Planning Decision Petition

Zoning Board of Appeals

- ☐ Special Permit(s)
- ☐ Variance
- ☐ Administrative Appeal
- ☐ Comprehensive Permit

Planning Board

- ☐ Site Plan Approval
- ☐ ANR endorsement
- ☐ Preliminary Subdivision Approval
- ☐ Definitive Subdivision Approval
- ☐ Special Permit(s)
- ☒ Stormwater Management Permit

Fee Rec'd

An additional fee will be due for advertising

Project Number

Submission Materials to be included with this Petition Form are outlined in the Town of Winchendon Zoning Bylaws and the Planning Board Regulations. This application shall not be deemed complete unless all required items are included or appropriate waivers have been requested.

Property Address	Doyle Avenue	Date	October 24, 2022
Property Owner's Name	Asher Construction, LLC		
Owner's Address	77 Nashua Road; Sharon, NH 03458	Book	67401 Page: 36
		Map	8 Lots-6, 14, 235-247
Petitioner's name	Asher Construction, LLC	Lot Size	Varies, see A-N-R
Petitioner's Phone No.	603-924-9424	Frontage	Varies, see A-N-R
Petitioner's address	77 Nashua Road; Sharon, NH 03458	Zone	R80

Project Summary & Decision Sought: We are proposing 7 single-family house on lots created by two approved A-N-R plans and are seeking Stormwater Management approval.

I hereby certify that the information provided in this application, and the accompanying drawing(s) of the property as well as any supporting datea are accurate, true and correct to the best of my knowledge and belief.

Signature of Applicant (or their representative) — Date: 10-25-22

Signature of Property Owner — Date: 10-25-22

Tax Certification (Treasurer has up to 10 days to complete this certification):

Pursuant to the provisions of Massachusetts General Law, Chapter 40, Section 57, the Town Bylaw, Licenses and Permits of Delinquent Taxpayer, Section 21.1: "Any Board… shall deny application… for any person, corportation or busienss enterprise who has neglected to pay any local taxes, fees, assessments, betterments or any municipal charge."

I hereby certify that the applicant or the owner of record owes no debt to the Town of Winchendon for a period of time greater than twelve (12) months.

Winchendon Treasurer — Date

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. Soil testing will be conducted in the near future to verify the groundwater elevation & material at each infiltration practice, however for design purposes, the highest groundwater on the lot for each septic was used for design groundwater elevation at the infiltration practice on the corresponding lot.

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 by NRCC Rainfall Data in the area (from Cornell).

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	22.69	57.55	155.06
Post-Construction Wetland	22.27	55.72	152.23
Pre-Construction Culvert*	19.21	47.00	126.73
Post-Construction Culvert*	18.15	44.89	120.18

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.

100 feet Abutters List Report

Winchendon, MA
October 25, 2022

Subject Properties:

Parcel Number:	8-0-14	Mailing Address:	ASHER CONSTRUCTION LLC
CAMA Number:	8-0-14		77 NASHUA RD
Property Address:	DOYLE AV		SHARON, NH 03458
Parcel Number:	8-0-235	Mailing Address:	ASHER CONSTRUCTION LLC
CAMA Number:	8-0-235		77 NASHUA RD
Property Address:	DOYLE AV		SHARON, NH 03458
Parcel Number:	8-0-236	Mailing Address:	ASHER CONSTRUCTION LLC
CAMA Number:	8-0-236		77 NASHUA RD
Property Address:	DOYLE AV		SHARON, NH 03458
Parcel Number:	8-0-6	Mailing Address:	ASHER CONSTRUCTION, LLC
CAMA Number:	8-0-6		77 NASHUA RD
Property Address:	DOYLE AV		SHARON, NH 03458

Abutters:

Parcel Number:	8-0-1	Mailing Address:	WENTWORTH, ROBERT PRESTON, KAREN
CAMA Number:	8-0-1		432 ALGER ST
Property Address:	432 ALGER ST		WINCHENDON, MA 01475
Parcel Number:	8-0-101	Mailing Address:	PAUL, RANDY L. PAUL, REBECCA M.
CAMA Number:	8-0-101		620 ALGER ST
Property Address:	620 ALGER ST		WINCHENDON, MA 01475
Parcel Number:	8-0-110	Mailing Address:	DELLMUTH, KENNETH R. DELLMUTH, LYNN F.
CAMA Number:	8-0-110		29 DOYLE AVENUE
Property Address:	29 DOYLE AV		WINCHENDON, MA 01475
Parcel Number:	8-0-114	Mailing Address:	WILSON, TIMOTHY A. MURPHY, MARJORIE T.
CAMA Number:	8-0-114		520 ALGER STREET
Property Address:	520 ALGER ST		WINCHENDON, MA 01475
Parcel Number:	8-0-116	Mailing Address:	JANHUNEN, KARL JANHUNEN, DENISE
CAMA Number:	8-0-116		576 ALGER STREET
Property Address:	576 ALGER ST		WINCHENDON, MA 01475
Parcel Number:	8-0-12	Mailing Address:	MURPHY, H.J. & J.L. C/O MICHAEL MURPHY
CAMA Number:	8-0-12		281 HITCHCOCK ROAD
Property Address:	DOYLE AV		WINCHENDON, MA 01475

100 feet Abutters List Report

Winchendon, MA
October 25, 2022

Parcel Number:	8-0-122	Mailing Address:	FLEURANT, JOSEPH F. FLEURANT, BONNIE A. 560 ALGER STREET WINCHENDON, MA 01475
CAMA Number:	8-0-122		
Property Address:	560 ALGER ST		
Parcel Number:	8-0-13	Mailing Address:	BISHOP, GLENDA A. 36 DOYLE AVENUE WINCHENDON, MA 01475
CAMA Number:	8-0-13		
Property Address:	36 DOYLE AV		
Parcel Number:	8-0-14	Mailing Address:	ASHER CONSTRUCTION LLC 77 NASHUA RD SHARON, NH 03458
CAMA Number:	8-0-14		
Property Address:	DOYLE AV		
Parcel Number:	8-0-15	Mailing Address:	DOODY, DAVID A. 361 HITCHCOCK RD WINCHENDON, MA 01475
CAMA Number:	8-0-15		
Property Address:	361 HITCHCOCK RD		
Parcel Number:	8-0-157	Mailing Address:	DURLING, DAVID A. DURLING, TINA L. 606 ALGER STREET WINCHENDON, MA 01475
CAMA Number:	8-0-157		
Property Address:	606 ALGER ST		
Parcel Number:	8-0-2	Mailing Address:	ARSENAULT, MICHAEL M. 476 ALGER STREET WINCHENDON, MA 01475
CAMA Number:	8-0-2		
Property Address:	476 ALGER ST		
Parcel Number:	8-0-235	Mailing Address:	ASHER CONSTRUCTION LLC 77 NASHUA RD SHARON, NH 03458
CAMA Number:	8-0-235		
Property Address:	DOYLE AV		
Parcel Number:	8-0-236	Mailing Address:	ASHER CONSTRUCTION LLC 77 NASHUA RD SHARON, NH 03458
CAMA Number:	8-0-236		
Property Address:	DOYLE AV		
Parcel Number:	8-0-237	Mailing Address:	ASHER CONSTRUCTION LLC 77 NASHUA RD SHARON, NH 03458
CAMA Number:	8-0-237		
Property Address:	DOYLE AV		
Parcel Number:	8-0-238	Mailing Address:	ASHER CONSTRUCTION LLC 77 NASHUA RD SHARON, NH 03458
CAMA Number:	8-0-238		
Property Address:	DOYLE AV		
Parcel Number:	8-0-239	Mailing Address:	ASHER CONSTRUCTION LLC 77 NASHUA RD SHARON, NH 03458
CAMA Number:	8-0-239		
Property Address:	DOYLE AV		
Parcel Number:	8-0-3	Mailing Address:	SAWYER, CHRISTOPHER SAWYER, HALEY 16 SOUTH ROAD SALISBURY, NH 03268
CAMA Number:	8-0-3		
Property Address:	ALGER ST		

100 feet Abutters List Report

Winchendon, MA
October 25, 2022

Parcel Number:	8-0-5	Mailing Address:	COMMUNITY RESOURCES FOR JUSTICE 79 CHANDLER STREET BOSTON, MA 02116
CAMA Number:	8-0-5		
Property Address:	680 ALGER ST		
Parcel Number:	8-0-8	Mailing Address:	HUGHES, RUSSELL T. HUGHES, BARBARA A. 35 DOYLE AVENUE WINCHENDON, MA 01475
CAMA Number:	8-0-8		
Property Address:	35 DOYLE AV		
Parcel Number:	8A1-0-28	Mailing Address:	GARNO, RICHARD E. GARNO, DOLORES A. 145 HALE STREET WINCHENDON, MA 01475
CAMA Number:	8A1-0-28		
Property Address:	HALE ST		
Parcel Number:	8A1-0-33	Mailing Address:	PFEIFLE, RAYMOND G. III PFEIFLE, MARIA L. 157 HALE STREET WINCHENDON, MA 01475
CAMA Number:	8A1-0-33		
Property Address:	157 HALE ST		
Parcel Number:	8A1-0-34	Mailing Address:	161 HALE ST REALTY TRUST PFEIFLE, BRIAN T. SR LE 161 HALE STREET WINCHENDON, MA 01475
CAMA Number:	8A1-0-34		
Property Address:	161 HALE ST		
Parcel Number:	8A1-0-35	Mailing Address:	LEGER MATTHEW S 181 HALE ST WINCHENDON, MA 01475
CAMA Number:	8A1-0-35		
Property Address:	181 HALE ST		
Parcel Number:	8A1-0-36	Mailing Address:	PFEIFLE, BRIAN T JR & THERESA 245 HALE STREET WINCHENDON, MA 01475
CAMA Number:	8A1-0-36		
Property Address:	HALE ST		

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".

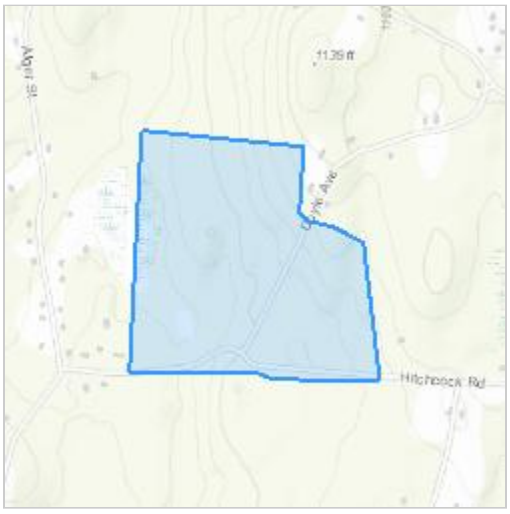
This species list is provided by:

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

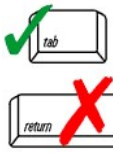
Agency: Graz Engineering
Name: Trevor Fletcher
Address: 323 W Lake Road
City: Fitzwilliam
State: NH
Zip: 03447
Email trevorfletcher91@yahoo.com
Phone: 6035856959

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.

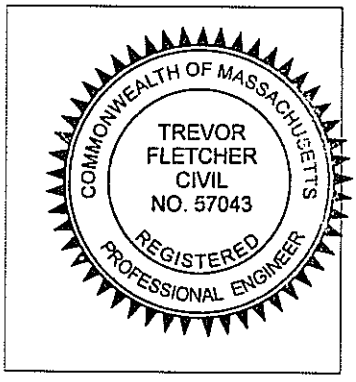
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

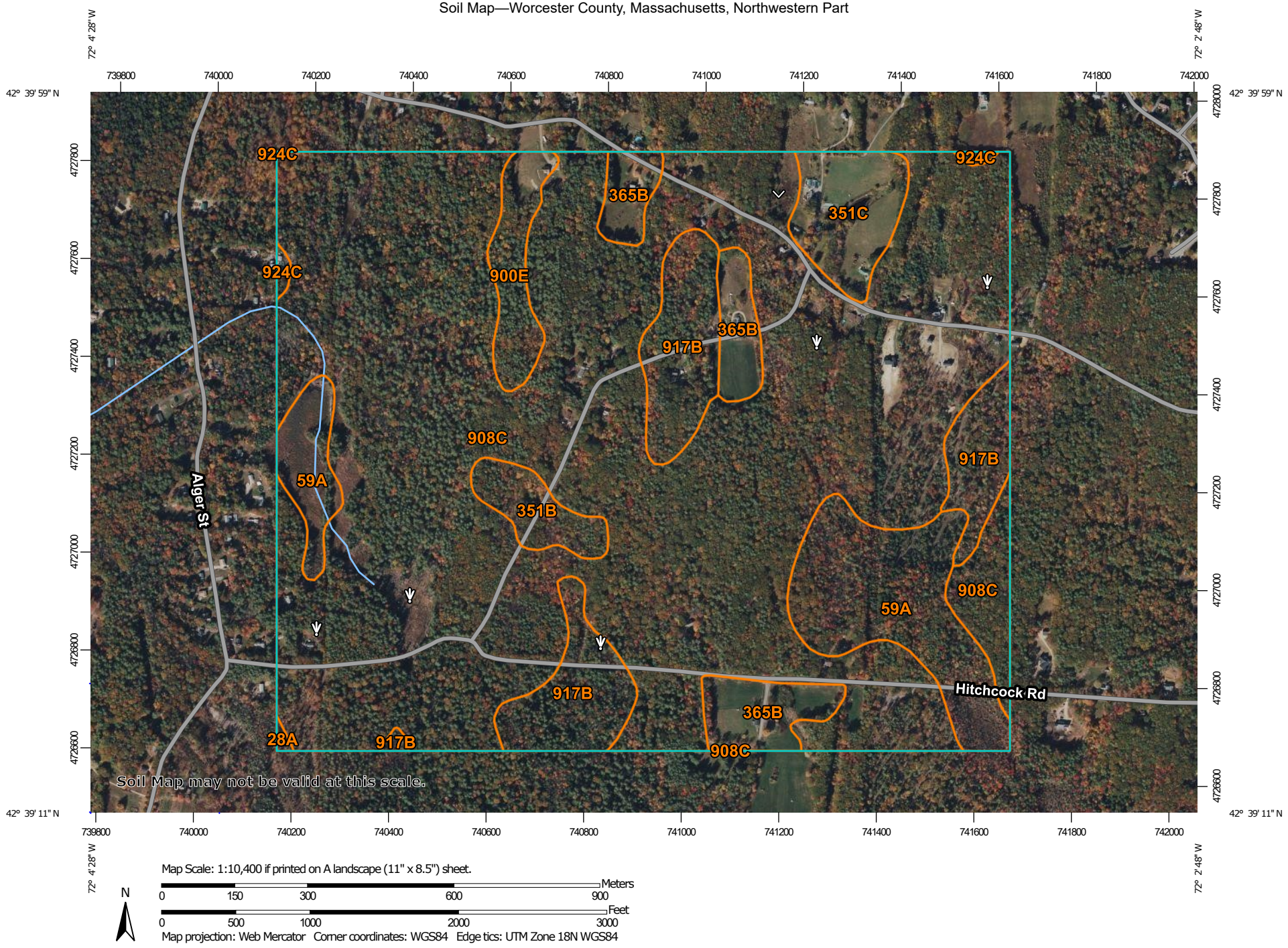
Standard 10: Prohibition of Illicit Discharges

☒ 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%**

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	Massachusetts
Location	
Longitude	72.063 degrees West
Latitude	42.658 degrees North
Elevation	0 feet
Date/Time	Mon, 24 Oct 2022 16:57:01 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.29	0.44	0.55	0.72	0.90	1.12	**1yr**	0.78	1.03	1.29	1.61	1.99	2.46	2.71	**1yr**	2.18	2.61	3.02	3.69	4.32	**1yr**
2yr	0.35	0.53	0.66	0.87	1.10	1.37	**2yr**	0.95	1.25	1.58	1.95	2.39	2.93	3.29	**2yr**	2.59	3.16	3.67	4.40	5.01	**2yr**
5yr	0.41	0.64	0.80	1.07	1.37	1.73	**5yr**	1.18	1.55	1.99	2.45	2.99	3.64	4.14	**5yr**	3.22	3.98	4.61	5.45	6.16	**5yr**
10yr	0.46	0.72	0.91	1.24	1.62	2.05	**10yr**	1.40	1.83	2.37	2.92	3.55	4.29	4.92	**10yr**	3.80	4.73	5.47	6.42	7.20	**10yr**
25yr	0.55	0.87	1.10	1.52	2.01	2.57	**25yr**	1.74	2.27	2.98	3.67	4.45	5.34	6.20	**25yr**	4.73	5.96	6.87	7.97	8.86	**25yr**
50yr	0.61	0.98	1.26	1.77	2.38	3.07	**50yr**	2.05	2.68	3.56	4.37	5.28	6.31	7.39	**50yr**	5.58	7.10	8.17	9.39	10.36	**50yr**
100yr	0.70	1.13	1.46	2.07	2.82	3.64	**100yr**	2.43	3.16	4.23	5.20	6.27	7.45	8.80	**100yr**	6.60	8.47	9.72	11.07	12.13	**100yr**
200yr	0.80	1.30	1.68	2.41	3.33	4.34	**200yr**	2.88	3.74	5.04	6.19	7.44	8.81	10.50	**200yr**	7.80	10.10	11.56	13.06	14.20	**200yr**
500yr	0.95	1.57	2.05	2.97	4.17	5.45	**500yr**	3.59	4.66	6.34	7.78	9.33	11.00	13.26	**500yr**	9.73	12.75	14.55	16.25	17.50	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.22	0.34	0.42	0.56	0.69	0.92	**1yr**	0.60	0.90	1.07	1.42	1.76	2.22	2.35	**1yr**	1.96	2.26	2.40	3.22	3.86	**1yr**
2yr	0.34	0.52	0.64	0.87	1.07	1.23	**2yr**	0.93	1.20	1.38	1.78	2.26	2.84	3.18	**2yr**	2.52	3.06	3.52	4.25	4.85	**2yr**
5yr	0.38	0.59	0.73	1.00	1.27	1.45	**5yr**	1.10	1.42	1.63	2.09	2.66	3.39	3.79	**5yr**	3.00	3.65	4.17	5.00	5.67	**5yr**
10yr	0.42	0.65	0.80	1.12	1.45	1.64	**10yr**	1.25	1.61	1.83	2.35	2.98	3.86	4.35	**10yr**	3.42	4.18	4.74	5.66	6.37	**10yr**
25yr	0.48	0.73	0.91	1.29	1.70	1.93	**25yr**	1.47	1.89	2.14	2.71	3.46	4.60	5.18	**25yr**	4.07	4.99	5.63	6.70	7.42	**25yr**
50yr	0.52	0.80	0.99	1.43	1.92	2.20	**50yr**	1.66	2.15	2.41	3.02	3.89	5.27	5.96	**50yr**	4.67	5.73	6.43	7.61	8.32	**50yr**
100yr	0.58	0.87	1.09	1.58	2.16	2.49	**100yr**	1.87	2.44	2.71	3.19	4.37	6.05	6.84	**100yr**	5.36	6.58	7.39	8.66	9.36	**100yr**
200yr	0.64	0.96	1.22	1.76	2.45	2.83	**200yr**	2.12	2.77	3.05	3.46	4.92	6.96	7.85	**200yr**	6.16	7.55	8.48	9.89	10.56	**200yr**
500yr	0.74	1.10	1.41	2.05	2.91	3.35	**500yr**	2.51	3.28	3.57	3.90	5.76	8.42	9.49	**500yr**	7.45	9.12	10.26	11.84	12.41	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.32	0.50	0.60	0.81	1.00	1.20	**1yr**	0.86	1.17	1.32	1.67	2.12	2.68	2.96	**1yr**	2.37	2.85	3.23	4.11	4.73	**1yr**
2yr	0.36	0.56	0.69	0.93	1.15	1.32	**2yr**	0.99	1.29	1.48	1.94	2.43	3.04	3.45	**2yr**	2.69	3.31	3.84	4.59	5.25	**2yr**
5yr	0.44	0.67	0.84	1.15	1.46	1.71	**5yr**	1.26	1.67	1.92	2.43	3.05	3.92	4.51	**5yr**	3.47	4.34	5.06	5.93	6.63	**5yr**
10yr	0.51	0.78	0.97	1.36	1.76	2.09	**10yr**	1.52	2.04	2.34	2.95	3.66	4.76	5.55	**10yr**	4.21	5.34	6.24	7.23	7.93	**10yr**
25yr	0.63	0.97	1.20	1.72	2.26	2.73	**25yr**	1.95	2.66	3.05	3.80	4.65	6.13	7.32	**25yr**	5.42	7.04	8.25	9.37	10.11	**25yr**
50yr	0.75	1.14	1.42	2.03	2.74	3.33	**50yr**	2.36	3.25	3.73	4.62	5.58	7.43	9.01	**50yr**	6.58	8.67	10.17	11.39	12.14	**50yr**
100yr	0.88	1.34	1.67	2.42	3.31	4.07	**100yr**	2.86	3.98	4.56	5.69	6.69	9.01	11.11	**100yr**	7.97	10.68	12.52	13.85	14.58	**100yr**
200yr	1.04	1.57	1.98	2.87	4.00	4.97	**200yr**	3.46	4.86	5.58	6.93	8.03	10.92	13.68	**200yr**	9.67	13.15	15.40	16.83	17.50	**200yr**
500yr	1.31	1.94	2.50	3.63	5.17	6.48	**500yr**	4.46	6.34	7.29	9.05	10.22	14.08	18.02	**500yr**	12.46	17.33	20.23	21.75	22.29	**500yr**

Powered by ACIS Northeast Regional Climate Center

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

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

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

(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	**528**	**C.F.**
Lot 14-2 Infil Basin	**214**	**C.F.**
14-2 Chambers	**320**	**C.F.**
Lot-6 Infil Basin	**672**	**C.F.**
Lot-6-1 Infil Basin	**428**	**C.F.**
Lot 6-2 Infil Basin	**666**	**C.F.**
Lot 6-3 Infil Basin	**523**	**C.F.**
Total Recharge	**3,351**	**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:	
207	**30**	**Hours**
117	**22**	**Hours**
317	**12**	**Hours**
242	**33**	**Hours**
232	**22**	**Hours**
907	**9**	**Hours**
338	**18**	**Hours**

Result is satisfactory for design purposes — 33 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 = 1029.33

Stage Storage Volumes

Elevation (Ft.)	Surface Area (Sq.Ft.)	Cum. Storage (Cu. Ft.)		
1028	207	0	1029.33	El. At Req. W.Q.V
1028.5	329	134	←	
1029	450	329	←	1029.4 - El @ Lowest Outlet
1029.5	572	584		
1030	693	900		
1030.5	836	1,282		

Lowest Outlet Elevation= 1,029.40

Supplied Water Quality Volume (Infiltration Basin):	***528 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 = 1015.21

Stage Storage Volumes

Elevation (Ft.)	Surface Area (Sq.Ft.)	Cum. Storage (Cu. Ft.)		
1013.67	317	0	1015.21	El. At Req. W.Q.V
1014.17	317	63	←	
1014.67	317	175	←	1015.5 - El @ Lowest Outlet
1015.17	317	272		
1015.67	317	342		

Lowest Outlet Elevation= 1,015.50

Supplied Water Quality Volume (Infiltration Basin):	***320 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 - 14-2

Required Storage Volume:

Subcatchment	Impervious Area (SF)	Imp. Area x 0.1 in runoff (Cu.Ft.)	
1S	2,536		
	2,536	**22**	**Required Storage**

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

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

Based on a req. storage = 22 (cu.Ft)

Min. Storage El. Req'd= 1019.36

Elevation (Ft.)	Surface Area (Sq.Ft.)	Cum Storage (Cu. Ft.)		
1019	24	0	1020.00	El. At Req. Storage Volume
1019.5	129	38	←	
1020	233	129		
1020.5	412	290		
1021	590	540		

The outlet weir has been designed at elevation: 1,020.00

Supplied Storage Volume: 129 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 Infiltration Basin

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 = 1019.70

Stage Storage Volumes

Elevation (Ft.)	Surface Area (Sq.Ft.)	Cum. Storage (Cu. Ft.)		
1019	117	0	1019.70	El. At Req. W.Q.V
1019.5	388	126	←	
1020	658	388	←	1019.7 - El @ Lowest Outlet
1020.5	996	801		

Lowest Outlet Elevation= 1,019.70

Supplied Water Quality Volume (Infiltration Basin):	***214 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 = 1041.35

Stage Storage Volumes

Elevation (Ft.)	Surface Area (Sq.Ft.)	Cum. Storage (Cu. Ft.)		
1040.5	242	0	1041.35	El. At Req. W.Q.V
1041	803	261	←	
1041.5	1,365	803	←	1041.4 - El @ Lowest Outlet
1042	1,926	1,626		
1042.5	2,441	2,718		

Lowest Outlet Elevation= 1,041.40

Supplied Water Quality Volume (Infiltration Basin):	***672 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 = 1030.91

Stage Storage Volumes

Elevation (Ft.)	Surface Area (Sq.Ft.)	Cum. Storage (Cu. Ft.)		
1030	232	0	1030.91	El. At Req. W.Q.V
1030.5	428	165	←	
1031	624	428	←	1031.0 - El @ Lowest Outlet
1031.5	819	788		
1032	1,015	1,247		
1032.5	1,426	1,857		

Lowest Outlet Elevation= 1,031.00

Supplied Water Quality Volume (Infiltration Basin):	***428 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 = 1010.53

Stage Storage Volumes

Elevation (Ft.)	Surface Area (Sq.Ft.)	Cum. Storage (Cu. Ft.)		
1010	907	0	1010.53	El. At Req. W.Q.V
1010.5	1,246	538	←	
1011	1,584	1,246	←	1010.6 - El @ Lowest Outlet
1011.5	1,923	2,122		
1012	2,261	3,168		
1012.5	2,907	4,460		

Lowest Outlet Elevation= 1,010.60

Supplied Water Quality Volume (Infiltration Basin):	***666 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):

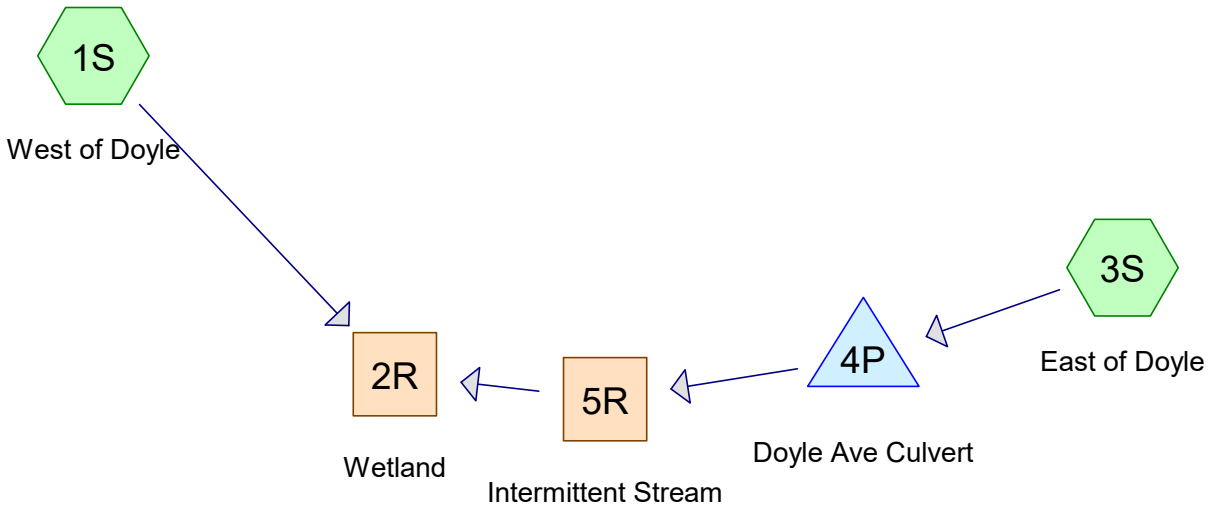
469 Cu. Ft. min. W.Q.V. storage elev req'd = 992.84

Stage Storage Volumes

Elevation (Ft.)	Surface Area (Sq.Ft.)	Cum. Storage (Cu. Ft.)		
992	338	0	992.84	El. At Req. W.Q.V
992.5	608	237	←	
993	879	608	←	992.9 - El @ Lowest Outlet
993.5	1,149	1,115		
994	1,419	1,757		
994.5	1,890	2,584		

Lowest Outlet Elevation= 992.90

Supplied Water Quality Volume (Infiltration Basin):	***523 Cu.Ft.***



Subcat Reach Pond Link

Routing Diagram for Doyle 6 Lots Pre
Prepared by HP, Printed 10/20/2022

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=0.72"
Flow Length=2,241' Slope=0.0610 '/' Tc=31.9 min CN=71 Runoff=13.54 cfs 1.982 af

Subcatchment 3S: East of Doyle Runoff Area=3,662,304 sf 1.39% Impervious Runoff Depth=0.72"
Flow Length=5,506' Slope=0.0350 '/' Tc=86.3 min CN=71 Runoff=19.21 cfs 5.048 af

Reach 2R: Wetland Inflow=22.69 cfs 7.030 af
Outflow=22.69 cfs 7.030 af

Reach 5R: Intermittent Stream Avg. Flow Depth=0.31' Max Vel=6.22 fps Inflow=18.76 cfs 5.048 af
n=0.025 L=394.0' S=0.0878 '/' Capacity=638.10 cfs Outflow=18.76 cfs 5.048 af

Pond 4P: Doyle Ave Culvert Peak Elev=998.40' Storage=4,954 cf Inflow=19.21 cfs 5.048 af
Outflow=18.76 cfs 5.048 af

Total Runoff Area = 117.088 ac Runoff Volume = 7.030 af Average Runoff Depth = 0.72"
98.91% Pervious = 115.811 ac 1.09% Impervious = 1.277 ac

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=1.60"
Flow Length=2,241' Slope=0.0610 '/' Tc=31.9 min CN=71 Runoff=32.84 cfs 4.391 af

Subcatchment 3S: East of Doyle Runoff Area=3,662,304 sf 1.39% Impervious Runoff Depth=1.60"
Flow Length=5,506' Slope=0.0350 '/' Tc=86.3 min CN=71 Runoff=47.01 cfs 11.182 af

Reach 2R: Wetland Inflow=57.55 cfs 15.573 af
Outflow=57.55 cfs 15.573 af

Reach 5R: Intermittent Stream Avg. Flow Depth=0.48' Max Vel=7.94 fps Inflow=47.00 cfs 11.182 af
n=0.025 L=394.0' S=0.0878 '/' Capacity=638.10 cfs Outflow=47.00 cfs 11.182 af

Pond 4P: Doyle Ave Culvert Peak Elev=999.29' Storage=12,612 cf Inflow=47.01 cfs 11.182 af
Outflow=47.00 cfs 11.182 af

Total Runoff Area = 117.088 ac Runoff Volume = 15.573 af Average Runoff Depth = 1.60"
98.91% Pervious = 115.811 ac 1.09% Impervious = 1.277 ac

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=4.11"
Flow Length=2,241' Slope=0.0610 '/' Tc=31.9 min CN=71 Runoff=87.51 cfs 11.294 af

Subcatchment 3S: East of Doyle Runoff Area=3,662,304 sf 1.39% Impervious Runoff Depth=4.11"
Flow Length=5,506' Slope=0.0350 '/' Tc=86.3 min CN=71 Runoff=126.86 cfs 28.762 af

Reach 2R: Wetland Inflow=155.06 cfs 40.056 af
Outflow=155.06 cfs 40.056 af

Reach 5R: Intermittent Stream Avg. Flow Depth=0.76' Max Vel=10.27 fps Inflow=126.73 cfs 28.762 af
n=0.025 L=394.0' S=0.0878 '/' Capacity=638.10 cfs Outflow=126.68 cfs 28.762 af

Pond 4P: Doyle Ave Culvert Peak Elev=999.66' Storage=16,778 cf Inflow=126.86 cfs 28.762 af
Outflow=126.73 cfs 28.762 af

Total Runoff Area = 117.088 ac Runoff Volume = 40.056 af Average Runoff Depth = 4.11"
98.91% Pervious = 115.811 ac 1.09% Impervious = 1.277 ac

Summary for Subcatchment 1S: West of Doyle

Runoff = 32.84 cfs @ 12.47 hrs, Volume= 4.391 af, Depth= 1.60"

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=4.29"

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 = 47.01 cfs @ 13.23 hrs, Volume= 11.182 af, Depth= 1.60"

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=4.29"

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 = 1.60" for 10-Year event
Inflow = 57.55 cfs @ 13.14 hrs, Volume= 15.573 af
Outflow = 57.55 cfs @ 13.14 hrs, Volume= 15.573 af, Atten= 0%, Lag= 0.0 min

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

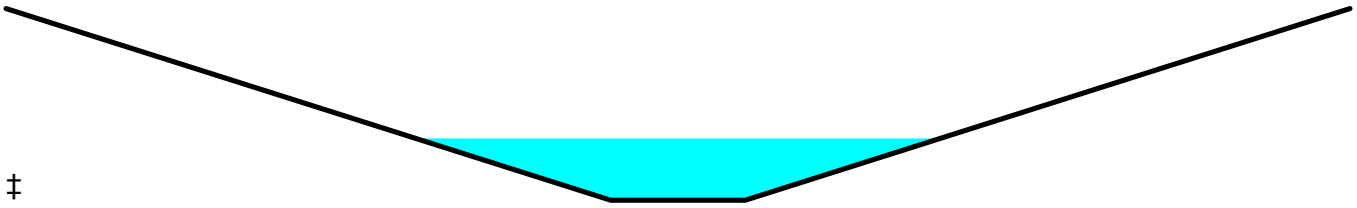
Summary for Reach 5R: Intermittent Stream

Inflow Area = 84.075 ac, 1.39% Impervious, Inflow Depth = 1.60" for 10-Year event
Inflow = 47.00 cfs @ 13.23 hrs, Volume= 11.182 af
Outflow = 47.00 cfs @ 13.24 hrs, Volume= 11.182 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= 7.94 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 3.77 fps, Avg. Travel Time= 1.7 min

Peak Storage= 2,331 cf @ 13.24 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 Pond 4P: Doyle Ave Culvert

Inflow Area = 84.075 ac, 1.39% Impervious, Inflow Depth = 1.60" for 10-Year event
Inflow = 47.01 cfs @ 13.23 hrs, Volume= 11.182 af
Outflow = 47.00 cfs @ 13.23 hrs, Volume= 11.182 af, Atten= 0%, Lag= 0.0 min
Primary = 47.00 cfs @ 13.23 hrs, Volume= 11.182 af

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 999.29' @ 13.23 hrs Surf.Area= 10,635 sf Storage= 12,612 cf

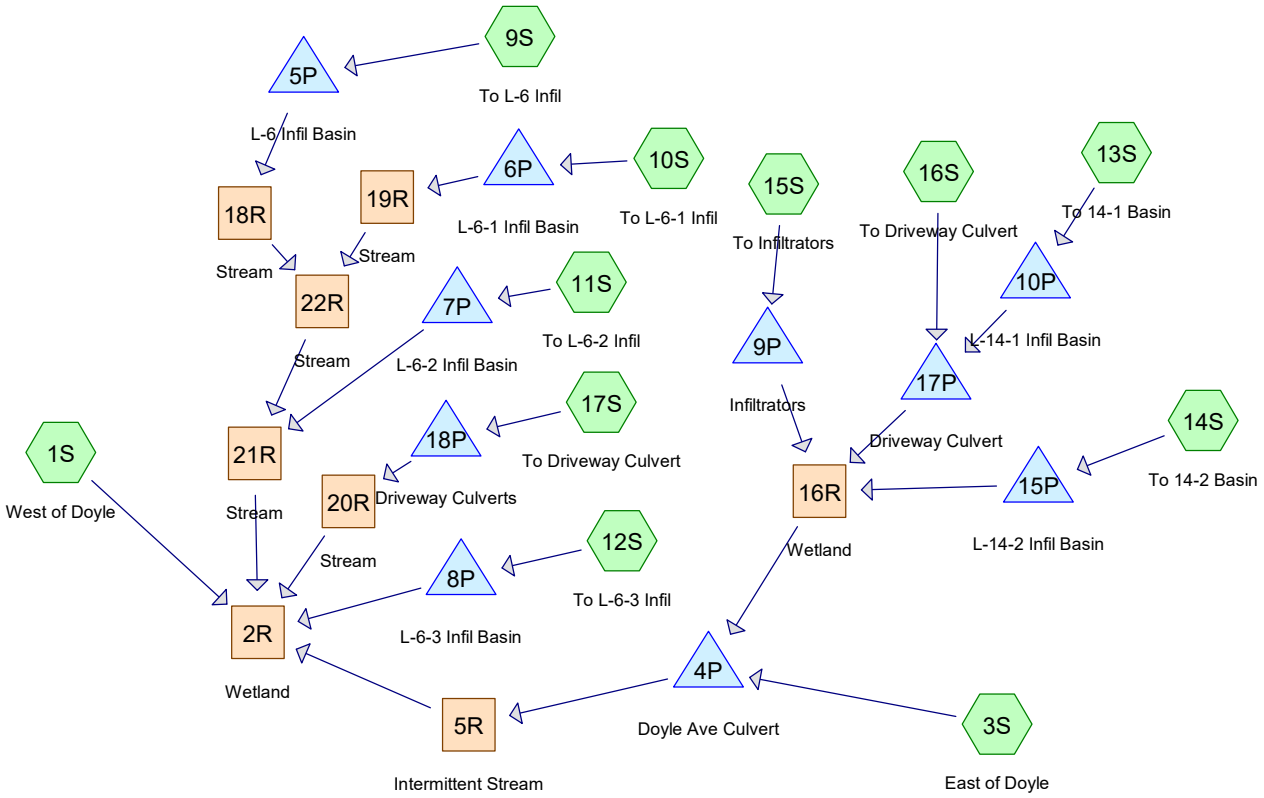
Plug-Flow detention time= 4.1 min calculated for 11.179 af (100% of inflow)
Center-of-Mass det. time= 4.1 min (931.9 - 927.9)

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=47.00 cfs @ 13.23 hrs HW=999.29' TW=996.06' (Dynamic Tailwater)
↑ **1=Culvert** (Barrel Controls 25.38 cfs @ 5.17 fps)
└ **2=Custom Weir/Orifice** (Weir Controls 21.62 cfs @ 1.67 fps)



Subcat Reach Pond Link

Routing Diagram for Doyle 6 Lots Post No Infil
Prepared by HP, Printed 10/25/2022

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)
7.036	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)
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
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=0.72"
Flow Length=2,241' Slope=0.0610 '/' Tc=31.9 min CN=71 Runoff=11.09 cfs 1.624 af

Subcatchment 3S: East of Doyle Runoff Area=3,340,303 sf 1.38% Impervious Runoff Depth=0.72"
Flow Length=5,506' Slope=0.0350 '/' Tc=86.3 min CN=71 Runoff=17.52 cfs 4.604 af

Subcatchment 9S: To L-6 Infil Runoff Area=102,183 sf 10.15% Impervious Runoff Depth=0.86"
Flow Length=544' Slope=0.0810 '/' Tc=8.2 min CN=74 Runoff=2.04 cfs 0.169 af

Subcatchment 10S: To L-6-1 Infil Runoff Area=24,211 sf 18.26% Impervious Runoff Depth=1.08"
Tc=6.0 min CN=78 Runoff=0.68 cfs 0.050 af

Subcatchment 11S: To L-6-2 Infil Runoff Area=36,314 sf 18.91% Impervious Runoff Depth=1.02"
Flow Length=442' Slope=0.0250 '/' Tc=11.5 min CN=77 Runoff=0.80 cfs 0.071 af

Subcatchment 12S: To L-6-3 Infil Runoff Area=25,147 sf 23.06% Impervious Runoff Depth=1.08"
Flow Length=402' Slope=0.0420 '/' Tc=8.0 min CN=78 Runoff=0.66 cfs 0.052 af

Subcatchment 13S: To 14-1 Basin Runoff Area=150,050 sf 9.38% Impervious Runoff Depth=0.86"
Flow Length=1,061' Slope=0.0600 '/' Tc=16.3 min CN=74 Runoff=2.35 cfs 0.248 af

Subcatchment 14S: To 14-2 Basin Runoff Area=8,244 sf 30.76% Impervious Runoff Depth=1.26"
Tc=6.0 min CN=81 Runoff=0.28 cfs 0.020 af

Subcatchment 15S: To Infiltrators Runoff Area=10,302 sf 32.33% Impervious Runoff Depth=1.14"
Tc=6.0 min CN=79 Runoff=0.31 cfs 0.022 af

Subcatchment 16S: To Driveway Culvert Runoff Area=153,405 sf 1.08% Impervious Runoff Depth=0.77"
Flow Length=1,094' Slope=0.0740 '/' Tc=15.9 min CN=72 Runoff=2.08 cfs 0.225 af

Subcatchment 17S: To Driveway Culvert Runoff Area=72,047 sf 0.22% Impervious Runoff Depth=0.72"
Tc=6.0 min CN=71 Runoff=1.23 cfs 0.099 af

Reach 2R: Wetland Inflow=22.27 cfs 7.107 af
Outflow=22.27 cfs 7.107 af

Reach 5R: Intermittent Stream Avg. Flow Depth=0.31' Max Vel=6.16 fps Inflow=18.15 cfs 5.095 af
n=0.025 L=394.0' S=0.0878 '/' Capacity=638.10 cfs Outflow=18.15 cfs 5.095 af

Reach 16R: Wetland Avg. Flow Depth=0.27' Max Vel=0.82 fps Inflow=4.68 cfs 0.491 af
n=0.100 L=505.0' S=0.0301 '/' Capacity=65.53 cfs Outflow=3.82 cfs 0.491 af

Reach 18R: Stream Avg. Flow Depth=0.22' Max Vel=1.28 fps Inflow=1.88 cfs 0.153 af
n=0.040 L=195.0' S=0.0154 '/' Capacity=46.68 cfs Outflow=1.77 cfs 0.153 af

Reach 19R: Stream Avg. Flow Depth=0.07' Max Vel=1.00 fps Inflow=0.27 cfs 0.040 af
n=0.040 L=406.0' S=0.0419 '/' Capacity=77.01 cfs Outflow=0.25 cfs 0.040 af

Reach 20R: Stream Avg. Flow Depth=0.11' Max Vel=1.96 fps Inflow=1.13 cfs 0.099 af
n=0.040 L=362.0' S=0.0925 '/' Capacity=314.84 cfs Outflow=1.07 cfs 0.099 af

Reach 21R: Stream Avg. Flow Depth=0.17' Max Vel=1.76 fps Inflow=1.80 cfs 0.249 af
n=0.040 L=400.0' S=0.0400 '/' Capacity=75.27 cfs Outflow=1.69 cfs 0.249 af

Reach 22R: Stream Avg. Flow Depth=0.16' Max Vel=2.11 fps Inflow=1.82 cfs 0.194 af
n=0.040 L=292.0' S=0.0651 '/' Capacity=96.00 cfs Outflow=1.76 cfs 0.194 af

Pond 4P: Doyle Ave Culvert Peak Elev=998.34' Storage=4,610 cf Inflow=18.49 cfs 5.095 af
Outflow=18.15 cfs 5.095 af

Pond 5P: L-6 Infil Basin Peak Elev=1,041.62' Storage=970 cf Inflow=2.04 cfs 0.169 af
Outflow=1.88 cfs 0.153 af

Pond 6P: L-6-1 Infil Basin Peak Elev=1,031.38' Storage=697 cf Inflow=0.68 cfs 0.050 af
Outflow=0.27 cfs 0.040 af

Pond 7P: L-6-2 Infil Basin Peak Elev=1,010.95' Storage=1,171 cf Inflow=0.80 cfs 0.071 af
Outflow=0.24 cfs 0.055 af

Pond 8P: L-6-3 Infil Basin Peak Elev=993.23' Storage=828 cf Inflow=0.66 cfs 0.052 af
Outflow=0.22 cfs 0.040 af

Pond 9P: Infiltrators Peak Elev=1,015.60' Storage=333 cf Inflow=0.31 cfs 0.022 af
Outflow=0.16 cfs 0.015 af

Pond 10P: L-14-1 Infil Basin Peak Elev=1,029.58' Storage=629 cf Inflow=2.35 cfs 0.248 af
Outflow=2.35 cfs 0.236 af

Pond 15P: L-14-2 Infil Basin Peak Elev=1,019.75' Storage=240 cf Inflow=0.28 cfs 0.020 af
Outflow=0.21 cfs 0.015 af

Pond 17P: Driveway Culvert Peak Elev=1,016.11' Storage=127 cf Inflow=4.42 cfs 0.461 af
Outflow=4.37 cfs 0.461 af

Pond 18P: Driveway Culverts Peak Elev=1,000.52' Storage=131 cf Inflow=1.23 cfs 0.099 af
Outflow=1.13 cfs 0.099 af

Total Runoff Area = 117.088 ac Runoff Volume = 7.184 af Average Runoff Depth = 0.74"
98.05% Pervious = 114.810 ac 1.95% Impervious = 2.278 ac

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=1.60"
Flow Length=2,241' Slope=0.0610 '/' Tc=31.9 min CN=71 Runoff=26.91 cfs 3.597 af

Subcatchment 3S: East of Doyle Runoff Area=3,340,303 sf 1.38% Impervious Runoff Depth=1.60"
Flow Length=5,506' Slope=0.0350 '/' Tc=86.3 min CN=71 Runoff=42.88 cfs 10.199 af

Subcatchment 9S: To L-6 Infil Runoff Area=102,183 sf 10.15% Impervious Runoff Depth=1.81"
Flow Length=544' Slope=0.0810 '/' Tc=8.2 min CN=74 Runoff=4.55 cfs 0.354 af

Subcatchment 10S: To L-6-1 Infil Runoff Area=24,211 sf 18.26% Impervious Runoff Depth=2.12"
Tc=6.0 min CN=78 Runoff=1.38 cfs 0.098 af

Subcatchment 11S: To L-6-2 Infil Runoff Area=36,314 sf 18.91% Impervious Runoff Depth=2.04"
Flow Length=442' Slope=0.0250 '/' Tc=11.5 min CN=77 Runoff=1.65 cfs 0.142 af

Subcatchment 12S: To L-6-3 Infil Runoff Area=25,147 sf 23.06% Impervious Runoff Depth=2.12"
Flow Length=402' Slope=0.0420 '/' Tc=8.0 min CN=78 Runoff=1.34 cfs 0.102 af

Subcatchment 13S: To 14-1 Basin Runoff Area=150,050 sf 9.38% Impervious Runoff Depth=1.81"
Flow Length=1,061' Slope=0.0600 '/' Tc=16.3 min CN=74 Runoff=5.27 cfs 0.520 af

Subcatchment 14S: To 14-2 Basin Runoff Area=8,244 sf 30.76% Impervious Runoff Depth=2.37"
Tc=6.0 min CN=81 Runoff=0.53 cfs 0.037 af

Subcatchment 15S: To Infiltrators Runoff Area=10,302 sf 32.33% Impervious Runoff Depth=2.20"
Tc=6.0 min CN=79 Runoff=0.61 cfs 0.043 af

Subcatchment 16S: To Driveway Culvert Runoff Area=153,405 sf 1.08% Impervious Runoff Depth=1.67"
Flow Length=1,094' Slope=0.0740 '/' Tc=15.9 min CN=72 Runoff=4.94 cfs 0.489 af

Subcatchment 17S: To Driveway Culvert Runoff Area=72,047 sf 0.22% Impervious Runoff Depth=1.60"
Tc=6.0 min CN=71 Runoff=3.01 cfs 0.220 af

Reach 2R: Wetland Inflow=55.72 cfs 15.725 af
Outflow=55.72 cfs 15.725 af

Reach 5R: Intermittent Stream Avg. Flow Depth=0.47' Max Vel=7.85 fps Inflow=44.89 cfs 11.265 af
n=0.025 L=394.0' S=0.0878 '/' Capacity=638.10 cfs Outflow=44.88 cfs 11.265 af

Reach 16R: Wetland Avg. Flow Depth=0.41' Max Vel=1.08 fps Inflow=10.80 cfs 1.066 af
n=0.100 L=505.0' S=0.0301 '/' Capacity=65.53 cfs Outflow=9.46 cfs 1.066 af

Reach 18R: Stream Avg. Flow Depth=0.33' Max Vel=1.68 fps Inflow=4.38 cfs 0.339 af
n=0.040 L=195.0' S=0.0154 '/' Capacity=46.68 cfs Outflow=4.27 cfs 0.339 af

Reach 19R: Stream Avg. Flow Depth=0.14' Max Vel=1.55 fps Inflow=1.29 cfs 0.088 af
n=0.040 L=406.0' S=0.0419 '/' Capacity=77.01 cfs Outflow=1.06 cfs 0.088 af

Reach 20R: Stream Avg. Flow Depth=0.15' Max Vel=2.47 fps Inflow=2.28 cfs 0.220 af
n=0.040 L=362.0' S=0.0925 '/' Capacity=314.84 cfs Outflow=2.24 cfs 0.220 af

Reach 21R: Stream Avg. Flow Depth=0.30' Max Vel=2.52 fps Inflow=5.67 cfs 0.553 af
n=0.040 L=400.0' S=0.0400 '/' Capacity=75.27 cfs Outflow=5.45 cfs 0.553 af

Reach 22R: Stream Avg. Flow Depth=0.26' Max Vel=2.95 fps Inflow=5.32 cfs 0.427 af
n=0.040 L=292.0' S=0.0651 '/' Capacity=96.00 cfs Outflow=5.23 cfs 0.427 af

Pond 4P: Doyle Ave Culvert Peak Elev=999.28' Storage=12,449 cf Inflow=44.98 cfs 11.265 af
Outflow=44.89 cfs 11.265 af

Pond 5P: L-6 Infil Basin Peak Elev=1,041.78' Storage=1,229 cf Inflow=4.55 cfs 0.354 af
Outflow=4.38 cfs 0.339 af

Pond 6P: L-6-1 Infil Basin Peak Elev=1,031.63' Storage=894 cf Inflow=1.38 cfs 0.098 af
Outflow=1.29 cfs 0.088 af

Pond 7P: L-6-2 Infil Basin Peak Elev=1,011.51' Storage=2,145 cf Inflow=1.65 cfs 0.142 af
Outflow=0.63 cfs 0.126 af

Pond 8P: L-6-3 Infil Basin Peak Elev=993.59' Storage=1,215 cf Inflow=1.34 cfs 0.102 af
Outflow=0.96 cfs 0.090 af

Pond 9P: Infiltrators Peak Elev=1,015.93' Storage=342 cf Inflow=0.61 cfs 0.043 af
Outflow=0.62 cfs 0.036 af

Pond 10P: L-14-1 Infil Basin Peak Elev=1,029.71' Storage=706 cf Inflow=5.27 cfs 0.520 af
Outflow=5.26 cfs 0.508 af

Pond 15P: L-14-2 Infil Basin Peak Elev=1,019.79' Storage=262 cf Inflow=0.53 cfs 0.037 af
Outflow=0.51 cfs 0.032 af

Pond 17P: Driveway Culvert Peak Elev=1,016.62' Storage=664 cf Inflow=10.20 cfs 0.997 af
Outflow=10.18 cfs 0.997 af

Pond 18P: Driveway Culverts Peak Elev=1,001.07' Storage=542 cf Inflow=3.01 cfs 0.220 af
Outflow=2.28 cfs 0.220 af

Total Runoff Area = 117.088 ac Runoff Volume = 15.803 af Average Runoff Depth = 1.62"
98.05% Pervious = 114.810 ac 1.95% Impervious = 2.278 ac

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=4.11"
Flow Length=2,241' Slope=0.0610 '/' Tc=31.9 min CN=71 Runoff=71.69 cfs 9.253 af

Subcatchment 3S: East of Doyle Runoff Area=3,340,303 sf 1.38% Impervious Runoff Depth=4.11"
Flow Length=5,506' Slope=0.0350 '/' Tc=86.3 min CN=71 Runoff=115.71 cfs 26.233 af

Subcatchment 9S: To L-6 Infil Runoff Area=102,183 sf 10.15% Impervious Runoff Depth=4.44"
Flow Length=544' Slope=0.0810 '/' Tc=8.2 min CN=74 Runoff=11.30 cfs 0.867 af

Subcatchment 10S: To L-6-1 Infil Runoff Area=24,211 sf 18.26% Impervious Runoff Depth=4.88"
Tc=6.0 min CN=78 Runoff=3.16 cfs 0.226 af

Subcatchment 11S: To L-6-2 Infil Runoff Area=36,314 sf 18.91% Impervious Runoff Depth=4.77"
Flow Length=442' Slope=0.0250 '/' Tc=11.5 min CN=77 Runoff=3.88 cfs 0.332 af

Subcatchment 12S: To L-6-3 Infil Runoff Area=25,147 sf 23.06% Impervious Runoff Depth=4.88"
Flow Length=402' Slope=0.0420 '/' Tc=8.0 min CN=78 Runoff=3.06 cfs 0.235 af

Subcatchment 13S: To 14-1 Basin Runoff Area=150,050 sf 9.38% Impervious Runoff Depth=4.44"
Flow Length=1,061' Slope=0.0600 '/' Tc=16.3 min CN=74 Runoff=13.14 cfs 1.274 af

Subcatchment 14S: To 14-2 Basin Runoff Area=8,244 sf 30.76% Impervious Runoff Depth=5.23"
Tc=6.0 min CN=81 Runoff=1.14 cfs 0.082 af

Subcatchment 15S: To Infiltrators Runoff Area=10,302 sf 32.33% Impervious Runoff Depth=5.00"
Tc=6.0 min CN=79 Runoff=1.37 cfs 0.099 af

Subcatchment 16S: To Driveway Culvert Runoff Area=153,405 sf 1.08% Impervious Runoff Depth=4.22"
Flow Length=1,094' Slope=0.0740 '/' Tc=15.9 min CN=72 Runoff=12.89 cfs 1.237 af

Subcatchment 17S: To Driveway Culvert Runoff Area=72,047 sf 0.22% Impervious Runoff Depth=4.11"
Tc=6.0 min CN=71 Runoff=7.97 cfs 0.566 af

Reach 2R: Wetland Inflow=152.23 cfs 40.326 af
Outflow=152.23 cfs 40.326 af

Reach 5R: Intermittent Stream Avg. Flow Depth=0.74' Max Vel=10.13 fps Inflow=120.18 cfs 28.900 af
n=0.025 L=394.0' S=0.0878 '/' Capacity=638.10 cfs Outflow=120.14 cfs 28.900 af

Reach 16R: Wetland Avg. Flow Depth=0.65' Max Vel=1.47 fps Inflow=27.31 cfs 2.667 af
n=0.100 L=505.0' S=0.0301 '/' Capacity=65.53 cfs Outflow=25.36 cfs 2.667 af

Reach 18R: Stream Avg. Flow Depth=0.51' Max Vel=2.24 fps Inflow=11.02 cfs 0.852 af
n=0.040 L=195.0' S=0.0154 '/' Capacity=46.68 cfs Outflow=10.85 cfs 0.852 af

Reach 19R: Stream Avg. Flow Depth=0.22' Max Vel=2.10 fps Inflow=3.09 cfs 0.216 af
n=0.040 L=406.0' S=0.0419 '/' Capacity=77.01 cfs Outflow=2.86 cfs 0.216 af

Reach 20R: Stream Avg. Flow Depth=0.20' Max Vel=2.92 fps Inflow=3.89 cfs 0.566 af
n=0.040 L=362.0' S=0.0925 '/' Capacity=314.84 cfs Outflow=3.89 cfs 0.566 af

Reach 21R: Stream Avg. Flow Depth=0.50' Max Vel=3.56 fps Inflow=17.05 cfs 1.384 af
n=0.040 L=400.0' S=0.0400 '/' Capacity=75.27 cfs Outflow=16.68 cfs 1.384 af

Reach 22R: Stream Avg. Flow Depth=0.40' Max Vel=3.95 fps Inflow=13.68 cfs 1.068 af
n=0.040 L=292.0' S=0.0651 '/' Capacity=96.00 cfs Outflow=13.53 cfs 1.068 af

Pond 4P: Doyle Ave Culvert Peak Elev=999.64' Storage=16,510 cf Inflow=120.29 cfs 28.900 af
Outflow=120.18 cfs 28.900 af

Pond 5P: L-6 Infil Basin Peak Elev=1,042.09' Storage=1,794 cf Inflow=11.30 cfs 0.867 af
Outflow=11.02 cfs 0.852 af

Pond 6P: L-6-1 Infil Basin Peak Elev=1,031.77' Storage=1,019 cf Inflow=3.16 cfs 0.226 af
Outflow=3.09 cfs 0.216 af

Pond 7P: L-6-2 Infil Basin Peak Elev=1,011.79' Storage=2,708 cf Inflow=3.88 cfs 0.332 af
Outflow=3.65 cfs 0.316 af

Pond 8P: L-6-3 Infil Basin Peak Elev=993.75' Storage=1,423 cf Inflow=3.06 cfs 0.235 af
Outflow=2.96 cfs 0.223 af

Pond 9P: Infiltrators Peak Elev=1,017.63' Storage=342 cf Inflow=1.37 cfs 0.099 af
Outflow=1.38 cfs 0.091 af

Pond 10P: L-14-1 Infil Basin Peak Elev=1,029.96' Storage=870 cf Inflow=13.14 cfs 1.274 af
Outflow=13.13 cfs 1.262 af

Pond 15P: L-14-2 Infil Basin Peak Elev=1,019.85' Storage=297 cf Inflow=1.14 cfs 0.082 af
Outflow=1.12 cfs 0.077 af

Pond 17P: Driveway Culvert Peak Elev=1,016.85' Storage=1,082 cf Inflow=25.98 cfs 2.499 af
Outflow=25.96 cfs 2.499 af

Pond 18P: Driveway Culverts Peak Elev=1,002.48' Storage=3,113 cf Inflow=7.97 cfs 0.566 af
Outflow=3.89 cfs 0.566 af

Total Runoff Area = 117.088 ac Runoff Volume = 40.404 af Average Runoff Depth = 4.14"
98.05% Pervious = 114.810 ac 1.95% Impervious = 2.278 ac

Summary for Subcatchment 1S: West of Doyle

Runoff = 26.91 cfs @ 12.47 hrs, Volume= 3.597 af, Depth= 1.60"

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=4.29"

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 = 42.88 cfs @ 13.23 hrs, Volume= 10.199 af, Depth= 1.60"

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=4.29"

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 = 4.55 cfs @ 12.12 hrs, Volume= 0.354 af, Depth= 1.81"

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=4.29"

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
12,866	74	>75% Grass cover, Good, HSG C
70,608	70	Woods, Good, HSG C
102,183	74	Weighted Average
91,813		89.85% Pervious Area
10,370		10.15% 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 = 1.38 cfs @ 12.09 hrs, Volume= 0.098 af, Depth= 2.12"

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=4.29"

Area (sf)	CN	Description
762	98	Roofs, HSG C
3,660	98	Paved parking, HSG C
19,789	74	>75% Grass cover, Good, HSG C
24,211	78	Weighted Average
19,789		81.74% Pervious Area
4,422		18.26% 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 = 1.65 cfs @ 12.16 hrs, Volume= 0.142 af, Depth= 2.04"

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=4.29"

Area (sf)	CN	Description
762	98	Roofs, HSG C
6,106	98	Paved parking, HSG C
17,763	74	>75% Grass cover, Good, HSG C
11,683	70	Woods, Good, HSG C
36,314	77	Weighted Average
29,446		81.09% Pervious Area
6,868		18.91% 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 = 1.34 cfs @ 12.12 hrs, Volume= 0.102 af, Depth= 2.12"

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=4.29"

Area (sf)	CN	Description
762	98	Roofs, HSG C
5,037	98	Paved parking, HSG C
12,459	74	>75% Grass cover, Good, HSG C
6,889	70	Woods, Good, HSG C
25,147	78	Weighted Average
19,348		76.94% Pervious Area
5,799		23.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	402	0.0420	0.84		**Lag/CN Method,**

Summary for Subcatchment 13S: To 14-1 Basin

Runoff = 5.27 cfs @ 12.23 hrs, Volume= 0.520 af, Depth= 1.81"

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=4.29"

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
29,729	74	>75% Grass cover, Good, HSG C
79,698	70	Woods, Good, HSG C
150,050	74	Weighted Average
135,982		90.62% Pervious Area
14,068		9.38% 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 = 0.53 cfs @ 12.09 hrs, Volume= 0.037 af, Depth= 2.37"

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=4.29"

Area (sf)	CN	Description
762	98	Roofs, HSG C
1,774	98	Paved parking, HSG C
5,708	74	>75% Grass cover, Good, HSG C
8,244	81	Weighted Average
5,708		69.24% Pervious Area
2,536		30.76% 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 = 0.61 cfs @ 12.09 hrs, Volume= 0.043 af, Depth= 2.20"

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=4.29"

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 = 4.94 cfs @ 12.23 hrs, Volume= 0.489 af, Depth= 1.67"

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=4.29"

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 = 3.01 cfs @ 12.09 hrs, Volume= 0.220 af, Depth= 1.60"

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=4.29"

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 Reach 2R: Wetland

Inflow Area = 117.088 ac, 1.95% Impervious, Inflow Depth = 1.61" for 10-Year event
Inflow = 55.72 cfs @ 12.99 hrs, Volume= 15.725 af
Outflow = 55.72 cfs @ 12.99 hrs, Volume= 15.725 af, Atten= 0%, Lag= 0.0 min

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

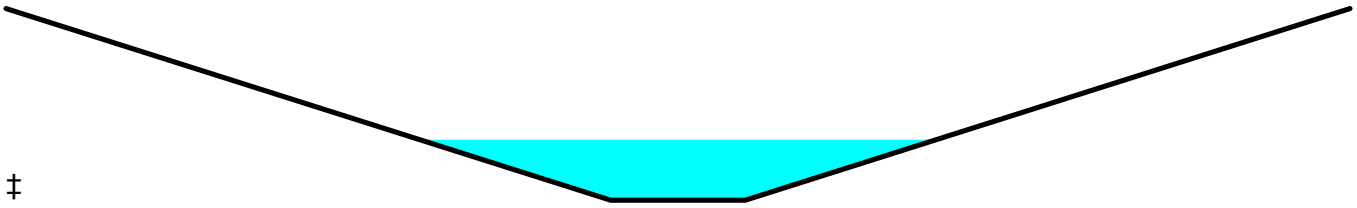
Summary for Reach 5R: Intermittent Stream

Inflow Area = 84.075 ac, 1.85% Impervious, Inflow Depth = 1.61" for 10-Year event
Inflow = 44.89 cfs @ 13.18 hrs, Volume= 11.265 af
Outflow = 44.88 cfs @ 13.19 hrs, Volume= 11.265 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= 7.85 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 3.40 fps, Avg. Travel Time= 1.9 min

Peak Storage= 2,253 cf @ 13.19 hrs
Average Depth at Peak Storage= 0.47'
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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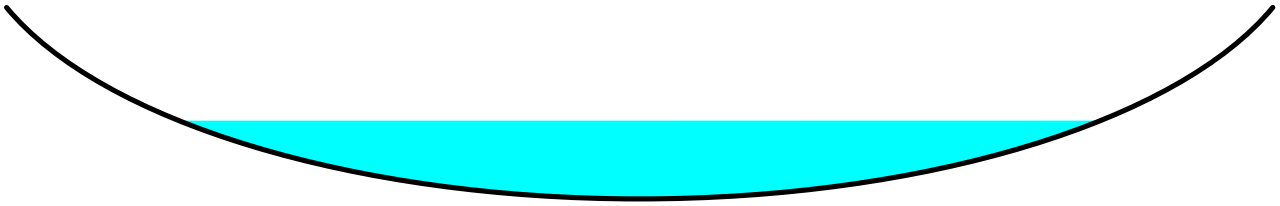
Summary for Reach 16R: Wetland

Inflow Area = 7.392 ac, 6.71% Impervious, Inflow Depth = 1.73" for 10-Year event
Inflow = 10.80 cfs @ 12.24 hrs, Volume= 1.066 af
Outflow = 9.46 cfs @ 12.34 hrs, Volume= 1.066 af, Atten= 12%, Lag= 5.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.08 fps, Min. Travel Time= 7.8 min
Avg. Velocity = 0.30 fps, Avg. Travel Time= 28.5 min

Peak Storage= 4,406 cf @ 12.34 hrs
Average Depth at Peak Storage= 0.41'
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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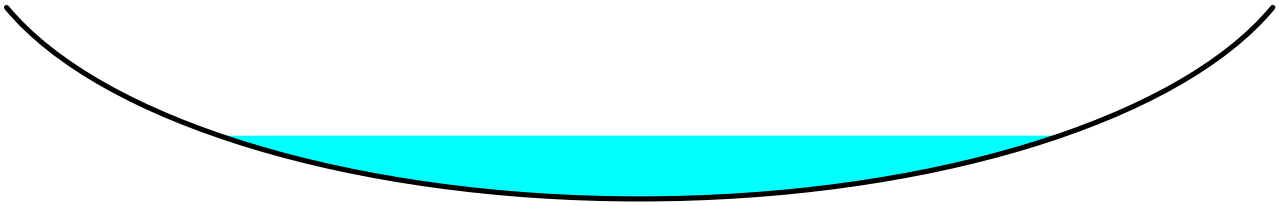
Summary for Reach 18R: Stream

Inflow Area = 2.346 ac, 10.15% Impervious, Inflow Depth = 1.73" for 10-Year event
Inflow = 4.38 cfs @ 12.15 hrs, Volume= 0.339 af
Outflow = 4.27 cfs @ 12.17 hrs, Volume= 0.339 af, Atten= 2%, Lag= 1.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.68 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 0.55 fps, Avg. Travel Time= 6.0 min

Peak Storage= 495 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.33'
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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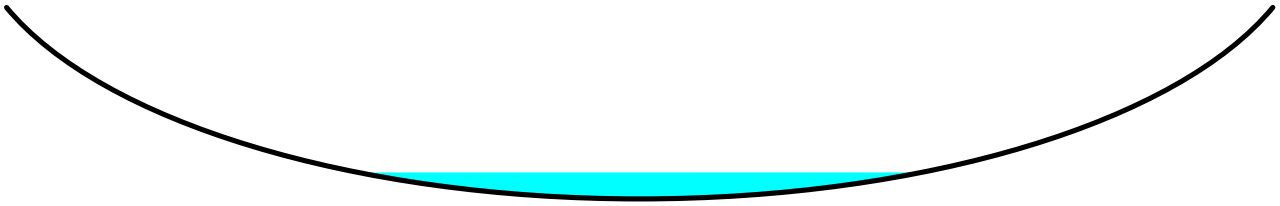
Summary for Reach 19R: Stream

Inflow Area = 0.556 ac, 18.26% Impervious, Inflow Depth = 1.91" for 10-Year event
Inflow = 1.29 cfs @ 12.12 hrs, Volume= 0.088 af
Outflow = 1.06 cfs @ 12.18 hrs, Volume= 0.088 af, Atten= 18%, Lag= 3.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.55 fps, Min. Travel Time= 4.4 min
Avg. Velocity = 0.46 fps, Avg. Travel Time= 14.8 min

Peak Storage= 278 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.14'
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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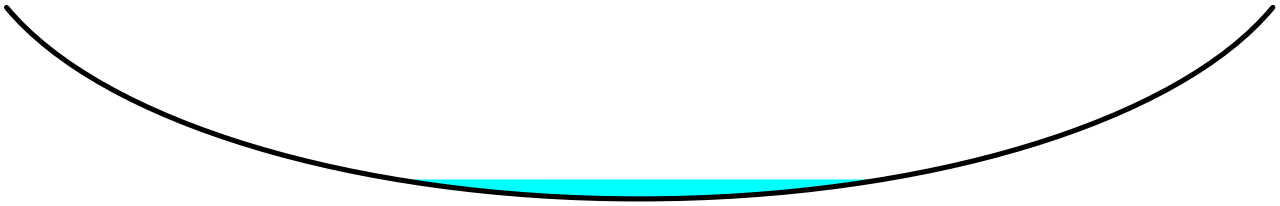
Summary for Reach 20R: Stream

Inflow Area = 1.654 ac, 0.22% Impervious, Inflow Depth = 1.60" for 10-Year event
Inflow = 2.28 cfs @ 12.16 hrs, Volume= 0.220 af
Outflow = 2.24 cfs @ 12.20 hrs, Volume= 0.220 af, Atten= 1%, Lag= 2.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.47 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 0.98 fps, Avg. Travel Time= 6.2 min

Peak Storage= 329 cf @ 12.20 hrs
Average Depth at Peak Storage= 0.15'
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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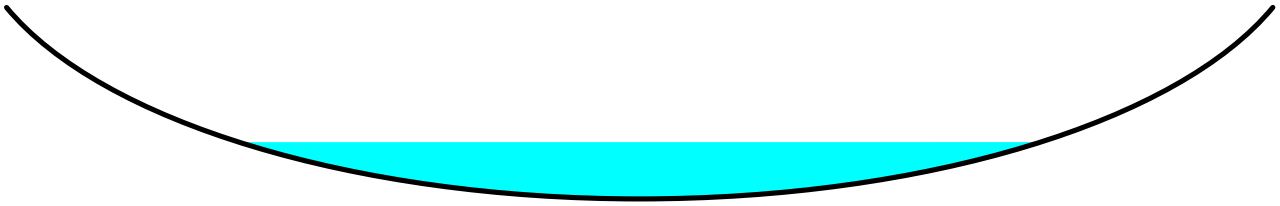
Summary for Reach 21R: Stream

Inflow Area = 3.735 ac, 13.31% Impervious, Inflow Depth = 1.78" for 10-Year event
Inflow = 5.67 cfs @ 12.20 hrs, Volume= 0.553 af
Outflow = 5.45 cfs @ 12.23 hrs, Volume= 0.553 af, Atten= 4%, Lag= 2.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.52 fps, Min. Travel Time= 2.6 min
Avg. Velocity = 0.71 fps, Avg. Travel Time= 9.4 min

Peak Storage= 865 cf @ 12.23 hrs
Average Depth at Peak Storage= 0.30'
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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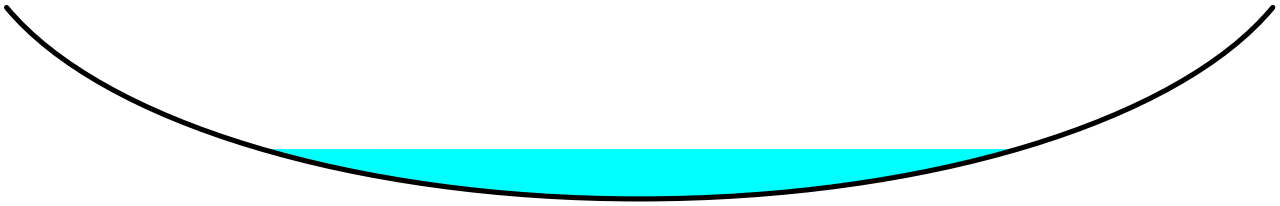
Summary for Reach 22R: Stream

Inflow Area = 2.902 ac, 11.70% Impervious, Inflow Depth = 1.77" for 10-Year event
Inflow = 5.32 cfs @ 12.17 hrs, Volume= 0.427 af
Outflow = 5.23 cfs @ 12.19 hrs, Volume= 0.427 af, Atten= 2%, Lag= 1.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.95 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 0.78 fps, Avg. Travel Time= 6.3 min

Peak Storage= 518 cf @ 12.19 hrs
Average Depth at Peak Storage= 0.26'
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, 1.85% Impervious, Inflow Depth = 1.61" for 10-Year event
Inflow = 44.98 cfs @ 13.14 hrs, Volume= 11.265 af
Outflow = 44.89 cfs @ 13.18 hrs, Volume= 11.265 af, Atten= 0%, Lag= 2.3 min
Primary = 44.89 cfs @ 13.18 hrs, Volume= 11.265 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 999.28' @ 13.18 hrs Surf.Area= 10,580 sf Storage= 12,449 cf

Plug-Flow detention time= 4.1 min calculated for 11.262 af (100% of inflow)
Center-of-Mass det. time= 4.1 min (927.0 - 922.8)

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=44.88 cfs @ 13.18 hrs HW=999.28' TW=996.05' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 25.22 cfs @ 5.14 fps)
└─**2=Custom Weir/Orifice** (Weir Controls 19.67 cfs @ 1.63 fps)

Summary for Pond 5P: L-6 Infil Basin

Inflow Area = 2.346 ac, 10.15% Impervious, Inflow Depth = 1.81" for 10-Year event
Inflow = 4.55 cfs @ 12.12 hrs, Volume= 0.354 af
Outflow = 4.38 cfs @ 12.15 hrs, Volume= 0.339 af, Atten= 4%, Lag= 1.6 min
Primary = 4.38 cfs @ 12.15 hrs, Volume= 0.339 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,041.78' @ 12.15 hrs Surf.Area= 1,678 sf Storage= 1,229 cf

Plug-Flow detention time= 35.9 min calculated for 0.339 af (96% of inflow)
Center-of-Mass det. time= 12.2 min (859.5 - 847.3)

Volume	Invert	Avail.Storage	Storage Description
#1	1,040.50'	2,718 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,040.50	242	0	0
1,042.00	1,926	1,626	1,626
1,042.50	2,441	1,092	2,718

Device	Routing	Invert	Outlet Devices
#1	Primary	1,041.40'	**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=4.37 cfs @ 12.15 hrs HW=1,041.78' TW=1,006.33' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 4.37 cfs @ 1.92 fps)

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

Inflow Area = 0.556 ac, 18.26% Impervious, Inflow Depth = 2.12" for 10-Year event
Inflow = 1.38 cfs @ 12.09 hrs, Volume= 0.098 af
Outflow = 1.29 cfs @ 12.12 hrs, Volume= 0.088 af, Atten= 7%, Lag= 1.9 min
Primary = 1.29 cfs @ 12.12 hrs, Volume= 0.088 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,031.63' @ 12.12 hrs Surf.Area= 868 sf Storage= 894 cf

Plug-Flow detention time= 89.5 min calculated for 0.088 af (90% of inflow)
Center-of-Mass det. time= 40.5 min (874.7 - 834.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,030.00'	1,857 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,030.00	232	0	0
1,032.00	1,015	1,247	1,247
1,032.50	1,426	610	1,857

Device	Routing	Invert	Outlet Devices
#1	Primary	1,031.00'	**6.0" Round Culvert** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,031.00' / 1,029.50' S= 0.0600 '/' Cc= 0.900 n= 0.010, Flow Area= 0.20 sf
#2	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

Primary OutFlow Max=1.29 cfs @ 12.12 hrs HW=1,031.63' TW=1,020.12' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 0.46 cfs @ 2.33 fps)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 0.83 cfs @ 1.10 fps)

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

Inflow Area = 0.834 ac, 18.91% Impervious, Inflow Depth = 2.04" for 10-Year event
Inflow = 1.65 cfs @ 12.16 hrs, Volume= 0.142 af
Outflow = 0.63 cfs @ 12.52 hrs, Volume= 0.126 af, Atten= 62%, Lag= 21.6 min
Primary = 0.63 cfs @ 12.52 hrs, Volume= 0.126 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,011.51' @ 12.52 hrs Surf.Area= 1,930 sf Storage= 2,145 cf

Plug-Flow detention time= 118.3 min calculated for 0.126 af (89% of inflow)
Center-of-Mass det. time= 66.0 min (908.1 - 842.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,010.00'	4,460 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,010.00	907	0	0
1,012.00	2,261	3,168	3,168
1,012.50	2,907	1,292	4,460

Device	Routing	Invert	Outlet Devices
#1	Primary	1,010.60'	**6.0" Round Culvert** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,010.60' / 1,009.00' S= 0.0640 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#2	Primary	1,011.50'	**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

Primary OutFlow Max=0.63 cfs @ 12.52 hrs HW=1,011.51' TW=984.23' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 0.61 cfs @ 3.09 fps)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 0.02 cfs @ 0.34 fps)

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

Inflow Area = 0.577 ac, 23.06% Impervious, Inflow Depth = 2.12" for 10-Year event
Inflow = 1.34 cfs @ 12.12 hrs, Volume= 0.102 af
Outflow = 0.96 cfs @ 12.21 hrs, Volume= 0.090 af, Atten= 28%, Lag= 5.7 min
Primary = 0.96 cfs @ 12.21 hrs, Volume= 0.090 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 993.59' @ 12.21 hrs Surf.Area= 1,195 sf Storage= 1,215 cf

Plug-Flow detention time= 107.4 min calculated for 0.090 af (88% of inflow)
Center-of-Mass det. time= 51.9 min (887.9 - 836.1)

Volume	Invert	Avail.Storage	Storage Description
#1	992.00'	2,584 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
992.00	338	0	0
994.00	1,419	1,757	1,757
994.50	1,890	827	2,584

Device	Routing	Invert	Outlet Devices
#1	Primary	992.90'	**6.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 992.90' / 991.50' S= 0.0700 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#2	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

Primary OutFlow Max=0.96 cfs @ 12.21 hrs HW=993.59' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 0.49 cfs @ 2.51 fps)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 0.46 cfs @ 0.91 fps)

Summary for Pond 9P: Infiltrators

Inflow Area = 0.237 ac, 32.33% Impervious, Inflow Depth = 2.20" for 10-Year event
Inflow = 0.61 cfs @ 12.09 hrs, Volume= 0.043 af
Outflow = 0.62 cfs @ 12.09 hrs, Volume= 0.036 af, Atten= 0%, Lag= 0.0 min
Primary = 0.62 cfs @ 12.09 hrs, Volume= 0.036 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,015.93' @ 12.09 hrs Surf.Area= 317 sf Storage= 342 cf

Plug-Flow detention time= 103.0 min calculated for 0.036 af (83% of inflow)
Center-of-Mass det. time= 32.2 min (863.6 - 831.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	1,013.67'	195 cf	**8.17'W x 38.80'L x 2.00'H Field A** 634 cf Overall - 147 cf Embedded = 486 cf x 40.0% Voids
#2A	1,014.17'	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
		342 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=0.62 cfs @ 12.09 hrs HW=1,015.93' TW=1,015.16' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 0.62 cfs @ 3.15 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

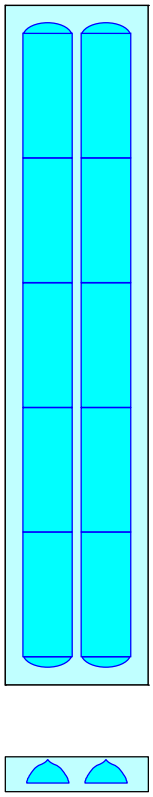
5 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 36.80' Row Length +12.0" End Stone x 2 = 38.80' Base Length
2 Rows x 34.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 8.17' Base Width
6.0" Base + 16.0" Chamber Height + 2.0" Cover = 2.00' Field Height

10 Chambers x 14.7 cf = 147.4 cf Chamber Storage

633.7 cf Field - 147.4 cf Chambers = 486.3 cf Stone x 40.0% Voids = 194.5 cf Stone Storage

Chamber Storage + Stone Storage = 341.9 cf = 0.008 af
Overall Storage Efficiency = 54.0%
Overall System Size = 38.80' x 8.17' x 2.00'

10 Chambers
23.5 cy Field
18.0 cy Stone



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

Inflow Area = 3.445 ac, 9.38% Impervious, Inflow Depth = 1.81" for 10-Year event
Inflow = 5.27 cfs @ 12.23 hrs, Volume= 0.520 af
Outflow = 5.26 cfs @ 12.24 hrs, Volume= 0.508 af, Atten= 0%, Lag= 0.4 min
Primary = 5.26 cfs @ 12.24 hrs, Volume= 0.508 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,029.71' @ 12.24 hrs Surf.Area= 621 sf Storage= 706 cf

Plug-Flow detention time= 19.1 min calculated for 0.508 af (98% of inflow)
Center-of-Mass det. time= 5.9 min (860.6 - 854.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,028.00'	1,282 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,028.00	207	0	0
1,030.00	693	900	900
1,030.50	836	382	1,282

Device	Routing	Invert	Outlet Devices
#1	Primary	1,029.40'	**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=5.26 cfs @ 12.24 hrs HW=1,029.71' TW=1,016.62' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 5.26 cfs @ 1.72 fps)

Summary for Pond 15P: L-14-2 Infil Basin

Inflow Area = 0.189 ac, 30.76% Impervious, Inflow Depth = 2.37" for 10-Year event
Inflow = 0.53 cfs @ 12.09 hrs, Volume= 0.037 af
Outflow = 0.51 cfs @ 12.11 hrs, Volume= 0.032 af, Atten= 2%, Lag= 1.1 min
Primary = 0.51 cfs @ 12.11 hrs, Volume= 0.032 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,019.79' @ 12.11 hrs Surf.Area= 545 sf Storage= 262 cf

Plug-Flow detention time= 87.3 min calculated for 0.032 af (87% of inflow)
Center-of-Mass det. time= 27.9 min (853.7 - 825.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,019.00'	801 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,019.00	117	0	0
1,020.00	658	388	388
1,020.50	996	414	801

Device	Routing	Invert	Outlet Devices
#1	Primary	1,019.70'	**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=0.51 cfs @ 12.11 hrs HW=1,019.79' TW=1,015.18' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.51 cfs @ 0.94 fps)

Summary for Pond 17P: Driveway Culvert

Inflow Area = 6.966 ac, 5.18% Impervious, Inflow Depth = 1.72" for 10-Year event
Inflow = 10.20 cfs @ 12.23 hrs, Volume= 0.997 af
Outflow = 10.18 cfs @ 12.24 hrs, Volume= 0.997 af, Atten= 0%, Lag= 0.5 min
Primary = 10.18 cfs @ 12.24 hrs, Volume= 0.997 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,016.62' @ 12.24 hrs Surf.Area= 1,621 sf Storage= 664 cf

Plug-Flow detention time= 0.7 min calculated for 0.997 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (860.9 - 860.3)

Volume	Invert	Avail.Storage	Storage Description
#1	1,015.20'	1,430 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	212	89	89
1,016.50	1,364	394	483
1,017.00	2,424	947	1,430

Device	Routing	Invert	Outlet Devices
#1	Primary	1,015.20'	**10.0" 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= 0.55 sf
#2	Primary	1,016.50'	**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=10.18 cfs @ 12.24 hrs HW=1,016.62' TW=1,015.28' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 6.23 cfs @ 3.81 fps)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 3.94 cfs @ 1.09 fps)

Summary for Pond 18P: Driveway Culverts

Inflow Area = 1.654 ac, 0.22% Impervious, Inflow Depth = 1.60" for 10-Year event
Inflow = 3.01 cfs @ 12.09 hrs, Volume= 0.220 af
Outflow = 2.28 cfs @ 12.16 hrs, Volume= 0.220 af, Atten= 24%, Lag= 4.3 min
Primary = 2.28 cfs @ 12.16 hrs, Volume= 0.220 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1,001.07' @ 12.16 hrs Surf.Area= 1,004 sf Storage= 542 cf

Plug-Flow detention time= 2.2 min calculated for 0.220 af (100% of inflow)
Center-of-Mass det. time= 2.1 min (855.6 - 853.5)

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'	**8.0" Round Culvert X 2.00** 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= 0.35 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=2.27 cfs @ 12.16 hrs HW=1,001.07' TW=999.65' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 2.27 cfs @ 3.26 fps)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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

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
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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.

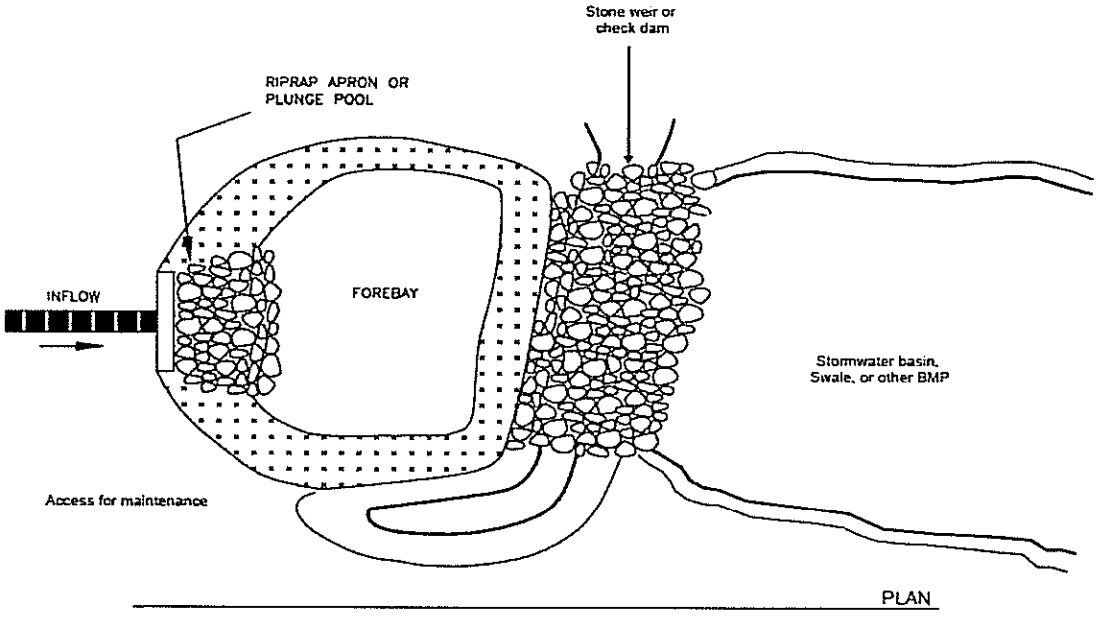
Maintenance requirements are on the following page.

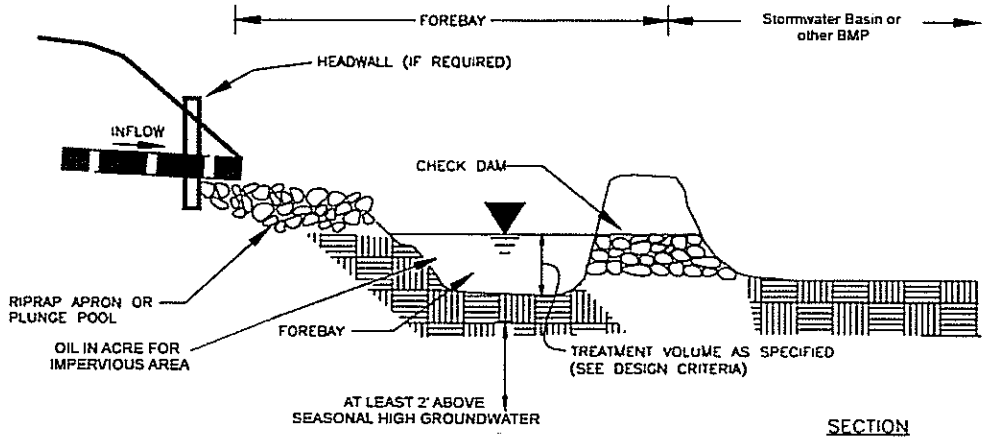
Sediment Forebays shown on BMP ID Plan labeled FB1-FB5

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-B6

Date	Inspector	Notes
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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’.

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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 - 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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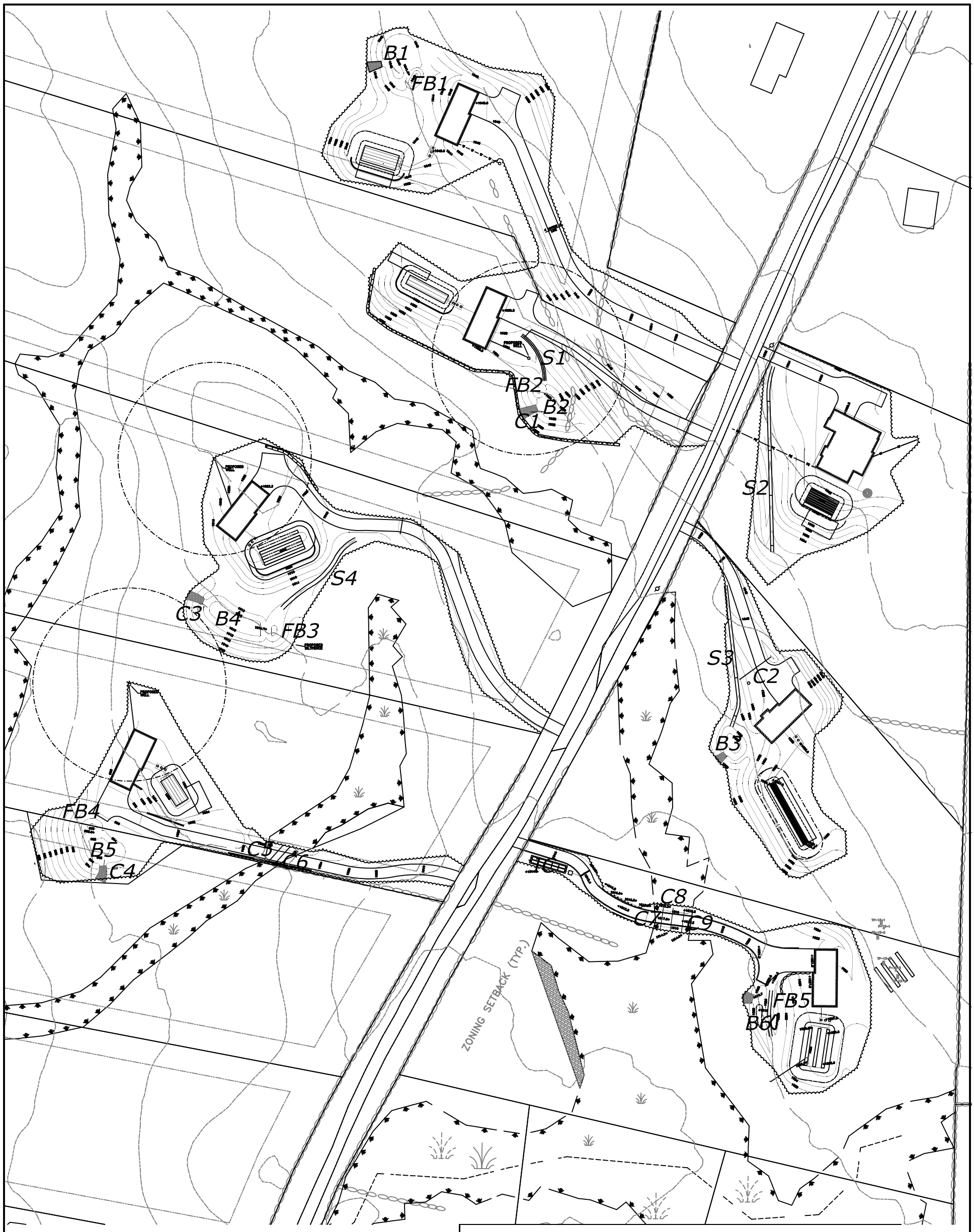
I – Invasive Species

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.



S1	SWALE
B1	BASIN
C1	CULVERT
FB1	SEDIMENT FOREBAY

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

GRAZ Engineering, LLC
www.grazengineering.com

351B BECKET FINE SANDY LOAM, 3-8% SLOPES

351C BECKET FINE SANDY LOAM, 8-15% SLOPES

365B SKERRY FINE SANDY LOAM, 3-8% SLOPES

900E BEKCET-MONADNOCK ASSOC, 15-45% SLOPES

908C BECKET-SKERRY ASSOC, 0-15% SLOPES

917D PILLSBURY-PEACHAM ASSOC, 0-8% SLOPES

3S SUBCATCHMENT (TYP)

8P POND (TYP)

20R REACH (TYP)

EXISTING CONDITION DRAINAGE PLAN

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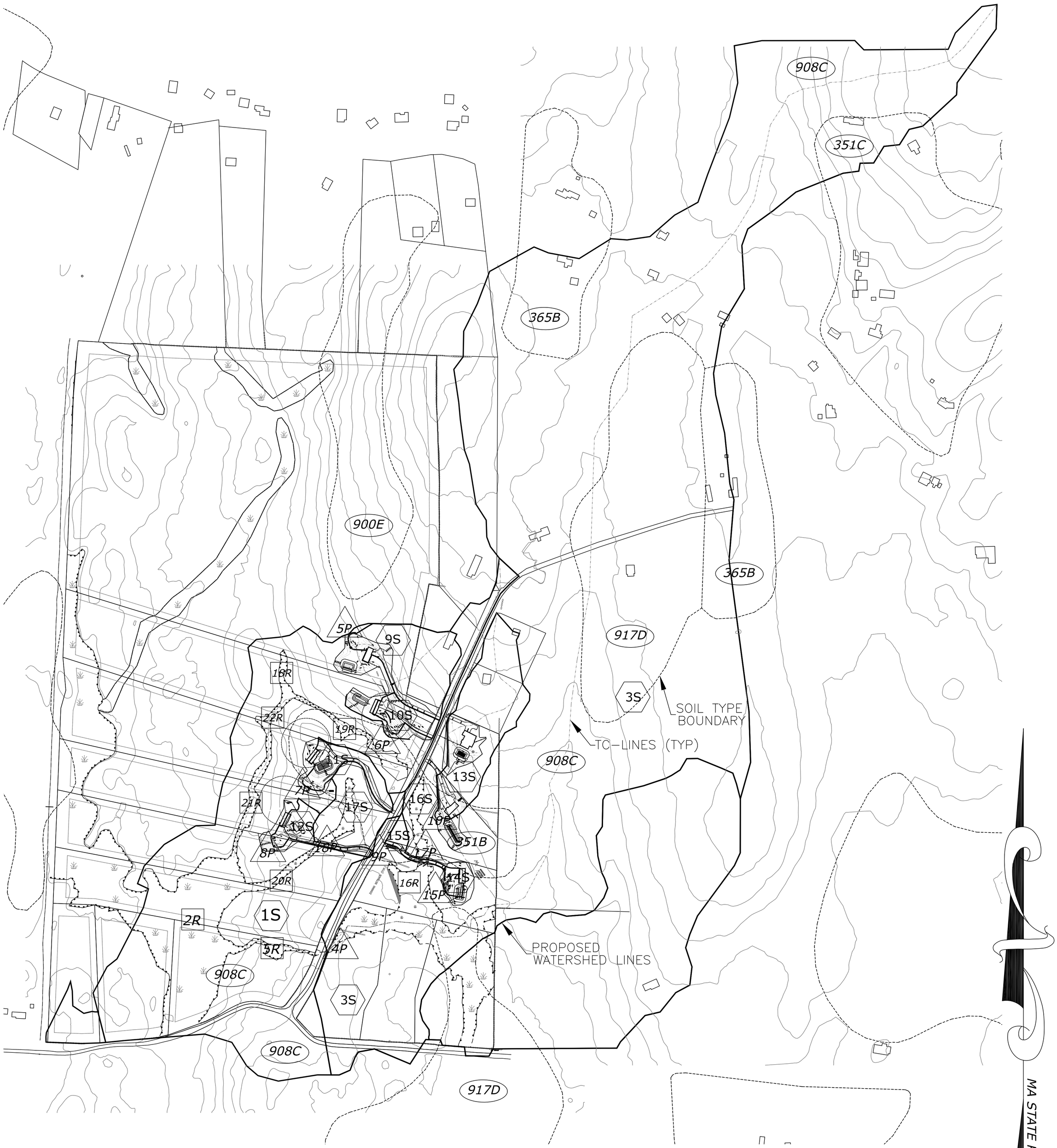

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