

Memorandum

TO: Mr. Frank Pohl
County Engineer
Department of Community Development

FROM: Kendra Moon, PE
Emma Stephens, EIT
Line and Grade Civil Engineering

DATE: ~~August 6th, 2025~~
Revised September 25th, 2025

RE: Miller School Expansion
Central Sewerage System and Central Water System Requests

Dear Frank,

On behalf of Miller School of Albemarle (MSA), please consider this notice to upgrade a central sewerage system (CSS) and a central water system (CWS) at the Miller School, located on TMP 72-32 in western Albemarle County. This request is associated with improvements necessitated by the expansion of the existing independent school to include three new dormitories and a new gymnasium. The Miller School currently operates with centralized sewage and water systems, as the property is not within the jurisdictional area for water or sewer. The central sewerage system was constructed in 1977 and consists of settling tanks and a gravity dosed drainage system, as this was installed prior to the requirement for a treatment system. Significant upgrades will be necessary to provide for the expected use associated with the expansion. There is no existing approval for this system from the Board of Supervisors, as it predates the requirement for it. The centralized water system has an operation permit issued by the Virginia Department of Health (VDH), which was last updated in 2021 and consists of three drilled wells, treatment facilities, three diaphragm tanks, two atmospheric storage tanks, and the distribution system (see Appendix A). The current permitted capacity satisfies the expected water use; however, water pipe replacement and new pipe connections are required for the expansion.

CENTRAL SEWERAGE SYSTEM

The proposed system will upgrade the existing onsite sewage system with centralized wastewater treatment and a new disposal area, permitted with the Virginia Department of Health (VDH) as an alternative onsite sewage system (AOSS); see Appendix B for further detail. The new system will greatly improve the existing disposal system by providing a treatment system adequate for handling existing and proposed facilities, developing a new primary drainfield area, and identifying reserve drainfield areas. Note that the proposed system has sufficient capacity and modularity to handle wastewater for Phase 1 and future expansions.

Number of Connections

There are 14 total connections to be made to this AOSS (4 proposed connections and 10 existing).

Phase 1 Proposed:

- 1 dormitory

Future Proposed:

- 2 dormitories
- 1 gymnasium

Existing:

- 1 dormitory (950 Samuel Miller Loop)
- 1 gymnasium (960 Samuel Miller Loop)
- 4 academic buildings (920, 980, 1000, and 1010 Samuel Miller Loop)

- 4 residences (500, 532, 534, 1030 Samuel Miller Loop)

All existing and proposed buildings are located on TMP 72-32 and owned by MSA. Refer to Appendices C and D for a map of existing and proposed connections.

Type of Central Sewerage System

The proposed AOSS consists of three parts: collection, treatment, and disposal. Septic tank effluent will be collected from each proposed building via a septic tank effluent gravity (STEG) system. The 3 proposed dormitories will have separate 3,000-gallon septic tanks with effluent filters that connect to the existing sanitary sewer on the east side of the campus behind the existing Wayland Hall dormitory. The proposed gymnasium will connect to the existing sanitary sewer located on the north side of campus.

First, effluent will flow by gravity to a primary treatment subsystem, which will direct primary treated wastewater to a flow equalization system consisting of modified existing tanks. The stored effluent will then be pumped approximately 2,270 ft to a secondary treatment system composed of a multistep biological treatment process that will treat effluent to treatment level 3 (TL-3) or below and reduce nitrogen to meet the Total Nitrogen (TN) limit. The existing gravity dosed trenches will be abandoned and new low pressure dosed laterals will be installed within the proposed primary drainfield area, as seen in Appendix E.

This CSS upgrade is needed for the site to handle wastewater for the proposed development. Additionally, the capacity of the existing drainfield has decreased due to structural failures, poor soils, hydraulic overloading, and organic overloading, further necessitating this system upgrade.

CENTRAL WATER SUPPLY

Proposed domestic water connections will connect from the existing domestic 10" water lateral served by three existing wells, which are permitted with the VDH Office of Drinking Water (ODW), as found in Appendix A. There are no changes proposed to this system as it is currently permitted up to 22,480 GPD, which exceeds the water use requirements of the current proposal. Note that there are also new non-potable fire service laterals proposed with this development, which are not sourced from the wells.

Number of Domestic Connections

There are 22 total domestic water lateral connections (4 proposed connections and 18 existing).

Phase 1 Proposed:

- 1 dormitory

Future Proposed:

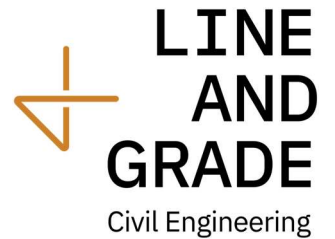
- 2 dormitories
- 1 gymnasium

Existing:

- 1 dormitory (950 Samuel Miller Loop)
- 1 gymnasium (960 Samuel Miller Loop)
- 4 academic buildings (920, 980, 1000, and 1010 Samuel Miller Loop)
- 7 residences (500, 523, 525, 532, 534, 985, and 1030 Samuel Miller Loop)
- 1 athletic field house (989 Samuel Miller Loop) and 3 associated baseball field facilities
- 1 gate house (1196 Samuel Miller Loop)

Again, all existing and proposed buildings are located on TMP 72-32 and owned by MSA. Appendices C and D illustrate existing and proposed connections.

Miller School Expansion
Central Sewage System & Central Water Supply Requests
September 25th, 2025



If you have any questions or require additional information, please do not hesitate to contact us at kmooon@line-grade.com or estephens@line-grade.com

Sincerely,

A handwritten signature in black ink that reads "Kendra G. Moon".

Kendra G. Moon, PE

A handwritten signature in black ink that appears to read "Emma Stephens".

Emma Stephens, EIT

List of Attachments:

- Appendix A: Waterworks Operation Permit Dated May 19, 2021
- Appendix B: Miller School of Albemarle Phase 1 Expansion AOSS Preliminary Design Summary
- Appendix C: Sewer and Water Overview
- Appendix D: Sewer and Water Inset Map
- Appendix E: Treatment and Drainfield Areas

APPENDIX A. WATERWORKS OPERATION PERMIT DATED MAY 19, 2021



COMMONWEALTH of VIRGINIA

DEPARTMENT OF HEALTH
OFFICE OF DRINKING WATER
Lexington Field Office

131 Walker Street
Lexington, VA 24450
Phone: 540-463-7136
Fax: 540-463-3892

SUBJECT: Albemarle County
Waterworks: Miller School
PWSID No: 2003475

May 24, 2021

Mr. Chris Fortier
The Miller School of Albemarle
1000 Samuel Miller Loop
Charlottesville, VA 22903-9328

Dear Mr. Fortier:

Enclosed please find Waterworks Operation Permit No. 2003475 with Operation Permit Conditions dated May 19, 2021 issued by the Commonwealth of Virginia Department of Health, Office of Drinking Water. This permit is your authorization from the State Health Commissioner to operate the subject waterworks located in Albemarle County in accordance with the *Waterworks Regulations*. This permit is not transferable. This permit does not suspend, minimize, or otherwise alter this owner's obligation to comply with applicable federal, state, or local laws and regulations or permits.

This permit is an amendment of the previously issued permit dated February 7, 2007, due to the addition of Well Number Four. This revised permit replaces and nullifies the original permit which should be destroyed immediately.

You will note that the permit indicates that this waterworks has a permitted capacity of 22,480 gpd. This limit is based on the maximum capacity of the system and shall not be exceeded.

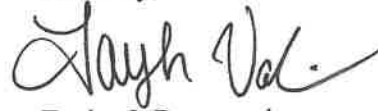
As provided by Rule 2A:2 of the Supreme Court of Virginia, you have thirty (30) days from the date you actually received this permit or the date it was mailed to you, whichever occurred first, within which to appeal this permit by filing a notice of appeal in accordance with the Rules of the Supreme Court of Virginia with the State Health Commissioner. In the event that this permit is sent to you by mail, three days are added to that period.

We look forward to your continued cooperation in the maintenance and operation of this waterworks.

Mr. Chris Fortier
Page 2 of 2

SUBJECT: Albemarle County
Waterworks: Miller School
PWSID No: 2003475

Sincerely,

A handwritten signature in black ink, appearing to read "Taylor J. Broussard", with a stylized flourish at the end.

For: Taylor J. Broussard
Assistant District Engineer

TJB/TLV/kk/210521-1

cc: Albemarle County Health Department
Albemarle County Executive
Albemarle County Building Official

ec: VDH, ODW - Central Office



Virginia Department of Health
Office of Drinking Water

Waterworks Operation Permit

The Miller School of Albemarle is hereby granted permission to operate the Miller School waterworks, a Class 6 community waterworks located in Albemarle County, in accordance with Title 32.1 of the *Code of Virginia* and the *Virginia Waterworks Regulations*, 12VAC5-590-10 *et seq.* The waterworks has a capacity of 22,480 gpd. This permit is issued with the understanding that this owner shall operate the waterworks in accordance with Part II of the *Virginia Waterworks Regulations* titled "Operation Regulations for Waterworks". This permit does not suspend, minimize, or otherwise alter this owner's obligation to comply with applicable federal, state, or local laws and regulations or permits. This permit may be revoked at any time upon written notice of revocation by the State Health Commissioner, if it is determined that The Miller School of Albemarle has failed to comply with this permit, including the Operation Permit Conditions.

Attachments: Operation Permit Conditions (✓), Variances (), Exemptions ()

PERMIT NO.: 2003475

EFFECTIVE DATE: May 19, 2021

APPROVED

Mark D. Perry, PE, Engineering Field Director, Lexington Field Office
for the State Health Commissioner pursuant to VA Code § 2.2-604

OPERATION PERMIT CONDITIONS

Operation Permit No.: 2003475
Waterworks Name: Miller School

Permit Effective Date: May 19, 2021
Waterworks Class: 6

OPERATOR REQUIREMENTS:

A Class 6 operator shall be in attendance as necessary to perform monitoring and process evaluation, and to make any process adjustments.

TREATMENT TECHNIQUE REQUIREMENTS:

This waterworks shall meet the following treatment techniques:

Lead and Copper Rule Water Quality Parameters

Entry Point

orthophosphate ≥ 0.27 mg/l as P (0.8 mg/l PO₄)

Distribution System

orthophosphate ≥ 0.27 mg/l as P (0.8 mg/l PO₄)

OPERATION, MONITORING, AND REPORTING:

Operation, monitoring, and reporting shall be in accordance with Title 32.1 of the *Code of Virginia* and 12VAC5-590 *et seq.* of the *Virginia Waterworks Regulations*. The State Board of Health of the Commonwealth of Virginia has issued additional operational, monitoring, and reporting requirements. This waterworks is subject to the following additional requirements:

1. Lead and Copper Rule Water Quality Parameters

The Miller School waterworks shall conduct monitoring for LCR Water Quality Parameters at the locations and frequency indicated below to begin during any monitoring period in which the lead or copper Action Level is exceeded.

Water Quality Parameter	Monitoring Location	Monitoring Frequency
pH	Entry Point	Every 2 weeks
Orthophosphate (as P)	Entry Point	Every 2 weeks
pH	Distribution System	Two (2) samples at 2 separate distribution system locations during each 6-month LCR monitoring period
Orthophosphate (as P)	Distribution System	Two (2) samples at 2 separate distribution system locations during each 6-month LCR monitoring period

2. Specific operational, monitoring and reporting requirements for corrosion control treatment:

This waterworks shall continuously operate corrosion control treatment and maintain the following corrosion control treatment operational control parameters:

1. In order to ensure satisfactory corrosion control treatment, the waterworks shall maintain and monitor:

- a. Orthophosphate (measured as P) of equal to or greater than 0.27 mg/L (0.8 mg/L as PO₄) at the Combined Wells 2, 3 and 4 entry point.
Measure and report on the monthly operation report at least two times per week.

WATERWORKS CAPACITY:

Source Capacity:

Well Number 2: 4,400 gpd
Well Number 3: 7,200 gpd
Well Number 4: 10,880 gpd
Total source capacity: 22,480 gpd

Treatment Capacity:

The following treatment is provided:

Corrosion Control, orthophosphate chemical feed (treatment technique requirement)
Chlorine Disinfection – sodium hypochlorite (voluntary)

The permitted capacity is not limited by the installed chemical feed systems.

Storage and Delivery Requirements:

The waterworks shall provide sufficient storage and distribution pumping capacity to provide a minimum working pressure of 20 psig at all service connections.

The total available effective storage volume is 36,580 gal which is equivalent to ½ day storage of the water demand of 73,160 gpd.

Permitted Capacity:

This waterworks is permitted for a capacity of 22,480 gpd due to limited source capacity.

**VIRGINIA DEPARTMENT OF HEALTH
WATERWORKS DESCRIPTION SHEET**

DATE: May 19, 2021

WATERWORKS NAME: Miller School

WATERWORKS CLASS: 6

COUNTY/CITY: Albemarle County

TYPE: Community

LOCATION: 1000 Samuel Miller Loop, Charlottesville, VA 22903

OWNER: The Miller School of Albemarle
Contact: Mr. Chris Fortier
1000 Samuel Miller Loop
Charlottesville, VA 22903-9328
Phone: 434-326-2115

OPERATOR: Licensed Class 6 Operator Required

PERMIT NUMBER: 2003475

TYPE OF TREATMENT: Disinfection and Corrosion Control

SOURCE: Three (3) drilled wells

CAPACITY: 22,480 gpd

DESCRIPTION OF THE WATERWORKS

The Miller School of Albemarle waterworks consists of three drilled wells, treatment facilities including chlorine disinfection and corrosion inhibitor feed, three diaphragm tanks, two atmospheric storage tanks and the distribution system.

Source Water

Well Number 2 is located approximately 400 feet southeast of the atmospheric storage tanks just beyond the treatment building. It was completed on May 1, 2000 and is drilled to a depth of 725 feet. The well is 10 inches in diameter to a depth of 87.5 feet, and 6 inches in diameter from 87.5 feet to a depth of 725 feet. The well is cased with 6-inch diameter steel casing and is cement grouted to a depth of 63 feet. The well casing extends 12 inches above a 6-foot by 6-foot concrete well apron and is equipped with a pitless adapter, watertight well cap, integral screened downward facing vent and a depth test airline. A totalizing flow meter, raw water sampling tap, and blowoff are located inside the treatment building. Water is pumped from the well by a submersible pump capable of producing 20 gpm at 545 feet TDH through the treatment building to the atmospheric storage tanks. The well yield following a 48-hour pump test in May 2000 was originally 27.5 gpm. The well yield has since declined significantly and an abbreviated 4-hour pump test in November 2015 produced a stabilized yield of 5.5 gpm.

Well Number 3 is located approximately 190 feet south-southeast of the atmospheric storage tanks. It was completed on November 8, 2000 and later deepened to 597 feet on July 22, 2015. The well is 10 inches in

diameter to a depth of 55 feet, 8.75 inches in diameter from 55 feet to a depth of 94 feet and 6 inches in diameter from 94 feet to a depth of 597 feet. The well is cased with 6-inch diameter steel casing to a depth of 94 feet and is cement grouted to a depth of 52 feet. The well casing extends 12 inches above a 6-foot by 6-foot concrete well apron and is equipped with a pitless adapter, watertight well cap, integral screened downward facing vent, and a depth test airline. A totalizing flow meter, raw water sampling tap, and blowoff are located inside the treatment building. Water is pumped from the well by a submersible pump capable of producing 20 gpm at 545 feet TDH through the treatment building to the atmospheric storage tanks. The well pump is set on a timer that limits operation to 6 hours per day. The stabilized yield following a 48-hour pump test in November 2015 was 12.5 gpm.

Well Number 4 is located approximately 800 feet south-southwest of the atmospheric storage tanks. It was completed on August 17, 2018 and is drilled to a depth of 405 feet. The well is 10 inches in diameter to a depth of 52 feet and 6 inches in diameter from 52 feet to a total depth of 405 feet. The well is cased with 6.25-inch diameter PVC casing and is cement grouted to a depth of 52 feet. The well casing extends 12 inches above a 6-foot by 6-foot concrete well apron and is equipped with a pitless adapter, watertight well cap, integral screened downward facing vent, and a depth test airline. A totalizing flow meter, raw water sampling tap and blowoff are located inside the treatment building. Water is pumped from the well by a submersible pump capable of delivering 11 gpm at 324 feet TDH. The reliable well yield was determined to be 13.6 gpm following a 48-hour pump test in December 2018 with the water level dropping from 28.7 feet (static level) to 149.5 feet.

Treatment

The treatment for Well 2 and 3 is housed together in one building while the treatment for Well 4 is housed in a separate building. Each well discharge line first receives orthophosphate for corrosion control followed by the injection of a sodium hypochlorite solution for disinfection.

Disinfection (voluntary) is achieved by the injection of sodium hypochlorite solution. Each well is treated with a separate chemical feed system prior to blending. The electronic diaphragm metering pumps provided for Well 2 and 3 have a capacity of 10 gpd and each pump draws solution from a 15-gallon polyethylene solution tank. The peristaltic metering pump provided for Well 4 has a capacity of 10 gpd and draws solution from a 30-gallon polyethylene solution tank. This treatment is provided at the owner's option and specific contact time is not required.

Corrosion control is achieved by injection of a zinc orthophosphate solution into the individual well discharge line for each well prior to blending. The electronic diaphragm metering pumps provided for Well 2 and 3 have a capacity of 12 gpd and each pump draws solution from a 30-gallon polyethylene solution tank. The peristaltic metering pump provided for Well 4 has a capacity of 10 gpd and draws solution from a 30-gallon polyethylene solution tank. Optimized corrosion control treatment is required based on past lead and copper Action Level exceedances.

Storage

Pressurized storage is provided for Well 2 and 3 by two 119-gallon capacity pre-pressurized bladder tanks located inside the treatment building. One tank is dedicated to each well and their main purpose is to reduce water hammer so the amount of actual storage contributed is negligible. Both tanks are equipped with a

pressure gauge, pressure relief valve and tank drain. Well 4 feeds directly into the 25,000-gallon atmospheric storage tank.

Atmospheric storage is provided by two ground level steel tanks. Redundant level controls are provided at both tanks to call for water from the wells. Both tanks float on the system and can be individually isolated for maintenance purposes. A consumption meter is provided on the combined outlet pipe from the tanks.

Tank Number 1 is constructed of welded steel and is 16 feet in diameter and 16 feet tall. It has a rated capacity of 25,000 gallons. Effective usable storage capacity is 23,300 gallons. It is equipped with a float level indicator, screened overflow, screened rooftop vent, bolted manway, rooftop access hatch and separate drain.

Tank Number 2 is constructed of welded steel and is 12 feet in diameter and 20 feet 4 inches tall. It has a rated capacity of 15,100 gallons. Effective usable storage capacity is 13,280 gallons. It is equipped with a screened overflow, screened rooftop vent, bolted manway, rooftop access hatch and separate drain. An enclosure is constructed around the base of the tank to prevent freezing of inlet, outlet and drain piping.

Standby Power

A 25kw propane generator is located behind the treatment building for Well 2 and 3 and activates automatically in the event of a power failure. This generator only serves Well 2 and 3 and their treatment equipment. A 7.5kw portable propane generator is provided to serve Well 4 and its treatment equipment.

WATERWORKS CAPACITY

1. **Estimated Water Demand:** This is a boarding school serving a population of approximately 205 staff and students. Up to 165 students and staff live on site with the remainder being commuters. Water production over the period February 2018 - January 2020 indicated an average usage of 10,132 gpd. The peak month demand during the period was 16,265 gpd in September 2019.

Peak Month Demand based on historical data = 16,265 gpd

Estimated Peak Hour Demand = (4.0 peak factor) (16,265 gpd) / (24 hr/day) = 2,711 gal/hr

2. **Source Capacity:**

Well ID	Yield, gpd = (gpm) (1,440 min/day)/ 1.8 SF		Well Pump, gpd = (gpm) (1,440 min/day)		Limiting Capacity, gpd
Well Number 2	5.5 gpm	4,400 gpd	20 gpm ¹	28,800 gpd	4,400 gpd
Well Number 3	12.5 gpm	10,000 gpd	20 gpm ^{1,2}	7,200 gpd	7,200 gpd
Well Number 4	13.6 gpm	10,880 gpd	11 gpm	15,840 gpd	10,880 gpd
Total					22,480 gpd

¹ The well is not pumped continuously and based on current observations this pumping rate does not result in excessive drawdown when operated intermittently.

² A timer limits pumping to 360 min/day maximum to avoid over-pumping.

3. Treatment Capacity:

Disinfection:

Assume a 0.5 mg/L chlorine residual is desired. This is not a required dosage.

Well Number 2:

Pumping rate = 20 gpm

Chemical feed pump capacity = 10 gpd

Feeding a ~ 0.317% (3,170 ppm) solution, the following solution feed rate is required:

Required solution feed rate = (20 gpm) (0.5 ppm) (1,440 min/day) / (3,170 ppm) = 4.5 gpd

The 10 gpd feeder is capable of achieving the target dosage.

Well Number 3:

Pumping rate = 20 gpm

Chemical feed pump capacity = 10 gpd

Feeding a ~ 0.317% (3,170 ppm) solution, the following solution feed rate is required:

Required solution feed rate = (20 gpm) (0.5 ppm) (1,440 min/day) / (3,170 ppm) = 4.5 gpd

The 10 gpd feeder is capable of achieving the target dosage.

Well Number 4:

Pumping rate = 11 gpm

Chemical feed pump capacity = 10 gpd

Feeding a ~ 0.158% (1,580 ppm) solution, the following solution feed rate is required:

Required solution feed rate = (11 gpm) (0.5 ppm) (1,440 min/day) / (1,580 ppm) = 5.0 gpd

The 10 gpd feeder is capable of achieving the target dosage.

Corrosion control with zinc orthophosphate:

A minimum 0.8 ppm as PO₄ orthophosphate residual is needed for optimal corrosion control based on historical results. A 1.0 ppm as PO₄ dose is needed to consistently achieve this residual. The zinc orthophosphate product used contains 36% orthophosphate and its bulk density is 11.0 lb/gal (~ 475,000 mg/L orthophosphate).

Well Number 2:

Pumping rate = 20 gpm

Chemical feed pump capacity = 12 gpd

Feeding a ~ 0.3% (3,000 ppm) solution, the following solution feed rate is required:

Required solution feed rate = (20 gpm) (1.0 ppm) (1,440 min/day) / (3,000 ppm) = 9.6 gpd

The 12 gpd feeder is capable of achieving the required dosage.

Well Number 3:

Pumping rate = 20 gpm

Chemical feed pump capacity = 12 gpd

Feeding a ~ 0.3% (3,000 ppm) solution, the following solution feed rate is required:

Required solution feed rate = (20 gpm) (1.0 ppm) (1,440 min/day) / (3,000 ppm) = 9.6 gpd

The 12 gpd feeder is capable of achieving the required dosage.

Miller School
May 19, 2021

Well Number 4:

Pumping rate = 11 gpm

Chemical feed pump capacity = 10 gpd

Feeding a ~ 0.3% (3,000 ppm) solution, the following solution feed rate is required:

Required solution feed rate = (11 gpm) (1.0 ppm) (1440 min/day) / (3,000 ppm) = 5.3 gpd

The 10 gpd feeder is capable of achieving the target dosage.

4. Storage Capacity:

Effective Storage

Tank Number 1 23,300 gal

Tank Number 2 13,280 gal

Total 36,580 gal

36,580 gal / 0.5 day = 73,160 gpd

CONCLUSION:

This waterworks is permitted for a capacity of 22,480 gpd due to limited source capacity.

OPERATION PERMIT HISTORY

Permit Issuance (Effective Date)	Description / Reason
May 27, 1970	Original issuance
October 25, 1977	Miscellaneous updates
March 29, 2002	Springs removed, Well Number 2 and 3 added, treatment updates
February 7, 2007	Well Number 1 removed, corrosion control treatment added
May 19, 2021	Second atmospheric tank added, Well 2 and 3 capacity reduced, Well 4 added, treatment updates, add Operation Permit Conditions. Correction to switched Well 2 and Well 3 names in prior permit.

TJB/kk

**APPENDIX B. MILLER SCHOOL OF ALBEMARLE PHASE 1 EXPANSION AOSS
PRELIMINARY DESIGN SUMMARY**

Miller School of Albemarle

Phase 1 Expansion

ALTERNATIVE ON-SITE SEWAGE SYSTEM PRELIMINARY DESIGN SUMMAY

REVISED

16 July 2025



Aqua Nova Engineering, PLC

3452 Bleak House Rd.

Earlsville VA 22936

Tel. 434-249-4497

Miller School of Albemarle -Phase 1 Expansion
Alternative Onsite Sewage System - Preliminary Engineering Report

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- Appendix B - Wastewater Treatment Design – Phase 1 expansion
- Appendix C - Effluent Dispersal System Design – Drainfield Calculations
- Appendix D - Soils Evaluation Data - Soil Profile Descriptions and Ksat Testing summary
- Appendix E - Existing Wastewater Analytical Results

INTRODUCTION

The Miller School of Albemarle is located in western Albemarle at 1000 Samuel Miller Loop (TMP 07200-00-00-03200). It is an independent school with approximately 309 students and 90 staff, some of which are boarding students. The school plans to expand its enrollment and facilities in two phases:

- Phase 1: Addition of 1 dormitory only to allow addition of up to 65 students and 10 staff. The totals would be 374 students and 100 staff.
- Phase 2: Addition of three new dormitories and a gymnasium to add up to 125 students and 20 staff. The totals would be 424 students and 110 staff.

Aqua Nova Engineering, PLC (Aqua Nova) has created this preliminary design for an alternative onsite sewage system (AOSS) that would handle wastewater from the school's existing operations and the proposed Phase 1 facility expansion. Sufficient tank capacity and modularity has been built into this design to accommodate Phase 2 expansions should the school decide to proceed. The design of the Phase 1 AOSS, including primary treatment, flow equalization, secondary treatment, and dispersal, is summarized herein.

The school is currently served by an onsite sewage system, consisting of settling tanks and gravity dosed drainfield system was permitted in 1977 for up to 15,000 GPD. There is no existing treatment system because it was not required when this system was originally installed. Therefore, a new secondary treatment system is proposed to handle wastewater from the existing and proposed facilities.

The existing drainfields are located in a field east of campus, just off of Dick Woods Road. The existing dispersal system has not failed in the sense that the distribution boxes are not overflowing and there is no apparent surfacing septic effluent. However, the capacity of the existing drainfield has diminished due to structural failures, poor soils, hydraulic overloading, and organic overloading. Aqua Nova concluded that it was not prudent to re-use the existing drainfield trenches for the new AOSS. Therefore, we identified a new drainfield area for a low pressure dosed trench system. Some areas in and around the existing drainfields have been proposed as reserve for the new primary drainfield.

PROJECTED WASTEWATER CHARACTERISTICS

Wastewater Sources and Flow

At Phase 2 buildout, the Miller School is projected to serve up to 424 students, with up to 110 staff and 500 visitors for events. A portion of these students and staff will be residents, and some staff members may have families living with them on campus. The primary wastewater sources will be dormitories and residences, school restrooms, showers, and food service in the cafeteria.

Current Sewage Flow Data Analysis

The current Sewage flows were estimated for each user type based on sewage flow data collected between January and May of 2025. To calculate the approximate peak week flow, a variable period (4-8 days) moving average was applied to the data set. This methodology showed that the approximate peak week flow was around 15,344 GPD. This peak occurred

Miller School of Albemarle -Phase 1 Expansion
Alternative Onsite Sewage System - Preliminary Engineering Report

during a rainy week with an estimated 23,000 gallons of infiltration and inflow of stormwater and groundwater, abbreviated as I&I.

Because this project will include work to identify and significantly reduce causes of I&I, the maximum of the dry periods without I&I was used to determine the base flow without any stormwater. Using the same 4-8 day moving average method above, the dry-weather peak week flow was determined to be 11,474 GPD. This is the flow that was used as the basis for extrapolation of the flow for the two phases of expansion. The calculation table for the base flow scenario is in Appendix A, Table A-1.

Sewer Flow Extrapolation

The Phase 1 design sewage flow was extrapolated from current sewer flows by estimating the flow per person for students and staff both daytime and resident. The per person flows were adjusted until calculated flow for the current population matched the average flow based on collected sewer data, as described above. Then the additional students and staff for the Phase 1 expansion were added in to estimate the sewer flow for this phase. Finally, a reduced I&I flow was included because it is likely not economical to eliminate all I&I when the collection system is improved. The resulting design peak week flow was determined to be about 15,500 GPD (rounded up from 15,254 GPD).

The same method described above was used to estimate the peak week flow for Phase 2 of expansion. The resulting design peak week flow was determined to be about 18,500 GPD (rounded up from 18,086 GPD). The calculations for the Phase 1 expanded flow is included as Table B-1 of Appendix B.

Loading and Concentrations

Aqua Nova had Inboden Environmental Services, Inc. (IES) analyze samples of the water in the pump tank (after the settling tanks) collected on two occasions, 13 Dec. 2023 and 25 Jan. 2024. Both days were supposed to have normal occupancy, but results of these analyses have lower CBOD, TSS and TKN than expected. The analytical report forms for the samples are included in Appendix E.

To provide a conservative design basis for the treatment system, Aqua Nova based the loading on typical values for CBOD, TSS and TKN loading rates adjusted only slightly based on the measured values from the samples. Table B-2, Appendix B is a summary of the estimated loading for CBOD, TSS and TKN (total Kjeldahl nitrogen) based on values from Virginia Sewage Handling and Disposal Regulations (Table 5.1) and reference texts. Table B-3 of Appendix B is a summary of the design sewage and primary treatment effluent characteristics.

PROPOSED WASTEWATER TREATMENT SYSTEM

The first stage of the onsite sewage treatment system will be primary screening followed by a flow equalization and treatment system. The flow equalization system will provide storage to average out peak flows to the treatment and disposal systems. Effluent will be dispersed into a low-pressure-dosed subsurface drainfield.

MODIFICATIONS TO THE COLLECTION SYSTEM

The collection system will be composed of some existing unfiltered sewage gravity pipes and new septic tank effluent to gravity (STEG) pipes for the new buildings. The existing collection system currently takes on some inflow and infiltration (I&I) during storm events. A thorough I&I investigation and remediation program will be conducted to reduce or eliminate I&I.

Existing Sewer Modifications

Corrections to the existing collection system will be made as determined by I&I investigations. The investigations will be conducted in an iterative, three step process wherein an investigation method will be carried out, repairs to deficiencies will be implemented, and then flow data will be analyzed after rainfall events to assess whether more involved investigations and corrections are required. The sequence of investigative methods will be as follows:

1. Visual inspection and sewer mapping.
2. Smoke testing.
3. Camera inspections possibly with dye testing.

Remediation of I&I may take any of the following forms:

1. Disconnecting storm drains and sump pumps from the sewer.
2. Installing seals on manhole lids.
3. Cleanout and lateral pipe repairs.
4. Grouting manhole penetrations and joints.
5. Adding manhole risers to prevent inflow.
6. Adding temporary sandbags to divert storm flow.

The maximum amount of I&I that will be allowed for in the design flow for the treatment system is 2,000 gallons per storm event day for up to 5 days in a week or up to 10,000 gallons in one severe storm event once per week.

Sewer for new buildings

The new buildings will have their sewer pipes connected to separate septic tanks with effluent filters that then discharge to STEG sewer collector pipes that tie into the existing sewer. This will be done to reduce the potential for clogging.

Primary Treatment

Sewage from the facility will flow by gravity to a primary treatment subsystem. This will incorporate a mechanical screen such as a bar or drum screen followed by the renovated existing sedimentation tank and then 10,000 gallons of additional settling tank with 1/16" passive filtration elements on the outlet. A solids management system will be included to receive the screened solids, dewater and store them for periodic hauling. Sludge accumulated in the sedimentation tanks will need to be pumped and hauled periodically.

Flow Equalization and Pumping

Primary treated sewage will flow into an equalization system consisting of existing tanks modified for the purpose and a pumping system. Calculations for the flow equalization volume are presented in Appendix B, Table B-4.

The equalization system will have a working volume of 15,000 gallons to store and pump primary treated effluent at a steady rate to the treatment system. The tank volume will be sized for the Phase 2 flow. Peak flow days (weekdays) are averaged with low flow days (weekends) lowering the maximum discharge volume and correspondingly, the daily BOD load. The stored septic tank effluent will be discharged to the treatment system at a maximum rate equal to the design flow. To ensure that this requirement is met, the pumps will be operated by a controller with adjustable dose duration and frequency and a flow meter will be used to monitor instantaneous, hourly, and daily flow.

Secondary treatment

The purpose of secondary treatment is to reduce BOD and TSS to TL-3 levels or below. Also, the secondary treatment system will remove nitrogen to meet the TN limit. The treatment system will be located uphill from the primary treatment and flow equalization systems and adjacent to the drainfield.

Secondary treatment will utilize a biological, fixed-film process with a pre-anoxic denitrification reactor. The aerobic fixed film process is the AdvanTex system by Orenco. This proprietary trickling filter system relies microbial communities attached textile strips to treat the wastewater. The wastewater is pumped into a system of sprayers that distribute it over the textile array. This oxygenates the wastewater and brings the wastewater in contact with the microorganisms that convert the waste compounds to benign products and some microbial biomass.

The proposed design includes two stages of recirculating, trickling biofilters to provide a high level of treatment and ensure complete conversion of ammonia to nitrate (nitrification). Nitrified process water is recirculated to an anoxic reactor located downstream of the Flow Equalization Tank which will provide biological denitrification and reduce the incoming BOD somewhat. The secondary effluent will have low BOD, TSS and nitrogen and will receive further treatment in the Tertiary Treatment system.

Pre-Anoxic Bioreactor

The 4,000-gallon Pre-anoxic Bioreactor receives primary effluent from the Equalization Tank and recycled flow from the Stage 2 AdvanTex system for biological nitrogen removal. The septic effluent pumped in from the Eq. Tank will be anaerobic and high in BOD. The process water pumped back from the AdvanTex system will have significant amounts of nitrate which is used by bacteria to oxidize some of the incoming BOD. The recycle flow will be aerobic, so recirculation rates will be controlled to prevent aerobic conditions in the Pre-anoxic Bioreactor.

The Controller will activate the recycle pump in the Stage 2 AdvanTex Recirculation Tank to move doses of nitrified process water through the Control Building, where alkalinity is added as necessary, to the Pre-Anoxic Bioreactor. Pump On/Off times will be set by the operator to provide the desired recycle rate. A propeller mixer will mix the tank contents without adding further oxygen. The Pre-Anoxic Bioreactor outlet will flow to the Stage 1 AdvanTex Recirculation Tank #1.

AdvanTex System

The AdvanTex system will have two stages, each with a recirculation tank and dedicated pumps to dose the textile media. The AdvanTex system was designed in accordance with the

loading and performance criteria provided by Orenco. The design calculations are presented in Table B-5 in Appendix B., and the system is summarized below.

1. Stage 1 AdvanTex will receive flow from the Anoxic Reactor. This stage has the following features:
 - a. This stage is primarily designed to remove BOD. The provided plan area of textile is 30% larger than the minimum required for the average BOD load per Table B-1.
 - b. 16,000-gallon recirculation volume consisting of two 7,500 gal. tanks that are connected at the bottom. This tank will contain the recirculation pumps, recirculation splitter valve, and float switches.
 - c. Six AdvanTex AX100 pods (#1-#6) with space for two future-optional units for Phase 2 (#7 & #8). The plan-area of textiles required is determined by Orenco's average hydraulic loading guidelines.
 - d. Each pod is dosed by a dedicated pump. Two pump connections and control circuits are reserved as future optional pump for dosing the future optional AX100 pods #7 & #8).
 - e. Drains from the AX100 pods go to a recirculating splitter valve, RSV1.
 - f. A recirculation splitter valve (RSV1) directs flow back into the Stage 1 recirc. Tank or forward to the Stage 2 Recirc. tank, depending on the level in the Stage 1 Recirculation Tank.
2. Stage 2 AdvanTex receives Stage 1 effluent from RSV1. This stage has the following features:
 - a. This stage provides further BOD removal and nitrification.
 - b. 6,000-gallon recirculation tank with duplex pumps (P8 and P9).
 - c. Three float switches for controlling the operation of the pumps.
 - d. Two AX100 pods based on hydraulic loading, dosed by alternatingly by P8 and P9. The plan area of textiles required is determined by Orenco's hydraulic loading guidelines. The average hydraulic loading is slightly exceeded, but this is inconsequential, because the first stage of treatment has exceeded capacity and the pods will not be loaded above their peak hydraulic loading limit.
 - e. AX100 pods drain to a recirculation splitter valve (RSV2), which either directs flow back into the Stage 2 Recirc Tank or forward to the effluent pump tank, depending on the level in the Stage 2 Recirculation Tank.
3. AdvanTex ventilation. The AdvanTex units are provided with passive ventilation to provide oxygen to the biofilms in the AX pods. This has been proven effective at supplying sufficient oxygen for BOD removal and nitrification.

4. Controls System. – the overall system Control Panel will control the AdvanTex dosing pumps. This Control Panel will have user set timing for the AdvanTex dosing to allow operators to adjust dosing timing and rest duration.

Alkalinity Addition

Alkalinity will be added as needed to the recycle pipe to the Pre-Anoxic Bioreactor by a chemical dosing pump (MP2) located in the Control Building and actuated by the Control Panel. The system will include a drum for sodium carbonate solution.

Nutrient Removal and Nitrogen Dilution

The AOSS will meet the requirements of 5 mg/L of total nitrogen (TN) at the project boundary through nitrogen removal in the treatment system and some dilution from rainfall in the Nitrogen Dilution Management Area (NDMA) shown in the map of the overall system layout in Attachment 1.

The influent is expected to have a total Kjeldahl nitrogen (TKN) of about 56 mg/L. The TKN is mostly converted into ammonia that is then nitrified in the Stage 1 and Stage 2 AdvanTex treatment pods such that 1 mg/L or less of TKN remains. Aerobic reactor water is pumped back from the Recirculation tank to the Pre-Anoxic Bioreactor for denitrification using the carbonaceous BOD in the incoming screened sewage. An overall nitrogen removal rate of 64% will be required to achieve an effluent total nitrogen of 20 mg/L.

The preliminary Nitrogen Dilution Management Area identified is 16.41 acres. Based on the preliminary nitrogen dilution calculations, a concentration of 20 mg/L in the dispersed effluent will result in a nitrogen concentration at the boundary less than 5 mg/L on an annual average. Calculations are summarized in Appendix B, Table B-6.

SYSTEM CONTROL PANEL

The AOSS will be controlled by the central control panel based on programmable logic controllers with a touch screen operator interface. The Control Panel will control all the devices in the treatment system as well as effluent dispersal. The HMI will allow operators to review system status and data and easily change settings for controlled devices. An internet connection to the Control Panel will allow remote access for (1) broadcasting alarms and (2) monitoring and control.

The control panel will be located in the Control Building along with the main electrical panel. Most devices will be powered directly from the Control Panel with built in overload protection. Hand/Off/Auto switches will be provided for critical components to allow for manual operation and testing.

DISPERSAL SYSTEM DESIGN

The existing gravity dosed trench system will be upgraded with low pressure- dosed laterals to provide required dispersal capacity. Drainfield Design Calculations for Phase 1 are summarized in Table C-1 and C-2 (Appendix C). A layout is shown in the attached drawing (Attachment 1). Soil Profile Descriptions (SPDs) for the replacement area are included in Appendix D as well as saturated hydraulic conductivity (kSat) tests. The first round of SPDs and some kSat tests were performed on November 28 and 29, 2023. Further SPDs were conducted on February 1, 2024,

Miller School of Albemarle -Phase 1 Expansion
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by HydroGeo Environmental, LLC. Further soil borings and SPDs were performed by HydroGeo on May 29, 2025. Aqua Nova performed SPDS on July 26th and 27th 2025. The SPDs and Ksat Results relevant to the design of Primary and Reserve Drainfields are summarized in Appendix D.

The preliminary design of the Phase 1 dispersal system is summarized below.

- Phase 1 Primary drainfield areas are:
 - Subfield C.
 - Subfield D.

The design of the primary drainfields is summarized in Appendix C, Table C-1. The layout of the primary drainfields is shown on a map of the drainfield area and soil test pits/borings (Page three of Attachment 1).

- Phase 1 Reserve drainfield areas are:
 - Subfield A
 - Subfield B
 - Subfield E
 - Subfield F
 - Subfield G

The design of the reserve drainfields is summarized in Appendix C, Table C-2. The layout of the reserve drainfields is shown on a map of the drainfield area and soil test pits/borings (Page three of Attachment 1).

Aqua Nova intends to perform additional soils evaluations to demonstrate drainfield capacity for Phase 2 of the expansion. These additional evaluations will be performed in the near future, to fully characterize the available adsorption capacity of the soils in the proposed area.

Treated effluent will be stored in an Effluent Pump Tank and pumped to each of the zones of the dispersal system. Flow to each zone will be controlled by an array of solenoid valves located in or near the existing gravity distribution box. The disposal zones will be time-dosed based on settings in the main control panel. Effluent flow will be monitored by a flow meter with a virtual totalizer for each zone to aid in balancing flow.

Appendix A - Existing Treatment System Flow Calculations**Project Name:** Miller School -EXISTING Boarding Sch.+ Day students

Updated: 1/17/2024

By: D. Maciolek

Table A-1. Wastewater Flow Estimated for Existing School during dry weather

Facility	Flow Unit	Capacity Units	Per Unit gpd	Sunday qty.	gal.	Monday qty.	gal.	Tuesday qty.	gal.	Wednesday qty.	gal.	Thursday qty.	gal.	Friday qty.	gal.	Saturday qty.	gal.	Week Total	Notes
Boarding Students (a)	person	80	50	80	4000	80	4,000	80	4,000	80	4,000	80	4,000	80	4,000	80	4,000	28,000	
Resident Staff (b)	person	12	75	12	900	12	900	12	900	12	900	12	900	12	900	12	900	6,300	
Day School Students	person	174	15	0	0	174	2,610	174	2,610	174	2,610	174	2,610	174	2,610	0	0	13,050	
Non-Resident Staff (c)	person	63	20	0	0	63	1,260	63	1,260	63	1,260	63	1,260	63	1,260	5	100	6,400	
Resident Families (d)	person	19	75	19	1,425	19	1,425	19	1,425	19	1,425	19	1,425	19	1,425	19	1,425	9,975	
Seven Riv. Day Students	person	55	10	0	0	55	550	55	550	55	550	55	550	55	550	0	0	2,750	
Seven Riv. Day Staff	person	15	20	0	0	15	300	15	300	15	300	15	300	15	300	2	40	1,540	
Maintenance/cleaning	event	5	150	5	750	3	450	0	0	4	600	0	0	4	600	0	0	2,400	
Event visitors (max.)	person	500	3	0	0	250	750	0	0	250	750	0	0	500	1,500	500	1,500	4,500	
	TOTAL			116	7,075		12,245		#####		#####		11,045		13,145		7,965	74,915	gal.
Total Students ONLY		309				Peak Day Design Flow, gpd #####										Week Avg.		10,702	gpd
Total Staff ONLY		90														M-F Avg.		11,975	gpd

- (a) Students living in dormitory buildings
 (b) Resident staff contributing to main sewer system
 (c) Staff that do not live on site but use facilities connected to sewer system
 (d) Members of families of staff living in housing that discharges to sewer system

Appendix B - Wastewater Treatment Design

Project Name: **Miller School of Albemarle**
 Scenario: **Phase 1 Expansion**
 Updated: **6/27/2025** By: **Cort Hammond**

Table B-1. Wastewater Flow Estimated from Various Sources Daily , persons

Facility	Flow Unit	Capacity Persons	Per Person gpd	Sunday pers. gal		Monday pers. gal		Tuesday pers. gal		Wednesday pers. gal		Thursday pers. gal		Friday pers. gal		Saturday pers. gal		Week Total	Notes
Current Boarding Students (a)	person	80	50	80	4000	80	4,000	80	4,000	80	4,000	80	4,000	80	4,000	80	4,000	28,000	
Added Boarding Students (b)	person	65	40	65	2600	65	2,600	65	2,600	65	2,600	65	2,600	65	2,600	65	2,600	18,200	
Resident Staff	person	12	75	12	900	12	900	12	900	12	900	12	900	12	900	12	900	6,300	
Added Resident Staff (b)	person	10	50	10	500	10	500	10	500	10	500	10	500	10	500	10	500	3,500	
Current Day School Students	person	174	15	0	0	174	2,610	174	2,610	174	2,610	174	2,610	174	2,610	0	0	13,050	
Non-Resident Staff (c)	person	63	20	0	0	63	1,260	63	1,260	63	1,260	63	1,260	63	1,260	0	0	6,300	
Resident Families (d)	person	19	75	19	1425	19	1,425	19	1,425	19	1,425	19	1,425	19	1,425	19	1,425	9,975	
Seven Riv. Day Students	person	55	10	0	0	55	550	55	550	55	550	55	550	55	550	0	0	2,750	
Seven Riv. Day Staff	person	15	20	0	0	15	300	15	300	15	300	15	300	15	300	0	0	1,500	
Maintenance/cleaning	event	5	150	5	750	3	450	0	0	5	750	0	0	0	0	5	750	2,700	
Event visitors (max.)	person	500	3	0	0	250	750	0	0	250	750	0	0	500	1,500	500	1,500	4,500	
Inflow/Infiltration	event						5,000		5,000										
	TOTAL				10,175		20,345		19145		15,645		14,145		15,645		11,675	106,775	gal.
Total Students ONLY		374								15,645						Week Avg.	15,254	gpd	
																	M-F Avg.	16,985	gpd

Peak Day Design Flow, gpd 20,345

- (a) Students living in dormitory buildings
 (b) Added resident students and staff will be housed in building with improved fixtures for water use efficiency.
 (c) Staff that do not live on site but use facilities connected to sewer system
 (d) Families of staff living in housing that discharges to sewer system

Table B-2. Waste Loading (Raw Sewage) Resulting Concentrations

Source or Area	Unit	Persons per unit	Reference Value Daily Load, lb/d			Design Per-unit Load, lb/d						Source Loading, lb/d *		
			BOD/TSS	TKN		BOD		TSS		TKN		BOD	TSS	TKN
Current Boarding Students (a)	person	80	0.200	0.029	(a)(b)	0.200	(c)	0.200	(c)	0.029	(c)	16.00	16.00	2.32
Resident Staff	person	12	0.200	0.029	(a)(b)	0.200	(c)	0.200	(c)	0.029	(c)	2.40	2.40	0.35
Current Day School Students	person	174	0.040	0.029	(a)(b)	0.050	(d)	0.050	(d)	0.020	(e)	8.70	8.70	3.48
Non-Resident Staff (c)	person	63	0.040	0.029	(a)(b)	0.100	(d)	0.100	(d)	0.020	(e)	6.30	6.30	1.26
Resident Families (d)	person	19	0.040	0.029	(a)(b)	0.200	(d)	0.200	(d)	0.020	(e)	3.80	3.80	0.38
Seven Riv. Day Students	person	55	0.040	0.029	(a)(b)	0.050	(d)	0.050	(d)	0.020	(e)	2.75	2.75	1.10
Seven Riv. Day Staff	person	15	0.040	0.029	(a)(b)	0.100	(d)	0.100	(d)	0.020	(e)	1.50	1.50	0.30
Maintenance/cleaning	event	5	0.040	0.029	(a)(b)	0.050	(d)	0.050	(d)	0.020	(e)	0.25	0.25	0.10
Event visitors (max.)	person	500	0.010	0.003	(a)(b)	0.010	(d)	0.010	(d)	0.001	(e)	5.00	5.00	0.73
Total Load												46.70	46.70	10.01
Combined Concentration at Peak Flow, mg/L												275.2	275.2	59.0

* Source load is the Design Per unit Load (lb/d) times the number of units for the source.

(a) Reference value for BOD and TSS daily mass load from VA Regs (Reference 1), Table 5.1.

(b) TKN from "Quantity of Waste Discharged by individuals on a dry weight basis, Typ. without ground up kitchen waste", Metcalf and Eddy (Ref. 2), Table 3-12, p. 182.

(c) Values for BOD and TSS are the Reference Value.

(d) Values for BOD and TSS are 100% of Reference Values times persons per unit

(e) Value for TKN is half (50%) of Reference Value times the persons per unit.

(f) Values for BOD, TSS and TKN are 1/4 (25%) of Reference Value times persons per unit.

References

1. Commonwealth of Virginia, Administrative Code, 12VAC5-610-670.
2. Tchobanoglous, Burton and Stensel [Metcalf and Eddy], 2002, Wastewater Engineering, fourth ed., McGraw Hill, Inc.
3. Crites and Tchobanoglous, 1998, Small and Decentralized Wastewater Management Systems, McGraw Hill, Inc.

Table B-3. Peak Design Criteria -Wastewater Treatment and Disposal (a)

Parameter	Computed Load d) lb/d	Primary Effl. Calculated Values (b)			Design Influent -Biological Treatmnt (c)		Design Effluent			
		Treatment Reduction % (d)	Flow (gpd) 20,345		Flow (gpd) 15,500		Avg. Conc. mg/L (f)		Removal % (g) Max. (f)	
			Load lb/d	Equivalent Conc., mg/L	Load lb/d	Equivalent Conc., mg/L				
BOD	46.7	30%	32.7	192.7	24.9	193	10		95%	10
TSS	46.7	75%	11.7	68.8	8.9	69	10		85%	10
TKN	10.0	5%	9.5	56.1	7.2	56	2		96%	2
Nitrate	0.0		0.0	0.0	0.0	0	18			18
Total Nitrogen	10.0	5%	9.5	56.1	7.2	56	20		64%	20
TP (a)	0.0		0.0	0.0	NA	NA	NA		-	
E. Coli, MPN/100 mL		NA			NA	NA	NA		-	
Min. Temperature, °F		NA			60	NA	NA			
Temperature, °C		NA			15.6	NA	NA			

(a) Flow, loading and resulting concentrations for design of biological treatment system, secondary clarifier and disposal system.

(b) Estimated flow and calculated load after reduction in primary treatment System and resulting concentration.

(c) Equalized flow and load for design of the biological treatment system.

(e) Estimated percent reduction in Primary Treatment, i.e., septic tanks with effluent filters.

Appendix B - Wastewater Treatment Design

Project Name:	Miller School of Albemarle			Updated by:	Cort H.
Scenario:	Phase 1 Expansion			Date:	6/27/2025
	Peak Daily Flows (gpd), from Table B-1.	20,345			

Table B-4. Equalization Volume & Average Flow (a)

Projected Flow Pattern			Discharge & Vol. in Tank, gal.	
Day Of week	Flow Estimate (a) Note	Daily Flow, gpd	DAILY Discharge (c)	Volume in Tank (d)
Monday	Norm. school	20,345	15,500	4,845
Tuesday	Norm. school	19,145	15,500	8,490
Wednesday	School + Sm. Event	15,645	15,500	8,635
Thursday	Norm. school	14,145	15,500	7,280
Friday	School + Lg. Event	15,645	15,500	7,425
Saturday	Weekend flow	11,675	15,500	3,600
Sunday	Weekend flow	10,175	15,500	0
TOTAL		106,775	108,500	
Daily Discharge (Equalized over 7 days) (c)		15,254	15,500	

Calculated Required Equalization Volume (e)	8,635	gal.	Start vol. gal.
Selected Equalization volume (f)	15,000	gal.	0

- (a) Equalization of septic tank effluent over a one week period to provide minimum average daily flow.
- (b) Fraction of peak flow generated for reduced business on day listed. Based on weekly flow pattern observed for similar developments.
- (c) Total flow pumped per day from Equalization Tank to the dispersal system.
- (d) Water volume in Equalization Tank (at midnight) = Start Vol. + Daily Flow - Daily Discharge.
- (e) Maximum value of "Volume in Tank".
- (f) Working volume above pump minimum submergence and allowing for alarm volume (high water).

Appendix B - Wastewater Treatment Design

Project Name:	Miller School of Albemarle	Checked By:	Highlight Legend
Scenario:	Phase 1 Expansion	D. Maciolek	Design input
Updated:	6/27/2025	By: C. Hammond	Important output
		7/10/2025	

Table B-5 Orenco AdvanTex® System Design (a)

Parameter	Septic Effluent Loading Value (c)	Unit	Stage 1 Advantex (b)				Stage 2 Advantex (b)		
			Loading Rate (d)	AX area required ft ² (e)	Effluent Load (e)	Estimated Effluent Conc. (f)	Loading Rate (d)	AX area required ft ² (e)	Estimated Effluent Conc. (f)
Flow- Average	15,500	gpd	25	620	N/A	NA	75	207	N/A
Flow - Peak	16,985	gpd	50	340	N/A	NA	125	136	N/A
BOD - average	24.9	lb/d	0.04	623	1.9	14.4	0.02	93	2.9
BOD - Peak	32.7	lb/d	0.08	409	1.6	11.5	0.04	41	2.3
TKN/TN- Average	7.2	lb/d	0.014	518	1.3	10.1	0.007	186	1.0
TKN/TN- Peak	9.5	lb/d	0.02	476	1.0	7.4	0.01	95	0.7
Advantex Module Requirements			Stage 1				Stage 2		
AX design:	Textile plan area per module, sq. ft.		Chose No. of Modules	Total Textile Plan Area, sq.ft.	Safety Factor (g)		Textile Plan Area, sq.ft.	Safety Factor (g)	
AX100	100		7	700	1.12		2	200	0.97
AX 20	20			0				0	

- (a) Design of biological treatment using Orenco Systems AdvanTex® textile trickling filter system.
- (b) Each stage consists of AdvanTex pods and dedicated recirculation tank.
- (c) Design Flow and Loading criteria from Tables B-3.
- (d) Recommended loading rates from Orenco Systems, Inc. 2017 Design/Engineering Binder.
- (e) Computed required area of Advantex AX unit. Actual area is determined by the number and size of AX units.
- (d) Estimated effluent load based on expected reduction in Stage 1 system.
- (f) Concentration equivalent computed from effluent load and flow.
- (g) Additional textile plan area provided compared to required computed area = (Provided Area - Required Area)/Required Area.

Appendix B - Effluent Disposal System Calculations

Table B-6. Effluent Total Nitrogen Dilution Model

Project Name: Miller School of Albemarle

Scenario: Phase 1 Expansion

Updated by: Cort Hammond

Date: 10-Jul-25

Input Variable

Input Variable	Value
Annual Total Rainfall in inches per year:	44
Percent of rainwater infiltrating for dilution (% Infiltr)	50%
Rainfall Area for dilution (a), Acres:	16.41 acres
(a) Area inside property line that contributes to groundwater flow to dilute effluent.	

Wastewater flow to Disposal Area

Disposal System Design Maximum Discharge, gpd	15,500
Days per Year with Max. Discharge	250
Influent Design TN, mg/L	56.1
Treatment Nitrogen Removal	64.3%
Treatment System Design Effluent TN, mg/L	20.0 (*)
Soil denitrification factor	0.1
Effective Dispersal concentration TN, mg/L	18.0

(*) VDH Regulations limit the effluent TN to 20 mg/L for flows 1,200 to 10,000. VAC 5-613-90 Sub-section D.

Equation One

Annual Total Nitrogen Load = Daily TN Load x Operating Days/year

Daily TN Influent Load =	7.25 lb/d	
	3.29 kg/d	
Annual TN Influent Load	1811.76 lb/year	
	822.25 kg/year	
	822,248,273 mg/year	
Daily TN Effluent Load =	2.33 lb/d	
	1.06 kg/d	1.05288
Annual TN Effluent Load	581.72 lb/year	
	264.00 kg/year	
	264,004,542 mg/year	

Equation Two

Rainwater Dilution Volume

Dilution Volume = $R/12 \times \%I \times Ad \times 43,560$ (sq. ft/acre) + effluent flow
 where R = Annual Rainfall in inches
 % Infiltr = % of total rainfall that infiltrates
 Ad = Acres available for infiltration of rainfall

Dilution Volume =	2,066,853 cu. ft/year
	15,461,093 gal/year
	58,458,392 L/yr

Equation Three

Total Nitrogen Concentration after Dilution:

Diluted TN = Effluent TN loading / Rainwater dilution

Diluted TN = Annual TN Load (mg/year) / Rainwater dilution (L/year)

Annual Average TN Concentration at edge of Dilution Area

Diluted TN Concentration = 4.52 mg/L

Appendix C - Effluent Disposal System Calculations

Project:	Miller School of Albemarle
Scenario:	Phase 1 Expansion
Updated:	7/16/2025 By: D. Maciolek

Table C-1. Primary Disposal Area -LPD Trenches with TL-3 Effluent

PEAK Design Flow		15,500	GPD		Disposal method		LPD					
Field Area	Dispersal Area										Alloc. Of Design Flow (d)	
	Estimated Perc. Rate mpi (a)	Loading Rate TL-3 Effluent gpd/ft² (b)	Width ft	Number of Trenches	Distance Trench CLs ft (c)	CHOSEN Trench Length, ft	TOTAL Absorption Area, sq. ft	Trench bottom depth, inch	Approx. Field Area ft²	Field Capacity, GPD		
C	50	1.00	3	12	9	85	3,060	70	10,200	3,060	19.7%	
D1	40	1.25	3	9	9	95	2,565	62	8,550	3,206	20.7%	
D2	40	1.25	3	9	9	95	2,565	62	8,550	3,206	20.7%	
D3	40	1.25	3	9	9	95	2,565	72	8,550	3,206	20.7%	
D4	40	1.25	3	9	9	95	2,565	72	8,550	3,206	20.7%	
Total flow (GPD)										15,885	102.5%	

Table C-2 RESERVE Disposal Area -LPD Trenches with TL-3 Effluent

PEAK Design Flow			15,500	GPD		Disposal method		LPD				
Field Area	Dispersal Area										Alloc. Of Design Flow (d)	
	Estimated Perc. Rate	Loading Rate			Distance Trench CLs	CHOSEN Trench	TOTAL Absorption	Trench bottom	Approx. Field Area	Field Capacity,		
	mpi (a)	TL-3 Effluent gpd/ft² (b)	Width ft	Number of Trenches	ft (c)	Length, ft	Area, sq. ft	depth, inch	ft²	GPD		
A	45	1.13	3	20	9	60	3,600	64	12,000	4,068	26%	
B	45	1.13	3	17	9	100	5,100	64	17,000	5,763	37%	
E	85	0.61	3	8	9	95	2,280	76	7,600	1,391	9%	
F	85	0.61	3	10	9	75	2,250	76	7,500	1,373	9%	
G	55	0.94	3	12	9	95	3,420	72	11,400	3,215	21%	
Total flow (GPD)										15,809	102%	

- (a) Design Percolation Rate per Soil Evaluation Report based on the soil horizon with the most favorable texture and structure.
 (b) Per Virginia Sewage Handling and Disposal Regulations, 12VAC5-610-950, Table 5.4.
 (c) Distance between trench centers. Three times trench width for slopes <20% ,Sewage Handling and Disposal Regulations, 12VAC 5-610, Section 950, F., page 96.
 (d) Field capacity divided by design flow. Total greater than 100% indicates combined capacity greater than design flow.

Soil Profile Descriptions by Drainfield

Project:	Miller School of Albemarle - Expansion	
Scenario:	Phase 1 Expansion - Drainfield Evaluation/Design	
UPDATED:	15-Jul-25	

PRIMARY Dispersal Area

Soil Profile Descriptions labeled 1.xx, 2.xx and 3.xx are by HydroGeo Environmental.
Those labeled 4.xx and 5.xx are by Aqua Nova Engineering.

FIELD /Date of Eval.	PIT/ BORING	HORIZON	DEPTH (in.)	Description	MPI	Notes
DRAINFIELD C - Primary						
C	11/28/2023	Pit 1.5	Ap	0-1	Dark brown (7.5YR 3/4) micaceous sandy loam; soft and friable; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	
			AB	1-12	Yellowish red (5YR 4/6) micaceous sandy clay loam; loose; medium subangular blocky; ~10% white quartz gravels; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary. (30 mpi)	
			Bt1	12-22	Dark red (2.5YR 3/6) micaceous clay loam; slightly loose and friable; medium subangular blocky; ~30% coarse blue quartz grains; few fine roots; few fine pore spaces; clay films; diffuse smooth boundary.	50
			Bt2	22-44	Red (2.5YR 4/8) micaceous sandy clay loam; slightly hard; weak medium subangular blocky; trace fine roots; trace fine pore spaces; clay films; diffuse smooth boundary.	85
			C	44-68	Red (2.5YR 4/8) gneissic saprolite, crushes to loam; slightly hard and friable; relict metamorphic foliation; sparse fine pore spaces.	30
C	11/28/2023	Pit 1.6	Ap	0-4	Reddish brown (5YR 4/4) micaceous loam; loose; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	
			AB	4-12	Yellowish red (5YR 4/6) micaceous sandy clay loam; loose; medium subangular blocky; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	
			Bt	12-36	Dark red (10R 3/6) micaceous sandy clay loam; slightly loose and friable; medium subangular blocky; few fine roots; common fine pore spaces; diffuse wavy boundary.	50
			C	36-74	Variegated light red, tans, and burnt yellow micaceous saprolite, crushes to sandy loam; loose and friable; sparse fine pore spaces.	35
C	2/1/2024	Pit 2.2	Ap	0-4	Dark reddish brown (7.5YR 3/4) micaceous clay loam; friable; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	
			Bt	4-37	Red (2.5YR 4/6) micaceous clay loam; slightly hard and friable; weak medium subangular blocky; few fine and medium roots; few fine and medium pore spaces; abrupt smooth boundary.	90
			BC	37-56	Red (2.5YR 4/6) micaceous clay loam; dark yellowish brown (10YR 3/6) lithochromic masses; slightly loose and friable; medium subangular blocky; common fine and medium roots; few fine and medium pore spaces; diffuse wavy boundary.	85
			C	56-82	Dark yellowish brown (10YR 4/6) saprolite, crushes to micaceous loamy sand; slightly loose and friable; abundant fine pore spaces.	35
C	2/1/2024	Pit 2.12	Ap	0-3	Dark reddish brown (2.5YR 3/4) micaceous sandy clay loam; loose and friable; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	
			Bt1	3-18	Reddish brown (5YR 4/4) micaceous sandy clay loam; slightly loose; medium subangular blocky; ~10% blue quartz grains; abundant fine and medium roots; common fine and medium pore spaces; abrupt smooth boundary.	80
			Bt2	18-54	Red (2.5YR 4/6) micaceous clay loam; slightly hard; weak fine subangular blocky; ~10% blue quartz grains; few fine roots; few fine pore spaces; diffuse smooth boundary.	85
			C	54-82	Variegated light reddish brown (2.5YR 6/4), yellowish red (5YR 4/6), and white saprolite, crushes to coarse loamy sand; slightly loose and friable.	30

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Soil Profile Descriptions by Drainfield

FIELD /Date of Eval.	PIT/ BORING	HORIZON	DEPTH (in.)	Description	MPI	Notes
C	2/1/2024 Pit 2.14	Ap	0-4	Dark reddish brown (2.5YR 3/4) micaceous sandy clay loam; loose and friable; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.		
		Bt1	4-15	Red (2.5YR 4/6) micaceous sandy clay loam; slightly loose; medium subangular blocky; ~10% blue quartz grains; abundant fine and medium roots; common fine and medium pore spaces; abrupt smooth boundary. (65 mpi)	65	
		Bt2	15-28	Red (2.5YR 4/6) micaceous clay loam; slightly hard and moist; fine to medium subangular blocky; common fine and medium roots; few fine pore spaces; black oxide staining; abrupt smooth boundary.	85	
		Bt3	28-58	Red (2.5YR 4/6) micaceous sandy clay loam; slightly hard; weak fine subangular blocky; few fine roots; few fine pore spaces; abrupt smooth boundary.	85	
		C	58-82	Reddish yellow (5YR 7/8) saprolite streaked with black micas, crushes to coarse sandy loam; slightly loose and friable.	45	
C	2/1/2024 Pit 2.15	Ap	0-3	Dark reddish brown (2.5YR 3/4) micaceous sandy clay loam; loose and friable; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	40	
		Bt1	3-14	Red (2.5YR 4/6) micaceous sandy clay loam; slightly loose; medium subangular blocky; ~10% blue quartz grains; abundant fine and medium roots; common fine and medium pore spaces; abrupt smooth boundary.	65	
		Bt2	14-28	Red (2.5YR 4/6) micaceous clay loam; slightly hard; medium subangular blocky; common fine and medium roots; few fine pore spaces; abrupt smooth boundary. (85 mpi)	85	
		Bt3	28-46	Red (2.5YR 4/6) micaceous clay; slightly hard; weak medium subangular blocky; ~25% blue quartz grains; common fine roots; few fine pore spaces; clay films; abrupt smooth boundary.	85	
		C	46-86	Variegated light reddish brown (2.5YR 6/4), yellowish red (5YR 4/6), and white saprolite, crushes to loamy sand; slightly loose and friable.	45	
C	6/26/2025 PIT 4.5	Ap	0-7	7.5 YR 4/3 brown loam	55	
		Bt1	7-31	2.5 YR 4/8 red, medium friable clay loam; weak sub-angular blocky; few quartz fragments	85	
		Bt2	31-56	2.5 YR 4/8 red, friable clay loam to sandy clay loam; sub-angular blocky	65	
		Ct	56-92	7.5 YR 5/8 strong brown, friable loam saprolite; density decreases with depth w/ few PM fragments	45	
C	6/26/2025 PIT 4.12	Ap	0-6	7.5 YR 4/3 brown loam	55	
		Bt1	6-32	2.5 YR 4/8 red, medium friable clay loam; sub-angular blocky	85	
		Bt2	32-54	2.5 YR 4/6 red, friable, micaceous sandy clay loam w/ few PM granules	45	
		C	54-92	7.5 YR 7/3 pink, crushes to friable sandy loam saprolite	35	
C	6/27/2025 PIT 4.13	Ap	0-5	7.5 YR 4/6 strong brown loam	60	
		Bt1	5-23	2.5 YR 4/8 red medium friable clay loam; weak sub-angular block	90	
		Bt2	23-46	2.5 YR 4/6 red friable clay loam to sandy clay loam; sub-angular blocky	80	
		Bt3	46-63	2.5 YR 4/6 red friable sandy clay loam w/ 5 YR 6/6 reddish yellow	75	
		C	63-90	5 YR 5/8 reddish yellow, crushes to sandy loam saprolite w/ 10 YR 8/3 very pale brown	35	DJM per Ksat tests
C	6/26/2025 PIT 5.4	Ap	0-6	7.5 YR 4/3 brown loam		
		Bt1	6-16	2.5 YR 4/8 red, micaceous clay loam; medium friable; weak sub-angular blocky		
		Bt2	16-49	2.5 YR 4/8 red, friable sandy clay loam; granular PM fragments	65	
		Ct	49-92	10 YR 8/2 very pale brown, slightly firm, crushes to loamy sand saprolite w/ few PM fragments; variegated w/ 10 YR 3/2 very dark grayish brown, 10YR 5/8 yellowish red	45	

Soil Profile Descriptions by Drainfield

FIELD /Date of Eval.	PIT/ BORING	HORIZON	DEPTH (in.)	Description	MPI	Notes
DRAINFIELD D - Primary						
D-3	11/28/2023	PIT 1.12	Ap	0-2	Reddish brown (5YR 4/4) micaceous loam; loose; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundarv.	30
			AB	2-10	Yellowish red (5YR 4/6) micaceous sandy clay loam; loose; medium subangular blocky; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundarv.	40
			Bt	10-30	Yellowish red (5YR 4/6) coarse micaceous sandy clay loam; loose; medium subangular blocky; common fine roots; common fine pore spaces; clay films; diffuse smooth boundarv.	50
			BC	30-46	Variegated red (2.5YR 4/8), dark reddish brown (2.5YR 3/6), and 10YR micaceous loam; slightly hard and friable; weak medium subangular blocky; common fine roots; common fine pore spaces; diffuse wavv boundarv.	45
			C	46-78	Variegated light reddish brown (2.5YR 6/4), yellowish red (5YR 4/6), and white gneissic saprolite, crushes to loam; slightly loose and friable; relict metamorphic foliation; few fine roots; few fine pore spaces.	30
D-1	11/28/2023	Pit 1.14	Ap	0-2	Reddish brown (5YR 4/4) micaceous loam; loose; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundarv.	30
			Bt	2-36	Yellowish red (5YR 4/6) micaceous sandy clay loam; loose; medium subangular blocky; common fine and medium roots; common fine and medium pore spaces; clay films; ~2% biochar fragments; diffuse smooth boundary.	55
			C	36-70	Light reddish brown (2.5YR 6/4) gneissic saprolite, crushes to loamy sand; loose and friable; massive to granular. (10 mpi)	20
D-1	11/28/2023	Pit 1.15	Ap	0-3	Reddish brown (5YR 4/3) micaceous loam; loose; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundarv.	30
			AB	3-12	Yellowish red (5YR 4/6) micaceous sandy clay loam; loose; medium subangular blocky; ~20% white quartz gravels; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundarv.	35
			Bt	12-34	Red (2.5YR 4/6) micaceous sandy clay loam; slightly loose and friable; medium subangular blocky; common fine roots; common fine pore spaces; clay films; trace biochar fragments; diffuse wavv boundarv.	45
			C	34-72	Light reddish brown (2.5YR 6/4) gneissic saprolite, crushes to fine loamy sand; loose and friable; massive to granular; common fractured quartz gravels and cobbles intermixed; common medium and fine pore spaces.	10
D-1	11/28/2023	Pit 1.16	AB	0-9	Yellowish red (5YR 4/6) micaceous sandy clay loam; friable; medium subangular blocky; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundarv.	40
			Bt1	9-24	Yellowish red (5YR 4/6) micaceous sandy clay loam; slightly loose; medium subangular blocky; trace white quartz gravels; few fine and medium roots; common fine and medium pore spaces; clay films; diffuse smooth boundarv.	50
			Bt2	24-42	Red (2.5YR 4/6) micaceous sandy clay loam; light yellowish brown (10YR 6/4) lithochromic splotches; slightly hard; medium subangular blocky; few fine roots; common fine pore spaces; diffuse wavv boundarv.	80
			C	42-72	Light reddish brown (2.5YR 6/4) gneissic saprolite, crushes to sandy loam; loose and friable; granular; few fractured quartz gravels and cobbles intermixed; few medium and fine pore spaces.	20

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Soil Profile Descriptions by Drainfield

FIELD /Date of Eval.	PIT/ BORING	HORIZON	DEPTH (in.)	Description	MPI	Notes
D-4	11/28/2023	Pit 1.17	Ap	0-3	Reddish brown (5YR 4/4) micaceous loam; loose; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundarv.	30
			AB	3-13	Yellowish red (5YR 4/6) micaceous sandy clay loam; loose and friable; medium subangular blocky; ~15% subrounded gravels; common fine and medium roots; common fine and medium pore spaces: diffuse wavy boundarv.	35
			1Bt	13-28	Red (2.5YR 4/6) micaceous sandy clay loam; slightly loose; medium subangular blocky; common fine roots; common fine pore spaces; diffuse smooth boundary.	55
			2Bt	28-50	Dark red (2.5YR 3/6) micaceous sandy clay loam; slightly hard; fine subangular blocky to weak platy structure; <5% mica schist channers; few fine roots; few medium and fine pore spaces: diffuse smooth boundary.	100
			C	50-66	Dark reddish brown (5YR 3/3) mica-schist saprolite, crushes to loam; red (10R) clay seams; slightly hard and friable; clay films; subvertical relict bedding.	30
D-3	2/1/2024	Pit 2.12	Refer to Drainfield C			
D-4						
D-2 D-3	2/1/2024	Pit 2.13	Ap	0-4	Dark reddish brown (2.5YR 3/4) micaceous sandy clay loam; loose and friable; granular; abundant fine and medium roots; abundant fine and medium pore spaces: abrupt smooth boundarv.	30
			Bt1	45765	Red (2.5YR 4/6) micaceous clay loam; slightly loose; medium subangular blocky; ~10% blue quartz grains; abundant fine and medium roots; common fine and medium pore spaces: abrupt smooth boundarv.	65
			Bt2	18-34	Red (2.5YR 4/6) clay loam; slightly hard; fine to medium subangular blocky; common fine and medium roots; few fine pore spaces; abrupt smooth boundary.	85
			Bt3	34-60	Red (2.5YR 4/6) micaceous clay loam; slightly hard; weak fine subangular blocky; few fine roots; few fine pore spaces; abrupt smooth boundary.	85
			C	60-85	Red (2.5YR 5/6) saprolite streaked with black micas, crushes to loamy sand; loose and friable.	30
D-2	2/1/2024	Pit 2.17	Ap	0-3	Dark reddish brown (2.5YR 3/4) micaceous sandy clay loam; loose and friable; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	40
			Bt1	45746	Red (2.5YR 4/6) micaceous clay loam; slightly loose; medium subangular blocky; abundant fine and medium roots; common fine pore spaces; diffuse smooth boundary.	65
			Bt2	30-50	Red (2.5YR 4/6) micaceous clay loam; hard; weak medium subangular blocky; ~5% cobbles of gneissic origin; few fine roots; common large pore spaces; diffuse wavy boundary.	85
			C	50-80	Reddish yellow (5YR 6/8) micaceous saprolite, crushes to fine loamy sand; slightly loose and friable.	30
D-4	6/26/2025	PIT 4.11	Ap	0-6	7.5 YR 4/3 brown loam	55
			Bt1	6-30	2.5 YR 4/8 red clay loam; weak sub-angular blocky; few quartz fragments	90
			Bt2	30-56	2.5YR 4/8 red, clay loam to sandy clay loam; somewhat friable; weak sub-angular blocky	75
			Ct	56-92	2.5 YR 5/8 red, grades into light, friable loam saprolite; variegated w/ 5 YR 5/8 yellowish red, 10 YR 6/8 brownish yellow	45

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Soil Profile Descriptions by Drainfield

FIELD /Date of Eval.	PIT/ BORING	HORIZON	DEPTH (in.)	Description	MPI	Notes
D-1 6/27/2025	PIT 4.13	Refer to Drainfield C				
D-2						
D-2 6/26/2025	Pit 5.1	Ap	0-4	7.5 YR 4/3 brown loam	55	
		Bt	4-17	2.5 YR 4/8 red clay loam; micaceous	85	
		BCt	17-44	2.5 YR 4/8 red, saprolitic sandy clay loam, friable, micaceous w/ 5 YR 4/2 dark reddish gray; weak sub-angular blocky	70	
		Ct	44-60	7.5 YR 5/6 strong brown, light, friable sandy loam saprolite; variegated w/ 5 YR 5/8 yellowish red, 10 YR 8/3 very pale brown	50	
		C	60-92	7.5 YR 5/6 strong brown, light, fine loamy sand saprolite; variegated w/ 5 YR 5/8 yellowish red, 10 YR 8/3 very pale brown	45	
D-2 6/26/2025	Pit 5.2	Ap	0-5	7.5 YR 4/3 brown loam	55	
		Bt1	5-16	2.5 YR 4/8 red clay loam; micaceous	80	
		Bt2	16-38	2.5 YR 4/8 red clay loam to sandy clay loam; somewhat friable, micaceous, weak sub-angular blocky; few PM fragments	75	
		Ct	38-62	7.5 YR 5/6 strong brown, friable, micaceous loam saprolite	50	
		C	62-90	10 YR 6/8 brownish yellow, very micaceous, fine loamy sand saprolite; variegated w/ 10 YR 3/2 very dark grayish brown, 10 YR 8/3 very pale brown, 10 YR 2/1 black (Mn.)	45	
D-3 6/26/2025	Pit 5.3	Ap	0-6	7.5 YR 4/3 brown loam		
		Bt1	6-42	2.5 YR 4/8 red clay loam; micaceous		
		Bt2	42-60	2.5 YR 4/8 red clay loam to sandy clay loam; somewhat friable, micaceous, weak sub-angular blocky; few PM fragments	55	
		Ct	60-92	5YR 5/8 yellowish red, friable loam saprolite w/ 7.5 YR 6/8 reddish yellow; few PM schist fragments	40	
D-4 6/26/2025	Pit 5.5	Ap	0-6	7.5 YR 4/3 brown loam	55	
		Bt1	6-40	2.5 YR 4/8 red, somewhat friable clay loam; sub-angular blocky	85	
		Bt2	40-57	2.5 YR 4/6 red, friable, micaceous sandy clay loam w/ few PM granules; weak-subangular blocky	70	
		Ct	57-92	5 YR 5/8 yellowish red, friable, micaceous loam saprolite; variegated w/ 7.5 YR 6/8 brownish yellow, 2.5 YR 4/8 red	50	
D-2 6/27/2025	Pit 5.8	Ap	0-6	7.5 YR 4/6 strong brown loam	60	
		Bt1	6-19	2.5 YR 4/8 red clay loam; sub-angular blocky	95	
		Bt2	19-36	2.5 YR 4/6 red friable clay loam; sub-angular blocky	90	
		Bt3	36-49	2.5 YR 4/6 red friable clay loam w/ 5 YR 6/6 reddish yellow; density lightens w/ depth; weak sub-angular blocky	80	
		Ct	49-90	10 YR 6/6 brownish yellow, fine loam saprolite; variegated w/ 5 YR 5/8 reddish yellow, 10 YR 8/3 very pale brown	50	

Soil Profile Descriptions by Drainfield

FIELD /Date of Eval.	PIT/ BORING	HORIZON	DEPTH (in.)	Description	MPI	Notes
D-4	6/27/2025	Pit 5.9	Ap	0-5 7.5 YR 4/6 strong brown loam	55	
			Bt1	5-21 2.5 YR 4/8 red clay loam; sub-angular blocky	90	
			Bt2	21-42 2.5 YR 4/6 red friable clay loam; sub-angular blocky	85	
			Bt3	42-60 2.5 YR 4/6 red friable clay loam w/ 5 YR 6/6 reddish yellow; density lightens w/ depth	80	
			Ct	60-92 10 YR 6/6 brownish yellow, fine loam saprolite; variegated w/ 5 YR 5/8 reddish yellow, 10 YR 8/3 very pale brown	45	
D-1	6/27/2025	Pit 5.13	Ap	0-8 7.5 YR 4/6 strong brown loam	65	
			Bt1	8-24 2.5 YR 4/8 red, dense clay loam; weak sub-angular blocky	95	
			Bt2	24-37 2.5 YR 4/8 red, less dense clay loam; weak sub-angular blocky	85	
			BCt	37-54 2.5 YR 5/6 red, light, friable, sandy clay loam; few quartz fragments	75	
			C	54-92 10 YR 6/8 brownish yellow, light, friable, micaceous loam saprolite; variegated w/10 YR 8/3 very pale brown, 10 YR 4/2 dark grayish brown	45	
RESERVE Dispersal Area				Soil Profile Descriptions labeled 1.xx, 2.xx and 3.xx are by HydroGeo Environmental. Those labeled 4.xx and 5.xx are by Aqua Nova Engineering.		
Drainfield A - Reserve						
A	11/28/2023	Pit 1.1	Ap	0-4 Reddish brown (5YR 4/4) micaceous loam; loose; granular; abundant fine roots; abundant fine and medium pore spaces; abrupt smooth boundary	35	
			Bt1	4-16 Red (2.5YR 4/8) micaceous sandy clay loam; brownish yellow (10YR 6/6) lithochromic splotches; loose and friable; medium subangular blocky; common fine and medium roots; abundant fine and medium pore spaces; diffuse smooth boundary	45	
			Bt2	16-30 Red (2.5YR 4/6) micaceous sandy clay loam; slightly hard and friable; weak medium subangular blocky; trace sub-rounded white quartz gravels; few fine roots; common fine pore spaces; diffuse wavy boundary	80	
			CB	30-40 Intermixed red (2.5YR 4/6) and (2.5YR 5/8) micaceous loam; slightly hard and friable; weak medium subangular blocky; trace fine roots; few fine pore spaces; clear wavy boundary	45	
			C	40-60 Light reddish brown (2.5YR 6/4) gneissic saprolite, crushes to fine loamy sand; loose and friable; massive to granular; vein of fractured quartz at ~42 inches; sparse fine pore spaces.	10	
A	11/28/2023	Pit 1.2	Ap	0-4 Dark brown (7.5YR 3/4) micaceous sandy loam; soft and friable; granular; ~10% coarse blue quartz grains; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary. (20 moi)	20	
			AB	4-8 Yellowish red (5YR 4/6) micaceous loam; soft and friable; medium subangular blocky to granular; ~10% coarse blue quartz grains; common fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	30	
			Bt1	8-20 Red (10R 5/8) micaceous sandy clay loam; slightly hard and friable; weak medium subangular blocky; ~30% coarse blue quartz grains; common fine roots; common fine pore spaces; clay films; diffuse smooth boundary.	45	
			Bt2	20-32 Red (2.5YR 4/6) micaceous sandy clay loam; yellowish brown (10YR 5/8) lithochromic streaks; slightly hard and friable; weak medium subangular blocky; ~20% coarse blue quartz grains; trace fine roots; few fine pore spaces; clay films; diffuse smooth boundary	85	
			C	32-74 Light reddish brown (2.5YR 6/4) gneissic saprolite, crushes to fine loamy sand; loose and friable; massive to granular; sparse fine pore spaces.	10	
A	11/28/2023	Pit 1.5	Refer to Drainfield C			

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Soil Profile Descriptions by Drainfield

FIELD	PIT/ BORING	HORIZON	DEPTH (in.)	Description	MPI	Notes
A	2/1/2024	Pit 2.1	Ap	0-3 Red (2.5YR 4/6) clay loam; friable; granular to fine subangular blocky; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	50	
			Bt	3-33 Red (2.5YR 4/6) micaceous clay loam; slightly hard; weak medium subangular blocky; few fine and medium roots; few fine and medium pore spaces; clay films; abrupt smooth boundary.	90	
			BC	33-48 Red (2.5YR 4/6) micaceous clay loam; dark yellowish brown (10YR 3/6) lithochromic masses; slightly loose and friable; medium subangular blocky; common fine and medium roots; few fine and medium pore spaces; diffuse wavy boundary.	90	
			C	48-80 Dark yellowish brown (10YR 4/6) saprolite, crushes to micaceous fine sandy loam; slightly loose and friable; common fine pore spaces; black oxide staining.	25	
A	2/1/2024	Pit 2.2	Refer to Drainfield C			
A	2/1/2024	Pit 2.4	Ap	0-4 Dark brown (7.5YR 3/4) micaceous sandy loam; loose and friable; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	30	
			Bt1	4-28 Yellowish red (5YR 4/6) micaceous sandy clay loam; loose; medium subangular blocky; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	65	
			Bt2	28-43 Dark red (2.5YR 3/6) micaceous clay loam; slightly loose and friable; medium subangular blocky; few fine roots; few fine pore spaces; clay films; diffuse smooth boundary.	85	
			BC	43-56 Red (2.5YR 4/8) micaceous sandy clay loam; slightly hard; weak medium subangular blocky; trace fine roots; trace fine pore spaces; clay films; diffuse smooth boundary.	85	
			C	56-88 Yellowish red (5YR 5/8) gneissic saprolite, crushes to loamy sand; slightly loose and friable; relict metamorphic foliation; sparse fine roots; sparse fine pore spaces.	10	
A	2/1/2024	Pit 2.10	Ap	0-4 Dark reddish brown (2.5YR 3/4) micaceous sandy clay loam; loose and friable; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	45	
			Bt1	4-19 Red (2.5YR 4/6) micaceous clay loam; slightly loose; medium subangular blocky; common fine and medium roots; common fine and medium pore spaces; abrupt smooth boundary.	85	
			Bt2	19-50 Red (2.5YR 4/6) micaceous clay loam; slightly hard; weak medium subangular blocky; few fine roots; few fine pore spaces; diffuse wavy boundary.	85	
			C	50-82 Strong brown (7.5YR 4/6) saprolite, crushes to loamy sand; slightly loose and friable; abundant fine roots; abundant fine pore spaces.	30	
A	6/12/2025	PIT 5.12	Ap	0-5 7.5 YR 4/6 strong brown loam	60	
			Bt1	5-19 2.5 YR 4/8 red friable clay loam; weak sub-angular blocky	90	
			Bt2	19-31 2.5 YR 4/6 red friable clay loam; sub-angular blocky	85	
			Ct	31-72 5 YR 5/8 yellowish red friable, sandy clay loam; saprolitic w/ PM granules	55	
			C	72-92 10 YR 4/6 dark yellowish brown, very friable, highly micaceous loam to sandy loam saprolite w/ 7.5 YR 5/8 strong brown	45	

Soil Profile Descriptions by Drainfield

FIELD /Date of Eval.	PIT/ BORING	HORIZON	DEPTH (in.)	Description	MPI	Notes
Drainfield B - Reserve						
B	11/28/2023	Pit 1.3	Ap	0-4	Dark brown (7.5YR 3/4) micaceous sandy loam; soft and friable; granular; ~10% coarse blue quartz grains; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	20
			Bt1	4-17	Red (10R 5/8) micaceous sandy clay loam; slightly hard and friable; weak medium subangular blocky; ~30% medium blue quartz grains; common fine roots; common fine pore spaces; clay films; diffuse smooth boundary.	45
			Bt2	17-36	Red (2.5YR 4/6) micaceous sandy clay loam; yellowish brown (10YR 5/8) lithochromic streaks; slightly hard and friable; weak medium subangular blocky; ~20% coarse blue quartz grains; trace fine roots; few fine pore spaces; diffuse wavy boundary.	85
			C	36-60	Light reddish brown (2.5YR 6/4) gneissic saprolite, crushes to loamy sand; loose and friable; massive to granular; sparse fine pore spaces.	10
B	11/28/2023	Pit 1.4	Ap	0-2	Dark brown (7.5YR 3/4) micaceous sandy loam; soft and friable; granular; sparse coarse blue quartz grains; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	20
			Bt1	2-20	Dark red (2.5YR 3/6) micaceous sandy clay loam; slightly loose and friable; weak medium subangular blocky; common fine roots; common fine pore spaces; diffuse smooth boundary.	45
			Bt2	20-46	Red (2.5YR 4/6) micaceous fine sandy clay loam; dark reddish brown (2.5YR 2.5/4) lithochromic masses of schistose origin; slightly hard and friable; medium subangular blocky; trace fine roots; few fine pore spaces; diffuse smooth boundary.	85
			C	46-72	Dark reddish brown (2.5YR 3/3) mica-schist saprolite, crushes to micaceous fine sandy loam; loose and friable; massive; sparse fine pore spaces.	25
B	2/1/2024	Pit 2.8	Ap	0-3	Dark brown (7.5YR 3/4) micaceous loam; loose and friable; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	45
			Bt1	3-18	Red (2.5YR 4/6) micaceous clay loam; loose and friable; medium subangular blocky; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	85
			Bt2	18-37	Red (2.5YR 4/6) micaceous clay loam; slightly hard and friable; weak medium subangular blocky; few fine roots; few fine pore spaces; diffuse smooth boundary.	85
			C	37-80	Dark yellowish brown (10YR 4/6) saprolite, crushes to fine loamy sand; slightly loose and friable; sparse fine pore spaces; black oxide staining.	30
B	2/1/2024	Pit 2.9	Ap	0-3	Dark brown (7.5YR 3/4) micaceous loam; loose and friable; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	45
			Bt1	3-15	Red (2.5YR 4/6) micaceous sandy clay loam; loose and friable; medium subangular blocky; common fine and medium roots; common fine and medium pore spaces; abrupt smooth boundary.	85
			Bt2	15-38	Red (2.5YR 4/6) micaceous clay loam; slightly hard and friable; weak medium subangular blocky; few fine roots; few fine pore spaces; diffuse smooth boundary.	85
			C	38-81	Variegated light reddish brown (2.5YR 6/4), yellowish red (5YR 4/6), and white saprolite, crushes to coarse loamy sand; loose; common fine pore spaces; black oxide staining.	30
B	2/1/2024	Pit 2-10	Refer to Drainfield A			

APPENDIX D

Printed: 7/16/2025

Soil Profile Descriptions by Drainfield

FIELD /Date of Eval.	PIT/ BORING	HORIZON	DEPTH (in.)	Description	MPI	Notes
B	2/1/2024	Pit 2.11	Ap	0-4 Dark reddish brown (2.5YR 3/4) micaceous sandy clay loam; loose and friable; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundarv.	45	
			Bt1	4-13 Red (2.5YR 4/6) micaceous clay loam; slightly loose; medium subangular blocky; common fine and medium roots; common fine and medium pore spaces; abrupt smooth boundarv.	80	
			Bt2	13-48 Red (2.5YR 4/6) micaceous clay loam; slightly hard; weak medium subangular blocky; few fine roots; few fine pore spaces; diffuse wavy boundary.	85	
			C	48-80 Reddish yellow (5YR 7/6) saprolite, crushes to loamy sand; slightly loose and friable; abundant fine roots; abundant fine pore spaces.	30	
B	6/27/2025	Pit 5.10	Ap	0-6 7.5 YR 4/6 strong brown loam	55	
			Bt1	6-20 2.5 YR 4/8 red, micaceous clay loam; weak sub-angular blocky	85	
			Bt2	20-45 2.5 YR 4/8 red, micaceous clay loam to sandy clay loam; sub-angular blocky; density lightens with depth; more friable	75	
			Ct	45-92 7.5 YR 5/6 strong brown, friable, highly micaceous sandy loam saprolite; variegated w/ 5 YR 4/6 reddish yellow, 5 YR 5/8 yellowish red	45	
B	6/27/2025	PIT 5.11	Ap	0-6 7.5 YR 4/6 strong brown loam	60	
			Bt1	6-29 2.5 YR 4/8 red clay loam; micaceous	90	
			Bt2	29-42 2.5 YR 4/6 red, somewhat friable, micaceous clay loam; weak sub-angular blocky	85	
			Ct	42-78 5 YR 5/8 yellowish red friable, light sandy clay loam; saprolitic w/ PM granules	70	
			C	78-92 10 YR 6/6 brownish yellow, very light, friable loam saprolite	45	

Drainfield E - Reserve

E	11/29/2023	Pit 1.23	Ap	0-3 Reddish brown (5YR 4/4) micaceous loam; loose; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundarv.	30	
			AB	3-10 Yellowish red (5YR 4/6) micaceous sandy clay loam; loose; medium subangular blocky; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundarv.	35	
			Bt1	10-27 Red (2.5YR 4/6) micaceous clay loam; trace yellowish brown (10YR 5/8) saprolitic gravels; slightly loose; medium subangular blocky; common fine roots; common fine pore spaces; clay films; black oxide staining; diffuse smooth boundary.	50	
			Bt2	27-50 Red (2.5YR 4/6) micaceous clay loam; slightly hard; weak medium subangular blocky; common fine roots; common fine pore spaces; black oxide staining; diffuse smooth boundarv.	90	
			C	50-72 Yellowish red (5YR 5/8) saprolite, crushes to fine micaceous loamy sand; slightly loose and friable.	15	
E	11/29/2023	Pit 1.24	Ap	0-7 Dark reddish brown (7.5YR 3/4) micaceous loam; friable; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundarv.	30	
			Bt1	7-22 Red (2.5YR 4/6) micaceous clay loam; loose and friable; medium subangular blocky; trace mica-schist channers; common fine and medium roots; common fine and medium pore spaces; diffuse smooth boundarv.	50	
			Bt2	22-35 Red (2.5YR 4/6) micaceous clay loam; slightly hard; weak medium subangular blocky; ~10% saprolitic cobbles; few fine roots; few fine pore spaces; diffuse wavy boundarv.	85	
			C	35-60 Variegated dark red (2.5YR 3/6) and yellowish brown (10YR 5/8) saprolite, crushes to sandy loam; hard and fragmented; ~20% hard rock content; few fine roots; few fine pore spaces; clay films; black oxide staining.	20	

APPENDIX D

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Soil Profile Descriptions by Drainfield

FIELD /Date of Eval.	PIT/ BORING	HORIZON	DEPTH (in.)	Description	MPI	Notes
E	11/29/2023	Pit 1.25	Ap	0-4 Dark reddish brown (7.5YR 3/4) micaceous loam; friable; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	30	
			Bt1	4-30 Red (2.5YR 4/6) micaceous sandy clay loam; slightly loose; medium subangular blocky; common fine and medium roots; common fine and medium pore spaces; abrupt smooth boundary.	50	
			Bt2	30-59 Red (2.5YR 4/6) micaceous sandy clay loam; slightly hard; fine subangular blocky to platy; trace fine roots; few fine pore spaces; clay films; abrupt smooth boundary.	100	
			C1	59-68 Reddish brown (5YR 4/4) sandy loam; slightly hard and friable; few fine pore spaces; clear smooth boundary.	20	
			C2	68-78 Variegated reddish brown (5YR 4/4) and yellowish brown (10YR 5/8) saprolite, crushes to fine sand; soft and loose.	10	
E	6/27/2025	Pit 5.14	Ap	0-8 7.5 YR 4/6 strong brown loam	65	
			Bt1	8-19 2.5 YR 4/8 red, heavy, dense clay loam	95	
			Bt2	19-37 2.5 YR 4/8 red, less dense clay loam; weak sub-angular blocky	90	
			Bt3	37-64 2.5 YR 4/6 red, friable clay loam; fair sub-angular blocky	80	
			C	64-90 2.5 YR 8/4 pink, light, friable loam saprolite w/ 5 YR 6/8 reddish yellow	50	

Drainfield F - Reserve

F	11/29/2023	Pit 1.28	Ap	0-2 Dark reddish brown (7.5YR 3/4) micaceous loam; friable; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	30	
			AB	2-8 Yellowish red (5YR 4/6) micaceous sandy clay loam; loose; medium subangular blocky; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	45	
			Bt1	8-20 Red (2.5YR 4/6) micaceous sandy clay loam; slightly loose; medium subangular blocky; ~20% slightly weathered gravels; common fine and medium roots; common fine and medium pore spaces; gradual wavy boundary.	50	
			Bt2	20-66 Red (2.5YR 4/6) micaceous sandy clay loam; hard and tight; weak medium subangular blocky; trace fine roots; trace fine pore spaces; abrupt smooth boundary.	95	
			C	66-72 Reddish brown (5YR 4/4) saprolite, crushes to sandy loam; slightly hard; few fine pore spaces.	20	Ksat 3 (84")

APPENDIX D

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Soil Profile Descriptions by Drainfield

FIELD /Date of Eval.	PIT/ BORING	HORIZON	DEPTH (in.)	Description	MPI	Notes
F	11/29/2023	Pit 1.29	Ap	0-3 Dark reddish brown (7.5YR 3/4) micaceous loam; friable; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundarv.	30	
			Bt1	3-18 Red (2.5YR 4/6) micaceous sandy clay loam; slightly loose; medium subangular blocky; <5% slightly weathered channery gravels; abundant fine and medium roots; abundant fine and medium pore spaces; gradual smooth boundary.	50	
			Bt2	18-56 Red (2.5YR 4/6) micaceous sandy clay loam; hard and friable; weak fine subangular blocky to platy; few fine roots; few fine pore spaces; clay films; gradual wavv boundarv.	100	
			C	56-60 Variegated reddish brown (5YR 4/4) and yellowish brown (10YR 5/8) saprolite, crushes to loamy sand; ~10% medium blue quartz grains; somewhat loose.	15	
F	11/29/2023	Pit 1.30	Ap	0-3 Dark reddish brown (7.5YR 3/4) micaceous loam; friable; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundarv.	30	
			AB	3-9 Yellowish red (5YR 4/6) micaceous sandy clay loam; loose; medium subangular blocky; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundarv.	45	
			Bt1	9-24 Red (2.5YR 4/6) micaceous clay loam; slightly loose; medium subangular blocky; few (10YR) lithochromic masses; common fine and medium roots; common fine and medium pore spaces: clay films: diffuse wavv boundarv.	60	
			Bt2	24-40 Red (2.5YR 4/6) micaceous sandy clay loam; hard and friable; weak medium subangular blocky; trace fine roots; trace fine pore spaces; clay films; gradual wavv boundarv.	85	
			C	40-45 Variegated reddish brown (5YR 4/4) and yellowish brown (10YR 5/8) saprolite, crushes to sandy loam; ~40% cobbles of granitic origin; somewhat loose matrix.	20	
F	5/29/2025	B3.1	Ap	0-3 Reddish brown (5YR 4/4) clay loam	75	
			AB	3-12 Dark red (2.5YR 3/6) clay	95	
			Bt	12-36 Yellowish red (5YR 5/6) clay loam; fine pores present; micaceous; friable	85	
			CB	36-50 Yellowish red (5YR 5/8) clay loam; black oxide staining present; micaceous; friable	80	
			C	50-72 Reddish yellow (5YR 6/6) loam variegated with red (2.5YR 5/8) saprolite; crushes to loam; micaceous; friable	40	
F	5/29/2025	B3.12	Ap	0-4 Brown (7.5YR 4/4) loam	65	
			Bt	4-32 Red (2.5YR 4/6) clay	95	
			CB	32-52 Dark red (2.5YR 3/6) clay loam; micaceous; friable	85	
			C	52-76 Red (7.5R 4/6) and purpley saprolite; micaceous; black oxide staining present; loose; friable; crushes to sandy clay loam	75	

Soil Profile Descriptions by Drainfield

FIELD /Date of Eval.	PIT/ BORING	HORIZON	DEPTH (in.)	Description	MPI	Notes
Drainfield G - Reserve						
G	11/29/2023	Pit 1.25	Refer to Drainfield E			
G	11/29/2023	Pit 1.26	Ap	0-4	Dark reddish brown (7.5YR 3/4) micaceous loam; friable; granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundarv.	30
			AB	4-9	Yellowish red (5YR 4/6) micaceous sandy clay loam; loose; medium subangular blocky; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundarv.	45
			Bt1	9-26	Red (2.5YR 4/6) micaceous clay loam; slightly hard; medium subangular blocky; common fine and medium roots; common fine and medium pore spaces; diffuse wavv boundarv.	60
			Bt2	26-48	Red (2.5YR 4/6) micaceous sandy clay loam; hard; weak medium subangular blocky; trace fine roots; few fine pore spaces; clay films; abrupt smooth boundarv.	85
			C	48-72	Reddish brown (5YR 4/4) saprolite, crushes to sandy loam; slightly loose; few fine pore spaces.	20
G	11/29/2023	Pit 1.27	Ap	0-8	Dark reddish brown (7.5YR 3/4) micaceous loam; friable; fine subangular blocky to granular; abundant fine and medium roots; abundant fine and medium pore spaces; abrupt smooth boundary.	30
			Bt1	8-20	Red (2.5YR 4/6) micaceous clay loam; slightly loose and friable; medium subangular blocky; common fine and medium roots; abundant fine and medium pore spaces; clay films; abrupt smooth boundarv.	60
			Bt2	20-45	Red (2.5YR 4/6) micaceous sandy clay loam; hard; fine subangular blocky to platy; trace fine roots; few fine pore spaces; clay films; abrupt smooth boundary.	100
			C1	45-63	Variegated light reddish brown (2.5YR 6/4), yellowish red (5YR 4/6), and white saprolite, crushes to sandy loam; slightly hard; few fine pore spaces; clear smooth boundarv.	20
			C2	63-77	Variegated light reddish brown (2.5YR 6/4), yellowish red (5YR 4/6), and white saprolite, crushes to sandy loam; loose; common fine pore spaces. (15 mpi)	15
G	3/13/2025	Pit 3.0	Ap	0-6	Reddish brown (5YR 4/4) :Clay Loam loose and friable; med. Subangular blocky texture; abundant fine and medium roots;	80
			AB	6-18	Red (2.5YR 4/6) micaceous clay loam; slightly loose; medium subangular blocky; ~10% blue quartz grains; abundant fine and medium roots;	
			Bt1	18-34	Dark Red (2.5YR 4/6) clay loam; slightly hard; fine to medium subangular blocky; common fine and medium roots;	55
			Bt2	30-50	Reddish Yellow (5YR 6/6) silty clay loam; med. subangular blocky; few fine roots; traces of saprolite	45
			B-C	50-60	Reddish yellow (5YR 6/6) Silty Loam and saprolite that crushes to loam; firm but friable.	40
			C	60-86	Reddish yellow (5YR 6/6) saprolite crushes to loamy sand; firm but very friable, many medium pores	20

APPENDIX D Ksat Tests Summary (a)

Soil Profile Descriptions and Saturated Hydraulic Conductivity Test Results
Miller School of Albemarle – Charlottesville, VA

HydroGeo Project #23-846
December 12, 2023

(a) Excepted from Soils Evaluation Report Dated 12 Dec. 2023

Ksat Testing Methods

Saturated hydraulic conductivity testing was performed using the Johnson Permeameter, a standard instrument for implementing constant head saturated hydraulic conductivity tests in accordance with ASTM Standard D 5126-90. The permeameter is inserted into an auger hole at the desired test depth. A calibrated reservoir on the ground surface is attached thereto with a suitable length of hose. Water is added to the calibrated reservoir and allowed to flow freely into the borehole until the soil becomes field saturated and an equilibrium level is reached in the borehole and inside the soil permeameter. The field worker records time and volume measurements during the test, which are used to calculate rate of water flow through the soil. Soil permeability is determined by solving appropriate mathematical equations (the Glover Solution), which utilize the equilibrium height of water, rate of water flow, and dimensions of the borehole as input parameters.

The borehole base is thoroughly wetted prior to commencement of data collection and a constant supply of water is applied to the system (even between measurement sets) to ensure saturation throughout the testing period. The final Ksat value for each borehole location is usually determined by selecting the lowest of the final three tallied Ksats for each test run (seen on data sheets in **Attachment D**), or the lowest non-anomalous Ksat value, once the flow rate of water into the saturated soil medium has stabilized.

Ksat values (**Table 1**) are expressed in units of centimeters per day (cm/day) and give an indication of how quickly water percolates through the soil at the depth measured. Higher Ksat values typically indicate soils that drain faster and lower Ksat values indicate soils that drain slower.

Saturated Hydraulic Conductivity Data

The test results are summarized in **Table 1** below:

Table 1: Summarized Infiltration Testing Data

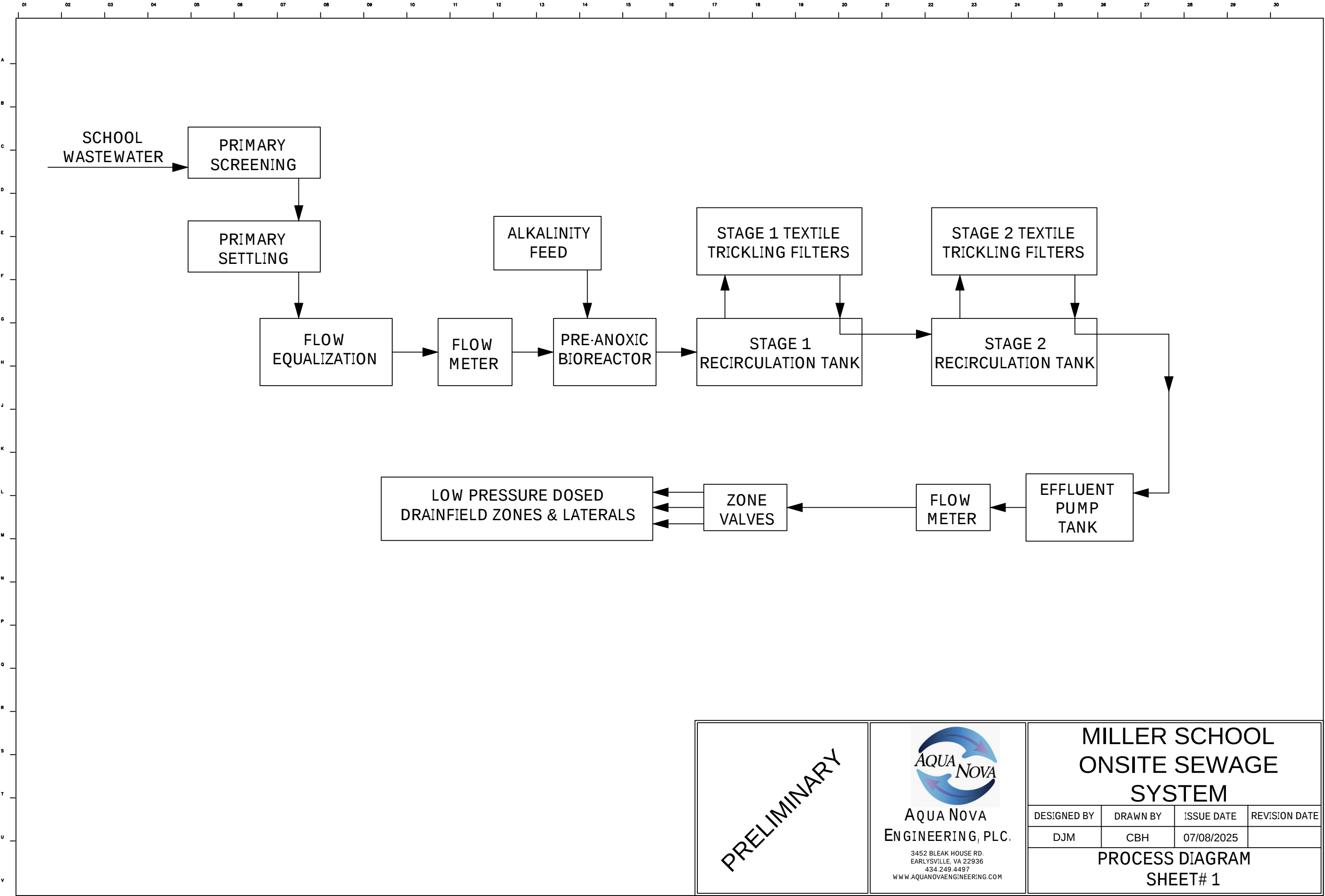
Test Date	Borehole ID	Borehole Depth (in)	Test Duration (min)	Estimated Ksat (cm/day)
11/29/2023	Ksat 1 (Pit 11)	20	100	0.4
11/29/2023	Ksat 2 (Pit 11)	42	80	1.7
11/29/2023	Ksat 3 (Pit 28)	84	46	29
11/29/2023	Ksat 4 (Pit 16)	36	40	5.1
11/29/2023	Ksat 5 (Pit 16)	50	60	37.2

Worksheets containing complete test data sets including measurements collected in the field, the time of measurements, soil temperature, boring depth, boring diameter, calculations, etc. are included in **Attachment B**; data plots showing flow rate vs. total elapsed time are also included in **Attachment B**.

Discussion

Many of the pits observed contain similar Bt horizons across the study area: a Bt1 which consists of sandy clay loam overlying a harder, less permeable sandy clay loam Bt2. We collected Ksats in these horizons for robust characterization and the Ksat in the Bt1 (which we expect to be more permeable) was slower than that observed in the Bt2. If the final design includes the installation of trench bottoms in either of the Bt horizons, additional Ksat test will be required to produce a statistically significant dataset for realistic infiltration rate determination to support your design.

That said, we encountered permeable saprolite (C horizon) in 29 of the 35 test pits. The infiltration properties of the saprolite are favorable for your proposed use; however, installation of trenches in the saprolite would require deep installation, which could be cost prohibitive (depending on details of the final



PRELIMINARY



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MILLER SCHOOL
ONSITE SEWAGE
SYSTEM

DESIGNED BY	DRAWN BY	ISSUE DATE	REVISION DATE
DJM	CBH	07/08/2025	

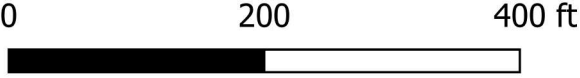
PROCESS DIAGRAM
SHEET# 1

MILLER SCHOOL PHASE 1 AOSS
PRELIMINARY LAYOUT TREATMENT AND DISPERSAL SYSTEMS

10 July 2025

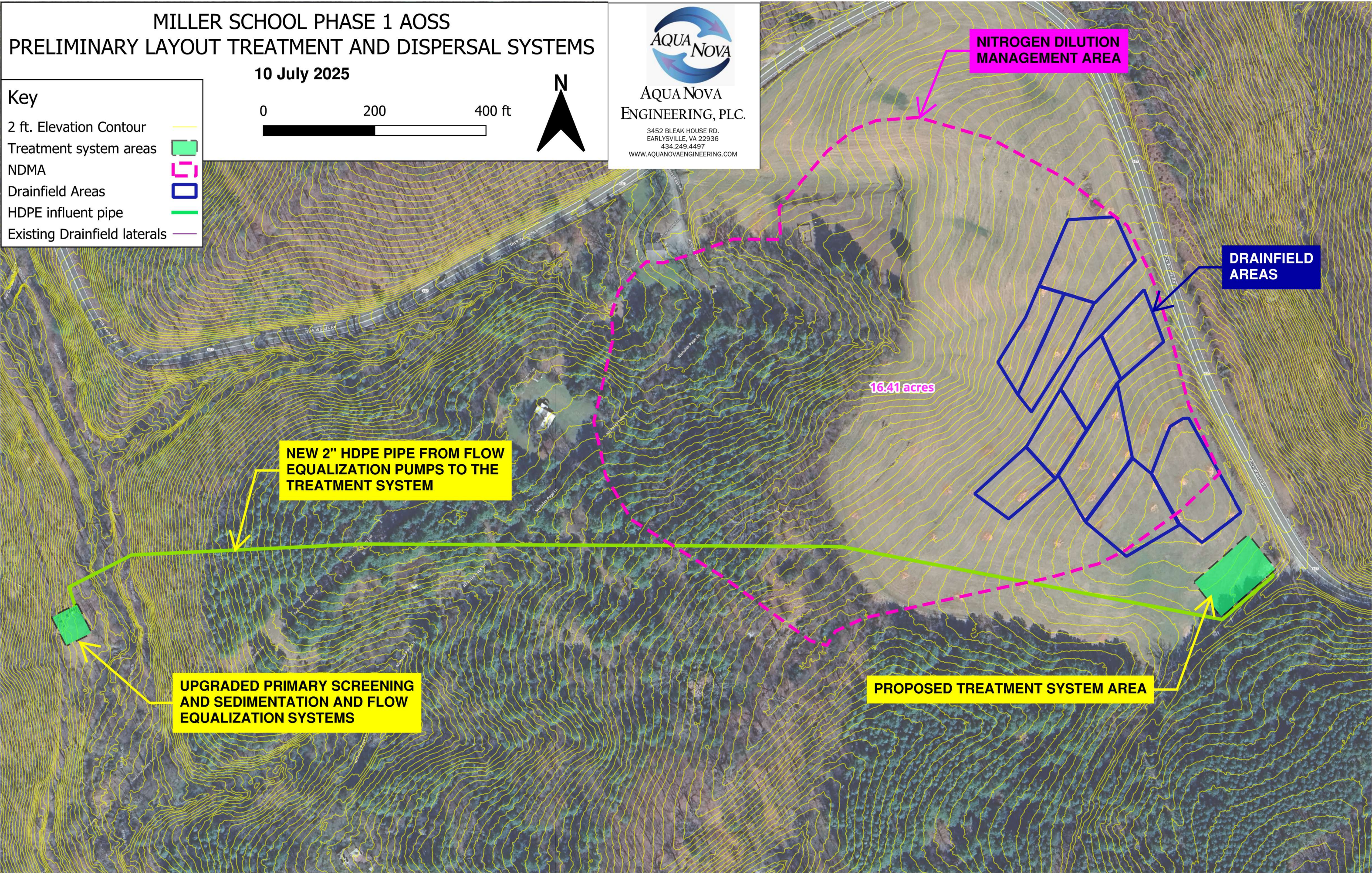
Key

- 2 ft. Elevation Contour
- Treatment system areas
- NDMA
- Drainfield Areas
- HDPE influent pipe
- Existing Drainfield laterals



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MILLER SCHOOL PHASE 1 AOSS - DRAINFIELD AREAS

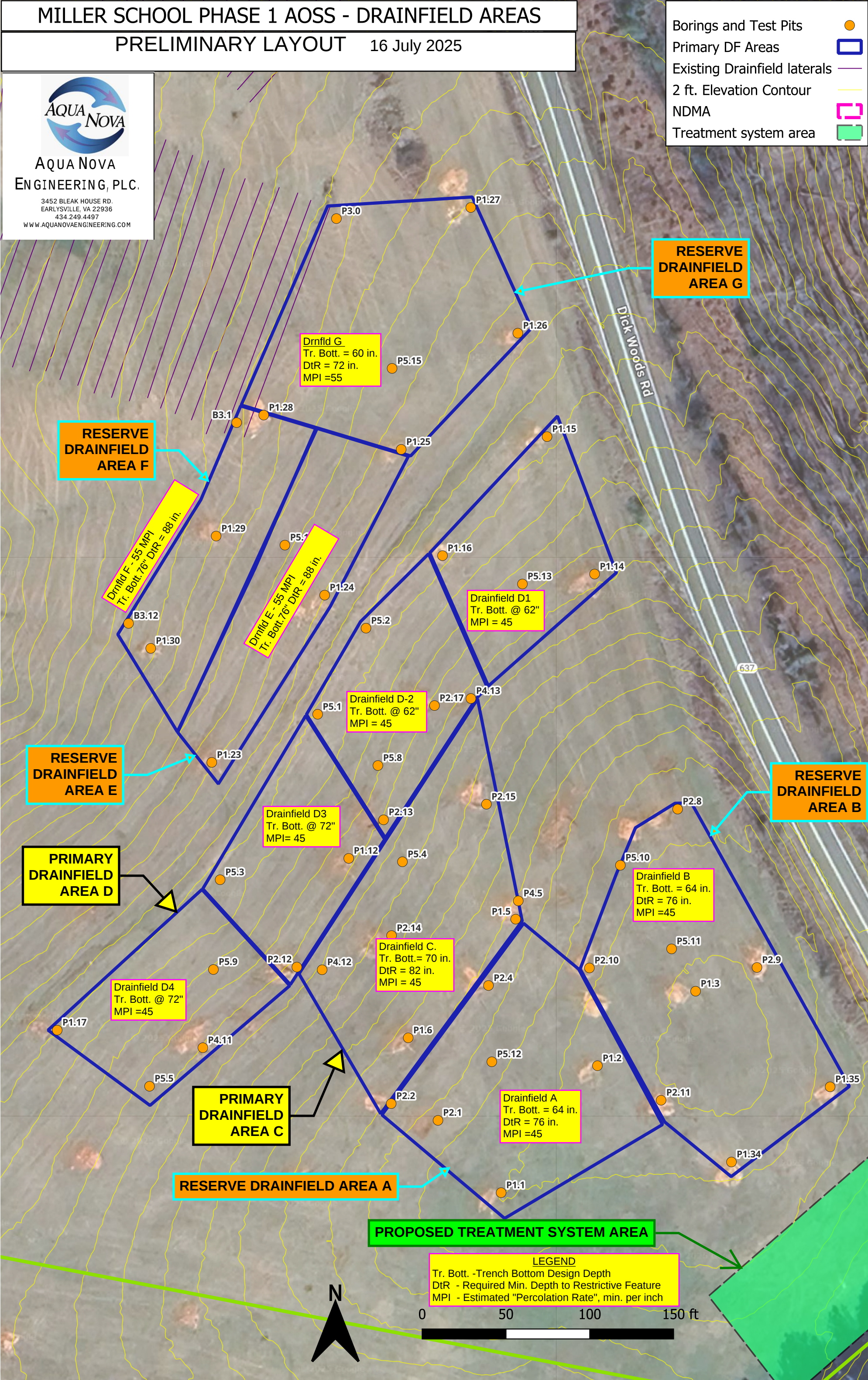
PRELIMINARY LAYOUT16 July 2025



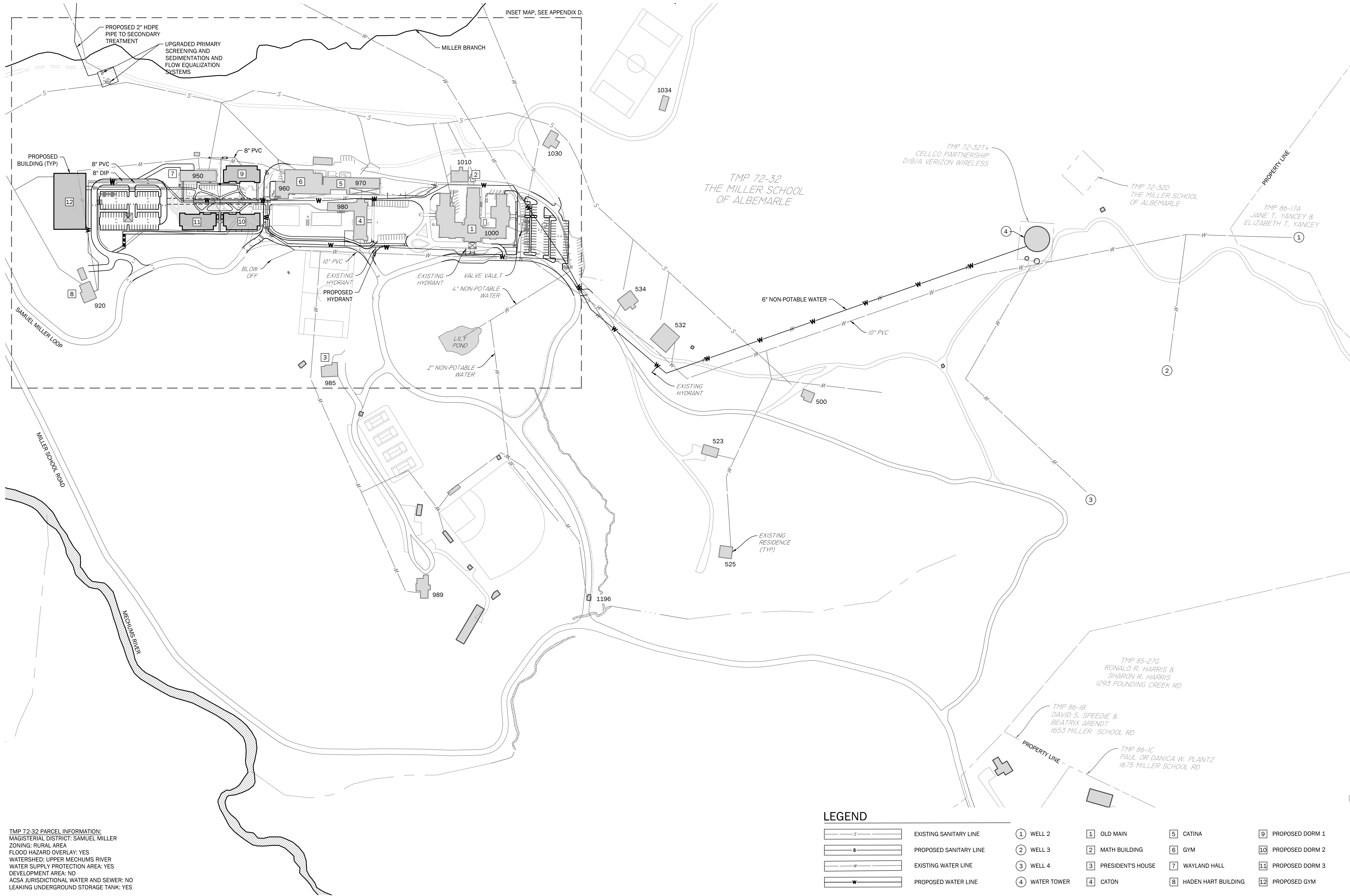
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- Borings and Test Pits
- Primary DF Areas
- Existing Drainfield laterals
- 2 ft. Elevation Contour
- NDMA
- Treatment system area



APPENDIX C. SEWER AND WATER OVERVIEW



TMP 72-32 PARCEL INFORMATION:
MAGISTERIAL DISTRICT: SAMUEL MILLER
ZONING: RURAL AREA
FLOOD HAZARD OVERLAY: YES
WATERSHED: UPPER MECHUMS RIVER
WATER SUPPLY PROTECTION AREA: YES
DEVELOPMENT AREA: NO
ACSA JURISDICTIONAL WATER AND SEWER: NO
LEAKING UNDERGROUND STORAGE TANK: YES

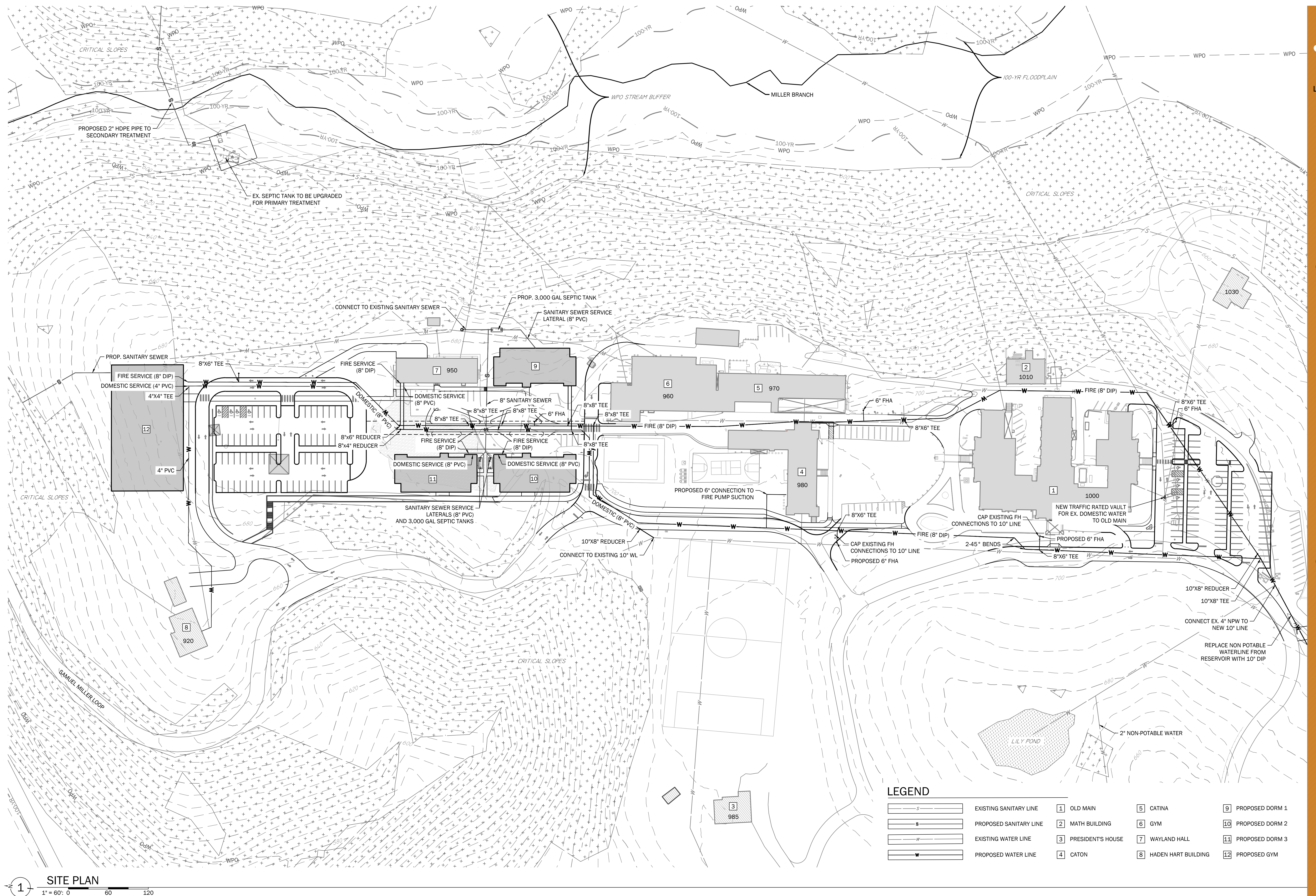
APPENDIX D. SEWER AND WATER INSET MAP



**SEWER AND WATER
MILLER SCHOOL EXPANSION**
ALBEMARLE COUNTY, VIRGINIA

9.25.2025

1



APPENDIX E. TREATMENT AND DRAINFIELD AREAS

