GRAZ Engineering, LLC
WWW.GRAZENGINEERING.COM
• 323 West Lake Road • Fitzwilliam, NH 03447 • Telephone (603) 585-6959 • Fax (603) 585-6960

Doyle Avenue, Winchendon, MA - A-N-R Development
Owner/Applicant: Asher Construction, LLC; 77 Nashua Road, Sharon, NH 03458
Engineer: GRAZ Engineering, LLC; 323 W. Lake Road; Fitzwilliam, NH 03447

Project Narrative

The proposed project consists of the subdivision two parcels, one on the east side of Doyle Ave, and one on the west side of Doyle Ave, into six and nine lots, respectively. This submittal will focus on the northern section of development on both lots (the four northernmost lots on the western side of Doyle, and the three northernmost lots on the eastern side of Doyle. All lots to be subdivided are A-N-R Single Family House Lots. Per Winchendon's Stormwater Bylaw, a Stormwater Permit is required because of the total disturbance on the lot to develop these houses (5 acres) is over the maximum allowable disturbance without a Stormwater Permit (1.0 Acre). To achieve the requirements of the Stormwater Bylaw, we have designed several infiltration systems to reduce the flow onto each street that abut the lots. These infiltration systems have been designed to retain a 1 inch x impervious area, which is adequate to treat stormwater to a 90% TSS and 60% TP standard per Winchendon Stormwater Management Regulations Section 8.(D)(1)(b).

These lots are large in size and consist of several wetland areas/intermittent streams throughout the wetland. These lots will all be serviced by private water and septic systems, which resulted in the houses needing to be designed in the interior of the lot rather than up by the roadway. The topography slopes moderately to the south-southwest to a very large swamp. From the swamp, water flows along a stream into Lake Dennison.

Test pits were conducted for the on-site septic systems on June 13, 2022 and January 24, 2022 by GRAZ Engineering. These test pits were dug to depths of 6'+/- with no reported refusals. Estimated seasonal high-water table was reported at 18" at the lowest, 40" at the highest. The soils were Fine & Loamy Sand/ Granular Sandy Loam. WebSoilSurvey reports that the soil is consistent throughout the site as a 908C – Becket-skerry association – extremely stony, with a pocket of 351B – Becket Fine Sandy Loam. **Further soil testing was conducted in November of 2022 to determine seasonal high groundwater elevations underneath all of the infiltration practices. The practices were adjusted to maintain a 2' separation from groundwater (minimum), and where that was not achievable, the design was reconfigured a as a rain garden.**

Although the infiltration basin to groundwater separation is two feet in all of the proposed basins, mounding analyses were not conducted as recharge has been omitted in the hydrology model, and it is not being used to attenuate the 10-year storm.

Hydrology Report Narrative

For the Hydrology Model, we analyzed the peak flow at three analysis points, which are generally where the flow meets the road it sheds water onto. In the case of the existing drainage on Leominster Street, we analyzed the total water that flows across the street. These analyses were conducted for the 2, 10, and 100-year storms events. The rainfall data was obtained through NOAA Atlas 14 data.

The enclosed analyses document the 'pre' and 'post' development stormwater runoff for the 2, 10, and 100-year storm events. The peak flowrates of runoff are compared as follows (cfs):

	2 year	10 year	100 year
Pre-Construction Wetland	21.40	59.49	131.57
Post-Construction Wetland	21.01	57.57	128.78
Pre-Construction Culvert*	17.64	48.59	107.58
Post-Construction Culvert*	17.07	46.39	102.03

A full stormwater report containing the full HydroCAD analysis, sizing calculations, etc. is attached.

Illicit Discharge Compliance Statement

Responsibility:

The Owner is responsible for ultimate compliance with all provisions of the Massachusetts Stormwater Management Policy, the USEPA NPDES Construction General Permit and responsible for identifying and eliminating illicit discharges (as defined by the USEPA).

Owner Name: Asher Construction, LLC
Address: 77 Nashua Road; Sharon, NH 03458
Telephone No.: 603-562-5181

Engineer's Compliance Statement:

To the best of my knowledge, the attached plans, computations and specifications meet the requirements of Standard 10 of the Massachusetts Stormwater Handbook regarding illicit discharges to the stormwater management system and that no detectable illicit discharges exist or are proposed on-site. All documents and attachments were prepared under my direction and qualified personnel properly gathered and evaluated the information submitted, to the best of my knowledge.

Included with this statement are site plans, drawn to scale, that identify the location of systems for conveying stormwater on the site and show that these systems do not allow the entry of any illicit discharges into the stormwater management system. The plans also show any systems for conveying wastewater and/or groundwater on the site and show that there are no connections between the stormwater and wastewater systems.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104

In Reply Refer To:
Project Code: 2023-0008243
Project Name: Doyle Ave A-N-R Development

October 25, 2022

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

Please review this letter each time you request an Official Species List, we will continue to update it with additional information and links to websites may change.

About Official Species Lists

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Federal and non-Federal project proponents have responsibilities under the Act to consider effects on listed species.

The enclosed species list identifies threatened, endangered, proposed, and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested by returning to an existing project's page in IPaC.

Endangered Species Act Project Review

Please visit the "**New England Field Office Endangered Species Project Review and Consultation**" website for step-by-step instructions on how to consider effects on listed

species and prepare and submit a project review package if necessary:

https://www.fws.gov/office/new-england-ecological-services/endangered-species-project-review

NOTE Please do not use the **Consultation Package Builder** tool in IPaC except in specific situations following coordination with our office. Please follow the project review guidance on our website instead and reference your **Project Code** in all correspondence.

Northern Long-eared Bat Update - Additionally, please note that on March 23, 2022, the Service published a proposal to reclassify the northern long-eared bat (NLEB) as endangered under the Endangered Species Act. The U.S. District Court for the District of Columbia has ordered the Service to complete a new final listing determination for the NLEB by November 2022 (Case 1:15-cv-00477, March 1, 2021). The bat, currently listed as threatened, faces extinction due to the range-wide impacts of white-nose syndrome (WNS), a deadly fungal disease affecting cave-dwelling bats across the continent. The proposed reclassification, if finalized, would remove the current 4(d) rule for the NLEB, as these rules may be applied only to threatened species. Depending on the type of effects a project has on NLEB, the change in the species' status may trigger the need to re-initiate consultation for any actions that are not completed and for which the Federal action agency retains discretion once the new listing determination becomes effective (anticipated to occur by December 30, 2022). If your project may result in incidental take of NLEB after the new listing goes into effect this will first need to be addressed in an updated consultation that includes an Incidental Take Statement. If your project may require re-initiation of consultation, please contact our office for additional guidance.

Additional Info About Section 7 of the Act
Under section 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to determine whether projects may affect threatened and endangered species and/or designated critical habitat. If a Federal agency, or its non-Federal representative, determines that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Federal agency also may need to consider proposed species and proposed critical habitat in the consultation. 50 CFR 402.14(c)(1) specifies the information required for consultation under the Act regardless of the format of the evaluation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/service/section-7-consultations

In addition to consultation requirements under Section 7(a)(2) of the ESA, please note that under sections 7(a)(1) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species. Please contact NEFO if you would like more information.

Candidate species that appear on the enclosed species list have no current protections under the

ESA. The species' occurrence on an official species list does not convey a requirement to consider impacts to this species as you would a proposed, threatened, or endangered species. The ESA does not provide for interagency consultations on candidate species under section 7, however, the Service recommends that all project proponents incorporate measures into projects to benefit candidate species and their habitats wherever possible.

Migratory Birds

In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see:

https://www.fws.gov/program/migratory-bird-permit

https://www.fws.gov/library/collections/bald-and-golden-eagle-management

Please feel free to contact us at **newengland@fws.gov** with your **Project Code** in the subject line if you need more information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat.

Attachment(s): Official Species List

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

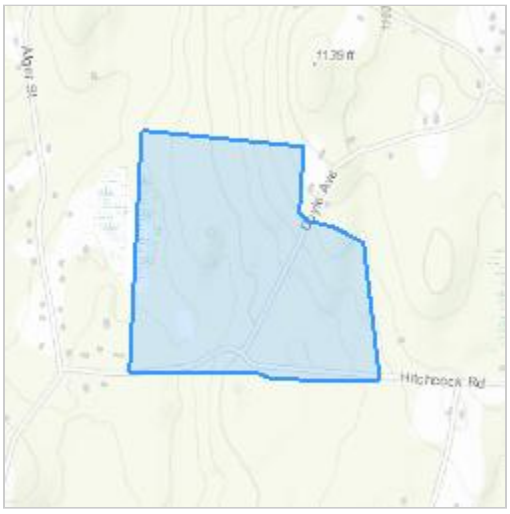
This species list is provided by:

New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
(603) 223-2541

Project Summary

Project Code: 2023-0008243
Project Name: Doyle Ave A-N-R Development
Project Type: Residential Construction
Project Description: The project is located on both sides of Doyle Avenue in the sketch shown. Overall, the project will be the consruction of 15 single family homes, broken out into two phases. The first phase is the 7 northernmost lots to be permitted first, then approvals will be sought after for the rest of the development at a later date. On average, each lot will consist of 30,000 S.F. of disturbance.
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@42.658896049999996,-72.06471831983612,14z



Counties: Worcester County, Massachusetts

Endangered Species Act Species

There is a total of 2 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

IPaC User Contact Information

Agency: Graz Engineering
Name: Trevor Fletcher
Address: 323 W Lake Road
City: Fitzwilliam
State: NH
Zip: 03447
Email trevorfletcher91@yahoo.com
Phone: 6035856959

EPA NeT CGP Coverage Status: Active: Doyle Ave A-N-R Development, NPDES ID: MAR1004C1

From: no-reply@epacdx.net

Date: Tuesday, November 8, 2022 at 10:31 AM EST

2022-11-08

Dear NeT User,

Coverage status has changed for a project / site under the CGP.

NPDES ID	Form Type	Coverage Status	Operator	Project/Site Name	EPA Comment
MAR1004C1	NOI	Active	Asher Construction, LLC	Doyle Ave A-N-R Development	

Your Notice of Intent (NOI) requesting coverage under EPA's Construction General Permit (CGP) has been accepted and authorization to discharge under the CGP became effective on 11/08/2022 and will expire on 02/16/2027.

Please note that this email does not represent a determination by EPA regarding the validity of the information you provided in your NOI or LEW. Your eligibility for coverage under this permit is based on the validity of the certification you provided. Your electronic signature on the NOI or LEW form certifies that you have read, understood, and are implementing all of the applicable requirements. An important aspect of this certification requires that you have correctly determined whether you are eligible for coverage under this permit.

The CGP requires you to have developed a Stormwater Pollution Prevention Plan (SWPPP) prior to submitting your NOI. The CGP also includes specific requirements for erosion and sediment controls, pollution prevention controls, conducting self-inspections, taking corrective actions, and conducting staff training. You must comply with any state, tribal, or territory-specific requirements in Part 9 (see https://www.epa.gov/npdes/stormwater-discharges-construction-activities#cgp).

A copy of the submission can be found here.

If you have questions about this email or about NeT CGP, please refer to NeT Support or e-mail NPDESereporting@epa.gov for assistance.

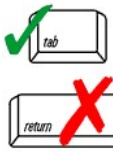
This is an automated notification; please do not reply to this email.

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.

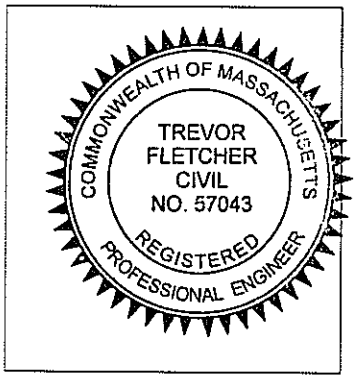
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the 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 10-25-22

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): _____

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 for 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.

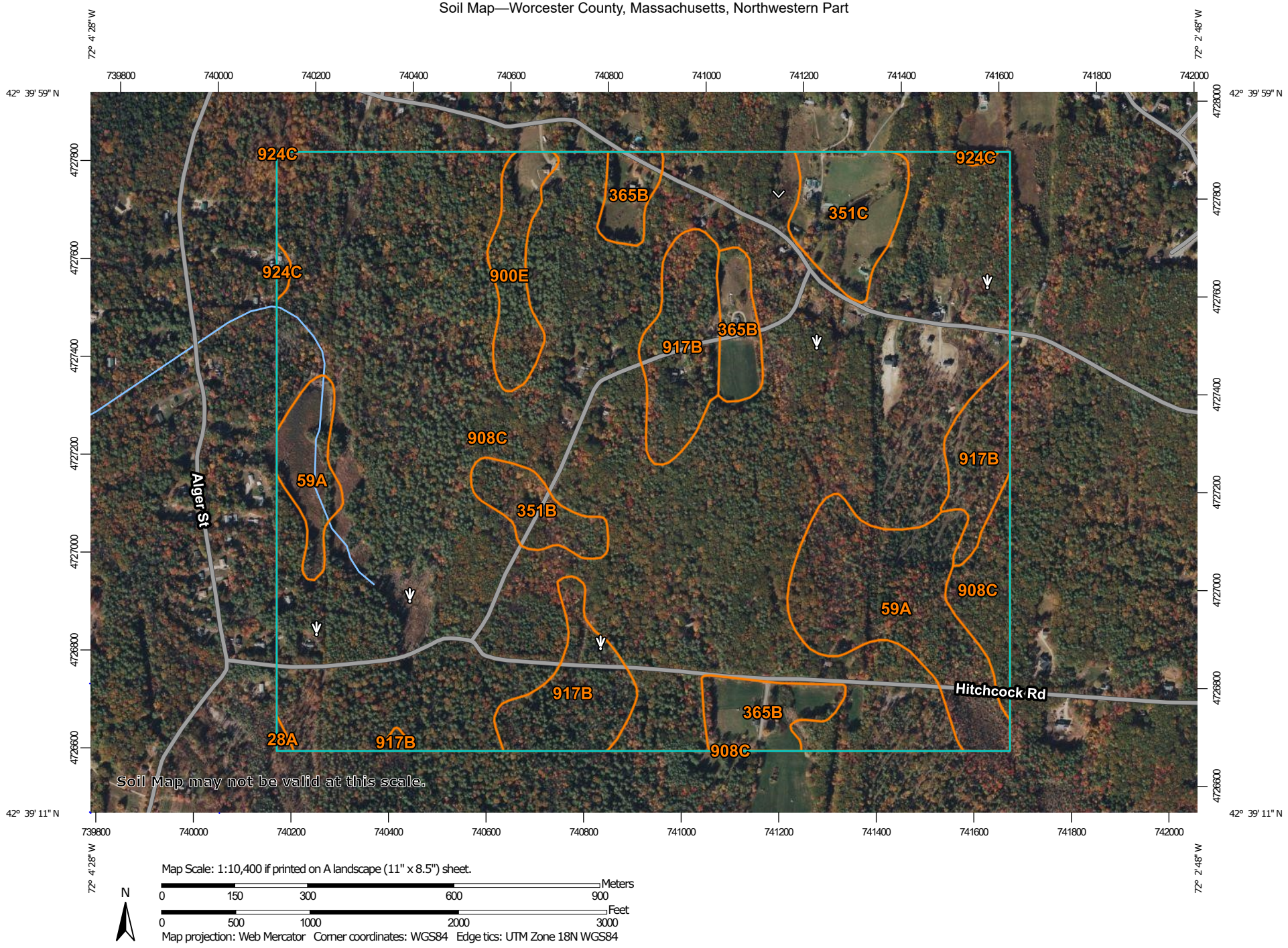
Standard 10: Prohibition of Illicit Discharges

☒ 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.

Soil Map—Worcester County, Massachusetts, Northwestern Part



Map Scale: 1:10,400 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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: Worcester County, Massachusetts, Northwestern Part
Survey Area Data: Version 16, Sep 9, 2022

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

Date(s) aerial images were photographed: Oct 15, 2020—Oct 31, 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
28A	Searsport loamy sand, 0 to 3 percent slopes	0.3	0.1%
59A	Bucksport and Wonsqueak mucks, 0 to 2 percent slopes	36.4	8.0%
351B	Becket fine sandy loam, 3 to 8 percent slopes	7.3	1.6%
351C	Becket fine sandy loam, 8 to 15 percent slopes	13.2	2.9%
365B	Skerry fine sandy loam, 3 to 8 percent slopes	18.8	4.1%
900E	Becket-Monadnock association, 15 to 45 percent slopes, extremely stony	9.5	2.1%
908C	Becket-Skerry association, 0 to 15 percent slopes, extremely stony	334.3	73.2%
917B	Pillsbury-Peacham association, 0 to 8 percent slopes, extremely stony	35.8	7.8%
924C	Tunbridge-Lyman-Berkshire association, 3 to 15 percent slopes, extremely stony	1.0	0.2%
Totals for Area of Interest		**456.6**	**100.0%**

Worcester County, Massachusetts, Northwestern Part

351B—Becket fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2w9pk
Elevation: 230 to 1,380 feet
Mean annual precipitation: 31 to 65 inches
Mean annual air temperature: 36 to 52 degrees F
Frost-free period: 90 to 160 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Becket

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainbase, interfluve, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bs1 - 7 to 14 inches: fine sandy loam
Bs2 - 14 to 24 inches: gravelly sandy loam
BC - 24 to 33 inches: gravelly sandy loam
Cd - 33 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Well drained
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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F144BY501ME - Loamy Slope (Northern Hardwoods)
Hydric soil rating: No

Minor Components

Skerry
Percent of map unit: 6 percent
Landform: Mountains, hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainbase, interfluve, nose slope, side slope
Microfeatures of landform position: Closed depressions, closed depressions
Down-slope shape: Convex, concave
Across-slope shape: Linear, concave
Hydric soil rating: No

Pillsbury
Percent of map unit: 4 percent
Landform: Mountains, hills
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Mountainbase, interfluve, nose slope, side slope
Microfeatures of landform position: Closed depressions, closed depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Tunbridge
Percent of map unit: 3 percent
Landform: Hills, mountains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainbase, interfluve, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Monadnock
Percent of map unit: 2 percent
Landform: Hills, mountains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainbase, interfluve, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex

Hydric soil rating: No

Data Source Information

Soil Survey Area: Worcester County, Massachusetts, Northwestern Part
Survey Area Data: Version 16, Sep 9, 2022

Worcester County, Massachusetts, Northwestern Part

351C—Becket fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w9pl
Elevation: 200 to 1,380 feet
Mean annual precipitation: 31 to 65 inches
Mean annual air temperature: 36 to 52 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Becket

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainflank, mountainbase, interfluve, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bs1 - 7 to 14 inches: fine sandy loam
Bs2 - 14 to 24 inches: gravelly sandy loam
BC - 24 to 33 inches: gravelly sandy loam
Cd - 33 to 65 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
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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F144BY501ME - Loamy Slope (Northern Hardwoods)
Hydric soil rating: No

Minor Components

Skerry
Percent of map unit: 6 percent
Landform: Mountains, hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank, mountainbase, interfluve, nose slope, side slope
Microfeatures of landform position: Open depressions, closed depressions, closed depressions, open depressions
Down-slope shape: Convex, concave
Across-slope shape: Linear, concave
Hydric soil rating: No

Tunbridge
Percent of map unit: 4 percent
Landform: Hills, mountains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainflank, mountainbase, interfluve, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Pillsbury
Percent of map unit: 3 percent
Landform: Mountains, hills
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Mountainflank, mountainbase, interfluve, nose slope, side slope
Microfeatures of landform position: Open depressions, closed depressions, closed depressions, open depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Monadnock
Percent of map unit: 2 percent
Landform: Hills, mountains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainflank, mountainbase, interfluve, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex

Hydric soil rating: No

Data Source Information

Soil Survey Area: Worcester County, Massachusetts, Northwestern Part
Survey Area Data: Version 16, Sep 9, 2022

Worcester County, Massachusetts, Northwestern Part

365B—Skerry fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2w9p8
Elevation: 260 to 1,210 feet
Mean annual precipitation: 31 to 65 inches
Mean annual air temperature: 36 to 52 degrees F
Frost-free period: 90 to 160 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Skerry

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainbase, interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist

Typical profile

Ap - 0 to 6 inches: fine sandy loam
Bs1 - 6 to 20 inches: gravelly fine sandy loam
Bs2 - 20 to 25 inches: gravelly fine sandy loam
Cd1 - 25 to 34 inches: gravelly loamy sand
Cd2 - 34 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 21 to 43 inches to densic material
Drainage class: Moderately well drained
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 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: C/D
Ecological site: F144BY501ME - Loamy Slope (Northern Hardwoods)
Hydric soil rating: No

Minor Components

Colonel
Percent of map unit: 6 percent
Landform: Mountains, hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Mountainbase, interfluve
Microfeatures of landform position: Closed depressions, closed depressions
Down-slope shape: Linear, concave
Across-slope shape: Concave
Hydric soil rating: No

Becket
Percent of map unit: 4 percent
Landform: Mountains, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainbase, interfluve
Microfeatures of landform position: Rises, rises
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Brayton
Percent of map unit: 3 percent
Landform: Mountains, hills
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Mountainbase, interfluve
Microfeatures of landform position: Closed depressions, closed depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Hermon
Percent of map unit: 2 percent
Landform: Mountains, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainbase, interfluve
Microfeatures of landform position: Rises, rises
Down-slope shape: Convex
Across-slope shape: Convex

Hydric soil rating: No

Data Source Information

Soil Survey Area: Worcester County, Massachusetts, Northwestern Part
Survey Area Data: Version 16, Sep 9, 2022

Worcester County, Massachusetts, Northwestern Part

900E—Becket-Monadnock association, 15 to 45 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2x9q3
Elevation: 750 to 1,280 feet
Mean annual precipitation: 36 to 65 inches
Mean annual air temperature: 36 to 52 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Becket, extremely stony, and similar soils: 45 percent
Monadnock, extremely stony, and similar soils: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Becket, Extremely Stony

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainflank, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
E - 2 to 4 inches: fine sandy loam
Bhs - 4 to 5 inches: fine sandy loam
Bs1 - 5 to 7 inches: fine sandy loam
Bs2 - 7 to 14 inches: fine sandy loam
Bs3 - 14 to 24 inches: gravelly sandy loam
BC - 24 to 33 inches: gravelly sandy loam
Cd - 33 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 15 to 45 percent
Surface area covered with cobbles, stones or boulders: 6.0 percent
Depth to restrictive feature: 21 to 43 inches to densic material
Drainage class: Well drained
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: More than 80 inches
Frequency of flooding: None

Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F144BY501ME - Loamy Slope (Northern Hardwoods)
Hydric soil rating: No

Description of Monadnock, Extremely Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainflank, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy supraglacial meltout till derived from granite and gneiss and/or mica schist and/or phyllite over sandy and gravelly supraglacial meltout till derived from granite and gneiss and/or mica schist and/or phyllite

Typical profile

Oe - 0 to 3 inches: moderately decomposed plant material
E - 3 to 8 inches: fine sandy loam
Bs1 - 8 to 10 inches: fine sandy loam
Bs2 - 10 to 12 inches: fine sandy loam
Bs3 - 12 to 22 inches: gravelly fine sandy loam
BC - 22 to 25 inches: gravelly fine sandy loam
2C1 - 25 to 45 inches: gravelly loamy sand
2C2 - 45 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 15 to 45 percent
Surface area covered with cobbles, stones or boulders: 6.0 percent
Depth to restrictive feature: 18 to 36 inches to strongly contrasting textural stratification
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B

Ecological site: F144BY505ME - Loamy over Sandy
Hydric soil rating: No

Minor Components

Skerry, extremely stony
Percent of map unit: 8 percent
Landform: Mountains, hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Lyman, extremely stony
Percent of map unit: 3 percent
Landform: Hills, mountains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountaintop, mountainflank, side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Peacham, extremely stony
Percent of map unit: 2 percent
Landform: Mountains, hills
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Mountainbase, interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Pillsbury, extremely stony
Percent of map unit: 2 percent
Landform: Mountains, hills
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Mountainflank, mountainbase, interfluve, nose slope, side slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Worcester County, Massachusetts, Northwestern Part
Survey Area Data: Version 16, Sep 9, 2022

Worcester County, Massachusetts, Northwestern Part

908C—Becket-Skerry association, 0 to 15 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2x9ny
Elevation: 820 to 1,280 feet
Mean annual precipitation: 36 to 65 inches
Mean annual air temperature: 36 to 52 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Becket, extremely stony, and similar soils: 45 percent
Skerry, extremely stony, and similar soils: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Becket, Extremely Stony

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainflank, mountainbase, interfluve, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
E - 2 to 4 inches: fine sandy loam
Bhs - 4 to 5 inches: fine sandy loam
Bs1 - 5 to 7 inches: fine sandy loam
Bs2 - 7 to 14 inches: fine sandy loam
Bs3 - 14 to 24 inches: gravelly sandy loam
BC - 24 to 33 inches: gravelly sandy loam
Cd - 33 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 15 percent
Surface area covered with cobbles, stones or boulders: 6.0 percent
Depth to restrictive feature: 21 to 43 inches to densic material
Drainage class: Well drained
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: More than 80 inches
Frequency of flooding: None

Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F144BY501ME - Loamy Slope (Northern Hardwoods)
Hydric soil rating: No

Description of Skerry, Extremely Stony

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank, mountainbase, interfluve, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist

Typical profile

Oa - 0 to 2 inches: highly decomposed plant material
E - 2 to 4 inches: fine sandy loam
Bhs - 4 to 6 inches: fine sandy loam
Bs1 - 6 to 20 inches: gravelly fine sandy loam
Bs2 - 20 to 25 inches: gravelly fine sandy loam
Cd1 - 25 to 34 inches: gravelly loamy sand
Cd2 - 34 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 15 percent
Surface area covered with cobbles, stones or boulders: 6.0 percent
Depth to restrictive feature: 21 to 43 inches to densic material
Drainage class: Moderately well drained
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 19 to 34 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C/D
Ecological site: F144BY501ME - Loamy Slope (Northern Hardwoods)
Hydric soil rating: No

Minor Components

Pillsbury, extremely stony
Percent of map unit: 6 percent
Landform: Mountains, hills
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Mountainflank, mountainbase, interfluve, nose slope, side slope
Microfeatures of landform position: Closed depressions, open depressions, open depressions, closed depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Monadnock, extremely stony
Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainflank, mountainbase, interfluve, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Berkshire, extremely stony
Percent of map unit: 5 percent
Landform: Mountains, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainflank, mountainbase, interfluve, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Tunbridge, extremely stony
Percent of map unit: 4 percent
Landform: Mountains, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainflank, mountainbase, interfluve, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Data Source Information

Soil Survey Area: Worcester County, Massachusetts, Northwestern Part
Survey Area Data: Version 16, Sep 9, 2022

Worcester County, Massachusetts, Northwestern Part

917B—Pillsbury-Peacham association, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 9c0q
Elevation: 0 to 2,100 feet
Mean annual precipitation: 39 to 55 inches
Mean annual air temperature: 39 to 45 degrees F
Frost-free period: 120 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Pillsbury and similar soils: 45 percent
Peacham and similar soils: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pillsbury

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable coarse-loamy eolian deposits over dense coarse-loamy lodgment till derived from granite and gneiss

Typical profile

A - 0 to 4 inches: gravelly fine sandy loam
Bg - 4 to 14 inches: gravelly fine sandy loam
Bw - 14 to 24 inches: gravelly fine sandy loam
Cd - 24 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 15 to 35 inches to densic material
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C/D
Ecological site: F144BY305ME - Wet Loamy Flat, F144BY301ME - Loamy Till Swamp
Hydric soil rating: Yes

Description of Peacham

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Highly-decomposed herbaceous organic material over dense coarse-loamy lodgment till derived from granite and gneiss

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
Oa - 2 to 11 inches: highly decomposed plant material
Bg - 11 to 14 inches: fine sandy loam
Cd - 14 to 18 inches: fine sandy loam
Cd - 18 to 65 inches: gravelly fine 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: 6 to 18 inches to densic material
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144BY301ME - Loamy Till Swamp
Hydric soil rating: Yes

Minor Components

Peru

Percent of map unit: 10 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Hydric soil rating: No

Wonsqueak

Percent of map unit: 6 percent
Landform: Bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Chocorua

Percent of map unit: 4 percent
Landform: Bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Worcester County, Massachusetts, Northwestern Part
Survey Area Data: Version 16, Sep 9, 2022

NOAA Atlas 14, Volume 10, Version 3
Location name: Winchendon, Massachusetts, USA*
Latitude: 42.6566°, Longitude: -72.0649°
Elevation: 1000.38 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.309** (0.250-0.384)	**0.367** (0.297-0.457)	**0.463** (0.373-0.578)	**0.542** (0.433-0.681)	**0.652** (0.501-0.858)	**0.735** (0.551-0.990)	**0.821** (0.593-1.15)	**0.915** (0.623-1.32)	**1.05** (0.682-1.57)	**1.15** (0.730-1.77)
10-min	**0.438** (0.354-0.543)	**0.521** (0.420-0.647)	**0.657** (0.529-0.820)	**0.769** (0.614-0.966)	**0.924** (0.709-1.22)	**1.04** (0.780-1.40)	**1.16** (0.839-1.63)	**1.30** (0.883-1.87)	**1.48** (0.966-2.22)	**1.63** (1.03-2.50)
15-min	**0.515** (0.416-0.639)	**0.612** (0.495-0.762)	**0.772** (0.621-0.963)	**0.904** (0.723-1.14)	**1.09** (0.835-1.43)	**1.23** (0.918-1.65)	**1.37** (0.988-1.91)	**1.53** (1.04-2.20)	**1.75** (1.14-2.61)	**1.92** (1.22-2.95)
30-min	**0.712** (0.576-0.885)	**0.844** (0.682-1.05)	**1.06** (0.853-1.32)	**1.24** (0.990-1.56)	**1.49** (1.14-1.96)	**1.67** (1.25-2.25)	**1.87** (1.35-2.61)	**2.08** (1.42-3.00)	**2.38** (1.55-3.57)	**2.63** (1.66-4.03)
60-min	**0.910** (0.736-1.13)	**1.08** (0.869-1.34)	**1.35** (1.09-1.68)	**1.57** (1.26-1.98)	**1.89** (1.45-2.48)	**2.12** (1.59-2.86)	**2.36** (1.71-3.31)	**2.64** (1.80-3.80)	**3.02** (1.97-4.53)	**3.34** (2.11-5.11)
2-hr	**1.13** (0.922-1.40)	**1.36** (1.10-1.68)	**1.72** (1.39-2.13)	**2.02** (1.63-2.53)	**2.44** (1.89-3.20)	**2.75** (2.08-3.70)	**3.08** (2.25-4.33)	**3.47** (2.37-4.97)	**4.04** (2.64-6.02)	**4.52** (2.87-6.88)
3-hr	**1.29** (1.05-1.58)	**1.55** (1.26-1.90)	**1.97** (1.60-2.44)	**2.33** (1.88-2.90)	**2.82** (2.19-3.69)	**3.18** (2.42-4.27)	**3.57** (2.62-5.01)	**4.04** (2.76-5.76)	**4.74** (3.10-7.03)	**5.33** (3.39-8.08)
6-hr	**1.60** (1.31-1.95)	**1.93** (1.59-2.36)	**2.48** (2.03-3.04)	**2.93** (2.38-3.62)	**3.56** (2.78-4.63)	**4.02** (3.07-5.37)	**4.52** (3.35-6.33)	**5.13** (3.53-7.28)	**6.07** (3.98-8.94)	**6.87** (4.38-10.3)
12-hr	**1.98** (1.64-2.40)	**2.39** (1.98-2.90)	**3.07** (2.53-3.74)	**3.63** (2.97-4.46)	**4.41** (3.47-5.70)	**4.98** (3.83-6.61)	**5.60** (4.17-7.79)	**6.36** (4.39-8.97)	**7.54** (4.96-11.0)	**8.55** (5.47-12.8)
24-hr	**2.36** (1.97-2.84)	**2.86** (2.38-3.45)	**3.68** (3.05-4.45)	**4.36** (3.58-5.31)	**5.29** (4.19-6.80)	**5.98** (4.62-7.89)	**6.73** (5.03-9.29)	**7.65** (5.29-10.7)	**9.05** (5.98-13.2)	**10.3** (6.59-15.2)
2-day	**2.71** (2.27-3.24)	**3.30** (2.77-3.95)	**4.27** (3.56-5.13)	**5.07** (4.20-6.13)	**6.17** (4.91-7.88)	**6.99** (5.43-9.15)	**7.87** (5.91-10.8)	**8.95** (6.22-12.4)	**10.6** (7.02-15.3)	**12.0** (7.72-17.7)
3-day	**2.96** (2.49-3.53)	**3.61** (3.03-4.30)	**4.66** (3.91-5.59)	**5.54** (4.61-6.68)	**6.75** (5.39-8.58)	**7.65** (5.96-9.97)	**8.61** (6.48-11.8)	**9.79** (6.82-13.6)	**11.6** (7.69-16.7)	**13.1** (8.45-19.3)
4-day	**3.19** (2.69-3.79)	**3.87** (3.27-4.61)	**4.99** (4.19-5.96)	**5.93** (4.94-7.12)	**7.21** (5.77-9.13)	**8.16** (6.37-10.6)	**9.18** (6.92-12.5)	**10.4** (7.28-14.4)	**12.3** (8.18-17.7)	**13.9** (8.99-20.4)
7-day	**3.84** (3.26-4.54)	**4.59** (3.89-5.43)	**5.82** (4.91-6.91)	**6.84** (5.73-8.17)	**8.24** (6.63-10.4)	**9.28** (7.28-12.0)	**10.4** (7.86-14.0)	**11.7** (8.23-16.1)	**13.7** (9.17-19.6)	**15.4** (10.00-22.5)
10-day	**4.49** (3.82-5.29)	**5.27** (4.48-6.21)	**6.54** (5.54-7.74)	**7.60** (6.39-9.05)	**9.06** (7.30-11.3)	**10.1** (7.96-13.0)	**11.3** (8.53-15.1)	**12.7** (8.89-17.3)	**14.6** (9.79-20.8)	**16.3** (10.6-23.7)
20-day	**6.48** (5.56-7.57)	**7.29** (6.24-8.53)	**8.61** (7.34-10.1)	**9.71** (8.22-11.5)	**11.2** (9.08-13.8)	**12.4** (9.72-15.6)	**13.6** (10.2-17.7)	**14.8** (10.5-20.0)	**16.5** (11.1-23.2)	**17.8** (11.6-25.7)
30-day	**8.13** (7.00-9.47)	**8.97** (7.71-10.5)	**10.3** (8.84-12.1)	**11.5** (9.73-13.5)	**13.0** (10.6-15.9)	**14.2** (11.2-17.8)	**15.4** (11.5-19.9)	**16.6** (11.8-22.3)	**18.0** (12.2-25.3)	**19.1** (12.5-27.4)
45-day	**10.2** (8.80-11.8)	**11.1** (9.54-12.8)	**12.5** (10.7-14.6)	**13.7** (11.7-16.1)	**15.3** (12.5-18.6)	**16.6** (13.1-20.6)	**17.9** (13.4-22.8)	**19.0** (13.5-25.4)	**20.3** (13.7-28.3)	**21.2** (13.8-30.2)
60-day	**11.9** (10.3-13.7)	**12.8** (11.1-14.8)	**14.3** (12.4-16.7)	**15.6** (13.3-18.3)	**17.4** (14.1-21.0)	**18.8** (14.8-23.1)	**20.0** (15.0-25.5)	**21.1** (15.1-28.2)	**22.4** (15.2-31.2)	**23.2** (15.3-33.1)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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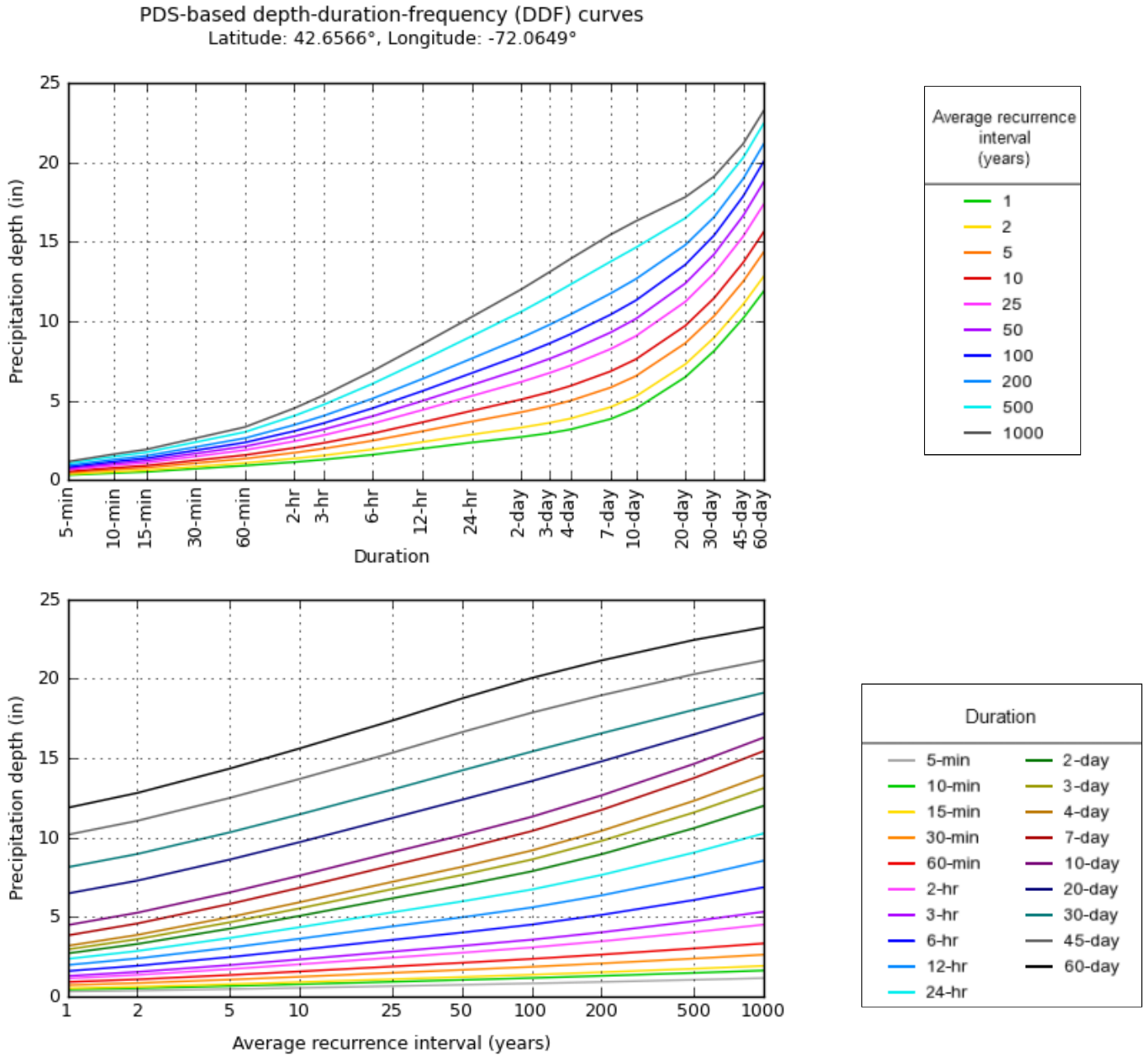
PF graphical



NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Tue Dec 27 21:03:55 2022

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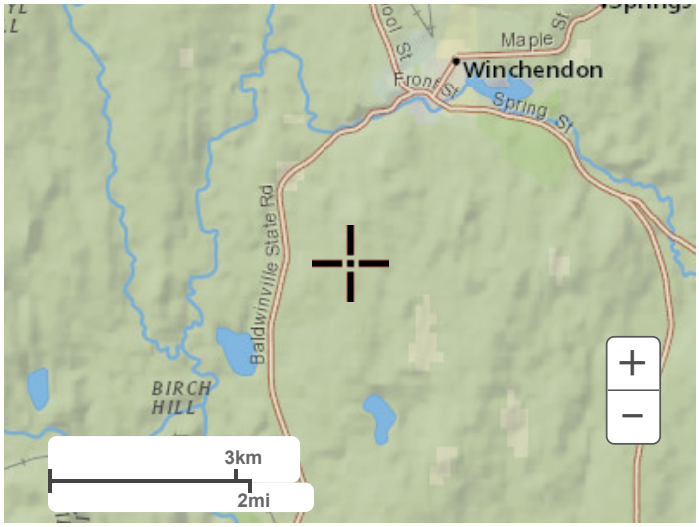
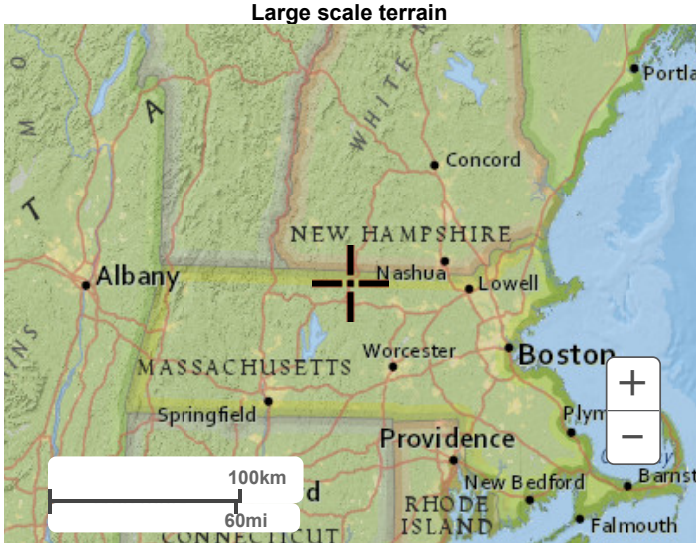
Maps & aerials

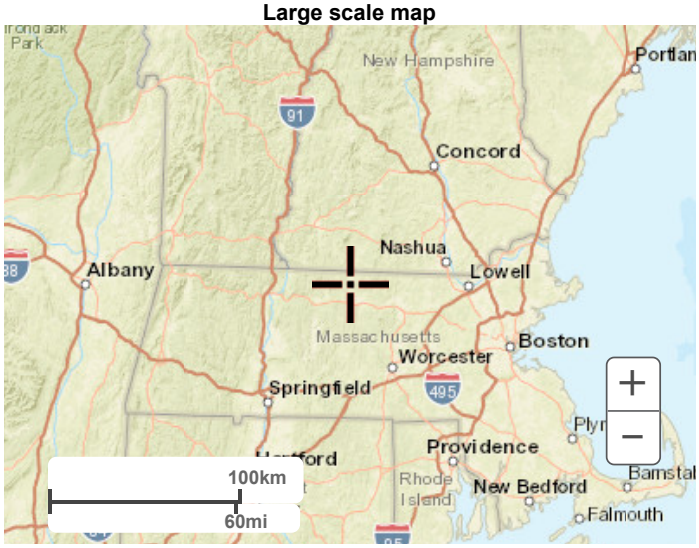
Small scale terrain



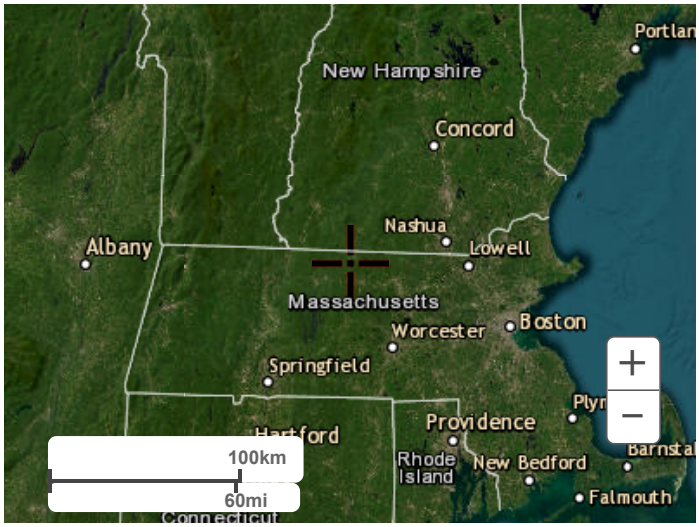
Large scale terrain



Large scale map



Large scale aerial



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National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Infiltration Basin/Infiltration Chamber Bed

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Infiltration Basin	**0.80**	**1.00**	**0.80**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**

Total TSS Removal = **80%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: Doyle Ave A-N-R Subdivision
Prepared By: Trevor Fletcher
Date: 24-Oct-22

*90% Removal - sized @ 1-inch x Imperivous Area

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location: Rain Garden

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Rain Garden	**0.90**	**1.00**	**0.90**	**0.10**
	0.00	**0.10**	**0.00**	**0.10**
	0.00	**0.10**	**0.00**	**0.10**
	0.00	**0.10**	**0.00**	**0.10**
	0.00	**0.10**	**0.00**	**0.10**

Total TSS Removal = **90%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: **Doyle Ave A-N-R Subdivision**

Prepared By: **Trevor Fletcher**

Date: **28-Dec-22**

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

Site Recharge to Groundwater *"Static Method"*

Soil type: C Rawls Rate: 1.02 In./Hr.
Impervious Area (A1): 46,074 s.f.

Soil type: C/D
Impervious Area (A2): 0 s.f.

Hydrologic Group	Target Depth Factor (F)	
A	0.60	inches
B	0.35	inches
C	0.25	inches
D	0.1	inches

Determine the required recharge volume:

Rv = F x impervious area

Rv = Required Recharge Volume
F = Target Depth Factor

$$Rv = \frac{F"HSGC" \times A1}{12 \text{ in./ft.}} + \frac{F"HSGC/D" \times A2}{12 \text{ in./ft.}} = 960 \text{ Cu.Ft.}$$

F"HSGC" x A1 = 11,519 ; F"HSGC/D" x A2 = 0

From Hydrocad determine the elevation that will hold back the required recharge volume:

Below is a excerpt from the stage storage table of Infiltration Pond 1.
Required Site Rv= 960

	Rv Provided	
Lot 14-1 Infil Basin	**508**	**C.F.**
14-2 Chambers	**279**	**C.F.**
Lot-6 Infil Basin	**708**	**C.F.**
Lot-6-1 Infil Basin	**395**	**C.F.**
Lot 6-2 Infil Basin	**591**	**C.F.**
Lot 6-3 Infil Basin	**487**	**C.F.**
Total Recharge	**2,968**	**C.F.**

Determine if the infiltration BMP will drain completely within 72 hours:

$$\text{Time drawdown} = \frac{Rv}{(K)\ (\text{Bottom Area})}$$

Rv = Storage Volume at Low Level Outlet (LLO) Elevation
K = Saturated Hydraulic Conductivity (Rawls Rate)
Bottom area = Bottom surface area not including sidewall

Btm Area	Time Drawdown:	
132	**45**	**Hours**
317	**10**	**Hours**
302	**28**	**Hours**
232	**20**	**Hours**
427	**16**	**Hours**
162	**35**	**Hours**

Result is satisfactory for design purposes 45 hrs. < 72 hrs.

Stormwater runoff volumes to be treated for water quality

Stormwater Policy Standard 4: 1-inch of runoff x total impervious area of post-development site

Lot-14-1 Infil Basin

Required Water Quality Volume:

Subcatchment	Impervious Area (SF)	Imp. Area x 1 in runoff (Cu.Ft.)	
13S	5,853		
		488	**Required W.Q.V.**

From Hydrocad determine the elevation that will hold back the required Water Quality Volume (WQV):

Below is a excerpt from the stage storage table of the Infiltration basin.

From Hydrocad determine the elevation that will hold back the required Water Quality Volume (WQV):

488 Cu. Ft. min. W.Q.V. storage elev req'd = 1029.16

Stage Storage Volumes

Elevation (Ft.)	Surface Area (Sq.Ft.)	Cum. Storage (Cu. Ft.)		
1027.5	132	0	1029.16	El. At Req. W.Q.V
1028	207	85	←	
1028.5	329	219	←	1029.2 - El @ Lowest Outlet
1029	450	413		
1029.5	572	669		
1030	693	985		
1030.5	836	1,367		

Lowest Outlet Elevation= 1,029.20

Supplied Water Quality Volume (Infiltration Basin):	***508 Cu.Ft.***

Stormwater runoff volumes to be treated for water quality

Stormwater Policy Standard 4: 1-inch of runoff x total impervious area of post-development site

Lot-14-2 Infil Chambers

Required Water Quality Volume:

Subcatchment	Impervious Area (SF)	Imp. Area x 1 in runoff (Cu.Ft.)	
15S	3,331		
		278	**Required W.Q.V.**

From Hydrocad determine the elevation that will hold back the required Water Quality Volume (WQV):

Below is a excerpt from the stage storage table of the Infiltration basin.

From Hydrocad determine the elevation that will hold back the required Water Quality Volume (WQV):

278 Cu. Ft. min. W.Q.V. storage elev req'd = 1016.70

Stage Storage Volumes

Elevation (Ft.)	Surface Area (Sq.Ft.)	Cum. Storage (Cu. Ft.)		
1015.2	317	0	1016.70	El. At Req. W.Q.V
1015.6	317	90	←	
1016	317	172	←	1016.7 - El @ Lowest Outlet
1016.4	317	240		
1016.8	317	291		
1017	317	317		

Lowest Outlet Elevation= 1,016.70

Supplied Water Quality Volume (Infiltration Basin):	***279 Cu.Ft.***

Stormwater runoff volumes to be treated for water quality

Stormwater Policy Standard 4: 1-inch of runoff x total impervious area of post-development site

Lot-14-2 Rain Garden

Required Water Quality Volume:

Subcatchment	Impervious Area (SF)	Imp. Area x 1 in runoff (Cu.Ft.)	
14S	2,536		
		211	**Required W.Q.V.**

From Hydrocad determine the elevation that will hold back the required Water Quality Volume (WQV):

Below is a excerpt from the stage storage table of the Infiltration basin.

From Hydrocad determine the elevation that will hold back the required Water Quality Volume (WQV):

211 Cu. Ft. min. W.Q.V. storage elev req'd = 1019.09

Stage Storage Volumes

Elevation (Ft.)	Surface Area (Sq.Ft.)	Cum. Storage (Cu. Ft.)		
1017.6	472	0	1019.09	El. At Req. W.Q.V
1019.6	472	283	←	
1020.3	1,097	832	←	1020 - El @ Lowest Outlet

Lowest Outlet Elevation= 1,020.00

Supplied Water Quality Volume (Infiltration Basin):	***543 Cu.Ft.***

Stormwater runoff volumes to be treated for water quality

- Sediment Forebay Design Criteria: 0.1-inch of runoff x total impervious area of post-development site

Sediment Forebay L-6

Required Storage Volume:

Subcatchment	Impervious Area (SF)	Imp. Area x 0.1 in runoff (Cu.Ft.)
2S	7,229	
		61 **Required Storage**

From Hydrocad determine the elevation that will hold back the required storage:

Below is a excerpt from the stage storage table of Sediment Forebay.

61 Cu.Ft., the min. storage elevation required = 1041.60

Stage Storage Volumes

Elevation (Ft.)	Surface Area (Sq.Ft.)	Cum. Storage (Cu. Ft.)	
1041	24	0	1041.60 El. At Req. Storage
1041.5	155	45	←
1042	286	155	

The weir outlet has been designed at elevation: 1,041.60

Supplied Storage Volume: 62 Cu.Ft.

Stormwater runoff volumes to be treated for water quality

Stormwater Policy Standard 4: 1-inch of runoff x total impervious area of post-development site

Lot-6 Infil Basin

Required Water Quality Volume:

Subcatchment	Impervious Area (SF)	Imp. Area x 1 in runoff (Cu.Ft.)	
9S	7,229		
		602	**Required W.Q.V.**

From Hydrocad determine the elevation that will hold back the required Water Quality Volume (WQV):

Below is a excerpt from the stage storage table of the Infiltration basin.

From Hydrocad determine the elevation that will hold back the required Water Quality Volume (WQV):

602 Cu. Ft. min. W.Q.V. storage elev req'd = 1040.91

Stage Storage Volumes

Elevation (Ft.)	Surface Area (Sq.Ft.)	Cum. Storage (Cu. Ft.)		
1040	302	0	1040.91	El. At Req. W.Q.V
1040.5	708	253	←	
1041	1,114	708	←	1041.0 - El @ Lowest Outlet
1041.5	1,520	1,367		
1042	1,926	2,228		
1042.7	2,441	3,756		

Lowest Outlet Elevation= 1,041.00

Supplied Water Quality Volume (Infiltration Basin):	***708 C.F.***

Stormwater runoff volumes to be treated for water quality

- Sediment Forebay Design Criteria: 0.1-inch of runoff x total impervious area of post-development site

Sediment Forebay 6-1

Required Storage Volume:

Subcatchment	Impervious Area (SF)	Imp. Area x 0.1 in runoff (Cu.Ft.)	
2S	4,440		
		37	**Required Storage**

From Hydrocad determine the elevation that will hold back the required storage:

Below is a excerpt from the stage storage table of Sediment Forebay.

37 Cu.Ft., the min. storage elevation required = 1031.29

Stage Storage Volumes

Elevation (Ft.)	Surface Area (Sq.Ft.)	Cum. Storage (Cu. Ft.)		
1030.5	9	0		
1031	59	17	1031.29	El. At Req. Storage
1031.5	108	59	←	
1032	158	125		

*No weir proposed - assume top of check dam

The Weir Elevation has been designed at elevation: 1,031.30

Supplied Storage Volume: 39 Cu.Ft.

Stormwater runoff volumes to be treated for water quality

Stormwater Policy Standard 4: 1-inch of runoff x total impervious area of post-development site

Lot-6-1 Infil Basin

Required Water Quality Volume:

Subcatchment	Impervious Area (SF)	Imp. Area x 1 in runoff (Cu.Ft.)	
10S	4,440		
		370	**Required W.Q.V.**

From Hydrocad determine the elevation that will hold back the required Water Quality Volume (WQV):

Below is a excerpt from the stage storage table of the Infiltration basin.

From Hydrocad determine the elevation that will hold back the required Water Quality Volume (WQV):

370 Cu. Ft. min. W.Q.V. storage elev req'd = 1031.16

Stage Storage Volumes

Elevation (Ft.)	Surface Area (Sq.Ft.)	Cum. Storage (Cu. Ft.)		
1030.3	232	0	1031.16	El. At Req. W.Q.V
1030.8	462	174	←	
1031.3	693	462	←	1031.2 - El @ Lowest Outlet
1031.8	923	866		
1032.3	1,169	1,388		
1032.8	1,426	2,036		

Lowest Outlet Elevation= 1,031.20

Supplied Water Quality Volume (Infiltration Basin):	***395 Cu.Ft.***

Stormwater runoff volumes to be treated for water quality

- Sediment Forebay Design Criteria: 0.1-inch of runoff x total impervious area of post-development site

Sediment Forebay 6-2

Required Storage Volume:

Subcatchment	Impervious Area (SF)	Imp. Area x 0.1 in runoff (Cu.Ft.)	
2S	6,868		
		58	**Required Storage**

From Hydrocad determine the elevation that will hold back the required storage:

Below is a excerpt from the stage storage table of Sediment Forebay.

58 Cu.Ft., the min. storage elevation required = 1010.46

Stage Storage Volumes

Elevation (Ft.)	Surface Area (Sq.Ft.)	Cum. Storage (Cu. Ft.)		
1010	54	0		
1010.5	211	66	1010.46	El. At Req. Storage
1011	367	211	←	
1011.5	524	433		
1012	680	734		

*No weir proposed - assume top of check dam

The Weir Elevation has been designed at elevation: 1,010.80

Supplied Storage Volume: 143 Cu.Ft.

Stormwater runoff volumes to be treated for water quality

Stormwater Policy Standard 4: 1-inch of runoff x total impervious area of post-development site

Lot-6-2 Infil Basin

Required Water Quality Volume:

Subcatchment	Impervious Area (SF)	Imp. Area x 1 in runoff (Cu.Ft.)	
11S	6,868		
		572	**Required W.Q.V.**

From Hydrocad determine the elevation that will hold back the required Water Quality Volume (WQV):

Below is a excerpt from the stage storage table of the Infiltration basin.

From Hydrocad determine the elevation that will hold back the required Water Quality Volume (WQV):

572 Cu. Ft. min. W.Q.V. storage elev req'd = 1009.98

Stage Storage Volumes

Elevation (Ft.)	Surface Area (Sq.Ft.)	Cum. Storage (Cu. Ft.)		
1009	427	0	1009.98	El. At Req. W.Q.V
1009.5	591	255	←	
1010	755	591	←	1010.0 - El @ Lowest Outlet
1010.5	962	1,020		
1011	1,169	1,553		
1011.5	1,375	2,189		
1012	1,582	2,928		
1012.5	2,080	3,844		

Lowest Outlet Elevation= 1,010.00

Supplied Water Quality Volume (Infiltration Basin):	***591 Cu.Ft.***

Stormwater runoff volumes to be treated for water quality

- Sediment Forebay Design Criteria: 0.1-inch of runoff x total impervious area of post-development site

Sediment Forebay 6-3

Required Storage Volume:

Subcatchment	Impervious Area (SF)	Imp. Area x 0.1 in runoff (Cu.Ft.)	
2S	5,632		
		47	**Required Storage**

From Hydrocad determine the elevation that will hold back the required storage:

Below is a excerpt from the stage storage table of Sediment Forebay.

47 Cu.Ft., the min. storage elevation required = 992.64

Stage Storage Volumes

Elevation (Ft.)	Surface Area (Sq.Ft.)	Cum. Storage (Cu. Ft.)		
992	37	0		
992.5	93	33	992.64	El. At Req. Storage
993	150	93	←	
993.5	206	182		
994	262	299		

*No weir proposed - assume top of check dam

The Weir Elevation has been designed at elevation: 993.00

Supplied Storage Volume: 93 Cu.Ft.

Stormwater runoff volumes to be treated for water quality

Stormwater Policy Standard 4: 1-inch of runoff x total impervious area of post-development site

Lot-6-3 Infil Basin

Required Water Quality Volume:

Subcatchment	Impervious Area (SF)	Imp. Area x 1 in runoff (Cu.Ft.)	
12S	5,632		
		469	**Required W.Q.V.**

From Hydrocad determine the elevation that will hold back the required Water Quality Volume (WQV):

Below is a excerpt from the stage storage table of the Infiltration basin.

From Hydrocad determine the elevation that will hold back the required Water Quality Volume (WQV):

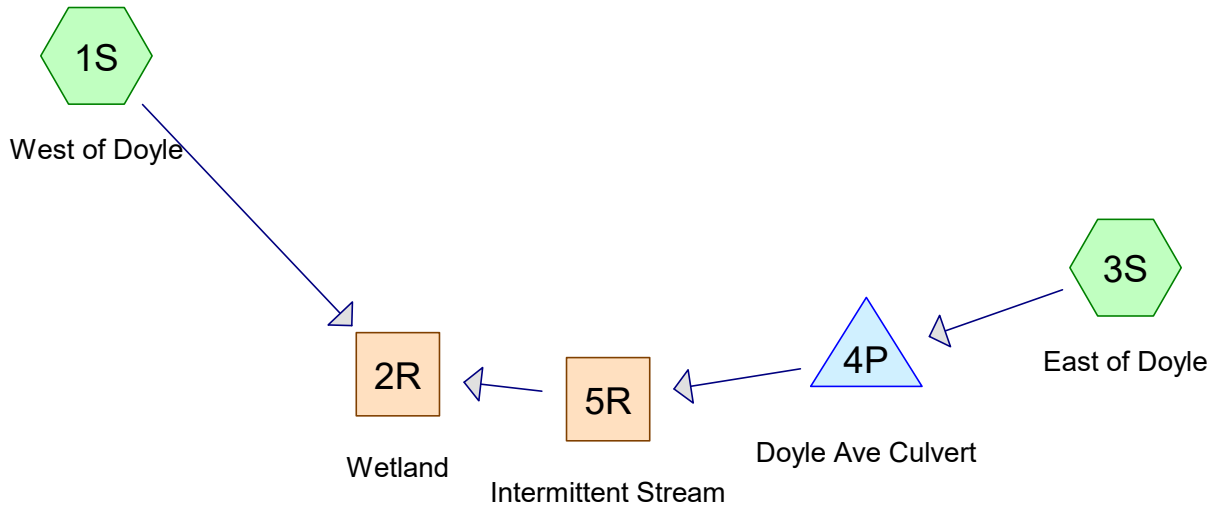
469 Cu. Ft. min. W.Q.V. storage elev req'd = 992.47

Stage Storage Volumes

Elevation (Ft.)	Surface Area (Sq.Ft.)	Cum. Storage (Cu. Ft.)		
991	162	0	992.47	El. At Req. W.Q.V
991.7	285	157	←	
992.5	608	487	←	992.5 - El @ Lowest Outlet
993.2	987	1,045		
994	1,419	2,007		
994.7	1,890	3,165		

Lowest Outlet Elevation= 992.50

Supplied Water Quality Volume (Infiltration Basin):	***487 Cu.Ft.***



Subcat Reach Pond Link

Routing Diagram for Doyle 6 Lots Pre
Prepared by HP, Printed 12/28/2022
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
6.975	77	2 acre lots, 12% imp, HSG C (1S, 3S)
3.876	74	>75% Grass cover, Good, HSG C (3S)
1.401	96	Gravel surface, HSG C (1S, 3S)
0.440	98	Roofs, HSG C (1S, 3S)
104.396	70	Woods, Good, HSG C (1S, 3S)
117.088	**71**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
117.088	HSG C	1S, 3S
0.000	HSG D	
0.000	Other	
117.088		**TOTAL AREA**

Time span=1.00-36.00 hrs, dt=0.01 hrs, 3501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: West of Doyle Runoff Area=1,438,057 sf 0.34% Impervious Runoff Depth=0.68"
Flow Length=2,241' Slope=0.0610 '/' Tc=31.9 min CN=71 Runoff=12.68 cfs 1.874 af

Subcatchment 3S: East of Doyle Runoff Area=3,662,304 sf 1.39% Impervious Runoff Depth=0.68"
Flow Length=5,506' Slope=0.0350 '/' Tc=86.3 min CN=71 Runoff=17.99 cfs 4.773 af

Reach 2R: Wetland Inflow=21.40 cfs 6.647 af
Outflow=21.40 cfs 6.647 af

Reach 5R: Intermittent Stream Avg. Flow Depth=0.30' Max Vel=6.12 fps Inflow=17.64 cfs 4.773 af
n=0.025 L=394.0' S=0.0878 '/' Capacity=638.10 cfs Outflow=17.63 cfs 4.773 af

Pond 4P: Doyle Ave Culvert Peak Elev=998.29' Storage=4,337 cf Inflow=17.99 cfs 4.773 af
Outflow=17.64 cfs 4.773 af

Total Runoff Area = 117.088 ac Runoff Volume = 6.647 af Average Runoff Depth = 0.68"
98.91% Pervious = 115.811 ac 1.09% Impervious = 1.277 ac

Summary for Reach 2R: Wetland

Inflow Area = 117.088 ac, 1.09% Impervious, Inflow Depth = 0.68" for 2-Year event
Inflow = 21.40 cfs @ 13.30 hrs, Volume= 6.647 af
Outflow = 21.40 cfs @ 13.30 hrs, Volume= 6.647 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs

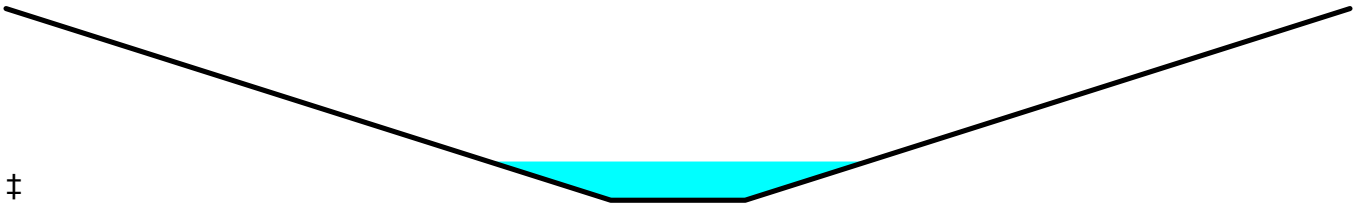
Summary for Reach 5R: Intermittent Stream

Inflow Area = 84.075 ac, 1.39% Impervious, Inflow Depth = 0.68" for 2-Year event
Inflow = 17.64 cfs @ 13.42 hrs, Volume= 4.773 af
Outflow = 17.63 cfs @ 13.43 hrs, Volume= 4.773 af, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.12 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 3.13 fps, Avg. Travel Time= 2.1 min

Peak Storage= 1,136 cf @ 13.43 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 1.50' Flow Area= 41.3 sf, Capacity= 638.10 cfs

5.00' x 1.50' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 15.0 '/' Top Width= 50.00'
Length= 394.0' Slope= 0.0878 '/'
Inlet Invert= 995.58', Outlet Invert= 961.00'



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Summary for Pond 4P: Doyle Ave Culvert

Inflow Area = 84.075 ac, 1.39% Impervious, Inflow Depth = 0.68" for 2-Year event
Inflow = 17.99 cfs @ 13.32 hrs, Volume= 4.773 af
Outflow = 17.64 cfs @ 13.42 hrs, Volume= 4.773 af, Atten= 2%, Lag= 5.7 min
Primary = 17.64 cfs @ 13.42 hrs, Volume= 4.773 af

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 998.29' @ 13.42 hrs Surf.Area= 5,369 sf Storage= 4,337 cf

Plug-Flow detention time= 2.8 min calculated for 4.771 af (100% of inflow)
Center-of-Mass det. time= 2.8 min (957.9 - 955.1)

Volume	Invert	Avail.Storage	Storage Description
#1	995.85'	37,946 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
995.85	0	0	0
997.00	1,119	643	643
998.00	3,644	2,382	3,025
999.00	9,570	6,607	9,632
1,000.00	13,181	11,376	21,007
1,001.00	20,697	16,939	37,946

Device	Routing	Invert	Outlet Devices
#1	Primary	995.85'	**30.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 995.85' / 995.58' S= 0.0090 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 4.91 sf
#2	Primary	999.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 Width (feet) 30.00 125.00 172.00

Primary OutFlow Max=17.64 cfs @ 13.42 hrs HW=998.29' TW=995.88' (Dynamic Tailwater)
↑ **1=Culvert** (Barrel Controls 17.64 cfs @ 4.58 fps)
└ **2=Custom Weir/Orifice** (Controls 0.00 cfs)

Time span=1.00-36.00 hrs, dt=0.01 hrs, 3501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: West of Doyle Runoff Area=1,438,057 sf 0.34% Impervious Runoff Depth=1.65"
Flow Length=2,241' Slope=0.0610 '/' Tc=31.9 min CN=71 Runoff=33.94 cfs 4.528 af

Subcatchment 3S: East of Doyle Runoff Area=3,662,304 sf 1.39% Impervious Runoff Depth=1.65"
Flow Length=5,506' Slope=0.0350 '/' Tc=86.3 min CN=71 Runoff=48.59 cfs 11.531 af

Reach 2R: Wetland Inflow=59.49 cfs 16.059 af
Outflow=59.49 cfs 16.059 af

Reach 5R: Intermittent Stream Avg. Flow Depth=0.49' Max Vel=8.01 fps Inflow=48.59 cfs 11.531 af
n=0.025 L=394.0' S=0.0878 '/' Capacity=638.10 cfs Outflow=48.59 cfs 11.531 af

Pond 4P: Doyle Ave Culvert Peak Elev=999.31' Storage=12,731 cf Inflow=48.59 cfs 11.531 af
Outflow=48.59 cfs 11.531 af

Total Runoff Area = 117.088 ac Runoff Volume = 16.059 af Average Runoff Depth = 1.65"
98.91% Pervious = 115.811 ac 1.09% Impervious = 1.277 ac

Summary for Subcatchment 1S: West of Doyle

Runoff = 33.94 cfs @ 12.47 hrs, Volume= 4.528 af, Depth= 1.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.36"

Area (sf)	CN	Description
1,388,610	70	Woods, Good, HSG C
23,764	77	2 acre lots, 12% imp, HSG C
23,679	96	Gravel surface, HSG C
2,004	98	Roofs, HSG C
1,438,057	71	Weighted Average
1,433,201		99.66% Pervious Area
4,856		0.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.9	2,241	0.0610	1.17		**Lag/CN Method,**

Summary for Subcatchment 3S: East of Doyle

Runoff = 48.59 cfs @ 13.22 hrs, Volume= 11.531 af, Depth= 1.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.36"

Area (sf)	CN	Description
3,158,874	70	Woods, Good, HSG C
168,851	74	>75% Grass cover, Good, HSG C
37,329	96	Gravel surface, HSG C
17,164	98	Roofs, HSG C
280,086	77	2 acre lots, 12% imp, HSG C
3,662,304	71	Weighted Average
3,611,530		98.61% Pervious Area
50,774		1.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
86.3	5,506	0.0350	1.06		**Lag/CN Method,**

Summary for Reach 2R: Wetland

Inflow Area = 117.088 ac, 1.09% Impervious, Inflow Depth = 1.65" for 10-Year event
Inflow = 59.49 cfs @ 13.08 hrs, Volume= 16.059 af
Outflow = 59.49 cfs @ 13.08 hrs, Volume= 16.059 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs

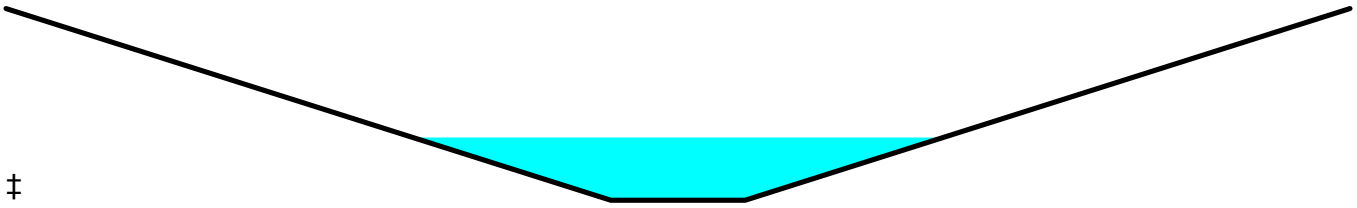
Summary for Reach 5R: Intermittent Stream

Inflow Area = 84.075 ac, 1.39% Impervious, Inflow Depth = 1.65" for 10-Year event
Inflow = 48.59 cfs @ 13.23 hrs, Volume= 11.531 af
Outflow = 48.59 cfs @ 13.23 hrs, Volume= 11.531 af, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.01 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 3.80 fps, Avg. Travel Time= 1.7 min

Peak Storage= 2,389 cf @ 13.23 hrs
Average Depth at Peak Storage= 0.49'
Bank-Full Depth= 1.50' Flow Area= 41.3 sf, Capacity= 638.10 cfs

5.00' x 1.50' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 15.0 '/' Top Width= 50.00'
Length= 394.0' Slope= 0.0878 '/'
Inlet Invert= 995.58', Outlet Invert= 961.00'



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Summary for Pond 4P: Doyle Ave Culvert

Inflow Area = 84.075 ac, 1.39% Impervious, Inflow Depth = 1.65" for 10-Year event
Inflow = 48.59 cfs @ 13.22 hrs, Volume= 11.531 af
Outflow = 48.59 cfs @ 13.23 hrs, Volume= 11.531 af, Atten= 0%, Lag= 0.4 min
Primary = 48.59 cfs @ 13.23 hrs, Volume= 11.531 af

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 999.31' @ 13.23 hrs Surf.Area= 10,675 sf Storage= 12,731 cf

Plug-Flow detention time= 4.0 min calculated for 11.528 af (100% of inflow)
Center-of-Mass det. time= 4.0 min (931.0 - 927.0)

Volume	Invert	Avail.Storage	Storage Description
#1	995.85'	37,946 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
995.85	0	0	0
997.00	1,119	643	643
998.00	3,644	2,382	3,025
999.00	9,570	6,607	9,632
1,000.00	13,181	11,376	21,007
1,001.00	20,697	16,939	37,946

Device	Routing	Invert	Outlet Devices
#1	Primary	995.85'	**30.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 995.85' / 995.58' S= 0.0090 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 4.91 sf
#2	Primary	999.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 Width (feet) 30.00 125.00 172.00

Primary OutFlow Max=48.59 cfs @ 13.23 hrs HW=999.31' TW=996.07' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 25.50 cfs @ 5.19 fps)
└─**2=Custom Weir/Orifice** (Weir Controls 23.09 cfs @ 1.69 fps)

Time span=1.00-36.00 hrs, dt=0.01 hrs, 3501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: West of Doyle Runoff Area=1,438,057 sf 0.34% Impervious Runoff Depth=3.50"
Flow Length=2,241' Slope=0.0610 '/' Tc=31.9 min CN=71 Runoff=74.42 cfs 9.621 af

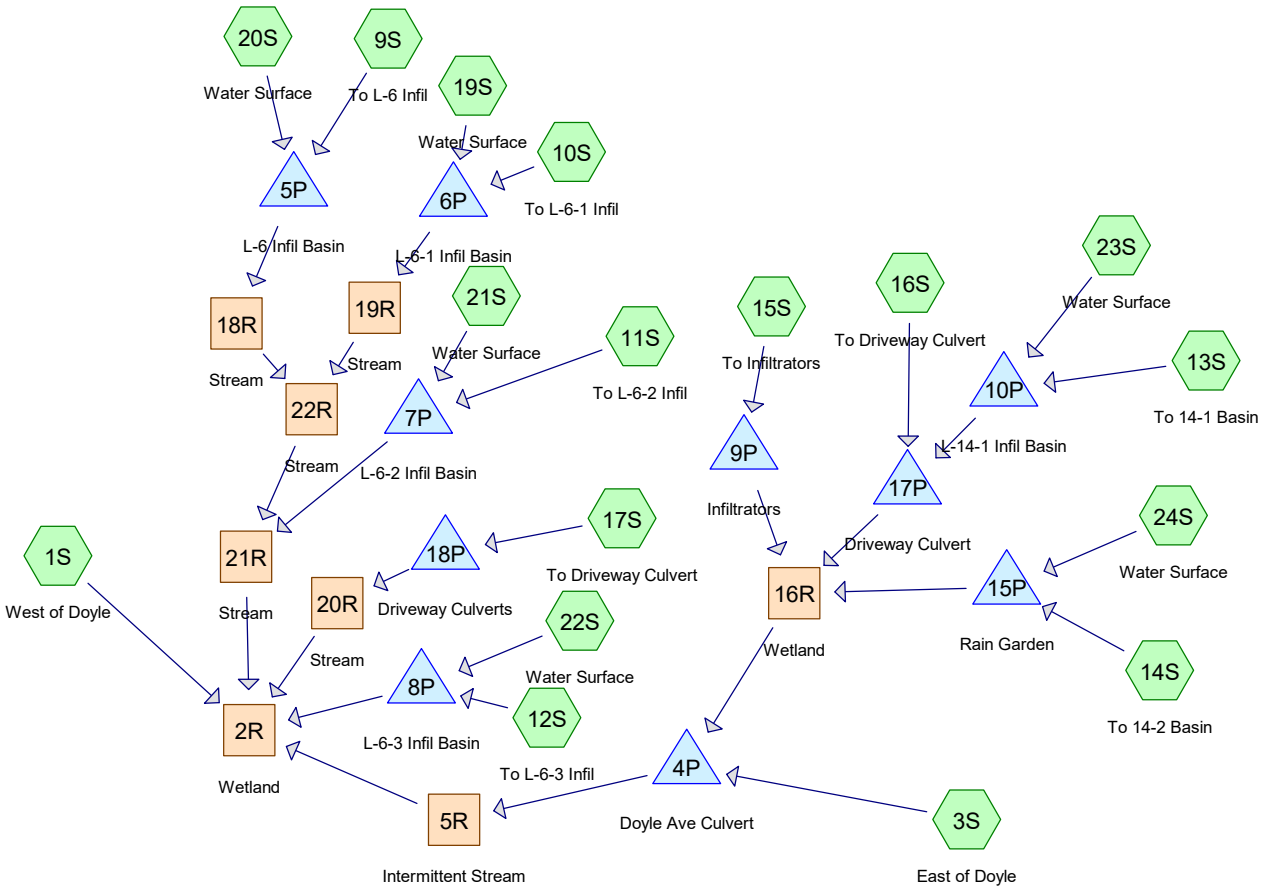
Subcatchment 3S: East of Doyle Runoff Area=3,662,304 sf 1.39% Impervious Runoff Depth=3.50"
Flow Length=5,506' Slope=0.0350 '/' Tc=86.3 min CN=71 Runoff=107.70 cfs 24.503 af

Reach 2R: Wetland Inflow=131.57 cfs 34.124 af
Outflow=131.57 cfs 34.124 af

Reach 5R: Intermittent Stream Avg. Flow Depth=0.70' Max Vel=9.84 fps Inflow=107.58 cfs 24.503 af
n=0.025 L=394.0' S=0.0878 '/' Capacity=638.10 cfs Outflow=107.54 cfs 24.503 af

Pond 4P: Doyle Ave Culvert Peak Elev=999.60' Storage=15,972 cf Inflow=107.70 cfs 24.503 af
Outflow=107.58 cfs 24.503 af

Total Runoff Area = 117.088 ac Runoff Volume = 34.124 af Average Runoff Depth = 3.50"
98.91% Pervious = 115.811 ac 1.09% Impervious = 1.277 ac



Routing Diagram for Doyle 6 Lots Post No Infil

Prepared by HP, Printed 12/28/2022

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
7.011	77	2 acre lots, 12% imp, HSG C (1S, 3S, 9S, 13S, 16S)
6.811	74	>75% Grass cover, Good, HSG C (1S, 3S, 9S, 10S, 11S, 12S, 13S, 14S, 15S, 16S, 17S)
1.401	96	Gravel surface, HSG C (1S, 3S, 16S, 17S)
0.699	98	Paved parking, HSG C (3S, 9S, 10S, 11S, 12S, 13S, 14S, 15S, 17S)
0.021	98	Paved roads w/curbs & sewers, HSG C (16S)
0.717	98	Roofs, HSG C (1S, 3S, 9S, 10S, 11S, 12S, 13S, 14S)
0.224	98	Water Surface, HSG C (19S, 20S, 21S, 22S, 23S, 24S)
100.204	70	Woods, Good, HSG C (1S, 3S, 9S, 11S, 12S, 13S, 15S, 16S, 17S)
117.088	**71**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
117.088	HSG C	1S, 3S, 9S, 10S, 11S, 12S, 13S, 14S, 15S, 16S, 17S, 19S, 20S, 21S, 22S, 23S, 24S
0.000	HSG D	
0.000	Other	
117.088		**TOTAL AREA**

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: West of Doyle Runoff Area=1,178,155 sf 0.34% Impervious Runoff Depth=0.68"
Flow Length=2,241' Slope=0.0610 '/' Tc=31.9 min CN=71 Runoff=10.39 cfs 1.535 af

Subcatchment 3S: East of Doyle Runoff Area=3,340,303 sf 1.38% Impervious Runoff Depth=0.68"
Flow Length=5,506' Slope=0.0350 '/' Tc=86.3 min CN=71 Runoff=16.41 cfs 4.353 af

Subcatchment 9S: To L-6 Infil Runoff Area=99,742 sf 10.40% Impervious Runoff Depth=0.82"
Flow Length=544' Slope=0.0810 '/' Tc=8.2 min CN=74 Runoff=1.87 cfs 0.157 af

Subcatchment 10S: To L-6-1 Infil Runoff Area=22,785 sf 19.41% Impervious Runoff Depth=1.09"
Tc=6.0 min CN=79 Runoff=0.65 cfs 0.047 af

Subcatchment 11S: To L-6-2 Infil Runoff Area=34,234 sf 20.06% Impervious Runoff Depth=0.98"
Flow Length=442' Slope=0.0250 '/' Tc=11.5 min CN=77 Runoff=0.71 cfs 0.064 af

Subcatchment 12S: To L-6-3 Infil Runoff Area=23,257 sf 24.93% Impervious Runoff Depth=1.09"
Flow Length=402' Slope=0.0420 '/' Tc=7.7 min CN=79 Runoff=0.62 cfs 0.048 af

Subcatchment 13S: To 14-1 Basin Runoff Area=149,214 sf 9.43% Impervious Runoff Depth=0.82"
Flow Length=1,061' Slope=0.0600 '/' Tc=16.3 min CN=74 Runoff=2.20 cfs 0.234 af

Subcatchment 14S: To 14-2 Basin Runoff Area=7,147 sf 35.48% Impervious Runoff Depth=1.33"
Tc=6.0 min CN=83 Runoff=0.26 cfs 0.018 af

Subcatchment 15S: To Infiltrators Runoff Area=10,302 sf 32.33% Impervious Runoff Depth=1.09"
Tc=6.0 min CN=79 Runoff=0.29 cfs 0.021 af

Subcatchment 16S: To Driveway Culvert Runoff Area=153,405 sf 1.08% Impervious Runoff Depth=0.73"
Flow Length=1,094' Slope=0.0740 '/' Tc=15.9 min CN=72 Runoff=1.95 cfs 0.213 af

Subcatchment 17S: To Driveway Culvert Runoff Area=72,047 sf 0.22% Impervious Runoff Depth=0.68"
Tc=6.0 min CN=71 Runoff=1.15 cfs 0.094 af

Subcatchment 19S: Water Surface Runoff Area=1,426 sf 100.00% Impervious Runoff Depth=2.63"
Tc=6.0 min CN=98 Runoff=0.09 cfs 0.007 af

Subcatchment 20S: Water Surface Runoff Area=2,441 sf 100.00% Impervious Runoff Depth=2.63"
Tc=6.0 min CN=98 Runoff=0.16 cfs 0.012 af

Subcatchment 21S: Water Surface Runoff Area=2,080 sf 100.00% Impervious Runoff Depth=2.63"
Tc=6.0 min CN=98 Runoff=0.13 cfs 0.010 af

Subcatchment 22S: Water Surface Runoff Area=1,890 sf 100.00% Impervious Runoff Depth=2.63"
Tc=6.0 min CN=98 Runoff=0.12 cfs 0.010 af

Subcatchment 23S: Water Surface Runoff Area=836 sf 100.00% Impervious Runoff Depth=2.63"
Tc=6.0 min CN=98 Runoff=0.05 cfs 0.004 af

Subcatchment 24S: Water Surface Runoff Area=1,097 sf 100.00% Impervious Runoff Depth=2.63"
Tc=6.0 min CN=98 Runoff=0.07 cfs 0.006 af

Reach 2R: Wetland Inflow=21.01 cfs 6.759 af
Outflow=21.01 cfs 6.759 af

Reach 5R: Intermittent Stream Avg. Flow Depth=0.30' Max Vel=6.06 fps Inflow=17.07 cfs 4.824 af
n=0.025 L=394.0' S=0.0878 '/' Capacity=638.10 cfs Outflow=17.07 cfs 4.824 af

Reach 16R: Wetland Avg. Flow Depth=0.26' Max Vel=0.80 fps Inflow=4.33 cfs 0.471 af
n=0.100 L=505.0' S=0.0301 '/' Capacity=65.53 cfs Outflow=3.52 cfs 0.471 af

Reach 18R: Stream Avg. Flow Depth=0.22' Max Vel=1.29 fps Inflow=1.91 cfs 0.153 af
n=0.040 L=195.0' S=0.0154 '/' Capacity=46.68 cfs Outflow=1.81 cfs 0.153 af

Reach 19R: Stream Avg. Flow Depth=0.09' Max Vel=1.14 fps Inflow=0.52 cfs 0.045 af
n=0.040 L=406.0' S=0.0419 '/' Capacity=77.01 cfs Outflow=0.39 cfs 0.045 af

Reach 20R: Stream Avg. Flow Depth=0.11' Max Vel=1.95 fps Inflow=1.13 cfs 0.094 af
n=0.040 L=362.0' S=0.0925 '/' Capacity=314.84 cfs Outflow=1.04 cfs 0.094 af

Reach 21R: Stream Avg. Flow Depth=0.20' Max Vel=1.92 fps Inflow=2.38 cfs 0.259 af
n=0.040 L=400.0' S=0.0400 '/' Capacity=75.27 cfs Outflow=2.25 cfs 0.259 af

Reach 22R: Stream Avg. Flow Depth=0.17' Max Vel=2.21 fps Inflow=2.11 cfs 0.198 af
n=0.040 L=292.0' S=0.0651 '/' Capacity=96.00 cfs Outflow=2.05 cfs 0.198 af

Pond 4P: Doyle Ave Culvert Peak Elev=998.24' Storage=4,058 cf Inflow=17.32 cfs 4.824 af
Outflow=17.07 cfs 4.824 af

Pond 5P: L-6 Infil Basin Peak Elev=1,041.22' Storage=971 cf Inflow=2.01 cfs 0.169 af
Outflow=1.91 cfs 0.153 af

Pond 6P: L-6-1 Infil Basin Peak Elev=1,031.55' Storage=652 cf Inflow=0.74 cfs 0.055 af
Outflow=0.52 cfs 0.045 af

Pond 7P: L-6-2 Infil Basin Peak Elev=1,010.46' Storage=985 cf Inflow=0.80 cfs 0.074 af
Outflow=0.44 cfs 0.061 af

Pond 8P: L-6-3 Infil Basin Peak Elev=992.92' Storage=786 cf Inflow=0.74 cfs 0.058 af
Outflow=0.38 cfs 0.047 af

Pond 9P: Infiltrators Peak Elev=1,015.65' Storage=100 cf Inflow=0.29 cfs 0.021 af
Outflow=0.28 cfs 0.020 af

Pond 10P: L-14-1 Infil Basin Peak Elev=1,029.37' Storage=597 cf Inflow=2.23 cfs 0.238 af
Outflow=2.22 cfs 0.227 af

Pond 15P: Rain Garden Peak Elev=1,020.02' Storage=557 cf Inflow=0.32 cfs 0.024 af
Outflow=0.06 cfs 0.011 af

Pond 17P: Driveway Culvert Peak Elev=1,015.80' Storage=124 cf Inflow=4.17 cfs 0.440 af
Outflow=4.17 cfs 0.440 af

Pond 18P: Driveway Culverts Peak Elev=1,000.34' Storage=58 cf Inflow=1.15 cfs 0.094 af
Outflow=1.13 cfs 0.094 af

Total Runoff Area = 117.088 ac Runoff Volume = 6.835 af Average Runoff Depth = 0.70"
97.86% Pervious = 114.586 ac 2.14% Impervious = 2.502 ac

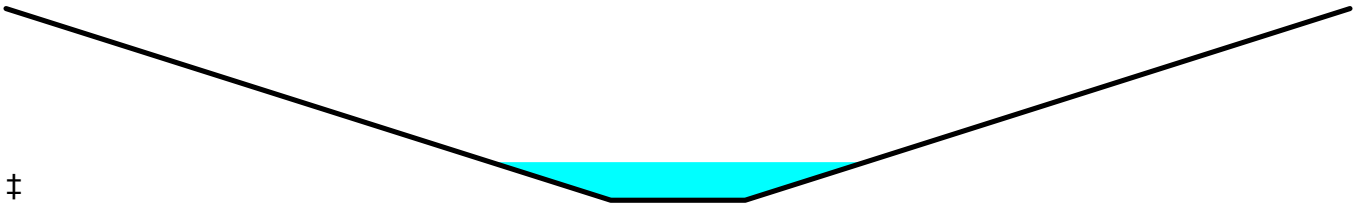
Summary for Reach 5R: Intermittent Stream

Inflow Area = 84.075 ac, 1.90% Impervious, Inflow Depth = 0.69" for 2-Year event
Inflow = 17.07 cfs @ 13.39 hrs, Volume= 4.824 af
Outflow = 17.07 cfs @ 13.40 hrs, Volume= 4.824 af, Atten= 0%, Lag= 0.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.06 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 2.84 fps, Avg. Travel Time= 2.3 min

Peak Storage= 1,110 cf @ 13.40 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 1.50' Flow Area= 41.3 sf, Capacity= 638.10 cfs

5.00' x 1.50' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 15.0 '/' Top Width= 50.00'
Length= 394.0' Slope= 0.0878 '/'
Inlet Invert= 995.58', Outlet Invert= 961.00'



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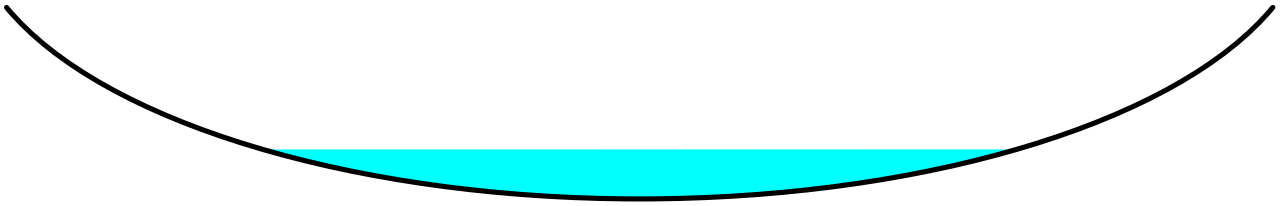
Summary for Reach 16R: Wetland

Inflow Area = 7.392 ac, 7.31% Impervious, Inflow Depth = 0.76" for 2-Year event
Inflow = 4.33 cfs @ 12.25 hrs, Volume= 0.471 af
Outflow = 3.52 cfs @ 12.41 hrs, Volume= 0.471 af, Atten= 19%, Lag= 9.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.80 fps, Min. Travel Time= 10.5 min
Avg. Velocity = 0.25 fps, Avg. Travel Time= 33.9 min

Peak Storage= 2,224 cf @ 12.41 hrs
Average Depth at Peak Storage= 0.26'
Bank-Full Depth= 1.00' Flow Area= 33.3 sf, Capacity= 65.53 cfs

50.00' x 1.00' deep Parabolic Channel, n= 0.100 Very weedy reaches w/pools
Length= 505.0' Slope= 0.0301 '/'
Inlet Invert= 1,014.90', Outlet Invert= 999.70'



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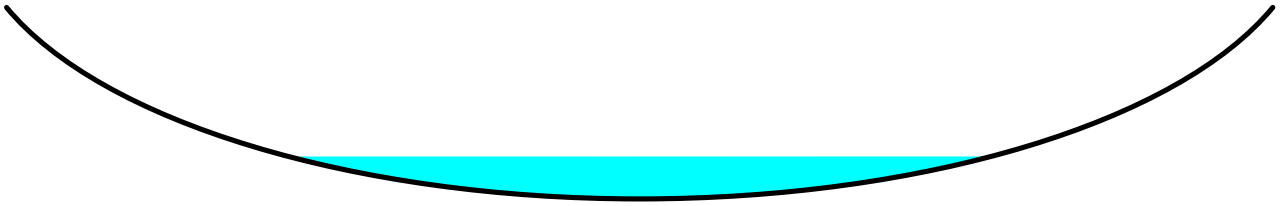
Summary for Reach 18R: Stream

Inflow Area = 2.346 ac, 12.54% Impervious, Inflow Depth = 0.78" for 2-Year event
Inflow = 1.91 cfs @ 12.16 hrs, Volume= 0.153 af
Outflow = 1.81 cfs @ 12.19 hrs, Volume= 0.153 af, Atten= 6%, Lag= 2.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.29 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 0.45 fps, Avg. Travel Time= 7.1 min

Peak Storage= 273 cf @ 12.19 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.00' Flow Area= 13.3 sf, Capacity= 46.68 cfs

20.00' x 1.00' deep Parabolic Channel, n= 0.040 Mountain streams
Length= 195.0' Slope= 0.0154 '/'
Inlet Invert= 1,006.00', Outlet Invert= 1,003.00'



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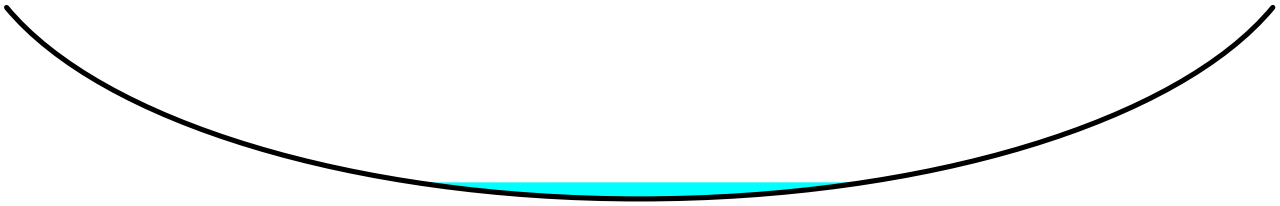
Summary for Reach 19R: Stream

Inflow Area = 0.556 ac, 24.15% Impervious, Inflow Depth > 0.98" for 2-Year event
Inflow = 0.52 cfs @ 12.17 hrs, Volume= 0.045 af
Outflow = 0.39 cfs @ 12.28 hrs, Volume= 0.045 af, Atten= 25%, Lag= 6.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.14 fps, Min. Travel Time= 5.9 min
Avg. Velocity = 0.40 fps, Avg. Travel Time= 16.8 min

Peak Storage= 140 cf @ 12.28 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 1.00' Flow Area= 13.3 sf, Capacity= 77.01 cfs

20.00' x 1.00' deep Parabolic Channel, n= 0.040 Mountain streams
Length= 406.0' Slope= 0.0419 '/'
Inlet Invert= 1,020.00', Outlet Invert= 1,003.00'



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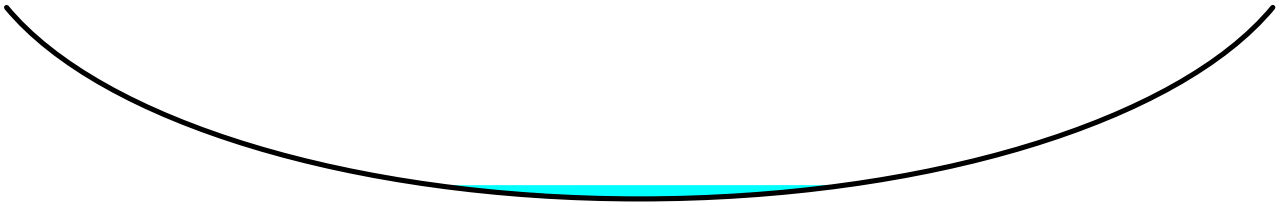
Summary for Reach 20R: Stream

Inflow Area = 1.654 ac, 0.22% Impervious, Inflow Depth = 0.68" for 2-Year event
Inflow = 1.13 cfs @ 12.12 hrs, Volume= 0.094 af
Outflow = 1.04 cfs @ 12.15 hrs, Volume= 0.094 af, Atten= 8%, Lag= 2.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.95 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 0.82 fps, Avg. Travel Time= 7.4 min

Peak Storage= 194 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.11'
Bank-Full Depth= 1.50' Flow Area= 28.0 sf, Capacity= 314.84 cfs

28.00' x 1.50' deep Parabolic Channel, n= 0.040 Mountain streams
Length= 362.0' Slope= 0.0925 '/'
Inlet Invert= 999.50', Outlet Invert= 966.00'



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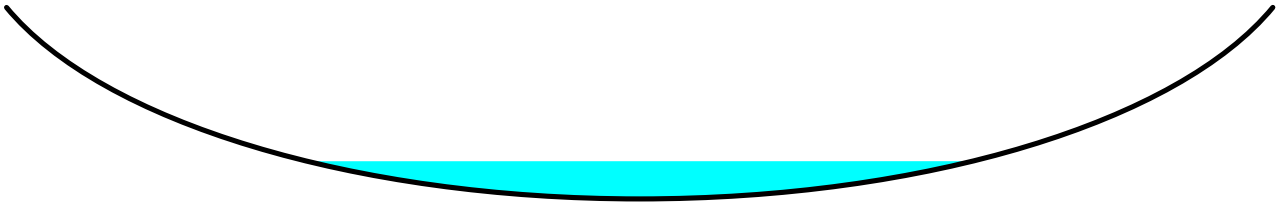
Summary for Reach 21R: Stream

Inflow Area = 3.735 ac, 16.97% Impervious, Inflow Depth = 0.83" for 2-Year event
Inflow = 2.38 cfs @ 12.26 hrs, Volume= 0.259 af
Outflow = 2.25 cfs @ 12.32 hrs, Volume= 0.259 af, Atten= 6%, Lag= 3.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.92 fps, Min. Travel Time= 3.5 min
Avg. Velocity = 0.59 fps, Avg. Travel Time= 11.3 min

Peak Storage= 468 cf @ 12.32 hrs
Average Depth at Peak Storage= 0.20'
Bank-Full Depth= 1.00' Flow Area= 13.3 sf, Capacity= 75.27 cfs

20.00' x 1.00' deep Parabolic Channel, n= 0.040 Mountain streams
Length= 400.0' Slope= 0.0400 '/'
Inlet Invert= 984.00', Outlet Invert= 968.00'



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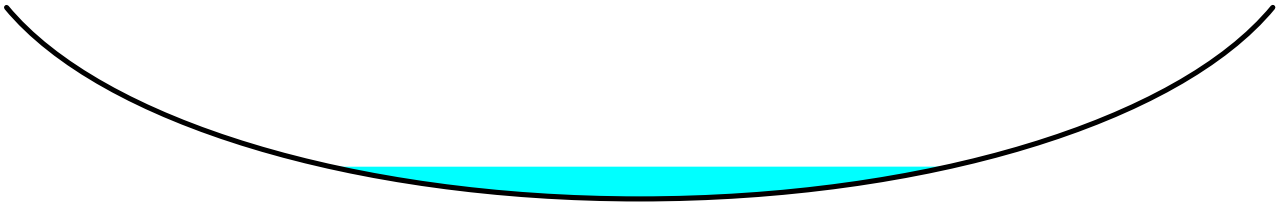
Summary for Reach 22R: Stream

Inflow Area = 2.902 ac, 14.76% Impervious, Inflow Depth = 0.82" for 2-Year event
Inflow = 2.11 cfs @ 12.21 hrs, Volume= 0.198 af
Outflow = 2.05 cfs @ 12.24 hrs, Volume= 0.198 af, Atten= 3%, Lag= 2.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.21 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 0.66 fps, Avg. Travel Time= 7.4 min

Peak Storage= 271 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.17'
Bank-Full Depth= 1.00' Flow Area= 13.3 sf, Capacity= 96.00 cfs

20.00' x 1.00' deep Parabolic Channel, n= 0.040 Mountain streams
Length= 292.0' Slope= 0.0651 '/'
Inlet Invert= 1,003.00', Outlet Invert= 984.00'



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Summary for Pond 4P: Doyle Ave Culvert

Inflow Area = 84.075 ac, 1.90% Impervious, Inflow Depth = 0.69" for 2-Year event
Inflow = 17.32 cfs @ 13.24 hrs, Volume= 4.824 af
Outflow = 17.07 cfs @ 13.39 hrs, Volume= 4.824 af, Atten= 1%, Lag= 8.6 min
Primary = 17.07 cfs @ 13.39 hrs, Volume= 4.824 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 998.24' @ 13.39 hrs Surf.Area= 5,052 sf Storage= 4,058 cf

Plug-Flow detention time= 2.7 min calculated for 4.823 af (100% of inflow)
Center-of-Mass det. time= 2.7 min (953.1 - 950.3)

Volume	Invert	Avail.Storage	Storage Description
#1	995.85'	37,946 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
995.85	0	0	0
997.00	1,119	643	643
998.00	3,644	2,382	3,025
999.00	9,570	6,607	9,632
1,000.00	13,181	11,376	21,007
1,001.00	20,697	16,939	37,946

Device	Routing	Invert	Outlet Devices
#1	Primary	995.85'	**30.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 995.85' / 995.58' S= 0.0090 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 4.91 sf
#2	Primary	999.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 Width (feet) 30.00 125.00 172.00

Primary OutFlow Max=17.07 cfs @ 13.39 hrs HW=998.24' TW=995.88' (Dynamic Tailwater)
↑**1=Culvert** (Barrel Controls 17.07 cfs @ 4.54 fps)
└**2=Custom Weir/Orifice** (Controls 0.00 cfs)

Summary for Pond 5P: L-6 Infil Basin

Inflow Area = 2.346 ac, 12.54% Impervious, Inflow Depth = 0.86" for 2-Year event
Inflow = 2.01 cfs @ 12.13 hrs, Volume= 0.169 af
Outflow = 1.91 cfs @ 12.16 hrs, Volume= 0.153 af, Atten= 5%, Lag= 1.8 min
Primary = 1.91 cfs @ 12.16 hrs, Volume= 0.153 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,041.22' @ 12.16 hrs Surf.Area= 1,292 sf Storage= 971 cf

Plug-Flow detention time= 71.2 min calculated for 0.153 af (90% of inflow)
Center-of-Mass det. time= 23.8 min (887.2 - 863.3)

Volume	Invert	Avail.Storage	Storage Description
#1	1,040.00'	3,756 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,040.00	302	0	0
1,042.00	1,926	2,228	2,228
1,042.70	2,441	1,528	3,756

Device	Routing	Invert	Outlet Devices
#1	Primary	1,041.00'	**6.0' long (Profile 6) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.12 3.41 3.59

Primary OutFlow Max=1.91 cfs @ 12.16 hrs HW=1,041.22' TW=1,006.21' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.91 cfs @ 1.46 fps)

Summary for Pond 6P: L-6-1 Infil Basin

Inflow Area = 0.556 ac, 24.15% Impervious, Inflow Depth = 1.18" for 2-Year event
Inflow = 0.74 cfs @ 12.09 hrs, Volume= 0.055 af
Outflow = 0.52 cfs @ 12.17 hrs, Volume= 0.045 af, Atten= 29%, Lag= 4.9 min
Primary = 0.52 cfs @ 12.17 hrs, Volume= 0.045 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,031.55' @ 12.17 hrs Surf.Area= 809 sf Storage= 652 cf

Plug-Flow detention time= 132.3 min calculated for 0.045 af (83% of inflow)
Center-of-Mass det. time= 60.6 min (900.5 - 839.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,030.30'	2,036 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,030.30	232	0	0
1,032.00	1,015	1,060	1,060
1,032.80	1,426	976	2,036

Device	Routing	Invert	Outlet Devices
#1	Primary	1,031.50'	**6.0' long (Profile 6) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.12 3.41 3.59
#2	Primary	1,031.20'	**6.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.52 cfs @ 12.17 hrs HW=1,031.55' TW=1,020.07' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 0.22 cfs @ 0.71 fps)
└**2=Orifice/Grate** (Orifice Controls 0.30 cfs @ 2.02 fps)

Summary for Pond 7P: L-6-2 Infil Basin

Inflow Area = 0.834 ac, 24.64% Impervious, Inflow Depth = 1.07" for 2-Year event
Inflow = 0.80 cfs @ 12.16 hrs, Volume= 0.074 af
Outflow = 0.44 cfs @ 12.42 hrs, Volume= 0.061 af, Atten= 45%, Lag= 15.7 min
Primary = 0.44 cfs @ 12.42 hrs, Volume= 0.061 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,010.46' @ 12.42 hrs Surf.Area= 946 sf Storage= 985 cf

Plug-Flow detention time= 143.5 min calculated for 0.061 af (82% of inflow)
Center-of-Mass det. time= 66.2 min (915.5 - 849.3)

Volume	Invert	Avail.Storage	Storage Description
#1	1,009.00'	3,844 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,009.00	427	0	0
1,010.00	755	591	591
1,012.00	1,582	2,337	2,928
1,012.50	2,080	916	3,844

Device	Routing	Invert	Outlet Devices
#1	Primary	1,011.20'	**6.0' long (Profile 6) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.12 3.41 3.59
#2	Primary	1,010.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.44 cfs @ 12.42 hrs HW=1,010.46' TW=984.19' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)
2=Orifice/Grate (Orifice Controls 0.44 cfs @ 2.32 fps)

Summary for Pond 8P: L-6-3 Infil Basin

Inflow Area = 0.577 ac, 30.58% Impervious, Inflow Depth = 1.20" for 2-Year event
Inflow = 0.74 cfs @ 12.11 hrs, Volume= 0.058 af
Outflow = 0.38 cfs @ 12.31 hrs, Volume= 0.047 af, Atten= 48%, Lag= 11.8 min
Primary = 0.38 cfs @ 12.31 hrs, Volume= 0.047 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 992.92' @ 12.31 hrs Surf.Area= 833 sf Storage= 786 cf

Plug-Flow detention time= 144.8 min calculated for 0.047 af (81% of inflow)
Center-of-Mass det. time= 65.8 min (903.9 - 838.1)

Volume	Invert	Avail.Storage	Storage Description
#1	991.00'	3,165 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
991.00	162	0	0
992.00	338	250	250
994.00	1,419	1,757	2,007
994.70	1,890	1,158	3,165

Device	Routing	Invert	Outlet Devices
#1	Primary	993.50'	**6.0' long (Profile 6) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.12 3.41 3.59
#2	Primary	992.50'	**6.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.38 cfs @ 12.31 hrs HW=992.92' TW=0.00' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)
2=Orifice/Grate (Orifice Controls 0.38 cfs @ 2.19 fps)

Summary for Pond 9P: Infiltrators

Inflow Area = 0.237 ac, 32.33% Impervious, Inflow Depth = 1.09" for 2-Year event
Inflow = 0.29 cfs @ 12.09 hrs, Volume= 0.021 af
Outflow = 0.28 cfs @ 12.11 hrs, Volume= 0.020 af, Atten= 3%, Lag= 1.3 min
Primary = 0.28 cfs @ 12.11 hrs, Volume= 0.020 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,015.65' @ 12.11 hrs Surf.Area= 317 sf Storage= 100 cf

Plug-Flow detention time= 54.1 min calculated for 0.020 af (93% of inflow)
Center-of-Mass det. time= 16.7 min (868.8 - 852.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	1,015.20'	173 cf	**8.17'W x 38.80'L x 1.83'H Field A** 581 cf Overall - 147 cf Embedded = 434 cf x 40.0% Voids
#2A	1,015.20'	147 cf	**ADS_StormTech SC-310 +Cap** x 10 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 10 Chambers in 2 Rows
		321 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	1,015.50'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.28 cfs @ 12.11 hrs HW=1,015.65' TW=1,015.02' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Weir Controls 0.28 cfs @ 1.25 fps)

Pond 9P: Infiltrators - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

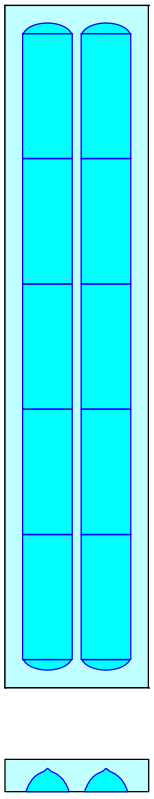
5 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 36.80' Row Length +12.0" End Stone x 2 = 38.80' Base Length
2 Rows x 34.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 8.17' Base Width
16.0" Chamber Height + 6.0" Cover = 1.83' Field Height

10 Chambers x 14.7 cf = 147.4 cf Chamber Storage

580.9 cf Field - 147.4 cf Chambers = 433.5 cf Stone x 40.0% Voids = 173.4 cf Stone Storage

Chamber Storage + Stone Storage = 320.8 cf = 0.007 af
Overall Storage Efficiency = 55.2%
Overall System Size = 38.80' x 8.17' x 1.83'

10 Chambers
21.5 cy Field
16.1 cy Stone



Summary for Pond 10P: L-14-1 Infil Basin

Inflow Area = 3.445 ac, 9.93% Impervious, Inflow Depth = 0.83" for 2-Year event
Inflow = 2.23 cfs @ 12.24 hrs, Volume= 0.238 af
Outflow = 2.22 cfs @ 12.25 hrs, Volume= 0.227 af, Atten= 0%, Lag= 0.6 min
Primary = 2.22 cfs @ 12.25 hrs, Volume= 0.227 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,029.37' @ 12.25 hrs Surf.Area= 540 sf Storage= 597 cf

Plug-Flow detention time= 36.3 min calculated for 0.227 af (95% of inflow)
Center-of-Mass det. time= 10.5 min (887.4 - 876.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,027.50'	1,367 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,027.50	132	0	0
1,028.00	207	85	85
1,030.00	693	900	985
1,030.50	836	382	1,367

Device	Routing	Invert	Outlet Devices
#1	Primary	1,029.20'	**10.0' long (Profile 6) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.12 3.41 3.59

Primary OutFlow Max=2.22 cfs @ 12.25 hrs HW=1,029.37' TW=1,015.80' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 2.22 cfs @ 1.29 fps)

Summary for Pond 15P: Rain Garden

Inflow Area = 0.189 ac, 44.07% Impervious, Inflow Depth = 1.51" for 2-Year event
Inflow = 0.32 cfs @ 12.09 hrs, Volume= 0.024 af
Outflow = 0.06 cfs @ 12.56 hrs, Volume= 0.011 af, Atten= 81%, Lag= 28.1 min
Primary = 0.06 cfs @ 12.56 hrs, Volume= 0.011 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,020.02' @ 12.56 hrs Surf.Area= 1,316 sf Storage= 557 cf

Plug-Flow detention time= 261.9 min calculated for 0.011 af (47% of inflow)
Center-of-Mass det. time= 138.2 min (958.1 - 819.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,017.60'	283 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 944 cf Overall x 30.0% Voids
#2	1,019.60'	549 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		832 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,017.60	472	0	0
1,019.60	472	944	944

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,019.60	472	0	0
1,020.30	1,097	549	549

Device	Routing	Invert	Outlet Devices
#1	Primary	1,020.00'	**9.0' long (Profile 6) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.12 3.41 3.59

Primary OutFlow Max=0.06 cfs @ 12.56 hrs HW=1,020.02' TW=1,015.15' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.06 cfs @ 0.40 fps)

Summary for Pond 17P: Driveway Culvert

Inflow Area = 6.966 ac, 5.46% Impervious, Inflow Depth = 0.76" for 2-Year event
Inflow = 4.17 cfs @ 12.25 hrs, Volume= 0.440 af
Outflow = 4.17 cfs @ 12.26 hrs, Volume= 0.440 af, Atten= 0%, Lag= 0.6 min
Primary = 4.17 cfs @ 12.26 hrs, Volume= 0.440 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,015.80' @ 12.26 hrs Surf.Area= 401 sf Storage= 124 cf

Plug-Flow detention time= 0.5 min calculated for 0.440 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (887.3 - 886.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,015.20'	5,797 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,015.20	10	0	0
1,016.00	528	215	215
1,016.50	1,364	473	688
1,017.00	2,424	947	1,635
1,018.00	5,900	4,162	5,797

Device	Routing	Invert	Outlet Devices
#1	Primary	1,015.20'	**18.0" Round Culvert X 3.00** L= 24.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,015.20' / 1,014.90' S= 0.0125 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf
#2	Primary	1,017.20'	**30.0' long (Profile 6) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.12 3.41 3.59

Primary OutFlow Max=4.17 cfs @ 12.26 hrs HW=1,015.80' TW=1,015.13' (Dynamic Tailwater)
1=Culvert (Inlet Controls 4.17 cfs @ 2.09 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 18P: Driveway Culverts

Inflow Area = 1.654 ac, 0.22% Impervious, Inflow Depth = 0.68" for 2-Year event
Inflow = 1.15 cfs @ 12.10 hrs, Volume= 0.094 af
Outflow = 1.13 cfs @ 12.12 hrs, Volume= 0.094 af, Atten= 2%, Lag= 0.9 min
Primary = 1.13 cfs @ 12.12 hrs, Volume= 0.094 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,000.34' @ 12.12 hrs Surf.Area= 330 sf Storage= 58 cf

Plug-Flow detention time= 1.0 min calculated for 0.094 af (100% of inflow)
Center-of-Mass det. time= 0.9 min (881.6 - 880.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,000.00'	12,612 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,000.00	10	0	0
1,002.00	1,870	1,880	1,880
1,003.00	4,737	3,304	5,184
1,004.00	10,120	7,429	12,612

Device	Routing	Invert	Outlet Devices
#1	Primary	1,000.00'	**12.0" Round Culvert X 3.00** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,000.00' / 999.50' S= 0.0200 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf
#2	Primary	1,003.00'	**60.0' long (Profile 6) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.12 3.41 3.59

Primary OutFlow Max=1.13 cfs @ 12.12 hrs HW=1,000.34' TW=999.60' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 1.13 cfs @ 1.58 fps)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: West of Doyle Runoff Area=1,178,155 sf 0.34% Impervious Runoff Depth=1.65"
Flow Length=2,241' Slope=0.0610 '/' Tc=31.9 min CN=71 Runoff=27.80 cfs 3.709 af

Subcatchment 3S: East of Doyle Runoff Area=3,340,303 sf 1.38% Impervious Runoff Depth=1.65"
Flow Length=5,506' Slope=0.0350 '/' Tc=86.3 min CN=71 Runoff=44.32 cfs 10.517 af

Subcatchment 9S: To L-6 Infil Runoff Area=99,742 sf 10.40% Impervious Runoff Depth=1.87"
Flow Length=544' Slope=0.0810 '/' Tc=8.2 min CN=74 Runoff=4.57 cfs 0.356 af

Subcatchment 10S: To L-6-1 Infil Runoff Area=22,785 sf 19.41% Impervious Runoff Depth=2.26"
Tc=6.0 min CN=79 Runoff=1.39 cfs 0.098 af

Subcatchment 11S: To L-6-2 Infil Runoff Area=34,234 sf 20.06% Impervious Runoff Depth=2.10"
Flow Length=442' Slope=0.0250 '/' Tc=11.5 min CN=77 Runoff=1.60 cfs 0.137 af

Subcatchment 12S: To L-6-3 Infil Runoff Area=23,257 sf 24.93% Impervious Runoff Depth=2.26"
Flow Length=402' Slope=0.0420 '/' Tc=7.7 min CN=79 Runoff=1.33 cfs 0.101 af

Subcatchment 13S: To 14-1 Basin Runoff Area=149,214 sf 9.43% Impervious Runoff Depth=1.87"
Flow Length=1,061' Slope=0.0600 '/' Tc=16.3 min CN=74 Runoff=5.40 cfs 0.532 af

Subcatchment 14S: To 14-2 Basin Runoff Area=7,147 sf 35.48% Impervious Runoff Depth=2.60"
Tc=6.0 min CN=83 Runoff=0.50 cfs 0.036 af

Subcatchment 15S: To Infiltrators Runoff Area=10,302 sf 32.33% Impervious Runoff Depth=2.26"
Tc=6.0 min CN=79 Runoff=0.63 cfs 0.045 af

Subcatchment 16S: To Driveway Culvert Runoff Area=153,405 sf 1.08% Impervious Runoff Depth=1.72"
Flow Length=1,094' Slope=0.0740 '/' Tc=15.9 min CN=72 Runoff=5.10 cfs 0.504 af

Subcatchment 17S: To Driveway Culvert Runoff Area=72,047 sf 0.22% Impervious Runoff Depth=1.65"
Tc=6.0 min CN=71 Runoff=3.11 cfs 0.227 af

Subcatchment 19S: Water Surface Runoff Area=1,426 sf 100.00% Impervious Runoff Depth=4.12"
Tc=6.0 min CN=98 Runoff=0.14 cfs 0.011 af

Subcatchment 20S: Water Surface Runoff Area=2,441 sf 100.00% Impervious Runoff Depth=4.12"
Tc=6.0 min CN=98 Runoff=0.24 cfs 0.019 af

Subcatchment 21S: Water Surface Runoff Area=2,080 sf 100.00% Impervious Runoff Depth=4.12"
Tc=6.0 min CN=98 Runoff=0.20 cfs 0.016 af

Subcatchment 22S: Water Surface Runoff Area=1,890 sf 100.00% Impervious Runoff Depth=4.12"
Tc=6.0 min CN=98 Runoff=0.18 cfs 0.015 af

Subcatchment 23S: Water Surface Runoff Area=836 sf 100.00% Impervious Runoff Depth=4.12"
Tc=6.0 min CN=98 Runoff=0.08 cfs 0.007 af

Subcatchment 24S: Water Surface Runoff Area=1,097 sf 100.00% Impervious Runoff Depth=4.12"
Tc=6.0 min CN=98 Runoff=0.11 cfs 0.009 af

Reach 2R: Wetland Inflow=57.57 cfs 16.263 af
Outflow=57.57 cfs 16.263 af

Reach 5R: Intermittent Stream Avg. Flow Depth=0.48' Max Vel=7.92 fps Inflow=46.39 cfs 11.623 af
n=0.025 L=394.0' S=0.0878 '/' Capacity=638.10 cfs Outflow=46.39 cfs 11.623 af

Reach 16R: Wetland Avg. Flow Depth=0.42' Max Vel=1.10 fps Inflow=11.22 cfs 1.106 af
n=0.100 L=505.0' S=0.0301 '/' Capacity=65.53 cfs Outflow=9.98 cfs 1.106 af

Reach 18R: Stream Avg. Flow Depth=0.34' Max Vel=1.71 fps Inflow=4.66 cfs 0.359 af
n=0.040 L=195.0' S=0.0154 '/' Capacity=46.68 cfs Outflow=4.54 cfs 0.359 af

Reach 19R: Stream Avg. Flow Depth=0.15' Max Vel=1.66 fps Inflow=1.48 cfs 0.101 af
n=0.040 L=406.0' S=0.0419 '/' Capacity=77.01 cfs Outflow=1.32 cfs 0.101 af

Reach 20R: Stream Avg. Flow Depth=0.17' Max Vel=2.67 fps Inflow=3.04 cfs 0.227 af
n=0.040 L=362.0' S=0.0925 '/' Capacity=314.84 cfs Outflow=2.91 cfs 0.227 af

Reach 21R: Stream Avg. Flow Depth=0.32' Max Vel=2.64 fps Inflow=6.55 cfs 0.600 af
n=0.040 L=400.0' S=0.0400 '/' Capacity=75.27 cfs Outflow=6.33 cfs 0.600 af

Reach 22R: Stream Avg. Flow Depth=0.27' Max Vel=3.04 fps Inflow=5.86 cfs 0.460 af
n=0.040 L=292.0' S=0.0651 '/' Capacity=96.00 cfs Outflow=5.76 cfs 0.460 af

Pond 4P: Doyle Ave Culvert Peak Elev=999.29' Storage=12,566 cf Inflow=46.49 cfs 11.623 af
Outflow=46.39 cfs 11.623 af

Pond 5P: L-6 Infil Basin Peak Elev=1,041.40' Storage=1,212 cf Inflow=4.79 cfs 0.375 af
Outflow=4.66 cfs 0.359 af

Pond 6P: L-6-1 Infil Basin Peak Elev=1,031.65' Storage=731 cf Inflow=1.52 cfs 0.110 af
Outflow=1.48 cfs 0.101 af

Pond 7P: L-6-2 Infil Basin Peak Elev=1,011.20' Storage=1,792 cf Inflow=1.75 cfs 0.154 af
Outflow=0.92 cfs 0.140 af

Pond 8P: L-6-3 Infil Basin Peak Elev=993.45' Storage=1,311 cf Inflow=1.51 cfs 0.115 af
Outflow=0.79 cfs 0.104 af

Pond 9P: Infiltrators Peak Elev=1,015.84' Storage=141 cf Inflow=0.63 cfs 0.045 af
Outflow=0.55 cfs 0.043 af

Pond 10P: L-14-1 Infil Basin Peak Elev=1,029.51' Storage=675 cf Inflow=5.44 cfs 0.539 af
Outflow=5.43 cfs 0.527 af

Pond 15P: Rain Garden Peak Elev=1,020.07' Storage=608 cf Inflow=0.61 cfs 0.044 af
Outflow=0.57 cfs 0.032 af

Pond 17P: Driveway Culvert Peak Elev=1,016.22' Storage=375 cf Inflow=10.53 cfs 1.031 af
Outflow=10.48 cfs 1.031 af

Pond 18P: Driveway Culverts Peak Elev=1,000.60' Storage=171 cf Inflow=3.11 cfs 0.227 af
Outflow=3.04 cfs 0.227 af

Total Runoff Area = 117.088 ac Runoff Volume = 16.339 af Average Runoff Depth = 1.67"
97.86% Pervious = 114.586 ac 2.14% Impervious = 2.502 ac

Summary for Subcatchment 1S: West of Doyle

Runoff = 27.80 cfs @ 12.47 hrs, Volume= 3.709 af, Depth= 1.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.36"

Area (sf)	CN	Description
1,092,071	70	Woods, Good, HSG C
14,283	77	2 acre lots, 12% imp, HSG C
22,519	96	Gravel surface, HSG C
2,250	98	Roofs, HSG C
47,032	74	>75% Grass cover, Good, HSG C
1,178,155	71	Weighted Average
1,174,191		99.66% Pervious Area
3,964		0.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.9	2,241	0.0610	1.17		**Lag/CN Method,**

Summary for Subcatchment 3S: East of Doyle

Runoff = 44.32 cfs @ 13.22 hrs, Volume= 10.517 af, Depth= 1.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.36"

Area (sf)	CN	Description
2,907,169	70	Woods, Good, HSG C
141,817	74	>75% Grass cover, Good, HSG C
29,575	96	Gravel surface, HSG C
16,344	98	Roofs, HSG C
245,104	77	2 acre lots, 12% imp, HSG C
294	98	Paved parking, HSG C
3,340,303	71	Weighted Average
3,294,253		98.62% Pervious Area
46,050		1.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
86.3	5,506	0.0350	1.06		**Lag/CN Method,**

Summary for Subcatchment 9S: To L-6 Infil

Runoff = 4.57 cfs @ 12.12 hrs, Volume= 0.356 af, Depth= 1.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.36"

Area (sf)	CN	Description
3,516	98	Roofs, HSG C
5,717	98	Paved parking, HSG C
9,476	77	2 acre lots, 12% imp, HSG C
10,425	74	>75% Grass cover, Good, HSG C
70,608	70	Woods, Good, HSG C
99,742	74	Weighted Average
89,372		89.60% Pervious Area
10,370		10.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	544	0.0810	1.11		**Lag/CN Method,**

Summary for Subcatchment 10S: To L-6-1 Infil

Runoff = 1.39 cfs @ 12.09 hrs, Volume= 0.098 af, Depth= 2.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.36"

Area (sf)	CN	Description
762	98	Roofs, HSG C
3,660	98	Paved parking, HSG C
18,363	74	>75% Grass cover, Good, HSG C
22,785	79	Weighted Average
18,363		80.59% Pervious Area
4,422		19.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 11S: To L-6-2 Infil

Runoff = 1.60 cfs @ 12.16 hrs, Volume= 0.137 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.36"

Area (sf)	CN	Description
762	98	Roofs, HSG C
6,106	98	Paved parking, HSG C
15,683	74	>75% Grass cover, Good, HSG C
11,683	70	Woods, Good, HSG C
34,234	77	Weighted Average
27,366		79.94% Pervious Area
6,868		20.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.5	442	0.0250	0.64		**Lag/CN Method,**

Summary for Subcatchment 12S: To L-6-3 Infil

Runoff = 1.33 cfs @ 12.11 hrs, Volume= 0.101 af, Depth= 2.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.36"

Area (sf)	CN	Description
762	98	Roofs, HSG C
5,037	98	Paved parking, HSG C
10,569	74	>75% Grass cover, Good, HSG C
6,889	70	Woods, Good, HSG C
23,257	79	Weighted Average
17,458		75.07% Pervious Area
5,799		24.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	402	0.0420	0.87		**Lag/CN Method,**

Summary for Subcatchment 13S: To 14-1 Basin

Runoff = 5.40 cfs @ 12.23 hrs, Volume= 0.532 af, Depth= 1.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.36"

Area (sf)	CN	Description
6,087	98	Roofs, HSG C
4,360	98	Paved parking, HSG C
30,176	77	2 acre lots, 12% imp, HSG C
28,893	74	>75% Grass cover, Good, HSG C
79,698	70	Woods, Good, HSG C
149,214	74	Weighted Average
135,146		90.57% Pervious Area
14,068		9.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	1,061	0.0600	1.09		**Lag/CN Method,**

Summary for Subcatchment 14S: To 14-2 Basin

Runoff = 0.50 cfs @ 12.09 hrs, Volume= 0.036 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.36"

Area (sf)	CN	Description
762	98	Roofs, HSG C
1,774	98	Paved parking, HSG C
4,611	74	>75% Grass cover, Good, HSG C
7,147	83	Weighted Average
4,611		64.52% Pervious Area
2,536		35.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 15S: To Infiltrators

Runoff = 0.63 cfs @ 12.09 hrs, Volume= 0.045 af, Depth= 2.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.36"

Area (sf)	CN	Description
3,331	98	Paved parking, HSG C
397	74	>75% Grass cover, Good, HSG C
6,574	70	Woods, Good, HSG C
10,302	79	Weighted Average
6,971		67.67% Pervious Area
3,331		32.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 16S: To Driveway Culvert

Runoff = 5.10 cfs @ 12.23 hrs, Volume= 0.504 af, Depth= 1.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.36"

Area (sf)	CN	Description
7,754	96	Gravel surface, HSG C
894	98	Paved roads w/curbs & sewers, HSG C
6,376	77	2 acre lots, 12% imp, HSG C
13,882	74	>75% Grass cover, Good, HSG C
124,499	70	Woods, Good, HSG C
153,405	72	Weighted Average
151,746		98.92% Pervious Area
1,659		1.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	1,094	0.0740	1.15		**Lag/CN Method,**

Summary for Subcatchment 17S: To Driveway Culvert

Runoff = 3.11 cfs @ 12.09 hrs, Volume= 0.227 af, Depth= 1.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.36"

Area (sf)	CN	Description
1,160	96	Gravel surface, HSG C
160	98	Paved parking, HSG C
5,026	74	>75% Grass cover, Good, HSG C
65,701	70	Woods, Good, HSG C
72,047	71	Weighted Average
71,887		99.78% Pervious Area
160		0.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 19S: Water Surface

Runoff = 0.14 cfs @ 12.08 hrs, Volume= 0.011 af, Depth= 4.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.36"

Area (sf)	CN	Description
1,426	98	Water Surface, HSG C
1,426		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 20S: Water Surface

Runoff = 0.24 cfs @ 12.08 hrs, Volume= 0.019 af, Depth= 4.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.36"

Area (sf)	CN	Description
2,441	98	Water Surface, HSG C
2,441		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 21S: Water Surface

Runoff = 0.20 cfs @ 12.08 hrs, Volume= 0.016 af, Depth= 4.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.36"

Area (sf)	CN	Description
2,080	98	Water Surface, HSG C
2,080		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 22S: Water Surface

Runoff = 0.18 cfs @ 12.08 hrs, Volume= 0.015 af, Depth= 4.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.36"

Area (sf)	CN	Description
1,890	98	Water Surface, HSG C
1,890		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 23S: Water Surface

Runoff = 0.08 cfs @ 12.08 hrs, Volume= 0.007 af, Depth= 4.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.36"

Area (sf)	CN	Description
836	98	Water Surface, HSG C
836		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 24S: Water Surface

Runoff = 0.11 cfs @ 12.08 hrs, Volume= 0.009 af, Depth= 4.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.36"

Area (sf)	CN	Description
1,097	98	Water Surface, HSG C
1,097		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 2R: Wetland

Inflow Area = 117.088 ac, 2.14% Impervious, Inflow Depth = 1.67" for 10-Year event
Inflow = 57.57 cfs @ 12.99 hrs, Volume= 16.263 af
Outflow = 57.57 cfs @ 12.99 hrs, Volume= 16.263 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

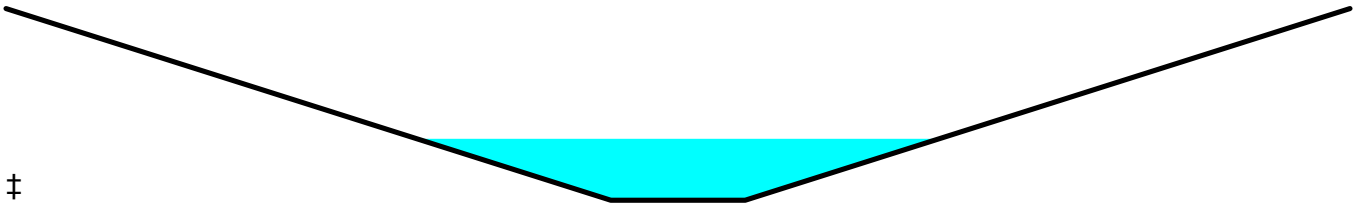
Summary for Reach 5R: Intermittent Stream

Inflow Area = 84.075 ac, 1.90% Impervious, Inflow Depth = 1.66" for 10-Year event
Inflow = 46.39 cfs @ 13.18 hrs, Volume= 11.623 af
Outflow = 46.39 cfs @ 13.19 hrs, Volume= 11.623 af, Atten= 0%, Lag= 0.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.92 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 3.42 fps, Avg. Travel Time= 1.9 min

Peak Storage= 2,309 cf @ 13.19 hrs
Average Depth at Peak Storage= 0.48'
Bank-Full Depth= 1.50' Flow Area= 41.3 sf, Capacity= 638.10 cfs

5.00' x 1.50' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 15.0 '/' Top Width= 50.00'
Length= 394.0' Slope= 0.0878 '/'
Inlet Invert= 995.58', Outlet Invert= 961.00'



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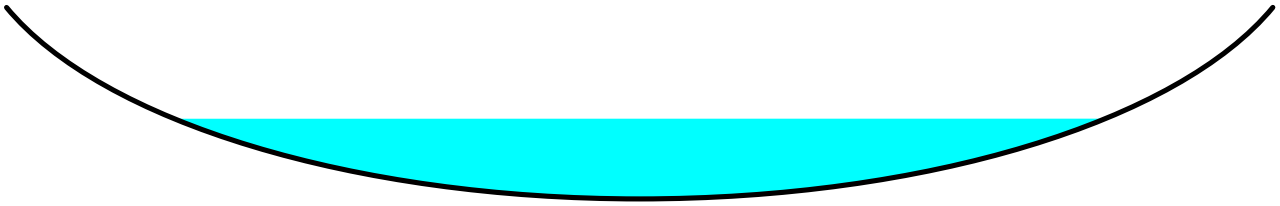
Summary for Reach 16R: Wetland

Inflow Area = 7.392 ac, 7.31% Impervious, Inflow Depth = 1.80" for 10-Year event
Inflow = 11.22 cfs @ 12.24 hrs, Volume= 1.106 af
Outflow = 9.98 cfs @ 12.33 hrs, Volume= 1.106 af, Atten= 11%, Lag= 5.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.10 fps, Min. Travel Time= 7.6 min
Avg. Velocity = 0.30 fps, Avg. Travel Time= 28.2 min

Peak Storage= 4,573 cf @ 12.33 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 1.00' Flow Area= 33.3 sf, Capacity= 65.53 cfs

50.00' x 1.00' deep Parabolic Channel, n= 0.100 Very weedy reaches w/pools
Length= 505.0' Slope= 0.0301 '/'
Inlet Invert= 1,014.90', Outlet Invert= 999.70'



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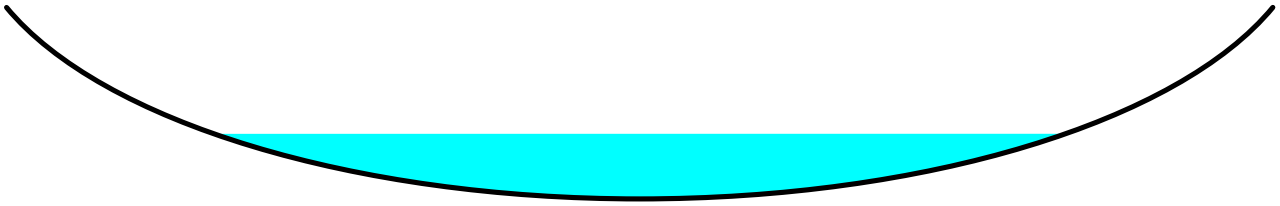
Summary for Reach 18R: Stream

Inflow Area = 2.346 ac, 12.54% Impervious, Inflow Depth = 1.84" for 10-Year event
Inflow = 4.66 cfs @ 12.14 hrs, Volume= 0.359 af
Outflow = 4.54 cfs @ 12.16 hrs, Volume= 0.359 af, Atten= 3%, Lag= 1.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.71 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 0.56 fps, Avg. Travel Time= 5.8 min

Peak Storage= 517 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.00' Flow Area= 13.3 sf, Capacity= 46.68 cfs

20.00' x 1.00' deep Parabolic Channel, n= 0.040 Mountain streams
Length= 195.0' Slope= 0.0154 '/'
Inlet Invert= 1,006.00', Outlet Invert= 1,003.00'



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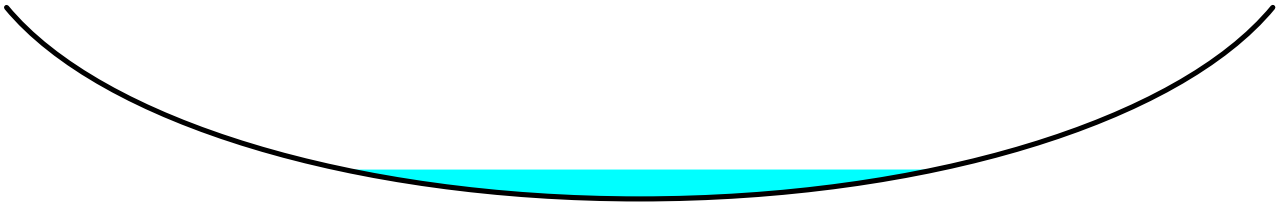
Summary for Reach 19R: Stream

Inflow Area = 0.556 ac, 24.15% Impervious, Inflow Depth = 2.17" for 10-Year event
Inflow = 1.48 cfs @ 12.11 hrs, Volume= 0.101 af
Outflow = 1.32 cfs @ 12.15 hrs, Volume= 0.101 af, Atten= 11%, Lag= 2.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.66 fps, Min. Travel Time= 4.1 min
Avg. Velocity = 0.46 fps, Avg. Travel Time= 14.6 min

Peak Storage= 324 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 1.00' Flow Area= 13.3 sf, Capacity= 77.01 cfs

20.00' x 1.00' deep Parabolic Channel, n= 0.040 Mountain streams
Length= 406.0' Slope= 0.0419 '/'
Inlet Invert= 1,020.00', Outlet Invert= 1,003.00'



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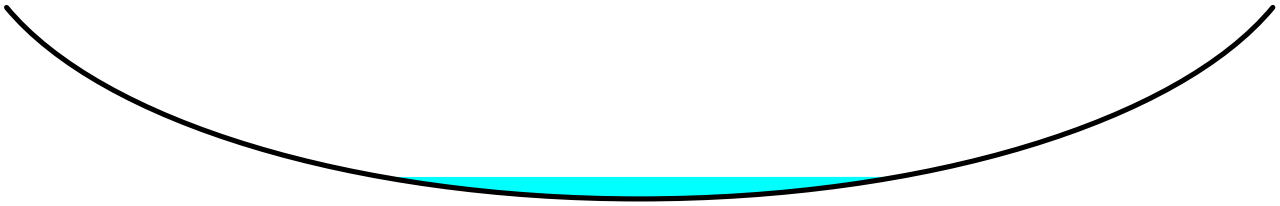
Summary for Reach 20R: Stream

Inflow Area = 1.654 ac, 0.22% Impervious, Inflow Depth = 1.65" for 10-Year event
Inflow = 3.04 cfs @ 12.11 hrs, Volume= 0.227 af
Outflow = 2.91 cfs @ 12.14 hrs, Volume= 0.227 af, Atten= 4%, Lag= 1.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.67 fps, Min. Travel Time= 2.3 min
Avg. Velocity = 0.98 fps, Avg. Travel Time= 6.1 min

Peak Storage= 394 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.17'
Bank-Full Depth= 1.50' Flow Area= 28.0 sf, Capacity= 314.84 cfs

28.00' x 1.50' deep Parabolic Channel, n= 0.040 Mountain streams
Length= 362.0' Slope= 0.0925 '/'
Inlet Invert= 999.50', Outlet Invert= 966.00'



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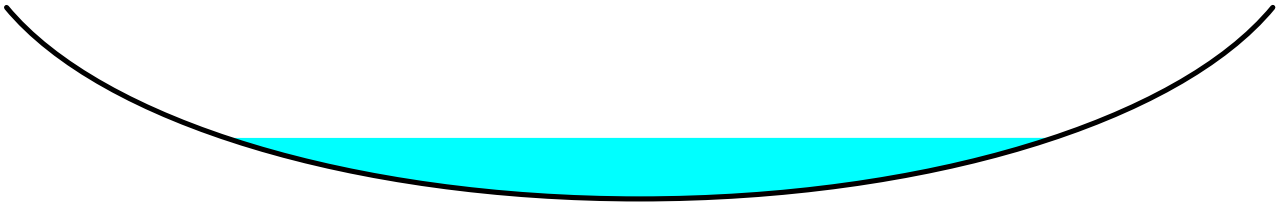
Summary for Reach 21R: Stream

Inflow Area = 3.735 ac, 16.97% Impervious, Inflow Depth = 1.93" for 10-Year event
Inflow = 6.55 cfs @ 12.18 hrs, Volume= 0.600 af
Outflow = 6.33 cfs @ 12.22 hrs, Volume= 0.600 af, Atten= 3%, Lag= 1.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.64 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 0.71 fps, Avg. Travel Time= 9.4 min

Peak Storage= 959 cf @ 12.22 hrs
Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 1.00' Flow Area= 13.3 sf, Capacity= 75.27 cfs

20.00' x 1.00' deep Parabolic Channel, n= 0.040 Mountain streams
Length= 400.0' Slope= 0.0400 '/'
Inlet Invert= 984.00', Outlet Invert= 968.00'



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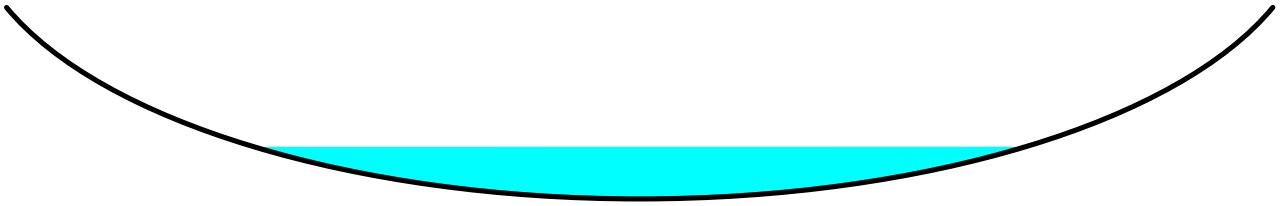
Summary for Reach 22R: Stream

Inflow Area = 2.902 ac, 14.76% Impervious, Inflow Depth = 1.90" for 10-Year event
Inflow = 5.86 cfs @ 12.16 hrs, Volume= 0.460 af
Outflow = 5.76 cfs @ 12.18 hrs, Volume= 0.460 af, Atten= 2%, Lag= 1.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.04 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 0.79 fps, Avg. Travel Time= 6.2 min

Peak Storage= 554 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 1.00' Flow Area= 13.3 sf, Capacity= 96.00 cfs

20.00' x 1.00' deep Parabolic Channel, n= 0.040 Mountain streams
Length= 292.0' Slope= 0.0651 '/'
Inlet Invert= 1,003.00', Outlet Invert= 984.00'



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Summary for Pond 4P: Doyle Ave Culvert

Inflow Area = 84.075 ac, 1.90% Impervious, Inflow Depth = 1.66" for 10-Year event
Inflow = 46.49 cfs @ 13.14 hrs, Volume= 11.623 af
Outflow = 46.39 cfs @ 13.18 hrs, Volume= 11.623 af, Atten= 0%, Lag= 2.1 min
Primary = 46.39 cfs @ 13.18 hrs, Volume= 11.623 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 999.29' @ 13.18 hrs Surf.Area= 10,619 sf Storage= 12,566 cf

Plug-Flow detention time= 4.1 min calculated for 11.620 af (100% of inflow)
Center-of-Mass det. time= 4.1 min (925.9 - 921.8)

Volume	Invert	Avail.Storage	Storage Description
#1	995.85'	37,946 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
995.85	0	0	0
997.00	1,119	643	643
998.00	3,644	2,382	3,025
999.00	9,570	6,607	9,632
1,000.00	13,181	11,376	21,007
1,001.00	20,697	16,939	37,946

Device	Routing	Invert	Outlet Devices
#1	Primary	995.85'	**30.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 995.85' / 995.58' S= 0.0090 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 4.91 sf
#2	Primary	999.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 Width (feet) 30.00 125.00 172.00

Primary OutFlow Max=46.39 cfs @ 13.18 hrs HW=999.29' TW=996.06' (Dynamic Tailwater)
1=Culvert (Barrel Controls 25.33 cfs @ 5.16 fps)
2=Custom Weir/Orifice (Weir Controls 21.06 cfs @ 1.65 fps)

Summary for Pond 5P: L-6 Infil Basin

Inflow Area = 2.346 ac, 12.54% Impervious, Inflow Depth = 1.92" for 10-Year event
Inflow = 4.79 cfs @ 12.12 hrs, Volume= 0.375 af
Outflow = 4.66 cfs @ 12.14 hrs, Volume= 0.359 af, Atten= 3%, Lag= 1.4 min
Primary = 4.66 cfs @ 12.14 hrs, Volume= 0.359 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,041.40' @ 12.14 hrs Surf.Area= 1,435 sf Storage= 1,212 cf

Plug-Flow detention time= 37.3 min calculated for 0.359 af (96% of inflow)
Center-of-Mass det. time= 13.6 min (855.1 - 841.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,040.00'	3,756 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,040.00	302	0	0
1,042.00	1,926	2,228	2,228
1,042.70	2,441	1,528	3,756

Device	Routing	Invert	Outlet Devices
#1	Primary	1,041.00'	**6.0' long (Profile 6) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.12 3.41 3.59

Primary OutFlow Max=4.66 cfs @ 12.14 hrs HW=1,041.40' TW=1,006.34' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 4.66 cfs @ 1.96 fps)

Summary for Pond 6P: L-6-1 Infil Basin

Inflow Area = 0.556 ac, 24.15% Impervious, Inflow Depth = 2.37" for 10-Year event
Inflow = 1.52 cfs @ 12.09 hrs, Volume= 0.110 af
Outflow = 1.48 cfs @ 12.11 hrs, Volume= 0.101 af, Atten= 3%, Lag= 1.2 min
Primary = 1.48 cfs @ 12.11 hrs, Volume= 0.101 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,031.65' @ 12.11 hrs Surf.Area= 853 sf Storage= 731 cf

Plug-Flow detention time= 79.7 min calculated for 0.101 af (92% of inflow)
Center-of-Mass det. time= 37.3 min (859.8 - 822.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,030.30'	2,036 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,030.30	232	0	0
1,032.00	1,015	1,060	1,060
1,032.80	1,426	976	2,036

Device	Routing	Invert	Outlet Devices
#1	Primary	1,031.50'	**6.0' long (Profile 6) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.12 3.41 3.59
#2	Primary	1,031.20'	**6.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.48 cfs @ 12.11 hrs HW=1,031.65' TW=1,020.15' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 1.06 cfs @ 1.20 fps)
└**2=Orifice/Grate** (Orifice Controls 0.42 cfs @ 2.28 fps)

Summary for Pond 7P: L-6-2 Infil Basin

Inflow Area = 0.834 ac, 24.64% Impervious, Inflow Depth = 2.21" for 10-Year event
Inflow = 1.75 cfs @ 12.15 hrs, Volume= 0.154 af
Outflow = 0.92 cfs @ 12.40 hrs, Volume= 0.140 af, Atten= 47%, Lag= 14.9 min
Primary = 0.92 cfs @ 12.40 hrs, Volume= 0.140 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,011.20' @ 12.40 hrs Surf.Area= 1,250 sf Storage= 1,792 cf

Plug-Flow detention time= 88.1 min calculated for 0.140 af (91% of inflow)
Center-of-Mass det. time= 43.7 min (875.3 - 831.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,009.00'	3,844 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,009.00	427	0	0
1,010.00	755	591	591
1,012.00	1,582	2,337	2,928
1,012.50	2,080	916	3,844

Device	Routing	Invert	Outlet Devices
#1	Primary	1,011.20'	**6.0' long (Profile 6) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.12 3.41 3.59
#2	Primary	1,010.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.92 cfs @ 12.40 hrs HW=1,011.20' TW=984.27' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)
2=Orifice/Grate (Orifice Controls 0.92 cfs @ 4.69 fps)

Summary for Pond 8P: L-6-3 Infil Basin

Inflow Area = 0.577 ac, 30.58% Impervious, Inflow Depth = 2.40" for 10-Year event
Inflow = 1.51 cfs @ 12.11 hrs, Volume= 0.115 af
Outflow = 0.79 cfs @ 12.28 hrs, Volume= 0.104 af, Atten= 47%, Lag= 10.4 min
Primary = 0.79 cfs @ 12.28 hrs, Volume= 0.104 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 993.45' @ 12.28 hrs Surf.Area= 1,123 sf Storage= 1,311 cf

Plug-Flow detention time= 91.6 min calculated for 0.104 af (90% of inflow)
Center-of-Mass det. time= 43.6 min (865.3 - 821.7)

Volume	Invert	Avail.Storage	Storage Description
#1	991.00'	3,165 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
991.00	162	0	0
992.00	338	250	250
994.00	1,419	1,757	2,007
994.70	1,890	1,158	3,165

Device	Routing	Invert	Outlet Devices
#1	Primary	993.50'	**6.0' long (Profile 6) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.12 3.41 3.59
#2	Primary	992.50'	**6.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.79 cfs @ 12.28 hrs HW=993.45' TW=0.00' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)
2=Orifice/Grate (Orifice Controls 0.79 cfs @ 4.04 fps)

Summary for Pond 9P: Infiltrators

Inflow Area = 0.237 ac, 32.33% Impervious, Inflow Depth = 2.26" for 10-Year event
Inflow = 0.63 cfs @ 12.09 hrs, Volume= 0.045 af
Outflow = 0.55 cfs @ 12.13 hrs, Volume= 0.043 af, Atten= 12%, Lag= 2.6 min
Primary = 0.55 cfs @ 12.13 hrs, Volume= 0.043 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,015.84' @ 12.13 hrs Surf.Area= 317 sf Storage= 141 cf

Plug-Flow detention time= 30.8 min calculated for 0.043 af (96% of inflow)
Center-of-Mass det. time= 11.1 min (841.8 - 830.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	1,015.20'	173 cf	**8.17'W x 38.80'L x 1.83'H Field A** 581 cf Overall - 147 cf Embedded = 434 cf x 40.0% Voids
#2A	1,015.20'	147 cf	**ADS_StormTech SC-310 +Cap** x 10 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 10 Chambers in 2 Rows
		321 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	1,015.50'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.55 cfs @ 12.13 hrs HW=1,015.84' TW=1,015.21' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 0.55 cfs @ 2.82 fps)

Pond 9P: Infiltrators - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

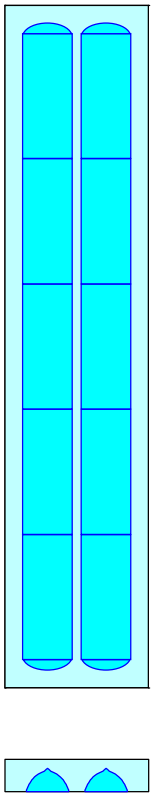
5 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 36.80' Row Length +12.0" End Stone x 2 = 38.80' Base Length
2 Rows x 34.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 8.17' Base Width
16.0" Chamber Height + 6.0" Cover = 1.83' Field Height

10 Chambers x 14.7 cf = 147.4 cf Chamber Storage

580.9 cf Field - 147.4 cf Chambers = 433.5 cf Stone x 40.0% Voids = 173.4 cf Stone Storage

Chamber Storage + Stone Storage = 320.8 cf = 0.007 af
Overall Storage Efficiency = 55.2%
Overall System Size = 38.80' x 8.17' x 1.83'

10 Chambers
21.5 cy Field
16.1 cy Stone



Summary for Pond 10P: L-14-1 Infil Basin

Inflow Area = 3.445 ac, 9.93% Impervious, Inflow Depth = 1.88" for 10-Year event
Inflow = 5.44 cfs @ 12.23 hrs, Volume= 0.539 af
Outflow = 5.43 cfs @ 12.24 hrs, Volume= 0.527 af, Atten= 0%, Lag= 0.4 min
Primary = 5.43 cfs @ 12.24 hrs, Volume= 0.527 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,029.51' @ 12.24 hrs Surf.Area= 574 sf Storage= 675 cf

Plug-Flow detention time= 18.3 min calculated for 0.527 af (98% of inflow)
Center-of-Mass det. time= 5.9 min (858.6 - 852.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,027.50'	1,367 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,027.50	132	0	0
1,028.00	207	85	85
1,030.00	693	900	985
1,030.50	836	382	1,367

Device	Routing	Invert	Outlet Devices
#1	Primary	1,029.20'	**10.0' long (Profile 6) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.12 3.41 3.59

Primary OutFlow Max=5.43 cfs @ 12.24 hrs HW=1,029.51' TW=1,016.22' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 5.43 cfs @ 1.74 fps)

Summary for Pond 15P: Rain Garden

Inflow Area = 0.189 ac, 44.07% Impervious, Inflow Depth = 2.80" for 10-Year event
Inflow = 0.61 cfs @ 12.09 hrs, Volume= 0.044 af
Outflow = 0.57 cfs @ 12.12 hrs, Volume= 0.032 af, Atten= 6%, Lag= 1.8 min
Primary = 0.57 cfs @ 12.12 hrs, Volume= 0.032 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,020.07' @ 12.12 hrs Surf.Area= 1,368 sf Storage= 608 cf

Plug-Flow detention time= 155.5 min calculated for 0.032 af (72% of inflow)
Center-of-Mass det. time= 62.4 min (868.0 - 805.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,017.60'	283 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 944 cf Overall x 30.0% Voids
#2	1,019.60'	549 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		832 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,017.60	472	0	0
1,019.60	472	944	944

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,019.60	472	0	0
1,020.30	1,097	549	549

Device	Routing	Invert	Outlet Devices
#1	Primary	1,020.00'	**9.0' long (Profile 6) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.12 3.41 3.59

Primary OutFlow Max=0.57 cfs @ 12.12 hrs HW=1,020.07' TW=1,015.20' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.57 cfs @ 0.85 fps)

Summary for Pond 17P: Driveway Culvert

Inflow Area = 6.966 ac, 5.46% Impervious, Inflow Depth = 1.78" for 10-Year event
Inflow = 10.53 cfs @ 12.23 hrs, Volume= 1.031 af
Outflow = 10.48 cfs @ 12.25 hrs, Volume= 1.031 af, Atten= 0%, Lag= 0.9 min
Primary = 10.48 cfs @ 12.25 hrs, Volume= 1.031 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,016.22' @ 12.25 hrs Surf.Area= 902 sf Storage= 375 cf

Plug-Flow detention time= 0.6 min calculated for 1.031 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (859.3 - 858.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,015.20'	5,797 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,015.20	10	0	0
1,016.00	528	215	215
1,016.50	1,364	473	688
1,017.00	2,424	947	1,635
1,018.00	5,900	4,162	5,797

Device	Routing	Invert	Outlet Devices
#1	Primary	1,015.20'	**18.0" Round Culvert X 3.00** L= 24.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,015.20' / 1,014.90' S= 0.0125 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf
#2	Primary	1,017.20'	**30.0' long (Profile 6) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.12 3.41 3.59

Primary OutFlow Max=10.48 cfs @ 12.25 hrs HW=1,016.22' TW=1,015.30' (Dynamic Tailwater)
1=Culvert (Inlet Controls 10.48 cfs @ 2.72 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 18P: Driveway Culverts

Inflow Area = 1.654 ac, 0.22% Impervious, Inflow Depth = 1.65" for 10-Year event
Inflow = 3.11 cfs @ 12.09 hrs, Volume= 0.227 af
Outflow = 3.04 cfs @ 12.11 hrs, Volume= 0.227 af, Atten= 2%, Lag= 1.1 min
Primary = 3.04 cfs @ 12.11 hrs, Volume= 0.227 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,000.60' @ 12.11 hrs Surf.Area= 564 sf Storage= 171 cf

Plug-Flow detention time= 0.9 min calculated for 0.227 af (100% of inflow)
Center-of-Mass det. time= 0.9 min (853.5 - 852.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,000.00'	12,612 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,000.00	10	0	0
1,002.00	1,870	1,880	1,880
1,003.00	4,737	3,304	5,184
1,004.00	10,120	7,429	12,612

Device	Routing	Invert	Outlet Devices
#1	Primary	1,000.00'	**12.0" Round Culvert X 3.00** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,000.00' / 999.50' S= 0.0200 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf
#2	Primary	1,003.00'	**60.0' long (Profile 6) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.12 3.41 3.59

Primary OutFlow Max=3.03 cfs @ 12.11 hrs HW=1,000.60' TW=999.67' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 3.03 cfs @ 2.07 fps)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

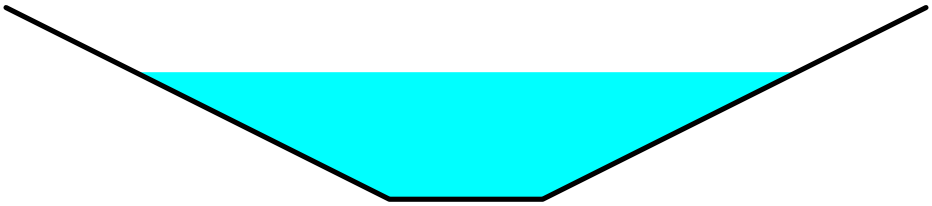
Summary for Reach 26R: L-14-1 Swale

Inflow Area = 3.425 ac, 9.43% Impervious, Inflow Depth = 2.60" for 25-Year event
Inflow = 7.61 cfs @ 12.23 hrs, Volume= 0.742 af
Outflow = 7.60 cfs @ 12.24 hrs, Volume= 0.742 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.45 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.38 fps, Avg. Travel Time= 1.8 min

Peak Storage= 328 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.83'
Bank-Full Depth= 1.25' Flow Area= 4.4 sf, Capacity= 19.03 cfs

1.00' x 1.25' deep channel, n= 0.069 Riprap, 6-inch
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 149.0' Slope= 0.0705 '/'
Inlet Invert= 1,040.50', Outlet Invert= 1,030.00'



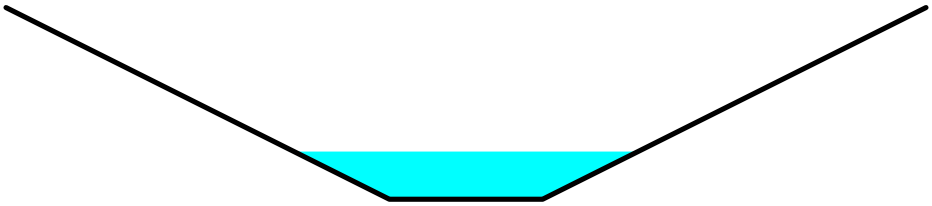
Summary for Reach 34R: L-6-1 Swale

Inflow Area = 0.523 ac, 19.41% Impervious, Inflow Depth = 3.05" for 25-Year event
Inflow = 1.87 cfs @ 12.09 hrs, Volume= 0.133 af
Outflow = 1.87 cfs @ 12.09 hrs, Volume= 0.133 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.72 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.21 fps, Avg. Travel Time= 0.8 min

Peak Storage= 28 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.31'
Bank-Full Depth= 1.25' Flow Area= 4.4 sf, Capacity= 34.96 cfs

1.00' x 1.25' deep channel, n= 0.041 Riprap, 2-inch
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 56.0' Slope= 0.0839 '/'
Inlet Invert= 1,037.70', Outlet Invert= 1,033.00'



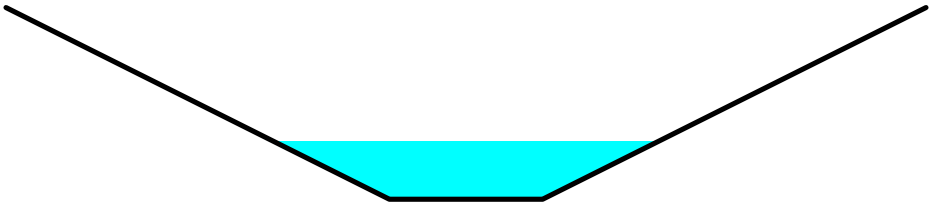
Summary for Reach 36R: L-6-2 Swale

Inflow Area = 0.786 ac, 20.06% Impervious, Inflow Depth = 2.87" for 25-Year event
Inflow = 2.20 cfs @ 12.16 hrs, Volume= 0.188 af
Outflow = 2.20 cfs @ 12.17 hrs, Volume= 0.188 af, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.29 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.17 fps, Avg. Travel Time= 1.5 min

Peak Storage= 71 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.38'
Bank-Full Depth= 1.25' Flow Area= 4.4 sf, Capacity= 27.74 cfs

1.00' x 1.25' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 106.0' Slope= 0.0283 '/'
Inlet Invert= 1,014.00', Outlet Invert= 1,011.00'



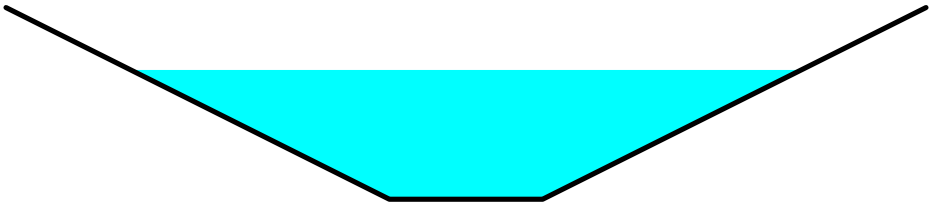
Summary for Reach 31R: L-14 Swale

Inflow Area = 3.425 ac, 9.43% Impervious, Inflow Depth = 2.60" for 25-Year event
Inflow = 7.61 cfs @ 12.23 hrs, Volume= 0.742 af
Outflow = 7.58 cfs @ 12.24 hrs, Volume= 0.742 af, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.35 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.33 fps, Avg. Travel Time= 2.4 min

Peak Storage= 435 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.84'
Bank-Full Depth= 1.25' Flow Area= 4.4 sf, Capacity= 18.30 cfs

1.00' x 1.25' deep channel, n= 0.069 Riprap, 6-inch
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 192.0' Slope= 0.0651 '/'
Inlet Invert= 1,062.50', Outlet Invert= 1,050.00'



Summary for Reach 28R: 14-1 Driveway Culvert

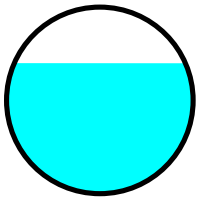
[52] Hint: Inlet/Outlet conditions not evaluated
[90] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 3.117 ac, 7.52% Impervious, Inflow Depth = 3.17" for 50-Year event
Inflow = 8.68 cfs @ 12.21 hrs, Volume= 0.823 af
Outflow = 8.68 cfs @ 12.22 hrs, Volume= 0.823 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 14.77 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 5.98 fps, Avg. Travel Time= 0.1 min

Peak Storage= 24 cf @ 12.22 hrs
Average Depth at Peak Storage= 0.70'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 10.36 cfs

12.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 40.0' Slope= 0.0500 '/'
Inlet Invert= 1,036.00', Outlet Invert= 1,034.00'



Summary for Pond 17P: Driveway Culvert

Inflow Area = 6.966 ac, 5.46% Impervious, Inflow Depth = 3.06" for 50-Year event
Inflow = 18.41 cfs @ 12.23 hrs, Volume= 1.776 af
Outflow = 17.89 cfs @ 12.26 hrs, Volume= 1.776 af, Atten= 3%, Lag= 2.3 min
Primary = 17.89 cfs @ 12.26 hrs, Volume= 1.776 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,016.74' @ 12.26 hrs Surf.Area= 1,868 sf Storage= 1,073 cf

Plug-Flow detention time= 0.6 min calculated for 1.775 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (843.0 - 842.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,015.20'	5,797 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,015.20	10	0	0
1,016.00	528	215	215
1,016.50	1,364	473	688
1,017.00	2,424	947	1,635
1,018.00	5,900	4,162	5,797

Device	Routing	Invert	Outlet Devices
#1	Primary	1,015.20'	**18.0" Round Culvert X 3.00** L= 24.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,015.20' / 1,014.90' S= 0.0125 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf
#2	Primary	1,017.20'	**30.0' long (Profile 6) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.12 3.41 3.59

Primary OutFlow Max=17.88 cfs @ 12.26 hrs HW=1,016.74' TW=1,015.43' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 17.88 cfs @ 3.37 fps)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 18P: Driveway Culverts

Inflow Area = 1.654 ac, 0.22% Impervious, Inflow Depth = 2.88" for 50-Year event
Inflow = 5.57 cfs @ 12.09 hrs, Volume= 0.397 af
Outflow = 5.37 cfs @ 12.11 hrs, Volume= 0.397 af, Atten= 4%, Lag= 1.4 min
Primary = 5.37 cfs @ 12.11 hrs, Volume= 0.397 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,000.86' @ 12.11 hrs Surf.Area= 809 sf Storage= 352 cf

Plug-Flow detention time= 0.9 min calculated for 0.397 af (100% of inflow)
Center-of-Mass det. time= 0.9 min (837.0 - 836.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,000.00'	12,612 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,000.00	10	0	0
1,002.00	1,870	1,880	1,880
1,003.00	4,737	3,304	5,184
1,004.00	10,120	7,429	12,612

Device	Routing	Invert	Outlet Devices
#1	Primary	1,000.00'	**12.0" Round Culvert X 3.00** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,000.00' / 999.50' S= 0.0200 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf
#2	Primary	1,003.00'	**60.0' long (Profile 6) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.12 3.41 3.59

Primary OutFlow Max=5.36 cfs @ 12.11 hrs HW=1,000.86' TW=999.72' (Dynamic Tailwater)
1=Culvert (Inlet Controls 5.36 cfs @ 2.49 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: West of Doyle Runoff Area=1,178,155 sf 0.34% Impervious Runoff Depth=3.50"
Flow Length=2,241' Slope=0.0610 '/' Tc=31.9 min CN=71 Runoff=60.97 cfs 7.883 af

Subcatchment 3S: East of Doyle Runoff Area=3,340,303 sf 1.38% Impervious Runoff Depth=3.50"
Flow Length=5,506' Slope=0.0350 '/' Tc=86.3 min CN=71 Runoff=98.23 cfs 22.349 af

Subcatchment 9S: To L-6 Infil Runoff Area=99,742 sf 10.40% Impervious Runoff Depth=3.81"
Flow Length=544' Slope=0.0810 '/' Tc=8.2 min CN=74 Runoff=9.47 cfs 0.727 af

Subcatchment 10S: To L-6-1 Infil Runoff Area=22,785 sf 19.41% Impervious Runoff Depth=4.34"
Tc=6.0 min CN=79 Runoff=2.65 cfs 0.189 af

Subcatchment 11S: To L-6-2 Infil Runoff Area=34,234 sf 20.06% Impervious Runoff Depth=4.12"
Flow Length=442' Slope=0.0250 '/' Tc=11.5 min CN=77 Runoff=3.16 cfs 0.270 af

Subcatchment 12S: To L-6-3 Infil Runoff Area=23,257 sf 24.93% Impervious Runoff Depth=4.34"
Flow Length=402' Slope=0.0420 '/' Tc=7.7 min CN=79 Runoff=2.55 cfs 0.193 af

Subcatchment 13S: To 14-1 Basin Runoff Area=149,214 sf 9.43% Impervious Runoff Depth=3.81"
Flow Length=1,061' Slope=0.0600 '/' Tc=16.3 min CN=74 Runoff=11.22 cfs 1.087 af

Subcatchment 14S: To 14-2 Basin Runoff Area=7,147 sf 35.48% Impervious Runoff Depth=4.77"
Tc=6.0 min CN=83 Runoff=0.90 cfs 0.065 af

Subcatchment 15S: To Infiltrators Runoff Area=10,302 sf 32.33% Impervious Runoff Depth=4.34"
Tc=6.0 min CN=79 Runoff=1.20 cfs 0.085 af

Subcatchment 16S: To Driveway Culvert Runoff Area=153,405 sf 1.08% Impervious Runoff Depth=3.60"
Flow Length=1,094' Slope=0.0740 '/' Tc=15.9 min CN=72 Runoff=10.98 cfs 1.057 af

Subcatchment 17S: To Driveway Culvert Runoff Area=72,047 sf 0.22% Impervious Runoff Depth=3.50"
Tc=6.0 min CN=71 Runoff=6.78 cfs 0.482 af

Subcatchment 19S: Water Surface Runoff Area=1,426 sf 100.00% Impervious Runoff Depth=6.49"
Tc=6.0 min CN=98 Runoff=0.22 cfs 0.018 af

Subcatchment 20S: Water Surface Runoff Area=2,441 sf 100.00% Impervious Runoff Depth=6.49"
Tc=6.0 min CN=98 Runoff=0.37 cfs 0.030 af

Subcatchment 21S: Water Surface Runoff Area=2,080 sf 100.00% Impervious Runoff Depth=6.49"
Tc=6.0 min CN=98 Runoff=0.32 cfs 0.026 af

Subcatchment 22S: Water Surface Runoff Area=1,890 sf 100.00% Impervious Runoff Depth=6.49"
Tc=6.0 min CN=98 Runoff=0.29 cfs 0.023 af

Subcatchment 23S: Water Surface Runoff Area=836 sf 100.00% Impervious Runoff Depth=6.49"
Tc=6.0 min CN=98 Runoff=0.13 cfs 0.010 af

Subcatchment 24S: Water Surface Runoff Area=1,097 sf 100.00% Impervious Runoff Depth=6.49"
Tc=6.0 min CN=98 Runoff=0.17 cfs 0.014 af

Reach 2R: Wetland Inflow=128.78 cfs 34.432 af
Outflow=128.78 cfs 34.432 af

Reach 5R: Intermittent Stream Avg. Flow Depth=0.69' Max Vel=9.71 fps Inflow=102.03 cfs 24.641 af
n=0.025 L=394.0' S=0.0878 '/' Capacity=638.10 cfs Outflow=101.99 cfs 24.641 af

Reach 16R: Wetland Avg. Flow Depth=0.59' Max Vel=1.39 fps Inflow=22.35 cfs 2.293 af
n=0.100 L=505.0' S=0.0301 '/' Capacity=65.53 cfs Outflow=21.21 cfs 2.293 af

Reach 18R: Stream Avg. Flow Depth=0.48' Max Vel=2.15 fps Inflow=9.63 cfs 0.741 af
n=0.040 L=195.0' S=0.0154 '/' Capacity=46.68 cfs Outflow=9.47 cfs 0.741 af

Reach 19R: Stream Avg. Flow Depth=0.21' Max Vel=2.04 fps Inflow=2.80 cfs 0.198 af
n=0.040 L=406.0' S=0.0419 '/' Capacity=77.01 cfs Outflow=2.58 cfs 0.198 af

Reach 20R: Stream Avg. Flow Depth=0.25' Max Vel=3.38 fps Inflow=6.36 cfs 0.482 af
n=0.040 L=362.0' S=0.0925 '/' Capacity=314.84 cfs Outflow=6.25 cfs 0.482 af

Reach 21R: Stream Avg. Flow Depth=0.47' Max Vel=3.42 fps Inflow=15.08 cfs 1.221 af
n=0.040 L=400.0' S=0.0400 '/' Capacity=75.27 cfs Outflow=14.68 cfs 1.221 af

Reach 22R: Stream Avg. Flow Depth=0.38' Max Vel=3.79 fps Inflow=12.03 cfs 0.938 af
n=0.040 L=292.0' S=0.0651 '/' Capacity=96.00 cfs Outflow=11.89 cfs 0.938 af

Pond 4P: Doyle Ave Culvert Peak Elev=999.57' Storage=15,724 cf Inflow=102.15 cfs 24.641 af
Outflow=102.03 cfs 24.641 af

Pond 5P: L-6 Infil Basin Peak Elev=1,041.63' Storage=1,572 cf Inflow=9.82 cfs 0.757 af
Outflow=9.63 cfs 0.741 af

Pond 6P: L-6-1 Infil Basin Peak Elev=1,031.75' Storage=817 cf Inflow=2.86 cfs 0.207 af
Outflow=2.80 cfs 0.198 af

Pond 7P: L-6-2 Infil Basin Peak Elev=1,011.44' Storage=2,109 cf Inflow=3.40 cfs 0.296 af
Outflow=3.25 cfs 0.282 af

Pond 8P: L-6-3 Infil Basin Peak Elev=993.70' Storage=1,608 cf Inflow=2.82 cfs 0.216 af
Outflow=2.62 cfs 0.205 af

Pond 9P: Infiltrators Peak Elev=1,016.60' Storage=266 cf Inflow=1.20 cfs 0.085 af
Outflow=0.99 cfs 0.084 af

Pond 10P: L-14-1 Infil Basin Peak Elev=1,029.71' Storage=792 cf Inflow=11.28 cfs 1.097 af
Outflow=11.27 cfs 1.086 af

Pond 15P: Rain Garden Peak Elev=1,020.11' Storage=641 cf Inflow=1.07 cfs 0.079 af
Outflow=1.04 cfs 0.066 af

Pond 17P: Driveway Culvert Peak Elev=1,017.05' Storage=1,757 cf Inflow=22.24 cfs 2.142 af
Outflow=21.12 cfs 2.142 af

Pond 18P: Driveway Culverts Peak Elev=1,001.00' Storage=479 cf Inflow=6.78 cfs 0.482 af
Outflow=6.36 cfs 0.482 af

Total Runoff Area = 117.088 ac Runoff Volume = 34.508 af Average Runoff Depth = 3.54"
97.86% Pervious = 114.586 ac 2.14% Impervious = 2.502 ac

Doyle Avenue A-N-R Residential Development

Budget Estimate

The Doyle Avenue A-N-R Residential Development is proposed with a stormwater system designed to treat & retain stormwater to minimize the impact of the development on the surrounding wetlands. These stormwater features must be maintained per the Operation and Maintenance plan submitted with the Stormwater Application. This maintenance is to be the sole responsibility of the owner of the property, and that responsibility is to be transferred with the sale of the property. Examples of maintenance and estimated costs are listed below (but are not limited to):

Removal of sediment from forebays/basins	$500-$1000/yr
Erosion repair/Rip-Rap replacement	$500-$1000/yr
Catch Basin Cleaning	$250-$500/yr
Total Cost:	$1,250-$2,500/yr

Doyle Avenue A-N-R Residential Development

Maintenance Agreement

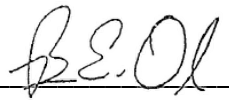
The Doyle Avenue A-N-R Residential Development is proposed with a stormwater system designed to treat & retain stormwater to minimize the impact of the development on the surrounding wetlands. These stormwater features must be maintained per the Operation and Maintenance plan submitted with the Stormwater Application. This maintenance is to be the sole responsibility of the owner of the property, and that responsibility is to be transferred with the sale of the property. Examples of maintenance are listed below (but are not limited to):

- Catch Basin Cleaning
- Removal of sediment from forebays/basins
- Erosion repair/Rip-Rap replacement

By signing this document, I certify that I am the owner of the property and agree to maintain the stormwater management system on my property. I will uphold the integrity of the system until the property is transferred to another entity who will then bear the responsibility of maintaining the stormwater management system.

Benjamin Olson on behalf of Asher Construction,LLC

Print Name



01-26-23

Signature

STORMWATER OPERATION & MAINTENANCE MANUAL
For The Doyle Ave A-N-R Residential Developemnt
Map-8 Lots-6, 14, 235-247
Doyle Avenue; Winchendon, MA 01475
Owner: Asher Construction, LLC
Owner Address: 77 Nashua Road; Sharon, NH 03458
Phone: 603-562-5181

This following manual outlines the inspection and maintenance requirements associated with stormwater management elements at the site. The owner, Asher Construction, LLC, shall provide the required construction controls as well as the inspections, operations and long-term maintenance for the term of his ownership. Any successor in title to the property shall also be bound by the requirements as described herein (within the confines of said successor's property) and/or as specified by the Town of Winchendon Planning Board and/or the Conservation Commission.

The Owner/operator shall review and be responsible for any requirements contained in the Stormwater Pollution Prevention Plan (SWPPP), and compliant with NPDES General Permit Conditions.

The site stormwater practices are enumerated below. Inspection and maintenance sheets are provided for each location. Refer to the BMP ID Plan for the location of the site Stormwater Management System.

An annual report shall be submitted to the DPW to ensure the town is kept up to date on inspection and maintenance procedures conducted at the site in any given year.

A- Conveyance Swales
B- Sediment Forebay
C- Infiltration Basins
D- Infiltrator Chamber Bed
E- Outlet Protection
F- Culverts
G- Catch Basin
H- Silt-Fencing
I- De-Icing Log
J- Invasive Species
K- Vegetated Filter Strip
L- Rain Garden

A- Conveyance Swales

This site contains four conveyance swales. These swales direct runoff from impervious areas to infiltration practices.

Maintenance requirements are on the following page.

Inspect all conveyance swales in one visit to the site, if work is required, refer to the BMP ID to identify which swale needs maintenance (S1-S4).

Date	Inspector	Notes

low velocities can act as sediment traps, add extra capacity to address sediment accumulation without reducing design capacity. Add an extra 0.3 to 0.5 feet of freeboard depth, if sediment accumulation is expected. Use side slopes of 3:1 or flatter to prevent side slope erosion. Make the longitudinal slope of the channel as flat as possible and not greater than 5%.

Install check dams in drainage channels when necessary to achieve velocities of 5 feet per second or less. See check dam section of this Handbook <<LINK>>. Do not use earthen check dams because they tend to erode on the downstream side, and it is difficult to establish and maintain grass on the dams. The maximum ponding time behind the check dam should not exceed 24 hours. Use outlet protection at discharge points from a drainage channel to prevent scour at the outlet.

The design for the drainage channel must include access for maintenance. When located along a highway, provide a breakdown lane with a width of 15 feet. When located along a street, off-street parking can be doubled up as the access, provided signs are posted indicating no parking is allowed during maintenance periods. When locating drainage channels adjacent to pervious surfaces, include a 15-foot wide grass strip to provide access for maintenance trucks.

Construction

Use temporary erosion and sediment controls during construction. Soil amendments, such as using aged compost that contains no biosolids, may be needed to encourage vegetation growth. Select a vegetation mix that suits the characteristics of the site. Seeding will require mulching with appropriate materials, such as mulch matting, straw, wood chips, other natural blankets, or synthetic blankets. Anchor blanket immediately after seeding. Provide new seedlings with adequate water until they are well established. Refer to the "Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas: A Guide for Planners, Designers, and Municipal Officials" <<LINK>> on sediment/erosion control for information regarding seeding, mulching, and use of blankets.

Maintenance

The maintenance and inspection schedule should take into consideration the effectiveness of the drainage channel. Inspect drainage channels the first few months after construction to make sure that there is no rilling or gullying, and that vegetation in the channels is adequate. Thereafter, inspect the channel twice a year for slope integrity, soil moisture, vegetative health, soil stability, soil compaction, soil erosion, ponding, and sediment accumulation.

Regular maintenance tasks include mowing, fertilizing, liming, watering, pruning, weeding, and pest control. Mow channels at least once per year. Do not cut the grass shorter than three to four inches. Keep grass height under 6 inches to maintain the design depth necessary to serve as a conveyance. Do not mow excessively, because it may increase the design flow velocity.

Remove sediment and debris manually at least once per year. Re-seed periodically to maintain the dense growth of grass vegetation. Take care to protect drainage channels from snow removal procedures and off-street parking. When drainage channels are located on private residential property, the operation and maintenance plan must clearly specify the private property owner who is responsible for carrying out the required maintenance. If the operation and maintenance plan calls for maintenance of drainage channels on private properties to be performed by a public entity or an association (e.g. homeowners association), maintenance easements must be obtained.

B- Sediment Forebay

This site contains five sediment forebays. These forebays pretreat stormwater prior to entry into the infiltration basins and must be maintained.

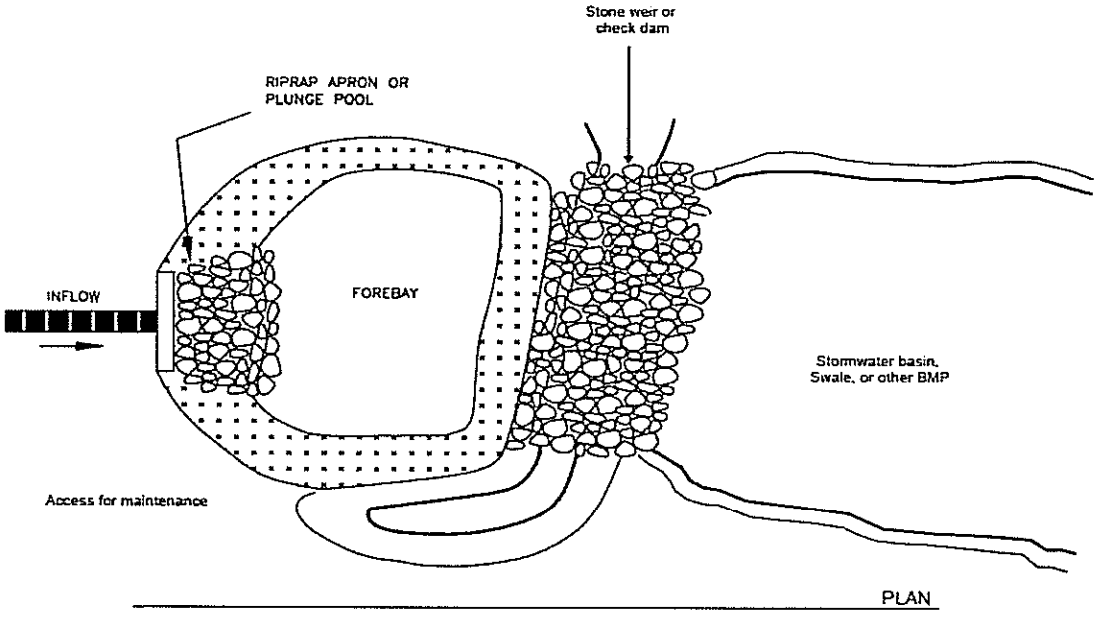
Maintenance requirements are on the following page.

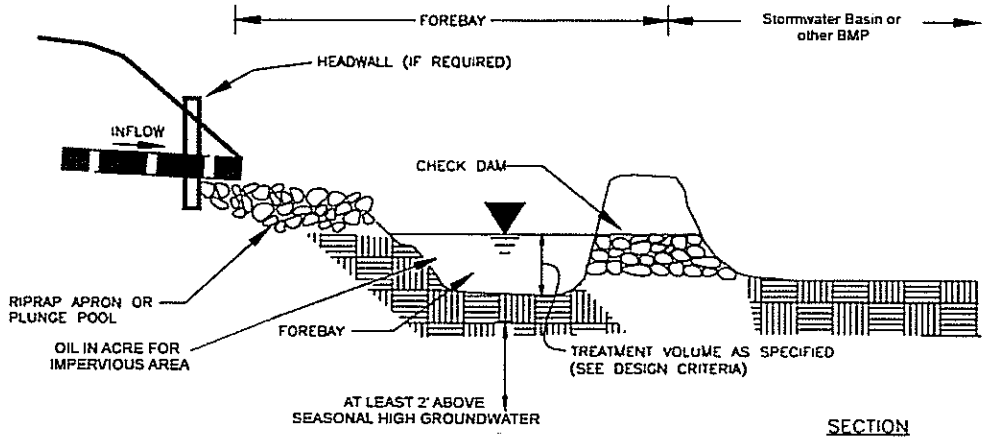
Sediment Forebays shown on BMP ID Plan labeled FB1-FB4

Date	Inspector	Notes

Maintenance

Sediments and associated pollutants are removed only when sediment forebays are actually cleaned out, so regular maintenance is essential. Frequently removing accumulated sediments will make it less likely that sediments will be resuspended. At a minimum, inspect sediment forebays monthly and clean them out at least four times per year. Stabilize the floor and sidewalls of the sediment forebay before making it operational, otherwise the practice will discharge excess amounts of suspended sediments. When mowing grasses, keep the grass height no greater than 6 inches. Set mower blades no lower than 3 to 4 inches. Check for signs of rilling and gullying and repair as needed. After removing the sediment, replace any vegetation damaged during the clean-out by either reseeding or re-sodding. When reseeding, incorporate practices such as hydroseeding with a tackifier, blanket, or similar practice to ensure that no scour occurs in the forebay, while the seeds germinate and develop roots.





CONSTRUCTION PERIOD SEDIMENT FOREBAYS SIZED 0.5"/ACRE PER ENTIRE CONTRIBUTING DRAINAGE AREA

adapted from the Vermont Stormwater Handbook

C – Infiltration Basin

This site contains six infiltration basins which should be regularly maintained.

Maintenance requirements are on the following page.

The infiltration basin is shown on the BMP ID Plan labelled B1-B5

Date	Inspector	Notes

the soils beneath the basin floor and side slopes and reduces infiltration capacity. Because some compaction of soils is inevitable during construction, add the required soil amendments and deeply till the basin floor with a rotary tiller or a disc harrow to a depth of 12 inches to restore infiltration rates after final grading.

Use proper erosion/sediment control during construction. Immediately following basin construction, stabilize the floor and side slopes of the basin with a dense turf of water-tolerant grass. Use low maintenance, rapidly germinating grasses, such as fescues. Do not sod the basin floor or side slopes. After the basin is completed, keep the basin roped or fenced off while construction proceeds on other parts of the site. Never direct construction period drainage to the infiltration basin. After construction is completed, do not direct runoff into the basin until the bottom and side slopes are fully stabilized.

Maintenance

Infiltration basins are prone to clogging and failure, so it is imperative to develop and implement aggressive maintenance plans and schedules. Installing the required pretreatment BMPs will significantly reduce maintenance requirements for the basin.

The Operation and Maintenance Plan required by Standard 9 must include inspections and preventive maintenance at least twice a year, and after every time drainage discharges through the high outlet orifice. The Plan must require inspecting the pretreatment BMPs in accordance with the minimal requirements specified for those practices and after every major storm event. A major storm event is defined as a storm that is equal to or greater than the 2-year, 24-hour storm (generally 2.9 to 3.6 inches in a 24-hour period, depending in geographic location in Massachusetts).

Once the basin is in use, inspect it after every major storm for the first few months to ensure it is stabilized and functioning properly and if necessary take corrective action. Note how long water remains standing in the basin after a storm; standing water within the basin 48 to 72 hours after a storm indicates that the infiltration capacity may have been overestimated. If the ponding is due to clogging, immediately address the reasons for the clogging (such as upland sediment erosion, excessive compaction of soils, or low spots).

Thereafter, inspect the infiltration basin at least twice per year. Important items to check during the inspection include:

- Signs of differential settlement,
- Cracking,
- Erosion,
- Leakage in the embankments
- Tree growth on the embankments
- Condition of riprap,
- Sediment accumulation and
- The health of the turf.

At least twice a year, mow the buffer area, side slopes, and basin bottom. Remove grass clippings and accumulated organic matter to prevent an impervious organic mat from forming. Remove trash and debris at the same time. Use deep tilling to break up clogged surfaces, and revegetate immediately.

Remove sediment from the basin as necessary, but wait until the floor of the basin is thoroughly dry. Use light equipment to remove the top layer so as to not compact the underlying soil. Deeply till the remaining soil, and revegetate as soon as possible. Inspect and clean pretreatment devices associated with basins at least twice a year, and ideally every other month.

References:

Center for Watershed Protection, http://www.stormwatercenter.net/Manual_Builder/Construction%20Specifications/Infiltration%20Trench%20Specifications.htm

Center for Watershed Protection, http://www.stormwatercenter.net/Manual_Builder/Performance%20Criteria/Infiltration.htm

Center for Watershed Protection, Stormwater Management Fact Sheet, Infiltration Basin, http://www.stormwatercenter.net/Assorted%20Fact%20Sheets/Tool6_Stormwater_Practices/Infiltration%20Practice/Infiltration%20Basin.htm

Ferguson, B.K., 1994. Stormwater Infiltration. CRC Press, Ann Arbor, MI.

or below the level of the adjacent grassed areas to ensure thorough drainage of these areas. When designing the channels, consider settlement of the lining and the adjacent areas, the potential for frost impacts on the lining and the potential for erosion or scour along the edges of the lining caused by bank-full velocities. Provide impervious linings with broken stone foundations and weep holes. Design the channel to maintain a low outflow discharge rate at the downstream end of the channel.

Use low-flow underdrains, connected to the principal outlet structure or other downstream discharge point, to promote thorough drying of the channel and the basin bottom. Consider the depth of the low flow channel when preparing the final bottom-grading plan.

Design dry detention basin side slopes to be no steeper than 3:1. Flatter slopes help to prevent erosion of the banks during larger storms, make routine bank maintenance tasks (such as mowing) easier, and allow access to the basin. Include a multi-stage outlet structure to provide an adequate level of water quality and flood control. To meet the water quantity control standards, use the required design storm runoff rates as outlet release rates.

Design the outlet to control the outflow rate without clogging. Locate the outlet structure in the embankment for maintenance, access, safety and aesthetics. Design the outlet to facilitate maintenance; the vital parts of the structures should be accessible during normal maintenance and emergency situations. Include a draw-down valve to allow the dry detention basin to completely drain within 24 hours. To prevent scour at the outlet, include a flow transition structure, such as a lined apron or plunge pad, to absorb the initial impact of the flow and reduce the velocity to a level that will not erode the receiving channel or area.

Design embankments and spillways in conformance with the state regulations for Dam Safety (302 CMR 10.00). All dry detention basins must have an emergency spillway capable of bypassing runoff from large storms without damaging the impounding structure. Provide an access for maintenance by public or private right-of-way, using a minimum width of 15 feet and a maximum slope of 5:1. This access should extend to the forebay, safety bench and outflow structure, and should never cross the emergency spillway, unless the spillway has been designed for that purpose. Use vegetative buffers around the perimeter of the basin for erosion control and additional sediment and nutrient removal.

Maintenance

It is critical to provide access for maintenance, especially to the interior of the basin. Inspect dry detention basins at least once per year to ensure that they are operating as intended. Inspect basins during and after storms to determine if the basin is meeting the expected detention times. Inspect the outlet structure for evidence of clogging or outflow release velocities that are greater than design flow. Potential problems that should be checked include: subsidence, erosion, cracking or tree growth on the embankment; damage to the emergency spillway; sediment accumulation around the outlet; inadequacy of the inlet/outlet channel erosion control measures; changes in the condition of the pilot channel; and erosion within the basin and banks. Make any necessary repairs immediately. During inspections, note changes to the detention basin or the contributing watershed because these changes could affect basin performance. Mow the side slopes, embankment, and emergency spillway at least twice per year. Remove trash and debris at this time. Remove sediment from the basin as necessary, and at least once every 10 years or when the basin is 50% full. Provide for an on-site sediment disposal area to reduce the overall sediment removal costs.

Resources:

MassHighway. Stormwater handbook for Highways and Bridges. May 2004.
T.R. Schueler. Center for Watershed Protection. Design of Stormwater Pond Systems. 1996.

D – Infiltrator Chamber Bed

This site contains one infiltrator chamber beds which should be regularly maintained.

Maintenance requirements consist of cleaning off the outlet grate cover to prevent blockage of overflow and undesirables from entering the infiltration system.

The infiltration chamber bed is shown on the BMP ID Plan labelled IC.

Date	Inspector	Notes
_____	_____	_____
_____	_____	_____
_____	_____	_____
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E – Outlet Protection

This site contains six outlet protection areas, one on each of the basins. Each are crucial to the function of the basins, and must be maintained regularly.

Maintenance requirements are on the following page.

The outlet protection locations are at the outlets of the infiltration basins. All outlet protection locations should be inspected in one visit and if work is required, refer to the ID Plan to identify which outlet needs maintenance.

Date	Inspector	Notes

F – Culverts

This site contains nine culverts which must be regularly inspected and maintained. Culverts must be inspected after every major rain event, and all debris must be cleared from the inlet/outlet of each culvert to ensure maximum flow through each culvert. Each culvert should be visually inspected for any structural damage, and should be repaired/replaced accordingly.

The culvert locations are shown on the BMP ID plan and are labelled as C1-C9. All culverts should be inspected during one visit, any maintenance done or needed on the culverts should be logged below with the correct BMP ID.

Date	Inspector	Notes
_____	_____	_____
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G – Catch Basin

This site contains one catch basin preceding the infiltration chamber bed and is to be regularly maintained.

Maintenance requirements are listed on the following sheet.

The catch basin precedes the infiltration chamber bed, shown on the BMP ID Plan as ‘IC’.

Date	Inspector	Notes
_____	_____	_____
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_____	_____	_____

Maintenance

Activity	Frequency
Inspect units	Four times per year
Clean units	Four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.

Maintenance

Regular maintenance is essential. Deep sump catch basins remain effective at removing pollutants only if they are cleaned out frequently. One study found that once 50% of the sump volume is filled, the catch basin is not able to retain additional sediments.

Inspect or clean deep sump basins at least four times per year and at the end of the foliage and snow-removal seasons. Sediments must also be removed four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin. If handling runoff from land uses with higher potential pollutant loads or discharging runoff near or to a critical area, more frequent cleaning may be necessary.

Clamshell buckets are typically used to remove sediment in Massachusetts. However, vacuum trucks are preferable, because they remove more trapped sediment and supernatant than clamshells. Vacuuming is also a speedier process and is less likely to snap the cast iron hood within the deep sump catch basin.

Always consider the safety of the staff cleaning deep sump catch basins. Cleaning a deep sump catch basin within a road with active traffic or even within a parking lot is dangerous, and a police detail may be necessary to safeguard workers.

Although catch basin debris often contains concentrations of oil and hazardous materials such as petroleum hydrocarbons and metals, MassDEP classifies them as solid waste. Unless there is evidence that they have been contaminated by a spill or other means, MassDEP does not routinely require catch basin cleanings to be tested before disposal. Contaminated catch basin cleanings must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000, and handled as hazardous waste.

In the absence of evidence of contamination, catch basin cleanings may be taken to a landfill or other facility permitted by MassDEP to accept solid waste, without any prior approval by MassDEP. However, some landfills require catch basin cleanings to be tested before they are accepted.

With prior MassDEP approval, catch basin cleanings may be used as grading and shaping materials at landfills undergoing closure (see Revised Guidelines for Determining Closure Activities at Inactive Unlined Landfill Sites) or as daily cover at active landfills. MassDEP also encourages the beneficial reuse of catch basin cleanings whenever possible. A Beneficial Reuse Determination is required for such use.

MassDEP regulations prohibit landfills from accepting materials that contain free-draining liquids. One way to remove liquids is to use a hydraulic lift truck during cleaning operations so that the material can be decanted at the site. After loading material from several catch basins into a truck, elevate the truck so that any free-draining liquid can flow back into the structure. If there is no free water in the truck, the material may be deemed to be sufficiently dry. Otherwise the catch basin cleanings must undergo a Paint Filter Liquids Test. Go to www. Mass.gov/dep/recycle/laws/cafacts.doc for information on all of the MassDEP requirements pertaining to the disposal of catch basin cleanings.

H – Silt Fencing

Below, log the inspection of all silt fencing on site, which surrounds the area of disturbance and prevents silt-laden runoff from escaping the site. It is important to be inspected and maintained regularly, with any deficiencies corrected immediately to prevent unnecessary erosion pollution.

Date	Amount	Type
_____	_____	_____
_____	_____	_____
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_____	_____	_____

I - De-Icing Log

Below, log the amount and type of de-icing materials applied to the site during the winter months.

Date	Amount	Type
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
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J – Invasive Species

If any invasive species begin to grow in the stormwater management practices, immediately call GRAZ Engineering (603)-585-6959 to be advised on actions to be taken regarding the specific invasive species.

K - Vegetated Filter Strip

This site contains a vegetated filter strip. This filter strip pretreats stormwater prior to entry into the rain garden and must be maintained.

Maintenance requirements are on the following page.

Filter Strip shown on BMP ID Plan as ‘FS’.

Date	Inspector	Notes
_____	_____	_____
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_____	_____	_____

Protect the area to be used for the filter strip by using upstream sediment traps.

Use as much of the existing topsoil on the site as possible to enhance plant growth.

Maintenance

Regular maintenance is critical for filter strips to be effective and to ensure that flow does not short-circuit the system. Conduct semi-annual inspections during the first year (and annually thereafter). Inspect the level spreader for sediment buildup and the vegetation for signs of erosion, bare spots, and overall health. Regular, frequent mowing of the grass is required. Remove sediment from the toe of slope or level spreader, and reseed bare spots as necessary. Periodically, remove sediment that accumulates near the top of the strip to maintain the appropriate slope and prevent formation of a "berm" that could impede the distribution of runoff as sheet flow.

When the filter strip is located in the buffer zone to a wetland resource area, the operation and maintenance plan must include strict measures to ensure that maintenance operations do not alter the wetland resource areas. Please note, filter strips are restricted to the outer 50 feet of the buffer zone.

Cold Climate Considerations

In cold climates such as Massachusetts, the depth of soil media that serves as the planting bed must extend below the frost line to minimize the effects of freezing. Avoid using peat and compost media, which retain water and freeze during the winter, and become impermeable and ineffective.

References:

Center for Watershed Protection, Stormwater Management Fact Sheet: Grassed Filter Strip, http://www.stormwatercenter.net/Assorted%20Fact%20Sheets/Tool6_Stormwater_Practices/Filtering%20Practice/Grassed%20Filter%20Strip.htm

Claytor, R.A. and T.R. Schueler. 1996. Design of Stormwater Filtering Systems. Center for Watershed Protection. Silver Spring, Maryland.

Connecticut Department of Environmental Protection. 2004. Connecticut Stormwater Quality Manual.

International Stormwater BMP Database, Biofilter – Grass Strip, http://www.bmpdatabase.org

Knox County, Stormwater Management Manual, Volume 2, Section 4.3.9, Filter Strip, Pp. 4-155 to 4-164, http://knoxcounty.org/stormwater/pdfs/vol2/4-3-9%20Filter%20Strip.pdf

Knoxville, City of, 2003, Knoxville BMP Manual Stormwater Treatment, Filter Strips and Swales, Practice No. ST – 05, http://www.ci.knoxville.tn.us/engineering/bmp_manual/ST-05.pdf

Maine Department of Environmental Protection. 2006, Maine Stormwater Best Management Practices Manual, Chapter 5, Pp. 5-1 to 5-18, http://www.maine.gov/dep/blwq//docstand/stormwater/stormwaterbmps/vol3/chapter5.pdf

Maryland Department of the Environment, 2000, Maryland Stormwater Design Manual, Volume I, Chapter 2, Unified Sizing Criteria, P. 2.39, http://www.mde.state.md.us/assets/document/chapter2.pdf

Massachusetts Highway Department. 2004. Storm Water Handbook for Highways and Bridges.

Metropolitan Council. 2001. Minnesota Urban Small Sites BMP Manual: Stormwater Best Management Practices for Cold Climates. Prepared by Barr Engineering Company. St. Paul, Minnesota.

New Jersey Department of Environmental Protection, 2004, Best Management Practice Manual, Chapter 9.10, Standard for Vegetated Filter Strip, Pp. 9.10-1 to 9.11-10, http://www.njstormwater.org/tier_A/pdf/NJ_SWBMP_9.10.pdf

New York State Department of Environmental Conservation (NYDEC). 2001. New York State Stormwater Management Design Manual. Prepared by Center for Watershed Protection. Albany, New York.

United States Environmental Protection Agency (EPA). 1999. Preliminary Data Summary of Urban Storm Water Best Management Practices. EPA 821-R99-012.

L - Rain Garden

This site contains a rain garden. This rain garden treats stormwater prior to discharge and eventual flow into wetlands, and must be maintained regularly.

Maintenance requirements are on the following page.

Rain Garden shown on BMP ID Plan as ‘RG’.

Date	Inspector	Notes

On-site soil mixing or placement is not allowed if soil is saturated or subject to water within 48 hours. Cover and store soil to prevent wetting or saturation.

Test soil for fertility and micro-nutrients and, only if necessary, amend mixture to create optimum conditions for plant establishment and early growth.

Grade the area to allow a ponding depth of 6 to 8 inches; depending on site conditions, more or less ponding may be appropriate.

Cover the soil with 2 to 3 inches of fine-shredded hardwood mulch.

The planting plan shall include a mix of herbaceous perennials, shrubs, and (if conditions permit) understory trees that can tolerate intermittent ponding, occasional saline conditions due to road salt, and extended dry periods. A list of plants that are suitable for bioretention areas can be found at the end of this section. To avoid a monoculture, it is a good practice to include one tree or shrub per 50 square feet of bioretention area, and at least 3 species each of herbaceous perennials and shrubs. Invasive and exotic species are prohibited. The planting plan should also meet any applicable local landscaping requirements.

All exfiltrating bioretention areas must be designed to drain within 72 hours. However, rain gardens are typically designed to drain water within a day and are thus unlikely to breed mosquitoes.

Bioretention cells, including rain gardens, require pretreatment, such as a vegetated filter strip. A stone or pea gravel diaphragm or, even better, a concrete level spreader upstream of a filter strip will enhance sheet flow and sediment removal.
Bioretention cells can be dosed with sheet flow, a surface inlet, or pipe flow. When using a surface inlet, first direct the flow to a sediment forebay. Alternatively, piped flow may be introduced to the bioretention system via an underdrain.

For bioretention cells dosed via sheet flow or surface inlets, include a ponding area to allow water to pond and be stored temporarily while stormwater is exfiltrating through the cell. Where bioretention areas are adjacent to parking areas, allow three inches of freeboard above the ponding depth to prevent flooding.

Most bioretention cells have an overflow drain that allows ponded water above the selected ponding depth to be dosed to an underdrain. If the bioretention system is designed to exfiltrate, the underdrain is not connected to an outlet, but instead terminates in the bioretention cell. If the bioretention area is not designed to exfiltrate, the underdrain is connected to an outlet for discharge or conveyance to additional best management practices.

Construction

During construction, avoid excessively compacting soils around the bioretention areas and accumulating silt around the drain field. To minimize sediment loading in the treatment area, direct runoff to the bioretention area only from areas that are stabilized; always divert construction runoff elsewhere.

To avoid compaction of the parent material, work from the edge of the area proposed as the location of an exfiltrationg bioretention cell. Never direct runoff to the cell until the cell and the contributing drainage areas are fully stabilized.

Place planting soils in 1-foot to 2-foot lifts and compact them with minimal pressure until the desired elevation is reached. Some engineers suggest flooding the cell between each lift placement in lieu of compaction.

Maintenance

Premature failure of bioretention areas is a significant issue caused by lack of regular maintenance. Ensuring long-term maintenance involves sustained public education and deed restrictions or covenants for privately owned cells. Bioretention areas require careful attention while plants are being established

Bioretention Maintenance Schedule

Activity	*Time of Year*	*Frequency*
Inspect & remove trash	Year round	Monthly
Mulch	Spring	Annually
Remove dead vegetation	Fall or Spring	Annually
Replace dead vegetation	Spring	Annually
Prune	Spring or Fall	Annually
Replace entire media & all vegetation	Late Spring/early Summer	As needed*

** Paying careful attention to pretreatment and operation & maintenance can extend the life of the soil media*

and seasonal landscaping maintenance thereafter.

In many cases, a landscaping contractor working elsewhere on the site can complete maintenance tasks. Inspect pretreatment devices and bioretention cells regularly for sediment build-up, structural damage, and standing water.

Inspect soil and repair eroded areas monthly. Re-mulch void areas as needed. Remove litter and debris monthly. Treat diseased vegetation as needed. Remove and replace dead vegetation twice per year (spring and fall).

Proper selection of plant species and support during establishment of vegetation should minimize—if not eliminate—the need for fertilizers and pesticides. Remove invasive species as needed to prevent these species from spreading into the bioretention area. Replace mulch every two years, in the early spring. Upon failure, excavate bioretention area, scarify bottom and sides, replace filter fabric and soil, replant, and mulch. A summary of maintenance activities can be found on the previous page.

Because the soil medium filters contaminants from runoff, the cation exchange capacity of the soil media will eventually be exhausted. When the cation exchange capacity of the soil media decreases, change the soil media to prevent contaminants from migrating to the groundwater, or from being discharged via an underdrain outlet. Using small shrubs and plants instead of larger trees will make it easier to replace the media with clean material when needed.

Plant maintenance is critical. Concentrated salts in roadway runoff may kill plants, necessitating removal of dead vegetation each spring and replanting. The operation and maintenance plan must include measures to make sure the plants are maintained. This is particularly true in residential subdivisions, where the operation and maintenance plan may assign each homeowner the legal responsibility to maintain a bioretention cell or rain garden on his or her property. Including the requirement in the property deed for new subdivisions may alert residential property owners to their legal responsibilities regarding the bioretention cells constructed on their lot.

Cold Climate Considerations

Never store snow in bioretention areas. The Operation and Maintenance plan must specify where on-site snow will be stored. All snow dumps must comply with MassDEP's guidance. When bioretention areas are located along roads, care must be taken during plowing operations to prevent snow from being plowed into the bioretention areas. If snow is plowed into the cells, runoff may bypass the cell and drain into downgradient wetlands without first receiving the required water quality treatment, and without recharging the groundwater.

References

Center for Watershed Protection, 2000, Bioretention as a Water Quality Best Management Practice, Article 110 from Watershed Protection Techniques; http://www.cwp.org/Downloads/ELC_PWP110.pdf

Federal Highway Administration , YEAR, Bioretention Fact Sheet, http://www.fhwa.dot.gov/environment/

Low Impact Development Center, 2003, Drainage – Bioretention Specification, http://www.lowimpactdevelopment.org/epa03/biospec.htm

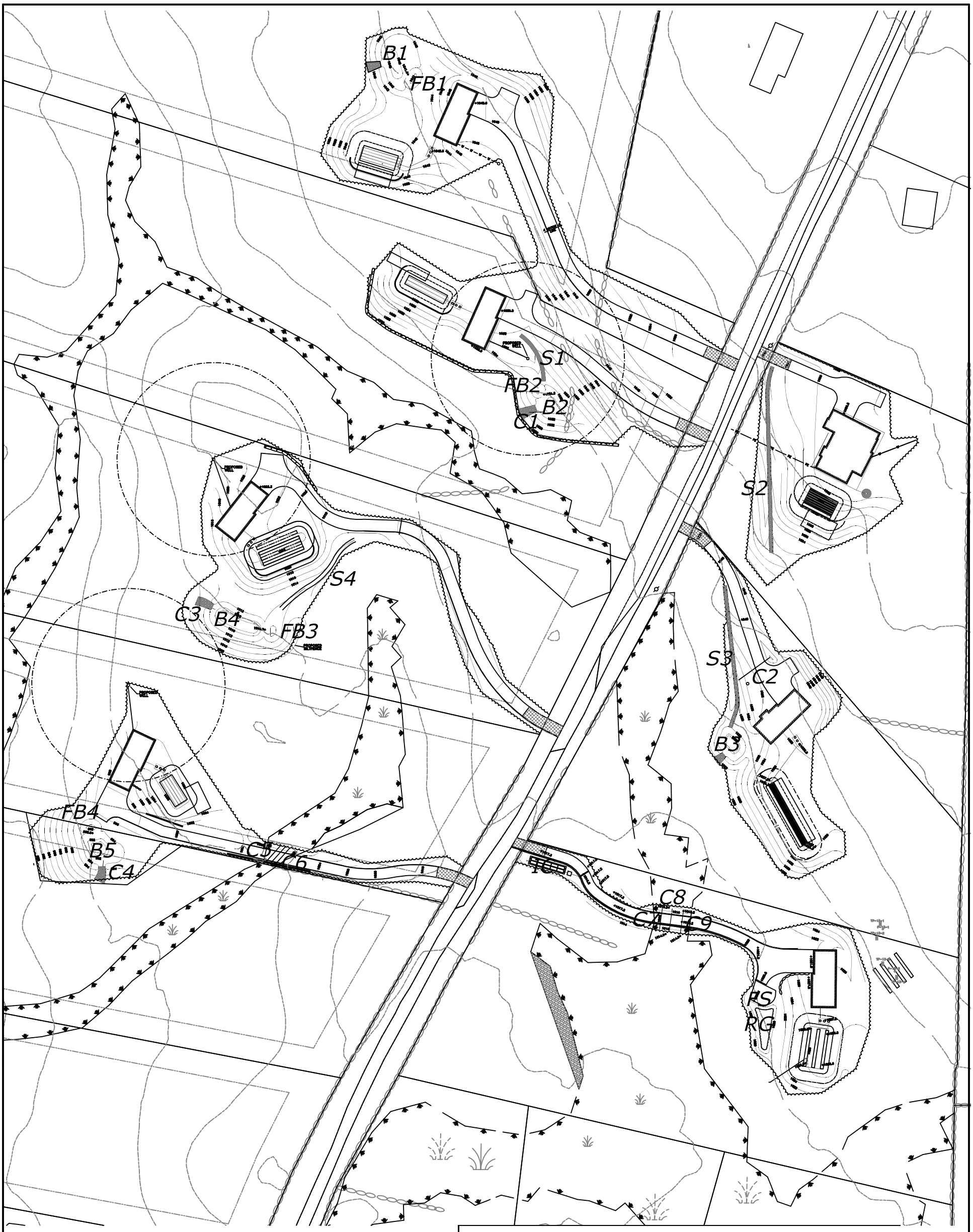
Prince Georges County, 2002, Bioretention Manual, http://www.goprincegeorgescounty.com/der/bioretention.asp

Puget Sound Action Team, 2005, Low Impact Development, Pp. 174 - 184 http://www.psat.wa.gov/Publications/LID_tech_manual05/LID_manual2005.pdf

U.S. Environmental Protection Agency, 1999, Stormwater Technology Fact Sheet, Bioretention, EPA 832-F-99-012, http://www.epa.gov/owm/mtb/biortn.pdf

U.S. Environmental Protection Agency, 2005, National Management Measures to Control Nonpoint Source Pollution from Urban Areas, Publication Number EPA 841-B-05-004, Pp. 5-29 http://www.epa.gov/nps/urbanmm/

University of North Carolina, www.bae.ncsu.edu/topic/bioretention www.bae.ncsu.edu/stormwater/PublicationFiles/DesigningRainGardens2001.pdf



S1	SWALE
B1	BASIN
C1	CULVERT
FB1	SEDIMENT FOREBAY
RG	RAIN GARDEN
FS	VEGETATED FILTER STRIP

REVISED 12-28-22

PROPOSED CONDITION DRAINAGE PLAN

DOYLE AVENUE RESIDENTIAL A-N-R LOTS
WINCHENDON, MA

OWNERS:
ASHER CONSTRUCTION, LLC
77 NASHUA ROAD
SHARON, NH 03458

OCTOBER 20, 2022

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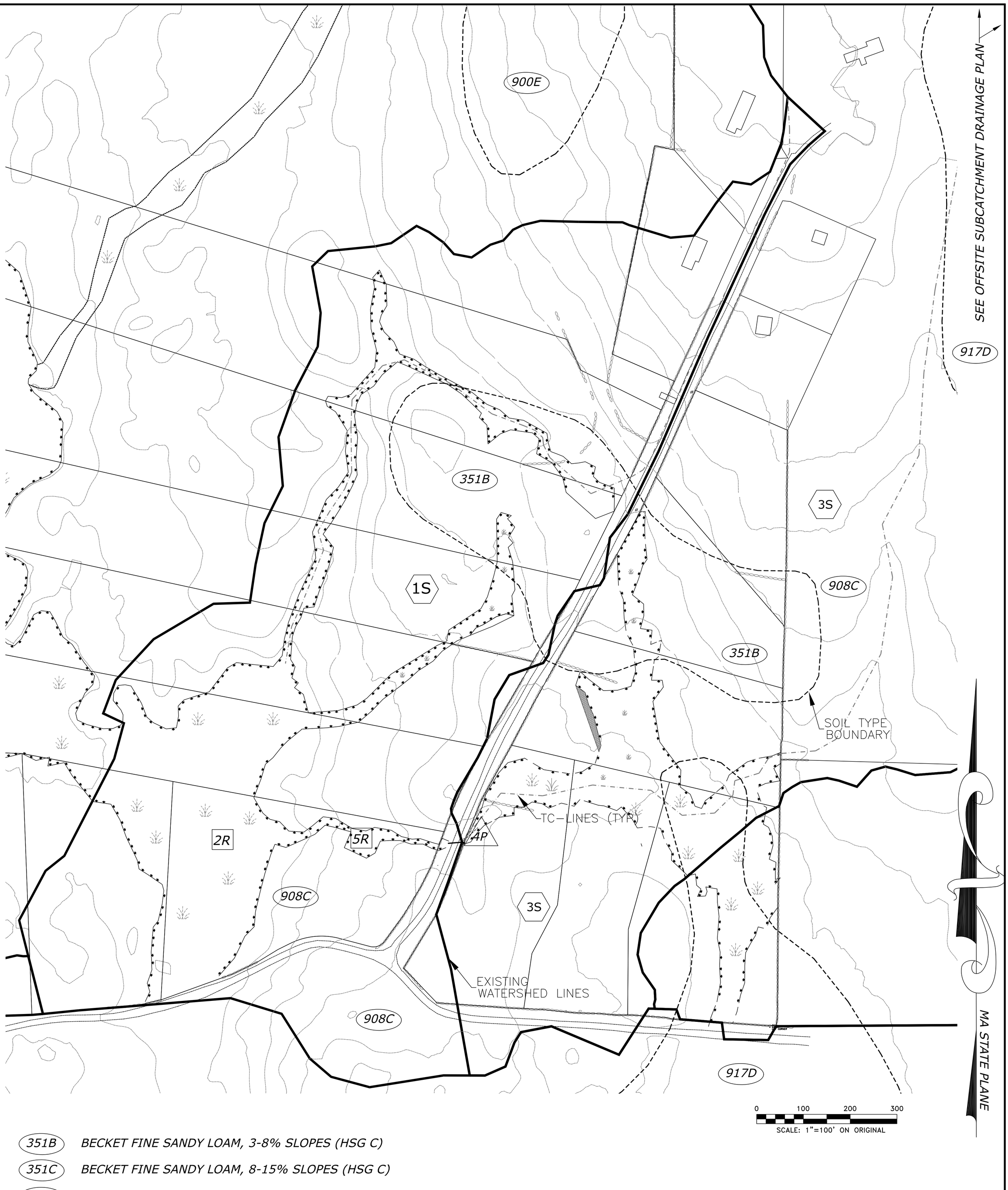

351B BECKET FINE SANDY LOAM, 3-8% SLOPES (HSG C)

351C BECKET FINE SANDY LOAM, 8-15% SLOPES (HSG C)

365B SKERRY FINE SANDY LOAM, 3-8% SLOPES (HSG C/D)

900E BEKCET-MONADNOCK ASSOC, 15-45% SLOPES (HSG B)

908C BECKET-SKERRY ASSOC, 0-15% SLOPES (HSG C)

917B PILLSBURY-PEACHAM ASSOC, 0-8% SLOPES (HSG C/D)

3S SUBCATCHMENT (TYP)

8P POND (TYP)

20R REACH (TYP)

REVISED 12/28/22

EXISTING CONDITION DRAINAGE PLAN

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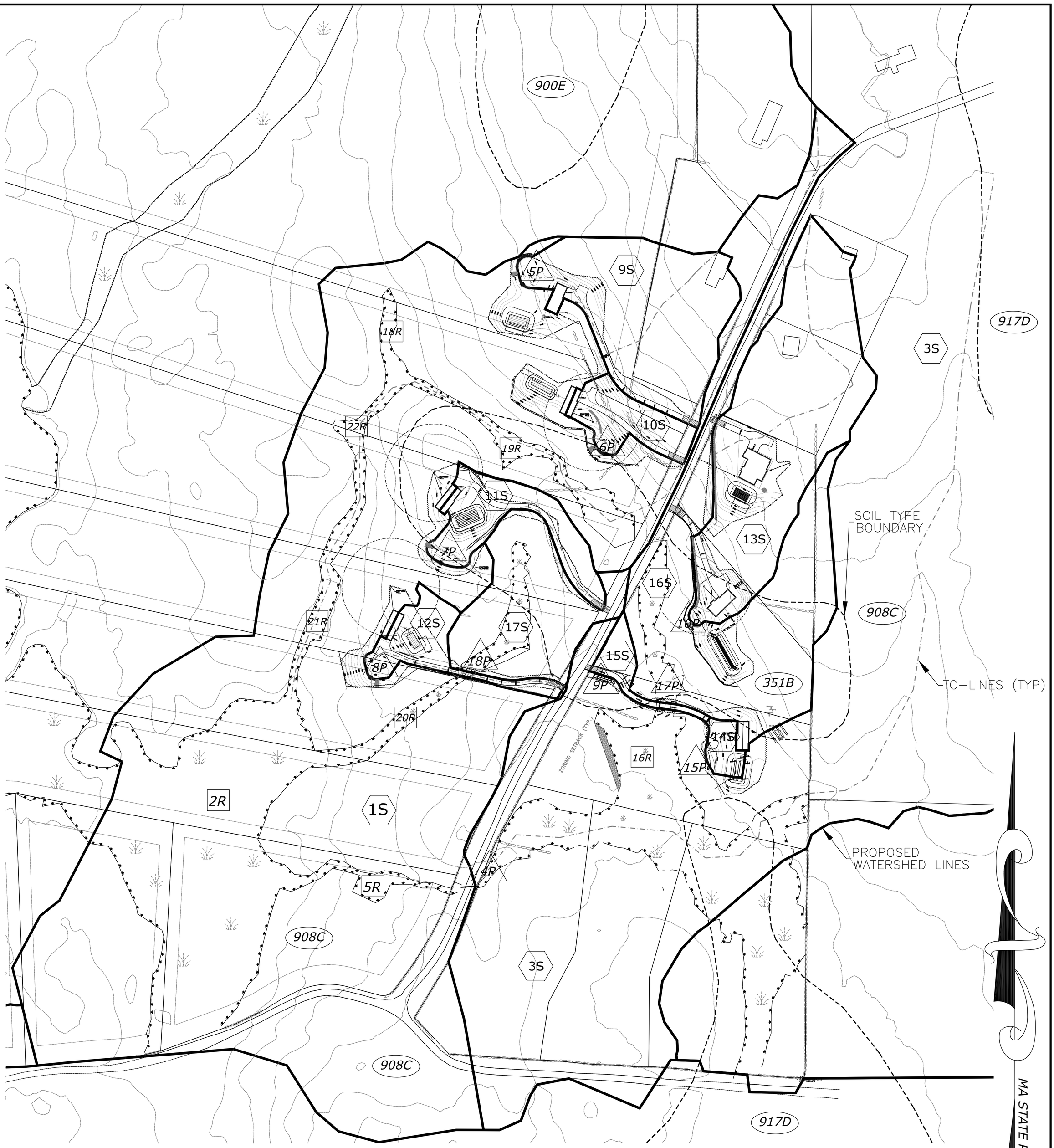

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3S SUBCATCHMENT (TYP)

8P POND (TYP)

20R REACH (TYP)

REVISED 12/28/22

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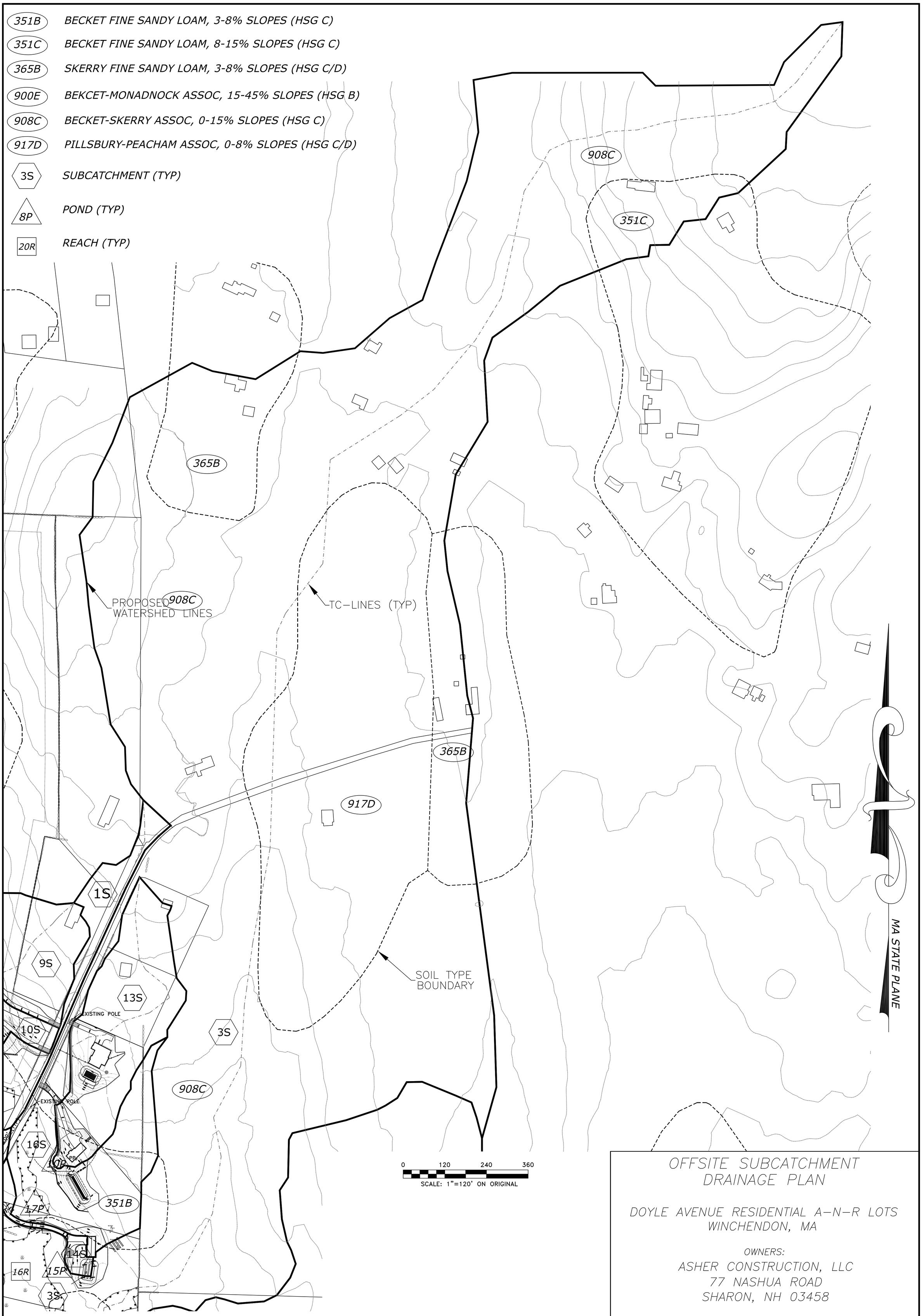

OFFSITE SUBCATCHMENT DRAINAGE PLAN

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