WRIGHT-PIERCE
Engineering a Better Environment

75 Washington Avenue, Suite 202
Portland, ME 04101
Phone: 207.761.2991 | Fax: 207.761.2978
www.wright-pierce.com

November 1, 2019
W-P Project No. 13926E

Mark Arienti, PE
Town Engineer
Town of Windham
8 School Road
Windham, ME 04062

Subject: Windham Wastewater Planning
Manchester Drive Site Investigation Results

Dear Mr. Arienti:

We have completed the preliminary investigation of the Manchester Drive site's suitability for subsurface disposal via drip dispersal technology, using the guidelines of the Maine Subsurface Wastewater Disposal Rules (10-144 Chapter 241). We have attached the HHE200 and HHE220 forms and mounding and transmissivity analyses to review and share with the DEP and Portland Water District. A complete list of attached documents is provided at the end of this letter. We have combined all documents into a single PDF file for electronic transmittal.

Site Description

The Manchester Drive site is 14 acres in extent, with approximately 7 acres suitable for effluent disposal. The ground surface slopes to the south, dropping about 10 feet in elevation across the site. The water table also slopes to the south and is estimated to drop about 3.5 feet in elevation across the site, based on water level data from two existing USGS monitoring wells. Available soils mapping and site-specific test pits indicate that the surficial soils are largely loamy sands with greater than 6 feet of unsaturated soils, which are generally well-suited for effluent disposal projects. The site is primarily wooded with developing forest.

Flow Basis

The Town has identified wastewater disposal needs in previous tasks. The most recent discussions have focused on the plan for treatment and disposal of 576 EDU's over a 40-year horizon (Wright-Pierce Comprehensive Wastewater Management Plan, May 2018). This is equivalent to a maximum month flow of 100,000 gallons per day (gpd). We anticipate that the basis for the grounwater discharge permit will be maximum monthly flow. This was the flow basis for modeling continuous flow into the ground when sizing the disposal system and conducting mounding and transmissivity analyses. However, for design of the system, we would envision the disposal system would be sized for the maximum daily flow which would be higher.

Sizing the Disposal Area per the Subsurface Rules

The Manchester Drive site was analyzed for subsurface disposal of treated wastewater effluent (30/30 mg/L BOD/TSS) and following the Maine Subsurface Disposal Rules (Rules) and the Oakson, Inc. Perc-Rite Drip Dispersal Design Guide for Advanced Treatment Effluent (Design Guide). The site investigation by Albert Frick Associates Inc. identified soils as "medium" for sizing disposal system for treated effluent, per the Rules. Following the Design Guide for the soils in Windham, the drip dispersal tubing design criteria is 1.02 gpd per linear foot of tubing. For Windham, at 100,000 gpd this requires 102,000 linear feet of tubing. The Design Guide suggests spacing the tubing between 1 foot and 2 feet on-center (OC). Spacing the tubing between 1 to 2 feet on-center results in 1 to 2 sf of land area per linear foot of tubing, or 102,000 square feet to 204,000 sf of disposal area for the tubing. The Manchester Drive Site has 301,000 sf of potential disposal area available, therefore this site is large enough for drip dispersal of 100,000 gpd when following the Design Guide at the most conservative spacing of 2 feet on-center.

Sizing the Disposal Area per Manufacturer Recommendation

The Perc-Rite Drip Dispersal Design Guide suggests confirming the loading rate for engineered systems with the manufacturer. For this site, Oakson has recommended a loading rate of 1.5 gpd/sf, based on their experience in other states and systems of this size. This is a higher loading rate than supported solely by the Rules described above and results in a disposal land area of 67,000 sf.

Summary of Hydrogeological Analysis

The hydrogeological analyses were completed for two disposal area sizes, 150,000 sf (per Design Guide) and 67,000 sf (per Oakson). The results of the hydrogeological analysis are attached in Appendix C.1.The hydrogeological memorandum attached in Appendix C.1 presents the results of the field investigation (test pits and infiltrometer tests), mounding, and transmissivity analyses. In summary, the infiltrometer tests confirm the ability of the soils to accept wastewater effluent over the range of loading rates used in the analyses. The mounding analysis for a disposal area of 150,000 sf and 67,000 sf indicates that the mound would be 6.4 to 7.2 feet above the seasonally high groundwater table, respectively, resulting in 2.8 to 3.6 feet of unsaturated soils below the drip dispersal tubing, respectively. This meets the minimum requirement of 2 feet of unsaturated soil per the Rules for both hydraulic loading rates. The mound is expected to dissipate downgradient from the site sufficiently to preclude the emergence of effluent-impacted groundwater within 50 feet of the larger disposal system. This meets the HHE-220 requirement of no breakout within 50 feet of the disposal system. However, the transmissivity analysis suggests that effluent-impacted groundwater will be present in the southern stormwater detention basin about 240 feet away from the disposal area.

The Manchester Drive Site is still a "go" using the approach prescribed in the Rules and Design Guide, with the exception of the southern detention pond and potential presence of effluent-impactacted groundwater.
We look forward to meeting with you, DEP and the Portland Water District to discuss the results of this investigation and the next steps. Please feel free to contact us should you have any questions or comments in the meantime.

Sincerely,
WRIGHT-PIERCE

Kyle M. Coolidge, PE
Lead Project Engineer/Project Manager
kyle.coolidge@wright-pierce.com

Enclosures

cc: *Neil Cheseldine*
Mike Giggey
Chris Dwinal

List of Attached Documents

Appendix A: HHE-220 Form

Appendix B: HHE-200 Form with attachments:

1. Letter from Albert Frick Associates, dated September 6, 2019
2. HHE-200 Form
3. Manchester Site Layout Drawing
4. Drip Dispersal Details Drawing
5. Soil Test Pit Logs by Frick
6. Historical Soil Test Pit Logs

Appendix C: Mounding and Transmissivity Analysis and Supporting Documents

1. Hydrogeologic Evaluation of the Manchester Drive Site DRAFT
2. Figure 1 Site Locus
3. Figure 2 Site Plan
4. Figure 3 Surficial Geology
5. Figure 4 NRCS Soils
6. Well Data
7. Groundwater Flow Direction Figure
8. Slug Tests Results
9. Mounding Analysis Calculations

Appendix D: Example Drip Dispersal System Operation and Maintenance Manuals

1. Example Manual with Process Descriptions and Installation Instructions
2. Example Manual with Inspection Schedule

APPENDIX A
HHE-220 Form

Maine Department of Health and Human Services
Division of Environmental Health
Subsurface Wastewater Program

DRAFT APPLICATION FOR ENGINEERED
SUBSURFACE WASTEWATER DISPOSAL SYSTEM

Please complete the following Sections. Please print or type.

Applicant/Owner

Company Name: Town of Windham

Contact Person: Mark Arienti, PE

Address: 8 School Road

Town/City: Windham State/Province: ME Zip/Postal Code: 04062

Country: United States

Telephone: (207) 894-5900 x 6124 Fax:

e-mail: mtarienti@windhammaine.us

Design Engineer

Company Name: Wright-Pierce

Contact Person: Kyle M. Coolidge, PE

Address: 11 Bowdoin Mill Island, Ste 140

Town/City: Topsham State: ME Zip Code: 04086

Telephone: (207) 319-1501 Fax: (207) 725-8721

e-mail: Kyle.Coolidge@wright-pierce.com

1. Property Location

Town/City: Windham, ME County: Cumberland

Tax Map and Lot Number: Map 18A Lot 48

Attach as ~~**"Exhibit A"**~~ **Appendix C Figure 1** a copy of the relevant section of the USGS 7.5' topographic map, if available, or 15' topographic map showing the location of the proposed engineered disposal system.

2. Project Description

Provide a brief written description of the proposal. Use a separate sheet if necessary.

The next step to developing public wastewater facilities is to locate a suitable site for subsurface disposal of wastewater effluent using the same 'go-no-go' planning approach used for previous site investigations. The Manchester Drive site was selected by the Town for further evaluation. This form (and attachments) summarize the results of evaluating this site for effluent disposal utilizing a conceptual design of drip-dispersal technology.

3. Design Flow

The design flow for this project is: __100,000__ gallons per day. Provide design flow calculations and assumptions used in the calculations. Use a separate sheet if necessary.

The Town has identified wastewater disposal needs in previous tasks. The most recent consensus is to plan for treatment and disposal of 576 EDU's over a 40-year horizon (Wright-Pierce Comprehensive Wastewater Management Plan, May 2018). This is equivalent to a maximum month flow of 100,000 gallons per day (gpd). This was the flow basis for modeling continuous flow to into the ground when sizing the disposal system and conducting mounding and transmissivity analyses.

4. Mounding Analysis

Submit as ~~**"Exhibit B"**~~ **Appendix C** an analysis of the proposed system design showing that there is adequate vertical separation between the bottom of the disposal field and any mounded water table. Include all calculations and assumptions used.

5. Transmissivity Analysis

Submit as ~~**"Exhibit C"**~~ **Appendix C** an analysis of the proposed system design showing that there are sufficient suitable soils down-gradient to prevent the effluent from surfacing within 50 feet of the disposal field. Include all calculations and assumptions used.

6. HHE-200 and Variance Form(s)

Submit as ~~**"Exhibit D"**~~ **Appendix B** a complete HHE-200 Form, and variance forms if applicable, ~~signed by a Professional Engineer~~. The design engineer may reference associated plans and soil test pit logs on pages 2 and 3 of the HHE-200 Form.

**HHE-200 to be signed and stamped upon completion of final design*

This project requires:

[ ] a First Time System Variance to the Maine Subsurface Wastewater Disposal Rules.

[ ] a Replacement System Variance to the Maine Subsurface Wastewater Disposal Rules.

[X] no variance to the Maine Subsurface Wastewater Disposal Rules.

7. **Operations and Maintenance Manual**

Submit as ~~**"Exhibit E"**~~ **Appendix D** an operations and maintenance manual for the owner with written recommendations for the operation and maintenance of the system, including inspection schedules, pumping schedules, and record keeping procedures.

8. Soil and Site Conditions

Submit as ~~**"Exhibit F"**~~ **Appendix B** soil test pit logs prepared by a licensed Site Evaluator. The test pits shall be of sufficient number to accurately describe the site conditions under the proposed disposal area and the down gradient fill extension.

9. Plans

Submit as ~~**"Exhibit G"**~~ **Appendix B** plans for the proposed engineered disposal system meeting provisions of Section 1102 of the Maine Subsurface Wastewater Disposal Rules. Two sets of plans are required, or one set of plans and one set of copies no larger than 11" x 17". Plans may be submitted for review purposes on a floppy disk or compact disc in *AutoDesk* AUTOCAD *.dwg format (rev. 14 or lower), but a signed and stamped hard copy will be required upon final approval.

~~The plans shall also specify the latitude and longitude of the center of the disposal area(s), expressed as degrees, minutes, and seconds. If this data is obtained from an electronic GIS device, provide the device's margin of error.~~

**center of disposal area to be provided during final design*

10. Review Fee

Submit a check or money order in the amount of $100.00 U.S. made payable to the Treasurer of the State of Maine.

I, _KYLE M. COOLIDGE__, am the design engineer for the subject design.
(print name)

I state that the information submitted is correct to the best of my knowledge and understand that any falsification is reason for the Department to deny the project.

_____	_____11573_____	___October 11, 2019_
Signature of Design Engineer	P.E. License Number	Date

Please note: To ensure a timely review of the project, make sure that the application is complete when submitted to the Division of Health Engineering.

Incomplete applications can not be processed, and will be returned to the design engineer for completion, unprocessed.

APPENDIX B
HHE-200 Form with Attachments

APPENDIX B-1
Letter from Albert Frick Associates, dated September 6, 2019

Albert Frick Associates, Inc.
Environmental Consultants
380B Main Street Gorham, ME 04038
T: (207) 839-5563 F: (207) 839-5564
www.albertfrick.com info@albertfrick.com

Brady Frick, LSE, President
Albert Frick, CSS, LSE
Christopher Coppi, CWS, LSE
Bryan Jordan, LSE
Matthew Logan, LSE
Jamie Latorre, Office Manager

November 1, 2019

Kyle M. Coolidge, P.E.
Project Manager/Lead Project Engineer
Wright-Pierce
75 Washington Ave, Suite 202
Portland, ME 04101

RE: Site Investigation for Subsurface Wastewater Disposal (100,000 gallons per day), Windham, ME

Dear Kyle:

I have completed the preliminary soil testing at the above referenced property on 8/15/19. The purpose of the investigation was to determine the suitability of the parcel, for on-site subsurface wastewater disposal. It is our understanding that the design flow of the proposed leach field will be approximately 100,000 gallons per day and it is the Town's preference to utilize a drip dispersal system such as *Perc-Rite*.

The soil is suitable in the area of TP-100 through TP-306, as defined by the *State of Maine Subsurface Wastewater Disposal Rules*. The soil profile conditions were found to be 5 B (medium sizing) on the easterly side of the property. The size of this suitable area is approximately 6.94 acres (see Septic Suitability Site Plan attached). Based on the 1.5 gallons per day/square foot sizing provided by *Perc-Rite,* the property should have sufficient area for wastewater disposal.

I have also enclosed a *Subsurface Wastewater Disposal Application* (HHE-200), as well as a drip dispersal detail. Both documents are intended for planning purposes only. A signed HHE-200 form is needed to obtain a permit once the final engineered design has been completed. Since we are still in the preliminary testing & planning phase of the project, the attached unsigned HHE-200 is not valid. The attached drip dispersal detail is conceptual and will change based on the final design. This document is intended to illustrate the general concept of the product.

Once the project moves into the design phase, pump stations, septic tanks and advanced treatment unit capacities have to be determined. Wastewater strengths of the effluent discharge will need to be less then 30mg/l for both Total Suspended Solids & Biochemical Oxygen Demand in order to utilize the drip dispersal system.

Please contact me if you have any questions or additional matters for discussion.

Respectfully,

Brady Frick, LSE

Enc. Soil Profile Logs
Septic Suitability Site Plan
Perc-Rite Detail Sheet
Unsigned HHE-200 Form

APPENDIX B-2
HHE-200 Form

SUBSURFACE WASTEWATER DISPOSAL SYSTEM APPLICATION

Maine Dept. Health & Human Services
Div of Environmental Health , 11 SHS
(207) 287-5672 FAX (207) 287-3165

PROPERTY LOCATION

City, Town, or Plantation	WINDHAM
Street or Road	MANCHESTER DRIVE & BASIN ROAD
Subdivision, Lot #	

>>CAUTION: LPI APPROVAL REQUIRED<<

Town/City _____ Permit #_____

Date Permit Issued __/__/__ Fee $ _____ Double Fee Charged [ ]

_____ LPI # _____

Local Plumbing Inspector Signature

OWNER/APPLICANT INFORMATION

Name (last, first, MI) ■ Owner ☐ Applicant

TOWN OF WINDHAM

Mailing Address of ■ Applicant	c/o KYLE COOLIDGE WRIGHT-PIERCE 75 WASHINGTON AVE; SUITE 202 PORTLAND, ME 04101
Daytime Tel. #	761-2991

The Subsurface Wastewater Disposal System *shall not* be installed until a Permit is issued by the Local Plumbing Inspector. The Permit shall authorize the owner or installer to install the disposal system in accordance with this application and the Maine Subsurface Wastewater Disposal Rules.

Municipal Tax Map # 18A Lot # PORTION OF 48

OWNER OR APPLICANT STATEMENT

I state and acknowledge that the information submitted is correct to the best of my knowledge and understand that any falsification is reason for the Department and/or Local Plumbing Inspector to deny a permit.

_____ _____
Signature of Owner/Applicant Date

CAUTION: INSPECTION REQUIRED

I have inspected the installation authorized above and found it to be in compliance with the Subsurface Wastewater Disposal Rules Application.

_____ (1st) Date Approved

_____ _____
Local Plumbing Inspector Signature (2nd) Date Approved

PERMIT INFORMATION

TYPE OF APPLICATION

■ 1. First Time System
☐ 2. Replacement System
Type Replaced: _____
Year Installed: _____
☐ 3. Expanded System
☐ a. <25% Expansion
☐ b. >25% Expansion
☐ 4. Experimental System
☐ 5. Seasonal Conversion

THIS APPLICATION REQUIRES

■ 1.No Rule Variance
☐ 2.First Time System Variance
☐ a. Local Plumbing Inspector Approval
☐ b. State & Local Plumbing Inspector Approval
☐ 3.Replacement System Variance
☐ a. Local Plumbing Inspector Approval
☐ b. State & Local Plumbing Inspector Approval
☐ 4.Minimum Lot Size Variance
☐ 5.Seasonal Conversion Permit

DISPOSAL SYSTEM COMPONENTS

☐ 1. Complete Non-Engineered System
☐ 2. Primitive System(graywater & alt toilet)
☐ 3. Alternative Toilet, specify: _____
☐ 4. Non-Engineered Treatment Tank (only)
☐ 5. Holding Tank, _____ gallons
☐ 6. Non-Engineered Disposal Field (only)
☐ 7. Separated Laundry System
■ 8. Complete Engineered System(2000gpd+)
☐ 9. Engineered Treatment Tank (only)
☐ 10. Engineered Disposal Field (only)
■ 11. Pre-treatment, specify: TO BE DETERMINED
☐ 12. Miscellaneous components
TERTIARY PRE-TREATMENT TO ACHIEVE EFFLUENT QUALITY OF LESS THAN 30mg/l BOD AND LESS THAN 30mg/l OF TSS

SIZE OF PROPERTY

14 +/- ☐ SQ. FT. ■ ACRES

DISPOSAL SYSTEM TO SERVE

☐ 1. Single Family Dwelling Unit, No. of Bedrooms: _____
☐ 2. Multiple Family Dwelling, No of Units: _____
■ 3. Other: NORTH WINDHAM BUSINESSES (specify)

Current Use ☐ Seasonal ☐ Year Round ■ Undeveloped

SHORELAND ZONING

☐ Yes ■ No

TYPE OF WATER SUPPLY

☐ 1. Drilled Well ☐ 2. Dug Well ☐ 3. Private
■ 4. Public ☐ 5. Other:

DESIGN DETAILS (SYSTEM LAYOUT SHOWN ON PAGE 3)

TREATMENT TANK S

TO BE DETERMINED BY ENGINEER
■ 1. Concrete
■ a. Regular
☐ b. Low Profile
☐ 2. Plastic
☐ 3. Other: _____
CAPACITY: 150,000 GAL.
TO BE DETERMINED BY ENGINEER

DISPOSAL FIELD TYPE & SIZE

☐ 1. Stone Bed ☐ 2. Stone Trench
■ 3. Proprietary Device
☐ a. Cluster array ■ c. Linear
■ b. Regular ☐ d. H-20 loaded
☐ 4. Other: _____
SIZE: 67,000 ■ sq. ft. ☐ lin. ft.
TO BE DETERMINED BY ENGINEER

GARBAGE DISPOSAL UNIT

■ 1. No ☐ 2. Yes ☐ 3. Maybe
If Yes or Maybe, specify one below:
☐ a. Multi-compartment tank
☐ b. _____ tanks in series
☐ c. Increase in tank capacity
☐ d. Filter on tank outlet

DESIGN FLOW

100,000 gallons per day
BASED ON:
☐ 1. Table 4A (dwelling unit(s))
■ 2. Table 4C (other facilities)
SHOW CALCULATIONS for other facilities

NORTH WINDHAM BUSINESSES
(MIXED USE)

☐ 3. Section 4G (meter readings)
ATTACH WATER-METER DATA

SOIL DATA & DESIGN CLASS

PROFILE 5 CONDITION B

at Observation Hole # TP 302
Depth >48 "
of Most Limiting Soil Factor

DISPOSAL FIELD SIZING

FINAL SIZING TO BE DETERMINED

■ 1. Medium - 2.6 sq.ft./gpd
☐ 2. Medium-Large - 3.3 sq.ft./gpd
☐ 3. Large - 4.1 sq.ft./gpd
☐ 4. Extra-Large - 5.0 sq.ft./gpd

EFFLUENT/EJECTOR PUMP

☐ 1. Not required
☐ 2. May be required
■ 3. Required
Specify only for engineered systems:
TO BE DETERMINED BY ENGINEER
DOSE: _____ gallons

LATITUDE AND LONGITUDE

at center of disposal area
Lat. N43 d 50 m 10.20 s
Lon. W70 d 26 m 50.58 s
if g.p.s., state margin of error

SITE EVALUATOR STATEMENT

I Certify that on 8/13/19 (date) I completed a site evaluation on this property and state that the data reported is accurate and that the proposed sytem is in compliance with the Subsurface Wastewater Disposal Rules (10-144A CMR 241).

Site Evaluator Signature	352 SE #	Date
BRADY A. FRICK		BRADY@ALBERTFRICK.COM
Site Evaluator Name Printed	Telephone Number	E-mail Address
Professional Engineer Signature	PE #	Date
Professional Engineer Name Printed	Telephone Number	E-mail Address

Note: Changes to or deviations from the design should be confirmed with the Site Evaluator

SUBSURFACE WASTEWATER DISPOSAL SYSTEM APPLICATION

Maine Department of Human Services
Division of Health Engineering, Station 10 SHS
(207) 287-5672 FAX (207) 287-4172

Town, City, Plantation	Street, Road Subdivision	Owner's Name
WINDHAM	MANCHESTER DRIVE & BASIN ROAD	TOWN OF WINDHAM

SITE PLAN — Scale 1" = _____ Ft. or as shown

SITE LOCATION PLAN (Attach Map from Maine Atlas for New System Variance)

SEE USGS
MAP ATTACHED

SEE SEPTIC SUITABILITY
SITE PLAN ATTACHED

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole _____ ☐ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)	Texture	Consistency	Color	Mottling
0				
10				
20	SEE SOIL PROFILE LOGS ATTACHED			
30				
40				
50				

Soil Classification	Slope	Limiting Factor	
Profile _____ Condition _____	_____ %	_____ "	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

Observation Hole _____ ☐ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)	Texture	Consistency	Color	Mottling
0				
10				
20				
30				
40				
50				

Soil Classification	Slope	Limiting Factor	
Profile _____ Condition _____	_____ %	_____ "	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

Site Evaluator Signature — 352 SE # — Date

Professional Engineer Signature — PE # — Date

ALBERT FRICK ASSOCIATES – 380-B MAIN STREET, GORHAM, MAINE 04038 – (207) 839-5563

SUBSURFACE WASTEWATER DISPOSAL SYSTEM APPLICATION

Maine Department of Human Services
Division of Health Engineering, Station 10 SHS
(207) 287-5672 FAX (207) 287-4172

Town, City, Plantation	Street, Road, Subdivision	Owner's Name
WINDHAM	MANCHESTER DRIVE & BASIN ROAD	TOWN OF WINDHAM

SUBSURFACE WASTEWATER DISPOSAL PLAN — SCALE 1" = ____ FT.

SEE SEPTIC SUITABILITY
SITE PLAN ATTACHED

0 10 20
GRAPHIC SCALE

FILL REQUIREMENTS
Depth of Fill (Upslope) : ____
Depth of Fill (Downslope) : ____
DEPTHS AT CROSS-SECTION (shown below)

CONSTRUCTION ELEVATIONS
Finished Grade Elevation
Top of Distribution Pipe or Proprietary Device
Bottom of Disposal Area
SEE DETAIL BELOW

ELEVATION REFERENCE POINT
Location & Description
Reference Elevation is: 0.0" or _____

DISPOSAL AREA CROSS SECTION
SCALE:
VERTICAL: 1" =
HORIZONTAL: 1" =

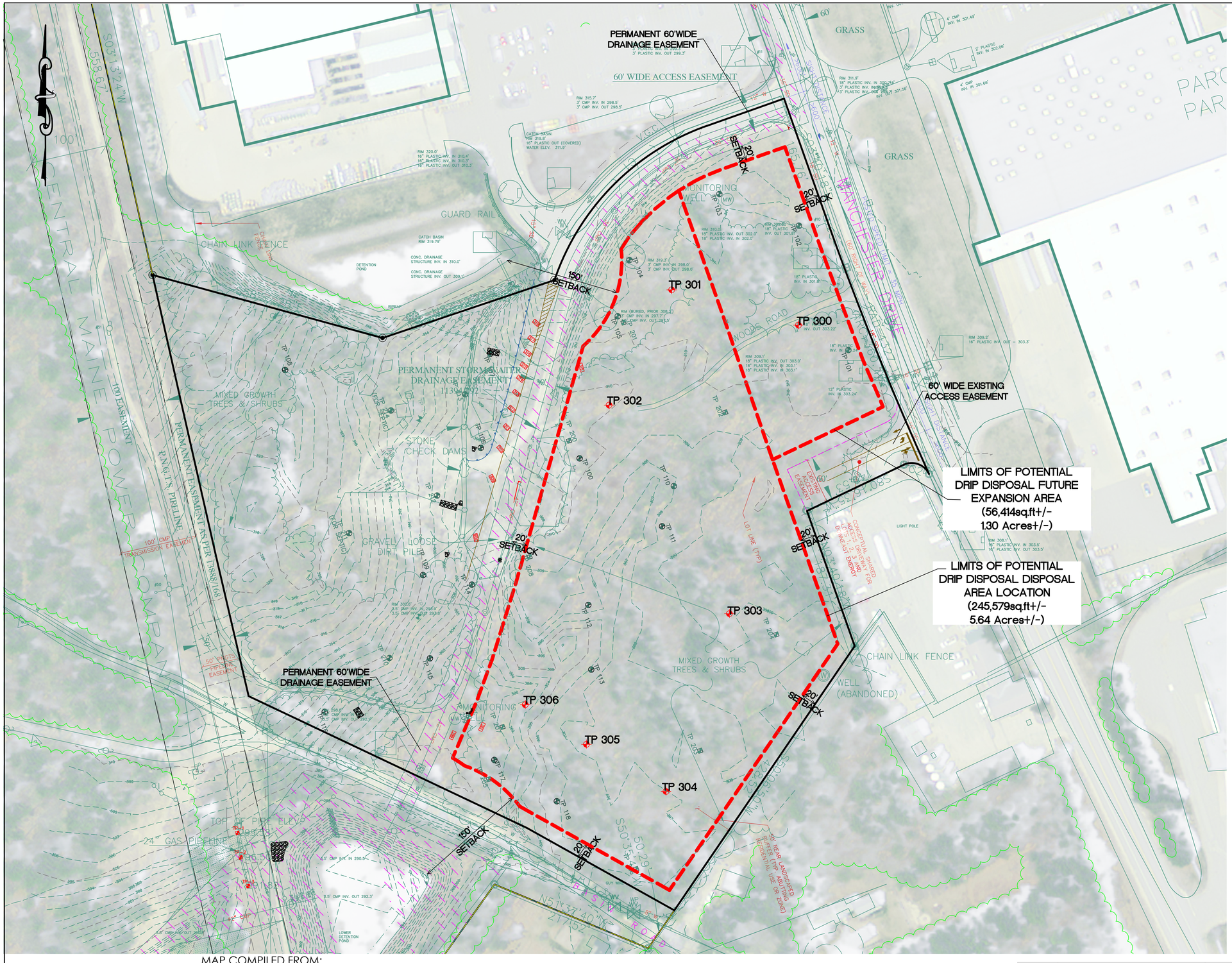
SEE PERC-RITE
DETAIL SHEET ATTACHED

Site Evaluator Signature — 352 SE # — Date

Professional Engineer Signature — PE # — Date

ALBERT FRICK ASSOCIATES – 380-B MAIN STREET, GORHAM, MAINE 04038 – (207) 839-5563

APPENDIX B-3
Manchester Site Layout Drawing



LEGEND

- POTENTIAL DRIP DISPOSAL AREAS
- PROPOSED PROPERTY BOUNDARY
- EASEMENT AREAS
- TP 100 SOIL TEST PIT (100 SERIES) EXCAVATED ON 10/4/2006)
- TP 213 SOIL TEST PIT (200 SERIES) EXCAVATED ON 2/11/2008)
- TP 205 SOIL TEST PIT (200 SERIES) EXCAVATED ON 2/11/2008)
- TP 305 SOIL TEST PIT (300 SERIES) EXCAVATED ON 8/15/2019)

NOTES:

1. PERC-RITE DRIP DISPERSAL MANUFACTURER RECOMMENDS 1.5 GPD/SF LOADING FACTOR. THIS RESULTS IN A MINIMUM DISPERSAL AREA OF 67,000 SF OF CLEARED AREA REQUIRED FOR 100,000 GPD.
2. ACTUAL LOCATION OF TUBING TO BE DETERMINED DURING DESIGN PROCESS WITHIN THE LIMITS OF POTENTIAL DRIP DISPOSAL AREA
3. ADJACENT PROPERTIES WITHIN 300' ARE ON PUBLIC WATER PER CONVERSATION WITH PORTLAND WATER DISTRICT
4. AFTER FINAL LOCATION OF DISPOSAL AREA IS DETERMINED, VERIFY NO POTABLE WELLS EXIST WITHIN 300' OF REVISED DISPOSAL AREA

GRAPHIC SCALE

60 0 30 60 120

(IN FEET)
1 inch = 60 ft.

MAP COMPILED FROM:

*PROPERTY BOUNDARY TRACED FROM 2007 MANCHESTER COMMERCIAL SUBDIVISION PLAN BY GORRILL PALMER CONSULTING ENGINEERS, INC.
*TOWN OF WINDHAM TAX MAP
*AERIAL PHOTOGRAPH FROM THE MAINE OFFICE OF GIS
*2' TOPOGRAPHIC CONTOURS FROM THE MAINE OFFICE OF GIS
*ON SITE LOCATIONS UTILIZING TRIMBLE GEO7X HANDHELD UNIT WITH SUBMETER ACCURACY

DATE:	REVISIONS:
10/10/19	UPDATED NOTES

SEPTIC SUITABILITY SITE PLAN
PREPARED FOR
WRIGHT PIERCE
MANCHESTER DRIVE AND BASIN ROAD
WINDHAM, MAINE

Albert Frick Associates, Inc.
Environmental Consultants
Gorham, Maine

Drawn By: B.J. | Checked By: B.F.
Date: 8/14/19 | Scale: 1" = 60'

APPENDIX B-4
Drip Dispersal Details Drawing

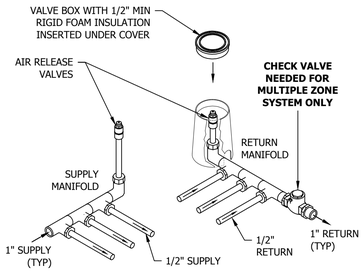
GENERAL CONSTRUCTION NOTES:

1. The system shall not be installed in wet or frozen soils.
2. Do not park, drive large equipment, or store materials on the dispersal area. No activity should occur on the dispersal area other than the minimum required to install the system.
3. All installation and construction techniques shall conform to the state and local codes pertaining to on-site wastewater systems and the permit for the site.
4. If site conditions are determined to require the installation of the system to deviate from the design plans, all work shall stop immediately and the designer and inspector shall be notified. Any ongoing work shall be the sole responsibility of the contractor.
5. Drip tubing may be installed with a vibratory plow, a static plow, a narrow trencher (< 6" wide), by hand trenching, or by scarifying the surface and bedding the drip tubing in clean sand meeting the requirements for fill material in the state code. For sand fill systems, cover consisting of 2" of the same sand and then topsoil meeting the approved depth requirement shall be provided.
6. All drip tubing is to be installed parallel to the contour.
7. Air release valves shall be placed below the ground surface in an insulated valve box but at an elevation above the highest drip line in that particular zone.
8. Vegetative cover must be replaced for installations where it is removed or buried during installation.
9. All cutting of rigid pvc pipe, flexible pvc, and drip tubing of size 2" or smaller shall be accomplished with pipe cutters. No sawing is allowed.
10. All rigid PVC pipe, flexible PVC pipe and drip tubing shall have the ends covered with duct tape after cutting to prevent construction debris from entering the pipe.
11. Prior to gluing, all joints shall be inspected for and cleared of any debris. All joints shall be cleaned and primed with pvc primer prior to being glued.
12. All PVC pipe and fittings shall be sch 40.
13. Whenever possible, all force mains shall be tested for leaks prior to being back- filled by pressurizing the system and observing for leakage.
14. The hydraulic unit shall be placed on top of the septic/treatment tank, pump chamber, or on a bed of 4" - 6" thick 3/4" gravel in a location within 30' of the pump.
15. If standing water is a problem in the vicinity of the hydraulic unit, a screened drain to daylight is required.
16. Electrician to provide separate circuits for the pump and controls/alarm, or as required by state and local codes.
17. All conduit entering the control panel shall be sealed at both ends to prevent condensation or gases inside the panel.

COLD CLIMATE NOTES:

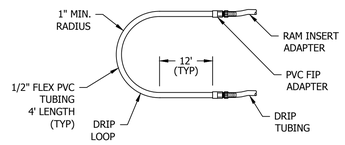
1. All attempts should be made to place the hydraulic unit in a location with an open southern exposure for warming purposes.
2. All pipes entering and leaving the hydraulic unit shall elbow vertically down 90 degrees to a depth below the frost line prior to extending away from the unit horizontally.
3. The supply and return lines shall be installed below the frost line. When this is not possible, rigid foam insulation (min 1" thick) shall be placed over those pipes that are above the frost line.
4. The vertical sections of pipe that travel through the frost zone and connect the supply and return lines to the manifolds shall be insulated sch 40 pvc pipe. Insulation shall consist of foam pipe wrap insulation and 1" rigid foam insulation strips made into a box. (see insulation detail)
5. Foil wrap insulation shall be placed over the supply/return manifolds and loop connectors so that at least 1' of insulation extends each direction beyond the fittings. (see insulation detail)
6. Air release valve enclosures shall be insulated with bagged Styrofoam peanuts, foil wrap insulation, and rigid foam insulation inside the lid. (see insulation detail)
7. All loops connecting drip runs shall be slightly elevated (minimum 1" - 2") so that they drain into the drip tubing after the pump shuts off. It is the contractor's responsibility to ensure that these loops stay elevated during and after the loops are backfilled.
8. Dense vegetative cover is to be established over the supply trench, return trench, manifolds, and drip tubing prior to the first exposure to freezing temperatures. If vegetation cannot be established then the entire drip dispersal field is to be covered with a thick layer (minimum 6") of mulch, straw/hay, or frost blanket until such turf cover is established.
9. Vegetation height over the drip dispersal area should be a minimum of 4" - 6" throughout the winter months.

NOTES:
1. ALL RIGID AND FLEXIBLE PVC ARE TO BE LOCATED ABOVE THE DRIP LINE TO ALLOW THE PIPES TO DRAIN.
2. THE AIR RELEASE VALVES SHALL BE PLACED AT THE HIGHEST POINT ON THE SUPPLY AND RETURN LINE FOR EACH ZONE.
3. EACH ZONE TO HAVE TWO AIR RELEASE VALVES.
4. RETURN LINES TO BE CONNECTED TO A COMMON RETURN LINE.

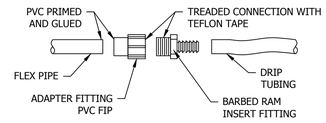


TYPICAL MANIFOLD CONNECTION
(NOT TO SCALE)

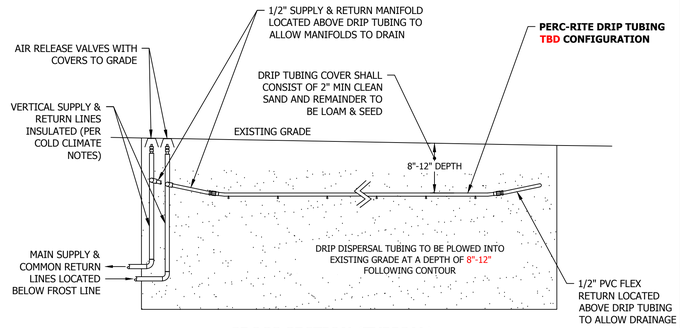
NOTE:
ALL DRIP LOOPS ARE TO BE LOCATED 2" ABOVE THE DRIP LINE TO ALLOW FOR THE LOOPS TO DRAIN.



TYPICAL DRIP LOOP CONNECTION
(NOT TO SCALE)



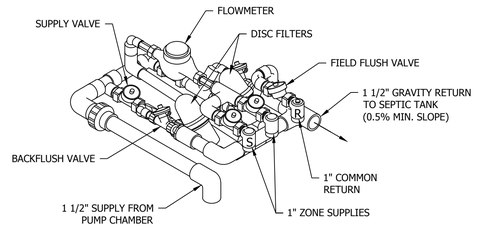
CONNECTIONING DRIP TUBING TO FLEXIBLE PVC PIPE



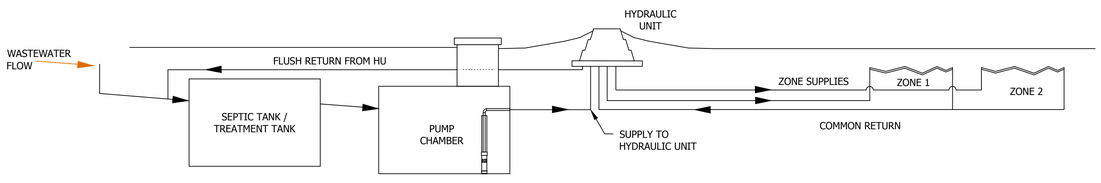
CROSS SECTION (TYPICAL)
PERC-RITE FIELD (TBD BY ENGINEER)
(NOT TO SCALE)

Note: All Perc-Rite components shall be obtained from Oakson, Inc, Gloucester, MA., 978-282-1322

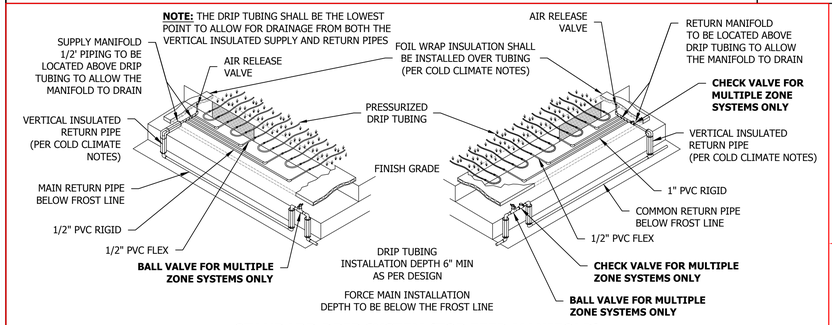
PERC-RITE DRIP TUBING TBD



PERC-RITE HYDRAULIC UNIT (15 GPM)
(NOT TO SCALE)



TYPICAL SYSTEM HYDRAULIC PROFILE
(NOT TO SCALE)

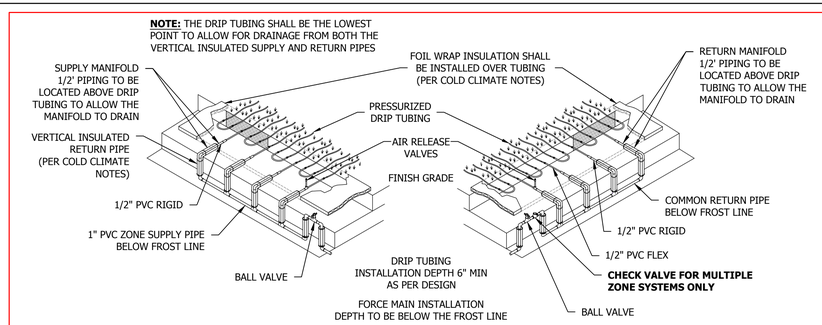


STANDARD DRIP SYSTEM (TOP FEED MANIFOLD)
(NOT TO SCALE)

DESIGN NOTES:
1. THIS SHEET IS BEING PROVIDED TO ILLUSTRATE THE GENERAL CONCEPT OF DRIP DISPERSAL.
2. THIS SHEET IS INTENDED FOR PLANNING PURPOSES ONLY. CERTAIN DETAILS SHOWN MAY NOT BE RELEVANT TO THE FINAL DESIGN. FINAL DETAILS WILL BE PROVIDED BY PERC-RITE

EITHER/OR

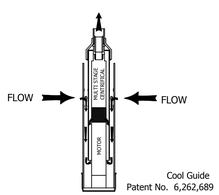
(TBD BY ENGINEER)



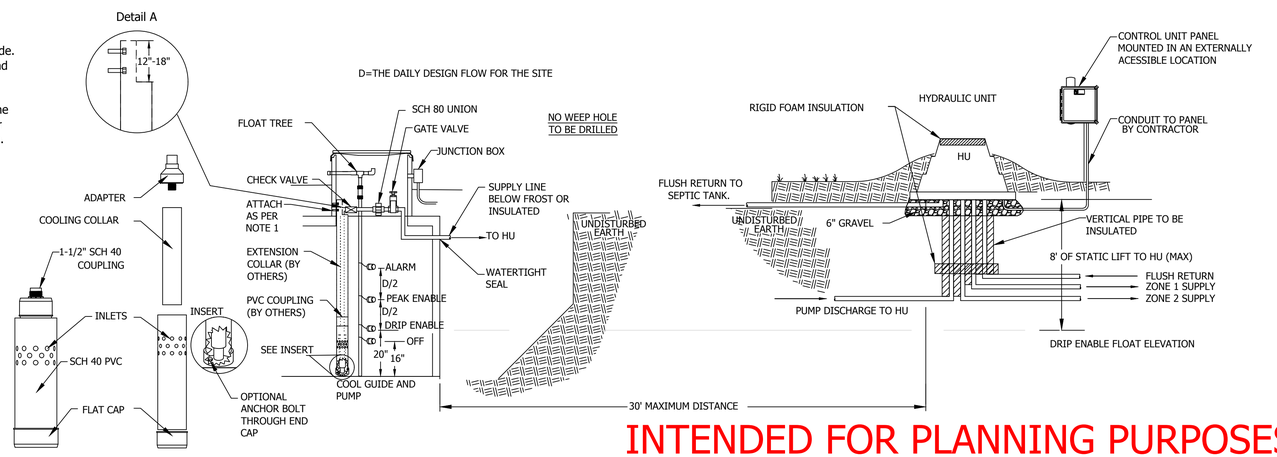
STANDARD DRIP SYSTEM (SIDE FEED MANIFOLD)
(NOT TO SCALE)

INSTALLATION INSTRUCTIONS:

1. Measure the distance from the bottom of the tank to 6" down from the top of the riser. Cut the extension pipe (by others) to the length necessary to reach this height. Cut half of the pipe down 12" to 18" away from the top of the pipe for a pump discharge pipe and attach to riser. (see detail A)
2. Glue the extension coupling (by others) to the extension pipe and to the cool guide.
3. For reuse of existing concrete pump chambers: glue on the cool guide flat cap and place the cool guide firmly in the bottom of the tank. Attach the extension to the riser with the anchors as shown.
4. For use in new concrete pump chambers: anchor the flat cap to the bottom of the tank in the proper location to hold the cool guide and extension. The cap may or may not be glued to the device. Attach the extension with the anchors as shown.
5. Place the pipe dope on the cool guide adapter threads and thread them into the pump discharge.
6. Attach cooling collar to adapter with set screw provided.
7. Glue pipe into flow collar and with pump attached, lower into the guide tube.
8. Attach to discharge pipe, valves, and connect electrical and specified.



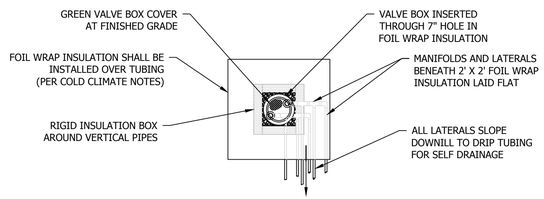
PERC-RITE HYDRAULIC UNIT (15 GPM)
(NOT TO SCALE)



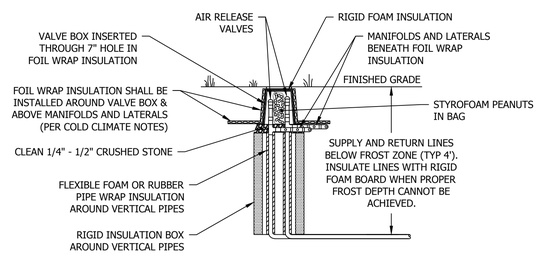
TYPICAL PUMP TANK & HYDRAULIC UNIT DETAIL
(NOT TO SCALE)

INTENDED FOR PLANNING PURPOSES ONLY

PERC-RITE DETAIL SHEET



TOP VIEW



CROSS SECTION

INSULATION DETAIL
(NOT TO SCALE)

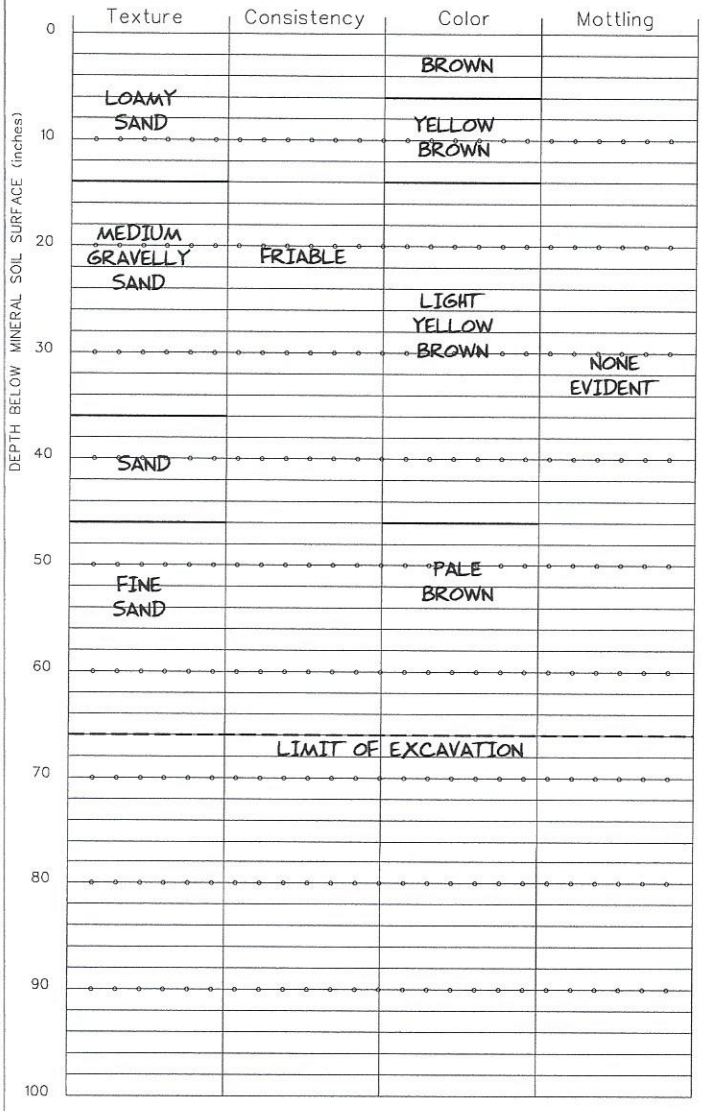
APPENDIX B-5
Soil Test Pit Logs by Frick

Town, City, Plantation	Street, Road Subdivision	PREPARED FOR Owner's Name
WINDHAM	MANCHESTER DRIVE AND BASIN ROAD	WRIGHT-PIERCE

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP 300 ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil

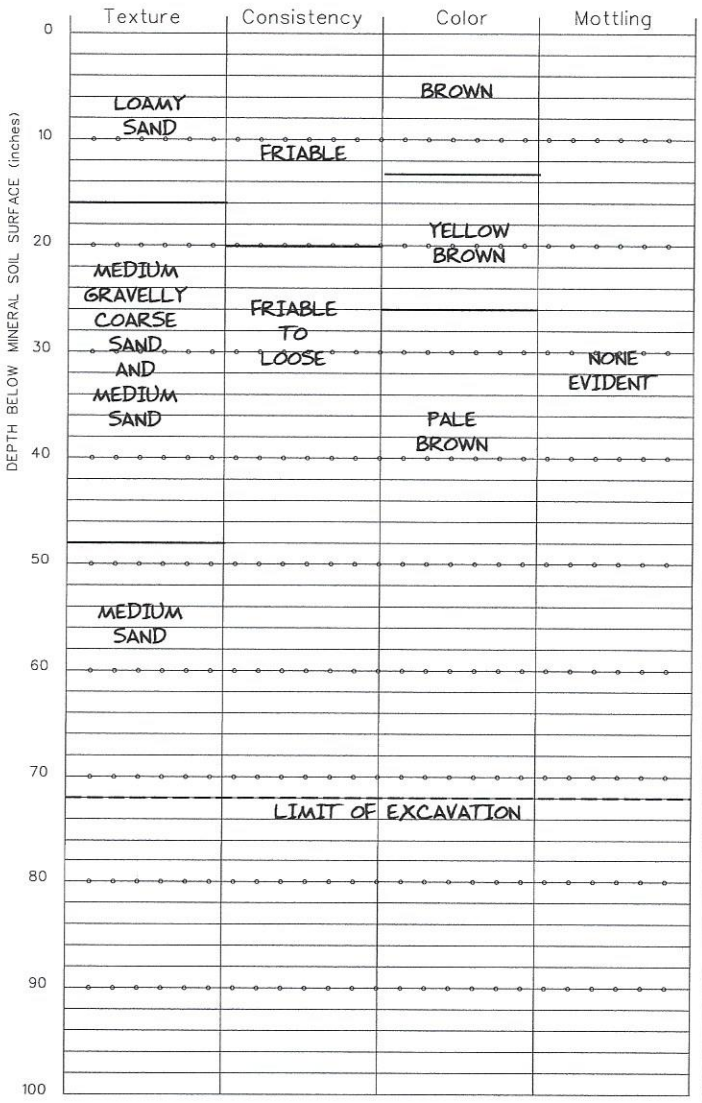


Soil Classification		Slope	Limiting Factor	
5 (Profile)	B (Condition)	0-3 %	_____"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

Soil Series Name:	Drainage Class:	Hydrologic Group:

Observation Hole TP 301 ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil



Soil Classification		Slope	Limiting Factor	
5 (Profile)	B (Condition)	0-3 %	_____"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

Soil Series Name:	Drainage Class:	Hydrologic Group:

BAZ

Site Evaluator/Soil Scientist Signature

352

SE/ CSS #

8/15/19

Date

ALBERT FRICK ASSOCIATES – 380-B MAIN STREET GORHAM, MAINE 04038 – (207) 839-5563

Town, City, Plantation	Street, Road Subdivision	PREPARED FOR Owner's Name
WINDHAM	MANCHESTER DRIVE AND BASIN ROAD	WRIGHT-PIERCE

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP 302 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)	Texture	Consistency	Color	Mottling
0–10	LOAMY SAND	FRIABLE	BROWN	
10–20			DARK BROWN	
20–30			YELLOW BROWN	NONE EVIDENT
30–40	GRAVELLY MEDIUM SAND	LOOSE	PALE BROWN	
40–50	SAND			
50–60		LIMIT OF EXCAVATION		
60–100				

Soil Classification	Slope	Limiting Factor	Ground Water / Restrictive Layer / Bedrock / Pit Depth
5 (Profile) B (Condition)	0-3 %	"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

Soil Series Name:	Drainage Class:	Hydrologic Group:

Observation Hole TP 303 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)	Texture	Consistency	Color	Mottling
0			BROWN	
			DARK YELLOW BROWN	
10	LOAMY SAND	FRIABLE	LIGHT YELLOW BROWN	
20			PALE BROWN	
30	GRAVELLY MEDIUM SAND	LOOSE		NONE EVIDENT
40				
50	FINE SAND			
60		LIMIT OF EXCAVATION		
70–100				

Soil Classification	Slope	Limiting Factor	Ground Water / Restrictive Layer / Bedrock / Pit Depth
5 (Profile) B (Condition)	0-3 %	"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

Soil Series Name:	Drainage Class:	Hydrologic Group:

BJA 21 — Site Evaluator/Soil Scientist Signature

352 — SE/ CSS *

8/15/19 — Date

ALBERT FRICK ASSOCIATES – 380-B MAIN STREET GORHAM, MAINE 04038 – (207) 839-5563

Town, City, Plantation	Street, Road Subdivision	PREPARED FOR Owner's Name
WINDHAM	MANCHESTER DRIVE AND BASIN ROAD	WRIGHT-PIERCE

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP 304 ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)	Texture	Consistency	Color	Mottling
0–10	LOAMY SAND	FRIABLE	BROWN	
10–20	GRAVELLY SAND	LOOSE	YELLOW BROWN; LIGHT YELLOW BROWN	NONE EVIDENT
20–30	SAND		PALE BROWN	
30–70				
	LIMIT OF EXCAVATION			

Soil Classification	Slope	Limiting Factor	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth
5 Profile / B Condition	0-3 %	_____"	

Soil Series Name:	Drainage Class:	Hydrologic Group:

Observation Hole TP 305 ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)	Texture	Consistency	Color	Mottling
0–10	LOAMY SAND	FRIABLE	BROWN	
10–20			LIGHT YELLOW BROWN	
20–30	GRAVELLY SAND	LOOSE	MIXED LIGHT YELLOW BROWN AND PALE BROWN	NONE EVIDENT
30–70	SAND			
	LIMIT OF EXCAVATION			

Soil Classification	Slope	Limiting Factor	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth
5 Profile / B Condition	0-3 %	_____"	

Soil Series Name:	Drainage Class:	Hydrologic Group:

BA-21

Site Evaluator/Soil Scientist Signature

352

SE/ CSS #

8/15/19

Date

ALBERT FRICK ASSOCIATES – 380-B MAIN STREET GORHAM, MAINE 04038 – (207) 839-5563

Town, City, Plantation	Street, Road Subdivision	PREPARED FOR Owner's Name
WINDHAM	MANCHESTER DRIVE AND BASIN ROAD	WRIGHT-PIERCE

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP 306 ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	LOAMY SAND	FRIABLE	BROWN	
10–20			YELLOW BROWN	
20–30	SAND WITH COARSE SAND LENSES	LOOSE	PALE BROWN	NONE EVIDENT
30–40				
40–50				
50–60				
60–70		LIMIT OF EXCAVATION		
70–80				
80–90				
90–100				

Soil Classification	Slope	Limiting Factor	
5 (Profile) B (Condition)	0-3 %	_____"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

Soil Series Name:	Drainage Class:	Hydrologic Group:

Observation Hole _____ ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–100				

Soil Classification	Slope	Limiting Factor	
(Profile) (Condition)	%	_____"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

Soil Series Name:	Drainage Class:	Hydrologic Group:

BJA

Site Evaluator/Soil Scientist Signature

352

SE/ CSS *

8/15/19

Date

ALBERT FRICK ASSOCIATES – 380-B MAIN STREET GORHAM, MAINE 04038 – (207) 839-5563

APPENDIX B-6
Historical Soil Test Pit Logs

Town, City, Plantation	Street, Road Subdivision	Owner's Name
WINDHAM	MANCHESTER DR. & BASIN ROAD	MANCHESTER PROPERTIES (FOR CORRILL - PALMER)

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP100 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0	GRAVELLY LOAMY SAND		BROWN	
10				
20	COARSE SAND & GRAVEL	FRIABLE	LIGHT YELLOWISH BROWN	
30		TO		NONE
		LOOSE		EVIDENT
40	FINE & MEDIUM SANDS		LIGHT OLIVE BROWN	
50	LIMIT OF EXCAVATION @ 71"			

Soil Classification	Slope	Limiting Factor	Ground Water / Restrictive Layer / Bedrock / Pit Depth
5 Profile / B Condition	___ %	___ "	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☒ Pit Depth

ADAMS

Observation Hole TP101 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0	LOAMY SAND		BROWN DARK YELLOWISH BROWN	
10				
20	MEDIUM & COARSE SANDS W/ TRACE GRAVEL	FRIABLE	YELLOWISH BROWN	NONE
30				EVIDENT
			LIGHT OLIVE BROWN	
40				
50	LIMIT OF EXCAVATION @ 55"			

Soil Classification	Slope	Limiting Factor	Ground Water / Restrictive Layer / Bedrock / Pit Depth
5 Profile / B Condition	___ %	___ "	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☒ Pit Depth

ADAMS

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP102 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0	LOAMY SAND		DARK BROWN	
10			DARK YELL. BROWN	
20	GRAVELLY MEDIUM & COARSE SANDS	FRIABLE	MIXED OLIVE BROWN	NONE EVIDENT
30	FINE & MEDIUM SANDS		LIGHT OLIVE BROWN	
40				
50	LIMIT OF EXCAVATION @ 53"			

Soil Classification	Slope	Limiting Factor	Ground Water / Restrictive Layer / Bedrock / Pit Depth
5 Profile / B Condition	___ %	___ "	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☒ Pit Depth

ADAMS

Observation Hole TP103 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0	GRAVELLY LOAMY SAND (INCLUDES OVERBURDEN)	FRIABLE	DARK BROWN YELLOWISH BROWN	
20				NONE
30	FINE & MEDIUM SANDS		LIGHT OLIVE BROWN	EVIDENT
40				
50	LIMIT OF EXCAVATION @ 54"			

Soil Classification	Slope	Limiting Factor	Ground Water / Restrictive Layer / Bedrock / Pit Depth
5 Profile / B Condition	___ %	___ "	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☒ Pit Depth

ADAMS

James Logan (for AFA) — Site Evaluator / Soil Scientist Signature

237/213 — SE/CSS #

10/4/06 — Date

Town, City, Plantation	Street, Road, Subdivision	Owner's Name
WINDHAM	MANCHESTER DR. & BASIN ROAD	MANCHESTER PROPERTIES

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP104 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	WOODY DEBRIS W/ LOAMY SAND & SAND (FILL)	FRIABLE	VARIABLE	
10–30	INCLUDES STUMPS			
30–50				

Soil Classification	Slope	Limiting Factor	
FILLED LAND / MADE LAND	____ %	____"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth
Profile / Condition			

Observation Hole TP105 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	VARIABLE LOAMY SAND & WOODY DEBRIS	SOMEWHAT FIRM (COMPACTED)	VARIABLE DARK BROWN & BROWN	
10–20	LOAMY SAND)	FRIABLE	DARK BROWN	NONE
20–30			DARK YELLOWISH BROWN	EVIDENT
30–40	FINE & MEDIUM SANDS		LIGHT OLIVE BROWN	
40–50	LIMIT OF EXCAVATION @ 68"			

FILL OVER

Soil Classification	Slope	Limiting Factor	
5 / B	____ %	____"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☒ Pit Depth
Profile / Condition			

FILL OVER ADAMS

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP106 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	STONY LOAMY SAND & SAND (FILL)	SOMEWHAT FIRM (COMPACTED)	VARIABLE BROWN & OLIVE BROWN	
10–20			DARK BROWN	
20–30	FINE & MEDIUM SANDS	FRIABLE	DK. YEL. BROWN	
30–40				
40–50	SILT LOAM	FIRM	OLIVE	COMMON FAINT

FILL OVER

Soil Classification	Slope	Limiting Factor	
7 / C	____ %	46"	☒ Ground Water ☒ Restrictive Layer ☐ Bedrock ☐ Pit Depth
Profile / Condition			

ELDRIDGE

Observation Hole TP107 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	LOAMY SAND) & SAND) (FILL)	SOMEWHAT FIRM (COMPACT)	VARIABLE BROWN	
10–20	LOAMY		DARK BROWN	NONE
20–30	SAND)	FRIABLE	DARK YELLOWISH BROWN	EVIDENT
30–40	FINE & MEDIUM SANDS		LIGHT OLIVE & OLIVE BROWN	
40–50	FILL OVER LIMIT OF EXC. @ 65"			

Soil Classification	Slope	Limiting Factor	
5 / B	____ %	____"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☒ Pit Depth
Profile / Condition			

ADAMS

James Logan (for AFA) — Site Evaluator / Soil Scientist Signature

237/213 — SE/CSS #

10/4/06 — Date

Town, City, Plantation	Street, Road Subdivision	Owner's Name
WINDHAM	MANCHESTER DR. & BASIN ROAD	MANCHESTER PROPERTIES

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP108 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	FINE SANDY LOAM	FRIABLE	DARK BROWN / DARK YELLOWISH BROWN	
20–30	STONY LOAMY SAND & SAND	SOMEWHAT FIRM TO FIRM	LIGHT OLIVE BROWN	
40–50	LIMIT OF EXCAVATION			

Soil Classification	Slope	Limiting Factor	
Profile: 3 / Condition: C	___ %	23"	☐ Ground Water ☒ Restrictive Layer ☐ Bedrock ☐ Pit Depth

BECKET

Observation Hole TP109 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	SAND (FILL)		OLIVE BROWN	
10–20	LOAMY SAND FORMERLY	FRIABLE	DARK BROWN	
20–30			DARK YELLOWISH BROWN	
40	LOAMY SAND & SAND	REFUSAL IN LARGE STONES	LT. OLIVE BR.	

FILL OVER

Soil Classification	Slope	Limiting Factor	
Profile: 3 / Condition: C	___ %	38"	☐ Ground Water ☒ Restrictive Layer ☐ Bedrock ☐ Pit Depth

BECKET

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP110 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	LOAMY SAND		DARK BROWN / DARK YELLOWISH BROWN	
10–20	MEDIUM & COARSE SANDS W/ TRACE GRAVEL	FRIABLE	YELLOWISH BROWN	
20–30			LIGHT OLIVE BROWN	NONE / EVIDENT
40–50	LIMIT OF EXCAVATION @ 53"			

Soil Classification	Slope	Limiting Factor	
Profile: 5 / Condition: B	___ %	___"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☒ Pit Depth

ADAMS

Observation Hole TP111 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	LOAMY SAND		DARK BROWN / YELLOWISH BROWN	
20	FINE & MEDIUM SANDS	FRIABLE	LIGHT OLIVE BROWN	NONE / EVIDENT
40–50	LIMIT OF EXCAVATION			

Soil Classification	Slope	Limiting Factor	
Profile: 5 / Condition: B	___ %	___"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

ADAMS

James Logan (for AFA) — Site Evaluator / Soil Scientist Signature

237/213 — SE/CSS #

10/4/06 — Date

Town, City, Plantation	Street, Road, Subdivision	Owner's Name
WINDHAM	MANCHESTER DR. & BASIN RD.	MANCHESTER PROPERTIES

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP112 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)	Texture	Consistency	Color	Mottling
0	LOAMY SAND		DK. BROWN	
10			DARK YELLOWISH BROWN	
20	FINE & MEDIUM SANDS	FRIABLE	LT. OLIVE BROWN	NONE
30				EVIDENT
40				
50	LIMIT OF EXCAVATION @ 69"			

Soil Classification	Slope	Limiting Factor	
5 Profile / B Condition	____ %	____ "	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☒ Pit Depth

ADAMS

Observation Hole TP113 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)	Texture	Consistency	Color	Mottling
0	LOAMY SAND		DARK BROWN	
10			YELLOWISH BROWN	
20	FINE & MEDIUM SANDS	FRIABLE	LIGHT OLIVE BROWN	NONE
30				EVIDENT
40				
50	LIMIT OF EXCAVATION			

Soil Classification	Slope	Limiting Factor	
5 Profile / B Condition	____ %	____ "	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

ADAMS

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP114 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)	Texture	Consistency	Color	Mottling
0	STONY SANDY LOAM		DARK BROWN	
10		FRIABLE	DARK YELLOWISH BROWN	
20	LOAMY SAND		YELLOWISH BROWN	
30	STONY LOAMY SAND & SAND)	SOMEWHAT FIRM TO FIRM	OLIVE BROWN	FEW, FAINT
40				
50	REFUSAL IN LARGE STONES @ 46"			

Soil Classification	Slope	Limiting Factor	
3 Profile / C Condition	____ %	28"	☒ Ground Water ☒ Restrictive Layer ☐ Bedrock ☐ Pit Depth

SKERRY

Observation Hole TP115 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)	Texture	Consistency	Color	Mottling
0	SANDY LOAM		DARK BROWN	
10	LOAMY SAND)	FRIABLE	DARK YELLOWISH BROWN	
20			YELL. BROWN	
30	STONY LOAMY SAND) & SAND)	FIRM	OLIVE BROWN	
40				
50	REFUSAL IN LARGE STONES			

Soil Classification	Slope	Limiting Factor	
3 Profile / C Condition	____ %	24"	☒ Ground Water ☒ Restrictive Layer ☐ Bedrock ☐ Pit Depth

BECKET

James Logan (for AFA) — Site Evaluator / Soil Scientist Signature

237/213 — SE/CSS #

10/4/06 — Date

Town, City, Plantation	Street, Road Subdivision	Owner's Name
WINDHAM	MANCHESTER DR. & BASIN RD.	MANCHESTER PROPERTIES

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP116 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	STONY SANDY LOAM	FRIABLE	DARK BROWN / DARK YELLOWISH BROWN	
10–20	STONY LOAMY		YELLOWISH BROWN	
20–30	SAND & SAND)	SOMEWHAT FIRM TO FIRM	LIGHT OLIVE BROWN	
30–40				
40–50	REFUSAL IN LARGE STONES @ 49"			

Soil Classification	Slope	Limiting Factor	
Profile: 3 / Condition: C	____ %	24"	☐ Ground Water ☒ Restrictive Layer ☐ Bedrock ☐ Pit Depth

BECKET

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP117 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	LOAMY SAND (OVERBURDEN)		BROWN / DARK BROWN	
10–20	LOAMY SAND)	FRIABLE	DARK YELLOWISH BROWN	NONE
20–30	FINE &		LIGHT OLIVE	EVIDENT
30–40	MEDIUM SANDS		BROWN	
40–50	LIMIT OF EXCAVATION @ 70"			

Soil Classification	Slope	Limiting Factor	
Profile: 5 / Condition: B	____ %	____"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☒ Pit Depth

ADAMS

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP118 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	LOAMY SAND)		DK. BROWN / YELLOWISH BROWN	
10–20	COARSE SAND & GRAVEL	FRIABLE	LIGHT OLIVE BROWN	NONE
20–30	FINE & MEDIUM SANDS			EVIDENT
30–40				
40–50	LIMIT OF EXCAVATION @ 59"			

Soil Classification	Slope	Limiting Factor	
Profile: 5 / Condition: B	____ %	____"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

ADAMS

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole _____ ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

Texture	Consistency	Color	Mottling

Soil Classification	Slope	Limiting Factor	
Profile: ____ / Condition: ____	____ %	____"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

James Fogarty (GOAFA) — Site Evaluator / Soil Scientist Signature

237/213 — SE/CSS #

10/14/06 — Date

784.01
K

Town, City, Plantation	Street, Road Subdivision	Owner's Name
WINDHAM	MANCHESTER ROAD	GORRILL-PALMER

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP 200 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0			DARK BROWN	
	GRAVELLY LOAMY SAND			NONE EVIDENT
10			DARK YELLOWISH BROWN	
		FRIABLE		
20				LIVE WOODY ROOTS TO 49"
	COARSE SAND		YELLOWISH BROWN	
30	FINE & MEDIUM SAND		LIGHT OLIVE BROWN	
40				
50				
60				
70				
80				NO FREE WATER @ 8'
90	(FINE SAND & SILT @ 8')	(SOMEWHAT FIRM @ 8')		
100	(LIMIT OF EXCAVATION @ 114")			COMMON FAINT

Soil Classification	Slope	Limiting Factor	
ADAMS (VARIANT)	____ %	_____ "	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth
Profile / Condition			

FINE SAND/SILT

Observation Hole TP 201 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0	LOAMY SAND (FILL)		BROWN	
10	LOAMY SAND		DARK BROWN	
20		FRIABLE	DARK YELLOWISH BROWN	
30	MEDIUM & COARSE SAND		LIGHT YELLOWISH BROWN	NONE EVIDENT
40	FINE & MEDIUM SAND		LIGHT OLIVE BROWN	
50				
60				
70	FINE SAND			
80				
90	(SILTY CLAY LOAM @ 10')	(FIRM @ 10')		(COMMON DISTINCT @ 10')
100	(LIMIT OF EXCAVATION @ 132" NO FREE WATER)			

Soil Classification	Slope	Limiting Factor	
ADAMS (VARIANT)	____ %	_____ "	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth
Profile / Condition			

DEEP ELDRIDGE CONDITIONS

STATE OF MAINE ★ JAMES LOGAN #213 ★ SOIL SCIENTIST

James Logan (for AFA)
Site Evaluator/Soil Scientist Signature

237/213
SE/CSS •

2/1/08
Date

ALBERT FRICK ASSOCIATES – 95A COUNTY ROAD GORHAM, MAINE 04038 – (207) 839-5563

Town, City, Plantation	Street, Road Subdivision	Owner's Name
WINDHAM	MANCHESTER ROAD	GORRILL-PALMER

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP 202 ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	LOAMY SAND		DARK BROWN	
10–20	FINE & MEDIUM SAND	FRIABLE	DARK YELLOWISH BROWN	NONE EVIDENT TO 60"+
20–30			LIGHT OLIVE BROWN	
30–90	(VERY FINE SAND @ 10')	(SOMEWHAT FIRM IN LENSES @ 10')		(FEW FAINT @ 10')

Soil Classification	Slope	Limiting Factor	
ADAMS (Profile / Condition)	____ %	"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

Observation Hole TP 203 ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	LOAMY SAND	FRIABLE	DARK BROWN	
10–20			DARK YELLOWISH BROWN	
20–30	MEDIUM SAND	LOOSE	YELLOWISH BROWN	
30–40			LIGHT OLIVE BROWN	
40–50	FINE & VERY FINE SAND TO 11'	FRIABLE	PALE OLIVE	NONE EVIDENT TO 70"+
50–100				NO FREE WATER
100	(LIMIT OF EXCAVATION @ 138")			

Soil Classification	Slope	Limiting Factor	
ADAMS (Profile / Condition)	____ %	"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

James Fogg (for AFA)

Site Evaluator/Soil Scientist Signature

237/213

SE/CSS *

2/1/08

Date

ALBERT FRICK ASSOCIATES – 95A COUNTY ROAD GORHAM, MAINE 04038 – (207) 839-5563

Town, City, Plantation	Street, Road Subdivision	Owner's Name
WINDHAM	MANCHESTER ROAD	GORRILL-PALMER

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP 204 ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0			DARK BROWN	
10	LOAMY SAND		DARK YELLOWISH BROWN	
20		FRIABLE		
30	FINE & MEDIUM SAND		LIGHT OLIVE BROWN	
40				
50	FINE SAND		PALE OLIVE	NONE EVIDENT
60				
70				
80				
90				
100	(LIMIT OF EXCAVATION @ 132")			

Soil Classification	Slope	Limiting Factor	
ADAMS	____ %	"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth
Profile / Condition			

Observation Hole TP 205 ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0	SANDY LOAM		DARK BROWN	
10				
20	LOAMY SAND	FRIABLE	DARK YELLOWISH BROWN	
30	FINE & MEDIUM SAND		YELLOWISH BROWN	
40			LIGHT OLIVE BROWN	NONE EVIDENT
50				
60				
70				
80				
90	FINE SAND		OLIVE	△△△ FREE WATER
100	LIMIT OF EXCAVATION			

Soil Classification	Slope	Limiting Factor	
ADAMS	____ %	"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth
Profile / Condition			

James Logan (for AFA)

Site Evaluator/Soil Scientist Signature

237/213

SE/CSS #

2/11/08

Date

ALBERT FRICK ASSOCIATES – 95A COUNTY ROAD GORHAM, MAINE 04038 – (207) 839-5563

Town, City, Plantation	Street, Road Subdivision	Owner's Name
WINDHAM	MANCHESTER ROAD	GORRILL-PALMER

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP 206 ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	LOAMY SAND		DARK BROWN	
10–20			DARK YELLOWISH BROWN	
20–30	FINE & MEDIUM SAND	FRIABLE	LIGHT YELLOWISH BROWN	
30–40	FINE SAND		LIGHT OLIVE BROWN	
40–90				(NO FREE WATER TO 11')
100	(LIMIT OF EXCAVATION @ 132")			

Soil Classification	Slope	Limiting Factor	
ADAMS	____ %	____"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth
Profile / Condition			

Observation Hole TP 207 ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	LOAMY SAND		DARK YELLOWISH BROWN	
10–20	FINE & MEDIUM SAND	FRIABLE	YELLOWISH BROWN	
20–30			LIGHT OLIVE BROWN	
30–80				
80	SILT LOAM TO 8.5'	SOMEWHAT FIRM	OLIVE	COMMON FAINT
90				(NO FREE WATER OBSERVED)
100	(LIMIT OF EXCAVATION @ 102")			

Soil Classification	Slope	Limiting Factor	
ADAMS (VARIANT)	____ %	____"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth
Profile / Condition			

James Fogarty (for AFA)

Site Evaluator/Soil Scientist Signature

237/213

SE/CSS #

2/1/08

Date

ALBERT FRICK ASSOCIATES – 95A COUNTY ROAD GORHAM, MAINE 04038 – (207) 839-5563

Town, City, Plantation	Street, Road Subdivision	Owner's Name
WINDHAM	MANCHESTER ROAD	GORRILL-PALMER

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP 208 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0			DARK BROWN	
10	LOAMY SAND		DARK YELLOWISH BROWN	
20		FRIABLE		
30	MEDIUM SAND		LIGHT YELLOWISH BROWN	
40				
50	FINE & MEDIUM SAND TO 9'		LIGHT OLIVE BROWN	
60				
70				
80	(SILT LOAM @ 9')	(FIRM @ 9')	(OLIVE @ 9')	(COMMON DISTINCT @ 9') (NO FREE WATER OBSERVED)
90				
100	(LIMIT OF EXCAVATION @ 120")			

Soil Classification	Slope	Limiting Factor	Ground Water / Restrictive Layer / Bedrock / Pit Depth
ADAMS (VARIANT)	____ %	"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth
Profile / Condition			

Observation Hole TP 209 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0				
10	SANDY LOAM		DARK BROWN	
20	LOAMY SAND	FRIABLE	DARK YELLOWISH BROWN	
30	FINE & MEDIUM SAND		LIGHT OLIVE BROWN	
40				
50	SILT LOAM W/ LOAMY FINE SAND LENSES	SOMEWHAT FIRM IN LENSES	OLIVE	FEW FAINT
60				
70				
80	(SILT LOAM @ 8.5')			(COMMON DISTINCT @ 8.5') (NO FREE WATER OBSERVED)
90				
100				

Soil Classification	Slope	Limiting Factor	Ground Water / Restrictive Layer / Bedrock / Pit Depth
ADAMS	____ %	"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth
Profile / Condition			

James Fagan (for AFA)
Site Evaluator/Soil Scientist Signature

237/213
SE/CSS #

2/1/08
Date

Town, City, Plantation	Street, Road Subdivision	Owner's Name
WINDHAM	MANCHESTER ROAD	GORRILL-PALMER

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP 210 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	SANDY LOAM		DARK BROWN	
10–20	GRAVELLY LOAMY SAND	FRIABLE	DARK YELLOWISH BROWN	
20–30			YELLOWISH BROWN	NONE EVIDENT
30–40	STONY LOAMY SAND & SAND	SOMEWHAT FIRM TO FIRM	LIGHT OLIVE BROWN	
40–100	(LIMIT OF EXCAVATION @ 120")			

Soil Classification	Slope	Limiting Factor	
BECKET (Profile / Condition)	____ %	26"	■ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

Observation Hole TP 211 ■ Test Pit ☐ Boring
_____" Depth of Organic Horizon Above Mineral Soil.

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	LOAM W/ OVERBURDEN (FILL)		VARIABLE BROWN	
10–30	SANDY LOAM	FRIABLE	DARK BROWN	
30–40	LOAMY SAND		DARK YELLOWISH BROWN	
40–50			YELLOWISH BROWN	
50–60	LOAMY SAND & SAND	SOMEWHAT FIRM TO FIRM	LIGHT OLIVE BROWN	COMMON FAINT
60–70		LIMIT OF EXCAVATION		

Soil Classification	Slope	Limiting Factor	
3 FILL OVER C (Profile / Condition)	____ %	46"	■ Ground Water ■ Restrictive Layer ☐ Bedrock ☐ Pit Depth

BECKET/SKERRY

James Logan (for AFA)
Site Evaluator/Soil Scientist Signature

237/213
SE/CSS #

2/11/08
Date

Town, City, Plantation	Street, Road Subdivision	Owner's Name
WINDHAM	MANCHESTER ROAD	GORRILL-PALMER

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP 212 ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	SAND (FILL)		LIGHT OLIVE BROWN	
10–20	LOAMY SAND	FRIABLE	DARK BROWN	
20–30	GRAVELLY LOAMY SAND & SAND	SOMEWHAT FIRM IN PLACE	YELLOWISH BROWN / MIXED OLIVE BROWN	
40			LIGHT OLIVE BROWN	
90				(NO FREE WATER OBSERVED)
100		LIMIT OF EXCAVATION		

Soil Classification		Slope	Limiting Factor	
3 (Profile)	C (Condition)	____ %	27"	☐ Ground Water ■ Restrictive Layer ☐ Bedrock ☐ Pit Depth

BECKET

Observation Hole TP 213 ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	LOAMY SAND	FRIABLE	DARK BROWN / DARK YELLOWISH BROWN	
20–30	FINE & MEDIUM SAND (OUTWASH)		LIGHT YELLOWISH BROWN	
40			OLIVE BROWN	
40–50	GRAVELLY LOAMY SAND & SAND (TILL)	FIRM		COMMON FAINT & △△△ FREE WATER
60		LIMIT OF EXCAVATION		

Soil Classification		Slope	Limiting Factor	
ATYPICAL (Profile)	(Condition)	____ %	43"	■ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

(FRIABLE SANDY OUTWASH OVER HARDPAN TILL) // MADE LAND

James Logan (for AFA)

Site Evaluator/Soil Scientist Signature

237/213

SE/CSS #

2/1/08

Date

ALBERT FRICK ASSOCIATES – 95A COUNTY ROAD GORHAM, MAINE 04038 – (207) 839-5563

Town, City, Plantation	Street, Road Subdivision	Owner's Name
WINDHAM	MANCHESTER ROAD	GORRILL-PALMER

SOIL DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole TP 2/4 ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

	Texture	Consistency	Color	Mottling
0–10	LOAMY SAND	FRIABLE	DARK BROWN	
10–20	LOAMY SAND & SAND (VERY STONY)	FIRM	LIGHT OLIVE BROWN	NONE EVIDENT
20–50			MIXED OLIVE BROWN	
50	LIMIT OF EXCAVATION			

Soil Classification		Slope	Limiting Factor	
3 (Profile)	C (Condition)	____ %	18 "	☐ Ground Water ■ Restrictive Layer ☐ Bedrock ☐ Pit Depth

(MAN-MADE SOILS NEARBY)

Observation Hole _____ ■ Test Pit ☐ Boring

_____" Depth of Organic Horizon Above Mineral Soil

DEPTH BELOW MINERAL SOIL SURFACE (inches)

Texture	Consistency	Color	Mottling

Soil Classification		Slope	Limiting Factor	
(Profile)	(Condition)	____ %	"	☐ Ground Water ☐ Restrictive Layer ☐ Bedrock ☐ Pit Depth

James Logan (for AFA)

Site Evaluator/Soil Scientist Signature

237/213

SE/CSS #

2/1/08

Date

ALBERT FRICK ASSOCIATES – 95A COUNTY ROAD GORHAM, MAINE 04038 – (207) 839-5563

APPENDIX C
Mounding and Transmissivity Analysis and Supporting Documents

APPENDIX C-1
Hydrogeologic Evaluation of the Manchester Drive Site

WRIGHT-PIERCE
Engineering a Better Environment

MEMORANDUM

TO:	File	**DATE:**	10/11/2019
FROM:	Greg Smith, CG	**PROJECT NO.:**	13926E
SUBJECT:	Windham Wastewater Planning Hydrogeologic Evaluation of the Manchester Drive Site **DRAFT**		

The town of Windham is seeking to identify a site with the capacity to handle 100,000 gallons per day (gpd) of treated wastewater effluent in a subsurface disposal system. This letter summarizes the findings of a recent study completed by Wright-Pierce at the Manchester Drive Site in Windham, Maine (the Site). The Site is in North Windham, east of Sebago Lake Basin as shown in the attached USGS topographic map **(Figure 1, Appendix C).**

Project Site

The Site consists of an approximately 14-acre parcel and is identified as part of Map 18A Lot 48 in the Town's property records. A preliminary review of geologic and soil maps indicates that the southern portion of the property is favorable for subsurface disposal. **Figure 2 (Appendix C)** shows the study area on the southern part of the property that was targeted for hydrogeologic evaluation.

The potential disposal area is approximately 7 acres and from the northeast to southwest across the study area there is an elevation change of 10 feet. The site is undeveloped and primarily developing forest. The site was previously assessed in 2006 and 2008 for the purpose of subdivision planning. A total of 33 test pits were completed in 2006 as part of an assessment for soil conditions for septic systems at the site. The logs and reporting for this work are included in **Appendix B.**

Geologic and Soil Conditions

The Study area is mapped as a glacio-marine delta in the Surficial Geology of the North Windham Quadrangle (OFM 97-41). These soils consist of largely well sorted sand and gravel with lesser percentages of finer grained soils (silt and clay). This deposit is expansive over a large portion of the town to the east, north, and south. These soils are also mapped as an aquifer in the Significant Sand and Gravel Aquifers of the North Windham Quadrangle (OFM 98-158). Areas north-northwest of the study area are mapped as glacial till. These soils are often indicative of shallow bedrock and typically have poor infiltration capacity. The mapped surficial geology is shown in Figure 3 **(Appendix C).**

The United States Department of Agriculture Natural Resource Conservation Service (NRCS) soil data shown in Figure 4 indicate that soils in the study area consist of the following:

- Hinckley Loamy Sand (HlB): Excessively drained glaciofluvial soils. These soils consist primarily of sand and gravel and have excellent capacity to transmit water.
- Deerfield Loamy Sand (DeB): Sand derived from outwash deposits and have good to moderately high capacity to transmit water.
- Windsor Loamy Sand (WmD): Sandy glacio-fluvial soils with moderately high capacity to transmit water.

Mapped geology and NRCS soil data indicate excellent infiltration potential for the site.

Well Data

The state of Maine keeps records of drilled wells throughout the state. Several private bedrock wells are mapped over 3,500 feet west of the study area. No wells were identified within 300 feet of the Site. The buildings surrounding the study area are serviced with public water.

Two wells that are part of a USGS monitoring well network in the area were identified at the site. Well data from USGS reports are included in **Appendix C** for reference and the well locations are shown in **Figure 3 (Appendix C)**. Historical data for these wells from 1996 shows a difference of approximately 3.45 feet in water elevation (CW1995 = 293.61 feet, CW2011 = 297.06 feet). The distance between the wells is approximately 820 feet indicating that the site has an approximate gradient of at 0.004 ft/ft. A regional groundwater model was developed by Sebago Technics for the area **(Appendix C**) using the USGS monitoring network to predict groundwater flow paths within the aquifer. The model indicates that groundwater flow is generally south/southwest across the site. The well data and the regional groundwater model support the determination that groundwater flow direction is to the southwest across the site. The following is a summary of these wells:

- CW1995 (DUN -1): Well log indicates that sand is present in this boring to a depth of 45 feet below ground surface (bgs) where glacial till was observed. The well screen was set from 22 to 32 feet below the ground surface. This well was accessed during field work; however, the well was obstructed or possibly collapsed, and water level data were not obtainable. Static water table at this location averages 13-14 feet bgs.
- CW2011 (BRW-1): The well log indicates that soils are generally fine to medium sand becoming fine grained at depth. The boring was terminated at 29 feet bgs and a well screen was set from 17 to 27 feet bgs. Static water table at this location averages 13-14 feet bgs.
- Seasonal fluctuation in water table was estimated to add as much as 2 to 3 feet to the groundwater table measured on August 15, 2019 based on the USGS well reports. Unsaturated soils were estimated to be 11 feet deep for this analysis.

Subsurface Exploration Program

A subsurface exploration program was completed on the Site on August 15, 2019 by Albert Frick Associates Inc. (Frick). It and consisted of seven test pits to fill in data gaps for the purposes of characterizing the site relative to the previous 2006 and 2008 work. Test Pits were logged by Brady

Frick, Licensed Site Evaluator (LSE) #352 as required for the evaluation and design of on-site engineered evaluation systems. Restrictive layers were not present at any of the locations and the site was observed to be well-sorted sands with trace gravel. Frick identified soils at the site to be 5B. The seasonal high-water table or bedrock was not encountered at any of the locations. A report by Brady Frick is included in **Appendix B** summarizes this work.

Double Ring Infiltrometer Tests

Three double ring infiltrometer tests were completed at the site along with the Frick test pit work on August 15, 2019. Infiltrometer tests were completed at test pit sites TP 300, TP 302 and TP 305 shown in the site layout in **Appendix B**. These test values represent unsaturated vertical hydraulic conductivity which is typically lower than the saturated hydraulic conductivity. This is due to air within the pore space of the soils tested that results in a lower available volume within the pore space to accommodate infiltrated water (reduced porosity) as well as additional surface tension limiting the velocity of infiltrated water moving through the soils. The following table is a summary of the double ring infiltrometer testing for these locations.

TABLE 1
DOUBLE RING INFILTROMETER TEST RESULTS

Location	Depth (Feet)	Unsaturated Vertical Hydraulic Capacity (Feet/Day)
TP 301	1.5	189
TP 302	2	60
TP 305	2	100
	Average	**116**

The lowest unsaturated vertical hydraulic capacity of 60 feet/day, is equivalent to 449 gpd/sf. The highest loading rate allowed under the Maine Subsurface Wastewater Disposal Rules for these soils is 0.38 gpd/sf for a standard disposal field. For the proprietary drip dispersal system at the Manchester Drive site, Oakson has recommended a loading rate of 1.5 gpd/sf. Infiltration rates for the site are not anticipated to be a restricting factor and exceed requirements of the proposed disposal system.

Slug Tests

Two overburden wells (CW1995 and CW2011) are located at the perimeter of the site. The USGS provided Wright-Pierce with access to these wells to conduct slug tests to estimate the saturated hydraulic conductivity within the aquifer. CW1995 is obstructed approximately 12 feet bgs and

water was not present within the well. Slug testing was successfully completed on CW2011. Hvorslev, Bouwer, and Rice solutions were used in AQTESOLV to calculate the hydraulic conductivity at the site. The estimated hydraulic conductivities for CW2011 were 702 and 529 feet per day, respectively. Hydraulic conductivities in this range are surprisingly high and do not correlate with the range expected for the aquifer based on USGS well logs. Slug test analysis results are included in **Appendix C.**

The wells were both drilled using a hollow stem auger. Hollow stem augers typically have a diameter of approximately eight inches to the end of the auger flight. Constructing these wells requires the installation of a sand pack around the well screen and casing. Given that the well log for this well shows fine to medium sand, it is likely that the slug test is measuring the hydraulic conductivity of the filter pack, and not that of the aquifer. For this reason, the slug test data was not used in the subsequent mounding and transmissivity analyses.

Mounding Analysis

The Maine Subsurface Rules require maintaining a minimum of 2 feet of unsaturated soil beneath the disposal system (drip dispersal tubes) at all times. The addition of water to the soils causes an increase in the height of the groundwater underneath the system, which is called a groundwater mound. Groundwater mounding is estimated using regression analysis to predict the height of a groundwater mound over time as a result of adding water to the subsurface soils. The analysis relies on aquifer parameters, infiltration area geometry, boundary conditions, and the loading rate per area. For this analysis we used AQTESOLV which utilizes the Hantush (1967) solution for calculation of groundwater mounding. This software also allows for input of boundary conditions relative to the infiltration area resulting in a more refined groundwater mounding analysis compared to the basic standard Hantush mounding analysis.

A mounding analysis was conducted for a disposal area of 150,000 square feet (scenario 1). Based on monitoring well CW1995 the downgradient aquifer is 45 feet deep (top of till). Upgradient well CW2011 was drilled to a depth of 29 feet and refusal was not encountered. The following criteria were used in the scenario 1 mounding analysis:

- Aquifer saturated thickness of 32 feet,
- Infiltration area size is approximately 230 by 660 feet average dimensions and totals 153,000 feet **(see Figure 2 in Appendix C)**,
- Continuous flow of 100,000 gallons per day,
- Loading rate of 0.089 feet per day (100,000 gallons per day/7.48 = 13,369 ft^3 per day; 13,369 ft^3 per day/150,000 square feet = 0.089 feet per day),
- No flow boundary approximately 300 feet north/northwest of the center of loading area based on published geologic mapping, and
- Hydraulic conductivity of 60 ft/day (lowest measured unsaturated vertical hydraulic conductivity).

The mounding analysis indicates that the mound height would be 6.4 feet above the seasonally high water table, or 4.6 feet below ground surface (11 feet of unsaturated soil subtract 6.4 feet of mound). This indicates that 56% of the unsaturated soils would become saturated under mounding conditions. If the drip dispersal tubes are installed 12 inches below the ground surface, there would be 3.6 feet of unsaturated soil beneath the disposal system and meets the requirement of the Maine Subsurface Disposal Rules.

Using the lowest hydraulic conductivity and a no flow boundary results in a conservative mounding analysis given the available data at the time of this report. The mounding analysis calculations are included in **Appendix C.**

Mounding was also analyzed for a second scenario using the Oakson recommended loading rate of 1.5 gpd/sf for their system. At this loading rate a minimum of 67,000 square feet is required for the disposal system. Scenario 2 mounding analysis was completed using the following criteria:

- Aquifer saturated thickness of 32 feet,
- Infiltration area size is approximately 260 by 260 feet average dimensions and totals 67,600 feet (Figure 2),
- 100,000 gallons per day loading rate over a 67,000 square foot drip irrigation system rectangular footprint **(no figure shown for this scenario),**
- No flow boundary approximately 300 feet north/northwest of the center of loading area based on published geologic mapping,
- 0.2 feet per day loading rate, and
  Hydraulic conductivity of 60 ft/day (lowest measured infiltration rate).

After 10 years of continuous operation the mound height would be approximately 7.2 feet above the seasonally high water table, or 2.8 feet bgs (11'-7.2'-1'). Using the same flow over a small area results in a higher loading rate and is still feasible at the site based on the mounding analysis.

Wastewater Mounding Impact Analysis (Transmissivity Analysis)

Subsurface disposal systems have the potential for breakout of infiltrated effluent to ground surface or surface water. Maine Subsurface Disposal Rules require us to verify that breakout will not occur within 50 feet of the subsurface disposal system. The mounding analysis for scenario 1 estimated a maximum mound height of 5.8 feet at 50 feet downgradient from the subsurface disposal system. CW1995 has a surveyed ground elevation of 307.5 feet amsl and a seasonal high-water table of approximately 296 feet amsl leaving approximately 6.2 feet of unsaturated soil bgs. No breakout is predicted to occur within 50 feet of the disposal area for scenario 1, as shown in **Figure 2, Appendix C**.

A stormwater detention pond is located approximately 230 feet northwest of the proposed subsurface wastewater disposal area **(Figure 2, Appendix C)**. Lidar derived contours indicate that the lowest elevation in this pond is approximately four feet higher than the proposed subsurface

wastewater disposal area indicating that breakout will not occur in this area due to groundwater mounding.

A second stormwater detention pond **(Figure 2, Appendix C)** is located approximately 240 feet south-southwest of the proposed subsurface wastewater disposal area. Lidar derived contours suggest that this bottom of this basin is at 290 feet amsl and 10 feet lower in elevation than the proposed subsurface wastewater disposal area. The seasonal high groundwater table in this area is 296 feet amsl (at CW1995) and therefore the bottom of the basin is 6 feet below the seasonally high groundwater table. Groundwater mounding for scenario 1 suggests that a mound of approximately 5.0 feet would be expected in the stormwater detention pond, and the seasonally high groundwater mound would be 301 feet amsl. This analysis suggests that effluent impacted groundwater will reach the southern detention pond and the water level within the pond could be 5 feet higher. This is not unexpected, considering that the bottom of the pond is below the seasonally high groundwater level. The elevation of the pond overflow is unknown, therefore it cannot be determined if the pond would overflow.

Conclusions

Test pit and infiltrometer testing results indicate that the soil hydraulic conductivity is not a limiting factor in the design of a drip irrigation system when applying maximum loading rate of 1.5 gpd/sf as recommended by Oakson. No groundwater was found in test pits excavated in August 2019 to the depth of 6 feet and data from two nearby USGS wells indicates that the water table is typically more than 11 feet down. Preliminary hydrogeologic analyses suggest that the site can accept 100,000 gpd of effluent and maintain the required unsaturated soil depth required by the Maine Subsurface Rules. Mounding and transmissivity analyses suggest that groundwater elevation at the site will rise by approximately 6.4 to 7.2 feet, depending on the selected loading rate, with a sustained flow of 100,000 gpd. Breakout is not predicted to occur within 50 feet of the disposal system; however, the transmissivity analysis suggests that effluent laden groundwater will be present in the southern detention pond that is 240 feet from the disposal area.

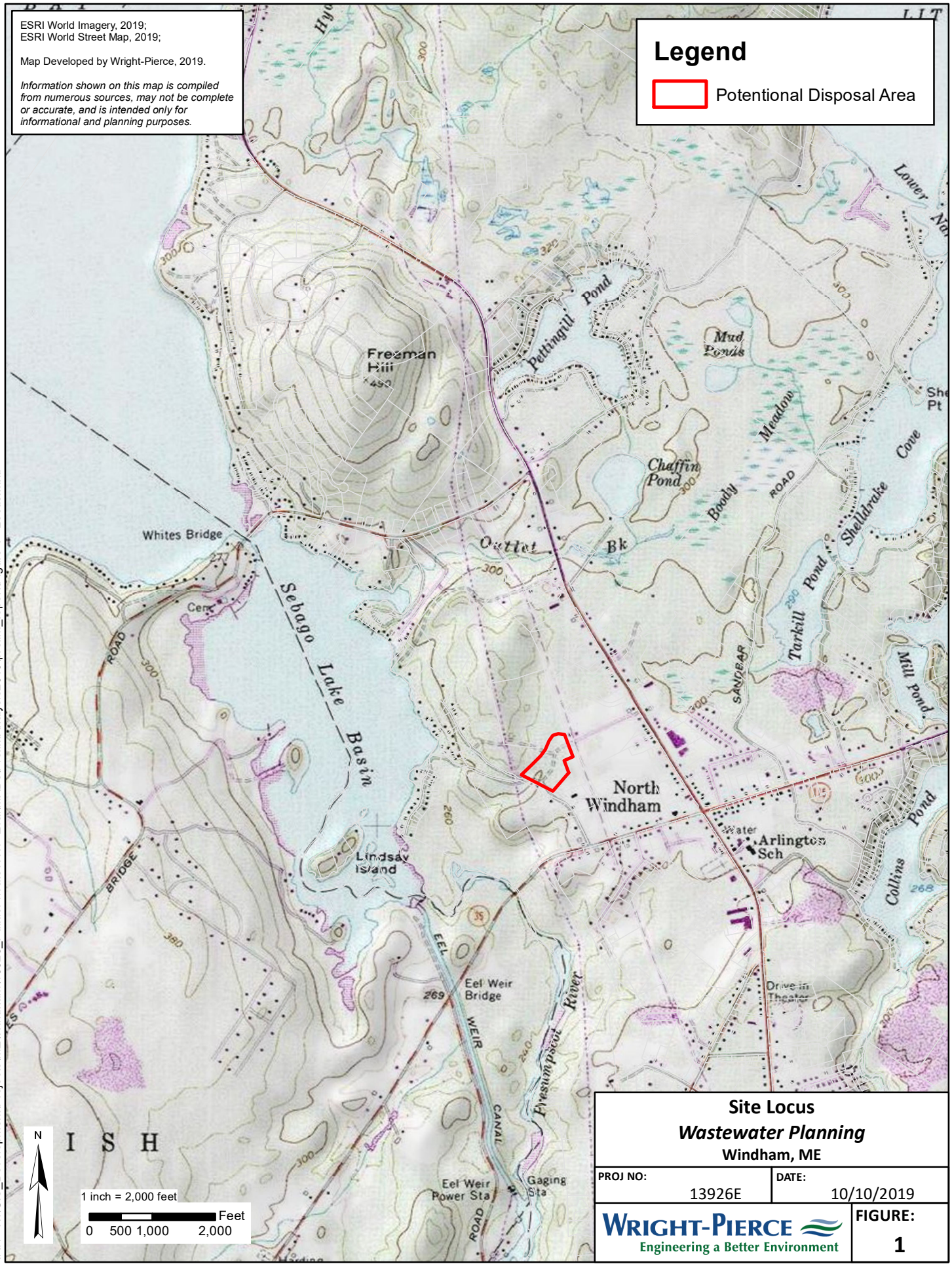
Next Steps

Several data gaps were identified relative to standard practice of developing the mounding analysis for a system of this size. For example, test pits were limited to a depth of 70 inches below ground surface and it has not been verified if there are more restrictive soils below this depth for much of the site. There are two wells on the site, however they are located at the site perimeter and one of the wells was not drilled deep enough to fully characterize aquifer. Given these data gaps, the aquifer thickness and geologic conditions deeper than six feet over much of the site have not been verified. The mounding analysis in this report is highly conservative and it is possible that calculated mounding height would be lower if these data gaps were addressed with additional field investigation. Additional field investigation may confirm higher specific capacities in saturated soils and greater average aquifer thickness than used in mounding calculations and therefore

support a lower mounding height. As such additional site-specific investigation and hydraulic analysis is recommended.

Enclosures

APPENDIX C-2
Figure 1 Site Locus



Site Locus

Wastewater Planning

Windham, ME

PROJ NO:	DATE:
13926E	10/10/2019

WRIGHT-PIERCE
Engineering a Better Environment

FIGURE: 1

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APPENDIX C-3
Figure 2 Site Plan

Contours from ME GIS Derived from Lidar

CW 2011

Stormwater Retention Pond

CW 1995

Stormwater Retention Pond

N

Legend

- Potential Waster Water Disposal Area
- USGS Monitoring Wells
- 240 Foot Disposal Area Buffer
- 50 Foot Disposal Area Buffer
- Drip Iirrigation Area
- Maine Elevation Contours 2 Feet (Feature layer)
- Parcels 2018
- Wetland

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, U

Site Plan

Site Evaluation, Windham, Maine

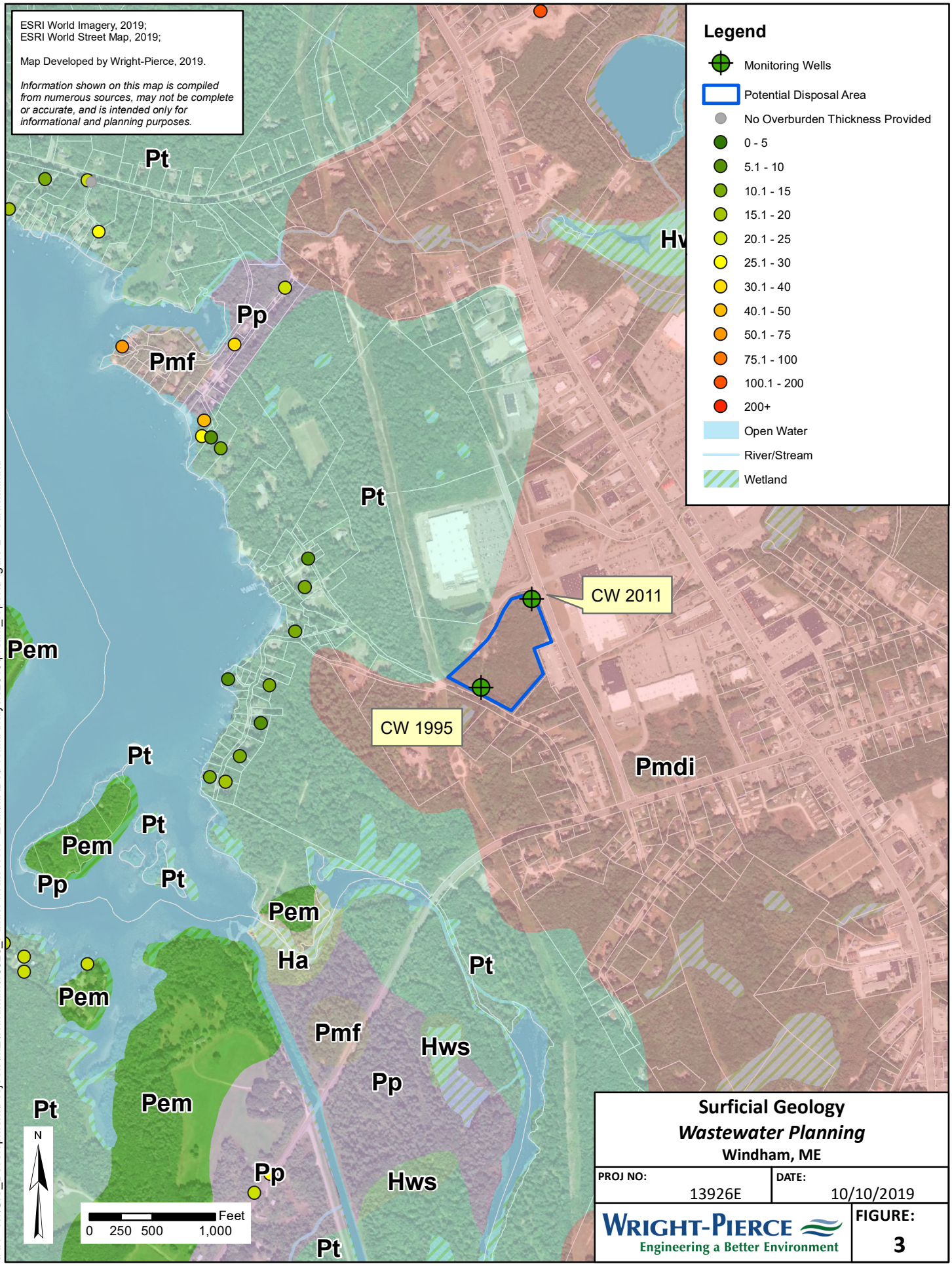
PROJ NO:	DATE:
13926E	10/7/2019

WRIGHT-PIERCE
Engineering a Better Environment

FIGURE: 2

XYZ W:\GIS_Development\Projects\ME\Windham\13926_PublicPrivateWWF-Eval\MXDs\PrelimAnalysis2019prelim_report\Figure 2 -site plan1.mxd

APPENDIX C-4
Figure 3 Surficial Geology



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Surficial Geology
Wastewater Planning
Windham, ME

PROJ NO:	DATE:
13926E	10/10/2019

WRIGHT-PIERCE
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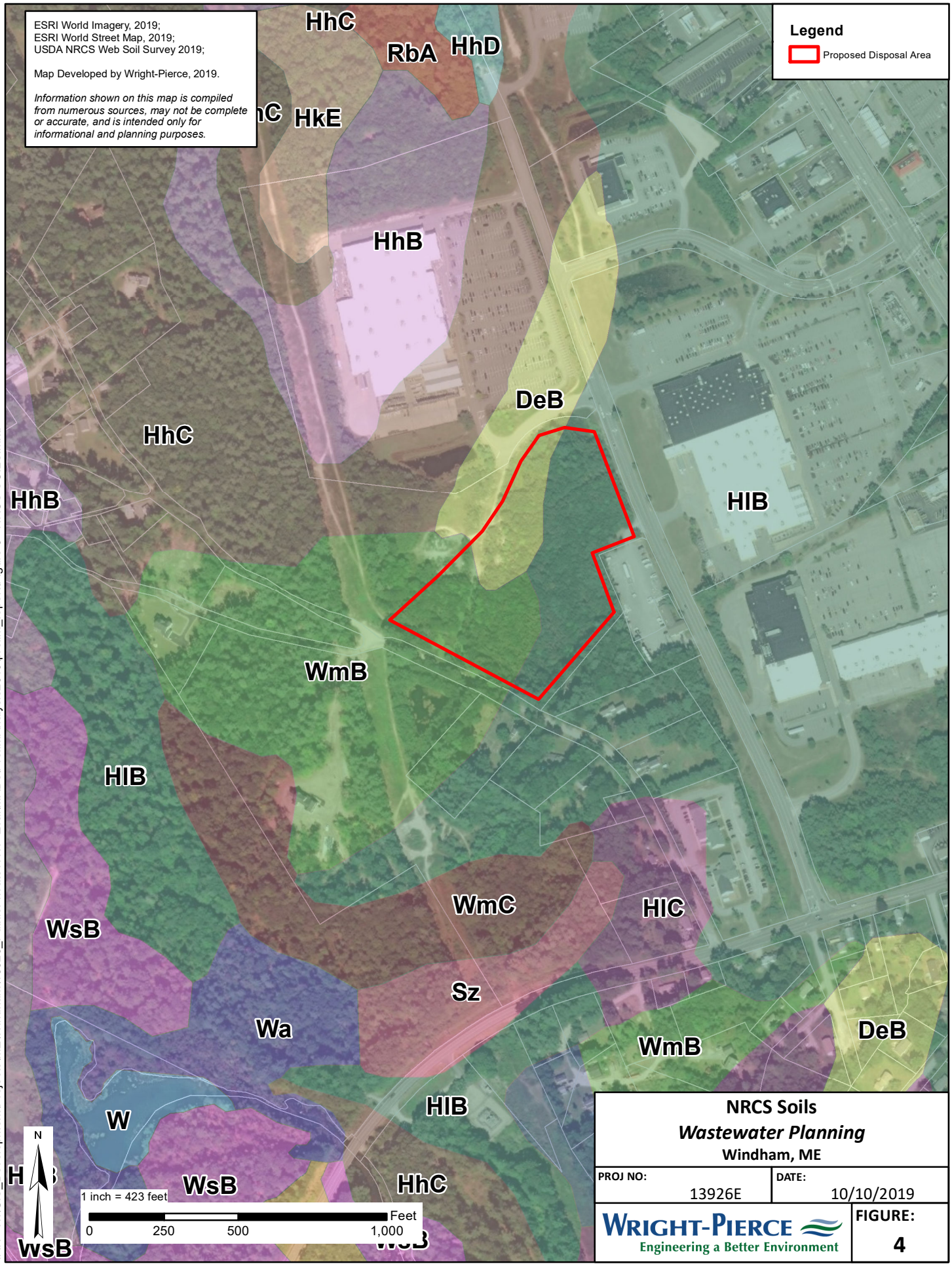
FIGURE: 3

APPENDIX C-5
Figure 4 NRCS Soils


ESRI World Imagery, 2019;
ESRI World Street Map, 2019;
USDA NRCS Web Soil Survey 2019;
Map Developed by Wright-Pierce, 2019.
Information shown on this map is compiled from numerous sources, may not be complete or accurate, and is intended only for informational and planning purposes.
Legend
Proposed Disposal Area
HhC
RbA
HhD
HkE
HhB
DeB
HhC
HhB
HlB
WmB
HlB
WmC
HlC
WsB
Sz
Wa
DeB
WmB
HlB
W
WsB
HhC
WsB
N
1 inch = 423 feet
0
250
500
1,000
Feet
NRCS Soils
Wastewater Planning
Windham, ME
PROJ NO:
13926E
DATE:
10/10/2019
WRIGHT-PIERCE
Engineering a Better Environment
FIGURE:
4
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APPENDIX C-6
Well Data

Table 2. Location of test borings, observation wells and screened intervals of wells, Presumpscot River Basin study area, Maine

[All wells installed by the USGS, May 1995 to May 1996, unless otherwise noted. Locations shown in figure 2. Altitude of land surface is in feet above sea level. Wells installed by USGS consist of 2-inch inner diameter polyvinylchloride pipe; slot size of well screens equal to .006 or .010 inch; ---- no data available]

Local identifier	Project identifier	USGS identifier	Latitude ° ′ ″	Longitude ° ′ ″	Altitude of land surface	Screened interval (feet below land surface)
CW 1971	ARL-1	435002070255701	43 49 55	70 25 59	299.8	17-22
CW 1972	BR2-A	434945070252801	43 49 38	70 25 30	296.3	72-77
CW 1973	BR2-B	434945070252901	43 49 38	70 25 30	296.4	41.6-46.6
CW 1974	BR2-C	434928070252901	43 49 20	70 25 31	288.5	47-52
CW 1975	WKR-1	434934070244101	43 49 27	70 24 43	273.9	32.5-37.5
CW 1977	CEO-1	434951070241401	43 49 51	70 24 14	----	----
CW 1978	VMR-1	434908070251201	43 49 01	70 25 14	243.0	22-27
CW 1979	CPW-1	435008070253901	43 50 01	70 25 41	309.1	104-109
CW 1980	MTW-1	434919070262601	43 49 12	70 26 28	307.1	31-36
CW 1981	FRB-1	435018070250201	43 50 11	70 25 04	312.9	44-49
CW 1982	CEM-1	434958070261601	43 49 51	70 26 18	297.5	40-45
CW 1983	SAN-1	435039070261101	43 50 02	70 26 12	307.8	32-37
CW 1984	CHA-1	435056070263701	43 50 48	70 26 39	295.1	120-130
CW 1985	CHA-2	435055070263601	43 50 48	70 26 39	295.1	15.5-25.5
CW 1986	TAN-1	434840070252901	43 49 05	70 25 31	256.4	73-83
CW 1987	KEL-1	434910070255601	43 49 03	70 25 58	303.5	101-111
CW 1988	PVW-1	434941070261901	43 49 34	70 26 21	290.6	48-55
CW 1989	MTW-2	434919070262602	43 49 12	70 26 28	307.0	14-19
CW 1990	ARL-2	435002070255601	43 49 55	70 25 58	299.9	60-80
CW 1991	TLR-1	434956070255101	43 49 49	70 25 52	283.3	57-67
CW 1992	BENT-1	435008070262901	43 50 01	70 26 31	305.0	37-42
CW 1993	BENT-2	435008070262902	43 50 01	70 26 31	305.0	22-27
CW 1994	NWW-1	434945070263401	43 49 38	70 26 36	276.7	10-15
CW 1995	DUN-1	435012070265101	43 50 05	70 26 53	307.5	22-32
CW 1996	WAL-2	435014070265401	43 50 07	70 26 55	----	----
CW 1997	WAL-3	435014070265402	43 50 07	70 26 55	300.1	----
CW 1998	WAL-1	435027070264801	43 50 20	70 26 50	312.0	30-35

Table 2. Location of observation wells and screened intervals of wells, Presumpscot River Basin, Maine --Continued

[All wells installed by the USGS, May 1995 to May 1996, unless otherwise noted. Altitude of land surface is in feet above sea level. Wells installed by USGS consist of 2-inch inner diameter polyvinylchloride pipe; slot size of well screens equal to .006 or .010 inch; ---- no data available]

Local identifier	Project identifier	USGS Identifier	Latitude ° ′ ″	Longitude ° ′ ″	Altitude of land surface	Screened interval (feet below land surface)
CW 1999	KEY-1	435026070264101	43 50 19	70 26 43	310.8	78-80
CW 2000	SSW-1	435041070262301	43 50 34	70 26 24	319.7	40-50
CW 2001	MPW-1	435131070261401	43 51 24	70 26 16	309.6	97-127
CW 2002	FHS-1	435045070265701	43 50 45	70 26 57	----	----
CW 2003	UWW-1	434946070252301	43 49 46	70 25 23	316.2	57-62
CW 2004	TCBY-1	434927070255101	43 49 27	70 25 51	315.0	38-58
CW 2005	CPW-2	435008070253902	43 50 08	70 25 39	309.0	38-48
CW 2006	OAK-1	435013070261501	43 50 13	70 26 15	313.1	22-32
CW 2007	CHA-3	435040070264501	43 50 40	70 26 45	301.4	14-24
CW 2008	MPW-2	435131070261402	43 51 31	70 26 14	309.5	17-27
CW 2009	KEY-2	435022070264102	43 50 26	70 26 41	310.8	12-22
CW 2010	MDW-1	435018070263201	43 50 18	70 26 32	310.7	22-32
CW 2011	BRW-1	435014070264901	43 50 14	70 26 49	310.7	17-27
CW 2012	CBW-1	435004070262101	43 50 04	70 26 21	307.6	17-27
CW 2013	YMCA-1	434527070303501	43 45 27	70 30 35	295.0	92-97
CW 2014	YMCA-2	434531070302001	43 45 31	70 30 20	255.0	190-200
CW 2015	YMCA-3	434544070301401	43 45 44	70 30 14	250.0	117-137
CW 2016	[1]SHW-1	435000070263701	43 50 00	70 26 37	303.6	----
CW 2017	[1]B-103	435146070271801	43 51 46	70 27 18	311.5	7.9-12.9
CW 2018	[1]TH-3	435136070270801	43 51 36	70 27 08	325.6	----
CW 2019	[1]TH-4	435136070271201	43 51 36	70 27 12	312.8	8.1-13.1

[1]Wells not installed by U.S. Geological Survey.

Table 8. Water levels in observation wells in the Presumpscot River Basin study area, Maine--Continued

[----, well not installed or water level not measured]

Local identifier	Project identifier	Water level, in feet above sea-level													
		8/15-8/16 1995	9/1 1995	9/19 1995	10/5 1995	10/17& 10/19 1995	11/22 1995	1/17-1/18 1996	2/22-2/23 1996	4/3 1996	5/6-5/7 1996	6/5-6/6 1996	7/9-7/10 1996	7/31-8/1 1996	9/5-9/6 1996
CW 1992	BENT1	292.35	291.81	291.59	291.37	291.55	293.79	292.13	293.27	293.75	294.43	293.91	293.03	293.14	292.11
CW 1993	BENT2	295.25	294.88	294.57	294.41	294.47	296.05	295.04	296.06	296.58	297.26	296.93	296.03	296.21	295.17
CW 1994	NWW1	274.44	273.46	272.71	273.14	275.08	276.81	276.07	-----	276.64	276.56	276.11	275.60	275.46	273.29
CW 1995	DUN-1	293.20	292.80	292.55	292.36	292.25	293.47	293.35	294.47	295.00	295.96	295.48	294.47	294.53	293.61
CW 1998	WAL-1	294.71	293.28	292.68	292.09	292.45	304.43	295.05	301.64	304.24	305.81	301.17	295.05	296.42	293.07
CW 1999	KEY-1	288.81	288.13	287.82	287.55	287.70	292.47	288.82	290.93	292.10	293.02	291.42	289.17	289.77	288.21
CW 2000	SSW-1	291.78	292.22	291.34	291.23	291.30	292.32	291.85	292.50	292.79	293.36	292.90	292.13	292.14	291.51
CW 2001	MPW-1	294.56	294.32	294.00	293.82	293.53	295.03	294.66	295.50	295.77	296.05	295.58	294.82	294.88	294.03
CW 2003	UWW1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	271.44	271.23	271.25	270.94
CW 2004	TCBY1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	265.95	265.31	265.39	264.84
CW 2005	CPW-2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	274.38	273.83	273.98	273.42
CW 2006	OAK-1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	295.83	295.21	295.29	294.62
CW 2007	CHA-3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	292.71	292.00	292.10	291.48
CW 2008	MPW-2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	296.10	295.65	295.55	295.22
CW 2009	KEY-2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	299.17	298.32	298.35	296.85
CW 2010	MDW1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	295.90	295.38	295.51	294.74
CW 2011	BRW-1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	298.96	298.07	298.38	297.06
CW 2012	CBW-1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	294.07	293.10	293.07	292.19
CW 2013	YMCA-1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	55.51[a]	55.27[a]	56.00[a]

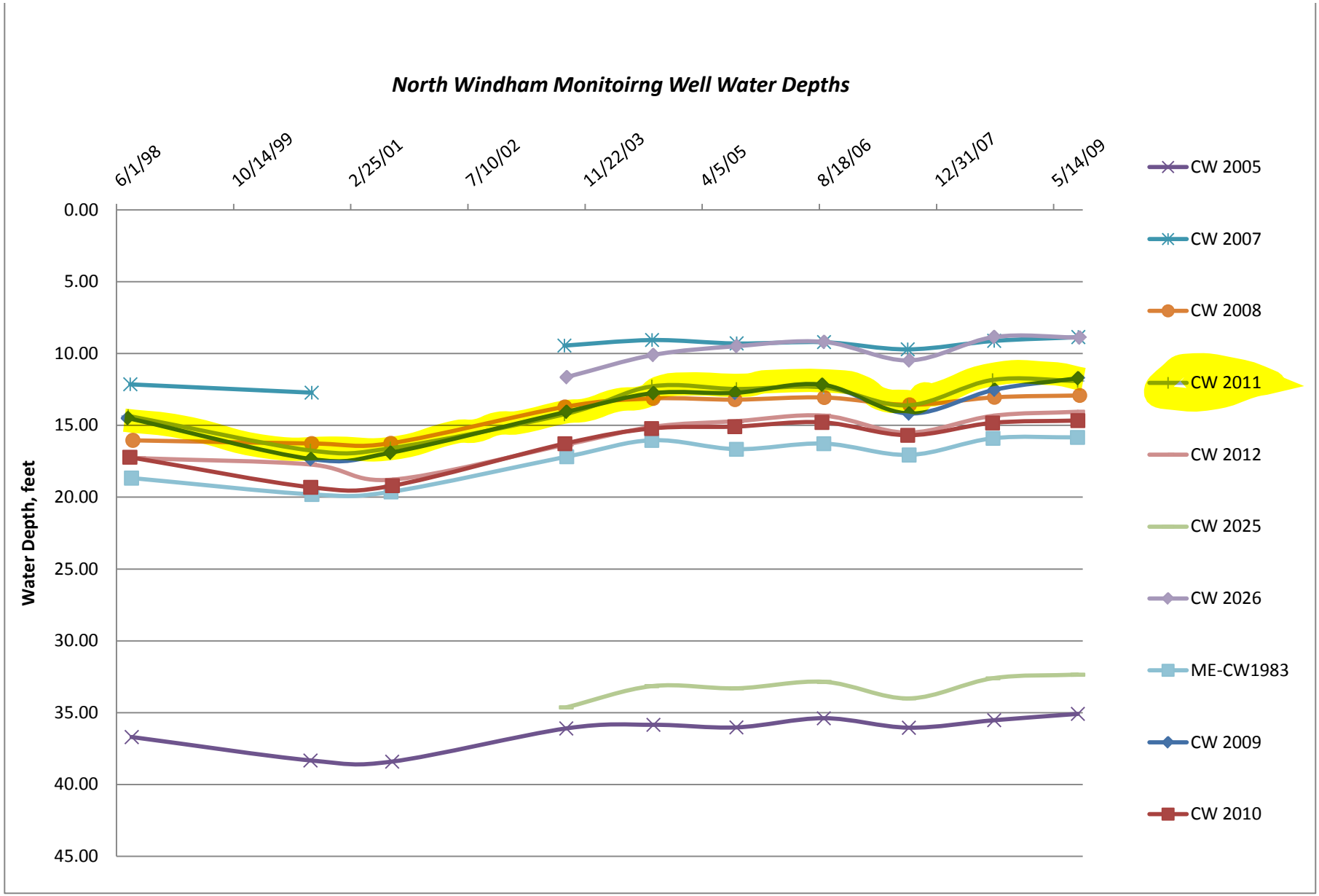

North Windham Monitoirng Well Water Depths
6/1/98
10/14/99
2/25/01
7/10/02
11/22/03
4/5/05
8/18/06
12/31/07
5/14/09
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
Water Depth, feet
CW 2005
CW 2007
CW 2008
CW 2011
CW 2012
CW 2025
CW 2026
ME-CW1983
CW 2009
CW 2010

Figure 10

Table 6. Lithologic logs of observation wells and test borings, Presumpscot River Basin study area, Maine

[Description of the sediment is in terms of grain-size diameter, in millimeters (mm): gravel, greater than 2.0 mm; very coarse sand, 1.0-2.0 mm; coarse sand, 0.5 -10 mm; medium sand, 0.25-0.5 mm; fine sand, 0.125-0.25 mm; very fine sand, 0.062-0.125 mm; silt, 0.004-0.062 mm; clay, less than 0.004 mm. [fill is foreign material, usually transported to an area. Refusal occurs when either bedrock, compact sediments, or sediments containing large cobbles are encountered. Depth below land surface: All depths are in feet below land surface]

Description of material	Depth From	To
CW1971 (ARL-1)		
Loam	0	2
Sand, fine silty	2	5
Sand, coarse to very coarse; pebbles	5	10
Sand, fine to medium; occasional granules	10	12
Sand, fine to medium	12	42
No sample	42	47
Sand, fine with varying amounts silt and clay	47	69
No sample	69	77
Sand, fine to coarse, silty; occasional pebbles	77	79
Till, with bedrock fragments	79	83
Refusal		83
CW1972 (BR2-A)		
Gravel, dirty	0	2
Sand, medium to coarse; some gravel	2	79
Till	79	84
Refusal		84
CW1973 (BR2-B)		
No sample	0	47
End of boring		47
CW1974 (BR2-C)		
Sand, medium	0	2
Sand, medium to coarse	2	7
Sand, fine to medium	7	12
Sand, fine to medium; occasional pebble	12	17
Sand, fine to medium	17	22
Sand, fine	22	37
Sand, medium; pebble	37	39
No sample	39	47
Sand, medium to very coarse; broken rock fragments	47	49
No sample	49	57
Sand, fine to coarse; broken rock fragments	57	59
No sample	59	67
Sand, fine to coarse	67	69
No sample	69	77
Sand, fine; pebbles near 79 feet	77	79
No sample	79	87
Sand, fine to coarse	87	89
No sample	89	97
Sand, fine to coarse; granules	97	99
No sample	99	106
Refusal		106
CW1975 (WKR-1)		
Sand, medium to fine	0	7
Clay	7	29
No sample; till began at 35 feet	29	37
Till	37	39
No sample	39	47.5
Refusal		47.5
CW1977 (CEO-1)		
Till, silty-fine sand cobbly	0	7
Refusal		7
CW1978 (VMR-1)		
Sand; silt; clay	0	6
No sample	6	22
Sand, fine to medium	22	24
No sample	24	27
Sand, fine to medium; broken rock	27	29
Refusal		29
CW1979 (CPW-1)		
Fill	0	2
No sample	2	37
Sand, fine to medium	37	59
No sample	59	97
Sand, very fine to fine	97	99
No sample	99	109
Refusal		109
CW1980 (MTW-1)		
Sand, fine to medium	0	19
No sample (hard layer between 27 and 29 feet)	19	29
Clay, on augers about		30
No sample	30	36
Refusal		36

Table 6. Lithologic logs of observation wells and test borings, Presumpscot River Basin study area, Maine, Continued

Description of material	Depth From	To
CW2003 (UWW-1)		
Sand, medium to coarse, some stones and occasionally cobbles	0	39
No sample (drilling change, bony at 59 ft.)	39	67
Refusal		67
CW2004 (TCBY-1)		
Sand, medium to coarse; some pebbles and stones	0	32
Sand, fine to coarse	32	34
Sand, coarse to fine	34	59
End of boring		59
CW2005 (CPW-2)		
No sample	0	47
Sand, fine to coarse	47	49
End of boring		49
CW2006 (OAK-1)		
Sand, medium to coarse; bony stones and cobbles	0	25
Sand, medium to coarse	25	29
No sample	29	32
End of boring		32
CW2007 (CHA-3)		
Fill	0	4
Sand, fine	4	22
Sand, fine with some medium	22	24
End of boring		24
CW2008 (MPW-2)		
No sample	0	27
Sand, fine to coarse	27	29
End of boring		29
CW2009 (KEY-2)		
No sample	0	22
Sand, fine	22	24
End of boring		24
CW2010 (MDW-1)		
Sand, medium to coarse	0	32
Sand, medium to coarse	32	34
End of boring		34

Description of material	Depth From	To
CW2011 (BRW-1)		
Sand, fine with some medium	0	20
No sample	20	27
Sand, fine; silt	27	29
End of boring		29
CW2012 (CBW-1)		
Sand, medium to fine	0	17
Sand, very fine	17	19
No sample (drilling change bony at 21 feet)	19	27
Till; broken rock fragments	27	29
End of boring		29
CW2013 (YMCA-1)		
Sand, coarse to fine; loam 0-0.5 feet some pebbles and gravel	0	27
Sand, medium to coarse	27	29
No sample	29	47
Sand, fine to very fine	47	49
No sample	49	67
Sand, very fine to fine some interbedded medium sand	67	69
No sample	69	97
Sand, medium to fine, some coarse	97	99
End of boring		100
CW2014 (YMCA-2)		
Sand, medium to coarse	0	17
Sand, medium to coarse; some stones	17	19
No sample	19	37
Sand, medium to coarse; (hard-coarse layer)	37	39
No sample	39	57
Sand, medium to coarse; some stones	57	59
No sample	59	77
Sand, medium to coarse	77	79
No sample	79	97
Sand, very coarse to fine	97	99
No sample	99	117
Sand, fine to medium; some pebbles (layered)	117	119
No sample	119	147
Sand, fine	147	149
No sample	149	200
End of boring		200

Robert G. Gerber, Inc.
a Jacques Whitford Company
Consulting Engineers and Environmental Scientists

174 South Freeport Road
Freeport, Maine 04032-1133
207-865-6138

LOG OF BORING DUN-1

Project:	Windham Ground Water Evaluation	Surface Elev.:	315.6	Total Depth:	52.0
Job No.:	1345	Top of PVC Elev.:	319.02	Hole Diameter:	3.25"
Location:	Windham, Maine	Equipment:	CME 55		
Coordinates:		Drilling Method:	Hollow Stem Auger		

Elevation, feet	Depth, feet	Graphic Log and Sample Types	Sample No.	% Recovery	MATERIAL DESCRIPTION	SPT, N value or RQD in %	Vane Shear Strength Sv / ≈ psf	COMMENTS	WELL INSTALLATION DETAILS
315.6	0				Medium to fine sand. LOAM			Stick-up = 3.4'.	
313.6					Medium to fine sand.				Bentonite
310	5								
	10				Sand becomes finer.				
300	15								Water level on 8/15/95
	20								
290	25			83	27.4' Fine to medium sand.	5			10' of 0.010 slotted screen.
	30								

Boring continues on next page

Date Started:	7/25/95
Date Completed:	7/25/95
Drilling Contractor:	USGS
Engineer/Geologist:	USGS
Approved By:	

Symbols:
- Auger Cutting
- Vane Shear
- SPT
- WL at time of boring
- UD
- Penetrometer
- Rock Core

Remarks: Jeff Dunlap. Boring data from provisional USGS field logs.

All depths in feet. Unless otherwise noted, water encountered but not recorded.

The stratification lines represent approximate boundaries. The transition may be gradual.

Robert G. Gerber, Inc.
a Jacques Whitford Company
Consulting Engineers and Environmental Scientists

174 South Freeport Road
Freeport, Maine 04032-1133
207-865-6138

LOG OF BORING DUN-1
(continued)

Project:	Windham Ground Water Evaluation	Surface Elev.:	315.6
Job No.:	1345	Top of PVC Elev.:	319.02
Location:	Windham, Maine	Equipment:	CME 55
Coordinates:		Drilling Method:	Hollow Stem Auger

Total Depth: 52.0
Hole Diameter: 3.25"

Elevation, feet	Depth, feet	Graphic Log and Sample Types	Sample No.	% Recovery	MATERIAL DESCRIPTION	SPT, N value or RQD in %	Vane Shear Strength Sv / s_r psf	COMMENTS	WELL INSTALLATION DETAILS
280	35								
	40								
270.6	45				Sandy TILL.				
270				83		72			
	50								
263.6					Boring terminated at 52.0' on refusal.				

Date Started: 7/25/95
Date Completed: 7/25/95
Drilling Contractor: USGS
Engineer/Geologist: USGS
Approved By:

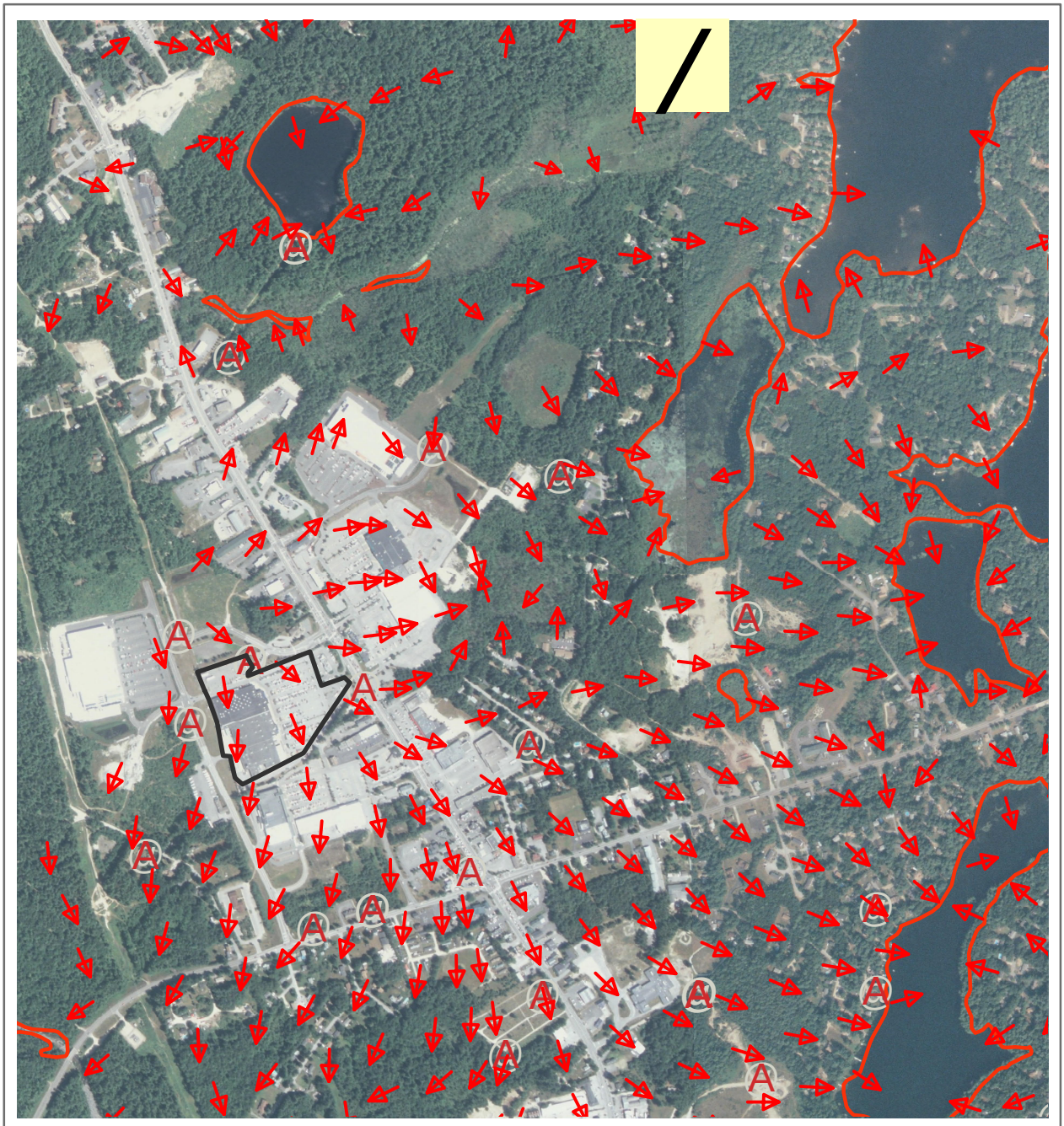
Symbols:
- Auger Cutting
- Vane Shear
- SPT
- WL at time of boring
- UD
- Penetrometer
- Rock Core

Remarks: Jeff Dunlap. Boring data from provisional USGS field logs.

All depths in feet. Unless otherwise noted, water encountered but not recorded.

The stratification lines represent approximate boundaries. The transition may be gradual.

APPENDIX C-7
Groundwater Flow Direction Figure

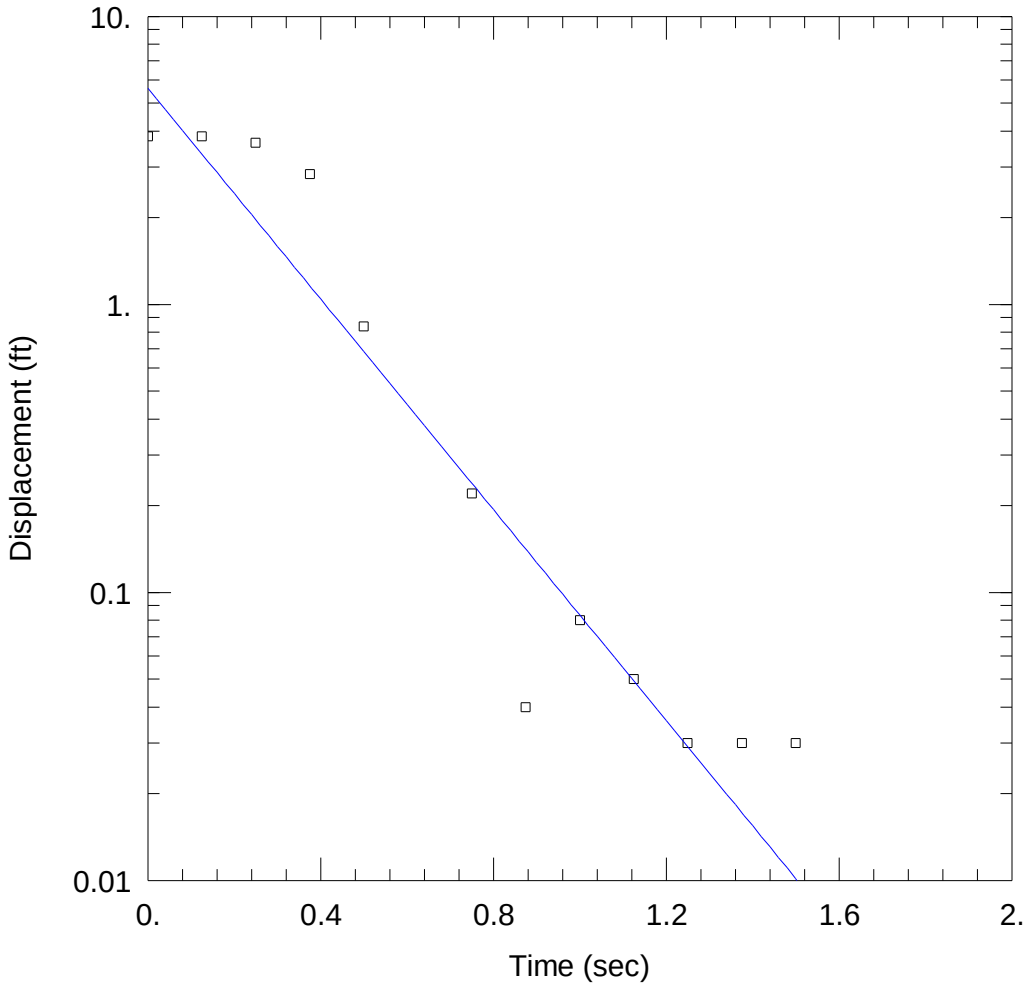


Model-Generated Groundwater Flow Vectors
North Windham Area
RGG 09106 6-2-09

Sebago Technics
Engineering Expertise You Can Build On
One Chabot Street
Westbrook, Me 04098-1339
Tel (207) 856-0277

Figure 2

APPENDIX C-8
Slug Tests Results



WELL TEST ANALYSIS

Data Set:
Date: 09/25/19 Time: 11:09:49

PROJECT INFORMATION

Company: Wright-Pierce
Client: Windham, Maine
Project: 13926E
Location: Lowes Lot
Test Well: CW 2011

AQUIFER DATA

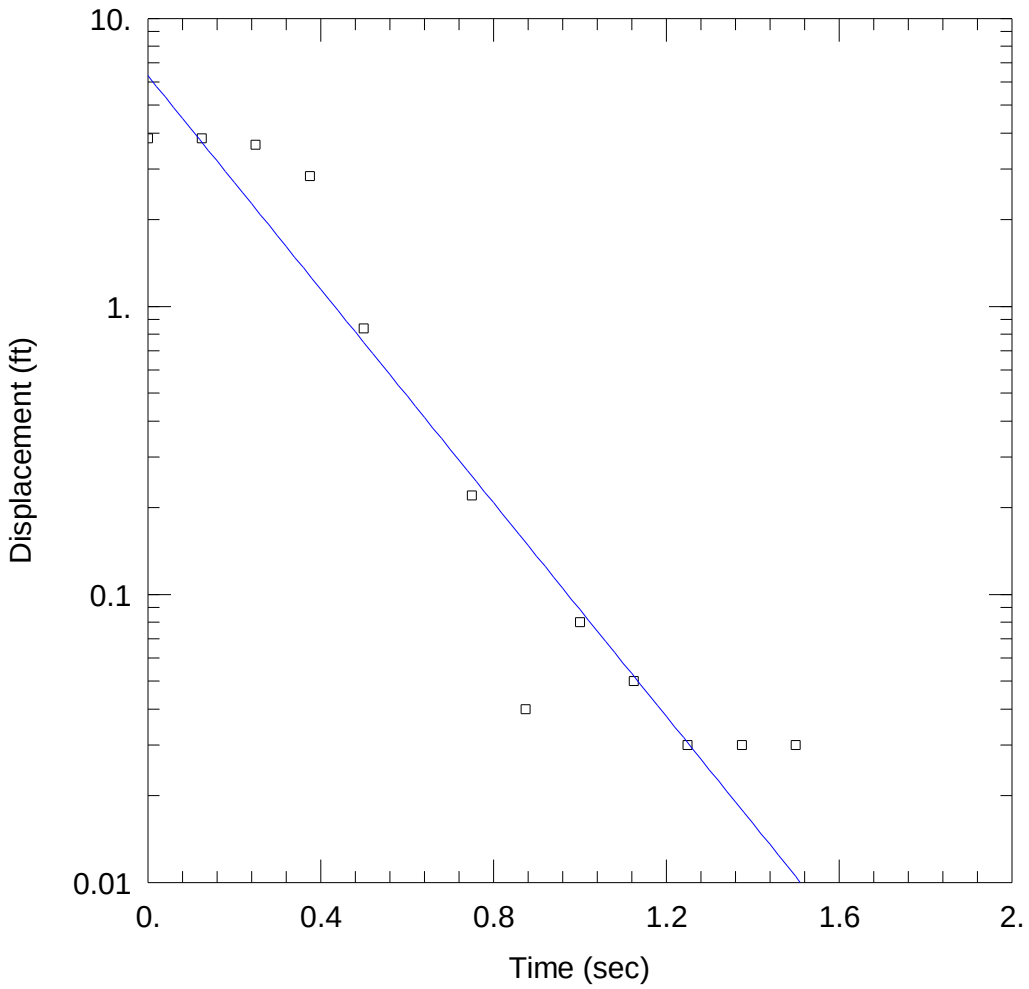
Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (CW 2011)

Initial Displacement: 3.83 ft
Total Well Penetration Depth: 21. ft
Casing Radius: 0.08333 ft
Static Water Column Height: 16. ft
Screen Length: 10. ft
Well Radius: 0.08333 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 526.5 ft/day
y0 = 5.631 ft



WELL TEST ANALYSIS

Data Set: J:\...\bouwer_gjs.aqt
Date: 09/25/19 Time: 11:12:44

PROJECT INFORMATION

Company: Wright-Pierce
Client: Windham, Maine
Project: 13926E
Location: Lowes Lot
Test Well: CW 2011

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (CW 2011)

Initial Displacement: 3.83 ft
Total Well Penetration Depth: 21. ft
Casing Radius: 0.08333 ft
Static Water Column Height: 16. ft
Screen Length: 10. ft
Well Radius: 0.08333 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 702. ft/day
y0 = 6.33 ft

APPENDIX C-9
Mounding Analysis Calculations

Transient Water-Table Rise Beneath a Rectangular Recharge Area
Groundwater Mounding Solution by Hantush (1967)

Aquifer Properties:
Hydraulic conductivity, K = 60 ft/day
Specific yield, Sy = 0.25
Initial saturated thickness, h(0) = 32 ft

Recharge Area Properties:
Recharge rate, w = 0.2 ft/day
Simulation time, t = 3650 day
Time when recharge stops, t(0) = 3650 day
X coordinate at center of recharge area, X = 1000 ft
Y coordinate at center of recharge area, Y = 1000 ft
Length in x direction, l = 260 ft
Length in y direction, a = 260 ft

Water-Table Rise at Center of Recharge Area:

t (day)	h (ft)
365	5.03901
730	5.70582
1095	6.09225
1460	6.36454
1825	6.57462
2190	6.74551
2555	6.88946
2920	7.01377
3285	7.1231
3650	7.22066

Report generated by AQTESOLV v4.50.002 (www.aqtesolv.com) on 10/10/19 at 15:31:15.

Transient Water-Table Rise Beneath a Rectangular Recharge Area
Groundwater Mounding Solution by Hantush (1967)

Aquifer Properties:
Hydraulic conductivity, K = 60 ft/day
Specific yield, Sy = 0.25
Initial saturated thickness, h(0) = 32 ft

Recharge Area Properties:
Recharge rate, w = 0.0891 ft/day
Simulation time, t = 3650 day
Time when recharge stops, t(0) = 3650 day
X coordinate at center of recharge area, X = 1000 ft
Y coordinate at center of recharge area, Y = 1000 ft
Length in x direction, l = 660 ft
Length in y direction, a = 230 ft

Water-Table Rise at Center of Recharge Area:

t (day)	h (ft)
365	4.19525
730	4.87097
1095	5.2641
1460	5.5415
1825	5.75566
2190	5.92994
2555	6.07678
2920	6.20359
3285	6.31514
3650	6.41469

Report generated by AQTESOLV v4.50.002 (www.aqtesolv.com) on 10/06/19 at 10:51:02.

APPENDIX D
Example Drip Dispersal System Operation and Maintenance Manuals

APPENDIX D-1
Example Manual with Inspection Schedule

AMERICAN "PERC-RITE®" DRIP DISPERSAL
OPERATING MANUAL

Table of Contents

AMERICAN MANUFACTURING COMPANY INC.
22011 Greenhouse Road Elkwood, VA. 22718
1-800-345-3132

PROJECT: "PERC-RITE®" Drip Dispersal System for the Bruner Tract, also now as The Courts at Chester Springs in West Vincent Township, Chester County, Pennsylvania.

CAPACITY: 50,659 GPD (MAX DAILY FLOW)

INTRODUCTION:

This Operating Manual is for the onsite *AMERICAN "PERC-RITE®" DRIP DISPERSAL SYSTEM* for the Bruner Tract in Chester County, Pennsylvania. The system utilizes a WWTP to treat the effluent followed by the approved American "Perc-Rite®" Drip Dispersal Technology to filter and dispose of a maximum of 50,659 gallons per day.

The proposed *AMERICAN "PERC-RITE®" DRIP DISPERSAL SYSTEM* is a unique fluid handling system for dispersal of septic quality effluent wastewater into the proposed soil system. The system incorporates filtration, time and level controlled application, and ultra low rate drip distribution.

PROCESS DESCRIPTION:

Following the WWTP, the wastewater is to collect in a final disposal pump chamber sized to hold a minimum of ½ - one full day of storage for emergency and flow equalization. The effluent will be time dosed via a four float operating system, two multi-stage submersible high head pumps and a "state of the art" controller. The effluent will undergo 100 micron disc filtration prior to final disposal through pressure compensating emitters located every two feet on-center inside the ½ inch Netafim Bioline polyethylene pressure compensating dripper tubing.

The *AMERICAN "PERC-RITE®" DRIP DISPERSAL SYSTEM* will accommodate the type of pretreatment process provided. Only primary treatment (the removal of large settleable solids) of sewage is necessary for the operation of this system. The installation of the system will have minimal site impact and after installation there should be virtually no visible indications that the installation site is being used for disposal purposes.

SYSTEM OPERATION:

The *AMERICAN "PERC-RITE®" DRIP DISPERSAL SYSTEM* is operated via a "state of the art" controller which is activated by level sensing devices (standard mechanical differential float switches) located in a dosing tank downstream from the pretreatment process. When activated by the rising level of effluent in the dosing tank, the controller will enable the disposal cycle, and as dictated by the time clock, pump the effluent through 100 micron disc filters and then to final drip dispersal.

The pump control panel is equipped with four float switches to control the timed doses to be discharged. The four float switches, "Redundant Off", "Standard Dose Enable", "Peak/Level Indicator" and "High Level" function as follows:

- Redundant Off - The water level must be high enough to overcome the "Redundant Off" (first & bottom) float in order for the pump to be permitted to run.
- Standard Dose Enable - When the water level rises high enough to overcome the "Standard Dose Enable" (second) float and the time clock has timed out the preset time delay (rest time between dosing cycles), the pump will activate and the lead zone(s) is dosed. The pump will continue to run for the length of time required to disperse of the specified dose volume and then shut off. The pump will remain off until the internal time

clock again times out the preset time delay which the pump will activate (as long as the "Standard Dose Enable" float is still up) and will run again until the specified volume is pumped. This process will repeat until the water level drops below the "Standard Dose Enable" float and the pump run timer has timed out.

- Peak / Level Indicator - Used to indicate level of effluent in final pump tank.

- High Level - If the water level rises enough to overcome the "High Level" (fourth) float, the audiovisual alarm will activate (if applicable). The audio portion of the alarm may be silenced by pressing the Test-Normal-Silence switch (located on the outside of the control panel) to the silence position. The alarm circuit will latch until manually reset after the "High Level" float returns to its normal (down) position. The alarm circuit is manually reset by switching the High Level Reset/Off-Normal switch (located inside the control panel on the inner door) to the Reset position and then back to Normal position.

Disc Filtration

The skid mounted centrifugal pumps (duplex) deliver unfiltered effluent to each of the 100 micron Arkal Disc filters during the normal forward filtration process. Periodically, each filter goes through a backflush cycle to clean the filters. The filter backflushing schedule is automatically triggered after a specified volume passes forward through the flow meter or after a specified differential pressure reading is detected between the upstream and downstream gauges. One filter valve closes, thus blocking the flow of unfiltered effluent to that filter. After a short delay, the other two flushing valves open. The clean effluent from the two forward filtration filters is directed to the outlet manifold. Filtered water from the outlet manifold now flows in reverse direction (in through the spine) of the filter to be backflushed and into the backflush nozzles, spinning the loosened discs and flushing the captured debris out the drain manifold. The accumulated impurities discharge back into the pretreatment unit. The backflush procedure lasts approximately fifteen to thirty seconds then the back flushing valve closes. Only after the first filter has completed its backflushing cycle, will the next filter begin its cycle of backflushing in the same manner as the first until all the filters have been backflushed. Effluent will then be pumped through clean disc filters, then through the flow meter and finally through the outlet manifold to the drip field supply line.

Drainfield Size & Dosing

The drip dispersal system will contain approximately 93,484 linear feet of drip tubing. The system will be made up of eighteen (18) separate drip zones. Each zone will have between 3,940 - 7,505 l.f. of pressure compensating drip tubing. Zones will all have multiple subzones and lateral configurations.

The drain fields are split into three areas: Bruner Area 1, Township South Parcel and Township North Parcel. Zones will be dosed TWO at a time. Provided that there is enough water in the final dosing tank to activate the “Off” and “Enable” floats, a drainfield dose will be initiated every __ minutes. When __ minute rest time has elapsed, the next zone(s) will automatically receive a dose (provided there is still adequate water in the pump chamber). Under maximum conditions zones will each be dosed approximately 8 times per day.

Each zone will undergo a “Forward Field Flush” every 25 cycles to scour the inside of the dripper tubing. In order to achieve minimum scouring velocity (2 ft/sec) at the distal end of each dripper lateral, each zone will be Forward Flushed individually.

DISPERSAL INSTALLATION & CONSTRUCTION TECHNIQUES

1. All installation and construction techniques shall conform to state and county codes pertaining to on site sewage systems and the permit for this site.

2. The installation of this system shall be in accordance with specifications and procedures as supplied by the Manufacturer of the equipment.

3. The drip tubing shall be installed using a vibratory plow or trencher.

4. All PVC pipe and fittings shall be PVC SCH 40 Type 1 rated for pressure applications. All glued joints shall be cleaned and primed with purple (dyed) PVC primer prior to being glued.

5. All cutting of PVC pipe, flexible PVC and dripper tubing of size 1 1/2" or smaller shall be accomplished with pipe cutters approved by American Manufacturing Company, Inc. No sawing of PVC, flexible PVC or dripper tubing of size 1 1/2" or smaller allowed.

6. All PVC pipe, flexible PVC and dripper tubing in the work area shall have the ends covered with duct tape to prevent construction debris from entering the pipe. Prior to gluing, all joints shall be inspected for and cleared of any construction debris.

7. All automatic valves (zone valves & field flush return valves) shall be installed with isolation valves, bypass valves, and disconnects (i.e. unions, flanges) for manual field operation during field maintenance events. All valves must be provided with at-grade access.

8. Drainfield supply and return lines and manifolds to be installed at adequate depth to prevent freezing. Horizontal spacing between the dripper lines and the installation depth to be as specified.

9. No activity on drainfield area other than minimum required to install system. Do not park equipment, drive large equipment over or store materials on drainfield area.

10. No wet weather installation is permitted.

11. The contractor shall be certified by American Manufacturing Company, Inc. to install this type of system and shall hold a pre construction meeting with the individuals responsible for soil evaluation, permitting and inspections prior to site work beginning to insure protection of the site conditions and to ensure the system is installed according to design.

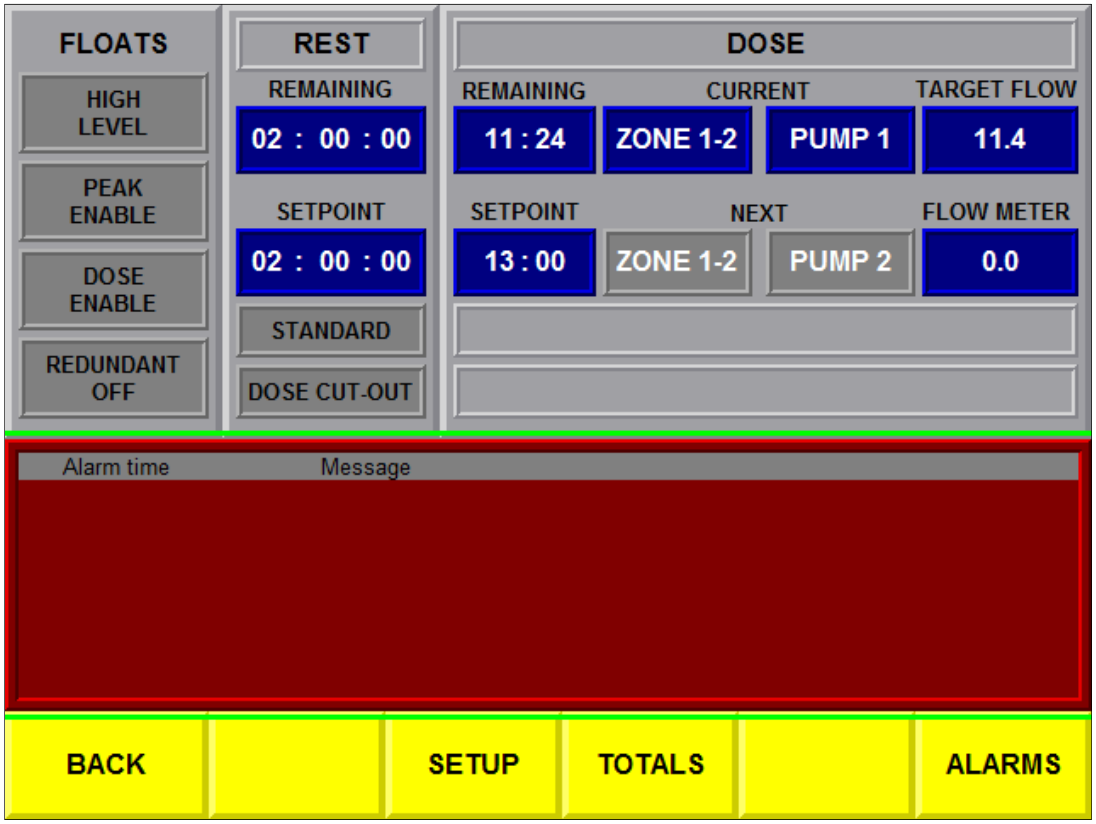
12. If site conditions are determined to require the installation of the system to deviate from these plans, all work shall stop immediately and the designer shall be notified. Any ongoing work shall be at the sole responsibility of the contractor.

13. All force mains shall be tested for leaks prior to drip tubing installation and prior to system startup. Uncovered force mains shall be visibly inspected for leaks. If a leak is suspected in covered force mains then the force main shall be re-tested at a minimum pressure of at least 50 percent above the design operating pressure, for at least 30 minutes. There shall be no discernible leakage.

American Manufacturing Company, Inc.
P.O. Box 97, Elkwood VA 22718

Operations Manual
Bruner Tract
ITEM: DP2-B9405 MODEL: DP5324-DAB114-ABGLX(21-5,HMI)Z

MAIN SCREEN



FLOATS: Gray background indicates that the float switch is not activated (down position). Green background indicates the float is activated.

REST: Indicates if the system is in STANDARD or PEAK REST mode. Indicates the REST SETPOINT and REST TIME REMAINING in HH:MM:SS. If the system uses a DOSE CUT-OUT feature the DOSE CUT-OUT box will turn RED when the DOSE CUT-OUT is activated. An active DOSE CUT-OUT prevents the system from running in automatic.

DOSE: Indicates the SETPOINT CYCLE RUN TIME and REMAINING CYCLE RUN TIME in MM:SS. TARGET FLOW is in GPM and is dependent on the set point for the zone(s) that is dosing. The FLOW METER reads the current flow rate in GPM.

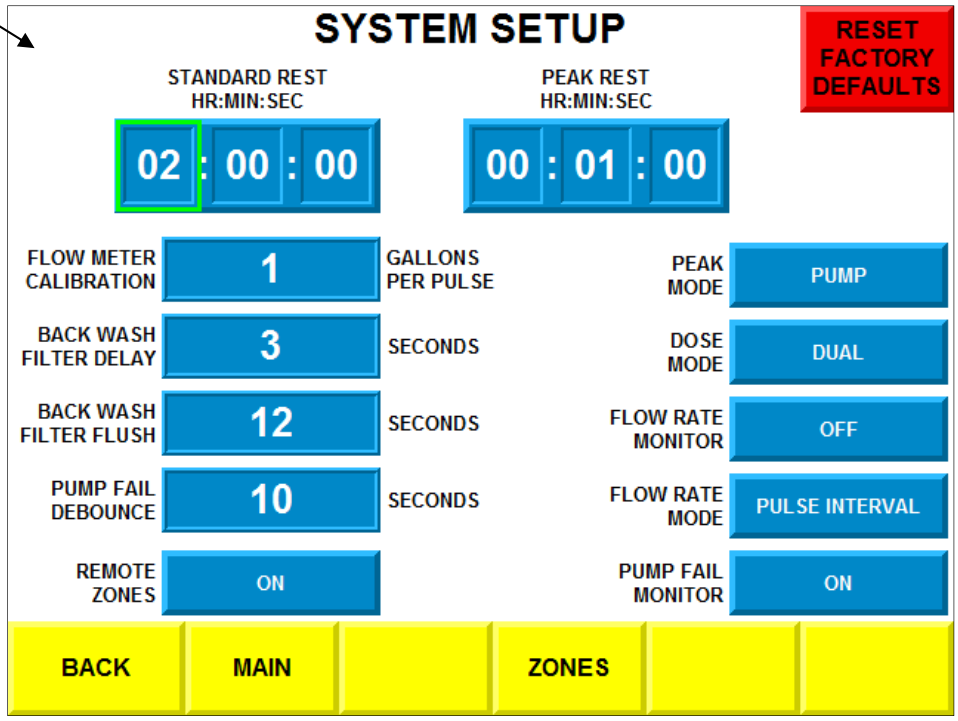
ALARM BOX: Displays active alarms and the time that they first occurred. These alarms are also listed on the ALARMS screen (from the Alarms tab button). When the alarm condition resets the alarm will no longer be listed in this box.

TAB BUTTONS: Along the bottom of the screen, tap to take you to the listed screen.

Operations Manual
Bruner Tract
ITEM: DP2-B9405 MODEL: DP5324-DAB114-ABGLX(21-5,HMI)Z

SYSTEM SETUP SCREEN

HIDDEN EXIT BUTTON: SEE PAGE 8 FOR MORE INFO.



STANDARD / PEAK REST: Enter the desired rest time between the start of cycles.

FLOW METER CALIBRATION: Typ. 1. Enter the gallons per pulse rate for the attached flow meter.

BACK WASH FILTER DELAY: The pause time before a filter flushes. Typ. 2-3 seconds.

BACK WASH FILTER FLUSH: The duration that each filter is flushed during each flush event. Typ. 10-20s.

PUMP FAIL DEBOUNCE TIME: The delay time that will trigger a PUMP FAIL ALARM when a pump fails.

PEAK MODE: Tab between PUMP, PUMP & ALARM and OFF.

DOSE MODE: Tab between Single Zone Dosing or Dual Zone Dosing.

FLOW RATE MONITOR: Tab between ON or OFF. Turn ON to monitor GPM rates to zones.

FLOW RATE MODE: Tab between PULSE INTERVAL and PULSE /MIN. Typ. PULSE INTERVAL.

PUMP FAIL MONITOR: Tab between ON or OFF. Typ. ON if panel has pump fail sensors.

REMOTE ZONES: Tab between ON or OFF. Typ. ON when the remote zone panel is in operation.

Operations Manual
Bruner Tract
ITEM: DP2-B9405 MODEL: DP5324-DAB114-ABGLX(21-5,HMI)Z

ZONE SETUP SCREEN

ZONE SETUP

	DOSE TIME MIN : SEC	FLOW RATE GPM	FLOW VARIANCE ALARM %	FLOW CAT ALARM %	FIELD FLUSH FREQ CYCLES	FLOW MONITOR DELAY SECS	FIELD FLUSH PRESS SECS
COPY ZONE 1 TO ALL							
ZONE 1	03 : 00	1.0	20	50	10	1	120
ZONE 2	03 : 00	2.0	20	50	10	1	120
ZONE 3	03 : 00	3.0	20	50	10	1	120
ZONE 4	03 : 00	4.0	20	50	10	1	120
ZONE 5	03 : 00	5.0	20	50	10	1	120
ZONE 6	03 : 00	6.0	20	50	10	1	120
ZONE 7	03 : 00	7.0	20	50	3	1	120
ZONE 8	03 : 00	8.0	20	50	10	1	120

BACK | MAIN | SYSTEM | | ZONE 9-16 | ZONE 17-24

NOTE: Tap on a cell and a key pad will pop up to allow entry of a parameter. The numbers shown in the cells above are the **FACTORY DEFAULTS**.

DOSE TIME: Enter the design dose cycle length for each zone in MM:SS.

FLOW RATE GPM: Enter the dosing flow rate in GPM for each zone depending on the zone characteristics (i.e. the amount of drip tubing in the zone, emitter spacing and emitter flow rate).

FLOW VARIANCE ALARM %: Used when FLOW RATE MONITOR is tabbed to ON. Used to trigger an alarm when the FLOW METER reading (GPM) on the MAIN SCREEN is compared to the TARGET FLOW RATE (GPM) for each zone. If the rate is greater than or less than the TARGET by the FLOW VARIANCE percentage a FLOW VARIANCE ALARM will be indicated under ACTIVE ALARMS on the MAIN screen.

Pressing the RESET/CYCLE START button on the inner door of the control panel will RESET this alarm. The ALARM event will be stored on the ALARMS screen.

ZONE SETUP SCREEN CONTINUED

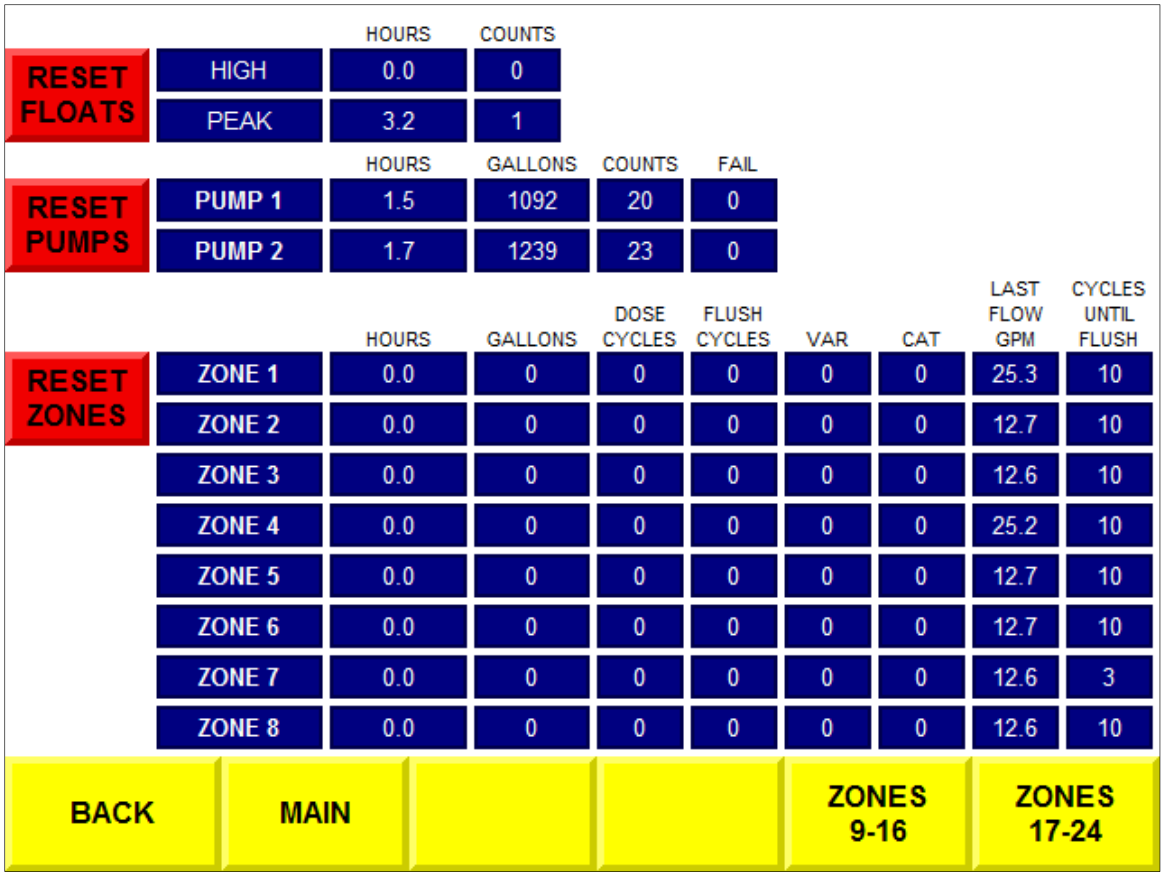
FLOW CATASTROPHIC (CAT) ALARM %: See FLOW VARIANCE ALARM % above. This is different from the VARIANCE alarm in that it indicates a larger flow rate discrepancy and will not only trigger an alarm but will also STOP the current DOSE CYSLE and lock out the ZONE that has the CATASTROPHIC FLOW event. That zone will remain locked -out (skipped in zone rotation) until manually reset by pressing the RESET/CYCLE START button on the inner door.

FIELD FLUSH FREQUENCY: Set how often the zone is to run a field flush cycle. Typically twice per month or once every two weeks. The default was estimated based on the expected cycles per day per zone.

FLOW MONITOR DELAY: At the start of each dose cycle the system will wait the number of seconds specified in this parameter before taking a comparison reading on the main screen of the FLOW METER reading (GPM) vs the TARGET FLOW RATE (GPM). The comparison is used to check for FLOW VARIANCE or FLOW CATASTROPHIC ALRAMS. The delay is to allow for the zone to come up to pressurization before a reading is taken. A reading taken too soon could read too high as the drip tubing is still filling up causing a false high flow CATASTROPHIC event. 60-90 seconds is typical.

FIELD FLUSH PRESSURIZATION: At the start of each FIELD FLUSH event the system will wait the number of seconds specified in this parameter before opening the ZONE RETURN valve to simulate the flush. The delay allows for the zone to fill up to pressurization.

TOTALS SCREEN



NOTE: Example data shown above. Please press the RESET button at system startup to clear the testing logs.

NOTE: Cycle counts and ETM (elapsed time meter) totals indicated for the Zones, Pumps and Floats. VAR and CAT are occurrence event totals for each zone for FLOW VARIANCE and FLOW CAT. ALARMS.

LAST FLOW GPM: Indicates the last FLOW METER reading (GPM) that was recorded for a zone during its last dose cycle. This number is useful when a zone has a current FLOW VARIANCE or FLOW CATASTROPHIC ALARM to determine if it was a high flow or low flow reading that triggered the event.

CYCLES UNITL FLUSH: Indicates the number of dose cycles for a zone that still need to occur before the zone does another FIELD FLUSH. When CYCLES UNTIL FLUSH counts down and reaches"0" the system will FLUSH the zone in place of the next scheduled DOSE. Once the zone flushes, the number in this cell will reset back to the FIELD FLUSH FREQUENCY parameter that was set on the ZONE SETUP SCREEN.

Operations Manual
Bruner Tract
ITEM: DP2-B9405 MODEL: DP5324-DAB114-ABGLX(21-5,HMI)Z

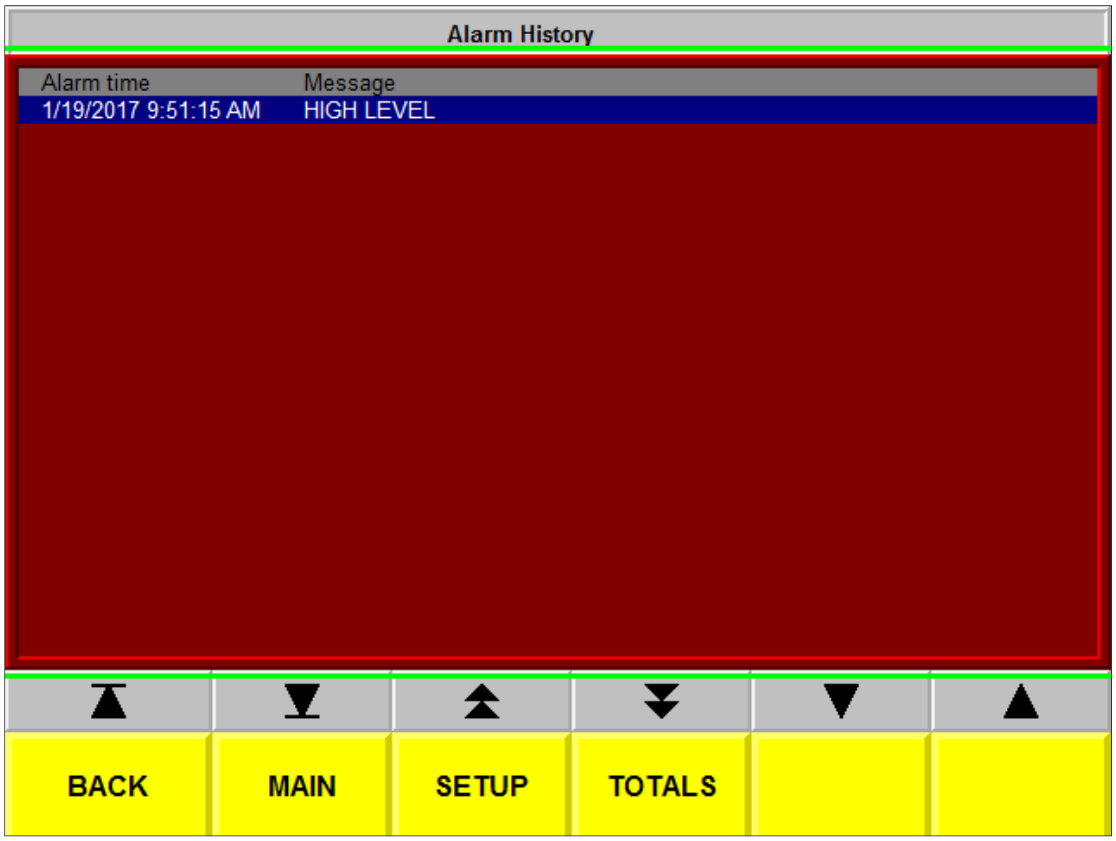
DAILY LOG SCREEN

	4/7	4/6	4/5	4/4	4/3	4/2	4/1	3/31	3/29	3/28	3/27
ZONE 1	0	0	10	0	12	0	12	0	0	1	1
ZONE 2	0	0	0	0	0	0	13	0	1	2	2
ZONE 3	0	0	0	0	13	0	12	0	0	3	3
ZONE 4	0	0	4144	0	0	0	13	6	0	4	4
ZONE 5	0	0	0	0	0	0	12	37	0	5	5
ZONE 6	0	0	0	0	13	0	13	38	0	6	6
ZONE 7	0	0	92	0	0	0	13	13	0	7	7
ZONE 8	0	0	53	0	0	0	13	13	0	7	7
ZONE 9	0	0	2	2414	2527	0	12	12	0	8	8
ZONE 10	0	0	2	0	38	0	38	18	0	10	10
ZONE 11	0	0	0	0	38	0	37	0	0	14	10
ZONE 12	0	0	0	0	37	0	38	20	0	24	0
ZONE 13	0	0	0	0	38	38	0	38	0	24	0
ZONE 14	0	0	0	0	76	76	0	74	0	30	0
ZONE 15	0	0	0	0	76	76	0	76	0	30	0
ZONE 16	0	0	0	0	74	74	0	76	0	29	14
ZONE 17	0	0	0	2464	2566	76	0	76	0	30	15
ZONE 18	0	0	0	0	75	75	0	75	0	40	20
ZONE 19	0	0	0	0	75	76	76	0	0	39	20
ZONE 20	0	0	0	0	71	76	76	0	0	40	20
ZONE 21	0	0	0	0	38	76	76	0	5	35	20
ZONE 22	0	0	0	0	37	75	75	0	20	20	19
ZONE 23	0	287	0	0	0	75	75	0	20	20	19
ZONE 24	0	299	0	0	0	76	75	0	0	20	20

BACK | MAIN | | | DAY 11-20 | DAY 21-30

NOTE: There are three daily log screens. Days 1-10, days 11-20 and days 21-30. Tap on the “DAY 11-20” or “DAY 21-30” buttons to view the daily log for each zone on those days. Logs are created at 11:59 PM each day. Logs are in “gallons”.

ALARMS SCREEN



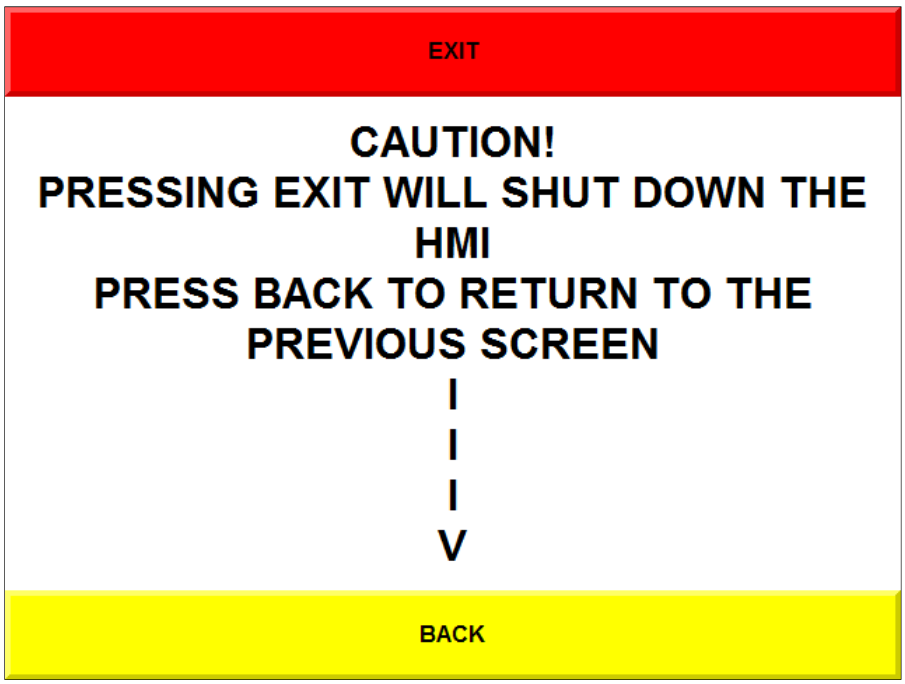
ALARM TIME: Time and Date stamp when an alarm event first occurred.

MESSAGE: Indicates the specific alarm event.

TYPICAL ALARMS:

HIGH LEVEL, PUMP FAIL, DIFFERENTIAL PRESSURE, PHASE MONITOR, PEAK LEVEL (IF IN PUMP & ALARM MODE), REMOTE POWER LOST, REMOTE COMMUNICATION LOST, ZONE FLOW VARIANCE and ZONE CATASTROPHIC FLOW VARIANCE.

HIDDEN EXIT BUTTON



SET DATE AND TIME: On the SYSTEM SETUP SCREEN select the hidden button in the upper left hand corner. It will ask you if you want to EXIT. To reset the DATE and TIME select EXIT.

PROGRAM NAME: X9405

PROGRAM PATH: S:\10 Engineering\Product Software\A-B\Bruner DP5324\Bruner Tract O&M X9405

APPENDIX D-2
Example Manual with Process Descriptions and Installation Instructions

Operation & Maintenance Manual

Hume New England
Monterey, MA

Oakson Contact:

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Operation and Maintenance Quick Guide
Perc-Rite® Drip Dispersal System
HUME NEW ENGLAND, MONTEREY, MA

- Record flow meter reading
- Calculate usage
- Perform cycle/restart if system is not running
- Inspect drip dispersal zones (walk field)
- Inspect filters and clean as needed
- Test control panel switches and skid solenoids
- Inspect field air release, ball, and check valves
- Time flow rates for each individual zone
- Lift floats and check input on PLC
- Perform common return cross-over test

1st inspection:	1 month
2nd inspection:	2 months
3rd inspection:	2 months
Remaining inspections:	quarterly

Quarterly Operation and Maintenance Procedure
Perc-Rite® Drip Dispersal System
HUME NEW ENGLAND, MONTEREY, MA

A. Field Conditions and Preparation

1. Obtain records from previous visit/start-up.
2. Walk the field to determine if wet spots are visible.
3. Inspect air release, ball, and check valves.
4. Inspect hydraulic unit and document flow meter reading.
5. Calculate and document average daily water usage.
6. Open pump chamber and check liquid level/floats.
7. Trigger alarm float

B. Control Lights and Switch Positions

1. Open the control panel.
2. Make sure all switches are in the automatic position.
3. Microprocessor: toggle through all screens to verify settings.
4. Verify float positions in pump chamber correspond with PLC reading.

C. Pump and Valve Operation

1. Place all switches from "AUTO" to "OFF".
2. Inspect (and clean if necessary) all disc filters.
3. Perform return line crossover test:
    a. Close and open appropriate shut off valves to allow flow to travel up the return line.
    b. Place one of the two pumps in "HAND".
    c. The flow meter should register flow and then zero out confirming all check valves are holding shut.
    d. Return all switches to "OFF" and return all crossover valves to regular operating positions.

4. Place pump switch in the "HAND" position. This will dead head pump against valves. The flow meter should not turn, and there should be no leaks.
    a. Check the flow rate for each individual zone by placing the switch in “HAND”.
    b. After pressurization time, document the flow rates by reading the flow meter for a timed minute as well as the flow reading on the PLC.
    c. Compare design flow to timed flow
    d. Flow variation is most common sign of system issue.

5. Check the return valve by placing the switch in “HAND” while one of the zones is running. The flow rate should increase dramatically.
6. Place all switches in the “AUTO” position. Run the system by depressing the “Cycle/Restart” button for 5 seconds. The system will now run a complete cycle in automatic mode (filter backwashing followed by a dual zone dose).

E. Finishing Up

1. All switches in control panel should be in “AUTO” position.
2. Close and secure all tanks, hydraulic unit, control panel, and air release valves.

NOTES:

Quarterly Operation and Maintenance Log
Perc-Rite® Drip Dispersal System
HUME NEW ENGLAND, MONTEREY, MA

Date:

HISTORICAL DATA and CURRENT READINGS

Previous flow meter reading: Date of last inspection:
Current flow meter reading: Calculated water usage:

Dose rate

ZONE 1:
ZONE 2:
ZONE 3:
ZONE 4:

FIELD CONDITIONS

A. Drip dispersal field: visible wet spots	YES	NO
Comments:		
B. Air release valves: erosion	YES	NO
leakage/spraying	YES	NO
Comments:		

PUMP CHAMBER/FLOAT OPERATION

A. Floats correspond with PLC reading	YES	NO
Comments:		
B. Alarm float working	YES	NO
Comments:		

CONTROL PANEL

A. Switches in AUTO position	YES	NO
Comments:		
B. Peak Level light on	YES	NO
Comments:		
C. Microprocessor: all screen settings correct	YES	NO
Comments:		

PUMP and VALVE OPERATION

A. Pump in HAND position: flow meter running YES NO
Comments:

B. Zones 1-4 (one at a time): flow meter running YES NO
dose rate correct YES NO
flush rate > dose rate YES NO
Comments:

C. Disc filter back flushing: working properly YES NO
Comments:

D. Disc filter inspection: excessive residue YES NO
cleaning required YES NO
Comments:

E. Switches returned to AUTO position YES NO
Comments:

F. RESET/CYCLE START: functioning properly YES NO
Comments:

G. Hydraulic Unit: leaks, crimps, or other issues YES NO
Comments:

H. Zone Manifold: leaks, crimps, or other issues YES NO
Comments:

I. Crossover: test return line check valves YES NO
Comments:

Notes: