STORMWATER MANAGEMENT REPORT

DEFINITIVE SUBDIVISION PLAN
"FISKE HILL EAST REALTY TRUST"
30 MAIN STREET
STURBRIDGE, MA 01566

Prepared for:
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Section I - Introduction

A. Scope of Analysis

The project Applicant, Fiske Hill East Realty Trust, retained McClure Engineering, Inc. (McClure) to prepare this engineering analysis of pre and post-development drainage runoff conditions for the proposed Definitive Subdivision Plan for the property located at 30 Main Street, Sturbridge, MA (Site).

This Stormwater Management Report provides the required analysis of the proposed stormwater system for compliance with the Town of Southbridge Bylaw requirements, and the Massachusetts 310 CMR 10.00 Wetland Protection Regulations as promulgated by the Commissioner of the Massachusetts Department of Environmental Protection (MassDEP) pursuant to the authority granted under the Wetland Protection Act, M.G.L. c. 131 sec. 40 (WPA). The analysis includes pre- and post- conditions hydrologic modeling, and hydraulic sizing of the conveyance systems, sizing and analysis of Stormwater Best Management Practices (BMPs) of structural or non-structural techniques for managing stormwater to prevent or reduce non-point source pollutants from entering surface waters or ground waters. This report will demonstrate that the stormwater management system as designed and laid out at 30 Main Street, Sturbridge, MA, complies with the referenced regulations.

A copy of the “MA-DEP Checklist for Stormwater Report” is included as Appendix A.

B. Site Description

The Subject Site is referenced as Sturbridge Assessor’s Parcel I.D. 415-03914-030 and consists of approximately 18.56 acres. The property lies on the northern side of Main Street approximately 1,600 feet west of the Southbridge Town Line. The parcel is more particularly described in deed book 32421, page 230 as recorded with the Worcester County Registry of Deeds.

The site, 18.56 acres, is located within the Rural and Commercial zoning districts. The existing site consists of mostly wooded area, as well as wetlands. The site topography slopes generally in a southerly direction towards Main Street.

The site is located within an area of minimal flood hazard (Zone X) per Flood Insurance Rate Map (FIRM) Worcester County Massachusetts (All Jurisdictions), Map Number 25027C0933E, effective on 07/04/2011 (see Appendix C).

C. Proposed Construction

The proposed site layout is for the construction of an approximately 1,050 foot long subdivision roadway. The construction will disturb approximately 3.0 acres of existing woodland. The proposed asphalt roadway is 28’ wide with bituminous concrete curbs, and 6’ wide concrete sidewalks on both sides of the roadway. The development is proposed to connect to municipal water and sewer systems, as well as have an underground electrical system. The stormwater management system consists of catch basins, manholes, a subsurface pipe network, an infiltration basin, and a small rain garden. Loam, seed, and stabilization blankets are proposed for all areas of disturbance.

Section II - Hydrologic Analysis

A. Purpose

The purpose of this analysis is to determine the peak rate of stormwater runoff leaving the site and to design a stormwater management system that will prevent offsite flooding impacts. MassDEP Stormwater Management Policy, Standard No. 2, requires that post-development peak stormwater discharge rates shall not exceed pre-development levels.

B. Methodology

The pre- and post-development stormwater runoff has been analyzed using HydroCAD, a stormwater modeling computer program. HydroCAD is a collection of techniques for the generation and routing of hydrographs, including Soil Conservation Service (SCS) Technical Release No. 20 (TR-20) and SCS Technical Release 55 (TR-55), Urban Hydrology for Small Watersheds. The analysis routes completely through one node at a time determining each outflow hydrograph before considering the next node.

The subcatchments have been modeled using SCS methods. Curve numbers, which are based upon the type of development and soil classifications, coupled with the time of concentration have been used to generate the peak storm flow for each area. The detailed information and results are provided in this report.

Hydrology

Computer Model:	HydroCAD 10.0 © 2013 Applied Microcomputer Systems, drainage modeling software;
Hydrologic Methodology:	TR-55 Methodology is used for analysis of peak flow and infiltration basin sizing.
Watershed Areas:	Watershed areas are calculated using AutoCAD software based on the subcatchment areas delineated on topographic mapping included as "Pre-Development Drainage" and "Post-Development Drainage". The areas shown, times of concentration and runoff coefficients are all consistent with the TR-55 drainage calculation method.

C. Selection of Storm Events

The intensity for each storm event was determined from the National Oceanic and Atmospheric Administration National Weather Service Atlas 14 Point Precipitation Frequency Estimates (See Appendix C). Evaluations were based upon a Type III, 24-hour storm. Rainfall frequency and intensity used in this analysis are as follows:

Design Storm Event	Rainfall Intensity
2 year	3.24 inches
10 year	5.05 inches
25 year	6.19 inches
100 year	7.93 inches

D. Soils Classification

Site soils classifications were obtained from the following sources:

1.) Advanced soil mapping performed by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), "Soil Survey of Worcester County, Massachusetts, Southern Part." (See Appendix C for detailed soil information).

The soils descriptions are mapped as follows:

71B – Ridgebury Fine Sandy Loam – "HSG D"
305C – Paxton Fine Sandy Loam – "HSG C"
307C – Paxton Fine Sandy Loam – "HSG C"
312B – Woodbridge Fine Sandy Loam – "HSG C"

2.) On site soil testing performed by Peter Engle, P.E. (SE#14009) on 9/3/20. See Appendix C for detailed soil logs. Testing pit locations are shown on the Definitive Plan Set.

Soil Permeability (k):

Design permeability (k) value:
k = 2.41 in / hr (Rawls Rate for Loamy Sand based upon on site soil testing)

E. Pre-Development Model Summary

The pre-development hydrologic model analyzes the existing stormwater runoff from the portion of the site to five different points of analysis. The model breaks the site into five subcatchments. The analysis points are: Wetland Series A, Wetland Series B/C, 28 Main Street (abutting property), Main Street, and Wetland Series D. The graphical presentation of the pre-development model is shown in Appendix D.

F. Post-Development Model Summary

The post development model is shown in Appendix E. The configuration of the post development sub-catchments, ponds and reaches are generally configured as the pre-model. The post-development subcatchment has been broken into several smaller subcatchments for the analysis, in order to properly size the proposed pipe network and infiltration basin. The analysis points are the same as the pre-development model. The graphical presentation of the post-development model is shown in Appendix E.

G. Summary of Peak Stormwater Discharge Rates

The Pre- and Post-Analyses HydroCAD Report of the 2, 10, 25 and 100 year frequency storms is provided in Appendix D and E respectively. The following summary table present results for the pre- and post-development analysis for the 2, 10, 25 and 100 year, 24-hr storm events at the analysis point as previously described. The table shows that post peak rate of runoff is less than or equal to that of pre-existing peak rate of runoff for all the storms as studied.

Table No. 1
Analysis Point 1: Wetland Series D

	Pre-Development (cfs)	Post-Development (cfs)	Net Change (cfs)
2 Year Storm	1.83	1.76	-0.07
10 Year Storm	4.86	4.68	-0.18
25 Year Storm	7.02	6.77	-0.25
100 Year Storm	10.55	10.17	-0.38

Table No. 2
Analysis Point 2: Main Street

	Pre-Development (cfs)	Post-Development (cfs)	Net Change (cfs)
2 Year Storm	0.71	0.39	-0.32
10 Year Storm	1.54	0.87	-0.67
25 Year Storm	2.09	1.20	-0.89
100 Year Storm	2.96	1.72	-1.24

Table No. 3
Analysis Point 3: 28 Main Street

	Pre-Development (cfs)	Post-Development (cfs)	Net Change (cfs)
2 Year Storm	0.21	0.15	-0.06
10 Year Storm	0.56	0.37	-0.19
25 Year Storm	0.81	0.52	-0.29
100 Year Storm	1.21	0.77	-0.44

Table No. 4
Analysis Point 4: Wetland Series B/C

	Pre-Development (cfs)	Post-Development (cfs)	Net Change (cfs)
2 Year Storm	2.95	2.61	-0.34
10 Year Storm	7.65	6.93	-0.72
25 Year Storm	10.97	10.68	-0.29
100 Year Storm	16.32	15.86	-0.46

Table No. 5
Analysis Point 5: Wetland Series A

	Pre-Development (cfs)	Post-Development (cfs)	Net Change (cfs)
2 Year Storm	1.07	0.97	-0.10
10 Year Storm	2.77	2.43	-0.34
25 Year Storm	3.97	3.45	-0.52
100 Year Storm	5.90	5.09	-0.81

A. Standard 1 – Computations to Show That Discharge Does Not Cause Scour or Erosion

No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

Proposed Full Compliance:
Basin #1 is designed with an outlet control structure which discharges stormwater via a 12” HDPE culvert. The culvert discharges to a winged headwall and a 18’ L x 22’ W rip rap outfall, which will inhibit concentrated flow and reduce stormwater velocities. The discharge flows and velocities of the 12” culvert are as follows:

Storm Frequency	Peak Flow Q, cfs	Max Outfall Velocity, ft/s
2	1.71	0.71
10	4.58	1.04
25	5.84	1.14
100	8.19	1.30

These velocities are within acceptable range to prevent scour to the downstream wetlands (Series C).

DMH #2 is designed with an outlet which discharges stormwater via a 12” HDPE culvert. The culvert discharges to a winged headwall and a 12’ L x 15’ W rip rap outfall within the proposed rain garden, which will inhibit concentrated flow and reduce stormwater velocities. The stormwater will then travel through the rain garden prior to discharge to the wetlands. The discharge flows and velocities of the 12” culvert are as follows:

Storm Frequency	Peak Flow Q, cfs	Max Outfall Velocity, ft/s
2	0.69	0.68
10	1.37	0.88
25	1.80	0.98
100	2.48	1.11

These velocities are within acceptable range to prevent scour to the downstream wetlands (Series C).

The site drainage system has been designed from calculations based upon the 100-year design storm event using the peak flows predicted by the HydroCAD 10 Dynamic Modelling Program. The Manning’s Equation has been used to size the drainage system pipe runs.

Manning’s Equation: Q = A 1.486 R2/3 S1/2 / n
Where: Q = Flow Discharge, cfs
A = Cross Sectional Area of Wetted Perimeter
n = Manning Coefficient of Channel Roughness
R = Hydraulic Radius (A/WP)
WP = Wetted Perimeter
S = Slope of Energy Gradient

The summary of these results is provided in Appendix F.

B. Standard 2 – Peak Rate Attenuation

Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for land subject to coastal storm flowage.

Proposed Full Compliance:
The peak rate attenuation analyses and summaries have been reported in hydrologic analysis provided in Section 2.G of this report documenting there is no increase to off-site peak flow rates. A review of FEMA Flood Insurance Rate Map (FIRM) #25027C0933E (reduced scale provided in Appendix C) was reviewed for this site. The site is located in an area of minimal flood hazard (Zone X). The analysis as submitted indicates that there will be no increase in rate of runoff that would cause an increase of the flood elevation downstream.

C. Standard 3 – Recharge

Loss of annual recharge to ground water shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development conditions based on soil type. This Standard is met when the storm water management system is design to infiltrate the required recharge volume as determined in accordance with the Massachusetts Storm water Handbook.

Proposed Full Compliance:
The majority of the stormwater runoff from the additional proposed impervious area will be directed to the proposed infiltration basin. See Appendix F for computations of Standards 3 and 4. The following is a summary of the recharge for the three basins

1. Required Recharge Volume
   a. Impervious Area, as obtained from proposed Site Plan:
      52,485 s.f. HSG C
   b. Required recharge volume Rv = F x Impervious Area (F = target depth factor, for HSG C = 0.25), therefore:
      Rv = 1093.5 c.f.
2. Provided Recharge Volume
   a. The proposed infiltration basin provides for 1,112 c.f. of storage volume below the lowest outlet (5” orifice in outlet control structure at elevation 653.7). According to the HydroCAD model, the basin infiltrates 6,275 c.f. during a two year storm event (2.41 inches/hour Rawls Rate for Loamy Sand).
3. Drawdown within 72 hours (see computations in appendix F):
   T = 12 x Provided Recharge Volume / (Rawls Rate x Basin Bottom Area)
   T = 4.07 hrs

D. Standard 4 – Water Quality

Stormwater management systems must be designed to remove 80% of the average annual post construction load of Total Suspended Solids (TSS). This standard is met when:

a. Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan and thereafter implemented and maintained;
b. Stormwater BMPs are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and
c. Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

Proposed Full Compliance:

1. Water Quality Treatment Volume
   V*wq* = (D*wq*/12 inches/ft) x (A*imp*) = (see Appendix F for computations):

   Infiltration Basin (44,515 s.f. impervious) – 1,855 c.f. required (D*wq* = 0.5 inch)
   BMP treats 6,278 c.f. during a two year storm event
   STIC450 and Raingarden (6,310 s.f. impervious) – 263 c.f. required (D*wq* = 0.5 inch)
   BMP treats 2,853 c.f. during a two year storm event
   Surface Flow to Main Street (1,660 s.f. impervious) – 70 c.f. required (D*wq* = 0.5 inch)
   Untreated

2. TSS removal percentage computations are provided in Appendix F for the BMP treatment train as designed. There are three treatment trains created for the proposed drainage system:

   - The proposed infiltration basin with sediment forebay, with deep sump and hooded catch basins is rated with 85% TSS removal.
   - The proposed DMH#2 (Stormceptor® Particle Separator) and Rain Garden is rated with 99% TSS removal.
   - The surface flow to Main Street goes untreated.

   Weighted Average for the Site = (44,515*0.85 + 6,310*0.99 + 1,660*0.00) / 52,485 = 84% TSS Removal

The TSS removal computations are provided in Appendix H.

A “Long Term Operation and Maintenance Plan” is being provided as Appendix H.

E. <u>Standard 5 – Land Uses with Higher Potential Pollutant Loads</u>

For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Storm water Handbook to eliminate or reduce the discharge of storm water runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention, all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, or storm water runoff, the proponent shall use the specific storm water BMP’s determined by the Department to be suitable for such use as provided in the Massachusetts Storm water Handbook.

Proposed Full Compliance:

- Not applicable - the Site is not a Land Use with High Potential Pollutant Loads.

F. <u>Standard 6 – Critical Areas</u>

Storm water discharges to a Zone II or Interim Wellhead Protection Area of a public water supply and storm water discharges near or any other critical area require the use of the specific storm water best management practices determined by the Department to be suitable for managing discharges to such area as provided in the Massachusetts Storm water Handbook.

Proposed Full Compliance:

- Not applicable - the site does not discharge to critical areas.

G. Standard 7 - Redevelopment

A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable; Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

Proposed Full Compliance:

- The Site is not considered a redevelopment, and all of the standards will be fully met.

H. Standard 8 – Construction Period Controls

A plan to control construction related impacts including erosion sedimentation and other pollution prevention sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) must be implemented.

Proposed Full Compliance:

- Draft - Weekly Construction Period Inspection Report is provided as Appendix G.
- Project will disturb > 1 Acre, therefore an EPA–NPDES Stormwater General Permit is required.
- The construction period erosion and sedimentation control plan has been outlined on the referenced site plans along with the sequence for implementation. The construction period erosion and sedimentation control are shown on the referenced plans.

I. Standard 9 – Operation and Maintenance Plan

A long term operation and maintenance plan must be developed and implemented to ensure that storm water management systems function as designed.

Proposed Full Compliance:

- Long Term Operation and Maintenance Plan is included in the Stormwater Management Report, Appendix H.

J. Standard 10 – Illicit Discharges to Drainage System

All illicit discharges to the stormwater management system are prohibited.

Proposed Full Compliance:

- The Long Term Operation and Maintenance Plan provided in Appendix H addresses illicit discharges to drainage system.

Table No. 1 provides a summary of off-site Pre- and Post-Development peak runoff flow rates and volumes**.**

A copy of the “MA-DEP Checklist for Stormwater Report” is included as **Appendix A**.

Appendix D & E includes the complete Pre-Development and Post-Development *HydroCAD* drainage calculation reports and **Figures DA-EX and DA-PR “Pre-“and “Post-Development Drainage Areas” plans** for your review.

Appendix F provides additional stormwater calculations relating to compliance with MA Stormwater Management Standard #3 and Standard #4.

Appendix G provides a DRAFT “Weekly Construction Period Inspection Report”

Appendix H provides a DRAFT “Long Term Stormwater Operation & Maintenance Plan”

The **“Fiske Hill East” Definitive Subdivision Plan, 30 Main Street and 20 Fiske Hill Road, Sturbridge, MA” prepared by McClure Engineering, Inc., dated 11/11/20 revise date 5/28/21** provides details of the complete stormwater management system design**.**

APPENDIX A

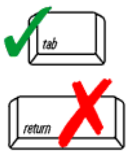
MA-DEP STORMWATER CHECKLIST

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.

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[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

COMMONWEALTH OF MASSACHUSETTS
PETER C
ENGLE
CIVIL
No. 53736
REGISTERED
PROFESSIONAL ENGINEER

5-27-21
Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist (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 (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 (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

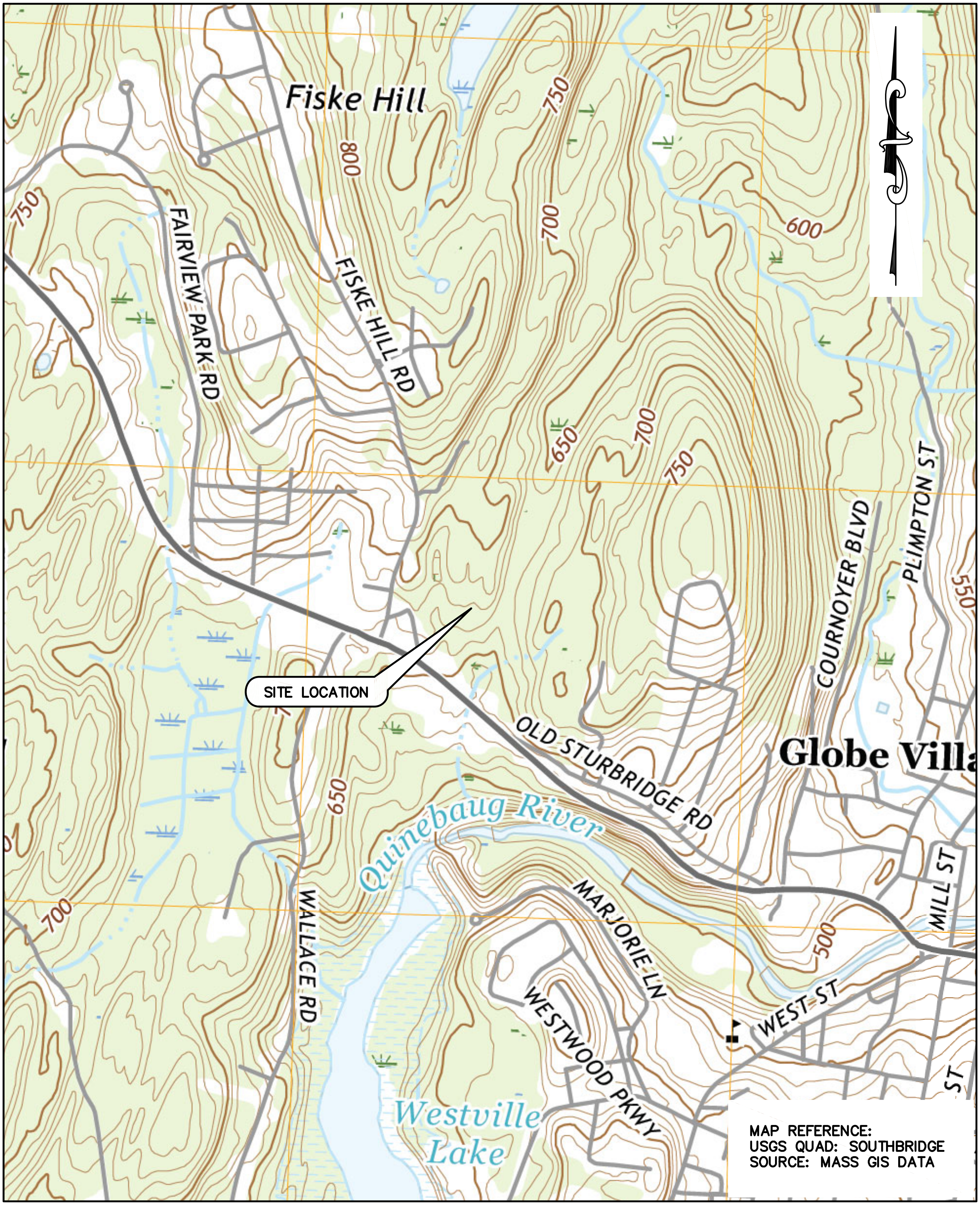
☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

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

APPENDIX B

USGS – Figure 1



DATE:	11-11-20
DRAWN BY:	MM
APPROVED BY:	PE
SCALE:	
HORZ:	1"=1000'

0 500' 1000'

McCLURE ENGINEERING, INC
119 Worcester Road
Charlton, MA 01507
Tel: (508) 248-2005
Fax (508) 248-4887
Email: pengle@mcclureengineers.com

USGS SITE LOCATION
"FISKE HILL EAST"
30 MAIN STREET & 20 FISKE HILL ROAD
STURBRIDGE, MASSACHUSETTS

PROJ. NO.	287-2117-K
DWG.	USGS

FIG 1

APPENDIX C

FEMA - FLOOD PLAIN MAPPING

NCRS SOIL MAPPING

ON-SITE SOIL TESTING LOGS

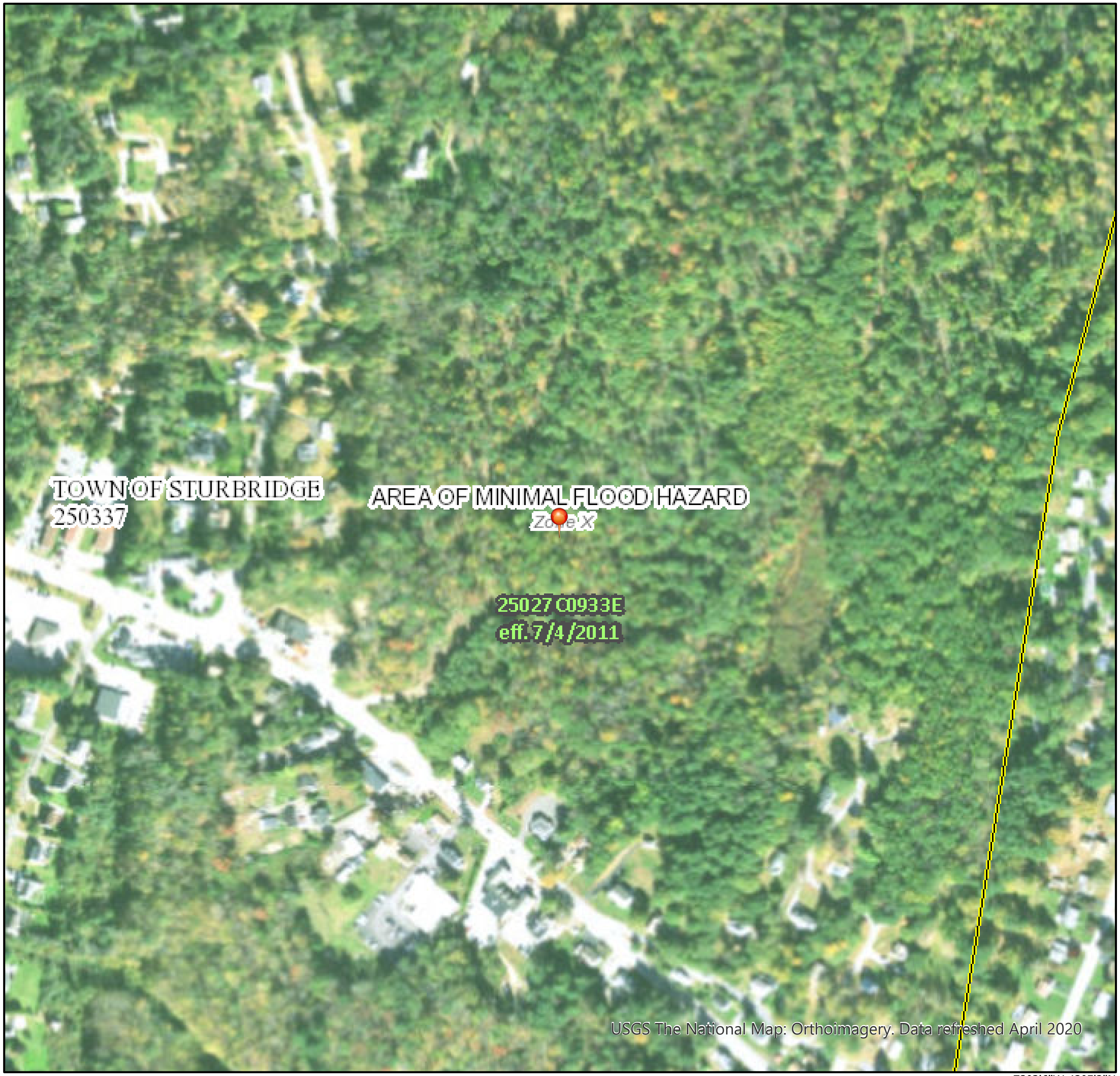
RAWLS TABLE

NOAA PRECIPITATION FREQUENCY ESTIMATES

National Flood Hazard Layer FIRMette

FEMA

72°3'43"W 42°5'29"N



72°3'6"W 42°5'2"N

Feet 0 250 500 1,000 1,500 2,000

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

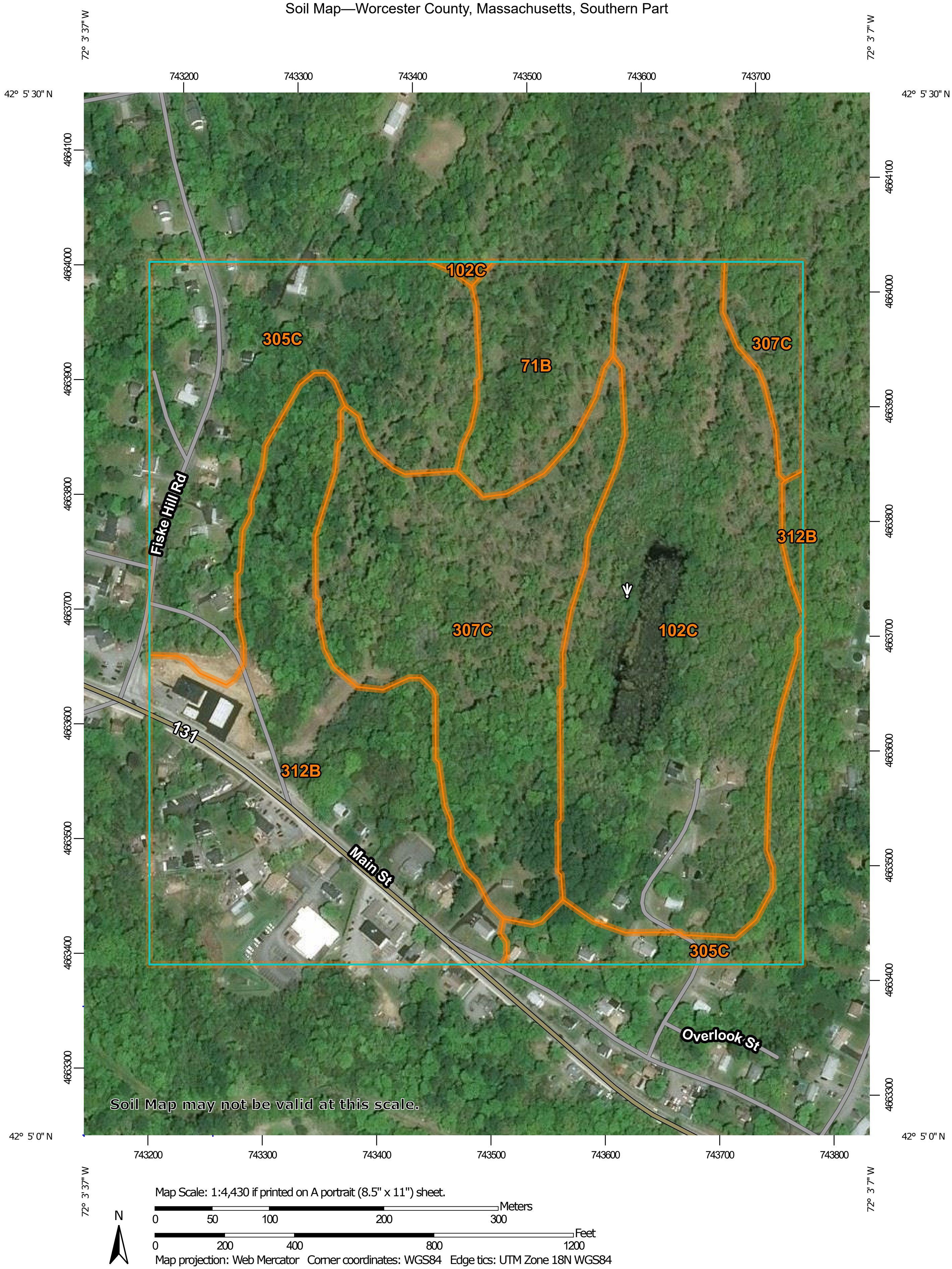
N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/31/2020 at 12:15 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.


72° 3' 37" W
72° 3' 7" W
743200
743300
743400
743500
743600
743700
42° 5' 30" N
42° 5' 30" N
4664100
4664000
4663900
4663800
4663700
4663600
4663500
4663400
4663300
102C
305C
71B
307C
312B
Fiske Hill Rd
307C
102C
131
312B
Main St
305C
Overlook St
Soil Map may not be valid at this scale.
42° 5' 0" N
42° 5' 0" N
743200
743300
743400
743500
743600
743700
743800
72° 3' 37" W
72° 3' 7" W
Map Scale: 1:4,430 if printed on A portrait (8.5" x 11") sheet.
Meters
0 50 100 200 300
N
Feet
0 200 400 800 1200
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, Southern Part
Survey Area Data: Version 13, Jun 11, 2020

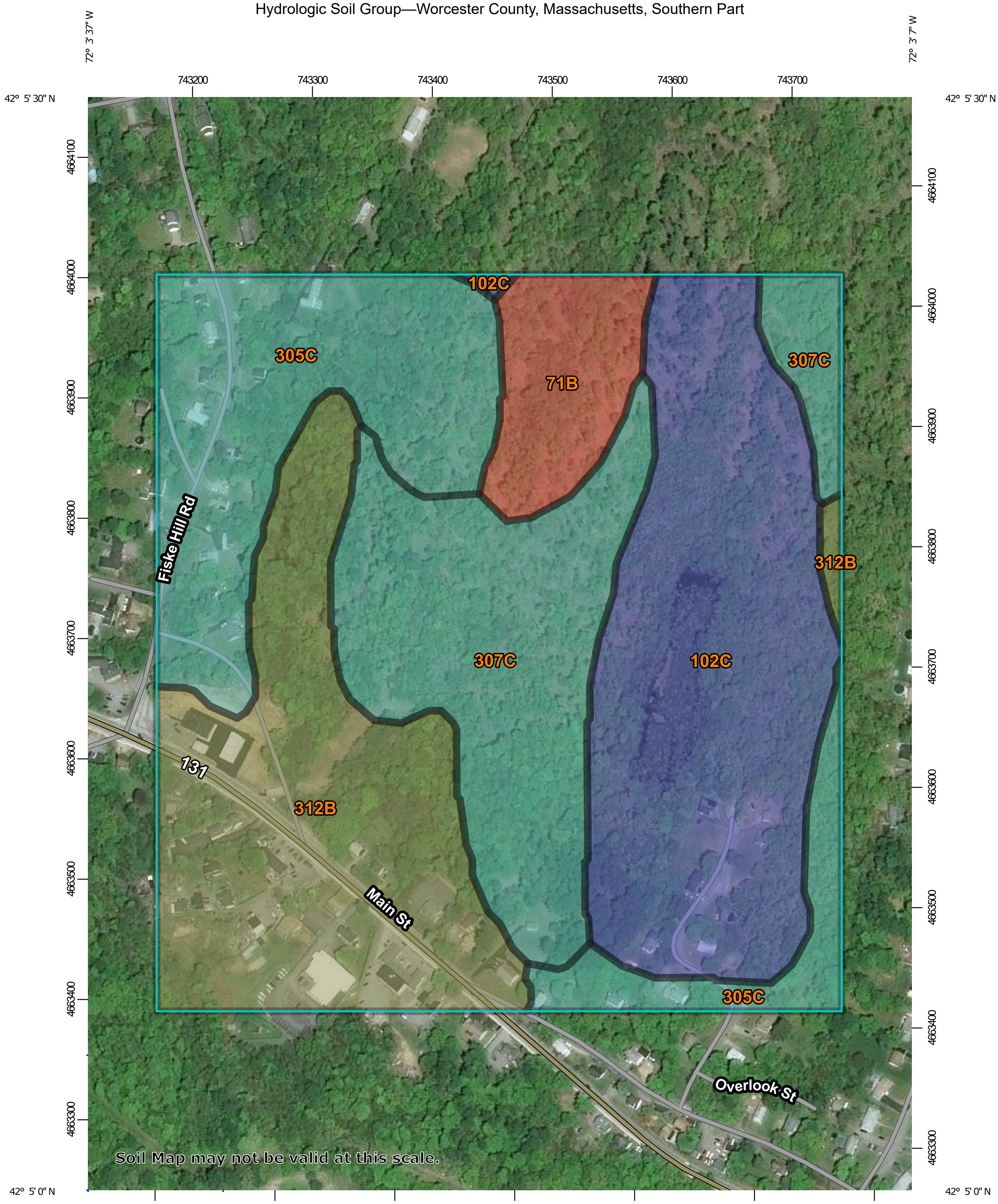
Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 18, 2019—Jul 9, 2019

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
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	5.2	6.0%
102C	Chatfield-Hollis-Rock outcrop complex, 0 to 15 percent slopes	23.4	27.0%
305C	Paxton fine sandy loam, 8 to 15 percent slopes	18.5	21.3%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	18.2	21.0%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	21.4	24.7%
Totals for Area of Interest		**86.8**	**100.0%**



Map Scale: 1:4,430 if printed on A portrait (8.5" x 11") sheet.

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

N

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 Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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, Southern Part
Survey Area Data: Version 13, Jun 11, 2020

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

Date(s) aerial images were photographed: May 18, 2019—Jul 9, 2019

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	D	5.2	6.0%
102C	Chatfield-Hollis-Rock outcrop complex, 0 to 15 percent slopes	B	23.4	27.0%
305C	Paxton fine sandy loam, 8 to 15 percent slopes	C	18.5	21.3%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	C	18.2	21.0%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	C/D	21.4	24.7%
Totals for Area of Interest			**86.8**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

McClure Engineering, Inc.
119 Worcester Road
Charlton, MA 01507
508.248.2005

TEST PIT REPORT FORM

Project: Definitive Subdivision 30 Main Street Sturbridge, MA	**Client:** Fiske Hill East Realty Trust	**Test Pit Number:** T.P. # 1 **Date performed:** September 3, 2020
Contractor: Brian Mitchell Flynn Construction	**McClure Observer:** Peter Engle, P.E. SE 14009	**Weather:** 70's Clear
Contractor personnel on site: 1 Operator w/ Mini Excavator	**Others on site:**	**Approx. Ground Elevation (feet):** 653.00 +/-

Depth (Inches)	Soil Horizon	USDA Soil Textural Classification	Soil Matrix	Redox Features (Inches)	Soil Structure	Soil Consistence	Other/Notes
0-3	Ao	SL	10YR3/2				
3-18	Bw	SL	10YR4/4				
18-72	C	GLS	10YR7/3	36" 10YR5/8	Massive	Friable	>10% Gravel Some Cobbles

Comments: No groundwater weeping or standing observed in Test Pit. Boulder at 72".	**Estimated Seasonal High Groundwater @:** 36" (Redox) **Refusal @:** >72"

McCLURE
ENGINEERING, INC

McClure Engineering, Inc.
119 Worcester Road
Charlton, MA 01507
508.248.2005

TEST PIT REPORT FORM

Project: Definitive Subdivision 30 Main Street Sturbridge, MA	**Client:** Fiske Hill East Realty Trust	**Test Pit Number:** T.P. # 2 **Date performed:** September 3, 2020
Contractor: Brian Mitchell Flynn Construction	**McClure Observer:** Peter Engle, P.E. SE 14009	**Weather:** 70's Clear
Contractor personnel on site: 1 Operator w/ Mini Excavator	**Others on site:**	**Approx. Ground Elevation (feet):** 653.00 +/-

Depth (Inches)	Soil Horizon	USDA Soil Textural Classification	Soil Matrix	Redox Features (Inches)	Soil Structure	Soil Consistence	Other/Notes
0-4	Ao	SL	10YR3/2				
4-18	Bw	SL	10YR4/4				
18-72	C	VGLS	10YR7/3	36" 10YR5/8	Massive	Friable	>20% Gravel Some Cobbles

Comments: No groundwater weeping or standing observed in Test Pit. Boulder at 72".	**Estimated Seasonal High Groundwater @:** 36" (Redox) **Refusal @:** >72"

McCLURE ENGINEERING, INC

McClure Engineering, Inc.
119 Worcester Road
Charlton, MA 01507
508.248.2005

TEST PIT REPORT FORM

Project: Definitive Subdivision 30 Main Street Sturbridge, MA	**Client:** Fiske Hill East Realty Trust	**Test Pit Number:** T.P. # 3 **Date performed:** September 3, 2020
Contractor: Brian Mitchell Flynn Construction	**McClure Observer:** Peter Engle, P.E. SE 14009	**Weather:** 70's Clear
Contractor personnel on site: 1 Operator w/ Mini Excavator	**Others on site:**	**Approx. Ground Elevation (feet):** 653.00 +/-

Depth (Inches)	Soil Horizon	USDA Soil Textural Classification	Soil Matrix	Redox Features (Inches)	Soil Structure	Soil Consistence	Other/Notes
0-4	Ao	SL	10YR3/2				
4-18	Bw	SL	10YR4/4				
18-84	C	GLS	10YR7/3	42" 10YR5/8	Massive	Friable	>10% Gravel Some Cobbles

Comments: No groundwater weeping or standing observed in Test Pit.	**Estimated Seasonal High Groundwater @:** 42" (Redox) **Refusal @:** >84"

Table 2.3.3. 1982 Rawls Rates[18]

Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate Inches/Hour
Sand	A	8.27
Loamy Sand	A	2.41
Sandy Loam	B	1.02
Loam	B	0.52
Silt Loam	C	0.27
Sandy Clay Loam	C	0.17
Clay Loam	D	0.09
Silty Clay Loam	D	0.06
Sandy Clay	D	0.05
Silty Clay	D	0.04
Clay	D	0.02

18 Rawls, Brakensiek and Saxton, 1982

NOAA Atlas 14, Volume 10, Version 3
Location name: Sturbridge, Massachusetts, USA*
Latitude: 42.0868°, Longitude: -72.059°
Elevation: 660.18 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.338** (0.263-0.428)	**0.399** (0.310-0.506)	**0.499** (0.386-0.635)	**0.582** (0.448-0.745)	**0.696** (0.518-0.931)	**0.783** (0.570-1.07)	**0.872** (0.616-1.24)	**0.968** (0.652-1.41)	**1.10** (0.714-1.67)	**1.21** (0.763-1.87)
10-min	**0.479** (0.373-0.607)	**0.566** (0.439-0.717)	**0.708** (0.547-0.901)	**0.825** (0.636-1.06)	**0.986** (0.734-1.32)	**1.11** (0.808-1.52)	**1.24** (0.873-1.75)	**1.37** (0.923-2.00)	**1.56** (1.01-2.36)	**1.71** (1.08-2.65)
15-min	**0.564** (0.438-0.714)	**0.666** (0.517-0.844)	**0.832** (0.644-1.06)	**0.970** (0.747-1.24)	**1.16** (0.864-1.55)	**1.30** (0.951-1.78)	**1.45** (1.03-2.06)	**1.61** (1.09-2.36)	**1.83** (1.19-2.78)	**2.01** (1.27-3.12)
30-min	**0.767** (0.596-0.972)	**0.906** (0.703-1.15)	**1.13** (0.877-1.44)	**1.32** (1.02-1.69)	**1.58** (1.18-2.11)	**1.78** (1.29-2.42)	**1.98** (1.40-2.80)	**2.19** (1.48-3.21)	**2.50** (1.62-3.78)	**2.73** (1.73-4.24)
60-min	**0.971** (0.755-1.23)	**1.15** (0.890-1.45)	**1.43** (1.11-1.82)	**1.67** (1.29-2.14)	**2.00** (1.49-2.67)	**2.25** (1.64-3.07)	**2.50** (1.77-3.54)	**2.78** (1.87-4.05)	**3.16** (2.05-4.79)	**3.46** (2.19-5.36)
2-hr	**1.25** (0.975-1.57)	**1.46** (1.14-1.84)	**1.82** (1.42-2.29)	**2.11** (1.63-2.68)	**2.51** (1.89-3.35)	**2.82** (2.07-3.84)	**3.14** (2.25-4.46)	**3.51** (2.37-5.10)	**4.06** (2.64-6.12)	**4.51** (2.86-6.95)
3-hr	**1.43** (1.12-1.79)	**1.68** (1.32-2.11)	**2.09** (1.64-2.63)	**2.43** (1.89-3.08)	**2.90** (2.19-3.86)	**3.25** (2.40-4.43)	**3.62** (2.61-5.16)	**4.07** (2.76-5.90)	**4.75** (3.10-7.15)	**5.33** (3.39-8.19)
6-hr	**1.79** (1.42-2.23)	**2.13** (1.68-2.66)	**2.69** (2.12-3.36)	**3.15** (2.46-3.96)	**3.78** (2.87-5.01)	**4.25** (3.17-5.78)	**4.76** (3.46-6.77)	**5.39** (3.66-7.77)	**6.37** (4.16-9.53)	**7.22** (4.60-11.0)
12-hr	**2.20** (1.76-2.72)	**2.67** (2.13-3.31)	**3.44** (2.73-4.27)	**4.08** (3.21-5.09)	**4.95** (3.79-6.53)	**5.59** (4.20-7.58)	**6.30** (4.61-8.94)	**7.18** (4.89-10.3)	**8.55** (5.60-12.7)	**9.74** (6.23-14.8)
24-hr	**2.63** (2.11-3.23)	**3.24** (2.60-3.98)	**4.23** (3.38-5.22)	**5.05** (4.01-6.27)	**6.19** (4.76-8.12)	**7.02** (5.30-9.46)	**7.93** (5.84-11.2)	**9.07** (6.21-12.9)	**10.8** (7.12-16.0)	**12.4** (7.94-18.7)
2-day	**3.06** (2.47-3.73)	**3.78** (3.05-4.62)	**4.96** (3.99-6.08)	**5.95** (4.75-7.33)	**7.30** (5.65-9.51)	**8.29** (6.29-11.1)	**9.38** (6.94-13.2)	**10.7** (7.38-15.2)	**12.9** (8.48-18.9)	**14.7** (9.47-22.1)
3-day	**3.34** (2.71-4.06)	**4.13** (3.35-5.02)	**5.42** (4.37-6.62)	**6.49** (5.21-7.97)	**7.96** (6.19-10.4)	**9.05** (6.90-12.1)	**10.2** (7.61-14.3)	**11.7** (8.08-16.6)	**14.1** (9.30-20.6)	**16.1** (10.4-24.1)
4-day	**3.58** (2.91-4.34)	**4.42** (3.59-5.36)	**5.79** (4.69-7.05)	**6.93** (5.58-8.49)	**8.50** (6.63-11.0)	**9.65** (7.38-12.9)	**10.9** (8.14-15.3)	**12.5** (8.64-17.6)	**15.0** (9.95-22.0)	**17.2** (11.1-25.7)
7-day	**4.25** (3.48-5.12)	**5.19** (4.24-6.26)	**6.74** (5.49-8.16)	**8.02** (6.49-9.77)	**9.79** (7.67-12.6)	**11.1** (8.51-14.7)	**12.5** (9.36-17.4)	**14.3** (9.91-20.1)	**17.2** (11.4-25.0)	**19.6** (12.7-29.2)
10-day	**4.93** (4.05-5.92)	**5.93** (4.86-7.13)	**7.57** (6.18-9.13)	**8.93** (7.25-10.8)	**10.8** (8.48-13.8)	**12.2** (9.37-16.0)	**13.7** (10.2-18.9)	**15.6** (10.8-21.7)	**18.5** (12.3-26.8)	**21.0** (13.6-31.2)
20-day	**7.11** (5.88-8.47)	**8.16** (6.74-9.74)	**9.89** (8.14-11.8)	**11.3** (9.25-13.7)	**13.3** (10.5-16.8)	**14.8** (11.4-19.1)	**16.3** (12.2-22.1)	**18.2** (12.7-25.2)	**20.8** (13.9-30.0)	**23.1** (15.0-34.0)
30-day	**8.93** (7.42-10.6)	**10.0** (8.30-11.9)	**11.8** (9.73-14.0)	**13.2** (10.9-15.9)	**15.3** (12.0-19.1)	**16.8** (12.9-21.5)	**18.4** (13.6-24.5)	**20.1** (14.1-27.6)	**22.4** (15.0-32.1)	**24.3** (15.8-35.6)
45-day	**11.2** (9.32-13.2)	**12.3** (10.2-14.6)	**14.1** (11.7-16.8)	**15.6** (12.9-18.7)	**17.7** (14.0-22.0)	**19.3** (14.9-24.6)	**20.9** (15.4-27.5)	**22.5** (15.8-30.8)	**24.5** (16.5-34.9)	**25.9** (16.9-37.9)
60-day	**13.0** (10.9-15.4)	**14.2** (11.9-16.8)	**16.1** (13.4-19.1)	**17.7** (14.6-21.1)	**19.8** (15.7-24.5)	**21.5** (16.6-27.2)	**23.2** (17.1-30.1)	**24.6** (17.4-33.6)	**26.3** (17.8-37.5)	**27.5** (18.0-40.1)

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

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

Please refer to NOAA Atlas 14 document for more information.

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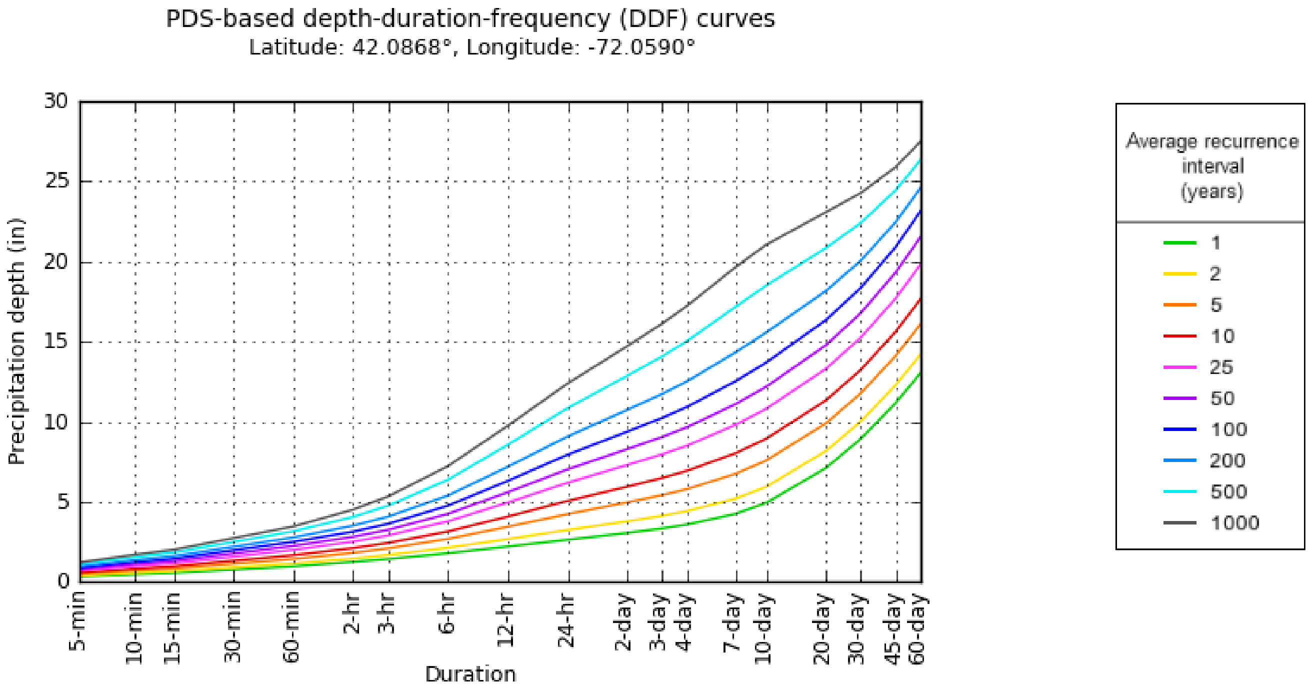
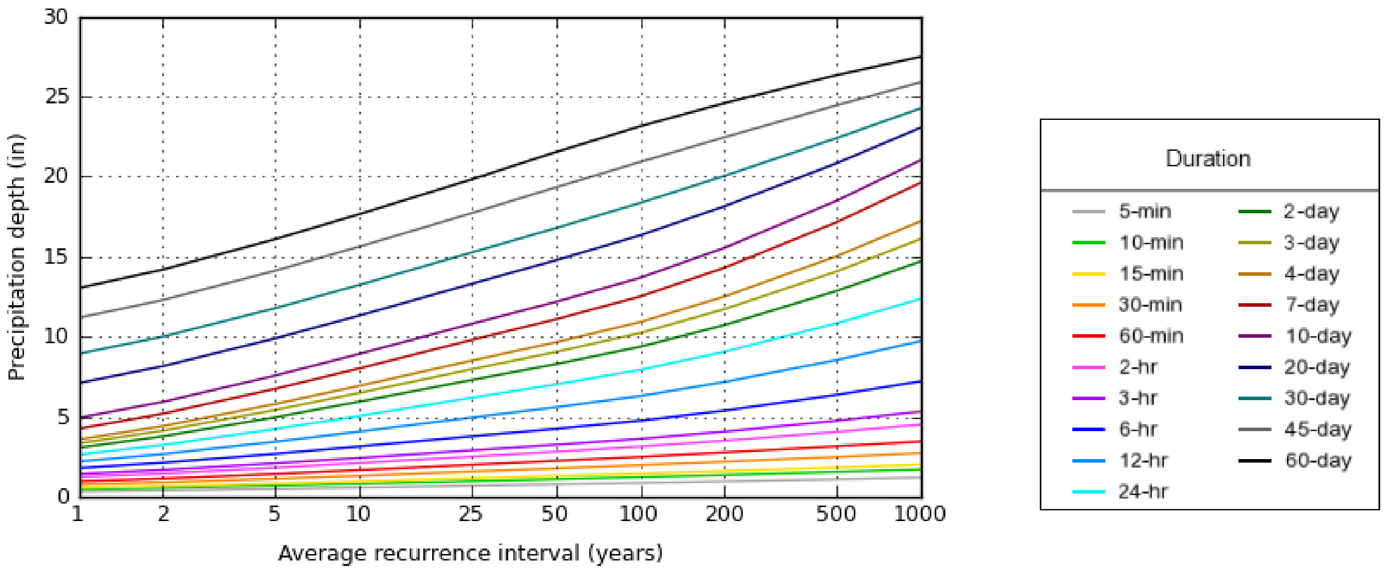
PF graphical





NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Fri Sep 18 14:59:04 2020

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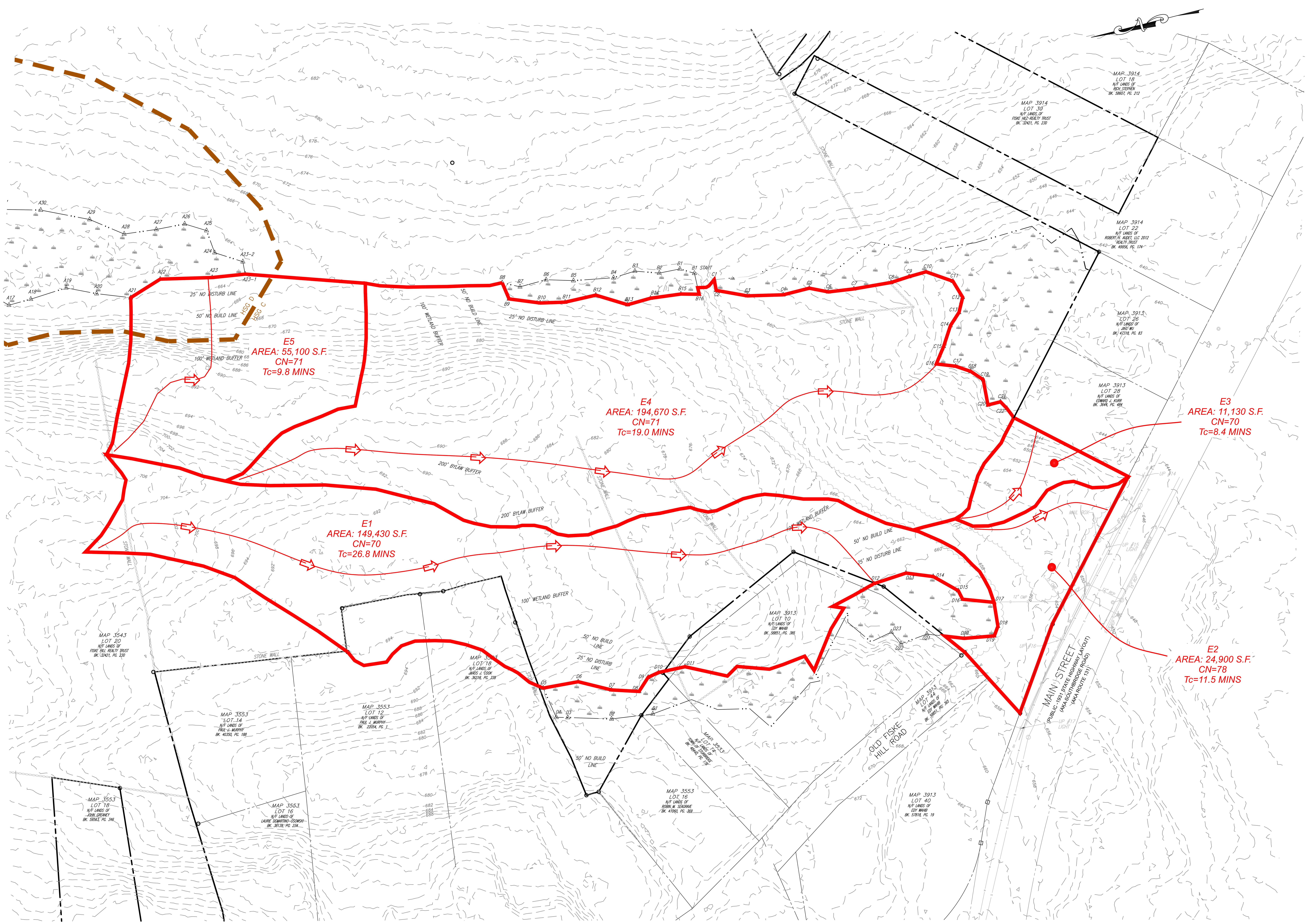
Maps & aerials

Small scale terrain

APPENDIX D

PRE-DEVELOPMENT
HYDROCAD DRAINAGE CALCULATIONS



HOR. SCALE IN FEET: 1"=50'
50 0 50 100 150

REVISIONS

REV	DATE	DESCRIPTION	MADE	APV'D
1	12.29.20	REV. PER CLIENT	WN	PE

PETER C. ENGLE, P.E.
PROFESSIONAL ENGINEER
MA LIC. NO. 53736

McCLURE
ENGINEERING, INC
119 Worcester Road
Charlton, MA 01507
Tel: (508) 248-2005
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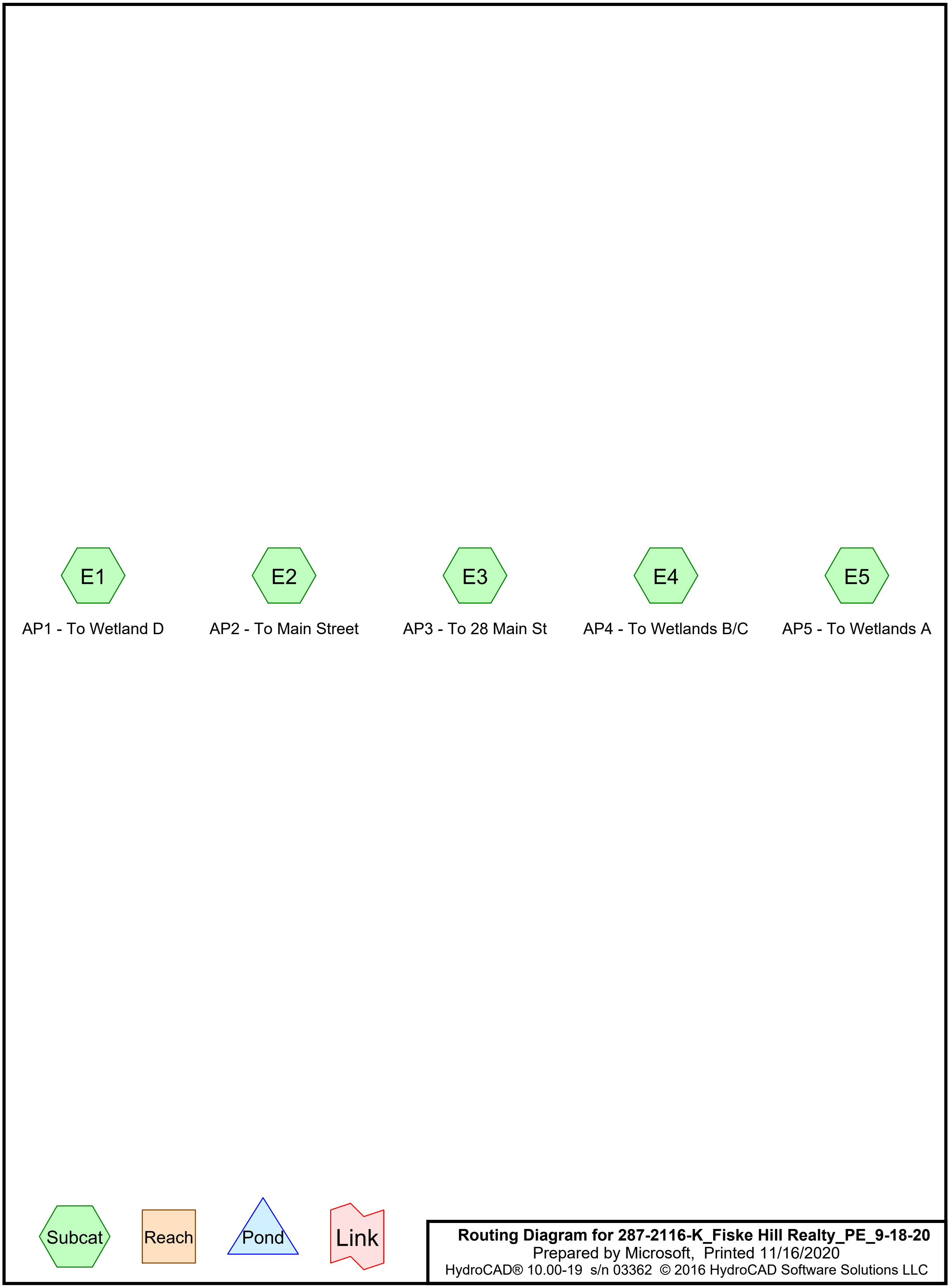
Email: pengle@mcclureengineers.com

DEFINITIVE SUBDIVISION PLAN
LOCATED AT
30 MAIN STREET & 20 FISKE HILL ROAD
STURBRIDGE, MA 01566
PREPARED FOR
FISKE HILL EAST REALTY TRUST
97 ARNOLD ROAD, FISKDALE, MA 01518

DRAWN BY:	MM
DATE:	11/11/2020
CHK BY:	PCE
SCALE:	1"=50'
PROJ. NO.	287-2117-K

PRE-DEVELOPMENT WATERSHED MAP

DA-EX



Routing Diagram for 287-2116-K_Fiske Hill Realty_PE_9-18-20
Prepared by Microsoft, Printed 11/16/2020

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
21,830	87	Dirt roads, HSG C (E2, E4)
403,370	70	Woods, Good, HSG C (E1, E2, E3, E4, E5)
10,030	77	Woods, Good, HSG D (E5)
435,230	**71**	**TOTAL AREA**

Summary for Subcatchment E1: AP1 - To Wetland D

Runoff = 1.83 cfs @ 12.42 hrs, Volume= 10,518 cf, Depth> 0.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
149,430	70	Woods, Good, HSG C
149,430		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	50	0.0500	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
2.5	170	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	240	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	505	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
26.8	965	Total			

Summary for Subcatchment E2: AP2 - To Main Street

Runoff = 0.71 cfs @ 12.17 hrs, Volume= 2,696 cf, Depth> 1.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
12,620	70	Woods, Good, HSG C
12,280	87	Dirt roads, HSG C
24,900	78	Weighted Average
24,900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
1.8	110	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.5	160	Total			

Summary for Subcatchment E3: AP3 - To 28 Main St

Runoff = 0.21 cfs @ 12.13 hrs, Volume= 788 cf, Depth> 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
11,130	70	Woods, Good, HSG C
11,130		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0800	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.9	75	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	30	0.2000	2.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.4	155	Total			

Summary for Subcatchment E4: AP4 - To Wetlands B/C

Runoff = 2.95 cfs @ 12.29 hrs, Volume= 14,557 cf, Depth> 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
185,120	70	Woods, Good, HSG C
9,550	87	Dirt roads, HSG C
194,670	71	Weighted Average
194,670		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.1000	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.5	50	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.7	240	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	25	0.0800	4.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.0	505	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
19.0	870	Total			

Summary for Subcatchment E5: AP5 - To Wetlands A

Runoff = 1.07 cfs @ 12.15 hrs, Volume= 4,131 cf, Depth> 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
45,070	70	Woods, Good, HSG C
10,030	77	Woods, Good, HSG D
55,100	71	Weighted Average
55,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	25	0.0400	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
2.2	25	0.4000	0.19		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
1.7	100	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	50	0.4500	3.35		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	50	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.8	250	Total			

Summary for Subcatchment E1: AP1 - To Wetland D

Runoff = 4.86 cfs @ 12.39 hrs, Volume= 25,652 cf, Depth> 2.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
149,430	70	Woods, Good, HSG C
149,430		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	50	0.0500	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
2.5	170	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	240	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	505	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
26.8	965	Total			

Summary for Subcatchment E2: AP2 - To Main Street

Runoff = 1.54 cfs @ 12.16 hrs, Volume= 5,702 cf, Depth> 2.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
12,620	70	Woods, Good, HSG C
12,280	87	Dirt roads, HSG C
24,900	78	Weighted Average
24,900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
1.8	110	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.5	160	Total			

Summary for Subcatchment E3: AP3 - To 28 Main St

Runoff = 0.56 cfs @ 12.12 hrs, Volume= 1,919 cf, Depth> 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
11,130	70	Woods, Good, HSG C
11,130		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0800	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.9	75	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	30	0.2000	2.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.4	155	Total			

Summary for Subcatchment E4: AP4 - To Wetlands B/C

Runoff = 7.65 cfs @ 12.27 hrs, Volume= 34,793 cf, Depth> 2.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
185,120	70	Woods, Good, HSG C
9,550	87	Dirt roads, HSG C
194,670	71	Weighted Average
194,670		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.1000	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.5	50	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.7	240	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	25	0.0800	4.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.0	505	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
19.0	870	Total			

Summary for Subcatchment E5: AP5 - To Wetlands A

Runoff = 2.77 cfs @ 12.14 hrs, Volume= 9,870 cf, Depth> 2.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
45,070	70	Woods, Good, HSG C
10,030	77	Woods, Good, HSG D
55,100	71	Weighted Average
55,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	25	0.0400	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
2.2	25	0.4000	0.19		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
1.7	100	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	50	0.4500	3.35		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	50	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.8	250	Total			

Summary for Subcatchment E1: AP1 - To Wetland D

Runoff = 7.02 cfs @ 12.38 hrs, Volume= 36,597 cf, Depth> 2.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
149,430	70	Woods, Good, HSG C
149,430		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	50	0.0500	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
2.5	170	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	240	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	505	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
26.8	965	Total			

Summary for Subcatchment E2: AP2 - To Main Street

Runoff = 2.09 cfs @ 12.16 hrs, Volume= 7,759 cf, Depth> 3.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
12,620	70	Woods, Good, HSG C
12,280	87	Dirt roads, HSG C
24,900	78	Weighted Average
24,900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
1.8	110	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.5	160	Total			

Summary for Subcatchment E3: AP3 - To 28 Main St

Runoff = 0.81 cfs @ 12.12 hrs, Volume= 2,737 cf, Depth> 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
11,130	70	Woods, Good, HSG C
11,130		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0800	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.9	75	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	30	0.2000	2.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.4	155	Total			

Summary for Subcatchment E4: AP4 - To Wetlands B/C

Runoff = 10.97 cfs @ 12.27 hrs, Volume= 49,316 cf, Depth> 3.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
185,120	70	Woods, Good, HSG C
9,550	87	Dirt roads, HSG C
194,670	71	Weighted Average
194,670		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.1000	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.5	50	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.7	240	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	25	0.0800	4.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.0	505	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
19.0	870	Total			

Summary for Subcatchment E5: AP5 - To Wetlands A

Runoff = 3.97 cfs @ 12.14 hrs, Volume= 13,987 cf, Depth> 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
45,070	70	Woods, Good, HSG C
10,030	77	Woods, Good, HSG D
55,100	71	Weighted Average
55,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	25	0.0400	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
2.2	25	0.4000	0.19		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
1.7	100	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	50	0.4500	3.35		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	50	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.8	250	Total			

Summary for Subcatchment E1: AP1 - To Wetland D

Runoff = 10.55 cfs @ 12.36 hrs, Volume= 54,539 cf, Depth> 4.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
149,430	70	Woods, Good, HSG C
149,430		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	50	0.0500	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
2.5	170	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	240	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	505	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
26.8	965	Total			

Summary for Subcatchment E2: AP2 - To Main Street

Runoff = 2.96 cfs @ 12.15 hrs, Volume= 11,030 cf, Depth> 5.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
12,620	70	Woods, Good, HSG C
12,280	87	Dirt roads, HSG C
24,900	78	Weighted Average
24,900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
1.8	110	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.5	160	Total			

Summary for Subcatchment E3: AP3 - To 28 Main St

Runoff = 1.21 cfs @ 12.12 hrs, Volume= 4,078 cf, Depth> 4.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
11,130	70	Woods, Good, HSG C
11,130		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0800	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.9	75	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	30	0.2000	2.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.4	155	Total			

Summary for Subcatchment E4: AP4 - To Wetlands B/C

Runoff = 16.32 cfs @ 12.26 hrs, Volume= 73,021 cf, Depth> 4.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
185,120	70	Woods, Good, HSG C
9,550	87	Dirt roads, HSG C
194,670	71	Weighted Average
194,670		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.1000	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.5	50	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.7	240	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	25	0.0800	4.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.0	505	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
19.0	870	Total			

Summary for Subcatchment E5: AP5 - To Wetlands A

Runoff = 5.90 cfs @ 12.14 hrs, Volume= 20,708 cf, Depth> 4.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
45,070	70	Woods, Good, HSG C
10,030	77	Woods, Good, HSG D
55,100	71	Weighted Average
55,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	25	0.0400	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
2.2	25	0.4000	0.19		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
1.7	100	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	50	0.4500	3.35		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	50	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.8	250	Total			

APPENDIX E

POST-DEVELOPMENT
HYDROCAD DRAINAGE CALCULATIONS

SUBCATCHMENT	AREA (s.f.)	CN	Tc(mins)
P4.1	16,385	88	10.6
P4.2	18,350	87	5.2
P4.3	7,390	90	5
P4.4	8,255	90	7.5
P4.5	8,005	94	5
P4.6	66,895	73	16.6
P4.7	7,380	83	5
P4.8	10,580	82	9.5
P4.9	13,780	89	5
P4.10	63,415	70	10.6
P4.11	5,255	74	5

REVISIONS

REV	DATE	DESCRIPTION	MADE	APV'D
1	12.29.20	REV. PER CLIENT	WN	PE
2	5.27.21	REV. PER PEER REVIEW	WN	PE

PETER C. ENGLE, P.E.
PROFESSIONAL ENGINEER
MA LIC. NO. 53736

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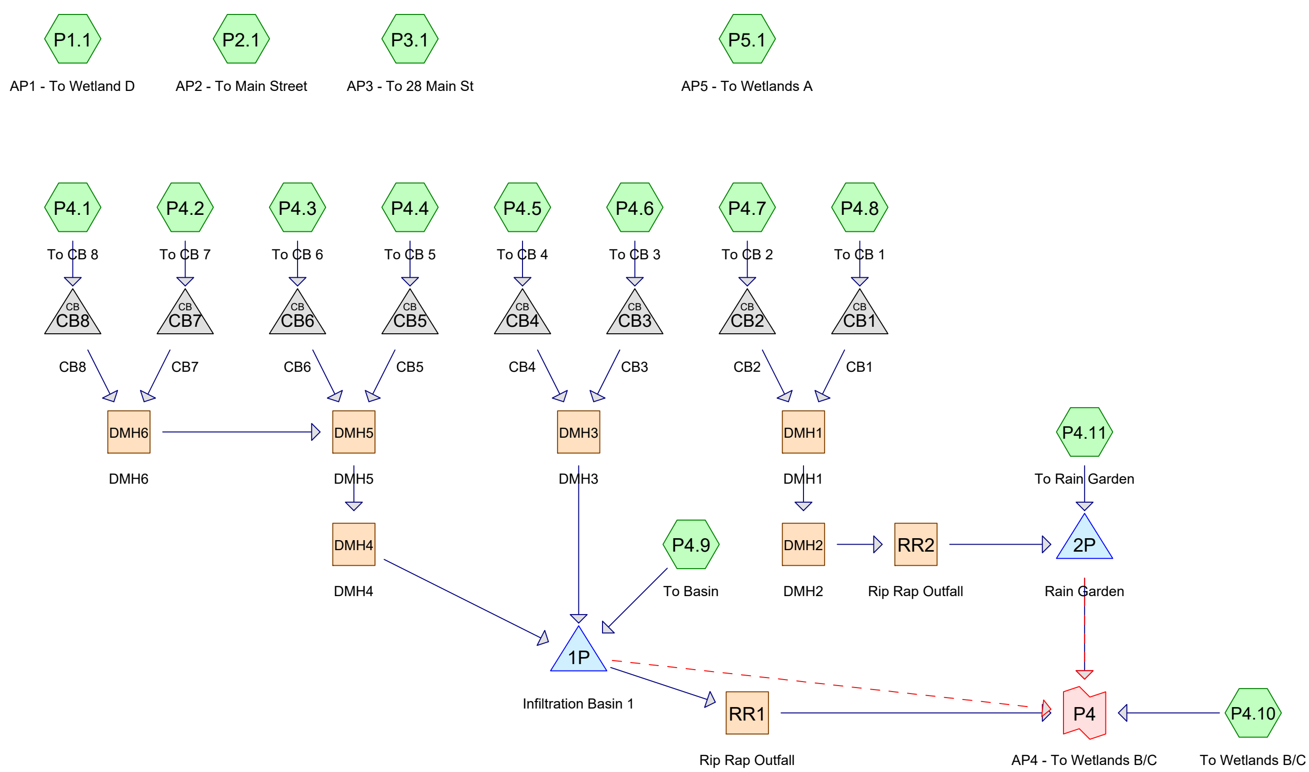
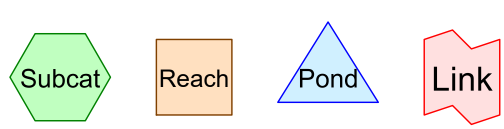
DEFINITIVE SUBDIVISION PLAN
LOCATED AT
30 MAIN STREET & 20 FISKE HILL ROAD
STURBRIDGE, MA 01566
PREPARED FOR
FISKE HILL EAST REALTY TRUST
97 ARNOLD ROAD, FISKDALE, MA 01518

DRAWN BY:	MM
DATE:	11/11/2020
CHK BY:	PCE
SCALE:	1"=50'
PROJ. NO.	287-2117-K

POST-DEVELOPMENT WATERSHED MAP

DA-PR





Routing Diagram for 287-2116-K_Fiske Hill Realty_PE_Rev2_5.26.21
Prepared by Microsoft, Printed 5/28/2021
HydroCAD® 10.00-19 s/n 03362 © 2016 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
70,995	74	>75% Grass cover, Good, HSG C (P1.1, P2.1, P3.1, P4.1, P4.10, P4.11, P4.2, P4.3, P4.4, P4.5, P4.6, P4.7, P4.8, P4.9, P5.1)
52,485	98	Paved roads w/curbs & sewers, HSG C (P2.1, P4.1, P4.2, P4.3, P4.4, P4.5, P4.6, P4.7, P4.8)
8,370	98	Water Surface, HSG C (P4.9)
293,350	70	Woods, Good, HSG C (P1.1, P2.1, P3.1, P4.1, P4.10, P4.2, P4.4, P4.6, P4.8, P5.1)
10,030	77	Woods, Good, HSG D (P5.1)
435,230	**75**	**TOTAL AREA**

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	DMH1	646.30	645.80	90.0	0.0056	0.013	12.0	0.0	0.0
2	DMH2	645.70	645.00	88.0	0.0080	0.013	12.0	0.0	0.0
3	DMH3	653.25	653.00	22.0	0.0114	0.013	15.0	0.0	0.0
4	DMH4	656.00	653.00	55.0	0.0545	0.013	12.0	0.0	0.0
5	DMH5	664.60	659.00	110.0	0.0509	0.013	12.0	0.0	0.0
6	DMH6	675.90	666.00	260.0	0.0381	0.013	12.0	0.0	0.0
7	1P	652.00	649.00	50.0	0.0600	0.013	12.0	0.0	0.0
8	2P	643.50	643.50	20.0	0.0000	0.013	4.0	0.0	0.0
9	CB1	646.60	646.40	23.0	0.0087	0.013	12.0	0.0	0.0
10	CB2	646.60	646.40	23.0	0.0087	0.013	12.0	0.0	0.0
11	CB3	653.60	653.35	22.0	0.0114	0.013	15.0	0.0	0.0
12	CB4	653.60	653.35	6.0	0.0417	0.013	12.0	0.0	0.0
13	CB5	670.90	669.90	12.0	0.0833	0.013	12.0	0.0	0.0
14	CB6	670.90	669.90	12.0	0.0833	0.013	12.0	0.0	0.0
15	CB7	681.80	681.00	12.0	0.0667	0.013	12.0	0.0	0.0
16	CB8	681.80	681.00	12.0	0.0667	0.013	12.0	0.0	0.0

Summary for Subcatchment P1.1: AP1 - To Wetland D

Runoff = 1.76 cfs @ 12.42 hrs, Volume= 10,138 cf, Depth> 0.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
142,405	70	Woods, Good, HSG C
1,630	74	>75% Grass cover, Good, HSG C
144,035	70	Weighted Average
144,035		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	50	0.0500	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
2.5	170	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	240	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	505	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
26.8	965	Total			

Summary for Subcatchment P2.1: AP2 - To Main Street

Runoff = 0.39 cfs @ 12.11 hrs, Volume= 1,294 cf, Depth> 1.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
2,510	70	Woods, Good, HSG C
1,660	98	Paved roads w/curbs & sewers, HSG C
9,015	74	>75% Grass cover, Good, HSG C
13,185	76	Weighted Average
11,525		87.41% Pervious Area
1,660		12.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	25	0.0250	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.5	65	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	15	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.3	105	Total			

Summary for Subcatchment P3.1: AP3 - To 28 Main St

Runoff = 0.15 cfs @ 12.08 hrs, Volume= 473 cf, Depth> 0.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
2,900	70	Woods, Good, HSG C
3,050	74	>75% Grass cover, Good, HSG C
5,950	72	Weighted Average
5,950		100.00% Pervious Area

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

Summary for Subcatchment P4.1: To CB 8

Runoff = 0.77 cfs @ 12.15 hrs, Volume= 2,770 cf, Depth> 2.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
1,330	70	Woods, Good, HSG C
10,105	98	Paved roads w/curbs & sewers, HSG C
4,950	74	>75% Grass cover, Good, HSG C
16,385	88	Weighted Average
6,280		38.33% Pervious Area
10,105		61.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0600	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
1.0	75	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	30	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	170	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
10.6	330	Total			

Summary for Subcatchment P4.10: To Wetlands B/C

Runoff = 1.17 cfs @ 12.14 hrs, Volume= 4,488 cf, Depth> 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
57,795	70	Woods, Good, HSG C
5,620	74	>75% Grass cover, Good, HSG C
63,415	70	Weighted Average
63,415		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.2000	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.2	30	0.2000	2.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.8	160	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.1	240	Total			

Summary for Subcatchment P4.11: To Rain Garden

Runoff = 0.15 cfs @ 12.08 hrs, Volume= 465 cf, Depth> 1.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
5,255	74	>75% Grass cover, Good, HSG C
5,255		100.00% Pervious Area

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

Summary for Subcatchment P4.2: To CB 7

Runoff = 0.99 cfs @ 12.08 hrs, Volume= 2,980 cf, Depth> 1.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
1,325	70	Woods, Good, HSG C
10,285	98	Paved roads w/curbs & sewers, HSG C
6,740	74	>75% Grass cover, Good, HSG C
18,350	87	Weighted Average
8,065		43.95% Pervious Area
10,285		56.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0300	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	60	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.2	115	Total			

Summary for Subcatchment P4.3: To CB 6

Runoff = 0.45 cfs @ 12.07 hrs, Volume= 1,357 cf, Depth> 2.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
5,075	98	Paved roads w/curbs & sewers, HSG C
2,315	74	>75% Grass cover, Good, HSG C
7,390	90	Weighted Average
2,315		31.33% Pervious Area
5,075		68.67% Impervious Area

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

Summary for Subcatchment P4.4: To CB 5

Runoff = 0.46 cfs @ 12.11 hrs, Volume= 1,515 cf, Depth> 2.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
130	70	Woods, Good, HSG C
5,615	98	Paved roads w/curbs & sewers, HSG C
2,510	74	>75% Grass cover, Good, HSG C
8,255	90	Weighted Average
2,640		31.98% Pervious Area
5,615		68.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	15	0.0500	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
3.0	35	0.0500	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
0.1	10	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	235	0.0400	4.06		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.5	300	Total			

Summary for Subcatchment P4.5: To CB 4

Runoff = 0.55 cfs @ 12.07 hrs, Volume= 1,722 cf, Depth> 2.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
6,710	98	Paved roads w/curbs & sewers, HSG C
1,295	74	>75% Grass cover, Good, HSG C
8,005	94	Weighted Average
1,295		16.18% Pervious Area
6,710		83.82% Impervious Area

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

Summary for Subcatchment P4.6: To CB 3

Runoff = 1.23 cfs @ 12.25 hrs, Volume= 5,596 cf, Depth> 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
50,635	70	Woods, Good, HSG C
6,725	98	Paved roads w/curbs & sewers, HSG C
9,535	74	>75% Grass cover, Good, HSG C
66,895	73	Weighted Average
60,170		89.95% Pervious Area
6,725		10.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	50	0.0500	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
5.9	395	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	170	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	25	0.0550	4.76		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.6	645	Total			

Summary for Subcatchment P4.7: To CB 2

Runoff = 0.34 cfs @ 12.08 hrs, Volume= 1,009 cf, Depth> 1.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
2,730	98	Paved roads w/curbs & sewers, HSG C
4,650	74	>75% Grass cover, Good, HSG C
7,380	83	Weighted Average
4,650		63.01% Pervious Area
2,730		36.99% Impervious Area

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

Summary for Subcatchment P4.8: To CB 1

Runoff = 0.40 cfs @ 12.13 hrs, Volume= 1,382 cf, Depth> 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
520	70	Woods, Good, HSG C
3,580	98	Paved roads w/curbs & sewers, HSG C
6,480	74	>75% Grass cover, Good, HSG C
10,580	82	Weighted Average
7,000		66.16% Pervious Area
3,580		33.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0600	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.2	15	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	45	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.8	160	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.5	275	Total			

Summary for Subcatchment P4.9: To Basin

Runoff = 0.81 cfs @ 12.07 hrs, Volume= 2,430 cf, Depth> 2.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
8,370	98	Water Surface, HSG C
5,410	74	>75% Grass cover, Good, HSG C
13,780	89	Weighted Average
5,410		39.26% Pervious Area
8,370		60.74% Impervious Area

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

Summary for Subcatchment P5.1: AP5 - To Wetlands A

Runoff = 0.97 cfs @ 12.15 hrs, Volume= 3,679 cf, Depth> 0.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2YearMass Rainfall=3.24"

Area (sf)	CN	Description
33,800	70	Woods, Good, HSG C
10,030	77	Woods, Good, HSG D
2,540	74	>75% Grass cover, Good, HSG C
46,370	72	Weighted Average
46,370		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	25	0.0400	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
2.2	25	0.4000	0.19		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
1.7	100	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	50	0.4500	3.35		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	50	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.8	250	Total			

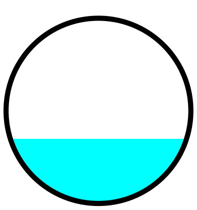
Summary for Reach DMH1: DMH1

Inflow Area = 17,960 sf, 35.13% Impervious, Inflow Depth > 1.60" for 2YearMass event
Inflow = 0.69 cfs @ 12.10 hrs, Volume= 2,391 cf
Outflow = 0.69 cfs @ 12.11 hrs, Volume= 2,389 cf, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.84 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.07 fps, Avg. Travel Time= 1.4 min

Peak Storage= 22 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.35'
Defined Flood Depth= 650.50' Flow Area= 87.1 sf, Capacity= -7,234.81 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.66 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 90.0' Slope= 0.0056 '/'
Inlet Invert= 646.30', Outlet Invert= 645.80'



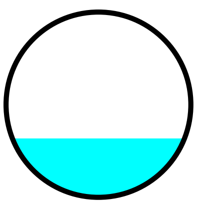
Summary for Reach DMH2: DMH2

Inflow Area = 17,960 sf, 35.13% Impervious, Inflow Depth > 1.60" for 2YearMass event
Inflow = 0.69 cfs @ 12.11 hrs, Volume= 2,389 cf
Outflow = 0.69 cfs @ 12.12 hrs, Volume= 2,389 cf, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.23 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.21 fps, Avg. Travel Time= 1.2 min

Peak Storage= 19 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.32'
Defined Flood Depth= 654.00' Flow Area= 87.6 sf, Capacity= -8,703.75 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.18 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 88.0' Slope= 0.0080 '/'
Inlet Invert= 645.70', Outlet Invert= 645.00'



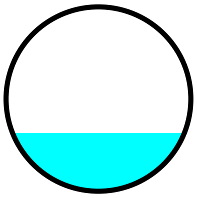
Summary for Reach DMH3: DMH3

Inflow Area = 74,900 sf, 17.94% Impervious, Inflow Depth > 1.17" for 2YearMass event
Inflow = 1.47 cfs @ 12.23 hrs, Volume= 7,318 cf
Outflow = 1.47 cfs @ 12.23 hrs, Volume= 7,317 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.46 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.62 fps, Avg. Travel Time= 0.2 min

Peak Storage= 7 cf @ 12.23 hrs
Average Depth at Peak Storage= 0.39'
Defined Flood Depth= 658.25' Flow Area= 110.4 sf, Capacity= -15,180.55 cfs
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 6.89 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 22.0' Slope= 0.0114 '/'
Inlet Invert= 653.25', Outlet Invert= 653.00'



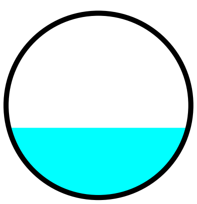
Summary for Reach DMH4: DMH4

Inflow Area = 50,380 sf, 61.69% Impervious, Inflow Depth > 2.05" for 2YearMass event
Inflow = 2.52 cfs @ 12.10 hrs, Volume= 8,618 cf
Outflow = 2.52 cfs @ 12.10 hrs, Volume= 8,618 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 9.28 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.23 fps, Avg. Travel Time= 0.3 min

Peak Storage= 15 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.38'
Defined Flood Depth= 668.70' Flow Area= 89.5 sf, Capacity= -23,305.02 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 8.32 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 55.0' Slope= 0.0545 '/'
Inlet Invert= 656.00', Outlet Invert= 653.00'



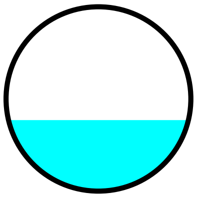
Summary for Reach DMH5: DMH5

Inflow Area = 50,380 sf, 61.69% Impervious, Inflow Depth > 2.05" for 2YearMass event
Inflow = 2.52 cfs @ 12.10 hrs, Volume= 8,620 cf
Outflow = 2.52 cfs @ 12.10 hrs, Volume= 8,618 cf, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 9.05 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.15 fps, Avg. Travel Time= 0.6 min

Peak Storage= 31 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.38'
Defined Flood Depth= 674.55' Flow Area= 90.3 sf, Capacity= -22,712.12 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 8.04 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 110.0' Slope= 0.0509 '/'
Inlet Invert= 664.60', Outlet Invert= 659.00'



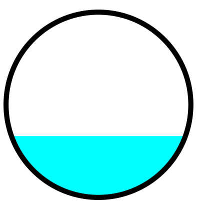
Summary for Reach DMH6: DMH6

Inflow Area = 34,735 sf, 58.70% Impervious, Inflow Depth > 1.99" for 2YearMass event
Inflow = 1.64 cfs @ 12.10 hrs, Volume= 5,750 cf
Outflow = 1.64 cfs @ 12.11 hrs, Volume= 5,747 cf, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.24 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.61 fps, Avg. Travel Time= 1.7 min

Peak Storage= 59 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.33'
Defined Flood Depth= 686.45' Flow Area= 91.9 sf, Capacity= -19,989.39 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.95 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 260.0' Slope= 0.0381 '/'
Inlet Invert= 675.90', Outlet Invert= 666.00'



Summary for Reach RR1: Rip Rap Outfall

Inflow Area = 139,060 sf, 38.03% Impervious, Inflow Depth = 0.96" for 2YearMass event
Inflow = 1.71 cfs @ 12.48 hrs, Volume= 11,090 cf
Outflow = 1.71 cfs @ 12.48 hrs, Volume= 11,090 cf, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.71 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.28 fps, Avg. Travel Time= 1.1 min

Peak Storage= 43 cf @ 12.48 hrs
Average Depth at Peak Storage= 0.13'
Bank-Full Depth= 1.00' Flow Area= 20.0 sf, Capacity= 51.24 cfs

18.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 22.00'
Length= 18.0' Slope= 0.0056 '/'
Inlet Invert= 649.10', Outlet Invert= 649.00'

Summary for Reach RR2: Rip Rap Outfall

Inflow Area =	17,960 sf, 35.13% Impervious,	Inflow Depth > 1.60"	for 2YearMass event
Inflow =	0.69 cfs @ 12.12 hrs, Volume=	2,389 cf	
Outflow =	0.69 cfs @ 12.12 hrs, Volume=	2,388 cf,	Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.68 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 0.20 fps, Avg. Travel Time= 1.0 min

Peak Storage= 12 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 1.00' Flow Area= 13.0 sf, Capacity= 39.26 cfs

11.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 15.00'
Length= 12.0' Slope= 0.0083 '/'
Inlet Invert= 645.10', Outlet Invert= 645.00'

Summary for Pond 1P: Infiltration Basin 1

Inflow Area =	139,060 sf, 38.03% Impervious,	Inflow Depth > 1.58"	for 2YearMass event
Inflow =	4.52 cfs @ 12.10 hrs, Volume=	18,365 cf	
Outflow =	1.91 cfs @ 12.48 hrs, Volume=	17,369 cf,	Atten= 58%, Lag= 22.8 min
Discarded =	0.21 cfs @ 12.48 hrs, Volume=	6,278 cf	
Primary =	1.71 cfs @ 12.48 hrs, Volume=	11,090 cf	
Secondary =	0.00 cfs @ 0.00 hrs, Volume=	0 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 655.32' @ 12.48 hrs Surf.Area= 3,690 sf Storage= 5,419 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 45.0 min (873.6 - 828.6)

Volume	Invert	Avail.Storage	Storage Description
#1	653.00'	20,511 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
653.00	1,360	345.0	0	0	1,360
654.00	2,050	490.0	1,693	1,693	11,004
656.00	4,730	705.0	6,596	8,289	31,484
658.00	7,605	730.0	12,222	20,511	34,679

Device	Routing	Invert	Outlet Devices
#1	Discarded	653.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Secondary	657.00'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#3	Primary	652.00'	**12.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 652.00' / 649.00' S= 0.0600 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#4	Device 3	653.70'	**5.0" Vert. Orifice/Grate** C= 0.600
#5	Device 3	654.40'	**6.0" Vert. Orifice/Grate** C= 0.600
#6	Device 3	655.10'	**8.0" Vert. Orifice/Grate** C= 0.600
#7	Device 3	655.50'	**8.0" Vert. Orifice/Grate** C= 0.600
#8	Device 3	657.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.21 cfs @ 12.48 hrs HW=655.32' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.21 cfs)

Primary OutFlow Max=1.71 cfs @ 12.48 hrs HW=655.32' TW=649.23' (Dynamic Tailwater)
└─**3=Culvert** (Passes 1.71 cfs of 6.35 cfs potential flow)
  ├─**4=Orifice/Grate** (Orifice Controls 0.78 cfs @ 5.71 fps)
  ├─**5=Orifice/Grate** (Orifice Controls 0.77 cfs @ 3.93 fps)
  ├─**6=Orifice/Grate** (Orifice Controls 0.16 cfs @ 1.58 fps)
  ├─**7=Orifice/Grate** (Controls 0.00 cfs)
  └─**8=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=653.00' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: Rain Garden

Inflow Area = 23,215 sf, 27.18% Impervious, Inflow Depth > 1.47" for 2YearMass event
Inflow = 0.83 cfs @ 12.11 hrs, Volume= 2,853 cf
Outflow = 0.43 cfs @ 12.33 hrs, Volume= 2,853 cf, Atten= 48%, Lag= 13.2 min
Discarded = 0.11 cfs @ 12.33 hrs, Volume= 1,680 cf
Primary = 0.32 cfs @ 12.33 hrs, Volume= 1,173 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 644.72' @ 12.33 hrs Surf.Area= 1,680 sf Storage= 474 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 10.9 min (851.3 - 840.4)

Volume	Invert	Avail.Storage	Storage Description
#1	643.50'	9 cf	**4.0" Round 4" Perf Pipe** Inside #5 L= 100.0'
#2	645.00'	1,038 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)
#3	645.00'	112 cf	**3" Mulch (Irregular)**Listed below (Recalc) 225 cf Overall x 50.0% Voids
#4	644.00'	420 cf	**12" Soil Media (Irregular)**Listed below (Recalc) 840 cf Overall x 50.0% Voids
#5	643.50'	165 cf	**6" Crushed Stone (Irregular)**Listed below (Recalc) 420 cf Overall - 9 cf Embedded = 411 cf x 40.0% Voids
		1,744 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
645.00	840	240.0	0	0	840
646.00	1,250	250.0	1,038	1,038	1,301

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
645.00	840	240.0	0	0	840
645.25	960	245.0	225	225	1,042

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
644.00	840	240.0	0	0	840
645.00	840	240.0	840	840	1,080

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
643.50	840	240.0	0	0	840
644.00	840	240.0	420	420	960

Device	Routing	Invert	Outlet Devices
#1	Discarded	643.50'	**2.410 in/hr Exfiltration over Wetted area**
#2	Secondary	645.50'	**5.0' long x 8.0' breadth Broad-Crested Rectangular Weir X 2.00** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#3	Primary	643.50'	**4.0" Round Culvert** L= 20.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 643.50' / 643.50' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf

Discarded OutFlow Max=0.11 cfs @ 12.33 hrs HW=644.72' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=0.32 cfs @ 12.33 hrs HW=644.72' TW=0.00' (Dynamic Tailwater)
└─**3=Culvert** (Barrel Controls 0.32 cfs @ 3.67 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=643.50' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond CB1: CB1

Inflow Area = 10,580 sf, 33.84% Impervious, Inflow Depth > 1.57" for 2YearMass event
Inflow = 0.40 cfs @ 12.13 hrs, Volume= 1,382 cf
Outflow = 0.40 cfs @ 12.13 hrs, Volume= 1,382 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.40 cfs @ 12.13 hrs, Volume= 1,382 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 646.94' @ 12.13 hrs
Flood Elev= 649.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	646.60'	**12.0" Round Culvert** L= 23.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 646.60' / 646.40' S= 0.0087 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.39 cfs @ 12.13 hrs HW=646.94' TW=646.64' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 0.39 cfs @ 2.50 fps)

Summary for Pond CB2: CB2

Inflow Area = 7,380 sf, 36.99% Impervious, Inflow Depth > 1.64" for 2YearMass event
Inflow = 0.34 cfs @ 12.08 hrs, Volume= 1,009 cf
Outflow = 0.34 cfs @ 12.08 hrs, Volume= 1,009 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.34 cfs @ 12.08 hrs, Volume= 1,009 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 646.91' @ 12.08 hrs
Flood Elev= 649.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	646.60'	**12.0" Round Culvert** L= 23.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 646.60' / 646.40' S= 0.0087 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.34 cfs @ 12.08 hrs HW=646.91' TW=646.64' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 0.34 cfs @ 2.40 fps)

Summary for Pond CB3: CB3

Inflow Area = 66,895 sf, 10.05% Impervious, Inflow Depth > 1.00" for 2YearMass event
Inflow = 1.23 cfs @ 12.25 hrs, Volume= 5,596 cf
Outflow = 1.23 cfs @ 12.25 hrs, Volume= 5,596 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.23 cfs @ 12.25 hrs, Volume= 5,596 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 654.17' @ 12.25 hrs
Flood Elev= 657.65'

Device	Routing	Invert	Outlet Devices
#1	Primary	653.60'	**15.0" Round Culvert** L= 22.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 653.60' / 653.35' S= 0.0114 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=1.23 cfs @ 12.25 hrs HW=654.17' TW=653.64' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 1.23 cfs @ 3.35 fps)

Summary for Pond CB4: CB4

Inflow Area = 8,005 sf, 83.82% Impervious, Inflow Depth > 2.58" for 2YearMass event
Inflow = 0.55 cfs @ 12.07 hrs, Volume= 1,722 cf
Outflow = 0.55 cfs @ 12.07 hrs, Volume= 1,722 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.55 cfs @ 12.07 hrs, Volume= 1,722 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 653.97' @ 12.07 hrs
Flood Elev= 657.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	653.60'	**12.0" Round Culvert** L= 6.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 653.60' / 653.35' S= 0.0417 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.55 cfs @ 12.07 hrs HW=653.97' TW=653.59' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.55 cfs @ 2.08 fps)

Summary for Pond CB5: CB5

Inflow Area =	8,255 sf,	68.02% Impervious,	Inflow Depth > 2.20"	for 2YearMass event
Inflow =	0.46 cfs @	12.11 hrs, Volume=	1,515 cf	
Outflow =	0.46 cfs @	12.11 hrs, Volume=	1,515 cf,	Atten= 0%, Lag= 0.0 min
Primary =	0.46 cfs @	12.11 hrs, Volume=	1,515 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 671.24' @ 12.11 hrs
Flood Elev= 674.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	670.90'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 670.90' / 669.90' S= 0.0833 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.46 cfs @ 12.11 hrs HW=671.24' TW=664.98' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.46 cfs @ 1.98 fps)

Summary for Pond CB6: CB6

Inflow Area =	7,390 sf,	68.67% Impervious,	Inflow Depth > 2.20"	for 2YearMass event
Inflow =	0.45 cfs @	12.07 hrs, Volume=	1,357 cf	
Outflow =	0.45 cfs @	12.07 hrs, Volume=	1,357 cf,	Atten= 0%, Lag= 0.0 min
Primary =	0.45 cfs @	12.07 hrs, Volume=	1,357 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 671.23' @ 12.07 hrs
Flood Elev= 674.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	670.90'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 670.90' / 669.90' S= 0.0833 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.45 cfs @ 12.07 hrs HW=671.23' TW=664.97' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.45 cfs @ 1.96 fps)

Summary for Pond CB7: CB7

Inflow Area = 18,350 sf, 56.05% Impervious, Inflow Depth > 1.95" for 2YearMass event
Inflow = 0.99 cfs @ 12.08 hrs, Volume= 2,980 cf
Outflow = 0.99 cfs @ 12.08 hrs, Volume= 2,980 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.99 cfs @ 12.08 hrs, Volume= 2,980 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 682.31' @ 12.08 hrs
Flood Elev= 686.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	681.80'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 681.80' / 681.00' S= 0.0667 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.99 cfs @ 12.08 hrs HW=682.31' TW=676.22' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.99 cfs @ 2.44 fps)

Summary for Pond CB8: CB8

Inflow Area = 16,385 sf, 61.67% Impervious, Inflow Depth > 2.03" for 2YearMass event
Inflow = 0.77 cfs @ 12.15 hrs, Volume= 2,770 cf
Outflow = 0.77 cfs @ 12.15 hrs, Volume= 2,770 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.77 cfs @ 12.15 hrs, Volume= 2,770 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 682.24' @ 12.15 hrs
Flood Elev= 686.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	681.80'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 681.80' / 681.00' S= 0.0667 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.77 cfs @ 12.15 hrs HW=682.24' TW=676.22' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.77 cfs @ 2.27 fps)

Summary for Link P4: AP4 - To Wetlands B/C

Inflow Area = 225,690 sf, 26.23% Impervious, Inflow Depth > 0.89" for 2YearMass event
Inflow = 2.61 cfs @ 12.37 hrs, Volume= 16,751 cf
Primary = 2.61 cfs @ 12.37 hrs, Volume= 16,751 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Subcatchment P1.1: AP1 - To Wetland D

Runoff = 4.68 cfs @ 12.39 hrs, Volume= 24,726 cf, Depth> 2.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
142,405	70	Woods, Good, HSG C
1,630	74	>75% Grass cover, Good, HSG C
144,035	70	Weighted Average
144,035		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	50	0.0500	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
2.5	170	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	240	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	505	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
26.8	965	Total			

Summary for Subcatchment P2.1: AP2 - To Main Street

Runoff = 0.87 cfs @ 12.11 hrs, Volume= 2,827 cf, Depth> 2.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
2,510	70	Woods, Good, HSG C
1,660	98	Paved roads w/curbs & sewers, HSG C
9,015	74	>75% Grass cover, Good, HSG C
13,185	76	Weighted Average
11,525		87.41% Pervious Area
1,660		12.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	25	0.0250	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.5	65	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	15	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.3	105	Total			

Summary for Subcatchment P3.1: AP3 - To 28 Main St

Runoff = 0.37 cfs @ 12.08 hrs, Volume= 1,108 cf, Depth> 2.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
2,900	70	Woods, Good, HSG C
3,050	74	>75% Grass cover, Good, HSG C
5,950	72	Weighted Average
5,950		100.00% Pervious Area

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

Summary for Subcatchment P4.1: To CB 8

Runoff = 1.38 cfs @ 12.14 hrs, Volume= 5,066 cf, Depth> 3.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
1,330	70	Woods, Good, HSG C
10,105	98	Paved roads w/curbs & sewers, HSG C
4,950	74	>75% Grass cover, Good, HSG C
16,385	88	Weighted Average
6,280		38.33% Pervious Area
10,105		61.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0600	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
1.0	75	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	30	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	170	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
10.6	330	Total			

Summary for Subcatchment P4.10: To Wetlands B/C

Runoff = 3.12 cfs @ 12.13 hrs, Volume= 10,934 cf, Depth> 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
57,795	70	Woods, Good, HSG C
5,620	74	>75% Grass cover, Good, HSG C
63,415	70	Weighted Average
63,415		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.2000	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.2	30	0.2000	2.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.8	160	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.1	240	Total			

Summary for Subcatchment P4.11: To Rain Garden

Runoff = 0.35 cfs @ 12.08 hrs, Volume= 1,052 cf, Depth> 2.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
5,255	74	>75% Grass cover, Good, HSG C
5,255		100.00% Pervious Area

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

Summary for Subcatchment P4.2: To CB 7

Runoff = 1.80 cfs @ 12.07 hrs, Volume= 5,522 cf, Depth> 3.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
1,325	70	Woods, Good, HSG C
10,285	98	Paved roads w/curbs & sewers, HSG C
6,740	74	>75% Grass cover, Good, HSG C
18,350	87	Weighted Average
8,065		43.95% Pervious Area
10,285		56.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0300	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	60	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.2	115	Total			

Summary for Subcatchment P4.3: To CB 6

Runoff = 0.78 cfs @ 12.07 hrs, Volume= 2,415 cf, Depth> 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
5,075	98	Paved roads w/curbs & sewers, HSG C
2,315	74	>75% Grass cover, Good, HSG C
7,390	90	Weighted Average
2,315		31.33% Pervious Area
5,075		68.67% Impervious Area

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

Summary for Subcatchment P4.4: To CB 5

Runoff = 0.80 cfs @ 12.10 hrs, Volume= 2,697 cf, Depth> 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
130	70	Woods, Good, HSG C
5,615	98	Paved roads w/curbs & sewers, HSG C
2,510	74	>75% Grass cover, Good, HSG C
8,255	90	Weighted Average
2,640		31.98% Pervious Area
5,615		68.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	15	0.0500	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
3.0	35	0.0500	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
0.1	10	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	235	0.0400	4.06		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.5	300	Total			

Summary for Subcatchment P4.5: To CB 4

Runoff = 0.90 cfs @ 12.07 hrs, Volume= 2,905 cf, Depth> 4.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
6,710	98	Paved roads w/curbs & sewers, HSG C
1,295	74	>75% Grass cover, Good, HSG C
8,005	94	Weighted Average
1,295		16.18% Pervious Area
6,710		83.82% Impervious Area

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

Summary for Subcatchment P4.6: To CB 3

Runoff = 3.01 cfs @ 12.23 hrs, Volume= 12,883 cf, Depth> 2.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
50,635	70	Woods, Good, HSG C
6,725	98	Paved roads w/curbs & sewers, HSG C
9,535	74	>75% Grass cover, Good, HSG C
66,895	73	Weighted Average
60,170		89.95% Pervious Area
6,725		10.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	50	0.0500	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
5.9	395	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	170	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	25	0.0550	4.76		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.6	645	Total			

Summary for Subcatchment P4.7: To CB 2

Runoff = 0.66 cfs @ 12.07 hrs, Volume= 1,978 cf, Depth> 3.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
2,730	98	Paved roads w/curbs & sewers, HSG C
4,650	74	>75% Grass cover, Good, HSG C
7,380	83	Weighted Average
4,650		63.01% Pervious Area
2,730		36.99% Impervious Area

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

Summary for Subcatchment P4.8: To CB 1

Runoff = 0.79 cfs @ 12.13 hrs, Volume= 2,749 cf, Depth> 3.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
520	70	Woods, Good, HSG C
3,580	98	Paved roads w/curbs & sewers, HSG C
6,480	74	>75% Grass cover, Good, HSG C
10,580	82	Weighted Average
7,000		66.16% Pervious Area
3,580		33.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0600	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.2	15	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	45	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.8	160	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.5	275	Total			

Summary for Subcatchment P4.9: To Basin

Runoff = 1.42 cfs @ 12.07 hrs, Volume= 4,383 cf, Depth> 3.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
8,370	98	Water Surface, HSG C
5,410	74	>75% Grass cover, Good, HSG C
13,780	89	Weighted Average
5,410		39.26% Pervious Area
8,370		60.74% Impervious Area

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

Summary for Subcatchment P5.1: AP5 - To Wetlands A

Runoff = 2.43 cfs @ 12.14 hrs, Volume= 8,623 cf, Depth> 2.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10YearMass Rainfall=5.05"

Area (sf)	CN	Description
33,800	70	Woods, Good, HSG C
10,030	77	Woods, Good, HSG D
2,540	74	>75% Grass cover, Good, HSG C
46,370	72	Weighted Average
46,370		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	25	0.0400	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
2.2	25	0.4000	0.19		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
1.7	100	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	50	0.4500	3.35		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	50	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.8	250	Total			

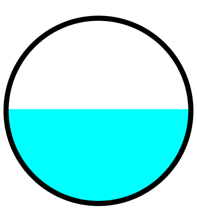
Summary for Reach DMH1: DMH1

Inflow Area = 17,960 sf, 35.13% Impervious, Inflow Depth > 3.16" for 10YearMass event
Inflow = 1.37 cfs @ 12.10 hrs, Volume= 4,727 cf
Outflow = 1.37 cfs @ 12.11 hrs, Volume= 4,726 cf, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.41 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.24 fps, Avg. Travel Time= 1.2 min

Peak Storage= 36 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.51'
Defined Flood Depth= 650.50' Flow Area= 87.1 sf, Capacity= -7,234.81 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.66 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 90.0' Slope= 0.0056 '/'
Inlet Invert= 646.30', Outlet Invert= 645.80'



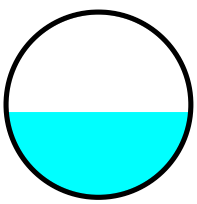
Summary for Reach DMH2: DMH2

Inflow Area = 17,960 sf, 35.13% Impervious, Inflow Depth > 3.16" for 10YearMass event
Inflow = 1.37 cfs @ 12.11 hrs, Volume= 4,726 cf
Outflow = 1.37 cfs @ 12.11 hrs, Volume= 4,725 cf, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.89 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.41 fps, Avg. Travel Time= 1.0 min

Peak Storage= 31 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.46'
Defined Flood Depth= 654.00' Flow Area= 87.6 sf, Capacity= -8,703.75 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.18 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 88.0' Slope= 0.0080 '/'
Inlet Invert= 645.70', Outlet Invert= 645.00'



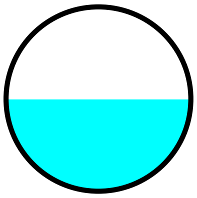
Summary for Reach DMH3: DMH3

Inflow Area = 74,900 sf, 17.94% Impervious, Inflow Depth > 2.53" for 10YearMass event
Inflow = 3.41 cfs @ 12.23 hrs, Volume= 15,788 cf
Outflow = 3.41 cfs @ 12.23 hrs, Volume= 15,787 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.60 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.95 fps, Avg. Travel Time= 0.2 min

Peak Storage= 13 cf @ 12.23 hrs
Average Depth at Peak Storage= 0.62'
Defined Flood Depth= 658.25' Flow Area= 110.4 sf, Capacity= -15,180.55 cfs
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 6.89 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 22.0' Slope= 0.0114 '/'
Inlet Invert= 653.25', Outlet Invert= 653.00'



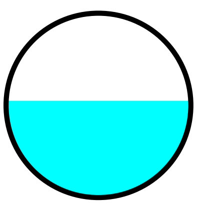
Summary for Reach DMH4: DMH4

Inflow Area = 50,380 sf, 61.69% Impervious, Inflow Depth > 3.74" for 10YearMass event
Inflow = 4.50 cfs @ 12.10 hrs, Volume= 15,694 cf
Outflow = 4.50 cfs @ 12.10 hrs, Volume= 15,693 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 10.80 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.73 fps, Avg. Travel Time= 0.2 min

Peak Storage= 23 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.52'
Defined Flood Depth= 668.70' Flow Area= 89.5 sf, Capacity= -23,305.02 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 8.32 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 55.0' Slope= 0.0545 '/'
Inlet Invert= 656.00', Outlet Invert= 653.00'



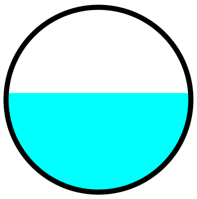
Summary for Reach DMH5: DMH5

Inflow Area = 50,380 sf, 61.69% Impervious, Inflow Depth > 3.74" for 10YearMass event
Inflow = 4.50 cfs @ 12.10 hrs, Volume= 15,696 cf
Outflow = 4.50 cfs @ 12.10 hrs, Volume= 15,694 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 10.52 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.64 fps, Avg. Travel Time= 0.5 min

Peak Storage= 47 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.54'
Defined Flood Depth= 674.55' Flow Area= 90.3 sf, Capacity= -22,712.12 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 8.04 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 110.0' Slope= 0.0509 '/'
Inlet Invert= 664.60', Outlet Invert= 659.00'



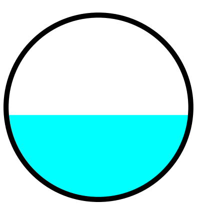
Summary for Reach DMH6: DMH6

Inflow Area = 34,735 sf, 58.70% Impervious, Inflow Depth > 3.66" for 10YearMass event
Inflow = 2.98 cfs @ 12.10 hrs, Volume= 10,588 cf
Outflow = 2.97 cfs @ 12.10 hrs, Volume= 10,584 cf, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.51 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 3.00 fps, Avg. Travel Time= 1.4 min

Peak Storage= 91 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.46'
Defined Flood Depth= 686.45' Flow Area= 91.9 sf, Capacity= -19,989.39 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.95 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 260.0' Slope= 0.0381 '/'
Inlet Invert= 675.90', Outlet Invert= 666.00'



Summary for Reach RR1: Rip Rap Outfall

Inflow Area = 139,060 sf, 38.03% Impervious, Inflow Depth > 2.32" for 10YearMass event
Inflow = 4.58 cfs @ 12.38 hrs, Volume= 26,866 cf
Outflow = 4.58 cfs @ 12.38 hrs, Volume= 26,862 cf, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.04 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 0.37 fps, Avg. Travel Time= 0.8 min

Peak Storage= 79 cf @ 12.38 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 1.00' Flow Area= 20.0 sf, Capacity= 51.24 cfs

18.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 22.00'
Length= 18.0' Slope= 0.0056 '/'
Inlet Invert= 649.10', Outlet Invert= 649.00'

Summary for Reach RR2: Rip Rap Outfall

Inflow Area = 17,960 sf, 35.13% Impervious, Inflow Depth > 3.16" for 10YearMass event
Inflow = 1.37 cfs @ 12.11 hrs, Volume= 4,725 cf
Outflow = 1.37 cfs @ 12.11 hrs, Volume= 4,723 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.88 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 0.24 fps, Avg. Travel Time= 0.8 min

Peak Storage= 19 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 1.00' Flow Area= 13.0 sf, Capacity= 39.26 cfs

11.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 15.00'
Length= 12.0' Slope= 0.0083 '/'
Inlet Invert= 645.10', Outlet Invert= 645.00'

Summary for Pond 1P: Infiltration Basin 1

Inflow Area = 139,060 sf, 38.03% Impervious, Inflow Depth > 3.09" for 10YearMass event
Inflow = 8.64 cfs @ 12.10 hrs, Volume= 35,863 cf
Outflow = 4.85 cfs @ 12.38 hrs, Volume= 34,553 cf, Atten= 44%, Lag= 16.7 min
Discarded = 0.28 cfs @ 12.38 hrs, Volume= 7,688 cf
Primary = 4.58 cfs @ 12.38 hrs, Volume= 26,866 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 656.17' @ 12.38 hrs Surf.Area= 4,950 sf Storage= 9,121 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 35.6 min (848.4 - 812.8)

Volume	Invert	Avail.Storage	Storage Description
#1	653.00'	20,511 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
653.00	1,360	345.0	0	0	1,360
654.00	2,050	490.0	1,693	1,693	11,004
656.00	4,730	705.0	6,596	8,289	31,484
658.00	7,605	730.0	12,222	20,511	34,679

Device	Routing	Invert	Outlet Devices
#1	Discarded	653.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Secondary	657.00'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#3	Primary	652.00'	**12.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 652.00' / 649.00' S= 0.0600 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#4	Device 3	653.70'	**5.0" Vert. Orifice/Grate** C= 0.600
#5	Device 3	654.40'	**6.0" Vert. Orifice/Grate** C= 0.600
#6	Device 3	655.10'	**8.0" Vert. Orifice/Grate** C= 0.600
#7	Device 3	655.50'	**8.0" Vert. Orifice/Grate** C= 0.600
#8	Device 3	657.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.28 cfs @ 12.38 hrs HW=656.17' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.28 cfs)

Primary OutFlow Max=4.58 cfs @ 12.38 hrs HW=656.17' TW=649.34' (Dynamic Tailwater)
└─**3=Culvert** (Passes 4.58 cfs of 7.25 cfs potential flow)
  ├─**4=Orifice/Grate** (Orifice Controls 0.99 cfs @ 7.24 fps)
  ├─**5=Orifice/Grate** (Orifice Controls 1.17 cfs @ 5.94 fps)
  ├─**6=Orifice/Grate** (Orifice Controls 1.44 cfs @ 4.14 fps)
  ├─**7=Orifice/Grate** (Orifice Controls 0.98 cfs @ 2.80 fps)
  └─**8=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=653.00' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: Rain Garden

Inflow Area = 23,215 sf, 27.18% Impervious, Inflow Depth > 2.99" for 10YearMass event
Inflow = 1.69 cfs @ 12.10 hrs, Volume= 5,775 cf
Outflow = 0.75 cfs @ 12.36 hrs, Volume= 5,775 cf, Atten= 55%, Lag= 15.5 min
Discarded = 0.23 cfs @ 12.36 hrs, Volume= 2,926 cf
Primary = 0.44 cfs @ 12.36 hrs, Volume= 2,822 cf
Secondary = 0.08 cfs @ 12.36 hrs, Volume= 27 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 645.52' @ 12.36 hrs Surf.Area= 3,684 sf Storage= 1,196 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 16.0 min (836.3 - 820.2)

Volume	Invert	Avail.Storage	Storage Description
#1	643.50'	9 cf	**4.0" Round 4" Perf Pipe** Inside #5 L= 100.0'
#2	645.00'	1,038 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)
#3	645.00'	112 cf	**3" Mulch (Irregular)**Listed below (Recalc) 225 cf Overall x 50.0% Voids
#4	644.00'	420 cf	**12" Soil Media (Irregular)**Listed below (Recalc) 840 cf Overall x 50.0% Voids
#5	643.50'	165 cf	**6" Crushed Stone (Irregular)**Listed below (Recalc) 420 cf Overall - 9 cf Embedded = 411 cf x 40.0% Voids
		1,744 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
645.00	840	240.0	0	0	840
646.00	1,250	250.0	1,038	1,038	1,301

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
645.00	840	240.0	0	0	840
645.25	960	245.0	225	225	1,042

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
644.00	840	240.0	0	0	840
645.00	840	240.0	840	840	1,080

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
643.50	840	240.0	0	0	840
644.00	840	240.0	420	420	960

Device	Routing	Invert	Outlet Devices
#1	Discarded	643.50'	**2.410 in/hr Exfiltration over Wetted area**
#2	Secondary	645.50'	**5.0' long x 8.0' breadth Broad-Crested Rectangular Weir X 2.00** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#3	Primary	643.50'	**4.0" Round Culvert** L= 20.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 643.50' / 643.50' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf

Discarded OutFlow Max=0.23 cfs @ 12.36 hrs HW=645.52' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.23 cfs)

Primary OutFlow Max=0.44 cfs @ 12.36 hrs HW=645.52' TW=0.00' (Dynamic Tailwater)
└─**3=Culvert** (Barrel Controls 0.44 cfs @ 5.08 fps)

Secondary OutFlow Max=0.08 cfs @ 12.36 hrs HW=645.52' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 0.08 cfs @ 0.36 fps)

Summary for Pond CB1: CB1

Inflow Area = 10,580 sf, 33.84% Impervious, Inflow Depth > 3.12" for 10YearMass event
Inflow = 0.79 cfs @ 12.13 hrs, Volume= 2,749 cf
Outflow = 0.79 cfs @ 12.13 hrs, Volume= 2,749 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.79 cfs @ 12.13 hrs, Volume= 2,749 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 647.11' @ 12.13 hrs
Flood Elev= 649.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	646.60'	**12.0" Round Culvert** L= 23.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 646.60' / 646.40' S= 0.0087 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.80 cfs @ 12.13 hrs HW=647.11' TW=646.80' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 0.80 cfs @ 2.87 fps)

Summary for Pond CB2: CB2

Inflow Area = 7,380 sf, 36.99% Impervious, Inflow Depth > 3.22" for 10YearMass event
Inflow = 0.66 cfs @ 12.07 hrs, Volume= 1,978 cf
Outflow = 0.66 cfs @ 12.07 hrs, Volume= 1,978 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.66 cfs @ 12.07 hrs, Volume= 1,978 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 647.07' @ 12.08 hrs
Flood Elev= 649.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	646.60'	**12.0" Round Culvert** L= 23.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 646.60' / 646.40' S= 0.0087 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.64 cfs @ 12.07 hrs HW=647.06' TW=646.79' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 0.64 cfs @ 2.64 fps)

Summary for Pond CB3: CB3

Inflow Area =	66,895 sf,	10.05% Impervious,	Inflow Depth > 2.31"	for 10YearMass event
Inflow =	3.01 cfs @	12.23 hrs, Volume=	12,883 cf	
Outflow =	3.01 cfs @	12.23 hrs, Volume=	12,883 cf,	Atten= 0%, Lag= 0.0 min
Primary =	3.01 cfs @	12.23 hrs, Volume=	12,883 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 654.58' @ 12.23 hrs
Flood Elev= 657.65'

Device	Routing	Invert	Outlet Devices
#1	Primary	653.60'	**15.0" Round Culvert** L= 22.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 653.60' / 653.35' S= 0.0114 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=3.01 cfs @ 12.23 hrs HW=654.58' TW=653.87' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 3.01 cfs @ 4.03 fps)

Summary for Pond CB4: CB4

Inflow Area =	8,005 sf,	83.82% Impervious,	Inflow Depth > 4.35"	for 10YearMass event
Inflow =	0.90 cfs @	12.07 hrs, Volume=	2,905 cf	
Outflow =	0.90 cfs @	12.07 hrs, Volume=	2,905 cf,	Atten= 0%, Lag= 0.0 min
Primary =	0.90 cfs @	12.07 hrs, Volume=	2,905 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 654.09' @ 12.08 hrs
Flood Elev= 657.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	653.60'	**12.0" Round Culvert** L= 6.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 653.60' / 653.35' S= 0.0417 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.89 cfs @ 12.07 hrs HW=654.09' TW=653.77' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 0.89 cfs @ 3.40 fps)

Summary for Pond CB5: CB5

Inflow Area = 8,255 sf, 68.02% Impervious, Inflow Depth > 3.92" for 10YearMass event
Inflow = 0.80 cfs @ 12.10 hrs, Volume= 2,697 cf
Outflow = 0.80 cfs @ 12.10 hrs, Volume= 2,697 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.80 cfs @ 12.10 hrs, Volume= 2,697 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 671.35' @ 12.10 hrs
Flood Elev= 674.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	670.90'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 670.90' / 669.90' S= 0.0833 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.80 cfs @ 12.10 hrs HW=671.35' TW=665.13' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 0.80 cfs @ 2.30 fps)

Summary for Pond CB6: CB6

Inflow Area = 7,390 sf, 68.67% Impervious, Inflow Depth > 3.92" for 10YearMass event
Inflow = 0.78 cfs @ 12.07 hrs, Volume= 2,415 cf
Outflow = 0.78 cfs @ 12.07 hrs, Volume= 2,415 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.78 cfs @ 12.07 hrs, Volume= 2,415 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 671.35' @ 12.07 hrs
Flood Elev= 674.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	670.90'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 670.90' / 669.90' S= 0.0833 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.78 cfs @ 12.07 hrs HW=671.35' TW=665.12' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 0.78 cfs @ 2.28 fps)

Summary for Pond CB7: CB7

Inflow Area = 18,350 sf, 56.05% Impervious, Inflow Depth > 3.61" for 10YearMass event
Inflow = 1.80 cfs @ 12.07 hrs, Volume= 5,522 cf
Outflow = 1.80 cfs @ 12.07 hrs, Volume= 5,522 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.80 cfs @ 12.07 hrs, Volume= 5,522 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 682.53' @ 12.07 hrs
Flood Elev= 686.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	681.80'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 681.80' / 681.00' S= 0.0667 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.80 cfs @ 12.07 hrs HW=682.53' TW=676.35' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 1.80 cfs @ 2.92 fps)

Summary for Pond CB8: CB8

Inflow Area = 16,385 sf, 61.67% Impervious, Inflow Depth > 3.71" for 10YearMass event
Inflow = 1.38 cfs @ 12.14 hrs, Volume= 5,066 cf
Outflow = 1.38 cfs @ 12.14 hrs, Volume= 5,066 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.38 cfs @ 12.14 hrs, Volume= 5,066 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 682.42' @ 12.14 hrs
Flood Elev= 686.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	681.80'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 681.80' / 681.00' S= 0.0667 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.37 cfs @ 12.14 hrs HW=682.42' TW=676.34' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 1.37 cfs @ 2.68 fps)

Summary for Link P4: AP4 - To Wetlands B/C

Inflow Area = 225,690 sf, 26.23% Impervious, Inflow Depth > 2.16" for 10YearMass event
Inflow = 6.94 cfs @ 12.19 hrs, Volume= 40,646 cf
Primary = 6.94 cfs @ 12.19 hrs, Volume= 40,646 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Subcatchment P1.1: AP1 - To Wetland D

Runoff = 6.77 cfs @ 12.38 hrs, Volume= 35,275 cf, Depth> 2.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
142,405	70	Woods, Good, HSG C
1,630	74	>75% Grass cover, Good, HSG C
144,035	70	Weighted Average
144,035		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	50	0.0500	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
2.5	170	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	240	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	505	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
26.8	965	Total			

Summary for Subcatchment P2.1: AP2 - To Main Street

Runoff = 1.20 cfs @ 12.11 hrs, Volume= 3,889 cf, Depth> 3.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
2,510	70	Woods, Good, HSG C
1,660	98	Paved roads w/curbs & sewers, HSG C
9,015	74	>75% Grass cover, Good, HSG C
13,185	76	Weighted Average
11,525		87.41% Pervious Area
1,660		12.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	25	0.0250	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.5	65	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	15	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.3	105	Total			

Summary for Subcatchment P3.1: AP3 - To 28 Main St

Runoff = 0.52 cfs @ 12.08 hrs, Volume= 1,560 cf, Depth> 3.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
2,900	70	Woods, Good, HSG C
3,050	74	>75% Grass cover, Good, HSG C
5,950	72	Weighted Average
5,950		100.00% Pervious Area

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

Summary for Subcatchment P4.1: To CB 8

Runoff = 1.76 cfs @ 12.14 hrs, Volume= 6,555 cf, Depth> 4.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
1,330	70	Woods, Good, HSG C
10,105	98	Paved roads w/curbs & sewers, HSG C
4,950	74	>75% Grass cover, Good, HSG C
16,385	88	Weighted Average
6,280		38.33% Pervious Area
10,105		61.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0600	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
1.0	75	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	30	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	170	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
10.6	330	Total			

Summary for Subcatchment P4.10: To Wetlands B/C

Runoff = 4.51 cfs @ 12.13 hrs, Volume= 15,594 cf, Depth> 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
57,795	70	Woods, Good, HSG C
5,620	74	>75% Grass cover, Good, HSG C
63,415	70	Weighted Average
63,415		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.2000	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.2	30	0.2000	2.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.8	160	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.1	240	Total			

Summary for Subcatchment P4.11: To Rain Garden

Runoff = 0.49 cfs @ 12.08 hrs, Volume= 1,464 cf, Depth> 3.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
5,255	74	>75% Grass cover, Good, HSG C
5,255		100.00% Pervious Area

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

Summary for Subcatchment P4.2: To CB 7

Runoff = 2.32 cfs @ 12.07 hrs, Volume= 7,180 cf, Depth> 4.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
1,325	70	Woods, Good, HSG C
10,285	98	Paved roads w/curbs & sewers, HSG C
6,740	74	>75% Grass cover, Good, HSG C
18,350	87	Weighted Average
8,065		43.95% Pervious Area
10,285		56.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0300	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	60	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.2	115	Total			

Summary for Subcatchment P4.3: To CB 6

Runoff = 0.99 cfs @ 12.07 hrs, Volume= 3,096 cf, Depth> 5.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
5,075	98	Paved roads w/curbs & sewers, HSG C
2,315	74	>75% Grass cover, Good, HSG C
7,390	90	Weighted Average
2,315		31.33% Pervious Area
5,075		68.67% Impervious Area

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

Summary for Subcatchment P4.4: To CB 5

Runoff = 1.01 cfs @ 12.10 hrs, Volume= 3,457 cf, Depth> 5.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
130	70	Woods, Good, HSG C
5,615	98	Paved roads w/curbs & sewers, HSG C
2,510	74	>75% Grass cover, Good, HSG C
8,255	90	Weighted Average
2,640		31.98% Pervious Area
5,615		68.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	15	0.0500	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
3.0	35	0.0500	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
0.1	10	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	235	0.0400	4.06		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.5	300	Total			

Summary for Subcatchment P4.5: To CB 4

Runoff = 1.12 cfs @ 12.07 hrs, Volume= 3,656 cf, Depth> 5.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
6,710	98	Paved roads w/curbs & sewers, HSG C
1,295	74	>75% Grass cover, Good, HSG C
8,005	94	Weighted Average
1,295		16.18% Pervious Area
6,710		83.82% Impervious Area

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

Summary for Subcatchment P4.6: To CB 3

Runoff = 4.25 cfs @ 12.23 hrs, Volume= 18,037 cf, Depth> 3.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
50,635	70	Woods, Good, HSG C
6,725	98	Paved roads w/curbs & sewers, HSG C
9,535	74	>75% Grass cover, Good, HSG C
66,895	73	Weighted Average
60,170		89.95% Pervious Area
6,725		10.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	50	0.0500	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
5.9	395	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	170	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	25	0.0550	4.76		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.6	645	Total			

Summary for Subcatchment P4.7: To CB 2

Runoff = 0.87 cfs @ 12.07 hrs, Volume= 2,623 cf, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
2,730	98	Paved roads w/curbs & sewers, HSG C
4,650	74	>75% Grass cover, Good, HSG C
7,380	83	Weighted Average
4,650		63.01% Pervious Area
2,730		36.99% Impervious Area

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

Summary for Subcatchment P4.8: To CB 1

Runoff = 1.04 cfs @ 12.13 hrs, Volume= 3,664 cf, Depth> 4.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
520	70	Woods, Good, HSG C
3,580	98	Paved roads w/curbs & sewers, HSG C
6,480	74	>75% Grass cover, Good, HSG C
10,580	82	Weighted Average
7,000		66.16% Pervious Area
3,580		33.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0600	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.2	15	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	45	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.8	160	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.5	275	Total			

Summary for Subcatchment P4.9: To Basin

Runoff = 1.81 cfs @ 12.07 hrs, Volume= 5,645 cf, Depth> 4.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
8,370	98	Water Surface, HSG C
5,410	74	>75% Grass cover, Good, HSG C
13,780	89	Weighted Average
5,410		39.26% Pervious Area
8,370		60.74% Impervious Area

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

Summary for Subcatchment P5.1: AP5 - To Wetlands A

Runoff = 3.45 cfs @ 12.14 hrs, Volume= 12,145 cf, Depth> 3.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25YearMass Rainfall=6.19"

Area (sf)	CN	Description
33,800	70	Woods, Good, HSG C
10,030	77	Woods, Good, HSG D
2,540	74	>75% Grass cover, Good, HSG C
46,370	72	Weighted Average
46,370		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	25	0.0400	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
2.2	25	0.4000	0.19		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
1.7	100	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	50	0.4500	3.35		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	50	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.8	250	Total			

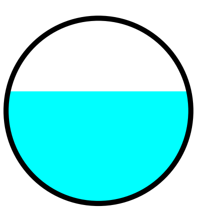
Summary for Reach DMH1: DMH1

Inflow Area = 17,960 sf, 35.13% Impervious, Inflow Depth > 4.20" for 25YearMass event
Inflow = 1.81 cfs @ 12.10 hrs, Volume= 6,286 cf
Outflow = 1.81 cfs @ 12.10 hrs, Volume= 6,284 cf, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.63 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.32 fps, Avg. Travel Time= 1.1 min

Peak Storage= 45 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.60'
Defined Flood Depth= 650.50' Flow Area= 87.1 sf, Capacity= -7,234.81 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.66 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 90.0' Slope= 0.0056 '/'
Inlet Invert= 646.30', Outlet Invert= 645.80'



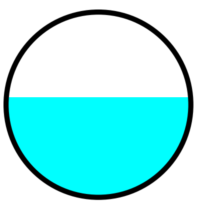
Summary for Reach DMH2: DMH2

Inflow Area = 17,960 sf, 35.13% Impervious, Inflow Depth > 4.20" for 25YearMass event
Inflow = 1.81 cfs @ 12.10 hrs, Volume= 6,284 cf
Outflow = 1.80 cfs @ 12.11 hrs, Volume= 6,283 cf, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.17 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.50 fps, Avg. Travel Time= 1.0 min

Peak Storage= 38 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.54'
Defined Flood Depth= 654.00' Flow Area= 87.6 sf, Capacity= -8,703.75 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.18 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 88.0' Slope= 0.0080 '/'
Inlet Invert= 645.70', Outlet Invert= 645.00'



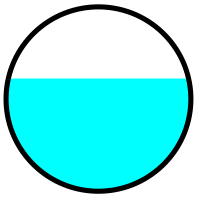
Summary for Reach DMH3: DMH3

Inflow Area = 74,900 sf, 17.94% Impervious, Inflow Depth > 3.48" for 25YearMass event
Inflow = 4.75 cfs @ 12.22 hrs, Volume= 21,693 cf
Outflow = 4.75 cfs @ 12.22 hrs, Volume= 21,692 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.05 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.12 fps, Avg. Travel Time= 0.2 min

Peak Storage= 17 cf @ 12.22 hrs
Average Depth at Peak Storage= 0.76'
Defined Flood Depth= 658.25' Flow Area= 110.4 sf, Capacity= -15,180.55 cfs
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 6.89 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 22.0' Slope= 0.0114 '/'
Inlet Invert= 653.25', Outlet Invert= 653.00'



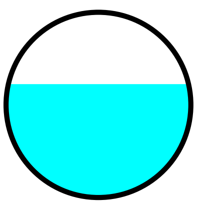
Summary for Reach DMH4: DMH4

Inflow Area = 50,380 sf, 61.69% Impervious, Inflow Depth > 4.83" for 25YearMass event
Inflow = 5.75 cfs @ 12.10 hrs, Volume= 20,282 cf
Outflow = 5.75 cfs @ 12.10 hrs, Volume= 20,281 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 11.43 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.99 fps, Avg. Travel Time= 0.2 min

Peak Storage= 28 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.61'
Defined Flood Depth= 668.70' Flow Area= 89.5 sf, Capacity= -23,305.02 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 8.32 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 55.0' Slope= 0.0545 '/'
Inlet Invert= 656.00', Outlet Invert= 653.00'



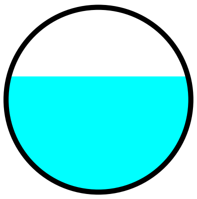
Summary for Reach DMH5: DMH5

Inflow Area = 50,380 sf, 61.69% Impervious, Inflow Depth > 4.83" for 25YearMass event
Inflow = 5.75 cfs @ 12.09 hrs, Volume= 20,284 cf
Outflow = 5.75 cfs @ 12.10 hrs, Volume= 20,282 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 11.12 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.89 fps, Avg. Travel Time= 0.5 min

Peak Storage= 57 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.63'
Defined Flood Depth= 674.55' Flow Area= 90.3 sf, Capacity= -22,712.12 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 8.04 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 110.0' Slope= 0.0509 '/'
Inlet Invert= 664.60', Outlet Invert= 659.00'



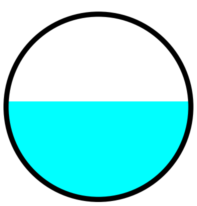
Summary for Reach DMH6: DMH6

Inflow Area = 34,735 sf, 58.70% Impervious, Inflow Depth > 4.75" for 25YearMass event
Inflow = 3.82 cfs @ 12.09 hrs, Volume= 13,735 cf
Outflow = 3.81 cfs @ 12.10 hrs, Volume= 13,731 cf, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 9.06 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 3.19 fps, Avg. Travel Time= 1.4 min

Peak Storage= 109 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.53'
Defined Flood Depth= 686.45' Flow Area= 91.9 sf, Capacity= -19,989.39 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.95 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 260.0' Slope= 0.0381 '/'
Inlet Invert= 675.90', Outlet Invert= 666.00'



Summary for Reach RR1: Rip Rap Outfall

Inflow Area = 139,060 sf, 38.03% Impervious, Inflow Depth > 3.26" for 25YearMass event
Inflow = 5.84 cfs @ 12.40 hrs, Volume= 37,734 cf
Outflow = 5.84 cfs @ 12.40 hrs, Volume= 37,728 cf, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.14 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 0.42 fps, Avg. Travel Time= 0.7 min

Peak Storage= 92 cf @ 12.40 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 1.00' Flow Area= 20.0 sf, Capacity= 51.24 cfs

18.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 22.00'
Length= 18.0' Slope= 0.0056 '/'
Inlet Invert= 649.10', Outlet Invert= 649.00'

Summary for Reach RR2: Rip Rap Outfall

Inflow Area =	17,960 sf, 35.13% Impervious,	Inflow Depth > 4.20"	for 25YearMass event
Inflow =	1.80 cfs @ 12.11 hrs, Volume=	6,283 cf	
Outflow =	1.80 cfs @ 12.11 hrs, Volume=	6,281 cf, Atten= 0%, Lag= 0.1 min	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.98 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 0.26 fps, Avg. Travel Time= 0.8 min

Peak Storage= 22 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 1.00' Flow Area= 13.0 sf, Capacity= 39.26 cfs

11.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 15.00'
Length= 12.0' Slope= 0.0083 '/'
Inlet Invert= 645.10', Outlet Invert= 645.00'

Summary for Pond 1P: Infiltration Basin 1

Inflow Area =	139,060 sf, 38.03% Impervious,	Inflow Depth > 4.11"	for 25YearMass event
Inflow =	11.34 cfs @ 12.10 hrs, Volume=	47,618 cf	
Outflow =	6.16 cfs @ 12.40 hrs, Volume=	46,215 cf, Atten= 46%, Lag= 17.5 min	
Discarded =	0.31 cfs @ 12.40 hrs, Volume=	8,481 cf	
Primary =	5.84 cfs @ 12.40 hrs, Volume=	37,734 cf	
Secondary =	0.00 cfs @ 0.00 hrs, Volume=	0 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 656.67' @ 12.40 hrs Surf.Area= 5,618 sf Storage= 11,754 cf

Plug-Flow detention time= 51.5 min calculated for 46,215 cf (97% of inflow)
Center-of-Mass det. time= 34.4 min (840.3 - 806.0)

Volume	Invert	Avail.Storage	Storage Description
#1	653.00'	20,511 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
653.00	1,360	345.0	0	0	1,360
654.00	2,050	490.0	1,693	1,693	11,004
656.00	4,730	705.0	6,596	8,289	31,484
658.00	7,605	730.0	12,222	20,511	34,679

Device	Routing	Invert	Outlet Devices
#1	Discarded	653.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Secondary	657.00'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#3	Primary	652.00'	**12.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 652.00' / 649.00' S= 0.0600 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#4	Device 3	653.70'	**5.0" Vert. Orifice/Grate** C= 0.600
#5	Device 3	654.40'	**6.0" Vert. Orifice/Grate** C= 0.600
#6	Device 3	655.10'	**8.0" Vert. Orifice/Grate** C= 0.600
#7	Device 3	655.50'	**8.0" Vert. Orifice/Grate** C= 0.600
#8	Device 3	657.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.31 cfs @ 12.40 hrs HW=656.67' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.31 cfs)

Primary OutFlow Max=5.84 cfs @ 12.40 hrs HW=656.67' TW=649.38' (Dynamic Tailwater)
└─**3=Culvert** (Passes 5.84 cfs of 7.72 cfs potential flow)
  ├─**4=Orifice/Grate** (Orifice Controls 1.09 cfs @ 8.00 fps)
  ├─**5=Orifice/Grate** (Orifice Controls 1.34 cfs @ 6.84 fps)
  ├─**6=Orifice/Grate** (Orifice Controls 1.87 cfs @ 5.36 fps)
  ├─**7=Orifice/Grate** (Orifice Controls 1.54 cfs @ 4.41 fps)
  └─**8=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=653.00' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: Rain Garden

Inflow Area = 23,215 sf, 27.18% Impervious, Inflow Depth > 4.00" for 25YearMass event
Inflow = 2.26 cfs @ 12.10 hrs, Volume= 7,745 cf
Outflow = 1.76 cfs @ 12.18 hrs, Volume= 7,745 cf, Atten= 22%, Lag= 5.0 min
Discarded = 0.23 cfs @ 12.18 hrs, Volume= 3,408 cf
Primary = 0.46 cfs @ 12.18 hrs, Volume= 3,611 cf
Secondary = 1.07 cfs @ 12.18 hrs, Volume= 726 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 645.62' @ 12.18 hrs Surf.Area= 3,727 sf Storage= 1,306 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 15.3 min (827.3 - 812.0)

Volume	Invert	Avail.Storage	Storage Description
#1	643.50'	9 cf	**4.0" Round 4" Perf Pipe** Inside #5 L= 100.0'
#2	645.00'	1,038 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)
#3	645.00'	112 cf	**3" Mulch (Irregular)**Listed below (Recalc) 225 cf Overall x 50.0% Voids
#4	644.00'	420 cf	**12" Soil Media (Irregular)**Listed below (Recalc) 840 cf Overall x 50.0% Voids
#5	643.50'	165 cf	**6" Crushed Stone (Irregular)**Listed below (Recalc) 420 cf Overall - 9 cf Embedded = 411 cf x 40.0% Voids
		1,744 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
645.00	840	240.0	0	0	840
646.00	1,250	250.0	1,038	1,038	1,301

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
645.00	840	240.0	0	0	840
645.25	960	245.0	225	225	1,042

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
644.00	840	240.0	0	0	840
645.00	840	240.0	840	840	1,080

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
643.50	840	240.0	0	0	840
644.00	840	240.0	420	420	960

Device	Routing	Invert	Outlet Devices
#1	Discarded	643.50'	**2.410 in/hr Exfiltration over Wetted area**
#2	Secondary	645.50'	**5.0' long x 8.0' breadth Broad-Crested Rectangular Weir X 2.00** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#3	Primary	643.50'	**4.0" Round Culvert** L= 20.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 643.50' / 643.50' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf

Discarded OutFlow Max=0.23 cfs @ 12.18 hrs HW=645.62' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.23 cfs)

Primary OutFlow Max=0.46 cfs @ 12.18 hrs HW=645.62' TW=0.00' (Dynamic Tailwater)
└─**3=Culvert** (Barrel Controls 0.46 cfs @ 5.23 fps)

Secondary OutFlow Max=1.07 cfs @ 12.18 hrs HW=645.62' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 1.07 cfs @ 0.86 fps)

Summary for Pond CB1: CB1

Inflow Area = 10,580 sf, 33.84% Impervious, Inflow Depth > 4.16" for 25YearMass event
Inflow = 1.04 cfs @ 12.13 hrs, Volume= 3,664 cf
Outflow = 1.04 cfs @ 12.13 hrs, Volume= 3,664 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.04 cfs @ 12.13 hrs, Volume= 3,664 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 647.21' @ 12.13 hrs
Flood Elev= 649.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	646.60'	**12.0" Round Culvert** L= 23.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 646.60' / 646.40' S= 0.0087 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.06 cfs @ 12.13 hrs HW=647.21' TW=646.89' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 1.06 cfs @ 3.00 fps)

Summary for Pond CB2: CB2

Inflow Area = 7,380 sf, 36.99% Impervious, Inflow Depth > 4.26" for 25YearMass event
Inflow = 0.87 cfs @ 12.07 hrs, Volume= 2,623 cf
Outflow = 0.87 cfs @ 12.07 hrs, Volume= 2,623 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.87 cfs @ 12.07 hrs, Volume= 2,623 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 647.16' @ 12.09 hrs
Flood Elev= 649.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	646.60'	**12.0" Round Culvert** L= 23.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 646.60' / 646.40' S= 0.0087 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.84 cfs @ 12.07 hrs HW=647.15' TW=646.88' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 0.84 cfs @ 2.73 fps)

Summary for Pond CB3: CB3

Inflow Area =	66,895 sf,	10.05% Impervious,	Inflow Depth > 3.24"	for 25YearMass event
Inflow =	4.25 cfs @	12.23 hrs, Volume=	18,037 cf	
Outflow =	4.25 cfs @	12.23 hrs, Volume=	18,037 cf,	Atten= 0%, Lag= 0.0 min
Primary =	4.25 cfs @	12.23 hrs, Volume=	18,037 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 654.84' @ 12.23 hrs
Flood Elev= 657.65'

Device	Routing	Invert	Outlet Devices
#1	Primary	653.60'	**15.0" Round Culvert** L= 22.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 653.60' / 653.35' S= 0.0114 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=4.25 cfs @ 12.23 hrs HW=654.84' TW=654.01' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 4.25 cfs @ 4.35 fps)

Summary for Pond CB4: CB4

Inflow Area =	8,005 sf,	83.82% Impervious,	Inflow Depth > 5.48"	for 25YearMass event
Inflow =	1.12 cfs @	12.07 hrs, Volume=	3,656 cf	
Outflow =	1.12 cfs @	12.07 hrs, Volume=	3,656 cf,	Atten= 0%, Lag= 0.0 min
Primary =	1.12 cfs @	12.07 hrs, Volume=	3,656 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 654.18' @ 12.09 hrs
Flood Elev= 657.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	653.60'	**12.0" Round Culvert** L= 6.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 653.60' / 653.35' S= 0.0417 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.09 cfs @ 12.07 hrs HW=654.18' TW=653.88' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 1.09 cfs @ 3.34 fps)

Summary for Pond CB5: CB5

Inflow Area = 8,255 sf, 68.02% Impervious, Inflow Depth > 5.03" for 25YearMass event
Inflow = 1.01 cfs @ 12.10 hrs, Volume= 3,457 cf
Outflow = 1.01 cfs @ 12.10 hrs, Volume= 3,457 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.01 cfs @ 12.10 hrs, Volume= 3,457 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 671.42' @ 12.10 hrs
Flood Elev= 674.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	670.90'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 670.90' / 669.90' S= 0.0833 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.01 cfs @ 12.10 hrs HW=671.42' TW=665.22' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 1.01 cfs @ 2.45 fps)

Summary for Pond CB6: CB6

Inflow Area = 7,390 sf, 68.67% Impervious, Inflow Depth > 5.03" for 25YearMass event
Inflow = 0.99 cfs @ 12.07 hrs, Volume= 3,096 cf
Outflow = 0.99 cfs @ 12.07 hrs, Volume= 3,096 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.99 cfs @ 12.07 hrs, Volume= 3,096 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 671.41' @ 12.07 hrs
Flood Elev= 674.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	670.90'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 670.90' / 669.90' S= 0.0833 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.99 cfs @ 12.07 hrs HW=671.41' TW=665.21' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 0.99 cfs @ 2.44 fps)

Summary for Pond CB7: CB7

Inflow Area = 18,350 sf, 56.05% Impervious, Inflow Depth > 4.70" for 25YearMass event
Inflow = 2.32 cfs @ 12.07 hrs, Volume= 7,180 cf
Outflow = 2.32 cfs @ 12.07 hrs, Volume= 7,180 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.32 cfs @ 12.07 hrs, Volume= 7,180 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 682.67' @ 12.07 hrs
Flood Elev= 686.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	681.80'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 681.80' / 681.00' S= 0.0667 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.31 cfs @ 12.07 hrs HW=682.67' TW=676.42' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 2.31 cfs @ 3.18 fps)

Summary for Pond CB8: CB8

Inflow Area = 16,385 sf, 61.67% Impervious, Inflow Depth > 4.80" for 25YearMass event
Inflow = 1.76 cfs @ 12.14 hrs, Volume= 6,555 cf
Outflow = 1.76 cfs @ 12.14 hrs, Volume= 6,555 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.76 cfs @ 12.14 hrs, Volume= 6,555 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 682.52' @ 12.14 hrs
Flood Elev= 686.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	681.80'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 681.80' / 681.00' S= 0.0667 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.76 cfs @ 12.14 hrs HW=682.52' TW=676.40' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 1.76 cfs @ 2.89 fps)

Summary for Link P4: AP4 - To Wetlands B/C

Inflow Area = 225,690 sf, 26.23% Impervious, Inflow Depth > 3.07" for 25YearMass event
Inflow = 10.69 cfs @ 12.17 hrs, Volume= 57,659 cf
Primary = 10.69 cfs @ 12.17 hrs, Volume= 57,659 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Subcatchment P1.1: AP1 - To Wetland D

Runoff = 10.17 cfs @ 12.36 hrs, Volume= 52,570 cf, Depth> 4.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
142,405	70	Woods, Good, HSG C
1,630	74	>75% Grass cover, Good, HSG C
144,035	70	Weighted Average
144,035		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	50	0.0500	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
2.5	170	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	240	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	505	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
26.8	965	Total			

Summary for Subcatchment P2.1: AP2 - To Main Street

Runoff = 1.72 cfs @ 12.10 hrs, Volume= 5,590 cf, Depth> 5.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
2,510	70	Woods, Good, HSG C
1,660	98	Paved roads w/curbs & sewers, HSG C
9,015	74	>75% Grass cover, Good, HSG C
13,185	76	Weighted Average
11,525		87.41% Pervious Area
1,660		12.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	25	0.0250	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.5	65	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	15	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.3	105	Total			

Summary for Subcatchment P3.1: AP3 - To 28 Main St

Runoff = 0.77 cfs @ 12.07 hrs, Volume= 2,295 cf, Depth> 4.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
2,900	70	Woods, Good, HSG C
3,050	74	>75% Grass cover, Good, HSG C
5,950	72	Weighted Average
5,950		100.00% Pervious Area

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

Summary for Subcatchment P4.1: To CB 8

Runoff = 2.34 cfs @ 12.14 hrs, Volume= 8,860 cf, Depth> 6.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
1,330	70	Woods, Good, HSG C
10,105	98	Paved roads w/curbs & sewers, HSG C
4,950	74	>75% Grass cover, Good, HSG C
16,385	88	Weighted Average
6,280		38.33% Pervious Area
10,105		61.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0600	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
1.0	75	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	30	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	170	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
10.6	330	Total			

Summary for Subcatchment P4.10: To Wetlands B/C

Runoff = 6.76 cfs @ 12.13 hrs, Volume= 23,232 cf, Depth> 4.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
57,795	70	Woods, Good, HSG C
5,620	74	>75% Grass cover, Good, HSG C
63,415	70	Weighted Average
63,415		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.2000	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.2	30	0.2000	2.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.8	160	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.1	240	Total			

Summary for Subcatchment P4.11: To Rain Garden

Runoff = 0.71 cfs @ 12.07 hrs, Volume= 2,128 cf, Depth> 4.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
5,255	74	>75% Grass cover, Good, HSG C
5,255		100.00% Pervious Area

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

Summary for Subcatchment P4.2: To CB 7

Runoff = 3.09 cfs @ 12.07 hrs, Volume= 9,751 cf, Depth> 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
1,325	70	Woods, Good, HSG C
10,285	98	Paved roads w/curbs & sewers, HSG C
6,740	74	>75% Grass cover, Good, HSG C
18,350	87	Weighted Average
8,065		43.95% Pervious Area
10,285		56.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0300	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	60	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.2	115	Total			

Summary for Subcatchment P4.3: To CB 6

Runoff = 1.30 cfs @ 12.07 hrs, Volume= 4,146 cf, Depth> 6.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
5,075	98	Paved roads w/curbs & sewers, HSG C
2,315	74	>75% Grass cover, Good, HSG C
7,390	90	Weighted Average
2,315		31.33% Pervious Area
5,075		68.67% Impervious Area

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

Summary for Subcatchment P4.4: To CB 5

Runoff = 1.33 cfs @ 12.10 hrs, Volume= 4,629 cf, Depth> 6.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
130	70	Woods, Good, HSG C
5,615	98	Paved roads w/curbs & sewers, HSG C
2,510	74	>75% Grass cover, Good, HSG C
8,255	90	Weighted Average
2,640		31.98% Pervious Area
5,615		68.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	15	0.0500	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
3.0	35	0.0500	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
0.1	10	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	235	0.0400	4.06		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.5	300	Total			

Summary for Subcatchment P4.5: To CB 4

Runoff = 1.46 cfs @ 12.07 hrs, Volume= 4,808 cf, Depth> 7.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
6,710	98	Paved roads w/curbs & sewers, HSG C
1,295	74	>75% Grass cover, Good, HSG C
8,005	94	Weighted Average
1,295		16.18% Pervious Area
6,710		83.82% Impervious Area

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

Summary for Subcatchment P4.6: To CB 3

Runoff = 6.22 cfs @ 12.23 hrs, Volume= 26,383 cf, Depth> 4.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
50,635	70	Woods, Good, HSG C
6,725	98	Paved roads w/curbs & sewers, HSG C
9,535	74	>75% Grass cover, Good, HSG C
66,895	73	Weighted Average
60,170		89.95% Pervious Area
6,725		10.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	50	0.0500	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
5.9	395	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	170	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	25	0.0550	4.76		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.6	645	Total			

Summary for Subcatchment P4.7: To CB 2

Runoff = 1.18 cfs @ 12.07 hrs, Volume= 3,632 cf, Depth> 5.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
2,730	98	Paved roads w/curbs & sewers, HSG C
4,650	74	>75% Grass cover, Good, HSG C
7,380	83	Weighted Average
4,650		63.01% Pervious Area
2,730		36.99% Impervious Area

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

Summary for Subcatchment P4.8: To CB 1

Runoff = 1.44 cfs @ 12.13 hrs, Volume= 5,100 cf, Depth> 5.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
520	70	Woods, Good, HSG C
3,580	98	Paved roads w/curbs & sewers, HSG C
6,480	74	>75% Grass cover, Good, HSG C
10,580	82	Weighted Average
7,000		66.16% Pervious Area
3,580		33.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0600	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.2	15	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	45	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	5	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.8	160	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.5	275	Total			

Summary for Subcatchment P4.9: To Basin

Runoff = 2.40 cfs @ 12.07 hrs, Volume= 7,594 cf, Depth> 6.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
8,370	98	Water Surface, HSG C
5,410	74	>75% Grass cover, Good, HSG C
13,780	89	Weighted Average
5,410		39.26% Pervious Area
8,370		60.74% Impervious Area

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

Summary for Subcatchment P5.1: AP5 - To Wetlands A

Runoff = 5.09 cfs @ 12.14 hrs, Volume= 17,869 cf, Depth> 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YearMass Rainfall=7.93"

Area (sf)	CN	Description
33,800	70	Woods, Good, HSG C
10,030	77	Woods, Good, HSG D
2,540	74	>75% Grass cover, Good, HSG C
46,370	72	Weighted Average
46,370		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	25	0.0400	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
2.2	25	0.4000	0.19		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
1.7	100	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	50	0.4500	3.35		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	50	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.8	250	Total			

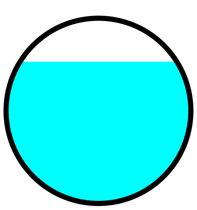
Summary for Reach DMH1: DMH1

Inflow Area = 17,960 sf, 35.13% Impervious, Inflow Depth > 5.83" for 100YearMass event
Inflow = 2.48 cfs @ 12.10 hrs, Volume= 8,732 cf
Outflow = 2.48 cfs @ 12.10 hrs, Volume= 8,730 cf, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.84 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.43 fps, Avg. Travel Time= 1.1 min

Peak Storage= 58 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.77'
Defined Flood Depth= 650.50' Flow Area= 87.1 sf, Capacity= -7,234.81 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.66 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 90.0' Slope= 0.0056 '/'
Inlet Invert= 646.30', Outlet Invert= 645.80'



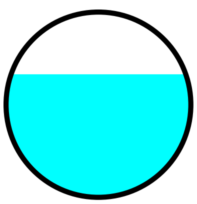
Summary for Reach DMH2: DMH2

Inflow Area = 17,960 sf, 35.13% Impervious, Inflow Depth > 5.83" for 100YearMass event
Inflow = 2.48 cfs @ 12.10 hrs, Volume= 8,730 cf
Outflow = 2.47 cfs @ 12.11 hrs, Volume= 8,728 cf, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.47 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.62 fps, Avg. Travel Time= 0.9 min

Peak Storage= 49 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.66'
Defined Flood Depth= 654.00' Flow Area= 87.6 sf, Capacity= -8,703.75 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.18 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 88.0' Slope= 0.0080 '/'
Inlet Invert= 645.70', Outlet Invert= 645.00'



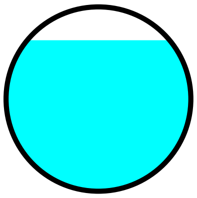
Summary for Reach DMH3: DMH3

Inflow Area = 74,900 sf, 17.94% Impervious, Inflow Depth > 5.00" for 100YearMass event
Inflow = 6.87 cfs @ 12.22 hrs, Volume= 31,191 cf
Outflow = 6.87 cfs @ 12.22 hrs, Volume= 31,189 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.40 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.34 fps, Avg. Travel Time= 0.2 min

Peak Storage= 24 cf @ 12.22 hrs
Average Depth at Peak Storage= 1.02'
Defined Flood Depth= 658.25' Flow Area= 110.4 sf, Capacity= -15,180.55 cfs
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 6.89 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 22.0' Slope= 0.0114 '/'
Inlet Invert= 653.25', Outlet Invert= 653.00'



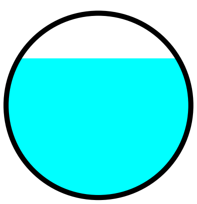
Summary for Reach DMH4: DMH4

Inflow Area = 50,380 sf, 61.69% Impervious, Inflow Depth > 6.52" for 100YearMass event
Inflow = 7.64 cfs @ 12.10 hrs, Volume= 27,378 cf
Outflow = 7.64 cfs @ 12.10 hrs, Volume= 27,377 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 12.02 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.33 fps, Avg. Travel Time= 0.2 min

Peak Storage= 35 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.75'
Defined Flood Depth= 668.70' Flow Area= 89.5 sf, Capacity= -23,305.02 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 8.32 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 55.0' Slope= 0.0545 '/'
Inlet Invert= 656.00', Outlet Invert= 653.00'



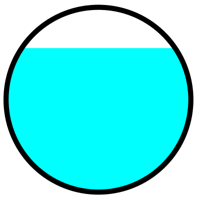
Summary for Reach DMH5: DMH5

Inflow Area = 50,380 sf, 61.69% Impervious, Inflow Depth > 6.52" for 100YearMass event
Inflow = 7.65 cfs @ 12.09 hrs, Volume= 27,381 cf
Outflow = 7.64 cfs @ 12.10 hrs, Volume= 27,378 cf, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 11.65 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 4.22 fps, Avg. Travel Time= 0.4 min

Peak Storage= 72 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.78'
Defined Flood Depth= 674.55' Flow Area= 90.3 sf, Capacity= -22,712.12 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 8.04 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 110.0' Slope= 0.0509 '/'
Inlet Invert= 664.60', Outlet Invert= 659.00'



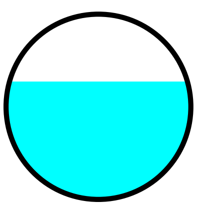
Summary for Reach DMH6: DMH6

Inflow Area = 34,735 sf, 58.70% Impervious, Inflow Depth > 6.43" for 100YearMass event
Inflow = 5.10 cfs @ 12.09 hrs, Volume= 18,611 cf
Outflow = 5.09 cfs @ 12.10 hrs, Volume= 18,606 cf, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 9.67 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.46 fps, Avg. Travel Time= 1.3 min

Peak Storage= 137 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.64'
Defined Flood Depth= 686.45' Flow Area= 91.9 sf, Capacity= -19,989.39 cfs
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.95 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 260.0' Slope= 0.0381 '/'
Inlet Invert= 675.90', Outlet Invert= 666.00'



Summary for Reach RR1: Rip Rap Outfall

Inflow Area = 139,060 sf, 38.03% Impervious, Inflow Depth > 4.62" for 100YearMass event
Inflow = 8.19 cfs @ 12.31 hrs, Volume= 53,578 cf
Outflow = 8.19 cfs @ 12.31 hrs, Volume= 53,570 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.30 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 0.47 fps, Avg. Travel Time= 0.6 min

Peak Storage= 113 cf @ 12.31 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.00' Flow Area= 20.0 sf, Capacity= 51.24 cfs

18.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 22.00'
Length= 18.0' Slope= 0.0056 '/'
Inlet Invert= 649.10', Outlet Invert= 649.00'

Summary for Reach RR2: Rip Rap Outfall

Inflow Area =	17,960 sf, 35.13% Impervious,	Inflow Depth > 5.83"	for 100YearMass event	
Inflow =	2.47 cfs @ 12.11 hrs,	Volume=	8,728 cf	
Outflow =	2.47 cfs @ 12.11 hrs,	Volume=	8,726 cf,	Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.11 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 0.29 fps, Avg. Travel Time= 0.7 min

Peak Storage= 27 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.20'
Bank-Full Depth= 1.00' Flow Area= 13.0 sf, Capacity= 39.26 cfs

11.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 15.00'
Length= 12.0' Slope= 0.0083 '/'
Inlet Invert= 645.10', Outlet Invert= 645.00'

Summary for Pond 1P: Infiltration Basin 1

Inflow Area =	139,060 sf, 38.03% Impervious,	Inflow Depth > 5.71"	for 100YearMass event	
Inflow =	15.51 cfs @ 12.10 hrs,	Volume=	66,161 cf	
Outflow =	10.58 cfs @ 12.31 hrs,	Volume=	64,640 cf,	Atten= 32%, Lag= 12.3 min
Discarded =	0.35 cfs @ 12.31 hrs,	Volume=	9,564 cf	
Primary =	8.19 cfs @ 12.31 hrs,	Volume=	53,578 cf	
Secondary =	2.04 cfs @ 12.31 hrs,	Volume=	1,498 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 657.19' @ 12.31 hrs Surf.Area= 6,356 sf Storage= 14,853 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 32.7 min (830.8 - 798.1)

Volume	Invert	Avail.Storage	Storage Description
#1	653.00'	20,511 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
653.00	1,360	345.0	0	0	1,360
654.00	2,050	490.0	1,693	1,693	11,004
656.00	4,730	705.0	6,596	8,289	31,484
658.00	7,605	730.0	12,222	20,511	34,679

Device	Routing	Invert	Outlet Devices
#1	Discarded	653.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Secondary	657.00'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#3	Primary	652.00'	**12.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 652.00' / 649.00' S= 0.0600 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#4	Device 3	653.70'	**5.0" Vert. Orifice/Grate** C= 0.600
#5	Device 3	654.40'	**6.0" Vert. Orifice/Grate** C= 0.600
#6	Device 3	655.10'	**8.0" Vert. Orifice/Grate** C= 0.600
#7	Device 3	655.50'	**8.0" Vert. Orifice/Grate** C= 0.600
#8	Device 3	657.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.35 cfs @ 12.31 hrs HW=657.19' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.35 cfs)

Primary OutFlow Max=8.19 cfs @ 12.31 hrs HW=657.19' TW=649.44' (Dynamic Tailwater)
└─**3=Culvert** (Inlet Controls 8.19 cfs @ 10.43 fps)
  ├─**4=Orifice/Grate** (Passes < 1.19 cfs potential flow)
  ├─**5=Orifice/Grate** (Passes < 1.51 cfs potential flow)
  ├─**6=Orifice/Grate** (Passes < 2.23 cfs potential flow)
  ├─**7=Orifice/Grate** (Passes < 1.96 cfs potential flow)
  └─**8=Orifice/Grate** (Passes < 1.68 cfs potential flow)

Secondary OutFlow Max=2.04 cfs @ 12.31 hrs HW=657.19' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 2.04 cfs @ 1.08 fps)

Summary for Pond 2P: Rain Garden

Inflow Area = 23,215 sf, 27.18% Impervious, Inflow Depth > 5.61" for 100YearMass event
Inflow = 3.13 cfs @ 12.10 hrs, Volume= 10,854 cf
Outflow = 3.02 cfs @ 12.13 hrs, Volume= 10,854 cf, Atten= 4%, Lag= 1.7 min
Discarded = 0.24 cfs @ 12.13 hrs, Volume= 4,038 cf
Primary = 0.47 cfs @ 12.13 hrs, Volume= 4,856 cf
Secondary = 2.31 cfs @ 12.13 hrs, Volume= 1,960 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 645.71' @ 12.13 hrs Surf.Area= 3,762 sf Storage= 1,398 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 14.6 min (817.1 - 802.5)

Volume	Invert	Avail.Storage	Storage Description
#1	643.50'	9 cf	**4.0" Round 4" Perf Pipe** Inside #5 L= 100.0'
#2	645.00'	1,038 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)
#3	645.00'	112 cf	**3" Mulch (Irregular)**Listed below (Recalc) 225 cf Overall x 50.0% Voids
#4	644.00'	420 cf	**12" Soil Media (Irregular)**Listed below (Recalc) 840 cf Overall x 50.0% Voids
#5	643.50'	165 cf	**6" Crushed Stone (Irregular)**Listed below (Recalc) 420 cf Overall - 9 cf Embedded = 411 cf x 40.0% Voids
		1,744 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
645.00	840	240.0	0	0	840
646.00	1,250	250.0	1,038	1,038	1,301

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
645.00	840	240.0	0	0	840
645.25	960	245.0	225	225	1,042

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
644.00	840	240.0	0	0	840
645.00	840	240.0	840	840	1,080

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
643.50	840	240.0	0	0	840
644.00	840	240.0	420	420	960

Device	Routing	Invert	Outlet Devices
#1	Discarded	643.50'	**2.410 in/hr Exfiltration over Wetted area**
#2	Secondary	645.50'	**5.0' long x 8.0' breadth Broad-Crested Rectangular Weir X 2.00** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#3	Primary	643.50'	**4.0" Round Culvert** L= 20.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 643.50' / 643.50' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf

Discarded OutFlow Max=0.24 cfs @ 12.13 hrs HW=645.71' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=0.47 cfs @ 12.13 hrs HW=645.71' TW=0.00' (Dynamic Tailwater)
└─**3=Culvert** (Barrel Controls 0.47 cfs @ 5.35 fps)

Secondary OutFlow Max=2.31 cfs @ 12.13 hrs HW=645.71' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 2.31 cfs @ 1.11 fps)

Summary for Pond CB1: CB1

Inflow Area = 10,580 sf, 33.84% Impervious, Inflow Depth > 5.78" for 100YearMass event
Inflow = 1.44 cfs @ 12.13 hrs, Volume= 5,100 cf
Outflow = 1.44 cfs @ 12.13 hrs, Volume= 5,100 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.44 cfs @ 12.13 hrs, Volume= 5,100 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 647.37' @ 12.12 hrs
Flood Elev= 649.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	646.60'	**12.0" Round Culvert** L= 23.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 646.60' / 646.40' S= 0.0087 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.46 cfs @ 12.13 hrs HW=647.37' TW=647.04' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 1.46 cfs @ 3.12 fps)

Summary for Pond CB2: CB2

Inflow Area = 7,380 sf, 36.99% Impervious, Inflow Depth > 5.91" for 100YearMass event
Inflow = 1.18 cfs @ 12.07 hrs, Volume= 3,632 cf
Outflow = 1.18 cfs @ 12.07 hrs, Volume= 3,632 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.18 cfs @ 12.07 hrs, Volume= 3,632 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 647.30' @ 12.09 hrs
Flood Elev= 649.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	646.60'	**12.0" Round Culvert** L= 23.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 646.60' / 646.40' S= 0.0087 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.13 cfs @ 12.07 hrs HW=647.29' TW=647.03' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 1.13 cfs @ 2.76 fps)

Summary for Pond CB3: CB3

Inflow Area = 66,895 sf, 10.05% Impervious, Inflow Depth > 4.73" for 100YearMass event
Inflow = 6.22 cfs @ 12.23 hrs, Volume= 26,383 cf
Outflow = 6.22 cfs @ 12.23 hrs, Volume= 26,383 cf, Atten= 0%, Lag= 0.0 min
Primary = 6.22 cfs @ 12.23 hrs, Volume= 26,383 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 655.40' @ 12.23 hrs
Flood Elev= 657.65'

Device	Routing	Invert	Outlet Devices
#1	Primary	653.60'	**15.0" Round Culvert** L= 22.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 653.60' / 653.35' S= 0.0114 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=6.22 cfs @ 12.23 hrs HW=655.40' TW=654.27' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 6.22 cfs @ 5.07 fps)

Summary for Pond CB4: CB4

Inflow Area = 8,005 sf, 83.82% Impervious, Inflow Depth > 7.21" for 100YearMass event
Inflow = 1.46 cfs @ 12.07 hrs, Volume= 4,808 cf
Outflow = 1.46 cfs @ 12.07 hrs, Volume= 4,808 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.46 cfs @ 12.07 hrs, Volume= 4,808 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 654.33' @ 12.10 hrs
Flood Elev= 657.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	653.60'	**12.0" Round Culvert** L= 6.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 653.60' / 653.35' S= 0.0417 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.40 cfs @ 12.07 hrs HW=654.32' TW=654.05' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 1.40 cfs @ 3.24 fps)

Summary for Pond CB5: CB5

Inflow Area = 8,255 sf, 68.02% Impervious, Inflow Depth > 6.73" for 100YearMass event
Inflow = 1.33 cfs @ 12.10 hrs, Volume= 4,629 cf
Outflow = 1.33 cfs @ 12.10 hrs, Volume= 4,629 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.33 cfs @ 12.10 hrs, Volume= 4,629 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 671.51' @ 12.10 hrs
Flood Elev= 674.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	670.90'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 670.90' / 669.90' S= 0.0833 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.33 cfs @ 12.10 hrs HW=671.51' TW=665.38' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 1.33 cfs @ 2.66 fps)

Summary for Pond CB6: CB6

Inflow Area = 7,390 sf, 68.67% Impervious, Inflow Depth > 6.73" for 100YearMass event
Inflow = 1.30 cfs @ 12.07 hrs, Volume= 4,146 cf
Outflow = 1.30 cfs @ 12.07 hrs, Volume= 4,146 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.30 cfs @ 12.07 hrs, Volume= 4,146 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 671.50' @ 12.07 hrs
Flood Elev= 674.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	670.90'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 670.90' / 669.90' S= 0.0833 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.30 cfs @ 12.07 hrs HW=671.50' TW=665.35' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 1.30 cfs @ 2.64 fps)

Summary for Pond CB7: CB7

Inflow Area = 18,350 sf, 56.05% Impervious, Inflow Depth > 6.38" for 100YearMass event
Inflow = 3.09 cfs @ 12.07 hrs, Volume= 9,751 cf
Outflow = 3.09 cfs @ 12.07 hrs, Volume= 9,751 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.09 cfs @ 12.07 hrs, Volume= 9,751 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 682.97' @ 12.07 hrs
Flood Elev= 686.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	681.80'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 681.80' / 681.00' S= 0.0667 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.09 cfs @ 12.07 hrs HW=682.97' TW=676.52' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 3.09 cfs @ 3.93 fps)

Summary for Pond CB8: CB8

Inflow Area = 16,385 sf, 61.67% Impervious, Inflow Depth > 6.49" for 100YearMass event
Inflow = 2.34 cfs @ 12.14 hrs, Volume= 8,860 cf
Outflow = 2.34 cfs @ 12.14 hrs, Volume= 8,860 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.34 cfs @ 12.14 hrs, Volume= 8,860 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 682.68' @ 12.14 hrs
Flood Elev= 686.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	681.80'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 681.80' / 681.00' S= 0.0667 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.34 cfs @ 12.14 hrs HW=682.68' TW=676.50' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 2.34 cfs @ 3.19 fps)

Summary for Link P4: AP4 - To Wetlands B/C

Inflow Area = 225,690 sf, 26.23% Impervious, Inflow Depth > 4.53" for 100YearMass event
Inflow = 15.88 cfs @ 12.26 hrs, Volume= 85,115 cf
Primary = 15.88 cfs @ 12.26 hrs, Volume= 85,115 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

APPENDIX F

ADDITIONAL DRAINAGE CALCULATION WORKSHEETS

Fiske Hill East Definitive Subdivision
Sturbridge, MA

Computations for Massachussetts Stormwater Standards 3/4

McClure Engineering, Inc.
November 11, 2020
Rev. May 27, 2021
By: PE

Table 2											
STANDARD 3 STORMWATER RECHARGE COMPUTATIONS:											
Structure	Structure Type		Impervious area, A (sf)	NRCS Hydrologic Soil Group	Recharge Target depth*, F (inches)	Total Required Recharge Volume**, Rv (c.f.)	Proposed Infiltration Storage Volume*** (c.f.)	Soil type / HSG	Rawls Infilt. Rate, k (inches/hr)	Infiltration Basin Bottom Area (S.F.)	Drawdown Time****, T (hrs)
Infiltration Basin	Infiltration Basin		52,485	C	0.25	1093.4375	1,112	Loamy Sand	2.41	1360	4.07
STANDARD 4 WATER QUALITY COMPUTATIONS:											
Discharge Location	Structure Type	Tributary Area (sf)	Impervious area, A (sf)	Water Quality Depth, Dwq (inches)	Required Water Quality Volume^, V*wq* (c.f.)	Provided Treatment Volume^^, (c.f.)	TSS Removal^^^ (%)				
Outfall 4	Infiltration Basin with Sediment Forebay		44,515	0.5	1854.79	6,278	85				
Outfall 1	STC450 and Rain Garden		6,310	0.5	262.92	2,853	99				
Main St	None		1,660	0.5	69.17	0	0				
			52,485		2186.88	9131.00	83.99				
* - From Table 2.3.2 MA Hydrologic Stormwater Handbook Volume 3, Chapter 1 Ducumenting Compliance.											
** - Rv, cubic feet = F/12 X (A)											
*** - Actual storage volume provided below lowest basin outlet from HydroCAD Computations, must be ≥ Rv											
**** - Time to infiltrate Stored volume = Rv/(k/12)(Basin Bottom Area)), must be ≤ 72 Hrs											
^ - V*wq* = (D*wq* /12 inches/foot) X (impervious Area, acres X 43560 S.F./Acrea)											
^^ - Actual volume of water treated through the treatment train during 2 year storm event from HydroCAD Computations, must be ≥ Vwq											
^^^ - See TSS Removal Spreadsheets											

PIPE SIZING CALCULATIONS
Table 4

From	To	Q100, cfs Hydrocadd	pipe D, in	pipe L, ft	Rim El, ft	invert out	Downstream Invert	Design pipe slope	Pipe Full V, f/s	Manning Q, cfs (n=.013)
CB1	DMH1	1.44	12	23	649.60	646.60	646.40	0.009	4.24	3.33
CB2	DMH1	1.18	12	23	649.60	646.60	646.40	0.009	4.24	3.33
DMH1	DMH2	2.48	12	90	650.50	646.30	645.80	0.006	3.39	2.66
DMH2	Outfall 1	2.47	12	88	654.00	645.70	645.00	0.008	4.06	3.19
CB3	DMH3	6.22	15	22	657.60	653.60	653.35	0.011	5.63	6.90
CB4	DMH3	1.46	12	6	657.60	653.60	653.35	0.042	9.28	7.29
DMH3	Outfall 2/ Basin	6.87	15	22	658.30	653.25	653.00	0.011	5.63	6.90
CB5	DMH5	1.33	12	12	674.90	670.90	669.90	0.083	13.13	10.31
CB6	DMH5	1.3	12	12	674.90	670.90	669.90	0.083	13.13	10.31
DMH5	DMH4	7.64	12	110	674.60	664.60	659.00	0.051	10.26	8.06
DMH4	Outfall 3/ Basin	7.64	12	55	668.00	656.00	653.00	0.055	10.62	8.34
CB7	DMH6	3.09	12	12	685.80	681.80	681.00	0.067	11.74	9.22
CB8	DMH6	2.34	12	12	685.80	681.80	681.00	0.067	11.74	9.22
DMH6	DMH5	5.09	12	260	685.90	675.90	666.00	0.038	8.88	6.97
Note:	N-12 Pipe, Use n=		0.013							

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: Outfall #4

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)
	0.00	1.00	0.00	1.00
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Infiltration Basin	0.80	0.75	0.60	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Total TSS Removal = **85%**

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

Project: Fiske Hill East Subdivision
Prepared By: PE
Date: 10/29/2020

*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

Mass. Dept. of Environmental Protection

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: Outfall 1

TSS Removal Calculation Worksheet

A	B TSS Removal	C Starting TSS	D Amount	E Remaining
STC 450i	**0.87**	**1.00**	**0.90**	**0.10**
Rain Garden	**0.90**	**0.10**	**0.09**	**0.01**

Total TSS Removal = 99%

Project: **Fiske Hill East Subdivision**

Prepared By: **PCE**

Date: **5/27/2021**

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

McClure Engineering, Inc.

Rip Rap Outfall Calculations

FROM CONNECTICUT GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL

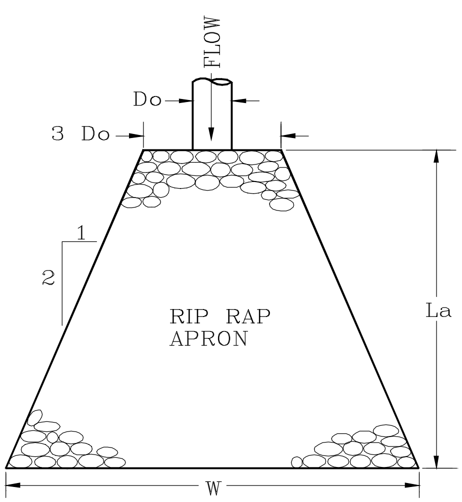
Fiske Hill East Definitive Subdivision

Basin Outlet

GIVEN:	Do =	1.0 ft		
	Q25 =	5.8 cfs		
	Tw =	0.49 ft		Tw = 49% of Do

FIND:	La =	Length of Rip Rap Pad
	W =	Width of Rip Rap Pad
	d50 =	Average Rock Diameter
	d100 =	Largest Rock Diameter
	T =	Thickness of Rip Rap Pad

La =	(1.7 * Q) / (Do ^(3/2)) + 8 * Do =	17.9 ft Min		
W =	3 * Do + La =	20.9 ft Min		
d50 =	(0.02 / Tw) * (Q / Do)^(4 / 3) =	5.2 in	=	6.83 lbs
d100 =	1.5 * (d50) =	7.7 in	=	23.06 lbs
T =	1.5 * (d100) or 6", whichever is greater	6.0 in		



Area = 214.49 ft^2

Volume = 1286.94 ft^3

Rip Rap Outfall Calculations

FROM CONNECTICUT GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL

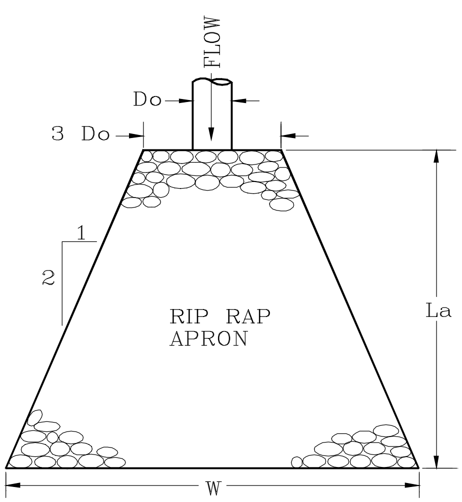
Fiske Hill East Definitive Subdivision

DMH2 Outlet

GIVEN:	Do =	1.0 ft		
	Q25 =	1.8 cfs		
	Tw =	0.49 ft	Tw = 49%	of Do

FIND:	La =	Length of Rip Rap Pad
	W =	Width of Rip Rap Pad
	d50 =	Average Rock Diameter
	d100 =	Largest Rock Diameter
	T =	Thickness of Rip Rap Pad

La =	(1.7 * Q) / (Do ^(3/2)) + 8 * Do =	11.1 ft Min		
W =	3 * Do + La =	14.1 ft Min		
d50 =	(0.02 / Tw) * (Q / Do)^(4 / 3) =	1.1 in	=	0.06 lbs
d100 =	1.5 * (d50) =	1.6 in	=	0.21 lbs
T =	1.5 * (d100) or 6", whichever is greater	6.0 in		



Area = 94.34 ft^2

Volume = 566.05 ft^3

APPENDIX G

CONSTRUCTION PERIOD STORMWATER POLLUTION PREVENTION PLAN AND DRAFT WEEKLY CONSTRUCTION PERIOD INSPECTION REPORT

Weekly Stormwater Construction Site Inspection Report
30 Main Street, Sturbridge, MA 01566

General Information			
Project Name	**FISKE HILL EAST**		
MassDEP File Number:			
Date of Inspection		**Start/End Time**	
Inspector's Name(s) & Contact Information			
Type of Inspection: ❑ Regular ❑ Pre-storm event ❑ During storm event ❑ Post-storm event			
Weather Information			
Has there been a storm event since the last inspection? ❑Yes ❑No **If yes, provide:** Storm Start Date & Time: Storm Duration (hrs): Approximate Amount of Precipitation (in):			
Weather at time of this inspection? ❑ Clear ❑Cloudy ❑ Rain ❑ Sleet ❑ Fog ❑ Snowing ❑ High Winds ❑ Other: Temperature:			
Have any discharges occurred since the last inspection? ❑Yes ❑No **If yes, describe:**			
Are there any discharges at the time of inspection? ❑Yes ❑No **If yes, describe:**			

	Site – Specific BMPs	**BMP Installed?**	**BMP Maintenance Required?**	**Corrective Action Needed and Notes**
1	Erosion Control Barrier	❑Yes ❑No	❑Yes ❑No	
2	Catch Basin Inlet Protection	❑Yes ❑No	❑Yes ❑No	
3	Temporary Soil Stabilization	❑Yes ❑No	❑Yes ❑No	
4	Stormwater System	❑Yes ❑No	❑Yes ❑No	

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title: ____

Signature:____ **Date:**____________________

Overall Site Issues

Below are some general site issues that should be assessed during inspections. Customize this list as needed for conditions at your site.

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
1	**Slopes** and disturbed areas not actively being worked properly stabilized?	❑Yes ❑No	❑Yes ❑No	
2	**Natural Resource** areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	❑Yes ❑No	❑Yes ❑No	
3	**Perimeter Controls** and sediment barriers adequately installed (keyed into substrate) and maintained?	❑Yes ❑No	❑Yes ❑No	
4	**Discharge Points** and receiving waters free of any sediment deposits?	❑Yes ❑No	❑Yes ❑No	
5	**Storm Drain Inlets** properly protected?	❑Yes ❑No	❑Yes ❑No	
6	**Construction exit** preventing sediment from being tracked into the street?	❑Yes ❑No	❑Yes ❑No	
7	**Trash / Litter** from work areas collected and placed in covered dumpsters?	❑Yes ❑No	❑Yes ❑No	
8	**Washout Facilities** (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	❑Yes ❑No	❑Yes ❑No	
9	**Vehicle and Equipment Fueling,** cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	❑Yes ❑No	❑Yes ❑No	
10	**Materials** that are potential stormwater contaminants stored inside or under cover?	❑Yes ❑No	❑Yes ❑No	
11	**Non-stormwater discharges** (wash water, dewatering) properly controlled?	❑Yes ❑No	❑Yes ❑No	

APPENDIX H

STORMWATER MANAGEMENT SYSTEM
LONG-TERM OPERATION & MAINTENANCE (O & M) PLAN

STORMWATER MANAGEMENT SYSTEM

Long Term Operations and Maintenance Plan

30 Main Street
Sturbridge, MA 01566

Prepared For:
Fiske Hill East Realty Trust
97 Arnold Road
Fiskdale, MA 01518

November 11, 2020
Rev. May 27, 2021

McCLURE ENGINEERING, INC

119 Worcester Road – Charlton, Massachusetts 01507 – T: 508.248.2005

TABLE OF CONTENTS

TABLES

ATTACHMENTS

Long-Term Operation & Maintenance Plan
Site Stormwater Management System
30 Main Street, Sturbridge, MA

Property Owner/Responsible Party: Fiske Hill East Realty Trust
97 Arnold Road
Fiskdale, MA 01518
Phone: (508) 450-0713

Storm Water Management System Owner: **(same as above)**

Site subject to Wetlands Protection Act: **<u>Yes</u>**

The Responsible Party Shall:

- Prepare an **"Operation and Maintenance (O & M) Compliance Statement" (Attachment #1)**
- Implement the routine and non-routine operation, maintenance, and inspection tasks in accordance with the procedures specified in this document to ensure that all storm water management systems function as designed.
- Maintain a log of all operation and maintenance (O & M) activities. Keep records for the last three (3) years, including inspections, repairs, replacement and disposal (for disposal, the log shall indicate the type of material and disposal location).
- Make this log available to **Town of Sturbridge** official representatives upon request;
- Allow **Town of Sturbridge** official representatives to inspect each storm water system "best management practice" (BMP) to determine whether the responsible party is implementing the operation and maintenance plan;
- Agree to notify in writing all future property owners of the presence of the storm water management system and the requirement for proper operation and maintenance.

Responsible Party shall maintain a contract with the following companies:

Landscaping and Pavement Maintenance: ____

Snow Removal and Plowing: ____

Storm Water System Maintenance: ____

Long-Term Operation & Maintenance Plan

30 Main Street, Sturbridge, MA

Site Description:

The Subject Site is referenced as Sturbridge Assessor's Parcel I.D. 415-03914-030 and consists of approximately 18.56 acres. The property lies on the northern side of Main Street approximately 1,600 feet west of the Southbridge Town Line. The parcel is more particularly described in deed book 32421, page 230 as recorded with the Worcester County Registry of Deeds.

The site, 18.56 acres, is located within the Rural and Commercial zoning districts. The existing site consists of mostly wooded area, as well as wetlands. The site topography slopes generally in a southerly direction towards Main Street.

The site is located within an area of minimal flood hazard (Zone X) per Flood Insurance Rate Map (FIRM) Worcester County Massachusetts (All Jurisdictions), Map Number 25027C0933E, effective on 07/04/2011

The proposed site layout is for the construction of an approximately 1,050 foot long subdivision roadway. The construction will disturb approximately 3.0 acres of existing woodland. The proposed asphalt roadway is 24' wide with bituminous concrete curbs, and 4' wide concrete sidewalks on both sides of the road for the majority of the roadway. The development is proposed to connect to municipal water and sewer systems, as well as have an underground electrical system. The stormwater management system consists of catch basins, manholes, a subsurface pipe network, and a single stormwater basin. The basin is proposed as an infiltration basin. Loam and seed is proposed for all areas of disturbance.

Details are provided on the following Site Plan drawings:

"Fiske Hill East" Definitive Subdivision Plan, 30 Main Street and 20 Fiske Hill Road, Sturbridge, MA" prepared by McClure Engineering, Inc., dated 11/11/20.

Operation and Maintenance (O&M) Plan

The purpose of this Storm Water Management System Operation and Maintenance Plan is to prevent erosion, sedimentation, pollution or other deterioration of the storm water management system and resource areas located on and adjacent to the property located at 30 Main Street, Sturbridge, MA. The storm water management system shall be maintained properly to assure its continued performance. Inspection and maintenance for the system should be in compliance with Table 1.

TABLE 1

STORMWATER SYSTEM INSPECTION AND MAINTENANCE SCHEDULE "Fiske Hill East" 30 Main Street, Sturbridge, MA		
Best Management Practice (BMP)	**Inspection Frequency**	**Maintenance Frequency**
STRUCTURAL BMPs		
Infiltration Basin	After every major storm during first 3 months of operation and twice a year thereafter and when there are discharges through the high outlet orifice.	Bi-Annual Min (Early Spring & Late Fall) and/or As Needed
Deep Sump Hooded Catch Basin	Quarterly	Quarterly and/or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the basin to the lowest pipe invert in the basin.
Sediment Forebay	Monthly	Quarterly and/or As Needed
Stormceptor 450	Quarterly	As Needed
Rain Garden/ BioRetention	Monthly	As Needed
Pipe Outfall/ Rip Rap Apron/ Level Spreader	After heavy rains and Bi-Annually Min (Early Spring & Late Fall)	Bi-Annual Min (Early Spring & Late Fall) and/or As Needed
NON-STRUCTURAL STORMWATER CONTROLS		
Landscaping	Bi-Annual (Early Spring & Late Fall)	Seasonally As Needed
Parking Area Sweeping	Bi-Annual (Early Spring & Late Fall)	Bi-Annual (2-Times / Year) (Apr/May and Oct/Nov.)
Snow Removal	Seasonally As Needed	In Accordance with M.G.L. Title XIV. Public Ways and Works; Chapter 85
Site Inspections	Bi-Annual (Early Spring & Late Fall)	Keep Records on File at Site for Three (3) Years

Responsible Party shall be responsible for the system and all Operation and Maintenance procedures, including those outlined in the following sections.

STRUCTURAL STORM WATER BMP MAINTENANCE:

Infiltration Basin:

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. Perform inspections and preventive maintenance at least twice a year, and after every time drainage discharges through the high outlet orifice. Inspect 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.

Deep Sump Hooded Catch Basin:

Regular maintenance is essential. Deep sump catch basins remain effective at removing pollutants only if they are cleaned out frequently. 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. 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. 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.

Sediment Forebay:

Sediment forebays should be readily accessible for maintenance and sediment removal. Inspect sediment forebays after each significant rainfall. Remove and properly dispose of sediment at least 2 times per year or when sediment deposits total approximately 12”. The effectiveness of a sediment forebay is based less on its size than on regular sediment removal. Place waste material in designated disposal areas. Smooth site to blend with surrounding area and stabilize. Clean or replace gravel when sediment pool does not drain properly. Stabilize the floor and sidewalls of the sediment forebay before making it operational, otherwise the practice will discharge excess amounts of suspended sediments. After removing the sediment, replace any vegetation damaged during the clean-out by reseeding. 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. Check embankment, emergency spillway, and outlet for erosion damage. Check embankment for: settlement, seepage, or slumping along the toe or around pipe. Look for signs of seepage or erosion. Repair immediately. Remove trash and other debris from principal spillway, emergency spillway, and pool area.

Stormceptor 450

Maintenance of the Stormceptor system is performed using vacuum trucks. No entry into the unit is required for maintenance (in most cases). The vacuum service industry is a well-established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean a Stormceptor will vary based on the size of unit and transportation distances. The need for maintenance can be determined easily by inspecting the unit from the surface. The depth of oil in the unit can be determined by inserting a dipstick in the oil inspection/cleanout port. Similarly, the depth of sediment can be measured from the surface without entry into the Stormceptor via a dipstick tube equipped with a ball valve. This tube would be inserted through the riser pipe. Maintenance should be performed once the sediment depth exceeds 8”. Although annual servicing is recommended, the frequency of maintenance may need to be increased or reduced based on local conditions (i.e. if the unit is filling up with sediment more quickly than projected, maintenance may be required semi-annually; conversely once the site has stabilized maintenance may only be required every two or three years). Oil is removed through the oil inspection/cleanout port and sediment is removed through the riser pipe. Alternatively, oil could be removed from the 24 inches (600 mm) opening if water is removed from the lower chamber to lower the oil level below the drop pipes. The following procedures should be taken when cleaning out Stormceptor: Check for oil through the oil cleanout port; Remove any oil separately using a small portable pump; Decant the water from the unit to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank; Remove the sludge from the bottom of the unit using the vacuum truck; Re-fill Stormceptor with water where required by the local jurisdiction.

Rain Garden/ BioRetention:

Bioretention areas require careful attention while plants are being established and seasonal landscaping maintenance thereafter. Inspect pretreatment devices and bioretention cells regularly for sediment build-up, structural damage, and standing water. Inspect soil and repair eroded areas monthly. Re-mulch void areas as needed. Remove litter and debris monthly. Treat diseased vegetation as needed. Remove and replace dead vegetation twice per year (spring and fall). Proper selection of plant species and support during establishment of vegetation should minimize—if not eliminate—the need for fertilizers and pesticides. Remove invasive species as needed to prevent these species from spreading into the bioretention area. Replace mulch every two years, in the early spring. Upon failure, excavate bioretention area, scarify bottom and sides, replace filter fabric and soil, replant, and mulch. Because the soil medium filters contaminants from runoff, the cation exchange capacity of the soil media will eventually be exhausted. When the cation exchange capacity of the soil media decreases, change the soil media to prevent contaminants from migrating to the groundwater, or from being discharged via an underdrain outlet. Using small shrubs and plants instead of larger trees will make it easier to replace the media with clean material when needed. Plant maintenance is critical. Concentrated salts in roadway runoff may kill plants, necessitating removal of dead vegetation each spring and replanting. Never store snow in bioretention areas.

Pipe Outfall/Rip Rap Apron/Level Spreader:
Inspect riprap outlet structures after heavy rains for erosion at sides and ends of apron and for stone displacement. Rock may need to be added if sediment builds up in the pore spaces of the outlet pad. Make repairs immediately using appropriate stone sizes. Do not place stones above finished grade. If erosion is occurring down gradient of the outfall, the down gradient vegetation is not stable and the area should be stabilized, the rip rap apron is not long or wide enough and needs to be increased, or the riprap stones are too small or not graded well. If movement of stone is occurring: riprap stones may be too small or not graded well, or the appropriate filter fabric may not be installed under riprap. If erosion occurs around apron and scour holes appear at outlet, foundation may not be excavated wide or deep enough. If erosion of the foundation is occurring, the appropriate filter fabric may not be installed under riprap.

Level spreaders should be inspected periodically and after every major storm. Any detrimental sediment accumulation should be removed. If rilling has taken place on the lip, the damage should be repaired and re-vegetated. Vegetation should be mowed occasionally to control weeds and encroachment of woody vegetation. Clippings should be removed and disposed of outside the spreader and away from the outlet area. Fertilization should be done as necessary to keep the vegetation healthy and dense. The spreader should be inspected after every runoff event to ensure that it is functioning correctly.

NON - STRUCTURAL STORM WATER MANAGEMENT CONTROLS / GOOD HOUSEKEEPING PRACTICES:

Hay bales:
Inspect straw/hay bales before a forecasted storm event, immediately after each runoff producing rainfall and at least daily during prolonged rainfall. Ensure there are not gaps between bales or evidence of undermining. Close attention should be paid to the repair of damaged bales, undercutting beneath bales, and flow around the ends of the bales. Necessary repairs to barriers or replacement of bales should be accomplished promptly. Replace rotted or sediment covered bales as necessary. Sediment deposits should be checked after each runoff-producing rainfall. They must be removed when the level of deposition reaches approximately one-half the height of the barrier. Any sediment deposits remaining in place after the straw bale barrier is no longer required should be dressed to conform to the existing grade, prepared and seeded.

Silt Fence:
A sediment fence requires a great deal of maintenance. Silt fences should be inspected immediately after each rainfall and at least daily during prolonged rainfall. Remove accumulated sediment when it reaches one half the height of the sediment fence. Remove sediment deposits promptly to provide adequate storage volume for the next rain and to reduce pressure on fence. Take care to avoid undermining fence during cleanout. Sagging, frayed, torn, or otherwise damaged fabric should be repaired or replaced. Repair end runs and undercutting. Inspect reinforcement and staking materials for structural integrity, and replace when necessary. Sediment deposits remaining after the fabric has been removed should be graded to conform to the existing topography and vegetated.

Mulching:
Mulching shall be used in areas which cannot be seeded because of the season, or are otherwise unfavorable for plant growth (traffic and parking areas). When properly applied, mulch offers a fast, effective means of controlling erosion and dust. Soil surfaces should be roughened prior to mulching. Run track-mounted machinery up and down the slope in order to leave horizontal depressions in the soil running parallel to the slope. Roughened soil surfaces should be mulched and/or seeded as soon as possible. Ensure there is a continuous, uniform, even coverage. Ensure mulch layer is not so thick that it suppresses desired seed germination and plant growth. Ensure rilling or gullying does not occur beneath "binded" mulch. Replace or repair mulch if washed or blown away. On steep slopes and critical areas such as waterways, use netting or anchoring with mulch to hold it in place. Inspect after rainstorms to check for movement of mulch or erosion. If washout, breakage, or erosion occurs, repair surface, reseed, remulch, and install new netting. Straw or grass mulches that blow or wash away should be repaired promptly. Blanket mulch that is displaced by flowing water should be repaired as soon as possible. Continue inspections until vegetation is well established.

Temporary & Permanent Seeding
The presence of temporary or permanent cover will provide stabilization and erosion protection to disturbed areas. Temporary seed mixes contain annual vegetation that grows quickly and helps stabilize an area until permanent vegetation can be established. Proper soil bed preparation, seeding method and soil moisture are critical for successful seed application. Before planting, scarify/roughen the soil surface and install appropriate surface drainage measures to prevent erosion and scouring. Seed with an approved conservation cover mix during the specified growing season, using native plant species. Seeding operations should be performed within one of the following periods: April 1 - May 31, August 1 - September 10, November 1 - December 15 as a dormant seeding (seeding rates shall be increased by 50% for dormant seeding). As needed, provide water, fertilizer, lime, and mulch to the seedbed. If it is unlikely that growth will occur due to cold weather, apply mulch for temporary stabilization. Inspect within 6 weeks of planting to see if stands are adequate. Check for damage after heavy rains. Stands should be uniform and dense. Fertilize, reseed, and mulch damaged and sparse areas immediately. Tack or tie down mulch as necessary. Seeds should be supplied with adequate moisture. Furnish water as needed, especially in abnormally hot or dry weather or on adverse sites. Water application rates should be controlled to prevent runoff. Inspect seeded areas for failure and make appropriate repairs and re-seed and re-plant as necessary. Inspect for bare spots, rilling, or gullying and correct as necessary. If stand has less than 40% cover, re-evaluate selection of seeding materials and quantities of fertilizer. Re-establish the stand following seedbed preparation and seeding

recommendations. If the season prevents resowing, mulch or jute netting is an effective temporary cover. Lack of water may also be an issue. Conduct a follow up survey after one year and re-seed failed areas. Temporarily stabilized areas will require permanent stabilization when the area has been completed as designed or when the growing season begins.

Landscape & Parking Area Maintenance
Landscape areas shall be maintained in a neat and orderly fashion. Landscape maintenance debris shall not be deposited on adjacent properties and properly disposed of off-site as necessary to maintain a clean and orderly appearance. Parking Areas shall be inspected often and after significant rainfall events. Inspect for signs of erosion, rilling, gullying. Regrade and repair parking areas as necessary. If areas are needing constant maintenance apply mulch/wood chips to help prevent further erosion. Areas not used for parking or traffic should be seeded for stabilization. All parking areas should be stabilized prior to off season shutdown, preferably with a mulch application.

Fertilizer, Herbicide, and Pesticide Storage
Storage of all fertilizers, herbicides, and pesticides will be indoors. Use of all fertilizers, herbicides, and pesticides shall be in a manner consistent with the products intended use.

Waste Storage & Trash Removal
All waste products are to be stored indoors, under cover, or within a covered dumpster. Inspect on-site area for litter and trash on a weekly basis. Any accumulated trash, litter, and discarded materials in this area will be removed and will be disposed of at a suitable location on a weekly basis. The loading and dumpster areas throughout the site will be inspected on a daily basis for cardboard and/or paper products and will be inspected on a weekly basis for any accumulated trash, litter, and discarded material. Dumpster to be kept closed when not in use.
Gates to the dumpster enclosure areas are proposed to be locked when not in use.

Hazardous Waste or Oil Spill Response Procedure

Initial Notification: In the event of a spill of hazardous waste or oil the facility manager or supervisor will be notified immediately by telephone.

Assessment – Initial Containment: The supervisor or manager will assess the incident and initiate control measures. The supervisor will first contact the Town of Sturbridge Fire Department and then notify the Town of Sturbridge. The Fire Department is ultimately responsible for matters of public health and safety and should be notified immediately.

Fire Department Telephone:	911 (Emergency) 508-347-2525 (Non-Emergency/Dispatch)
Police Department Telephone:	911 (Emergency) 508-347-2525 (Non-Emergency/Dispatch)

Further Notification: Based on the assessment by the Fire Chief, additional notification to a clean up contractor may be made. The Massachusetts Department of Environmental Protection and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of clean up and notification required.

SNOW MANAGEMENT PLAN:

Snow plowing will be done to allow access to the site and provide safe passage from vehicle to front door. No salt shall be used to treat unpaved areas during snow and ice conditions. Snow from lighter storms will be plowed to the perimeter of the parking lots and allowed to melt onto the pavement surfaces. Snow will be temporarily stock piled on the pavement surface during larger storm events to keep the parking area open for customers. This stockpiling will be temporary and will be located within designated areas throughout the Site, furthest away from the building entrances. If Site snow storage interferes with parking lot operations (i.e. blocking of travel aisles, sight distance, or parking) the snow pile will be either removed or reduced legally in a legal manner by the snow plow vendor within 24 hours.

Winter Road Salt & Sand Use Restrictions

Salt and sand for winter de-icing will only be stored indoors or under cover. Use of road salt and sand will only be used on a limited basis during the winter months to insure safe passage of pedestrian walkways and parking areas.

INSPECTIONS / RECORDKEEPING / TRAINING:

Routine Inspections

Routine inspections and maintenance to be conducted with the frequency described in this Operation and Maintenance Plan. An example inspection form is provided in **Attachment #2.**

Recordkeeping

Records of all drainage system inspections and maintenance shall be kept on file for a period of at least three (3) years and provided to the Town of Southbridge upon request.

PUBLIC SAFETY FEATURES:

All cast iron storm water structure grates and covers shall be kept in good condition and kept closed at all times. Any damaged or broken structures will be replaced immediately upon discovery;

OPERATION AND MAINTENANCE BUDGET ESTIMATE:

The responsible party agrees to maintain an adequate annual budget to provide for the routine maintenance activities detailed in this document including but not limited to:

- Infiltration Basin Maintenance
- Deep Sump Hooded Catch Basin Maintenance
- Sediment Forebay Maintenance
- Stormceptor Maintenance
- Raingarden Maintenance
- Pipe Outfall/ Rip Rap Apron/ Level Spreader Maintenance
- Landscape Maintenance
- Trash Removal
- Snow Plowing & Removal

Attachment #1

Operation & Maintenance (O & M) Compliance Statement

Illicit Discharge Compliance Statement
Site Storm water Management System

30 Main Street, Sturbridge, MA

Property Owner/Responsible Party: Fiske Hill East Realty Trust
97 Arnold Road
Fiskdale, MA 01518
Phone: (508) 450-0713

Storm water Management System Owner: **(same as above)**

Site subject to Wetlands Protection Act: **Yes**

The above listed Responsible Party is responsible for implementation of this "Long-Term Operation and Maintenance Plan" and certifies that:

- The site has been inspected for erosion and appropriate steps have been taken to permanently stabilize any eroded areas.
- All aspects of storm water BMPs have been inspected for damage, wear and malfunction, and appropriate steps have been taken to repair or replace the system or portions of the system so that the storm water at the site may be managed in accordance with the Stormwater Management Standards, revise date January 2, 2008.
- There is no record or knowledge of existing illicit discharges to the on-site stormwater management system.
- All "future property owners" must be notified of their continuing legal responsibility to operate and maintain the existing stormwater management system structures.
- The "Long-Term Operation and Maintenance Plan" for the storm water BMPs is being implemented.

Signature of Responsible Party:

______________________________ ________

Fiske Hill East Realty Trust Date

Attachment #2

Inspection & Maintenance Reports

Long-Term Operation and Maintenance Plan
Storm Water Management System

30 Main Street, Sturbridge, MA

INSPECTION AND MAINTENANCE REPORT FORM

Note: This Log should be copied prior to use. Note Additional Comments on back of Form.

Inspector's Name: ____________________ Date: ___________ Time: ________ am/pm

Inspector's Qualifications: ____

Days Since Last Rainfall: ______________ Amount of Last Rainfall: _______ inches

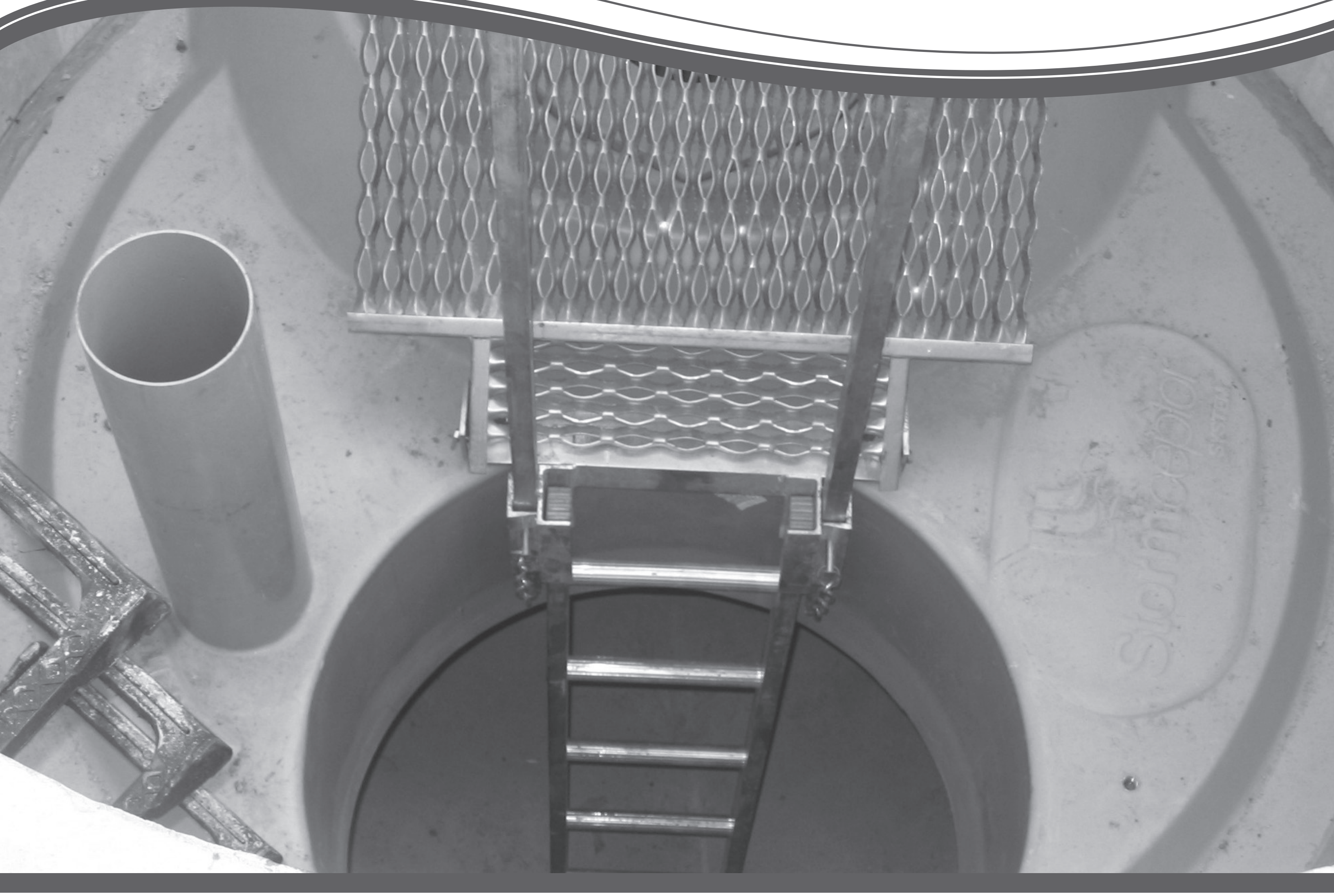
Item/Condition to be Checked	Maintenance Required		Corrective Action & Date
	No	Yes	
Infiltration Basin			*Inspect Twice Per Year Minimum, Report encountered issues to engineer as soon as possible.
Deep Sump Hooded Catch Basin			
Sediment Forebay			
Stormceptor 450			
Rain Garden/ BioRetention			
Pipe Outfall/ Rip Rap Apron/ Level Spreader			
Landscaping / Trash Removal			
Snow Removal (seasonal)			

Corrective Actions Taken (if necessary):

Attachment #3

Stormceptor O&M Document

Stormceptor® STC
Operation and Maintenance Guide



Stormceptor Design Notes

- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.

Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences			
Inlet Pipe Configuration	STC 450i	STC 900 to STC 7200	STC 11000 to STC 16000
Single inlet pipe	3 in. (75 mm)	1 in. (25 mm)	3 in. (75 mm)
Multiple inlet pipes	3 in. (75 mm)	3 in. (75 mm)	Only one inlet pipe.

Maximum inlet and outlet pipe diameters:

Inlet/Outlet Configuration	Inlet Unit STC 450i	In-Line Unit STC 900 to STC 7200	Series* STC 11000 to STC 16000
Straight Through	24 inch (600 mm)	42 inch (1050 mm)	60 inch (1500 mm)
Bend (90 degrees)	18 inch (450 mm)	33 inch (825 mm)	33 inch (825 mm)

- The inlet and in-line Stormceptor units can accommodate turns to a maximum of 90 degrees.
- Minimum distance from top of grade to crown is 2 feet (0.6 m)
- Submerged conditions. A unit is submerged when the standing water elevation at the proposed location of the Stormceptor unit is greater than the outlet invert elevation during zero flow conditions. In these cases, please contact your local Stormceptor representative and provide the following information:
- Top of grade elevation
- Stormceptor inlet and outlet pipe diameters and invert elevations
- Standing water elevation
- Stormceptor head loss, K = 1.3 (for submerged condition, K = 4)

Stormceptor® STC

OPERATION AND MAINTENANCE GUIDE
Table of Content

1. About Stormceptor

The Stormceptor® STC (Standard Treatment Cell) was developed by Imbrium™ Systems to address the growing need to remove and isolate pollution from the storm drain system before it enters the environment. The Stormceptor STC targets hydrocarbons and total suspended solids (TSS) in stormwater runoff. It improves water quality by removing contaminants through the gravitational settling of fine sediments and floatation of hydrocarbons while preventing the re-suspension or scour of previously captured pollutants.

The development of the Stormceptor STC revolutionized stormwater treatment, and created an entirely new category of environmental technology. Protecting thousands of waterways around the world, the Stormceptor System has set the standard for effective stormwater treatment.

1.1. Patent Information

The Stormceptor technology is protected by the following patents:

- Australia Patent No. 693,164 • 693,164 • 707,133 • 729,096 • 779401
- Austrian Patent No. 289647
- Canadian Patent No 2,009,208 •2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 (Pending)
- China Patent No 1168439
- Denmark DK 711879
- German DE 69534021
- Indonesian Patent No 16688
- Japan Patent No 9-11476 (Pending)
- Korea 10-2000-0026101 (Pending)
- Malaysia Patent No PI9701737 (Pending)
- New Zealand Patent No 314646
- United States Patent No 4,985,148 • 5,498,331 • 5,725,760 • 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690
- Stormceptor OSR Patent Pending • Stormceptor LCS Patent Pending

2. Stormceptor Design Overview

2.1. Design Philosophy

The patented Stormceptor System has been designed to focus on the environmental objective of providing long-term pollution control. The unique and innovative Stormceptor design allows for continuous positive treatment of runoff during all rainfall events, while ensuring that all captured pollutants are retained within the system, even during intense storm events.

An integral part of the Stormceptor design is PCSWMM for Stormceptor - sizing software developed in conjunction with Computational Hydraulics Inc. (CHI) and internationally acclaimed expert, Dr. Bill James. Using local historical rainfall data and continuous simulation modeling, this software allows a Stormceptor unit to be designed for each individual site and the corresponding water quality objectives.

By using PCSWMM for Stormceptor, the Stormceptor System can be designed to remove a wide range of particles (typically from 20 to 2,000 microns), and can also be customized to remove a specific particle size distribution (PSD). The specified PSD should accurately reflect what is in the stormwater runoff to ensure the device is achieving the desired water quality objective. Since stormwater runoff contains small particles (less than 75 microns), it is important to design a treatment system to remove smaller particles in addition to coarse particles.

2.2. Benefits

The Stormceptor System removes free oil and suspended solids from stormwater, preventing spills and non-point source pollution from entering downstream lakes and rivers. The key benefits, capabilities and applications of the Stormceptor System are as follows:

- Provides continuous positive treatment during all rainfall events
- Can be designed to remove over 80% of the annual sediment load
- Removes a wide range of particles
- Can be designed to remove a specific particle size distribution (PSD)
- Captures free oil from stormwater
- Prevents scouring or re-suspension of trapped pollutants
- Pre-treatment to reduce maintenance costs for downstream treatment measures (ponds, swales, detention basins, filters)
- Groundwater recharge protection
- Spills capture and mitigation
- Simple to design and specify
- Designed to your local watershed conditions
- Small footprint to allow for easy retrofit installations
- Easy to maintain (vacuum truck)
- Multiple inlets can connect to a single unit
- Suitable as a bend structure
- Pre-engineered for traffic loading (minimum AASHTO HS-20)
- Minimal elevation drop between inlet and outlet pipes
- Small head loss
- Additional protection provided by an 18” (457 mm) fiberglass skirt below the top of the insert, for the containment of hydrocarbons in the event of a spill.

2.3. Environmental Benefit

Freshwater resources are vital to the health and welfare of their surrounding communities. There is increasing public awareness, government regulations and corporate commitment to reducing the pollution entering our waterways. A major source of this pollution originates from stormwater runoff from urban areas. Rainfall runoff carries oils, sediment and other contaminants from roads and parking lots discharging directly into our streams, lakes and coastal waterways.

The Stormceptor System is designed to isolate contaminants from getting into the natural environment. The Stormceptor technology provides protection for the environment from spills that occur at service stations and vehicle accident sites, while also removing contaminated sediment in runoff that washes from roads and parking lots.

3. Key Operation Features

3.1. Scour Prevention

A key feature of the Stormceptor System is its patented scour prevention technology. This innovation ensures pollutants are captured and retained during all rainfall events, even extreme storms. The Stormceptor System provides continuous positive treatment for all rainfall events, including intense storms. Stormceptor slows incoming runoff, controlling and reducing velocities in the lower chamber to create a non-turbulent environment that promotes free oils and floatable debris to rise and sediment to settle.

The patented scour prevention technology, the fiberglass insert, regulates flows into the lower chamber through a combination of a weir and orifice while diverting high energy flows away through the upper chamber to prevent scouring. Laboratory testing demonstrated no scouring when tested up to 125% of the unit's operating rate, with the unit loaded to 100% sediment capacity (NJDEP, 2005). Second, the depth of the lower chamber ensures the sediment storage zone is adequately separated from the path of flow in the lower chamber to prevent scouring.

3.2. Operational Hydraulic Loading Rate

Designers and regulators need to evaluate the treatment capacity and performance of manufactured stormwater treatment systems. A commonly used parameter is the "operational hydraulic loading rate" which originated as a design methodology for wastewater treatment devices.

Operational hydraulic loading rate may be calculated by dividing the flow rate into a device by its settling area. This represents the critical settling velocity that is the prime determinant to quantify the influent particle size and density captured by the device. PCSWMM for Stormceptor uses a similar parameter that is calculated by dividing the hydraulic detention time in the device by the fall distance of the sediment.

$$v_{SC} = \frac{H}{6_H} = \frac{Q}{A_S}$$

Where:

v_{SC} = critical settling velocity, ft/s (m/s)

H = tank depth, ft (m)

$Ø_H$ = hydraulic detention time, ft/s (m/s)

Q = volumetric flow rate, ft3/s (m3/s)

A_S = surface area, ft^2 (m^2)

(Tchobanoglous, G. and Schroeder, E.D. 1987. Water Quality. Addison Wesley.)

Unlike designing typical wastewater devices, stormwater systems are designed for highly variable flow rates including intense peak flows. PCSWMM for Stormceptor incorporates all of the flows into its calculations, ensuring that the operational hydraulic loading rate is considered not only for one flow rate, but for all flows including extreme events.

3.3. Double Wall Containment

The Stormceptor System was conceived as a pollution identifier to assist with identifying illicit discharges. The fiberglass insert has a continuous skirt that lines the concrete barrel wall for a depth of 18 inches (457 mm) that provides double wall containment for hydrocarbons storage. This protective barrier ensures that toxic floatables do not migrate through the concrete wall into the surrounding soils.

4. Stormceptor Product Line

4.1. Stormceptor Models

A summary of Stormceptor models and capacities are listed in Table 1.

Table 1. Stormceptor Models

Stormceptor Model	Total Storage Volume U.S. Gal (L)	Hydrocarbon Storage Capacity U.S. Gal (L)	Maximum Sediment Capacity ft^3 (L)
STC 450i	470 (1,780)	86 (330)	46 (1,302)
STC 900	952 (3,600)	251 (950)	89 (2,520)
STC 1200	1,234 (4,670)	251 (950)	127 (3,596)
STC 1800	1,833 (6,940)	251 (950)	207 (5,861)
STC 2400	2,462 (9,320)	840 (3,180)	205 (5,805)
STC 3600	3,715 (1,406)	840 (3,180)	373 (10,562)
STC 4800	5,059 (1,950)	909 (3,440)	543 (15,376)
STC 6000	6,136 (23,230)	909 (3,440)	687 (19,453)
STC 7200	7,420 (28,090)	1,059 (4,010)	839 (23,757)
STC 11000	11,194 (42,370)	2,797 (10, 590)	1,086 (30,752)
STC 13000	13,348 (50,530)	2,797 (10, 590)	1,374 (38,907)
STC 16000	15,918 (60,260)	3,055 (11, 560)	1,677 (47,487)

NOTE: Storage volumes may vary slightly from region to region. For detailed information, contact your local Stormceptor representative.

4.2. Inline Stormceptor

The Inline Stormceptor, Figure 1, is the standard design for most stormwater treatment applications. The patented Stormceptor design allows the Inline unit to maintain continuous positive treatment of total suspended solids (TSS) year-round, regardless of flow rate. The Inline Stormceptor is composed of a precast concrete tank with a fiberglass insert situated at the invert of the storm sewer pipe, creating an upper chamber above the insert and a lower chamber below the insert.

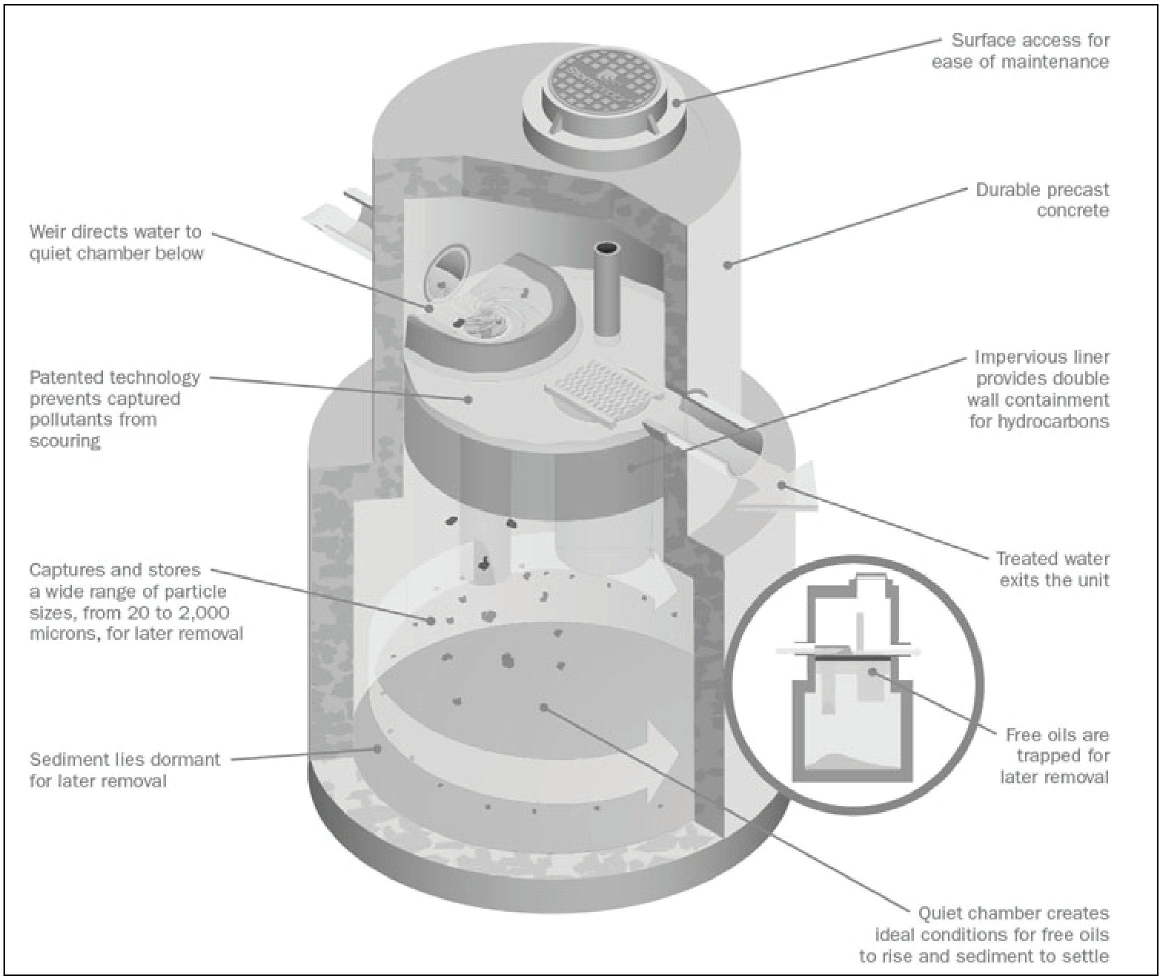


Figure 1. Inline Stormceptor

Operation

As water flows into the Stormceptor unit, it is slowed and directed to the lower chamber by a weir and drop tee. The stormwater enters the lower chamber, a non-turbulent environment, allowing free oils to rise and sediment to settle. The oil is captured underneath the fiberglass insert and shielded from exposure to the concrete walls by a fiberglass skirt. After the pollutants separate, treated water continues up a riser pipe, and exits the lower chamber on the downstream side of the weir before leaving the unit. During high flow events, the Stormceptor System's patented scour prevention technology ensures continuous pollutant removal and prevents re-suspension of previously captured pollutants.

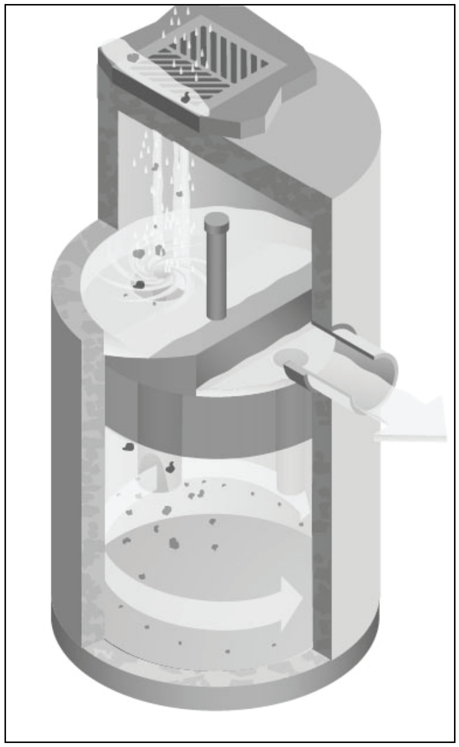


Figure 2. Inlet Stormceptor

4.3. Inlet Stormceptor

The Inlet Stormceptor System, Figure 2, was designed to provide protection for parking lots, loading bays, gas stations and other spill-prone areas. The Inlet Stormceptor is designed to remove sediment from stormwater introduced through a grated inlet, a storm sewer pipe, or both.

The Inlet Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

4.4. Series Stormceptor

Designed to treat larger drainage areas, the Series Stormceptor System, Figure 3, consists of two adjacent Stormceptor models that function in parallel. This design eliminates the need for additional structures and piping to reduce installation costs.

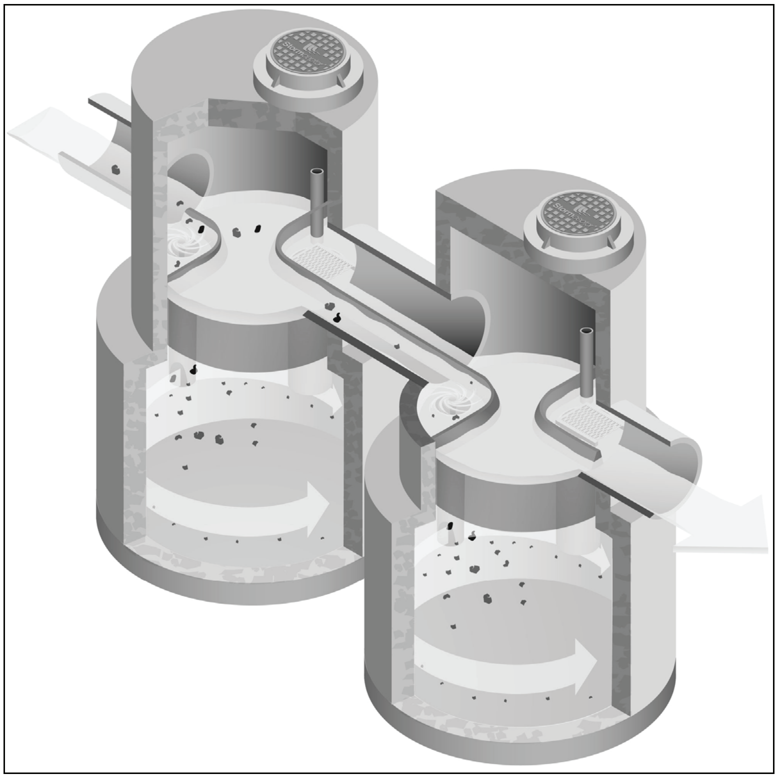


Figure 3. Series System

The Series Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

5. Sizing the Stormceptor System

The Stormceptor System is a versatile product that can be used for many different aspects of water quality improvement. While addressing these needs, there are conditions that the designer needs to be aware of in order to size the Stormceptor model to meet the demands of each individual site in an efficient and cost-effective manner.

PCSWMM for Stormceptor is the support tool used for identifying the appropriate Stormceptor model. In order to size a unit, it is recommended the user follow the seven design steps in the program. The steps are as follows:

STEP 1 – Project Details

The first step prior to sizing the Stormceptor System is to clearly identify the water quality objective for the development. It is recommended that a level of annual sediment (TSS) removal be identified and defined by a particle size distribution.

STEP 2 – Site Details

Identify the site development by the drainage area and the level of imperviousness. It is recommended that imperviousness be calculated based on the actual area of imperviousness based on paved surfaces, sidewalks and rooftops.

STEP 3 – Upstream Attenuation

The Stormceptor System is designed as a water quality device and is sometimes used in conjunction with onsite water quantity control devices such as ponds or underground detention systems. When possible, a greater benefit is typically achieved when installing a Stormceptor unit upstream of a detention facility. By placing the Stormceptor unit upstream of a detention structure, a benefit of less maintenance of the detention facility is realized.

STEP 4 – Particle Size Distribution

It is critical that the PSD be defined as part of the water quality objective. PSD is critical for the design of treatment system for a unit process of gravity settling and governs the size of a treatment system. A range of particle sizes has been provided and it is recommended that clays and silt-sized particles be considered in addition to sand and gravel-sized particles. Options and sample PSDs are provided in PCSWMM for Stormceptor. The default particle size distribution is the Fine Distribution, Table 2, option.

Table 2. Fine Distribution

Particle Size	Distribution	Specific Gravity
20	20%	1.3
60	20%	1.8
150	20%	2.2
400	20%	2.65
2000	20%	2.65

If the objective is the long-term removal of 80% of the total suspended solids on a given site, the PSD should be representative of the expected sediment on the site. For example, a system designed to remove 80% of coarse particles (greater than 75 microns) would provide relatively poor removal efficiency of finer particles that may be naturally prevalent in runoff from the site.

Since the small particle fraction contributes a disproportionately large amount of the total available particle surface area for pollutant adsorption, a system designed primarily for coarse particle capture will compromise water quality objectives.

STEP 5 – Rainfall Records

Local historical rainfall has been acquired from the U.S. National Oceanic and Atmospheric Administration, Environment Canada and regulatory agencies across North America. The rainfall data provided with PCSMM for Stormceptor provides an accurate estimation of small storm hydrology by modeling actual historical storm events including duration, intensities and peaks.

STEP 6 – Summary

At this point, the program may be executed to predict the level of TSS removal from the site. Once the simulation has completed, a table shall be generated identifying the TSS removal of each Stormceptor unit.

STEP 7 – Sizing Summary

Performance estimates of all Stormceptor units for the given site parameters will be displayed in a tabular format. The unit that meets the water quality objective, identified in Step 1, will be highlighted.

5.1. PCSWMM for Stormceptor

The Stormceptor System has been developed in conjunction with PCSWMM for Stormceptor as a technological solution to achieve water quality goals. Together, these two innovations model, simulate, predict and calculate the water quality objectives desired by a design engineer for TSS removal.

PCSWMM for Stormceptor is a proprietary sizing program which uses site specific inputs to a computer model to simulate sediment accumulation, hydrology and long-term total suspended solids removal. The model has been calibrated to field monitoring results from Stormceptor units that have been monitored in North America. The sizing methodology can be described by three processes:

1. Determination of real time hydrology
2. Buildup and wash off of TSS from impervious land areas
3. TSS transport through the Stormceptor (settling and discharge). The use of a calibrated model is the preferred method for sizing stormwater quality structures for the following reasons:
   - The hydrology of the local area is properly and accurately incorporated in the sizing (distribution of flows, flow rate ranges and peaks, back-to-back storms, inter-event times)
   - The distribution of TSS with the hydrology is properly and accurately considered in the sizing
   - Particle size distribution is properly considered in the sizing
   - The sizing can be optimized for TSS removal
   - The cost benefit of alternate TSS removal criteria can be easily assessed
   - The program assesses the performance of all Stormceptor models. Sizing may be selected based on a specific water quality outcome or based on the Maximum Extent Practicable

For more information regarding PCSWMM for Stormceptor, contact your local Stormceptor representative, or visit www.imbriumsystems.com to download a free copy of the program.

5.2. Sediment Loading Characteristics

The way in which sediment is transferred to stormwater can have a considerable effect on which type of system is implemented. On typical impervious surfaces (e.g. parking lots) sediment will build over time and wash off with the next rainfall. When rainfall patterns are examined, a short intense storm will have a higher concentration of sediment than a long slow drizzle. Together with rainfall data representing the site's typical rainfall patterns, sediment loading characteristics play a part in the correct sizing of a stormwater quality device.

Typical Sites

For standard site design of the Stormceptor System, PCSWMM for Stormceptor is utilized to accurately assess the unit's performance. As an integral part of the product's design, the program can be used to meet local requirements for total suspended solid removal. Typical installations of manufactured stormwater treatment devices would occur on areas such as paved parking lots or paved roads. These are considered "stable" surfaces which have non – erodible surfaces.

Unstable Sites

While standard sites consist of stable concrete or asphalt surfaces, sites such as gravel parking lots, or maintenance yards with stockpiles of sediment would be classified as "unstable". These types of sites do not exhibit first flush characteristics, are highly erodible and exhibit atypical sediment loading characteristics and must therefore be sized more carefully. Contact your local Stormceptor representative for assistance in selecting a proper unit sized for such unstable sites.

6. Spill Controls

When considering the removal of total petroleum hydrocarbons (TPH) from a storm sewer system there are two functions of the system: oil removal, and spill capture.

'Oil Removal' describes the capture of the minute volumes of free oil mobilized from impervious surfaces. In this instance relatively low concentrations, volumes and flow rates are considered. While the Stormceptor unit will still provide an appreciable oil removal function during higher flow events and/or with higher TPH concentrations, desired effluent limits may be exceeded under these conditions.

‘Spill Capture’ describes a manner of TPH removal more appropriate to recovery of a relatively high volume of a single phase deleterious liquid that is introduced to the storm sewer system over a relatively short duration. The two design criteria involved when considering this manner of introduction are overall volume and the specific gravity of the material. A standard Stormceptor unit will be able to capture and retain a maximum spill volume and a minimum specific gravity.

For spill characteristics that fall outside these limits, unit modifications are required. Contact your local Stormceptor Representative for more information.

One of the key features of the Stormceptor technology is its ability to capture and retain spills. While the standard Stormceptor System provides excellent protection for spill control, there are additional options to enhance spill protection if desired.

6.1. Oil Level Alarm

The oil level alarm is an electronic monitoring system designed to trigger a visual and audible alarm when a pre-set level of oil is reached within the lower chamber. As a standard, the oil

level alarm is designed to trigger at approximately 85% of the unit’s available depth level for oil capture. The feature acts as a safeguard against spills caused by exceeding the oil storage capacity of the separator and eliminates the need for manual oil level inspection.

The oil level alarm installed on the Stormceptor insert is illustrated in Figure 4.

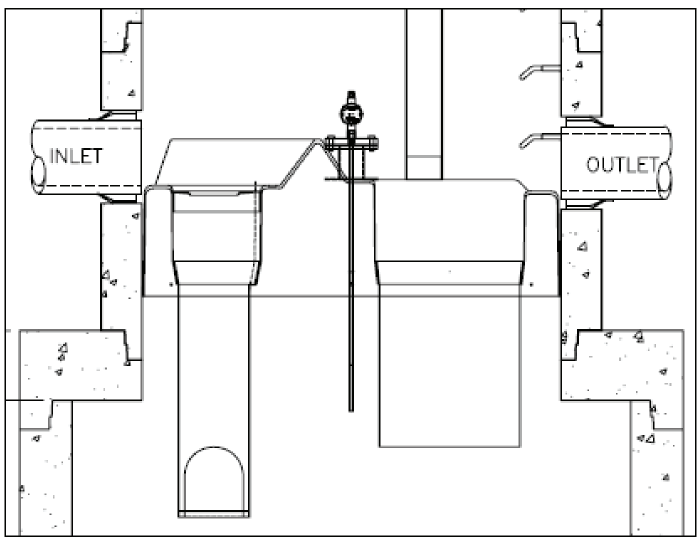


Figure 4. Oil level alarm

6.2. Increased Volume Storage Capacity

The Stormceptor unit may be modified to store a greater spill volume than is typically available. Under such a scenario, instead of installing a larger than required unit, modifications can be made to the recommended Stormceptor model to accommodate larger volumes. Contact your local Stormceptor representative for additional information and assistance for modifications.

7. Stormceptor Options

The Stormceptor System allows flexibility to incorporate to existing and new storm drainage infrastructure. The following section identifies considerations that should be reviewed when installing the system into a drainage network. For conditions that fall outside of the recommendations in this section, please contact your local Stormceptor representative for further guidance.

7.1. Installation Depth Minimum Cover

The minimum distance from the top of grade to the crown of the inlet pipe is 24 inches (600 mm). For situations that have a lower minimum distance, contact your local Stormceptor representative.

7.2. Maximum Inlet and Outlet Pipe Diameters

Maximum inlet and outlet pipe diameters are illustrated in Figure 5. Contact your local Stormceptor representative for larger pipe diameters

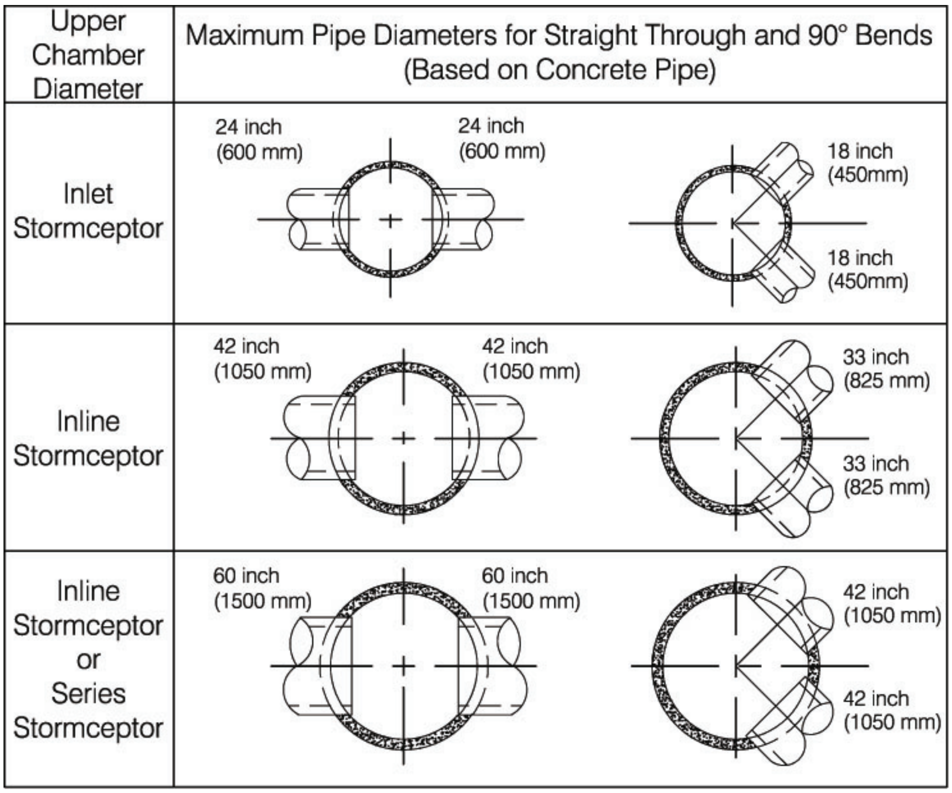


Figure 5. Maximum pipe diameters for straight through and bend applications

*The bend should only be incorporated into the second structure (downstream structure) of the Series Stormceptor System

7.3. Bends

The Stormceptor System can be used to change horizontal alignment in the storm drain network up to a maximum of 90 degrees. Figure 6 illustrates the typical bend situations of the Stormceptor System. Bends should only be applied to the second structure (downstream structure) of the Series Stormceptor System.

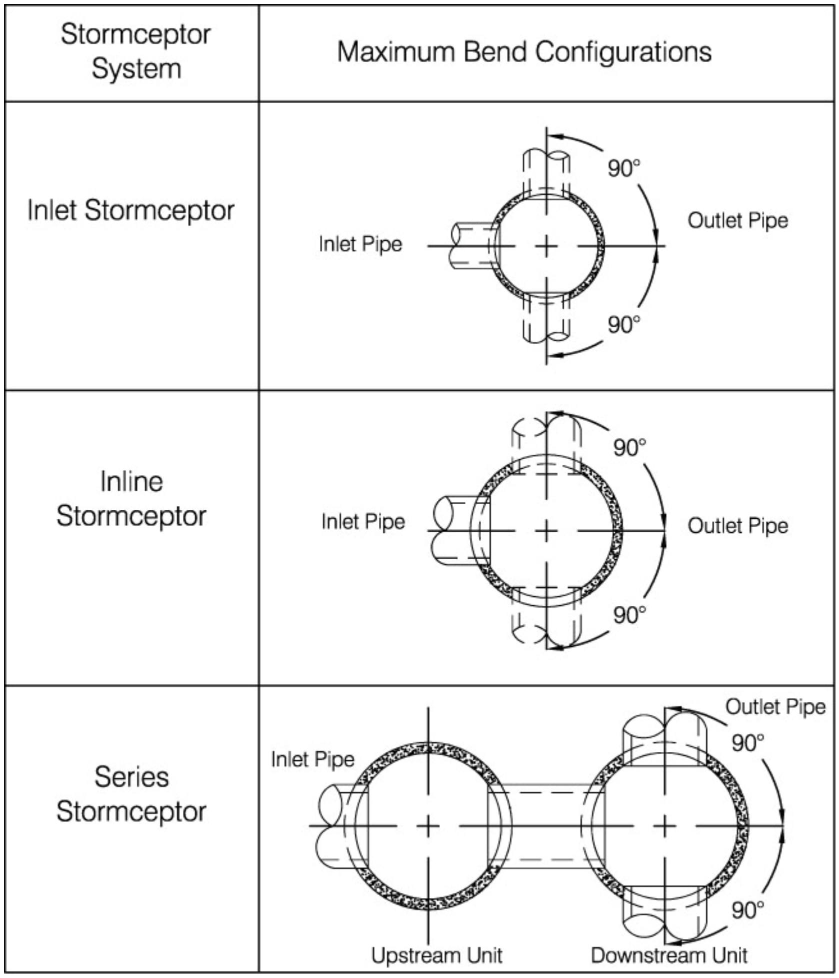


Figure 6. Maximum bend angles

7.4. Multiple Inlet Pipes

The Inlet and Inline Stormceptor System can accommodate two or more inlet pipes. The maximum number of inlet pipes that can be accommodated into a Stormceptor unit is a function of the number, alignment and diameter of the pipes and its effects on the structural integrity of the precast concrete. When multiple inlet pipes are used for new developments, each inlet pipe shall have an invert elevation 3 inches (75 mm) higher than the outlet pipe invert elevation.

7.5. Inlet/Outlet Pipe Invert Elevations

Recommended inlet and outlet pipe invert differences are listed in Table 3.

Table 3. Recommended Drops Between Inlet and Outlet Pipe Inverts

Number of Inlet Pipes	Inlet System	In-Line System	Series System
1	3 inches (75 mm)	1 inch (25 mm)	3 inches (75 mm)
>1	3 inches (75 mm)	3 inches (75 mm)	Not Applicable

7.6. Shallow Stormceptor

In cases where there may be restrictions to the depth of burial of storm sewer systems. In this situation, for selected Stormceptor models, the lower chamber components may be increased in diameter to reduce the overall depth of excavation required.

7.7. Customized Live Load

The Stormceptor system is typically designed for local highway truck loading (AASHTO HS- 20). When the project requires live loads greater than HS-20, the Stormceptor System may be customized structurally for a pre-specified live load. Contact your local Stormceptor representative for customized loading conditions.

7.8. Pre-treatment

The Stormceptor System may be sized to remove sediment and for spills control in conjunction with other stormwater BMPs to meet the water quality objective. For pretreatment applications, the Stormceptor System should be the first unit in a treatment train. The benefits of pre-treatment include the extension of the operational life (extension of maintenance frequency) of large stormwater management facilities, prevention of spills and lower total life- cycle maintenance cost.

7.9. Head loss

The head loss through the Stormceptor System is similar to a 60 degree bend at a manhole. The K value for calculating minor losses is approximately 1.3 (minor loss = k*1.3v2/2g).

However, when a Submerged modification is applied to a Stormceptor unit, the corresponding K value is 4.

7.10. Submerged

The Submerged modification, Figure 7, allows the Stormceptor System to operate in submerged or partially submerged storm sewers. This configuration can be installed on all models of the Stormceptor System by modifying the fiberglass insert. A customized weir height and a secondary drop tee are added.

Submerged instances are defined as standing water in the storm drain system during zero flow conditions. In these instances, the following information is necessary for the proper design and application of submerged modifications:

- Stormceptor top of grade elevation
- Stormceptor outlet pipe invert elevation
- Standing water elevation

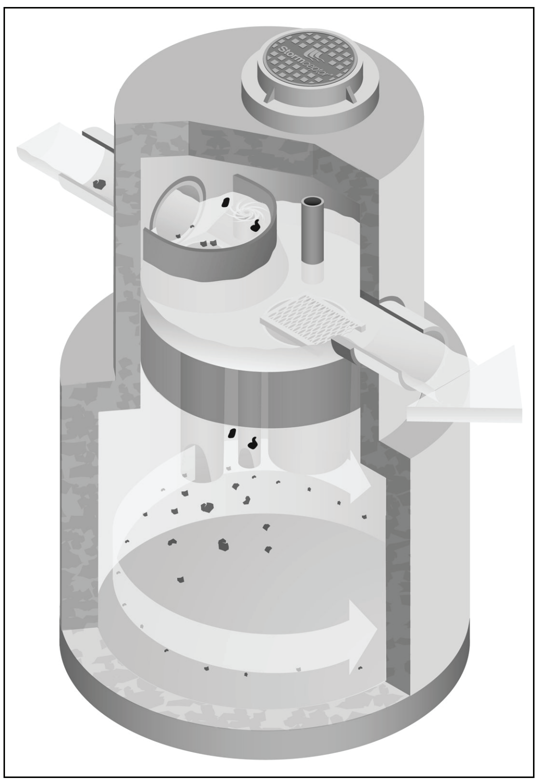


Figure 7. Submerged Stormceptor

8. Comparing Technologies

Designers have many choices available to achieve water quality goals in the treatment of stormwater runoff. Since many alternatives are available for use in stormwater quality treatment it is important to consider how to make an appropriate comparison between "approved alternatives". The following is a guide to assist with the accurate comparison of differing technologies and performance claims.

8.1. Particle Size Distribution (PSD)

The most sensitive parameter to the design of a stormwater quality device is the selection of the design particle size. While it is recommended that the actual particle size distribution (PSD) for sites be measured prior to sizing, alternative values for particle size should be selected to represent what is likely to occur naturally on the site. A reasonable estimate of a particle size distribution likely to be found on parking lots or other impervious surfaces should consist of a wide range of particles such as 20 microns to 2,000 microns (Ontario MOE, 1994).

There is no absolute right particle size distribution or specific gravity and the user is cautioned to review the site location, characteristics, material handling practices and regulatory requirements when selecting a particle size distribution. When comparing technologies, designs using different PSDs will result in incomparable TSS removal efficiencies. The PSD of the TSS removed needs to be standard between two products to allow for an accurate comparison.

8.2. Scour Prevention

In order to accurately predict the performance of a manufactured treatment device, there must be confidence that it will perform under all conditions. Since rainfall patterns cannot be predicted, stormwater quality devices placed in storm sewer systems must be able to withstand extreme events, and ensure that all pollutants previously captured are retained in the system.

In order to have confidence in a system's performance under extreme conditions, independent validation of scour prevention is essential when examining different technologies. Lack of independent verification of scour prevention should make a designer wary of accepting any product's performance claims.

8.3. Hydraulics

Full scale laboratory testing has been used to confirm the hydraulics of the Stormceptor System. Results of lab testing have been used to physically design the Stormceptor System and the sewer pipes entering and leaving the unit. Key benefits of Stormceptor are:

- Low head loss (typical k value of 1.3)
- Minimal inlet/outlet invert elevation drop across the structure
- Use as a bend structure
- Accommodates multiple inlets

The adaptability of the treatment device to the storm sewer design infrastructure can affect the overall performance and cost of the site.

8.4. Hydrology

Stormwater quality treatment technologies need to perform under varying climatic conditions. These can vary from long low intensity rainfall to short duration, high intensity storms. Since a treatment device is expected to perform under all these conditions, it makes sense that any system's design should accommodate those conditions as well.

Long-term continuous simulation evaluates the performance of a technology under the varying conditions expected in the climate of the subject site. Single, peak event design does not provide this information and is not equivalent to long-term simulation. Designers should request long-term simulation performance to ensure the technology can meet the long-term water quality objective.

9. Testing

The Stormceptor System has been the most widely monitored stormwater treatment technology in the world. Performance verification and monitoring programs are completed to the strictest standards and integrity. Since its introduction in 1990, numerous independent field tests and studies detailing the effectiveness of the Stormceptor System have been completed.

- Coventry University, UK – 97% removal of oil, 83% removal of sand and 73% removal of peat
- National Water Research Institute, Canada, - scaled testing for the development of the Stormceptor System identifying both TSS removal and scour prevention.
- New Jersey TARP Program – full scale testing of an STC 900 demonstrating 75% TSS removal of particles from 1 to 1000 microns. Scour testing completed demonstrated that the system does not scour. The New Jersey Department of Environmental Protection was followed.
- City of Indianapolis – full scale testing of an STC 900 demonstrating over 80% TSS removal of particles from 50 microns to 300 microns at 130% of the unit's operating rate. Scour testing completed demonstrated that the system does not scour.
- Westwood Massachusetts (1997), demonstrated >80% TSS removal
- Como Park (1997), demonstrated 76% TSS removal
- Ontario MOE SWAMP Program – 57% removal of 1 to 25 micron particles
- Laval Quebec – 50% removal of 1 to 25 micron particles

10. Installation

The installation of the concrete Stormceptor should conform in general to state highway, or local specifications for the installation of manholes. Selected sections of a general specification that are applicable are summarized in the following sections.

10.1. Excavation

Excavation for the installation of the Stormceptor should conform to state highway, or local specifications. Topsoil removed during the excavation for the Stormceptor should be stockpiled in designated areas and should not be mixed with subsoil or other materials.

Topsoil stockpiles and the general site preparation for the installation of the Stormceptor should conform to state highway or local specifications.

The Stormceptor should not be installed on frozen ground. Excavation should extend a minimum of 12 inches (300 mm) from the precast concrete surfaces plus an allowance for shoring and bracing where required. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.

In areas with a high water table, continuous dewatering may be required to ensure that the excavation is stable and free of water.

10.2. Backfilling

Backfill material should conform to state highway or local specifications. Backfill material should be placed in uniform layers not exceeding 12 inches (300mm) in depth and compacted to state highway or local specifications.

11. Stormceptor Construction Sequence

The concrete Stormceptor is installed in sections in the following sequence:

1. Aggregate base
2. Base slab
3. Lower chamber sections
4. Upper chamber section with fiberglass insert
5. Connect inlet and outlet pipes
6. Assembly of fiberglass insert components (drop tee, riser pipe, oil cleanout port and orifice plate
7. Remainder of upper chamber
8. Frame and access cover

The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

Adjustment of the Stormceptor can be performed by lifting the upper sections free of the excavated area, re-leveling the base and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary. Once the Stormceptor has been constructed, any lift holes must be plugged with mortar.

12. Maintenance

12.1. Health and Safety

The Stormceptor System has been designed considering safety first. It is recommended that confined space entry protocols be followed if entry to the unit is required. In addition, the fiberglass insert has the following health and safety features:

- Designed to withstand the weight of personnel
- A safety grate is located over the 24 inch (600 mm) riser pipe opening
- Ladder rungs can be provided for entry into the unit, if required

12.2. Maintenance Procedures

Maintenance of the Stormceptor system is performed using vacuum trucks. No entry into the unit is required for maintenance (in most cases). The vacuum service industry is a well- established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean a Stormceptor will vary based on the size of unit and transportation distances.

The need for maintenance can be determined easily by inspecting the unit from the surface. The depth of oil in the unit can be determined by inserting a dipstick in the oil inspection/cleanout port.

Similarly, the depth of sediment can be measured from the surface without entry into the Stormceptor via a dipstick tube equipped with a ball valve. This tube would be inserted through the riser pipe. Maintenance should be performed once the sediment depth exceeds the guideline values provided in the Table 4.

Table 4. Sediment Depths Indicating Required Servicing*

Particle Size	Specific Gravity
Model	Sediment Depth inches (mm)
450i	8 (200)
900	8 (200)
1200	10 (250)
1800	15 (381)
2400	12 (300)
3600	17 (430)
4800	15 (380)
6000	18 (460)
7200	15 (381)
11000	17 (380)
13000	20 (500)
16000	17 (380)
* based on 15% of the Stormceptor unit's total storage	

Although annual servicing is recommended, the frequency of maintenance may need to be increased or reduced based on local conditions (i.e. if the unit is filling up with sediment more quickly than projected, maintenance may be required semi-annually; conversely once the site has stabilized maintenance may only be required every two or three years).

Oil is removed through the oil inspection/cleanout port and sediment is removed through the riser pipe. Alternatively oil could be removed from the 24 inches (600 mm) opening if water is removed from the lower chamber to lower the oil level below the drop pipes.

The following procedures should be taken when cleaning out Stormceptor:

1. Check for oil through the oil cleanout port
2. Remove any oil separately using a small portable pump
3. Decant the water from the unit to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank
4. Remove the sludge from the bottom of the unit using the vacuum truck
5. Re-fill Stormceptor with water where required by the local jurisdiction

12.3. Submerged Stormceptor

Careful attention should be paid to maintenance of the Submerged Stormceptor System. In cases where the storm drain system is submerged, there is a requirement to plug both the inlet and outlet pipes to economically clean out the unit.

12.4. Hydrocarbon Spills

The Stormceptor is often installed in areas where the potential for spills is great. The Stormceptor System should be cleaned immediately after a spill occurs by a licensed liquid waste hauler.

12.5. Disposal

Requirements for the disposal of material from the Stormceptor System are similar to that of any other stormwater Best Management Practice (BMP) where permitted. Disposal options for the sediment may range from disposal in a sanitary trunk sewer upstream of a sewage treatment plant, to disposal in a sanitary landfill site. Petroleum waste products collected in the Stormceptor (free oil/chemical/fuel spills) should be removed by a licensed waste management company.

12.6. Oil Sheens

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a rainbow or sheen can be seen at very small oil concentrations (<10 mg/L). Stormceptor will remove over 98% of all free oil spills from storm sewer systems for dry weather or frequently occurring runoff events.

The appearance of a sheen at the outlet with high influent oil concentrations does not mean the unit is not working to this level of removal. In addition, if the influent oil is emulsified the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified conditions.

SUPPORT

Drawings and specifications are available at www.ContechES.com.

Site-specific design support is available from our engineers.

CONTECH ENGINEERED SOLUTIONS
800-925-5240
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