Stormwater Report
For
Fearing Hill Road Solar Project
Wareham, Massachusetts

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APPENDICES

1.0 INTRODUCTION

This report analyzes the hydrological impacts of the Fearing Hill Road Solar Project, a proposed ground-mounted, solar photovoltaic solar array, totaling ±26.8 acres, located at 91 & 101 Fearing Hill Road (Lots 1000 and 1007 on Wareham Assessor Maps 91 and 74) in Wareham, Massachusetts (the "site"). The site is privately owned land on the north side of Fearing Hill Road, and is currently undeveloped woodland, with adjacent residential properties to the south and west and undeveloped woodlands to the north and east.

The site does not fall within any DEP mapped surface or groundwater protection areas, or Town designated Aquifer Protection or Watershed Protection Overlay Districts. The site is not located within a FEMA Flood Zone or an Estimated Habitat of Rare Wildlife or Priority Habitat of Rare Species, as mapped by the Natural Heritage and Endangered Species Program (NHESP). The site is not located within any Area of Critical Environmental Concern (ACEC).

The property has a Bordering Vegetated Wetland (BVW) system located along the northern portion of the site and an Isolated Vegetated Wetland System (IVW) located along the western property boundary along an abandoned railroad bed.

Topography throughout the undeveloped site can be generalized as a gentle, gradual slope which runs uphill from south to north to a peak in the center of the site. A slight north/south ridge line divides the property, with the northern portion draining toward the wetland system to the north and the southern portion of the site draining to the aforementioned isolated wetland system to the west.

The proposed ±26.8-acre solar development project is comprised of two solar arrays, perimeter fencing, photovoltaic solar panels, racking systems, inverters, transformers, and battery storage units with associated concrete pads, above and below ground utilities, stormwater facilities, and a gravel road to access to all electrical equipment pads.

2.0 PROPOSED STORMWATER MANAGEMENT SYSTEM

The Stormwater system for the project has been evaluated and designed based upon DEP Wetland Program Policy 17.1: Photovoltaic System Solar Array Review, the Town of Wareham Rules and Regulations of the Planning Board, as well as the DEP Stormwater Policy of encouraging environmentally-sensitive design with minimal point source discharges.

The site will be graded in such a way that stormwater runoff from the proposed development area will be directed to a series of stormwater Best Management Practices (BMPs), including grassed and rock lined swales, stormwater detention basins, and stone infiltration trenches which will prevent direct discharge of untreated stormwater to the wetland's areas on the site. The proposed stormwater management system has also been designed to attenuate any increase in peak flows resulting from development of the site.

3.0 COMPLIANCE WITH DEP STORMWATER MANAGEMENT STANDARDS

Standard 1: No New Untreated Discharges

There are no new impervious surfaces proposed as part of the solar project that will generate suspended solids or other measurable stormwater contaminants. The only measurable impervious surface on the site is the concrete electrical equipment pads and those will be limited to foot traffic only. All access roads will be gravel which, DEP Program Policy 17.1 does not consider impervious and the area under the arrays will be comprised of tall grasses. Therefore, there will be no untreated discharge and it is our opinion that Standard 1 has been met.

Standard 2: Peak Rate Attenuation

Based upon the existing contours and runoff patterns on the site, as well as any sensitive areas off site, a total of 4 Design Points were evaluated for peak rate attenuation. Pre- and Post-Development stormwater calculations were performed for the 2, 10 and 100-year, Type III storm events. A comparison of the Pre- vs. Post-Development peak runoff rates for each storm event at each of the Design Points is summarized in the tables below:

Design Point #1 – Eastern Wetland		
Storm Event	***Pre-Development***	***Post-Development***
2-year	14.39 cfs	13.51 cfs
10-year	28.87 cfs	27.54 cfs
100-year	58.09 cfs	53.10 cfs

Design Point #2 – Western Wetland		
Storm Event	***Pre-Development***	***Post-Development***
2-year	7.53 cfs	7.44 cfs
10-year	18.69 cfs	18.35 cfs
100-year	43.12 cfs	41.78 cfs

As shown in the tables, the peak rates for stormwater runoff generated under Post Development condition will be equal to or less than the peak rates generated under Pre-Development conditions for the all storm events.

Complete runoff calculations for the 2, 10 and 100-year Type III storm events including ground cover, soils types and times of concentration paths for the Pre-Development conditions and Post-Development conditions are provided in Appendix B.

Standard 3: Groundwater Recharge

Based upon a review of the Web Soil Survey, soils within the proposed development area have been identified as Broxton sandy loam, Mattapoisett loamy sand, Montauk Fine sandy loam, Scituate gravelly sandy loam, and Birchwood sand, which have been classified as Hydrologic Soil Groups C/D, D, C, C/D, B/D, respectfully. The groundwater recharge volume required for the proposed impervious surfaces is calculated by the following formula:

$$R_v = (F)(A_{IMP})$$

R_v = Required Recharge Volume
F=Target Depth Factor: 0.25 inch for C soils
A_{IMP} = Proposed Impervious Area

The only measurable impervious surface on the site is the concrete electrical equipment pads. The calculations in the Appendix show that the infiltration trench recharge volume provided of 180 cf exceeds the required recharging volume of 133 CF. As a result, it is our opinion that Standard 3 has been met.

Standard 4: Water Quality

There are no new impervious surfaces proposed as part of the solar project that will generate suspended solids or other measurable stormwater contaminants. The only measurable impervious surface on the site is the concrete electrical equipment pads and those will be limited to foot traffic only. All access roads will be gravel, which DEP Program Policy 17.1 does not consider impervious, and the area under the arrays will be comprised of tall grasses. Therefore, it is our opinion that Standard 4 has been met.

Standard 5: Land Uses with Higher Pollutant Loads (LUHPPLs)

The proposed development is not a LUHPPL and therefore Standard 5 is not applicable.

Standard 6: Critical Areas

The project does not have any discharges within a Zone II, Interim Wellhead Protection Areas or near or to any Critical Areas as defined by the Massachusetts Stormwater Handbook. Therefore, it is our opinion that Standard 6 is not applicable.

Standard 7: Redevelopment Projects

The proposed project is not a redevelopment project and therefore Standard 7 is not applicable.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Erosion and Sedimentation Control Plan is provided on the Site plans along with notes/instructions for the contractor and details/location of all erosion control measures. Prior to the start of construction, a Stormwater Pollution Prevention Plan (SWPPP) will be completed in order to better define the proposed intensive stormwater management practices to be used during the construction phase of that project.

Standard 9: Long Term Operation and Maintenance Plan

A Long Term Pollution Prevention and Stormwater Operation and Maintenance Plan is provided in with the submittal package. All erosion and sedimentation controls will be installed prior to any and all land disturbance on the site.

Standard 10: Prohibition of Illicit Discharges

To our knowledge, there are no existing illicit discharges to existing stormwater systems on the Site and measures to prevent illicit discharges from the proposed development to proposed stormwater systems on the Site will be included within the Long Term Pollution Prevention Plan. As required, an Illicit Discharge Compliance Statement will be submitted prior to the discharge of any stormwater to the post-construction stormwater Best Management Practices (BMPs).

APPENDIX A

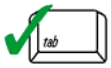
MassDEP Checklist for Stormwater Report

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

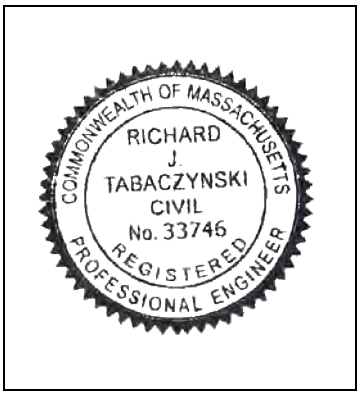
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☒ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☒ Grass Channel
- ☐ Green Roof
- ☒ Other (describe): Detention Basin

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☐ Static ☒ Simple Dynamic ☐ Dynamic Field[1]

☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☐ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☐ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☐ The BMP is sized (and calculations provided) based on:

- ☐ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☐ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☐ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

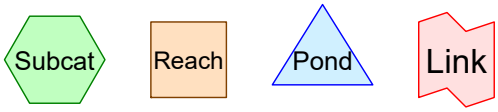
☐ An Illicit Discharge Compliance Statement is attached;

☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

APPENDIX B

Pre- and Post-Development HydroCAD Stormwater Analysis

PRE-DEVELOPMENT



Routing Diagram for 3055.01- FEARING HILL RD - PRE
Prepared by Atlantic Design Engineers, Printed 5/14/2021
HydroCAD® 10.00-25 s/n 00480 © 2019 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.123	74	>75% Grass cover, Good, HSG C (2S)
7.698	55	Woods, Good, HSG B (1S, 2S)
24.511	70	Woods, Good, HSG C (1S, 2S)
3.899	77	Woods, Good, HSG D (1S)
36.230	**68**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
7.698	HSG B	1S, 2S
24.634	HSG C	1S, 2S
3.899	HSG D	1S
0.000	Other	
36.230		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.123	0.000	0.000	0.123	>75% Grass cover, Good	2S
0.000	7.698	24.511	3.899	0.000	36.107	Woods, Good	1S, 2S
0.000	**7.698**	**24.634**	**3.899**	**0.000**	**36.230**	**TOTAL AREA**	

Time span=1.00-36.00 hrs, dt=0.05 hrs, 701 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: 1S Runoff Area=809,848 sf 0.00% Impervious Runoff Depth=1.00"
Flow Length=463' Tc=17.0 min CN=71 Runoff=14.39 cfs 1.6 af

Subcatchment 2S: 2S Runoff Area=768,337 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=576' Tc=17.7 min CN=64 Runoff=7.53 cfs 1.0 af

Reach DP1: Eastern Wetland Inflow=14.39 cfs 1.6 af
Outflow=14.39 cfs 1.6 af

Reach DP2: Western Wetland Inflow=7.53 cfs 1.0 af
Outflow=7.53 cfs 1.0 af

Total Runoff Area = 36.230 ac Runoff Volume = 2.5 af Average Runoff Depth = 0.83"
100.00% Pervious = 36.230 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: 1S

Runoff = 14.39 cfs @ 12.26 hrs, Volume= 1.6 af, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.40"

Area (sf)	CN	Description
41,299	55	Woods, Good, HSG B
598,726	70	Woods, Good, HSG C
169,823	77	Woods, Good, HSG D
809,848	71	Weighted Average
809,848		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.3	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
1.7	413	0.0670	4.17		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
17.0	463	Total			

Summary for Subcatchment 2S: 2S

Runoff = 7.53 cfs @ 12.30 hrs, Volume= 1.0 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.40"

Area (sf)	CN	Description
294,009	55	Woods, Good, HSG B
468,954	70	Woods, Good, HSG C
5,374	74	>75% Grass cover, Good, HSG C
768,337	64	Weighted Average
768,337		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.3	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
2.4	526	0.0500	3.60		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
17.7	576	Total			

Summary for Reach DP1: Eastern Wetland

Inflow Area = 18.592 ac, 0.00% Impervious, Inflow Depth = 1.00" for 2-yr event
Inflow = 14.39 cfs @ 12.26 hrs, Volume= 1.6 af
Outflow = 14.39 cfs @ 12.26 hrs, Volume= 1.6 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Western Wetland

Inflow Area =	17.639 ac,	0.00% Impervious,	Inflow Depth =	0.66"	for 2-yr event
Inflow =	7.53 cfs @	12.30 hrs, Volume=	1.0 af		
Outflow =	7.53 cfs @	12.30 hrs, Volume=	1.0 af,	Atten= 0%,	Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Time span=1.00-36.00 hrs, dt=0.05 hrs, 701 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: 1S Runoff Area=809,848 sf 0.00% Impervious Runoff Depth=1.89"
Flow Length=463' Tc=17.0 min CN=71 Runoff=28.87 cfs 2.9 af

Subcatchment 2S: 2S Runoff Area=768,337 sf 0.00% Impervious Runoff Depth=1.39"
Flow Length=576' Tc=17.7 min CN=64 Runoff=18.69 cfs 2.0 af

Reach DP1: Eastern Wetland Inflow=28.87 cfs 2.9 af
Outflow=28.87 cfs 2.9 af

Reach DP2: Western Wetland Inflow=18.69 cfs 2.0 af
Outflow=18.69 cfs 2.0 af

Total Runoff Area = 36.230 ac Runoff Volume = 5.0 af Average Runoff Depth = 1.65"
100.00% Pervious = 36.230 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: 1S

Runoff = 28.87 cfs @ 12.25 hrs, Volume= 2.9 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.70"

Area (sf)	CN	Description
41,299	55	Woods, Good, HSG B
598,726	70	Woods, Good, HSG C
169,823	77	Woods, Good, HSG D
809,848	71	Weighted Average
809,848		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.3	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
1.7	413	0.0670	4.17		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
17.0	463	Total			

Summary for Subcatchment 2S: 2S

Runoff = 18.69 cfs @ 12.27 hrs, Volume= 2.0 af, Depth= 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.70"

Area (sf)	CN	Description
294,009	55	Woods, Good, HSG B
468,954	70	Woods, Good, HSG C
5,374	74	>75% Grass cover, Good, HSG C
768,337	64	Weighted Average
768,337		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.3	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
2.4	526	0.0500	3.60		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
17.7	576	Total			

Summary for Reach DP1: Eastern Wetland

Inflow Area = 18.592 ac, 0.00% Impervious, Inflow Depth = 1.89" for 10-yr event
Inflow = 28.87 cfs @ 12.25 hrs, Volume= 2.9 af
Outflow = 28.87 cfs @ 12.25 hrs, Volume= 2.9 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Western Wetland

Inflow Area = 17.639 ac, 0.00% Impervious, Inflow Depth = 1.39" for 10-yr event
Inflow = 18.69 cfs @ 12.27 hrs, Volume= 2.0 af
Outflow = 18.69 cfs @ 12.27 hrs, Volume= 2.0 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Time span=1.00-36.00 hrs, dt=0.05 hrs, 701 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: 1S Runoff Area=809,848 sf 0.00% Impervious Runoff Depth=3.72"
Flow Length=463' Tc=17.0 min CN=71 Runoff=58.09 cfs 5.8 af

Subcatchment 2S: 2S Runoff Area=768,337 sf 0.00% Impervious Runoff Depth=3.00"
Flow Length=576' Tc=17.7 min CN=64 Runoff=43.12 cfs 4.4 af

Reach DP1: Eastern Wetland Inflow=58.09 cfs 5.8 af
Outflow=58.09 cfs 5.8 af

Reach DP2: Western Wetland Inflow=43.12 cfs 4.4 af
Outflow=43.12 cfs 4.4 af

Total Runoff Area = 36.230 ac Runoff Volume = 10.2 af Average Runoff Depth = 3.37"
100.00% Pervious = 36.230 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: 1S

Runoff = 58.09 cfs @ 12.24 hrs, Volume= 5.8 af, Depth= 3.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
41,299	55	Woods, Good, HSG B
598,726	70	Woods, Good, HSG C
169,823	77	Woods, Good, HSG D
809,848	71	Weighted Average
809,848		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.3	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
1.7	413	0.0670	4.17		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
17.0	463	Total			

Summary for Subcatchment 2S: 2S

Runoff = 43.12 cfs @ 12.26 hrs, Volume= 4.4 af, Depth= 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
294,009	55	Woods, Good, HSG B
468,954	70	Woods, Good, HSG C
5,374	74	>75% Grass cover, Good, HSG C
768,337	64	Weighted Average
768,337		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.3	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.60"
2.4	526	0.0500	3.60		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
17.7	576	Total			

Summary for Reach DP1: Eastern Wetland

Inflow Area = 18.592 ac, 0.00% Impervious, Inflow Depth = 3.72" for 100-yr event
Inflow = 58.09 cfs @ 12.24 hrs, Volume= 5.8 af
Outflow = 58.09 cfs @ 12.24 hrs, Volume= 5.8 af, Atten= 0%, Lag= 0.0 min

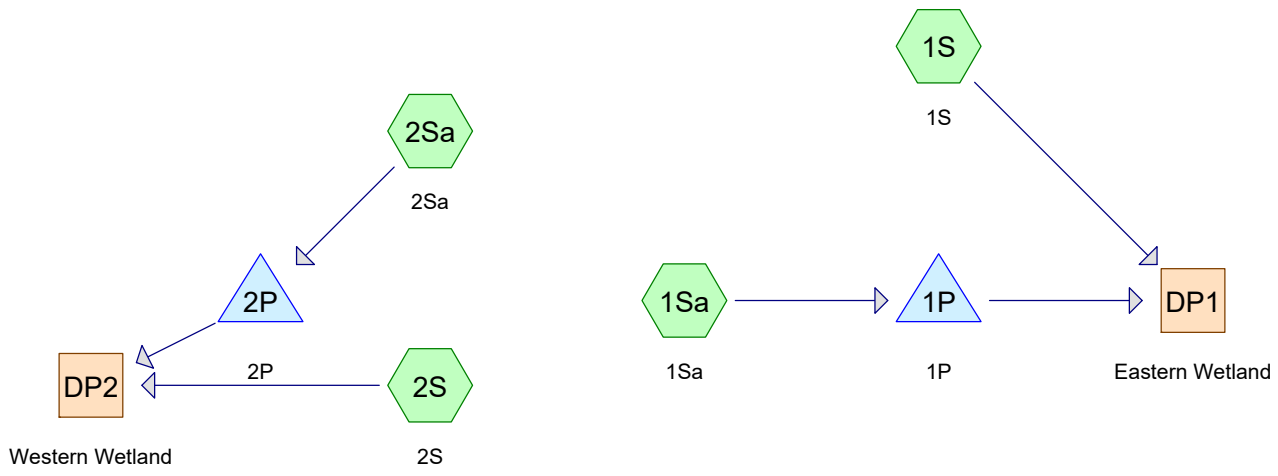
Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

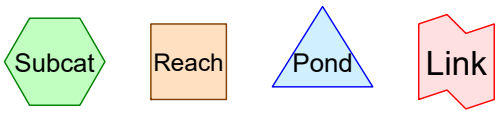
Summary for Reach DP2: Western Wetland

Inflow Area = 17.639 ac, 0.00% Impervious, Inflow Depth = 3.00" for 100-yr event
Inflow = 43.12 cfs @ 12.26 hrs, Volume= 4.4 af
Outflow = 43.12 cfs @ 12.26 hrs, Volume= 4.4 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

POST-DEVELOPMENT





Routing Diagram for 3055.01- FEARING HILL RD - POST
Prepared by Atlantic Design Engineers, Printed 5/14/2021
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.622	61	>75% Grass cover, Good, HSG B (1S, 2S, 2Sa)
20.074	74	>75% Grass cover, Good, HSG C (1S, 1Sa, 2S, 2Sa)
2.004	80	>75% Grass cover, Good, HSG D (1S, 1Sa)
0.424	96	Gravel surface, HSG C (1Sa, 2S, 2Sa)
0.147	98	Unconnected pavement, HSG C (1Sa)
4.076	55	Woods, Good, HSG B (1S, 2S)
3.944	70	Woods, Good, HSG C (1S, 2S)
1.937	77	Woods, Good, HSG D (1S)
36.230	**71**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
7.698	HSG B	1S, 2S, 2Sa
24.590	HSG C	1S, 1Sa, 2S, 2Sa
3.942	HSG D	1S, 1Sa
0.000	Other	
36.230		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	3.622	20.074	2.004	0.000	25.701	>75% Grass cover, Good	1S, 1Sa, 2S, 2Sa
0.000	0.000	0.424	0.000	0.000	0.424	Gravel surface	1Sa, 2S, 2Sa
0.000	0.000	0.147	0.000	0.000	0.147	Unconnected pavement	1Sa
0.000	4.076	3.944	1.937	0.000	9.957	Woods, Good	1S, 2S
0.000	**7.698**	**24.590**	**3.942**	**0.000**	**36.230**	**TOTAL AREA**	

Time span=1.00-36.00 hrs, dt=0.05 hrs, 701 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: 1S Runoff Area=503,795 sf 0.00% Impervious Runoff Depth=1.11"
Flow Length=463' Tc=8.7 min CN=73 Runoff=12.76 cfs 1.1 af

Subcatchment 1Sa: 1Sa Runoff Area=310,322 sf 2.07% Impervious Runoff Depth=1.23"
Flow Length=283' Tc=8.0 min CN=75 Runoff=9.13 cfs 0.7 af

Subcatchment 2S: 2S Runoff Area=489,330 sf 0.00% Impervious Runoff Depth=0.70"
Flow Length=506' Tc=8.3 min CN=65 Runoff=6.82 cfs 0.7 af

Subcatchment 2Sa: 2Sa Runoff Area=274,737 sf 0.00% Impervious Runoff Depth=1.06"
Flow Length=447' Tc=8.7 min CN=72 Runoff=6.53 cfs 0.6 af

Reach DP1: Eastern Wetland Inflow=13.51 cfs 1.8 af
Outflow=13.51 cfs 1.8 af

Reach DP2: Western Wetland Inflow=7.44 cfs 1.2 af
Outflow=7.44 cfs 1.2 af

Pond 1P: 1P Peak Elev=72.42' Storage=11,136 cf Inflow=9.13 cfs 0.7 af
Outflow=2.36 cfs 0.7 af

Pond 2P: 2P Peak Elev=68.35' Storage=8,193 cf Inflow=6.53 cfs 0.6 af
Outflow=1.61 cfs 0.6 af

Total Runoff Area = 36.230 ac Runoff Volume = 3.0 af Average Runoff Depth = 1.00"
99.59% Pervious = 36.083 ac 0.41% Impervious = 0.147 ac

Summary for Subcatchment 1S: 1S

Runoff = 12.76 cfs @ 12.14 hrs, Volume= 1.1 af, Depth= 1.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.40"

Area (sf)	CN	Description
21,863	55	Woods, Good, HSG B
58,921	70	Woods, Good, HSG C
84,391	77	Woods, Good, HSG D
19,436	61	>75% Grass cover, Good, HSG B
254,552	74	>75% Grass cover, Good, HSG C
64,632	80	>75% Grass cover, Good, HSG D
503,795	73	Weighted Average
503,795		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0100	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
1.7	413	0.0670	4.17		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.7	463	Total			

Summary for Subcatchment 1Sa: 1Sa

Runoff = 9.13 cfs @ 12.12 hrs, Volume= 0.7 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.40"

Area (sf)	CN	Description
5,142	96	Gravel surface, HSG C
276,084	74	>75% Grass cover, Good, HSG C
6,415	98	Unconnected pavement, HSG C
22,681	80	>75% Grass cover, Good, HSG D
310,322	75	Weighted Average
303,907		97.93% Pervious Area
6,415		2.07% Impervious Area
6,415		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0100	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
1.0	233	0.0640	4.07		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.0	283	Total			

Summary for Subcatchment 2S: 2S

Runoff = 6.82 cfs @ 12.15 hrs, Volume= 0.7 af, Depth= 0.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.40"

Area (sf)	CN	Description
155,682	55	Woods, Good, HSG B
112,881	70	Woods, Good, HSG C
10,167	96	Gravel surface, HSG C
81,315	61	>75% Grass cover, Good, HSG B
129,285	74	>75% Grass cover, Good, HSG C
489,330	65	Weighted Average
489,330		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0160	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
2.5	456	0.0370	3.10		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.3	506	Total			

Summary for Subcatchment 2Sa: 2Sa

Runoff = 6.53 cfs @ 12.14 hrs, Volume= 0.6 af, Depth= 1.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.40"

Area (sf)	CN	Description
3,182	96	Gravel surface, HSG C
57,035	61	>75% Grass cover, Good, HSG B
214,520	74	>75% Grass cover, Good, HSG C
274,737	72	Weighted Average
274,737		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0100	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
1.7	397	0.0570	3.84		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.7	447	Total			

Summary for Reach DP1: Eastern Wetland

Inflow Area = 18.690 ac, 0.79% Impervious, Inflow Depth > 1.16" for 2-yr event
Inflow = 13.51 cfs @ 12.14 hrs, Volume= 1.8 af
Outflow = 13.51 cfs @ 12.14 hrs, Volume= 1.8 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Western Wetland

Inflow Area = 17.541 ac, 0.00% Impervious, Inflow Depth > 0.83" for 2-yr event
Inflow = 7.44 cfs @ 12.15 hrs, Volume= 1.2 af
Outflow = 7.44 cfs @ 12.15 hrs, Volume= 1.2 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: 1P

Inflow Area = 7.124 ac, 2.07% Impervious, Inflow Depth = 1.23" for 2-yr event
Inflow = 9.13 cfs @ 12.12 hrs, Volume= 0.7 af
Outflow = 2.36 cfs @ 12.57 hrs, Volume= 0.7 af, Atten= 74%, Lag= 26.7 min
Primary = 2.36 cfs @ 12.57 hrs, Volume= 0.7 af

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 72.42' @ 12.57 hrs Surf.Area= 13,162 sf Storage= 11,136 cf

Plug-Flow detention time= 110.4 min calculated for 0.7 af (100% of inflow)
Center-of-Mass det. time= 108.4 min (965.4 - 857.1)

Volume	Invert	Avail.Storage	Storage Description
#1	71.00'	80,142 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
71.00	3,529	509.0	0	0	3,529
72.00	9,683	1,043.0	6,353	6,353	69,485
73.00	18,832	1,200.0	14,006	20,359	97,531
74.00	29,935	1,394.0	24,170	44,529	137,598
75.00	41,611	1,569.0	35,613	80,142	178,887

Device	Routing	Invert	Outlet Devices
#1	Primary	74.50'	**20.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	71.00'	**6.0" Round Culvert** L= 45.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 71.00' / 70.55' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#3	Primary	71.90'	**10.0" Round Culvert X 2.00** L= 40.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 71.90' / 71.43' S= 0.0117 '/' Cc= 0.900

n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf

Primary OutFlow Max=2.35 cfs @ 12.57 hrs HW=72.42' (Free Discharge)
- **1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **2=Culvert** (Barrel Controls 0.80 cfs @ 4.10 fps)
- **3=Culvert** (Inlet Controls 1.55 cfs @ 2.17 fps)

Summary for Pond 2P: 2P

Inflow Area =	6.307 ac,	0.00% Impervious,	Inflow Depth =	1.06"	for 2-yr event
Inflow =	6.53 cfs @	12.14 hrs,	Volume=	0.6 af	
Outflow =	1.61 cfs @	12.62 hrs,	Volume=	0.6 af,	Atten= 75%, Lag= 28.7 min
Primary =	1.61 cfs @	12.62 hrs,	Volume=	0.6 af	

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 68.35' @ 12.62 hrs Surf.Area= 9,240 sf Storage= 8,193 cf

Plug-Flow detention time= 103.0 min calculated for 0.6 af (100% of inflow)
Center-of-Mass det. time= 101.9 min (969.1 - 867.2)

Volume	Invert	Avail.Storage	Storage Description
#1	67.00'	56,082 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
67.00	3,119	266.0	0	0	3,119
68.00	7,649	413.0	5,217	5,217	11,069
69.00	12,549	538.0	9,998	15,216	20,541
70.00	19,749	756.0	16,014	31,229	42,998
71.00	30,334	887.0	24,853	56,082	60,146

Device	Routing	Invert	Outlet Devices
#1	Primary	70.50'	**20.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#2	Primary	67.00'	**6.0" Round Culvert** L= 33.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 67.00' / 66.67' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#3	Primary	68.00'	**10.0" Round Culvert X 2.00** L= 27.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 68.00' / 67.68' S= 0.0119 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf

Primary OutFlow Max=1.61 cfs @ 12.62 hrs HW=68.35' (Free Discharge)
- **1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **2=Culvert** (Barrel Controls 0.83 cfs @ 4.20 fps)
- **3=Culvert** (Inlet Controls 0.78 cfs @ 1.78 fps)

Time span=1.00-36.00 hrs, dt=0.05 hrs, 701 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: 1S Runoff Area=503,795 sf 0.00% Impervious Runoff Depth=2.05"
Flow Length=463' Tc=8.7 min CN=73 Runoff=24.47 cfs 2.0 af

Subcatchment 1Sa: 1Sa Runoff Area=310,322 sf 2.07% Impervious Runoff Depth=2.21"
Flow Length=283' Tc=8.0 min CN=75 Runoff=16.89 cfs 1.3 af

Subcatchment 2S: 2S Runoff Area=489,330 sf 0.00% Impervious Runoff Depth=1.46"
Flow Length=506' Tc=8.3 min CN=65 Runoff=16.21 cfs 1.4 af

Subcatchment 2Sa: 2Sa Runoff Area=274,737 sf 0.00% Impervious Runoff Depth=1.97"
Flow Length=447' Tc=8.7 min CN=72 Runoff=12.78 cfs 1.0 af

Reach DP1: Eastern Wetland Inflow=27.54 cfs 3.3 af
Outflow=27.54 cfs 3.3 af

Reach DP2: Western Wetland Inflow=18.35 cfs 2.4 af
Outflow=18.35 cfs 2.4 af

Pond 1P: 1P Peak Elev=72.97' Storage=19,873 cf Inflow=16.89 cfs 1.3 af
Outflow=4.71 cfs 1.3 af

Pond 2P: 2P Peak Elev=68.93' Storage=14,375 cf Inflow=12.78 cfs 1.0 af
Outflow=4.33 cfs 1.0 af

Total Runoff Area = 36.230 ac Runoff Volume = 5.7 af Average Runoff Depth = 1.88"
99.59% Pervious = 36.083 ac 0.41% Impervious = 0.147 ac

Summary for Subcatchment 1S: 1S

Runoff = 24.47 cfs @ 12.13 hrs, Volume= 2.0 af, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.70"

Area (sf)	CN	Description
21,863	55	Woods, Good, HSG B
58,921	70	Woods, Good, HSG C
84,391	77	Woods, Good, HSG D
19,436	61	>75% Grass cover, Good, HSG B
254,552	74	>75% Grass cover, Good, HSG C
64,632	80	>75% Grass cover, Good, HSG D
503,795	73	Weighted Average
503,795		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0100	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
1.7	413	0.0670	4.17		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.7	463	Total			

Summary for Subcatchment 1Sa: 1Sa

Runoff = 16.89 cfs @ 12.12 hrs, Volume= 1.3 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.70"

Area (sf)	CN	Description
5,142	96	Gravel surface, HSG C
276,084	74	>75% Grass cover, Good, HSG C
6,415	98	Unconnected pavement, HSG C
22,681	80	>75% Grass cover, Good, HSG D
310,322	75	Weighted Average
303,907		97.93% Pervious Area
6,415		2.07% Impervious Area
6,415		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0100	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
1.0	233	0.0640	4.07		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.0	283	Total			

Summary for Subcatchment 2S: 2S

Runoff = 16.21 cfs @ 12.13 hrs, Volume= 1.4 af, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.70"

Area (sf)	CN	Description
155,682	55	Woods, Good, HSG B
112,881	70	Woods, Good, HSG C
10,167	96	Gravel surface, HSG C
81,315	61	>75% Grass cover, Good, HSG B
129,285	74	>75% Grass cover, Good, HSG C
489,330	65	Weighted Average
489,330		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0160	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
2.5	456	0.0370	3.10		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.3	506	Total			

Summary for Subcatchment 2Sa: 2Sa

Runoff = 12.78 cfs @ 12.13 hrs, Volume= 1.0 af, Depth= 1.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.70"

Area (sf)	CN	Description
3,182	96	Gravel surface, HSG C
57,035	61	>75% Grass cover, Good, HSG B
214,520	74	>75% Grass cover, Good, HSG C
274,737	72	Weighted Average
274,737		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0100	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
1.7	397	0.0570	3.84		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.7	447	Total			

Summary for Reach DP1: Eastern Wetland

Inflow Area = 18.690 ac, 0.79% Impervious, Inflow Depth > 2.11" for 10-yr event
Inflow = 27.54 cfs @ 12.14 hrs, Volume= 3.3 af
Outflow = 27.54 cfs @ 12.14 hrs, Volume= 3.3 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Western Wetland

Inflow Area = 17.541 ac, 0.00% Impervious, Inflow Depth > 1.64" for 10-yr event
Inflow = 18.35 cfs @ 12.15 hrs, Volume= 2.4 af
Outflow = 18.35 cfs @ 12.15 hrs, Volume= 2.4 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: 1P

Inflow Area = 7.124 ac, 2.07% Impervious, Inflow Depth = 2.21" for 10-yr event
Inflow = 16.89 cfs @ 12.12 hrs, Volume= 1.3 af
Outflow = 4.71 cfs @ 12.53 hrs, Volume= 1.3 af, Atten= 72%, Lag= 24.4 min
Primary = 4.71 cfs @ 12.53 hrs, Volume= 1.3 af

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 72.97' @ 12.53 hrs Surf.Area= 18,556 sf Storage= 19,873 cf

Plug-Flow detention time= 94.1 min calculated for 1.3 af (100% of inflow)
Center-of-Mass det. time= 92.9 min (932.7 - 839.7)

Volume	Invert	Avail.Storage	Storage Description
#1	71.00'	80,142 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
71.00	3,529	509.0	0	0	3,529
72.00	9,683	1,043.0	6,353	6,353	69,485
73.00	18,832	1,200.0	14,006	20,359	97,531
74.00	29,935	1,394.0	24,170	44,529	137,598
75.00	41,611	1,569.0	35,613	80,142	178,887

Device	Routing	Invert	Outlet Devices
#1	Primary	74.50'	**20.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	71.00'	**6.0" Round Culvert** L= 45.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 71.00' / 70.55' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#3	Primary	71.90'	**10.0" Round Culvert X 2.00** L= 40.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 71.90' / 71.43' S= 0.0117 '/' Cc= 0.900

n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf

Primary OutFlow Max=4.71 cfs @ 12.53 hrs HW=72.97' (Free Discharge)
- **1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **2=Culvert** (Barrel Controls 0.95 cfs @ 4.85 fps)
- **3=Culvert** (Inlet Controls 3.75 cfs @ 3.44 fps)

Summary for Pond 2P: 2P

Inflow Area = 6.307 ac, 0.00% Impervious, Inflow Depth = 1.97" for 10-yr event
Inflow = 12.78 cfs @ 12.13 hrs, Volume= 1.0 af
Outflow = 4.33 cfs @ 12.50 hrs, Volume= 1.0 af, Atten= 66%, Lag= 22.3 min
Primary = 4.33 cfs @ 12.50 hrs, Volume= 1.0 af

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 68.93' @ 12.50 hrs Surf.Area= 12,178 sf Storage= 14,375 cf

Plug-Flow detention time= 84.2 min calculated for 1.0 af (100% of inflow)
Center-of-Mass det. time= 83.8 min (932.1 - 848.3)

Volume	Invert	Avail.Storage	Storage Description
#1	67.00'	56,082 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
67.00	3,119	266.0	0	0	3,119
68.00	7,649	413.0	5,217	5,217	11,069
69.00	12,549	538.0	9,998	15,216	20,541
70.00	19,749	756.0	16,014	31,229	42,998
71.00	30,334	887.0	24,853	56,082	60,146

Device	Routing	Invert	Outlet Devices
#1	Primary	70.50'	**20.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#2	Primary	67.00'	**6.0" Round Culvert** L= 33.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 67.00' / 66.67' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#3	Primary	68.00'	**10.0" Round Culvert X 2.00** L= 27.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 68.00' / 67.68' S= 0.0119 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf

Primary OutFlow Max=4.33 cfs @ 12.50 hrs HW=68.93' (Free Discharge)
- **1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **2=Culvert** (Barrel Controls 1.01 cfs @ 5.13 fps)
- **3=Culvert** (Inlet Controls 3.33 cfs @ 3.05 fps)

Time span=1.00-36.00 hrs, dt=0.05 hrs, 701 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: 1S Runoff Area=503,795 sf 0.00% Impervious Runoff Depth=3.94"
Flow Length=463' Tc=8.7 min CN=73 Runoff=47.94 cfs 3.8 af

Subcatchment 1Sa: 1Sa Runoff Area=310,322 sf 2.07% Impervious Runoff Depth=4.15"
Flow Length=283' Tc=8.0 min CN=75 Runoff=31.91 cfs 2.5 af

Subcatchment 2S: 2S Runoff Area=489,330 sf 0.00% Impervious Runoff Depth=3.10"
Flow Length=506' Tc=8.3 min CN=65 Runoff=36.82 cfs 2.9 af

Subcatchment 2Sa: 2Sa Runoff Area=274,737 sf 0.00% Impervious Runoff Depth=3.83"
Flow Length=447' Tc=8.7 min CN=72 Runoff=25.24 cfs 2.0 af

Reach DP1: Eastern Wetland Inflow=53.10 cfs 6.3 af
Outflow=53.10 cfs 6.3 af

Reach DP2: Western Wetland Inflow=41.78 cfs 4.9 af
Outflow=41.78 cfs 4.9 af

Pond 1P: 1P Peak Elev=73.87' Storage=40,843 cf Inflow=31.91 cfs 2.5 af
Outflow=6.94 cfs 2.5 af

Pond 2P: 2P Peak Elev=69.95' Storage=30,222 cf Inflow=25.24 cfs 2.0 af
Outflow=7.00 cfs 2.0 af

Total Runoff Area = 36.230 ac Runoff Volume = 11.2 af Average Runoff Depth = 3.70"
99.59% Pervious = 36.083 ac 0.41% Impervious = 0.147 ac

Summary for Subcatchment 1S: 1S

Runoff = 47.94 cfs @ 12.12 hrs, Volume= 3.8 af, Depth= 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
21,863	55	Woods, Good, HSG B
58,921	70	Woods, Good, HSG C
84,391	77	Woods, Good, HSG D
19,436	61	>75% Grass cover, Good, HSG B
254,552	74	>75% Grass cover, Good, HSG C
64,632	80	>75% Grass cover, Good, HSG D
503,795	73	Weighted Average
503,795		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0100	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
1.7	413	0.0670	4.17		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.7	463	Total			

Summary for Subcatchment 1Sa: 1Sa

Runoff = 31.91 cfs @ 12.11 hrs, Volume= 2.5 af, Depth= 4.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
5,142	96	Gravel surface, HSG C
276,084	74	>75% Grass cover, Good, HSG C
6,415	98	Unconnected pavement, HSG C
22,681	80	>75% Grass cover, Good, HSG D
310,322	75	Weighted Average
303,907		97.93% Pervious Area
6,415		2.07% Impervious Area
6,415		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0100	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
1.0	233	0.0640	4.07		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.0	283	Total			

Summary for Subcatchment 2S: 2S

Runoff = 36.82 cfs @ 12.12 hrs, Volume= 2.9 af, Depth= 3.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
155,682	55	Woods, Good, HSG B
112,881	70	Woods, Good, HSG C
10,167	96	Gravel surface, HSG C
81,315	61	>75% Grass cover, Good, HSG B
129,285	74	>75% Grass cover, Good, HSG C
489,330	65	Weighted Average
489,330		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0160	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
2.5	456	0.0370	3.10		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.3	506	Total			

Summary for Subcatchment 2Sa: 2Sa

Runoff = 25.24 cfs @ 12.13 hrs, Volume= 2.0 af, Depth= 3.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
3,182	96	Gravel surface, HSG C
57,035	61	>75% Grass cover, Good, HSG B
214,520	74	>75% Grass cover, Good, HSG C
274,737	72	Weighted Average
274,737		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0100	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
1.7	397	0.0570	3.84		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.7	447	Total			

Summary for Reach DP1: Eastern Wetland

Inflow Area = 18.690 ac, 0.79% Impervious, Inflow Depth = 4.01" for 100-yr event
Inflow = 53.10 cfs @ 12.13 hrs, Volume= 6.3 af
Outflow = 53.10 cfs @ 12.13 hrs, Volume= 6.3 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Western Wetland

Inflow Area = 17.541 ac, 0.00% Impervious, Inflow Depth = 3.36" for 100-yr event
Inflow = 41.78 cfs @ 12.13 hrs, Volume= 4.9 af
Outflow = 41.78 cfs @ 12.13 hrs, Volume= 4.9 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: 1P

Inflow Area = 7.124 ac, 2.07% Impervious, Inflow Depth = 4.15" for 100-yr event
Inflow = 31.91 cfs @ 12.11 hrs, Volume= 2.5 af
Outflow = 6.94 cfs @ 12.57 hrs, Volume= 2.5 af, Atten= 78%, Lag= 27.2 min
Primary = 6.94 cfs @ 12.57 hrs, Volume= 2.5 af

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 73.87' @ 12.57 hrs Surf.Area= 28,390 sf Storage= 40,843 cf

Plug-Flow detention time= 94.2 min calculated for 2.5 af (100% of inflow)
Center-of-Mass det. time= 93.4 min (914.9 - 821.6)

Volume	Invert	Avail.Storage	Storage Description
#1	71.00'	80,142 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
71.00	3,529	509.0	0	0	3,529
72.00	9,683	1,043.0	6,353	6,353	69,485
73.00	18,832	1,200.0	14,006	20,359	97,531
74.00	29,935	1,394.0	24,170	44,529	137,598
75.00	41,611	1,569.0	35,613	80,142	178,887

Device	Routing	Invert	Outlet Devices
#1	Primary	74.50'	**20.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	71.00'	**6.0" Round Culvert** L= 45.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 71.00' / 70.55' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#3	Primary	71.90'	**10.0" Round Culvert X 2.00** L= 40.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 71.90' / 71.43' S= 0.0117 '/' Cc= 0.900

n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf

Primary OutFlow Max=6.93 cfs @ 12.57 hrs HW=73.87' (Free Discharge)
- **1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **2=Culvert** (Barrel Controls 1.15 cfs @ 5.88 fps)
- **3=Culvert** (Inlet Controls 5.78 cfs @ 5.30 fps)

Summary for Pond 2P: 2P

Inflow Area = 6.307 ac, 0.00% Impervious, Inflow Depth = 3.83" for 100-yr event
Inflow = 25.24 cfs @ 12.13 hrs, Volume= 2.0 af
Outflow = 7.00 cfs @ 12.53 hrs, Volume= 2.0 af, Atten= 72%, Lag= 24.6 min
Primary = 7.00 cfs @ 12.53 hrs, Volume= 2.0 af

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 69.95' @ 12.53 hrs Surf.Area= 19,338 sf Storage= 30,222 cf

Plug-Flow detention time= 78.6 min calculated for 2.0 af (100% of inflow)
Center-of-Mass det. time= 77.9 min (906.8 - 828.9)

Volume	Invert	Avail.Storage	Storage Description
#1	67.00'	56,082 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
67.00	3,119	266.0	0	0	3,119
68.00	7,649	413.0	5,217	5,217	11,069
69.00	12,549	538.0	9,998	15,216	20,541
70.00	19,749	756.0	16,014	31,229	42,998
71.00	30,334	887.0	24,853	56,082	60,146

Device	Routing	Invert	Outlet Devices
#1	Primary	70.50'	**20.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#2	Primary	67.00'	**6.0" Round Culvert** L= 33.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 67.00' / 66.67' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#3	Primary	68.00'	**10.0" Round Culvert X 2.00** L= 27.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 68.00' / 67.68' S= 0.0119 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf

Primary OutFlow Max=7.00 cfs @ 12.53 hrs HW=69.95' (Free Discharge)
- **1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **2=Culvert** (Barrel Controls 1.26 cfs @ 6.44 fps)
- **3=Culvert** (Inlet Controls 5.73 cfs @ 5.26 fps)

APPENDIX C

Pre- and Post-Development Watershed Plans

LEGEND

1P	STORMWATER BASIN
1S	SUBCATCHMENT AREA
DP1	DESIGN POINT
	Tc PATH
	SUBCATCHMENT AND UNDISTURBED AREA BOUNDARY
32A "D"	HYDROLOGIC SOIL GROUP AND BOUNDARY

Atlantic® DESIGN ENGINEERS, INC.
P.O. Box 1051, Sandwich, MA 02563 (508) 888 – 9282

Designed by :
Drawn by :
Checked by :
Survey chk. by :
Approved by :

SCALE
SCALE 1" = 120'
0 60 120 240

DATE	NO.	BY	DATE	REVISION

APPLICANT:
WAREHAM MA 3, LLC
100 SUMMIT LAKE DRIVE, SUITE 210
VALHALLA, NY 10595

PRE DEVELOPMENT WATERSHED PLAN
FOR
FEARING HILL ROAD SOLAR PROJECT
WAREHAM, MA 02576
MAY 17, 2021

FILE: 3055.02–WSHD

Sheet	of
1	1

JOB NUMBER
3055.02

GRID NORTH TARGET

LEGEND

1P	STORMWATER BASIN
1S	SUBCATCHMENT AREA
DP1	DESIGN POINT
	Tc PATH
	SUBCATCHMENT AND UNDISTURBED AREA BOUNDARY
32A "D"	HYDROLOGIC SOIL GROUP AND BOUNDARY

FILE: 3055.02-WSHD

Atlantic® DESIGN ENGINEERS, INC.
P.O. Box 1051, Sandwich, MA 02563 (508) 888 – 9282

Designed by :
Drawn by :
Checked by :
Survey chk. by :
Approved by :

SCALE
SCALE 1" = 120'
0 60 120 240

DATE

NO.	BY	DATE	REVISION

APPLICANT:
WAREHAM MA 3, LLC
100 SUMMIT LAKE DRIVE, SUITE 210
VALHALLA, NY 10595

POST DEVELOPMENT WATERSHED PLAN
FOR
FEARING HILL ROAD SOLAR PROJECT
WAREHAM, MA 02576
MAY 17, 2021

Sheet 1 of 1
JOB NUMBER 3055.02

APPENDIX D

Miscellaneous Calculations

Infiltration Trench 72 Hour Drawdown Calculations

Design Engineer:	Atlantic Design Engineers, INC	Job No.:	3055.02
Project Name:	Fearing Hill Rd Solar Project	Calc'd By:	PMJ
Location:	Wareham, MA	Date:	5/17/2021

Time Drawdown (Tdd)=Rv/[(K)(A)(n)]

Rv = Storage Volume
K = Saturated Hydraulic Conductivity (0.27 in/hr or 0.023 ft/hr applied)
A = Bottom Area of Trench (LxW)
n = Porosity of Stone (n=0.40 for 40% void ratio)

Rv considers calculated volume provided within trench as conservative approach

Infiltration Trench #1in 1SA

Trench Dimensions	100 ft Long	
	2 ft Wide	
	1 ft Deep	
Storage Volume Provided in Trench (Rv)=	80 cf = (100x2x1x0.4)	
Time to Drawdown (Tdd)=	80/(0.023*(125*2)*0.4)=	**43 hrs < 72 hrs - Requirement Met**

Infiltration Trench #2 in 1SA

Trench Dimensions	125 ft Long	
	2 ft Wide	
	1 ft Deep	
Storage Volume Provided in Trench (Rv)=	100 cf = (25x2x1x0.4)	
Time to Drawdown (Tdd)=	80/(0.023*(100*2)*0.4)=	**43 hrs < 72 hrs - Requirement Met**

Required Recharge Volume

Design Engineer:	Atlantic Design Engineers, Inc.	Job No.:	3055.02
Project Name:	Fearing Hill Rd Solar Project	Calc'd By:	PMJ
Location:	Wareham, MA	Date:	5/17/2021

The groundwater recharge volume is required for the proposed **impervious** surfaces. We consider the 2 equipment pads (4) 12' X 20' to be impervious surface in this calculation.

Rv = (F) (Aimp)
Rv = Required Recharge Volume
Aimp= Impervious Area on site
F = Target Depth Factor: 0.25 inch for C soils

Infiltration Trenches (2 each, 1= 100'Lx2'Wx1'D & 2= @ 125'Lx2'WX1'D) = 180 CF

Total proposed impervious area =	6,400 sf			
Required Recharge Volume (Rv) =	6,400	* 0.25" * (1/12)=	133	cf
Recharge Volume Provided				
Infiltration Trenches (2 total)			180	cf
Total Volume Provided			180	cf

Total Required Recharge Volume on Site=	**133**	**cf**	
Total Recharge Volume Provided on the Site=	**180**	**cf**	**REQUIREMENT MET**

APPENDIX E

Long Term Stormwater Operation and Maintenance Plan

Fearing Hill Road Solar Project, Wareham, MA

Post-Construction

Long Term Stormwater Operation & Maintenance Plan

May 17, 2021

A. GENERAL NOTES

1. Upon completion of construction, the operation and maintenance of all components of the stormwater management system will be the responsibility (financially and otherwise) of the system owner (responsible party):

Wareham MA 3, LLC.
100 Summit Lake Drive, Suite 210
(978) 888-4088

_____ _____

Signature **Date**

2. The responsible party shall file an inspection report with the Town of Acushnet Planning Board following each site inspection as recommended in the Operation & Maintenance (O&M) Schedule. The inspection report shall identify the date of inspection, name, and contact number of responsible party, specific structures inspected, specific maintenance and/or repairs required and general observations. Any deficiencies noted in the inspection report shall be corrected to the Town of Acushnet Planning Board's satisfaction.

3. Disposal of accumulated sediment and hydrocarbons to be in accordance with the applicable local, state, and federal guidelines and regulations.

4. There shall be no illicit discharge of any waste or waste water into the stormwater management system. The maintenance of the facility shall be undertaken in such a manner as to prevent any discharge of waste or waste water into the stormwater management system. Any waste oil or other waste products generated during the maintenance shall be properly disposed of offsite in accordance with applicable local, state, and federal guidelines and regulations.

5. The Town will be notified of changes in project ownership or assignment of operation and maintenance financial responsibility.

6. The maintenance schedule in this operation and maintenance (O&M) Plan will only be amended by mutual agreement of the Town and the responsible party. Amendments will be made in writing and signed by the responsible party.

B. STORMWATER SYSTEM/BMPs

Erosion Control Barriers:

Erosion control barriers (sediment log, straw wattles, silt fence, etc.) should be inspected immediately after each run-off producing rainfall event and at least daily during prolonged rainfall. Sediment deposits must be removed when the level of deposition reaches approximately one-half the height of the barrier. Sediment shall be disposed of in a suitable area and protected from erosion by either structural or vegetative means.

Grassed Swale with Check Dams:

Inspect at a minimum of twice a year, or after major storm events (2" or greater). Repair eroded spots immediately after inspection. Additional inspections should be scheduled during the first few months to ensure that the vegetation in the channels is established adequately. Accumulated sediment shall be removed at least once a year or before it exceeds 0.5' in depth, whichever occurs first. Sediment shall be disposed of in a suitable area and protected from erosion by either structural or vegetative means.

Rock Lined Swales:

During construction rock lined swales shall be inspected immediately after each run-off producing rainfall event and at least daily during prolonged rainfall. After construction, inspect at a minimum of twice a year or after major storm events (>0.25 inches per 2017 cgp), repair eroded spots immediately after inspection. additional inspections should be scheduled during the first few months to ensure that the channels is established adequately. Accumulated sediment shall be removed at least once a year or before it exceeds 0.25' in depth, whichever occurs first.

Detention Basins

Inspect after every major storm event (>0.25 inches per 2017 cgp) during construction and for the first few months after construction to ensure proper stabilization and function, thereafter inspect at least twice per year during wet weather to ensure the system is

draining properly. Check for accumulation of sediment and ponding of water. If ponding water is visible inside the basin for several days after a storm event, notify the engineer for possible remedial measures. Remove sediment as necessary during construction, while the system is dry, and at least every 5 years after construction. Detention basins upper stage, side slope, embankment and spillway shall be mowed twice a year. Clippings to be removed from basins, areas immediately up-gradient and properly disposed of.

Stone Trench

Inspect after every major storm event (>0.25 inches per 2017 cgp) during construction. Once site is stabilized and re-vegetated, cut away/remove temporary cover fold and inspect and for the first few months after construction to ensure proper stabilization and function, thereafter inspect at least twice per year during wet weather to ensure the system is working properly. remove sediment as necessary during construction, and at least every five years after construction. Once construction is completed check for accumulation of sediment, debris and leaf litter twice a year thereafter.

APPENDIX F

NRCS Soil Survey Maps and Soil Group Descriptions

United States Department of Agriculture

Natural Resources Conservation Service

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

Custom Soil Resource Report for Plymouth County, Massachusetts

April 6, 2021

Preface

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

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

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

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

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

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

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

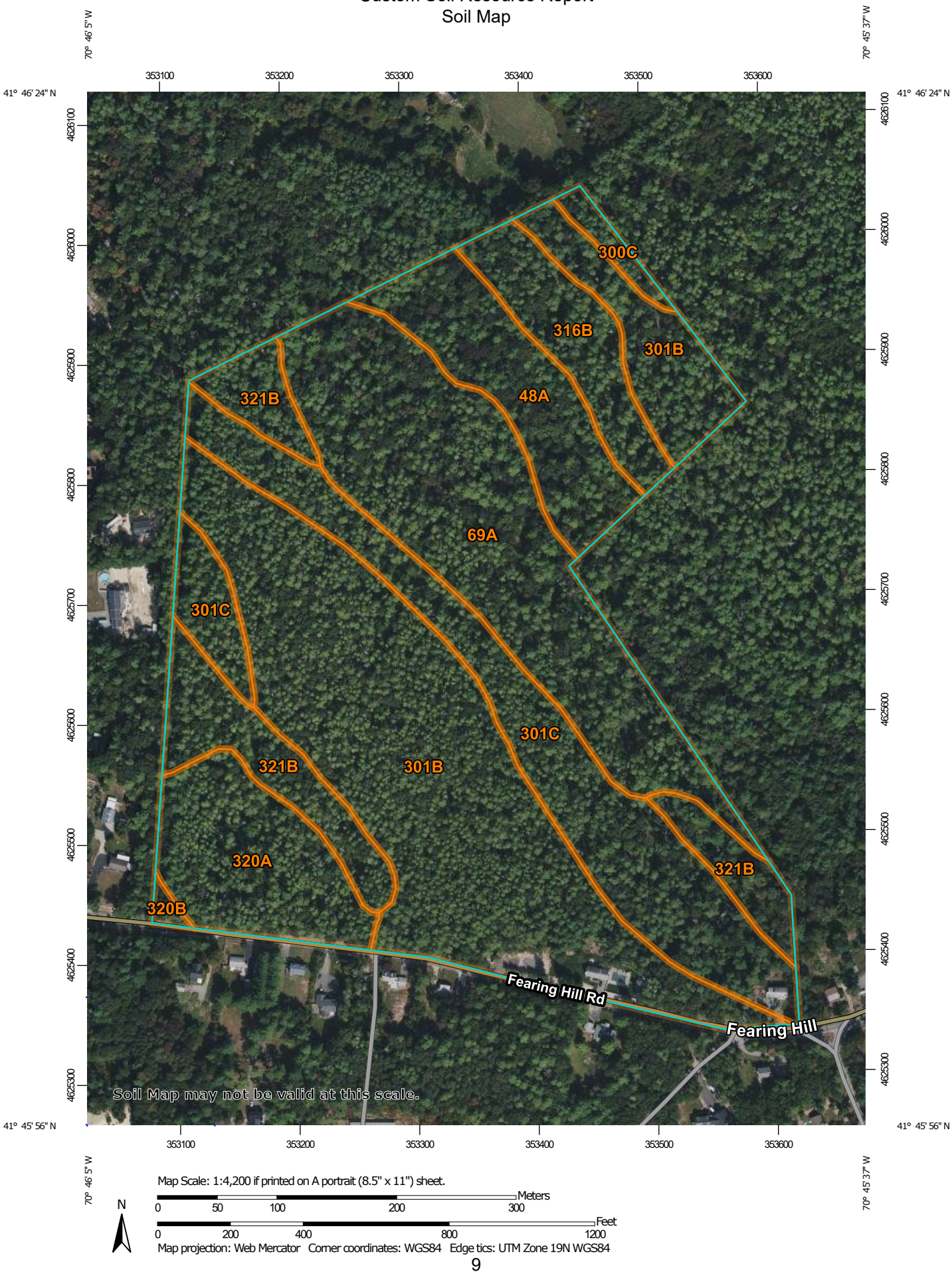
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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

Soil Map

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

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

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

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

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

Soil Survey Area: Plymouth County, Massachusetts
Survey Area Data: Version 13, Jun 9, 2020

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

Date(s) aerial images were photographed: Sep 25, 2020—Oct 9, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
48A	Brockton sandy loam, 0 to 3 percent slopes, extremely stony	4.8	7.7%
69A	Mattapoisett loamy sand, 0 to 3 percent slopes, extremely stony	12.5	19.9%
300C	Montauk fine sandy loam, 8 to 15 percent slopes	0.6	0.9%
301B	Montauk fine sandy loam, 0 to 8 percent slopes, very stony	20.9	33.3%
301C	Montauk fine sandy loam, 8 to 15 percent slopes, very stony	10.2	16.2%
316B	Scituate gravelly sandy loam, 3 to 8 percent slopes, very stony	3.2	5.0%
320A	Birchwood sand, 0 to 3 percent slopes	4.9	7.7%
320B	Birchwood sand, 3 to 8 percent slopes	0.2	0.3%
321B	Birchwood sand, 3 to 8 percent slopes, very stony	5.6	8.9%
Totals for Area of Interest		**62.8**	**100.0%**

Map Unit Descriptions

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

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

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties

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

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

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

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

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

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

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

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

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

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

Plymouth County, Massachusetts

48A—Brockton sandy loam, 0 to 3 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: bqt8
Elevation: 0 to 400 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Brockton, Extremely Stony

Setting

Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy lodgment till

Typical profile

Oe - 0 to 5 inches: moderately decomposed plant material
A - 5 to 14 inches: sandy loam
Cg - 14 to 20 inches: gravelly loamy sand
Cdg - 20 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 14 to 28 inches to densic material
Drainage class: Very poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 1.42 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water capacity: Very low (about 1.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 4 percent

Landform: Bogs, swamps, marshes, depressions, kettles
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Mattapoisett, extremely stony
Percent of map unit: 4 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Norwell, extremely stony
Percent of map unit: 4 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman, extremely stony
Percent of map unit: 4 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Ridgebury, extremely stony
Percent of map unit: 4 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

69A—Mattapoisett loamy sand, 0 to 3 percent slopes, extremely stony

Map Unit Setting
National map unit symbol: bcxg
Elevation: 10 to 400 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Mattapoisett, extremely stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mattapoisett, Extremely Stony

Setting

Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy eolian deposits and/or sandy glaciofluvial deposits over coarse-loamy lodgment till

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
Oa - 1 to 3 inches: highly decomposed plant material
A - 3 to 7 inches: loamy sand
Eg1 - 7 to 10 inches: loamy sand
Eg2 - 10 to 14 inches: loamy coarse sand
Bh - 14 to 18 inches: loamy coarse sand
Bhsm - 18 to 23 inches: loamy coarse sand
Bsm - 23 to 31 inches: loamy coarse sand
2Cd - 31 to 65 inches: sandy loam

Properties and qualities

Slope: 0 to 3 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 11 to 20 inches to ortstein; 31 to 53 inches to densic material
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Available water capacity: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: Yes

Minor Components

Birchwood, very stony

Percent of map unit: 7 percent
Landform: Drumlins, ground moraines, till plains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave

Across-slope shape: Concave
Hydric soil rating: No

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

Norwell, extremely stony
Percent of map unit: 3 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

300C—Montauk fine sandy loam, 8 to 15 percent slopes

Map Unit Setting
National map unit symbol: 2w80p
Elevation: 0 to 1,100 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

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

Description of Montauk

Setting
Landform: Drumlins, hills, ground moraines, recessionial moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy lodgment till derived from gneiss, granite, and/or schist

Typical profile
Ap - 0 to 4 inches: fine sandy loam
Bw1 - 4 to 26 inches: fine sandy loam
Bw2 - 26 to 34 inches: sandy loam

2Cd - 34 to 72 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Scituate

Percent of map unit: 6 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Canton

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury

Percent of map unit: 4 percent
Landform: Depressions, drainageways, hills, ground moraines
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

301B—Montauk fine sandy loam, 0 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w80v
Elevation: 0 to 1,070 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Montauk, very stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Montauk, Very Stony

Setting

Landform: Drumlins, hills, ground moraines, recessionial moraines
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 6 inches: fine sandy loam
Bw1 - 6 to 28 inches: fine sandy loam
Bw2 - 28 to 36 inches: sandy loam
2Cd - 36 to 74 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Scituate, very stony
Percent of map unit: 6 percent
Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Summit, footslope, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Canton, very stony
Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury, very stony
Percent of map unit: 4 percent
Landform: Depressions, drainageways, hills, ground moraines
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

301C—Montauk fine sandy loam, 8 to 15 percent slopes, very stony

Map Unit Setting
National map unit symbol: 2w80w
Elevation: 0 to 1,120 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

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

Description of Montauk, Very Stony

Setting

Landform: Hills, drumlins, ground moraines, recessionial moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 6 inches: fine sandy loam
Bw1 - 6 to 28 inches: fine sandy loam
Bw2 - 28 to 36 inches: sandy loam
2Cd - 36 to 74 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Scituate, very stony

Percent of map unit: 6 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Canton, very stony

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear

Across-slope shape: Convex
Hydric soil rating: No

Ridgebury, very stony
Percent of map unit: 4 percent
Landform: Hills, ground moraines, depressions, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

316B—Scituate gravelly sandy loam, 3 to 8 percent slopes, very stony

Map Unit Setting
National map unit symbol: bczw
Elevation: 10 to 400 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

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

Description of Scituate, Very Stony

Setting
Landform: Ridges, drumlins
Landform position (two-dimensional): Shoulder, footslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy eolian deposits over sandy lodgment till

Typical profile
Ap - 0 to 11 inches: gravelly sandy loam
Bw1 - 11 to 15 inches: gravelly sandy loam
Bw2 - 15 to 20 inches: sandy loam
BC1 - 20 to 25 inches: gravelly sandy loam
BC2 - 25 to 35 inches: sandy loam
Cd1 - 35 to 46 inches: loamy coarse sand
Cd2 - 46 to 60 inches: loamy coarse sand

Properties and qualities
Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.5 percent
Depth to restrictive feature: 20 to 35 inches to densic material
Drainage class: Moderately well drained

Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 15 to 20 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Woodbridge, very stony

Percent of map unit: 5 percent
Landform: Drumlins, hills, till plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Montauk, very stony

Percent of map unit: 5 percent
Landform: Till plains, drumlins, ground moraines
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Birchwood, very stony

Percent of map unit: 5 percent
Landform: Drumlins, ground moraines, till plains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Norwell, extremely stony

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

320A—Birchwood sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 9y45
Elevation: 10 to 400 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Birchwood

Setting

Landform: Ground moraines, till plains, drumlins
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy eolian deposits and/or sandy glaciofluvial deposits over coarse-loamy lodgment till

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
Oe - 1 to 3 inches: moderately decomposed plant material
Oa - 3 to 4 inches: highly decomposed plant material
E - 4 to 5 inches: sand
Ap - 5 to 8 inches: loamy sand
Bs - 8 to 13 inches: loamy sand
Bw1 - 13 to 19 inches: loamy sand
Bw2 - 19 to 29 inches: loamy sand
BC - 29 to 40 inches: sand
Cd1 - 40 to 55 inches: gravelly sandy loam
Cd2 - 55 to 75 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 35 to 59 inches to densic material
Drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 12 to 29 inches
Frequency of flooding: None
Frequency of ponding: None

Available water capacity: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Poquonock

Percent of map unit: 6 percent
Landform: Drumlins, ground moraines, till plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Mattapoisett

Percent of map unit: 6 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scituate

Percent of map unit: 5 percent
Landform: Drumlins, ridges
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Newfields

Percent of map unit: 3 percent
Landform: Moraines, till plains, hills
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

320B—Birchwood sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9y42

Elevation: 10 to 400 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Birchwood

Setting

Landform: Drumlins, ground moraines, till plains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy eolian deposits and/or sandy glaciofluvial deposits over coarse-loamy lodgment till

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
Oe - 1 to 3 inches: moderately decomposed plant material
Oa - 3 to 4 inches: highly decomposed plant material
E - 4 to 5 inches: sand
Ap - 5 to 8 inches: loamy sand
Bs - 8 to 13 inches: loamy sand
Bw1 - 13 to 19 inches: loamy sand
Bw2 - 19 to 29 inches: loamy sand
BC - 29 to 40 inches: sand
Cd1 - 40 to 55 inches: gravelly sandy loam
Cd2 - 55 to 75 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 35 to 59 inches to densic material
Drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 12 to 29 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Poquonock

Percent of map unit: 6 percent
Landform: Till plains, drumlins, ground moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Mattapoisett

Percent of map unit: 6 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scituate

Percent of map unit: 5 percent
Landform: Drumlins, ridges
Landform position (two-dimensional): Shoulder, footslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Newfields

Percent of map unit: 3 percent
Landform: Moraines, till plains, hills
Landform position (two-dimensional): Footslope, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

321B—Birchwood sand, 3 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 9y47
Elevation: 0 to 400 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Birchwood, very stony, and similar soils: 80 percent

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

Description of Birchwood, Very Stony

Setting

Landform: Ground moraines, till plains, drumlins
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy eolian deposits and/or sandy glaciofluvial deposits over coarse-loamy lodgment till

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
Oe - 1 to 3 inches: moderately decomposed plant material
Oa - 3 to 4 inches: highly decomposed plant material
E - 4 to 5 inches: sand
Ap - 5 to 8 inches: loamy sand
Bs - 8 to 13 inches: loamy sand
Bw1 - 13 to 19 inches: loamy sand
Bw2 - 19 to 29 inches: loamy sand
BC - 29 to 40 inches: sand
Cd1 - 40 to 55 inches: gravelly sandy loam
Cd2 - 55 to 75 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.0 percent
Depth to restrictive feature: 35 to 59 inches to densic material
Drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 12 to 29 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Poquonock, very stony

Percent of map unit: 6 percent
Landform: Drumlins, ground moraines, till plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Mattapoisett, extremely stony

Percent of map unit: 6 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scituate, very stony

Percent of map unit: 5 percent
Landform: Ridges, drumlins
Landform position (two-dimensional): Footslope, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Newfields, extremely stony

Percent of map unit: 3 percent
Landform: Moraines, hills, till plains
Landform position (two-dimensional): Footslope, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf