing\[2018-10-12 Deep Test Log.xls]TP-3

Tighe&Bond
Engineers | Environmental Specialists
Services provided in New York by T&B Engineering, P.C.

Project/Site Information

M1784-004 Wastwater Evlauation
Mill Road
Millerton, New York 12546

Test Pit No. **TP-4**
Page No. 4 of 6
File No.
Checked By:

T&B Rep.	R. Morrison	Contractor	Village of Millerton DPW			Date	10/12/18
		Operator	Cole Lawrence			Ground Elev.	Unkown
Weather		Make		Model		Time Started	9:00 AM
		Capacity		Reach	ft.	Time Completed	2:00 PM

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0	0" - 18" Light Brown Loam, Gravel 0-5% 18" - 86" Silt Loam, Brown-Grey color, Gravel 5-10%, Cobbles 5%	N/A		M		
1'				M		
2'						
3'						
4'						
5'						
6'						
7'						
8'						
9'						
10'						
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1. Inconsistent lenses of redox features found typically around cobles. Redox features were as high as 23" but very sparatic in formation
2. Bedrock not encountered
3. No topsoil layer noted.
4. No groundwater encountered.

Test Pit Plan

Volume = _____ cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
N/A	N/A

Tighe&Bond
Engineers | Environmental Specialists
Services provided in New York by T&B Engineering, P.C.

Project/Site Information

M1784-004 Wastwater Evlauation
Mill Road
Millerton, New York 12546

Test Pit No. **TP-5**
Page No. 5 of 6
File No.
Checked By:

T&B Rep.	R. Morrison	Contractor	Village of Millerton DPW			Date	10/12/18
		Operator	Cole Lawrence			Ground Elev.	Unkown
Weather		Make		Model		Time Started	9:00 AM
		Capacity		Reach	ft.	Time Completed	2:00 PM

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0	0" - 25" Light Brown Loam, Gravel 0-5%	N/A		M		
1'	25" - 92" Silt Loam, Brown-Grey color, Gravel 5-10%, Cobbles 5%			M		
2'	Root Depth noted at 24"					
3'						
4'						
5'						
6'						
7'						
8'						
9'						
10'						
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1. Inconsistent lenses of redox features found typically around cobles. Redox features were as high as 24" but very sparatic in formation
2. Bedrock not encountered
3. No topsoil layer noted.
4. No groundwater encountered.

Test Pit Plan

Volume = _____ cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
N/A	N/A

J:\M\M1784 Millerton\004 - Wastewater Evaluation\Data\Soils\Testing\[2018-10-12 Deep Test Log.xls]TP-5

Tighe&Bond
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Services provided in New York by T&B Engineering, P.C.

Project/Site Information

M1784-004 Wastwater Evlauation
Mill Road
Millerton, New York 12546

Test Pit No. **TP-6**
Page No. 6 of 6
File No.
Checked By:

T&B Rep.	R. Morrison	Contractor	Village of Millerton DPW			Date	10/12/18
		Operator	Cole Lawrence			Ground Elev.	Unkown
Weather		Make		Model		Time Started	9:00 AM
		Capacity		Reach	ft.	Time Completed	2:00 PM

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0	0" - 36" Light Brown Loam, Gravel 0-5%	N/A		M		
1'	36" - 94" Silt Loam, Brown-Grey color, gravel 10-15%, cobbles 5%			M		
2'						
3'						
4'						
5'						
6'						
7'						
8'						
9'						
10'						
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1. Inconsistent lenses of redox features found typically around cobles. Redox features were as high as 38" but very sparatic in formation
2. Purple magmanes marks found in siil matrixs
3. Bedrock not encountered
4. Water weeping in test pit. Was not left open to equalize.

Test Pit Plan

Volume = _____ cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
N/A	51"

J:\M\M1784 Millerton\004 - Wastewater Evaluation\Data\Soils\Testing\[2018-10-12 Deep Test Log.xls]TP-6

DUTCHESS COUNTY DEPARTMENT OF HEALTH

P E R C O L A T I O N T E S T D A T A

Name: Mill Street Wastewater Evaluation (T)(V)(C) Millerton Date: 10-26-18

TAX GRID #

By: Ryan Morrison DCHD Inspector N/A - Preliminary Test for Evaluation

Lot No.	Test Hole No.	Test Hole Depth	Soil Type	Soaked	TEST RUNS					
					*	1	2	3	4	5
	1		Silty Loam	Yes	Finish	12:07	12:18	12:51		
					Start	12:00	12:10	12:42		
					Time	7 min	8 min	9 min		
					Finish					
					Start					
					Time					
	2		Silty Loam	Yes	Finish	1:11	1:21	1:28		
					Start	1:05	1:14	1:22		
					Time	6 min	7 min	6 min		
					Finish					
					Start					
					Time					
	3		Silty Loam	Yes	Finish	1:55	2:07	2:11		
					Start	1:48	1:57	2:10		
					Time	7 min	10 min	11 min		
					Finish					
					Start					
					Time					
					Finish					
					Start					
					Time					
					Finish					
					Start					
					Time					
					Finish					
					Start					
					Time					
					Finish					
					Start					
					Time					

I, _____, the undersigned, certify that these percolation tests were done by myself or under my direction according to the standard procedure. The data and results presented are true and correct.

Dated: _____ Signature: _____

License No. (P.E.)(L.S.) _____

HD-184

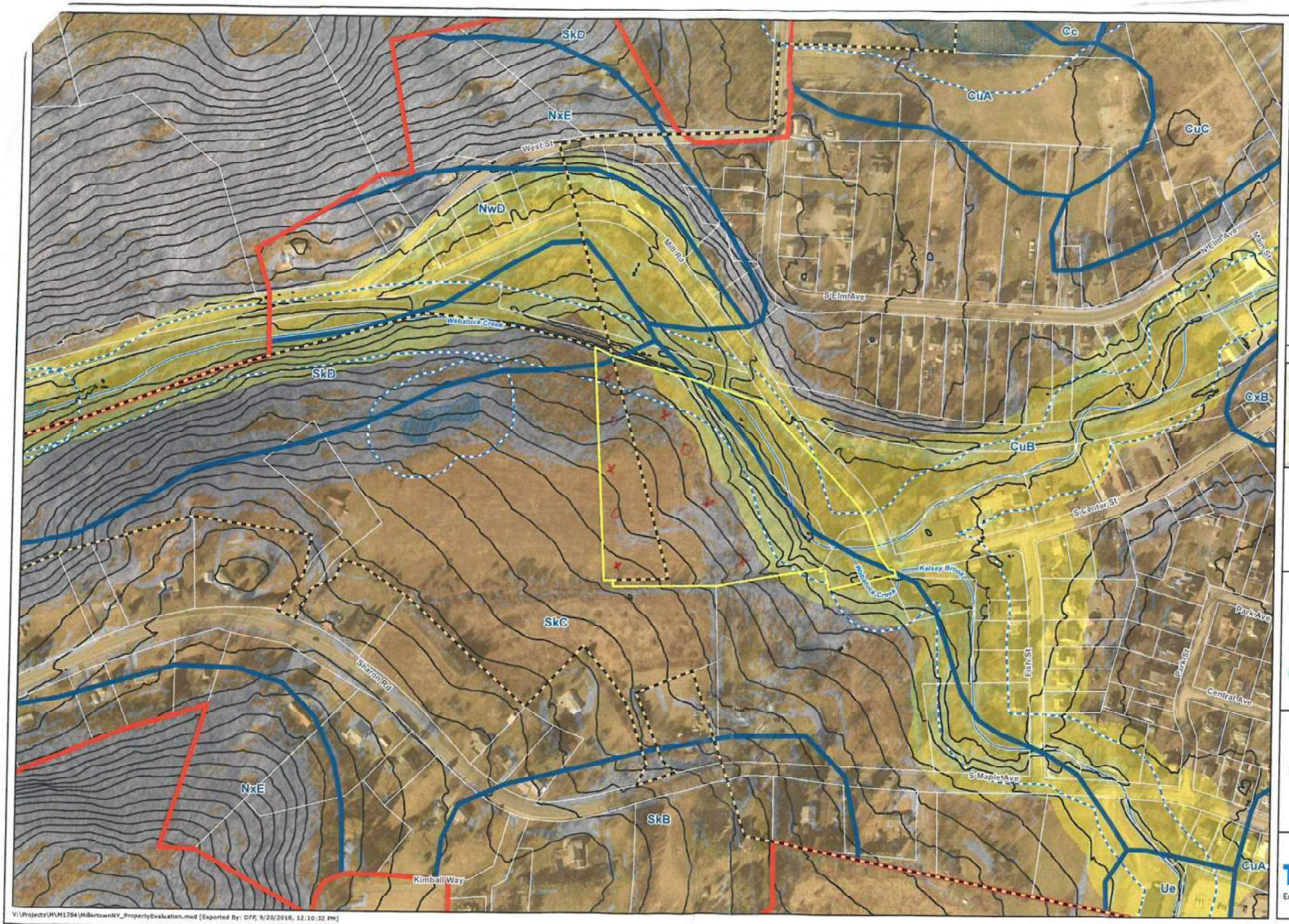

Figure 3
Mill Street Property Evaluation

LEGEND

- Millerton Project Boundary
- Mill Street Property Boundary
- Parcel Bounadry
- Village / Town Boundary
- Soil Type Boundary
- 10 Foot Contours
- Stream / River
- 100' Wetlands Buffer
- NWI Wetland
- Water
- 100 Year Flood Zone Buffer
- Less than 15% Slope
- Greater than 15% Slope

LOCUS MAP

0 125 250
Feet
1:3,000

NOTES

1) Ortho provided by dtsaes.ny.gov (2015).
2) Parcels lines are approximate.
3) Only parcels Zoned GB, R20,000, or R10,000 are included in sewer district selection

X- Deep test
O - Perc test

10-12-18

Village of Millerton
Sewer District Delineation

September 2018

Tighe&Bond
Engineers | Environmental Specialists

V:\Projects\M\M1784\MillertownNY_PropertyEvaluation.mxd [Exported By: DFP, 9/20/2018, 12:10:32 PM]

M-1784

Tighe&Bond

APPENDIX I

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST
Alternative No. 2 - Biofiltration System with GGSF Absorption Field
Village of Millerton, NY
Wastewater Feasibility Evaluation
Project No. M1784

Item Description	Unit Cost	Units	Quantity	Cost
STEP Collection System				**$ 4,739,000**
Pump out Existing Septic Tanks and Abandon in Place	$750	EA	141	$ 105,800
STEP System Installation (1,000 Gallon Tank)	$9,200	EA	119	$ 1,094,800
STEP System Installation (1,500 Gallon Tank)	$12,800	EA	18	$ 230,400
STEP System Installation (4,000 Gallon Tank)	$14,800	EA	4	$ 59,200
Service Lateral Installation (1-1/2" HDPE)	$4,000	EA	141	$ 564,000
Restoration for STEP System/Service Lateral Installation	$3,400	EA	141	$ 479,400
2"-4" HDPE Forcemain Installation (Directional Drilling)	$52	LF	15050	$ 782,600
6" HDPE Forcemain Installation (Directional Drilling)	$70	LF	2600	$ 182,000
Excavation and Connection at Junctions	$5,700	EA	54	$ 307,800
Air Releases	$4,000	EA	9	$ 36,000
Clean-outs	$2,300	EA	40	$ 92,000
Bridge Crossing	$6,800	EA	1	$ 6,800
Pavement Repairs	$2,300	EA	108	$ 248,400
Lawn Restoration	$12	SY	9800	$ 117,600
Clearing and Grubbing in Right-of-Ways	$13,600	Acre	3	$ 40,800
NYSDOT Crossing	$6,800	EA	5	$ 34,000
Mobilization/Demobilization	5%	LS	1	$ 219,100
Traffic Control	3%	LS	1	$ 138,100
Site Work				**$ 36,000**
Clearing and Grubbing	$13,600	Acre	0.5	$ 6,800
Rough Grading for Access Roadway	$4,000	EA	1	$ 4,000
Prepare and Roll Subbase for Access Roadway	$3	SY	1300	$ 3,900
Stabilization Fabric for Access Roadway	$2	SY	1300	$ 2,600
Gravel and Compaction for Access Roadway	$10	SY	1300	$ 13,000
Culvert	$1,700	EA	2	$ 3,400
Mobilization/Demobilization	5%	LS	1	$ 1,700
Electrical Service				**$ 21,000**
Utility Pole Installation	$1,200	EA	8	$ 9,600
Excavation for Underground Electrical Utilities	$5	LF	200	$ 1,000
Bedding for Underground Conduits	$7	LF	200	$ 1,400
Direct Burial of PVC Conduits	$7	LF	200	$ 1,400
Service Entrance	$5,700	LS	1	$ 5,700
Mobilization/Demobilization	5%	LS	1	$ 1,000
Biofiltration Resource Recovery System				**$ 2,719,000**
Pre-anoxic/EQ Tanks	$216,364	LS	1	$ 216,400
Pre-anoxic/EQ Tanks Access and Pumping Equipment	$14,000	LS	1	$ 14,000
Pre-anoxic/EQ Tank Installation	30%	LS	1	$ 69,200
Orenco AdvanTex AX-MAX Phase I Units (10 Units)	$1,084,364	LS	1	$ 1,084,400
Orenco T-MAX Effluent Pump Tank	$87,818	LS	1	$ 87,900
Orenco Treatment Unit Ancillary Equipment	$110,727	LS	1	$ 110,800
Telemetry Control Panel	$68,000	LS	1	$ 68,000
Instrumentation/Flow Meter	$18,100	LS	1	$ 18,100
Control Building	$80,000	LS	1	$ 80,000
Water Service	$5,000	LS	1	$ 5,000
Orenco Treatment System Installation	20%	LS	1	$ 290,900
Contractor's Overhead & Profit on Treatment System	15%	LS	1	$ 240,000
Backup Generator	$34,000	EA	1	$ 34,000
Electrical Work	20%	LS	1	$ 82,000
Material Shipping	12%	LS	1	$ 202,200
Commissioning and Operator Training	$7,400	LS	1	$ 7,400
Mobilization/Demobilization	5%	LS	1	$ 108,100
GGSF Absorption Fields				**$ 1,140,000**
Clearing and Grubbing	$13,600	Acre	0.5	$ 6,800
Brush Hogging	$800	Acre	3.5	$ 2,800
Rough Grading for Absorption Field	$17,000	LS	1	$ 17,000
Trenching and Backfill for Absorption Field Trenches	$9	LF	9800	$ 88,200
GGSF Product & System Sand	$27	LF	9800	$ 264,600
Placing System Sand	$7	LF	9800	$ 68,600
Vent Piping	$9	LF	1960	$ 17,700
Trenching and Backfill for Tight Pipes	$7	LF	4900	$ 34,300
Schedule 40 Tight Pipe	$9	LF	4900	$ 44,100
GGSF System Installation Labor	60%	LS	1	$ 326,500
Final Grading, Mulch & Seed	$6	SY	16940	$ 101,700
Groundwater Monitoring Wells	$28,300	EA	4	$ 113,200
Mobilization/Demobilization	5%	LS	1	$ 54,300
			Construction Subtotal	*$ 8,655,000*
			Property Acquisition	$ 283,000
			Contingency (20%)	$ 1,788,000
			Total Estimated Project Cost	**$ 10,726,000**

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST
Alternative No. 3 - MBR System with Surface Return
Village of Millerton, NY
Wastewater Feasibility Evaluation
Project No. M1784

Item Description	Unit Cost	Units	Quantity	Cost
STEP Collection System				**$ 4,739,000**
Pump out Existing Septic Tanks and Abandon in Place	$750	EA	141	$ 105,800
STEP System Installation (1,000 Gallon Tank)	$9,200	EA	119	$ 1,094,800
STEP System Installation (1,500 Gallon Tank)	$12,800	EA	18	$ 230,400
STEP System Installation (4,000 Gallon Tank)	$14,800	EA	4	$ 59,200
Service Lateral Installation (1-1/2" HDPE)	$4,000	EA	141	$ 564,000
Restoration for STEP System/Service Lateral Installation	$3,400	EA	141	$ 479,400
2"-4" HDPE Forcemain Installation (Directional Drilling)	$52	LF	15050	$ 782,600
6" HDPE Forcemain Installation (Directional Drilling)	$70	LF	2600	$ 182,000
Excavation and Connection at Junctions	$5,700	EA	54	$ 307,800
Air Releases	$4,000	EA	9	$ 36,000
Clean-outs	$2,300	EA	40	$ 92,000
Bridge Crossing	$6,800	EA	1	$ 6,800
Pavement Repairs	$2,300	EA	108	$ 248,400
Lawn Restoration	$12	SY	9800	$ 117,600
Clearing and Grubbing in Right-of-Ways	$13,600	Acre	3	$ 40,800
NYSDOT Crossing	$6,800	EA	5	$ 34,000
Mobilization/Demobilization	5%	LS	1	$ 219,100
Traffic Control	3%	LS	1	$ 138,100
Site Work				**$ 83,000**
Clearing and Grubbing	$13,600	Acre	1.5	$ 20,400
Brush Hogging	$800	Acre	2.0	$ 1,600
Rough Grading for Access Road	$2,900	EA	1	$ 2,900
Prepare and Roll Subbase for Access Road	$3	SY	800	$ 2,400
Stabilization Fabric for Access Road	$2	SY	800	$ 1,600
Gravel and Compaction for Access Road	$10	SY	800	$ 8,000
Culvert for Access Road	$1,700	EA	2	$ 3,400
Secondary Access R.O.W.	$1	SF	16000	$ 9,600
Rough Grading for Secondary Access Road	$4,000	EA	1	$ 4,000
Prepare and Roll Subbase for Secondary Access Road	$3	SY	1067	$ 3,200
Stabilization Fabric for Secondary Access Road	$2	SY	1067	$ 2,200
Gravel and Compaction for Secondary Access Road	$10	SY	1067	$ 10,700
Culvert for Secondary Access Road	$1,700	EA	1	$ 1,700
Final Grading, Mulch & Seed	$6	SY	1111	$ 6,700
Mobilization/Demobilization	5%	LS	1	$ 4,000
Electrical Service				**$ 21,000**
Utility Pole Installation	$1,200	EA	8	$ 9,600
Excavation for Underground Electrical Utilities	$5	LF	200	$ 1,000
Bedding for Underground Conduits	$7	LF	200	$ 1,400
Direct Burial of PVC Conduits	$7	LF	200	$ 1,400
Service Entrance	$5,700	LS	1	$ 5,700
Mobilization/Demobilization	5%	LS	1	$ 1,000
MBR Resource Recovery System				**$ 3,441,000**
Ovivo MicroBLOX Treatment System	$1,681,273	LS	1	$ 1,681,300
MBR Treatment System Installation, Testing, and Start-up	30%	LS	1	$ 504,400
Contractor's Overhead & Profit on Treatment System	15%	LS	1	$ 252,200
Rough Site Grading for Building and Tanks	$2,900	EA	1	$ 2,900
Concrete Slab on Grade for Building	$24	SF	4500	$ 108,000
Metal Building	$46	SF	4500	$ 207,000
Water Service	$5,000	LS	1	$ 5,000
Gantry Crane	$11,400	LS	1	$ 11,400
Building Plumbing	20%	LS	1	$ 36,400
Building HVAC	30%	LS	1	$ 62,100
Backup Generator	$45,300	EA	1	$ 45,300
Building Electric Work	40%	LS	1	$ 101,000
Instrumentation/Control	5%	LS	1	$ 84,100
Interior Process Pipe Work	10%	LS	1	$ 168,200
Lab Equipment	$8,500	LS	1	$ 8,500
Commissioning and Operator Training	$11,400	LS	1	$ 11,400
Mobilization/Demobilization	5%	LS	1	$ 151,100
Surface Return				**$ 56,000**
Clearing and Grubbing	$13,600	Acre	0.5	$ 6,800
Trenching and Backfill	$8	LF	400	$ 3,200
Gravity Outfall Piping	$15	LF	400	$ 6,000
Pipe Bedding	$8	LF	400	$ 3,200
Concrete Outfall Structure	$22,700	EA	1	$ 22,700
Rip Rap	$115	SY	33	$ 3,900
Final Grading, Mulch & Seed	$6	SY	100	$ 600
Dewatering, Erosion Protection	$6,800	EA	1	$ 6,800
Mobilization/Demobilization	5%	LS	1	$ 2,700
			Construction Subtotal	*$ 8,340,000*
			Property Acquisition	$ -
			Contingency (20%)	$ 1,668,000
			Total Estimated Project Cost	**$ 10,008,000**

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST
Alternative No. 4 - Biofiltration System with Surface Return
Village of Millerton, NY
Wastewater Feasibility Evaluation
Project No. M1784

Item Description	Unit Cost	Units	Quantity	Cost
STEP Collection System				**$ 4,739,000**
Pump out Existing Septic Tanks and Abandon in Place	$750	EA	141	$ 105,800
STEP System Installation (1,000 Gallon Tank)	$9,200	EA	119	$ 1,094,800
STEP System Installation (1,500 Gallon Tank)	$12,800	EA	18	$ 230,400
STEP System Installation (4,000 Gallon Tank)	$14,800	EA	4	$ 59,200
Service Lateral Installation (1-1/2" HDPE)	$4,000	EA	141	$ 564,000
Restoration for STEP System/Service Lateral Installation	$3,400	EA	141	$ 479,400
2"-4" HDPE Forcemain Installation (Directional Drilling)	$52	LF	15050	$ 782,600
6" HDPE Forcemain Installation (Directional Drilling)	$70	LF	2600	$ 182,000
Excavation and Connection at Junctions	$5,700	EA	54	$ 307,800
Air Releases	$4,000	EA	9	$ 36,000
Clean-outs	$2,300	EA	40	$ 92,000
Bridge Crossing	$6,800	EA	1	$ 6,800
Pavement Repairs	$2,300	EA	108	$ 248,400
Lawn Restoration	$12	SY	9800	$ 117,600
Clearing and Grubbing in Right-of-Ways	$13,600	Acre	3	$ 40,800
NYSDOT Crossing	$6,800	EA	5	$ 34,000
Mobilization/Demobilization	5%	LS	1	$ 219,100
Traffic Control	3%	LS	1	$ 138,100
Site Work				**$ 83,000**
Clearing and Grubbing	$13,600	Acre	1.5	$ 20,400
Brush Hogging	$800	Acre	2.0	$ 1,600
Rough Grading for Access Road	$2,900	EA	1	$ 2,900
Prepare and Roll Subbase for Access Road	$3	SY	800	$ 2,400
Stabilization Fabric for Access Road	$2	SY	800	$ 1,600
Gravel and Compaction for Access Road	$10	SY	800	$ 8,000
Culvert for Access Road	$1,700	EA	2	$ 3,400
Secondary Access R.O.W.	$1	SF	16000	$ 9,600
Rough Grading for Secondary Access Road	$4,000	EA	1	$ 4,000
Prepare and Roll Subbase for Secondary Access Road	$3	SY	1067	$ 3,200
Stabilization Fabric for Secondary Access Road	$2	SY	1067	$ 2,200
Gravel and Compaction for Secondary Access Road	$10	SY	1067	$ 10,700
Culvert for Secondary Access Road	$1,700	EA	1	$ 1,700
Final Grading, Mulch & Seed	$6	SY	1111	$ 6,700
Mobilization/Demobilization	5%	LS	1	$ 4,000
Electrical Service				**$ 21,000**
Utility Pole Installation	$1,200	EA	8	$ 9,600
Excavation for Underground Electrical Utilities	$5	LF	200	$ 1,000
Bedding for Underground Conduits	$7	LF	200	$ 1,400
Direct Burial of PVC Conduits	$7	LF	200	$ 1,400
Service Entrance	$5,700	LS	1	$ 5,700
Mobilization/Demobilization	5%	LS	1	$ 1,000
Biofiltration Resource Recovery System				**$ 3,773,000**
Treatment System Tanks and Componenents	$2,064,364	LS	1	$ 2,064,400
Treatment System Ancillary Equipment	$48,364	LS	1	$ 48,400
UV Disinfection System	$35,000	LS	1	$ 35,000
Control Building	$80,000	LS	1	$ 80,000
Water Service	$5,000	LS	1	$ 5,000
Treatment System Installation	30%	LS	1	$ 669,900
Material Shipping	$201,000	LS	1	$ 201,000
Contractor's Overhead & Profit on Treatment System	15%	LS	1	$ 322,200
Backup Generator	$34,000	EA	1	$ 34,000
Electrical Work	20%	LS	1	$ 157,800
Mobilization/Demobilization	5%	LS	1	$ 154,800
Surface Return				**$ 56,000**
Clearing and Grubbing	$13,600	Acre	0.5	$ 6,800
Trenching and Backfill	$8	LF	400	$ 3,200
Gravity Outfall Piping	$15	LF	400	$ 6,000
Pipe Bedding	$8	LF	400	$ 3,200
Concrete Outfall Structure	$22,700	EA	1	$ 22,700
Rip Rap	$115	SY	33	$ 3,900
Final Grading, Mulch & Seed	$6	SY	100	$ 600
Dewatering, Erosion Protection	$6,800	EA	1	$ 6,800
Mobilization/Demobilization	5%	LS	1	$ 2,700
			Construction Subtotal	*$ 8,672,000*
			Property Acquisition	$ -
			Contingency (20%)	$ 1,734,000
			Total Estimated Project Cost	**$ 10,406,000**

ENGINEER'S OPINION OF PROBABLE ANNUAL OPERATION & MAINTENANCE COST
Alternative No. 2 - Biofiltration System with GGSF Absorption Field
Village of Millerton, NY
Wastewater Feasibility Evaluation
Project No. M1784

Item Description	Unit Cost	Units	Quantity	Cost
STEP Collection System				**$ 46,700**
Proactive System Maintenance	$75	Hour	104	$ 7,800
Reactive System Maintenance	$75	Hour	87	$ 6,500
STEP Tank Pumping	$750	Each	27	$ 20,400
Equipment Repair and Replacement	$12,000	Year	1	$ 12,000
Biofiltration Resource Recovery System				**$ 35,700**
Regular System Maintenance	$75	Hour	156	$ 11,700
Emergency Maintenance	$75	Hour	26	$ 2,000
Energy Consumption (Treatment System)	$0.10	kWh	116136	$ 11,700
Energy Consumption (Control Building)	$0.10	kWh	7300	$ 800
Cellular Service for Communication	$40	Month	12	$ 500
Treatment Tank Pumping	$600	Year	1	$ 600
Textile Replacement	$1,700	Year	1	$ 1,700
Pump Repair and Replacement	$1,800	Year	1	$ 1,800
Float Replacement	$460	Year	1	$ 500
Flow Meter Calibration	$290	Year	1	$ 300
Sampling Supplies	$600	Year	1	$ 600
Laboratory Fees	$100	Month	12	$ 1,200
Misc. Maintenance Supplies	$750	Year	1	$ 800
Mowing around Treatment Units	$50	Hour	30	$ 1,500
GGSF Absorption Field				**$ 1,900**
Mowing Absorption Field	$50	Hour	30	$ 1,500
Laboratory Testing - Nitrite - Quarterly	$50	Each	8	$ 400
			Annual O&M Subtotal	*$ 84,300*
			Contingency (20%)	$ 16,900
			Administration, Billing, & Accounting	$ 15,000
			Total Estimated Annual O&M Cost	**$ 116,200**

ENGINEER'S OPINION OF PROBABLE ANNUAL OPERATION & MAINTENANCE COST
Alternative No. 3 - MBR System with Surface Return
Village of Millerton, NY
Wastewater Feasibility Evaluation
Project No. M1784

Item Description	Unit Cost	Units	Quantity	Cost
STEP Collection System				**$ 46,700**
Proactive System Maintenance	$75	Hour	104	$ 7,800
Reactive System Maintenance	$75	Hour	87	$ 6,500
STEP Tank Pumping	$750	Each	27	$ 20,400
Equipment Repair and Replacement	$12,000	Year	1	$ 12,000
MBR Resource Recovery System				**$ 106,900**
Regular System Maintenance	$75	Hour	520	$ 39,000
Emergency Maintenance	$75	Hour	26	$ 2,000
Energy Consumption (Treatment System)	$0.10	kWh	225305	$ 22,600
Energy Consumption (Building)	$0.10	kWh	18250	$ 1,900
Cellular Service for Communication	$40	Month	12	$ 500
Chemical Usage	$200	Year	1	$ 200
Sludge Handling Costs	$20,200	Year	1	$ 20,200
MBR Equipment Repair and Replacement	$9,000	Year	1	$ 9,000
MBR Equipment R&R Labor	$75	Hour	22	$ 1,700
Flow Meter Calibration	$290	Year	1	$ 300
Building Maintenance	$1,000	Year	1	$ 1,000
Building Heating/Ventilation	$250	Month	12	$ 3,000
Sampling Supplies	$600	Year	1	$ 600
Laboratory Fees	$200	Month	12	$ 2,400
Misc. Maintenance Supplies	$1,000	Year	1	$ 1,000
Mowing Around Building	$50	Hour	30	$ 1,500
Surface Return				**$ 1,000**
Cleaning/Maintenance	$1,000	Year	1	$ 1,000
			Annual O&M Subtotal	*$ 154,600*
			Contingency (20%)	$ 31,000
			Administration, Billing, & Accounting	$ 15,000
			Total Estimated Annual O&M Cost	**$ 201,000**

ENGINEER'S OPINION OF PROBABLE ANNUAL OPERATION & MAINTENANCE COST
Alternative No. 4 - Biofiltration System with Surface Return
Village of Millerton, NY
Wastewater Feasibility Evaluation
Project No. M1784

Item Description	Unit Cost	Units	Quantity	Cost
STEP Collection System				**$ 46,700**
Proactive System Maintenance	$75	Hour	104	$ 7,800
Reactive System Maintenance	$75	Hour	87	$ 6,500
STEP Tank Pumping	$750	Each	27	$ 20,400
Equipment Repair and Replacement	$12,000	Year	1	$ 12,000
Biofiltration Resource Recovery System				**$ 61,400**
Regular System Maintenance	$75	Hour	364	$ 27,300
Emergency Maintenance	$75	Hour	26	$ 2,000
Energy Consumption (Treatment System)	$0.10	kWh	171882	$ 17,200
Energy Consumption (Control Building)	$0.10	kWh	7300	$ 800
Cellular Service for Communication	$40	Month	12	$ 500
Treatment Tank Pumping	$700	Year	1	$ 700
Textile Replacement	$2,545	Year	1	$ 2,600
Pump Repair and Replacement	$3,945	Year	1	$ 4,000
Float Replacement	$500	Year	1	$ 500
Flow Meter Calibration	$290	Year	1	$ 300
Sampling Supplies	$600	Year	1	$ 600
Laboratory Fees	$200	Month	12	$ 2,400
Misc. Maintenance Supplies	$1,000	Year	1	$ 1,000
Mowing Around Treatment System	$50	Hour	30	$ 1,500
Surface Return				**$ 1,000**
Cleaning/Maintenance	$1,000	Year	1	$ 1,000
			Annual O&M Subtotal	*$ 109,100*
			Contingency (20%)	$ 21,900
			Administration, Billing, & Accounting	$ 15,000
			Total Estimated Annual O&M Cost	**$ 146,000**

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APPENDIX J

Engineering Report Certification

During the preparation of this Engineering Report, I have studied and evaluated the cost and effectiveness of the processes, materials, techniques, and technologies for carrying out the proposed project or activity for which assistance is being sought from the New York State Clean Water State Revolving Fund. In my professional opinion, I have recommended for selection, to the maximum extent practicable, a project or activity that maximizes the potential for efficient water use, reuse, recapture, and conservation, and energy conservation, taking into account the cost of constructing the project or activity, the cost of operating and maintaining the project or activity over the life of the project or activity, and the cost of replacing the project and activity.

Title of Engineering Report: Wastewater Feasibility Evaluation – Village of Millerton

Date of Report: March 2020, Revised June 2020, Revised April 2022, Revised June 2024 For NYSDEC, Revised July 2025 For NYSDEC

Professional Engineer's Name: Erin K. Moore, PE, BCEE

Signature:

Date: July 17, 2025

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APPENDIX K

NEW YORK STATE OF OPPORTUNITY. | Department of Health | Environmental Facilities Corporation

Smart Growth Assessment Form

This form should be completed by the applicant's project engineer or other design professional.[1]

Applicant Information

Applicant: Village of Millerton, NY Project No.: M1784

Project Name: Village of Millerton Wastewater Treatment System

Is project construction complete? ☐ Yes, date: ☑ No

Project Summary: (provide a short project summary in plain language including the location of the area the project serves)

The proposed project includes construction of a new septic tank effluent collection system, treatment system, and disposal system primarily serving the Main Street and surrounding areas in the Village of Millerton, NY and Town of North East.

Section 1 – Screening Questions

1. Prior Approvals

1A. Has the project been previously approved for Environmental Facilities Corporation (EFC) financial assistance? ☐ Yes ☑ No

1B. If so, what was the project number(s) for the prior approval(s)? Project No.:

Is the scope of the project substantially the same as that which was approved? ☐ Yes ☐ No

IF THE PROJECT WAS PREVIOUSLY APPROVED BY EFC'S BOARD AND THE SCOPE OF THE PROJECT HAS NOT MATERIALLY CHANGED, THE PROJECT IS **NOT** SUBJECT TO SMART GROWTH REVIEW. SKIP TO SIGNATURE BLOCK.

2. New or Expanded Infrastructure

2A. Does the project add new wastewater collection/new water mains or a new wastewater treatment system/water treatment plant? ☑ Yes ☐ No

Note: A new infrastructure project adds wastewater collection/water mains or a wastewater treatment/water treatment plant where none existed previously

2B. Will the project result in either: ☐ Yes ☑ No

An increase of the State Pollutant Discharge Elimination System (SPDES) permitted flow capacity for an existing treatment system;

OR

An increase such that a Department of Environmental Conservation (DEC) water withdrawal permit will need to be obtained or modified, or result in the Department of Health (DOH) approving an increase in the capacity of the water treatment plant?

Note: An expanded infrastructure project results in an increase of the SPDES permitted flow capacity for the wastewater treatment system, or an increase of the permitted water withdrawal or the permitted flow capacity for the water treatment system.

[1] If project construction is complete and the project was not previously financed through EFC, an authorized municipal representative may complete and sign this assessment.

IF THE ANSWER IS "NO" TO BOTH "2A" and "2B" ON THE PREVIOUS PAGE, THE PROJECT IS NOT SUBJECT TO FURTHER SMART GROWTH REVIEW. SKIP TO SIGNATURE BLOCK.

3. Court or Administrative Consent Orders

3A. Is the project expressly required by a court or administrative consent order? ☐ Yes ☑ No

3B. If so, have you previously submitted the order to EFC or DOH? If not, please attach. ☐ Yes ☐ No

Section 2 – Additional Information Needed for Relevant Smart Growth Criteria

EFC has determined that the following smart growth criteria are relevant for EFC-funded projects and that projects must meet each of these criteria to the extent practicable:

1. Uses or Improves Existing Infrastructure

1A. Does the project use or improve existing infrastructure? ☑ Yes ☐ No

Please describe:

As part of the proposed project, existing septic tanks, tight tanks, and leach fields (some of which are failing or constrained due to inadequate site conditions) will be cleaned, abandoned, and replaced with new septic tank effluent pump systems. The septic tank effluent will be treated before disposal to Webatuck Creek.

2. Serves a Municipal Center

Projects must serve an area in either 2A, 2B or 2C to the extent practicable.

2A. Does the project serve an area **limited** to one or more of the following municipal centers?

i. A City or incorporated Village	☑Yes ☐No
ii. A central business district	☐Yes ☑No
iii. A main street	☑Yes ☐No
iv. A downtown area	☐Yes ☑No
v. A Brownfield Opportunity Area (for more information, go to www.dos.ny.gov & search "Brownfield")	☐Yes ☑No
vi. A downtown area of a Local Waterfront Revitalization Program Area (for more information, go to www.dos.ny.gov and search "Waterfront Revitalization")	☐Yes ☑No
vii. An area of transit-oriented development	☐Yes ☑No
viii. An Environmental Justice Area (for more information, go to www.dec.ny.gov/public/899.html)	☐Yes ☑No
ix. A Hardship/Poverty Area ***Note: Projects that primarily serve census tracts and block numbering areas with a poverty rate of at least twenty percent according to the latest census data***	☐Yes ☑No

Please describe all selections:

The project and the proposed sewer district will serve the Village General Business District, the commercial areas along Route 22, and the Town of North East Boulevard District along Route 44. These areas of the Village and Town are the highest priority due to site constraints, small parcels, and limitations on growth of businesses along Main Street due to inadequate wastewater capacity.

2B. If the project serves an area located outside of a municipal center, does it serve an area located adjacent to a municipal center which has clearly defined borders, designated for concentrated development in a municipal or regional comprehensive plan and exhibit strong land use, transportation, infrastructure and economic connections to an existing municipal center? ☐Yes ☐No

Please describe:

2C. If the project is not located in a municipal center as defined above, is the area designated by a comprehensive plan and identified in zoning ordinance as a future municipal center? ☐Yes ☐No

Please describe and reference applicable plans:

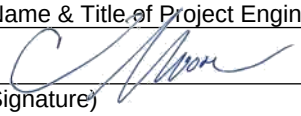
3. Resiliency Criteria

3A. Was there consideration of future physical climate risk due to sea-level rise, storm surge, and/or flooding during the planning of this project? ☑Yes ☐No

Please describe:

The proposed wastewater treatment site is more than 50 feet above the 100-year flood elevation in the area.

Signature Block: By entering your name in the box below, you agree that you are authorized to act on behalf of the applicant and that the information contained in this Smart Growth Assessment is true, correct and complete to the best of your knowledge and belief.

Applicant: Village of Millerton	Phone Number: 845-516-5835
Erin K. Moore, PE, BCEE	
(Name & Title of Project Engineer or Design Professional or Authorized Municipal Representative)	
	4-13-2022
(Signature)	(Date)

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APPENDIX L

PROJECT COSTS

The project costs are comprised of two components, the capital cost and the operation and maintenance cost. The capital costs are the anticipated costs to construct the proposed sewer system. The operation and maintenance (O&M) costs are the annual costs for labor, materials, and accounting associated with a functional sewer system.

Capital Costs

The anticipated total capital cost for construction of the water resource recovery system serving the Village of Millerton and Town of Northeast with grant and hardship financing is presented in Table 1, below.

TABLE 1 - Total Project Cost and Funding

	Millerton	**Northeast**	**Combined**
Total Project Costs	$ 10,866,000	$ 2,964,000	$ 13,830,000
Less Other Sources of Funding			
-Dutchess County Grant	$ 165,000	$ 35,000	$ 200,000
-CFD Grant	$ 786,997	$ 172,755	$ 959,752
-EFC IMG	$ 4,167,321	$ 914,778	$ 5,082,099
Project Cost to be Financed	$ 5,746,682	$ 1,841,467	$ 7,588,149

The financing of the debt service costs are based on the number of Benefit Units (BU) per parcel. The assessments to pay the debt service costs are based on a reasonably estimated benefit associated with the availability of the sewer system based on the type of use. The Benefit Unit Schedule is presented in Table 2.

TABLE 2 - Benefit Unit Schedule

Type of Usage	Benefit Units
Auto Dealer/Repair	1 per business plus 1 per 1,000 sq ft of building area[1]
Bank	1 per business plus 1 per 1,000 sq ft of building area[1]
Commercial uses not included elsewhere in this schedule	1 per business plus 1 per 1,000 sq ft of building area[1]
Dentist	1 per business plus 1 per chair
Doctor/Therapist/Vet	1 per business plus 1 per practitioner
Fitness Studio, Gym	1 per business plus 1 per 1,000 square feet of building area[1] plus 1 per two shower stalls
Gas station, convenience store/mini mart - No food preparation	1 per business plus 1 per 1,000 sq ft of building area[1]
+ Additional food preparation, up to 12 seats	2 per business
Hairdresser, salon, spa, nails, barbershop	1 per business plus 1 per station with sink plus 1 per 4 chairs without sink
Hotel, motel, inn	1 per establishment plus 1 per two rooms
Kennel/Groomers	1 per business plus 1 per two runs/cages/stations
Library, Museum, Cultural Building, Religious	1 per business plus 1 per 1,000 sq ft of building area[1], add for separate assembly hall
Office	1 per business plus 1 per 1,000 sq ft of building area[1]
Park	1 per parcel
+ Additional for Park facilities	1 per 1,000 square feet of building[1], 1 per each restroom facility, 1 per each two shower units, 5 per swimming pool
Residence (1 to 3 bedrooms)	1 per residence
2-family residence (1 to 3 bedrooms per unit)	2 per residence
3-family residence (1 to 3 bedrooms per unit)	3 per residence
Apartments (1 to 3 bedrooms)	1 per apartment
+ Additional bedrooms over allowance	0.5 per bedroom
+ Grease trap cleanout charge	3 per cleanout
Retail	1 per business plus 1 per 1,000 sq ft of building area[1]
Supermarkets	1 per business plus 1 per 1,000 sq ft of building area[1]
Theater, Assembly Hall	1 per business plus 1 per 35 seats
Vacant land, parking lot, storage lot	1 per parcel

[1]Building area of first BU includes all buildings up to 1,000 sq ft. Additional area is rounded. Ex: An office of 600 sq ft will have 2 BUs. An office of 1,499 sq. ft. will have 2 Bus. An office of 1,501 sq ft will have 3 BUs.

[2]If more than one use is associated with an individual parcel, the Benefit Units will be aggregated.

There are a total of 378 benefit units, 88 residential and 290 commercial in the Village of Millerton. There is are a total of 67 benefit units in the Town of North East, all of which are commercial. Table 3 provides the cost per benefit unit for the Village and the Town.

TABLE 3 - Cost per Benefit Unit

	Millerton	Northeast	Combined
Project Cost to be Financed	$ 5,746,682	$ 1,841,467	$ 7,588,149
Annual Cost at 0% and 30-year repayment period	$ 191,566	$ 61,382	$ 252,938
Benefit Units (BU)	378	67	445
Annual Cost per BU	$ 506.76	$ 916.15	---

Operation & Maintenance Costs

The anticipated annual O&M cost for the water resource recovery system is $144,000. The O&M costs include maintenance of the collection system, septic tank pumping and maintenance, operator labor, electricity for the water resource recovery system, laboratory services, a contingency, and administrative costs. The O&M costs for the system is presented in Table 4, below.

TABLE 4 - O&M Cost

	Millerton	Northeast	Combined
Total O&M Costs	$ 118,100	$ 29,500	$ 144,000

Operation and maintenance costs are recovered based upon flow, with the assumption that water used becomes discharged as wastewater. In cases where parcels are not located on the Village water system, meters will be provided. The initial O&M fee is based upon existing flows, not future flow. There are both residential and commercial rates for O&M fees. Residential fees are based upon average daily flow, as residential flows are typical more consistently spread over the 24-hour period and represent average to low strength wastewater. The residential O&M Fee is $197/year ($16.41 per month) for up to a flow of 225 gpd which is a conservative single family water usage within the Village. Flows are allotted in increments of 225 gpd, for instance a 2-family home is allotted 450 gpd, and 3-famiy home 675 gpd. Flow beyond this volume will be charged at $5.70 per 1,000 gallons based upon the annual O&M cost of $144,000 divided by the total annual gallons ($144,000/70,000 x 365 days/1000 gallons). Billing and fees for flows over average usage will be assessed on a quarterly basis. For example, a 90-day billing period would result in a flow allocation of 20,250 gallons for a single family parcel (90 days x 225 gallons per day = 20,225 gallons). A single family parcel using 25,000 gallons during this period would be charged the standard fee for three months at $16.41 per month ($49.23) plus the overage (25,000 – 20,225 = 4,750 gallons/1000 gallons = 4.75 x $5.70 = $27.08) for a total quarterly operation and maintenance fee of $76.81.

Commercial operation and maintenance fees are based upon a demand charge system where costs are based upon peak usage as this peak is what drives the cost of maintaining the treatment and collection system infrastructure. Unlike residential users, commercial users have a higher demand on the treatment system capacity including higher peak flows, higher strength wastewater concentrations and greater anticipated use of the system’s capacity reserves. The peaking factor is established through the 10 States Standards (10 SS) peak

hour peaking factor computational methodology. A population of 600 has been assumed for the wastewater service area resulting in a peak hour peaking factor of 4.0.

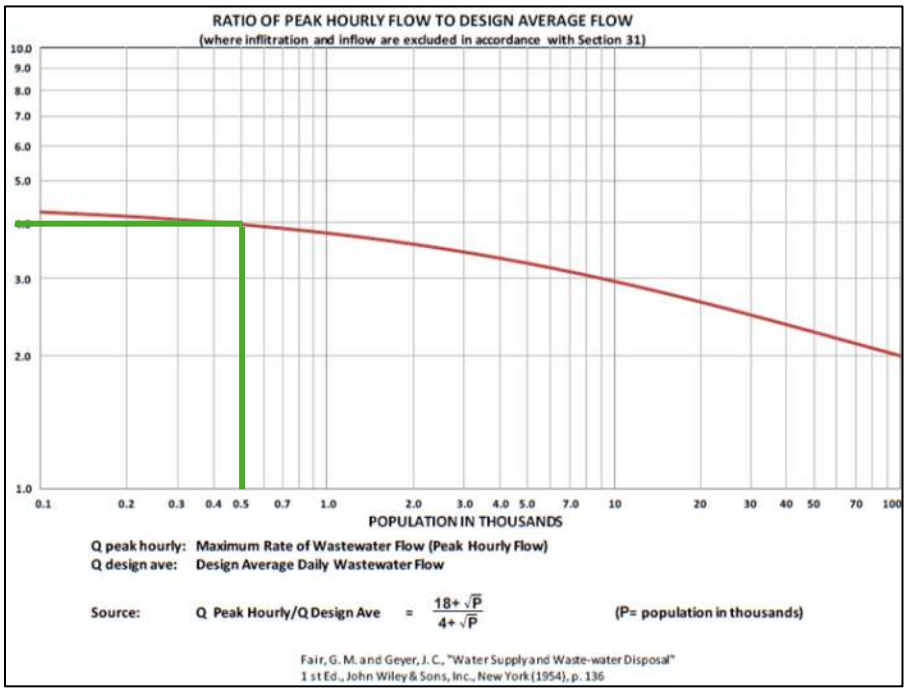

Figure 4.1
Ten States Standards Peak Hour Factor Calculation

The peak hourly usage per commercial user is anticipated to be 900 gpd (flow at peak hour), approximately four times the assumed residential rate of 225 gpd, resulting in a commercial O&M Fee is $788/year ($75 per month) for average flows up to a flow of 225 gpd. Average flows are allotted in increments of 225 gpd based upon historical usage records. For actual billing purposes flows will be divided by 225 gpd and billed at the commercial rate. Flow beyond this volume will be charged at $5.70 per 1,000 gallons as described earlier. Billing and fees for flows over average usage will be assessed on a quarterly basis. For example, a business using 45,000 gallons over a 90-day billing period would result in an average daily flow of 500 gpd. (45,000 gallons/90 days = 500 gpd). This is results in two increments of 225 gpd (225 gpd x 2 = 450 gpd), or $1,576 per year ($131.33 per month) The commercial parcel would be charged the standard commercial fee for three months at $131.33 per month ($394.00) plus the overage (45,000 – 40,500 = 4,500 gallons/1000 gallons = 4.5 x $5.70 = $25.65) for a total quarterly operation and maintenance fee of $419.65.

Estimated First Year Annual Cost for a Typical Parcel

The typical residential parcel in the Village is a single-family residence (1 BU). As previously noted, for the purposes of this estimate a flow of 225 gpd per single family residential parcel is used to provide anticipated operation & maintenance costs, however, users will be charged on actual water usage for the operation and maintenance portion of this user charge for flows in excess of 225 gpd increments.

The typical non-residential parcel in the system is a small commercial user (2 BU).

Table 5 & 6 provides the typical annual cost for typical users in Millerton and Northeast, respectively.

TABLE 5 - Anticipated Example User Fees - Village of Millerton

User	Annual Capital Cost (BU)	Annual O&M Cost @225 gpd	Total Annual Cost	Total Monthly Cost
Single Family Res. (1 BU)	$ 506.76	$ 197	$ 703.76	**$ 58.64**
Small Commercial (2 BU)	$ 1,013.52	$ 788	$ 1,801.52	**$ 150.13**

TABLE 6 - Anticipated Example User Fees - Town of North East

User	Annual Capital Cost (BU)	Annual O&M Cost @225 gpd	Total Annual Cost	Total Monthly Cost
Single Family Res. (1 BU)	$ 916.15	$ 197	$ 1,113.15	**$ 92.76**
Small Commercial (2 BU)	$ 1,832.30	$ 788	$ 2,620.30	**$ 218.36**

Flow over the allotted quantity of 225 gpd increments will be charged additionally at a rate of $5.60 per 1,000 gallons which is the equivalent O&M cost and presented previously.

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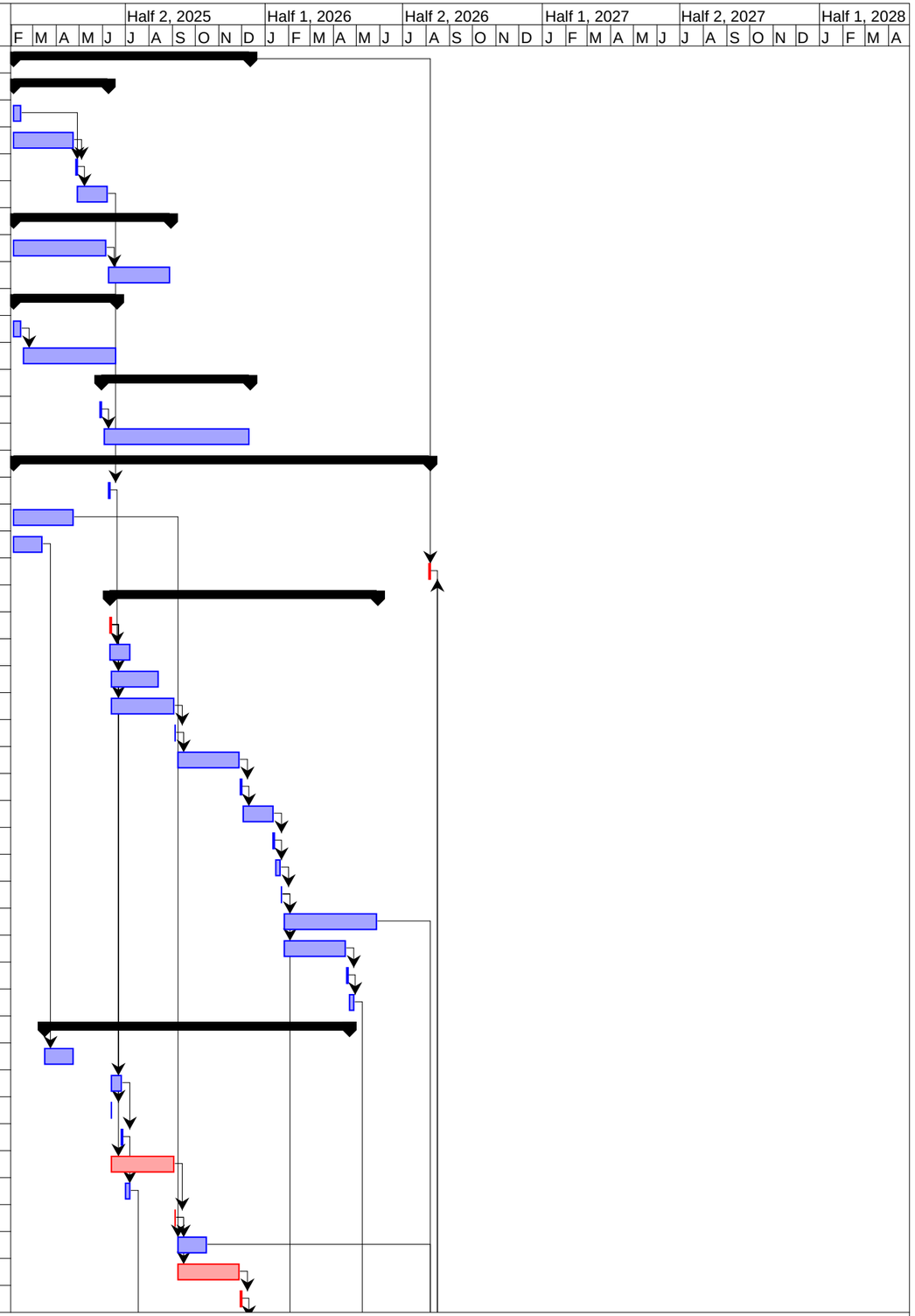
APPENDIX M

	Name	Duration	Start	Finish	Predecessors
1	**Project Funding**	**225 days**	**2/3/25 8:00 AM**	**12/12/25 5:00 PM**	
2	**2024 CPF Grant**	**91 days**	**2/3/25 8:00 AM**	**6/9/25 5:00 PM**	
3	Grant Application	10 days	2/3/25 8:00 AM	2/14/25 5:00 PM	
4	Environmental Information Document	60 days	2/3/25 8:00 AM	4/25/25 5:00 PM	
5	Complete Grant Application	1 day	4/28/25 8:00 AM	4/28/25 5:00 PM	3;4
6	Grant Review and Approval	30 days	4/29/25 8:00 AM	6/9/25 5:00 PM	5
7	**2024 IMG Grant**	**150 days**	**2/3/25 8:00 AM**	**8/29/25 5:00 PM**	
8	EFC to Contact Village for Program Requirements	90 days	2/3/25 8:00 AM	6/6/25 5:00 PM	
9	Complete Program Requirements	60 days	6/9/25 8:00 AM	8/29/25 5:00 PM	8
10	**USDA Rural Development**	**100 days**	**2/3/25 8:00 AM**	**6/20/25 5:00 PM**	
11	Update RD Application	10 days	2/3/25 8:00 AM	2/14/25 5:00 PM	
12	RD Award	90 days	2/17/25 8:00 AM	6/20/25 5:00 PM	11
13	**2025 Funding**	**141 days**	**5/30/25 7:00 AM**	**12/12/25 5:00 PM**	
14	IUP Deadline	1 day	5/30/25 7:00 AM	5/30/25 5:00 PM	
15	2025 Awards	140 days	6/2/25 8:00 AM	12/12/25 5:00 PM	14
16	**Village Tasks & Decisions**	**394 days**	**2/3/25 8:00 AM**	**8/6/26 5:00 PM**	
17	Execute Final Design Amendment	1 day	6/10/25 8:00 AM	6/10/25 5:00 PM	6
18	Access Road ROW Discussion w/ Property Owner	60 days	2/3/25 8:00 AM	4/25/25 5:00 PM	
19	Permission to Perform Borings at WWTP Site	30 days	2/3/25 8:00 AM	3/14/25 5:00 PM	
20	Decide to Advance to Construction	1 day	8/6/26 8:00 AM	8/6/26 5:00 PM	1;60
21	**Collection System Final Design**	**253 days**	**6/11/25 8:00 AM**	**5/29/26 5:00 PM**	
22	Kick-off Meeting	1 day	6/12/25 7:00 AM	6/12/25 5:00 PM	
23	Survey 5 Additional Parcels	20 days	6/11/25 8:00 AM	7/8/25 5:00 PM	17
24	House-to-House Inspections	45 days	6/13/25 8:00 AM	8/14/25 5:00 PM	22
25	Collection System 30% Design	60 days	6/13/25 8:00 AM	9/4/25 5:00 PM	22
26	Collection System 30% Design Review Meeting/Walk-T..	1 day	9/5/25 8:00 AM	9/5/25 5:00 PM	25
27	Colection System 60% Design	60 days	9/8/25 8:00 AM	11/28/25 5:00 PM	26
28	Collection System 60% Design Review Meeting	1 day	12/1/25 8:00 AM	12/1/25 5:00 PM	27
29	Collection System 90% Design	30 days	12/2/25 8:00 AM	1/12/26 5:00 PM	28
30	Collection System 90% Design Review Meeting	1 day	1/13/26 8:00 AM	1/13/26 5:00 PM	29
31	Collection System Permit Set Edits	7 days	1/14/26 8:00 AM	1/22/26 5:00 PM	30
32	Submit Collection System Design for Regulatory Review	1 day	1/23/26 8:00 AM	1/23/26 5:00 PM	31
33	Easements	90 days	1/26/26 8:00 AM	5/29/26 5:00 PM	32
34	Regulatory Review	60 days	1/26/26 8:00 AM	4/17/26 5:00 PM	32
35	Regulator Review Meeting	1 day	4/20/26 8:00 AM	4/20/26 5:00 PM	34
36	Collection System Design Approval	7 days	4/21/26 8:00 AM	4/29/26 5:00 PM	35
37	**Treatment System Final Design**	**287 days**	**3/17/25 8:00 AM**	**4/21/26 5:00 PM**	
38	Borings	30 days	3/17/25 8:00 AM	4/25/25 5:00 PM	19
39	Update Flow Estimate	10 days	6/13/25 8:00 AM	6/26/25 5:00 PM	22
40	Site Visit	1 day	6/13/25 8:00 AM	6/13/25 5:00 PM	22
41	Preliminary SPDES Application Meeting	1 day	6/27/25 8:00 AM	6/27/25 5:00 PM	39
42	Treatment System 30% Design	60 days	6/13/25 8:00 AM	9/4/25 5:00 PM	22
43	Submit SPDES Permit Application	7 days	6/30/25 8:00 AM	7/8/25 5:00 PM	41
44	Treatment System 30% Design Review Meeting	1 day	9/5/25 8:00 AM	9/5/25 5:00 PM	42
45	Acess Road ROW	30 days	9/8/25 8:00 AM	10/17/25 5:00 PM	18;44
46	Treatment System 60% Design	60 days	9/8/25 8:00 AM	11/28/25 5:00 PM	44
47	Treatment System 60% Design Review Meeting	1 day	12/1/25 8:00 AM	12/1/25 5:00 PM	46



	Name	Duration	Start	Finish	Predecessors
48	Treatment System 90% Design	30 days	12/2/25 8:00 AM	1/12/26 5:00 PM	47
49	Treatment System 90% Design Review Meeting	1 day	1/13/26 8:00 AM	1/13/26 5:00 PM	48
50	Treatment System Permit Set Edits	7 days	1/14/26 8:00 AM	1/22/26 5:00 PM	49
51	Submit Treatment System Design for Regulatory Review	1 day	1/23/26 8:00 AM	1/23/26 5:00 PM	50
52	Regulatory Review	60 days	1/26/26 8:00 AM	4/17/26 5:00 PM	51
53	Regulator Review Meeting	1 day	4/20/26 8:00 AM	4/20/26 5:00 PM	52
54	Treatment System Design Approval	1 day	4/21/26 8:00 AM	4/21/26 5:00 PM	53
55	**Permitting**	**217 days**	**7/9/25 8:00 AM**	**5/7/26 5:00 PM**	
56	SPDES Permit Approval	60 days	7/9/25 8:00 AM	9/30/25 5:00 PM	43
57	Joint Application for Permit (ACOE)	14 days	1/26/26 8:00 AM	2/12/26 5:00 PM	51
58	Joint Application Approval	60 days	2/13/26 8:00 AM	5/7/26 5:00 PM	57
59	DOT Permitting	30 days	1/26/26 8:00 AM	3/6/26 5:00 PM	32
60	**Bidding**	**64 days**	**5/8/26 8:00 AM**	**8/5/26 5:00 PM**	
61	Advertise for Bidding	5 days	5/8/26 8:00 AM	5/14/26 5:00 PM	36;54;55
62	Bidding Period	45 days	5/15/26 8:00 AM	7/16/26 5:00 PM	61
63	Bid Review	14 days	7/17/26 8:00 AM	8/5/26 5:00 PM	62
64	**Construction**	**427 days**	**8/7/26 8:00 AM**	**3/27/28 5:00 PM**	
65	Notice to Proceed	1 day	8/7/26 8:00 AM	8/7/26 5:00 PM	20;33;45
66	Treatment System Construction	270 days	8/10/26 8:00 AM	8/20/27 5:00 PM	65
67	Collection System Construction	365 days	8/10/26 8:00 AM	12/31/27 5:00 PM	65
68	System Start-up/Testing	30 days	1/3/28 8:00 AM	2/11/28 5:00 PM	66;67
69	Closeout	60 days	1/3/28 8:00 AM	3/24/28 5:00 PM	66;67
70	Construction Complete	1 day	3/27/28 8:00 AM	3/27/28 5:00 PM	68;69