HANCOCK ASSOCIATES

Stormwater Report
In Support of
Permit Site Plan
for
39 West Street
(Map 55, Lot 51)
Medway, MA

Prepared By:
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Prepared For:
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Introduction

Steven Brody proposes to construct a 24-unit two-story residential condominium building with parking for thirty-six (36) vehicles on the ground level on a 64,366 square foot parcel at 39 West Street in Medway, MA. Associated improvements will include paved vehicular and pedestrian areas, outdoor amenity space, landscaped areas, stormwater management systems, and utility services. The project area is currently comprised of a single-family dwelling, paved driveway, gravel vehicular areas, woodland, and grassed areas. The project area is currently accessed by a paved driveway in front of the existing garage and a gravel driveway to the north of the existing dwelling which accesses the rear of the site. A new paved driveway is proposed in the location of the existing gravel driveway. The site is bounded by West Street to the east, Boston Edison Company to the north and northwest, Roche's Building Company to the west, and GBW Senior Apartments LLC to the south. Elevations on site range from 211 near the center of the south side property line to 197 near the center of the north side property line at the northern wetland. The site generally drains south to north through the center of the site but is split into two (2) watersheds with one (1) shedding to the west toward Hopping Brook and one (1) shedding to the north wetland.

The entirety of the project area is within a FEMA Zone X Area of Minimal Flood Hazard on FEMA map number 25021C0139F dated July 8, 2025. The proposed stormwater management system will include catch basins with deep sumps and hoods, underground infiltration chambers, a flow-through treatment device, an infiltration basin, and a network of pipes.

The proposed stormwater management system was designed to meet the Stormwater Management Standards described in the Massachusetts Stormwater Handbook and the Town of Medway's Stormwater Design Requirements. The following report describes the system's compliance with these standards.

Standard 1: No New Untreated Discharges

The Massachusetts Stormwater Handbook states that no new stormwater conveyances may discharge untreated stormwater directly to or cause erosions in wetlands or waters of the Commonwealth. The project does not include any new untreated stormwater conveyances.

Standard 2: Peak Rate Attenuation

The Massachusetts Stormwater Handbook states that stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. A summary of the existing and proposed discharge rates follows. The proposed discharge rates of runoff are at or below the existing rates to the same discharge points. Please see the attached "Pre-Development Watershed Plan" and "Post-Development Watershed Plan" (Appendix IV) and HydroCAD output (Appendix V) for more information.

For the purpose of these calculations the following assumptions were made:

- The same total watershed area of the drainage areas is used to compare the existing and proposed conditions.
- The Natural Resources Conservation Service (NRCS) Web Soil Survey of Middlesex County defines soils in the project area as 254B, Merrimac fine sandy loam (Hydrologic Soil Group A). The soil testing completed by Hancock Associates on March 13, 2025 and July 14, 2025 indicate that the upper layer consists of sand and sandy loam, while the parent material consists of coarse sand with gravel to gravelly loamy sand. A Rawls Rate of 8.27 inches/hour was used for the underground infiltration system, which corresponds to Hydrologic Soil Group A, Sand. A Rawls Rate of 2.41 inches/hour was used for the infiltration basin, which corresponds to Hydrologic Soil Group A, Loamy Sand.

Two (2) drainage areas have been modeled to represent the existing condition:

- Drainage Area 1S consists of a majority of the site including the existing house, paved driveways and walkways, gravel driveway, grass and woodland. Stormwater runoff from 1S drains via overland flow to the wetland near the center of north property line.
- Drainage Area 2S consists of a mobile home and woodland. Stormwater runoff from 2S drains via overland flow to Hopping Brook to the west.

In the proposed condition a stormwater management system will collect and treat stormwater runoff from the project site. This system will include catch basins with deep sumps and hoods, underground infiltration chambers, a flow-through treatment device, an infiltration basin, and a network of pipes. Five (5) drainage areas have been modeled to represent the proposed condition:

- Drainage Area 10S will consist of the northern portion of the property draining to the wetland. This area will consist of lawn, landscaped areas, and wooded areas. Stormwater discharge from 10S will flow via overland flow to the north wetland.
- Drainage Area 11S will consist of all paved vehicular and pedestrian areas, lawn, and landscaped areas. Stormwater discharge from 11S will drain via deep sump catch basins, to a flow-through treatment device and infiltration basin. The outfall of the infiltration basin will be to the north wetland.
- Drainage Area 12S will consist of proposed roof area. Stormwater discharge from 12S will drain via roof leaders to the underground infiltration chambers to the west of the building. The overflow from this system will be discharged to the infiltration basin.
- Drainage Area 13S will consist of a small portion of grass lawn and landscaped area to the south of the building. Stormwater discharge from 13S will drain via flared end section and pipe to the north wetland.
- Drainage Area 20S will consist of wooded areas. Stormwater discharge from 20S will drain via overland flow to Hopping Brook to the west.

The following table compares the peak rates of runoff under the existing and proposed conditions using the latest NOAA Atlas 14 Plus precipitation rates.:

Table 1: Peak Rates of Runoff

Discharge Point	**Peak Rate (cfs)**							
	2-Year Storm (3.84" Rainfall Depth)		**10-Year Storm** (6.04" Rainfall Depth)		**50-Year Storm** (9.00" Rainfall Depth)		**100-Year Storm** (10.62" Rainfall Depth)	
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
North Wetland (1R/10R)	0.11 cfs	0.10 cfs	1.14 cfs	1.07 cfs	3.60 cfs	3.59 cfs	5.18 cfs	4.98 cfs
Hopping Brook (2R/20R)	0.0 cfs	0.0 cfs	0.0 cfs	0.0 cfs	0.07 cfs	0.05 cfs	0.17 cfs	0.12 cfs

cfs – Cubic Feet per Second

<u>Standard 3: Recharge</u>

The Massachusetts Stormwater Handbook states that loss of annual recharge to groundwater shall be eliminated or minimized. The annual recharge from the post-development site shall approximate the annual recharge from the pre-development conditions based on soil type. Recharge volumes are provided

for all of the proposed impervious areas. For the purpose of these calculations, all of the project areas are considered to be Hydrologic Soil Group A. The required recharge volume is 0.6" multiplied by the net increase of impervious surfaces. Please see the attached HydroCAD summaries for the recharge volumes provided within the infiltration chambers (Appendix VI). The volumes are as follows:

Required Recharge Volume, HSG A = Target Depth * Impervious Area = 0.6" * 12,480 SF = 624 CF

The recharge volume is provided below the weir of underground infiltration chambers and below the lowest outlet orifice of the infiltration basin. The volume provided below weir in the Stormtech DC-780 Chambers is 1,181 cubic feet. The volume provided below the lowest outlet orifice of the infiltration basin is 842 cubic feet. Therefore, the total recharge volume provided is 2,023 cubic feet. Since the volume provided is greater than the required recharge volume, the standard is met.

Drawdown Calculations:
The Massachusetts Stormwater Handbook states that the recharge volume must drain within 72 hours. The soil testing completed by Hancock Associates on March 13, 2025 and July 14, 2025 indicate that the upper layer consists of sand and sandy loam, while the parent material consists of coarse sand with gravel to gravelly loamy sand. A Rawls Rate of 8.27 inches/hour was used for the underground infiltration system, which corresponds to Hydrologic Soil Group A, Sand. A Rawls Rate of 2.41 inches/hour was used for the infiltration basin, which corresponds to Hydrologic Soil Group A, Loamy Sand. Please see soil logs on the Grading and Drainage Plan for more information. The following "drawdown" calculation use these Rawls Rates:

Stormtech DC-780 Chambers
Drawdown Time = Storage Volume / (Rawl's Rate * Bottom Area)
= 1,181 CF / (8.27 in/hr * 592 SF) = 2.9 Hours

Infiltration Basin
Drawdown Time = Storage Volume / (Rawl's Rate * Bottom Area)
= 842 CF / (2.41 in/hr * 80 SF) = 52.4 Hours

Since the drawdown times of 2.9 hours and 52.4 hours is less than 72 hours, the requirement is met. A four (4) foot offset to groundwater is provided in both underground infiltration systems, so a mounding analysis is not required.

Standard 4: Water Quality

The Massachusetts Stormwater Handbook states that systems shall be designed to remove 80% of the average annual post-development construction load of Total Suspended Solids (TSS). The Medway Stormwater Management and Land Disturbance Bylaw (Medway General Bylaws – Article 26) states that 90% of the average annual load of Total Suspended Solids (TSS) and 60% of the average annual load of Total Phosphorus (TP) generated from the impervious area on the site must be removed.

Stormwater runoff from vehicular paved areas will be treated for at least 90% TSS removal via catch basins with deep sumps and hoods, a flow-through treatment device, and infiltration basin. The treatment train computations are as follows:

Table 2: Treatment Train Calculation #1 – Infiltration Basin

BMP	TSS Removal Rate	Starting TSS Load	Amount Removed	Remaining Load
Deep Sump Catch Basins with Hoods	0.25	1	0.25	0.75
Contech VortSentry HS	0.8	0.75	0.6	0.15
Infiltration Basin	0.8	0.15	0.12	0.03
Total TSS Removal				97%

1. BMP Verification Deep Sump Hooded Catch Basin:
Must have 0.25 acre impervious area or less contributing: Area = 0.25 acres or less for each CB.
Must have less than 2.5 cfs inflow in the 25-year storm: All catch basin have inflow less than 2.5 cfs in the 25-year storm.

2. BMP Verification – Contech VortSentry HS
The Contech VortSentry HS has been sized to provide 80% TSS removal per the VortSentry HS Guide: Operation, Design, Performance, and Maintenance and the per the DEP's Equivalent Water Quality Peak Flow Rate guidelines (See Figure 3 and 4 from MassDEP "Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based on Manufactured Propriety Stormwater Treatment Practices"):

$V_{WQ} = (D_{WQ}/12 \text{ inches/foot}) * (A_{IMP} \text{ square feet})$

Where:

V_{WQ} = *Required Water Quality Volume (in cubic feet)*

D_{WQ} = *Water Quality Depth: one-inch for discharges within a Zone II or Interim Wellhead Protection Area, to or near another critical area, runoff from a LUHPPL, or exfiltration to soils with infiltration rate of 2.4 inches/hour or greater; ½-inch for discharges near or to other areas.*

A_{IMP} = *Impervious Area*

VortSentry HS Sizing
Time of Concentration, Tc = 6 minutes = 0.1 hours
Unit Peak Discharge, qu = 774 csm/in (MassDEP, Figure 4)
csm/in = cfs/mi^2/watershed inch
Impervious Paved Surface Area, A = 13,090 sf = 0.30 acres = 0.000470 mi^2
Water Quality Volume, WQV = 1 Inch*
Water Quality Flow, WQF = (qu)(A)(WQV) = (774 csm/in)(0.000470 mi^2)(1 inch) = 0.36 cfs
Contech Unit -VortSentry HS36 Model =0.55 cfs (>0.36 cfs Req'd)
*Exfiltration to soils with infiltration rate of 2.4 inches/hour or greater

Infiltration Basin
$V_{WQ} = (D_{WQ}/12 \text{ inches/foot}) * (A_{IMP} \text{ square feet})$
$V_{WQ} = (1 \text{ Inch}/12 \text{ inches/foot}) * (13{,}090 \text{ sf})$
V_{WQ} = 1,091 cf (See WQ Storm Event in Appendix V)

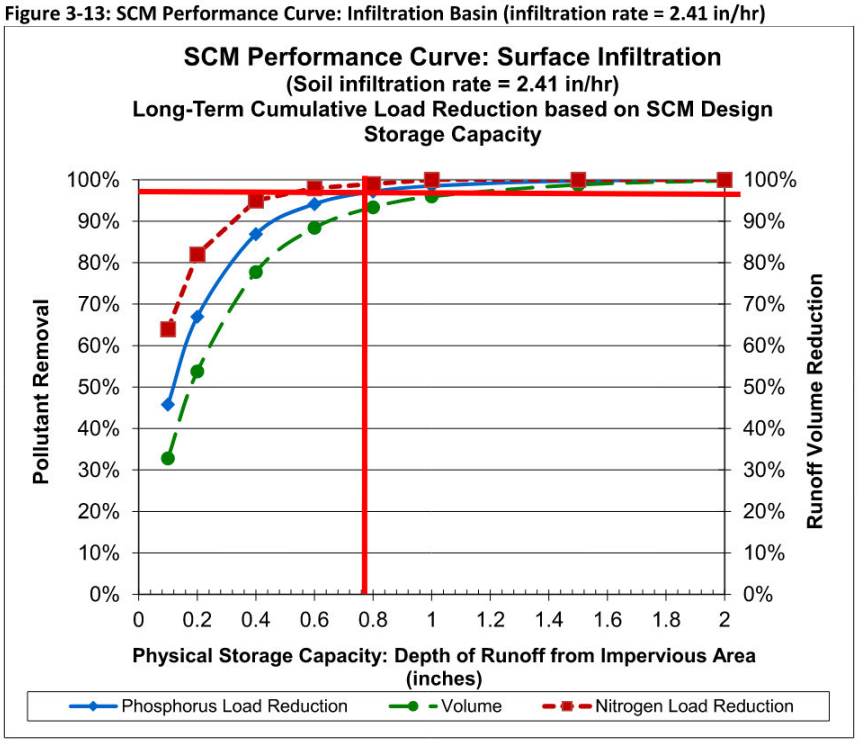
3. Infiltration Verification – Infiltration Basin
According to MA Stormwater BMP specifications, 44% pretreatment is required prior to discharge to an infiltration BMP; 85% pretreatment is provided. This standard is met.

4. Phosphorus Removal Verification – Infiltration Basin

Physical Storage Capacity Calculation:
842 cf storage provided / 13,090 sf captured impervious = 0.77 inches

The proposed infiltration system will remove 96.55% of cumulative phosphorus loads from the paved areas, see figure below.

Figure 3-13: SCM Performance Curve: Infiltration Basin (infiltration rate = 2.41 in/hr)



Standard 5: Land Uses with Higher Potential Pollutant Loads

The proposed project is not a Land Use with Higher Potential Pollutant Load (LUHPPL).

Standard 6: Critical Area

The proposed project is not within a Critical Area.

Standard 7: Redevelopment

The proposed project is a not a redevelopment due to the increase of impervious area.

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

Best management practices (BMP) for erosion and sedimentation control are staked straw bales, filter fences, wattles, hydro seeding, and phased development. Many stormwater BMP technologies (e.g., infiltration technologies) are not designed to handle the high concentrations of sediments typically found in construction runoff and must be protected from construction-related sediment loadings. Construction BMP's **must** be maintained. In developing the proposed project certain measures will be

implemented to minimize impacts erosion and sedimentation could have on surrounding areas. This section addresses items that involve proper construction techniques, close surveillance of workmanship, and immediate response to emergency situations. The developer must be prepared to provide whatever reasonable measures are necessary to protect the environment during construction and to stabilize all disturbed areas as soon as construction ends. Construction period pollution prevention and erosion and sediment control shall meet the requirements for the 2022 EPA Construction General Permit for all projects requiring coverage under the CGP.

Pre-Construction

1. The contractor shall have a stockpile of materials required to control erosion on-site to be used to supplement or repair erosion control devices. These materials shall include, but are not limited to straw bales, silt fence, wattles and crushed stone.
2. The contractor is responsible for erosion control on site and shall utilize erosion control measures where needed, regardless of whether the measures are specified on the plan or in the order of conditions.

Preliminary Site Work

1. Excavated materials should be stockpiled, separating the topsoil for future use on the site. Erosion control shall be utilized along the down slope side of the piles and side slopes shall not exceed 2:1.
2. If intense rainfall is anticipated, the installation of supplemental straw bale dikes, silt fences, or armored dikes shall be considered.
3. Unsuitable excavated material shall be removed from the site.
4. Construction entrance shall be installed.
5. Existing catch basins shall be protected with silt sacks.

Ongoing Site Work

1. Erosion control measures shall be regularly inspected and replaced as needed.
2. Dewatering shall be done in a manner so as not to transmit silt, sand or particulate matter to the receiving water or existing drainage system.

Landscaping

1. Landscaping shall occur as soon as possible to provide permanent stabilization of disturbed surfaces.
2. If the season or adverse weather conditions do not allow the establishment of vegetation, temporary mulching with straw, wood chips weighted with snow fence or branches, or other methods shall be provided.
3. A minimum of 6 inches of topsoil shall be placed and its surface smoothed to the specified grades.
4. The use of herbicides is strongly discouraged.
5. Hydro seeding is encouraged for steep slopes. Application rates on slopes greater than 3:1 shall have a minimum seeding rate of 5-lbs/1000 SF. A latex or fiber tackifier shall be used on these slopes at a minimum rate of 50 lbs. of tackifier per 500 gallons of water used.

Standard 9: Operations and Maintenance Plan

See Appendix VII for the Operations and Maintenance Plan.

Standard 10: Prohibition of Illicit Discharges

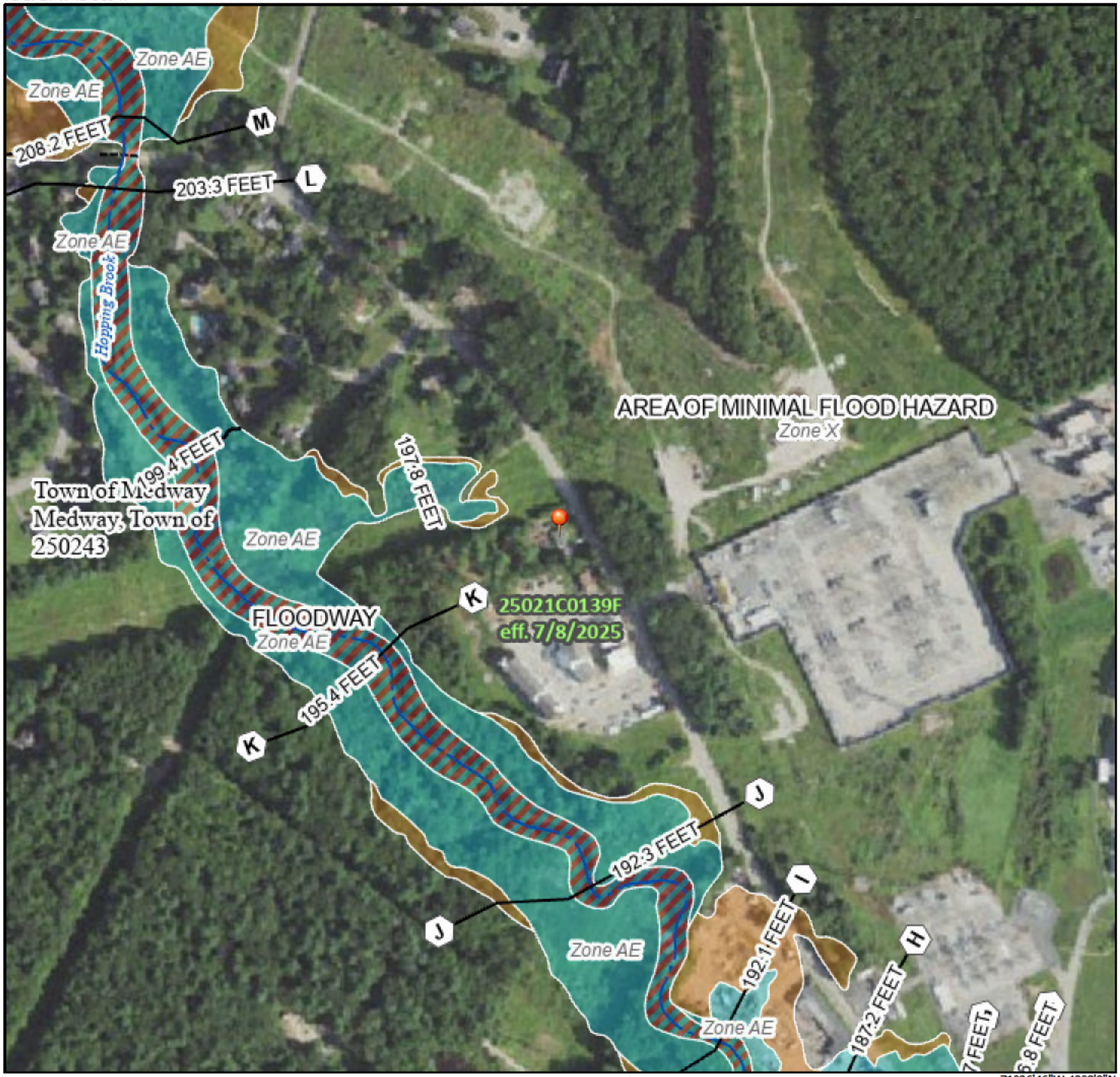
A signed “Illicit Discharge Compliance Statement” is included in the attached Operation and Maintenance Plan in Appendix VII.

Appendix I FIRMette

National Flood Hazard Layer FIRMette

FEMA

71°27'24"W 42°8'35"N



71°26'46"W 42°8'9"N

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

1:6,000

Basemap Imagery Source: USGS National Map 2023

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
- Coastal Transect
- 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 7/23/2025 at 1:42 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.

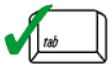
Appendix II Stormwater Checklist

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.

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

Appendix III NRCS Soils Map

Map Scale: 1:1,290 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N 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: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 20, Aug 27, 2024

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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
5	Saco silt loam, frequently ponded, 0 to 1 percent slopes, frequently flooded	B/D	0.6	13.0%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	3.4	72.4%
260B	Sudbury fine sandy loam, 2 to 8 percent slopes	B	0.7	14.6%
Totals for Area of Interest			**4.7**	**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

Appendix IV Pre-Development and Post-Development Watershed Plans

PERMIT SITE PLAN

39 West Street
Medway, MA 02053

ASSESSORS:

MAP	PARCEL
55	51

PREPARED FOR:

STEVEN G. BRODY

39 West Street
Medway, MA 02053

HANCOCK ASSOCIATES

Civil Engineers

Land Surveyors

Wetland Scientists

315 ELM STREET, MARLBOROUGH, MA 01752
VOICE (508) 460-1111, FAX (508) 460-1121
WWW.HANCOCKASSOCIATES.COM

NO.	BY	APP	DATE	ISSUE/REVISION DESCRIPTION

DATE:	8/11/25	DESIGN BY:	DJR
SCALE:	1"=20'	DRAWN BY:	DJR
APPRVD. BY:	JP	CHECK BY:	BGG

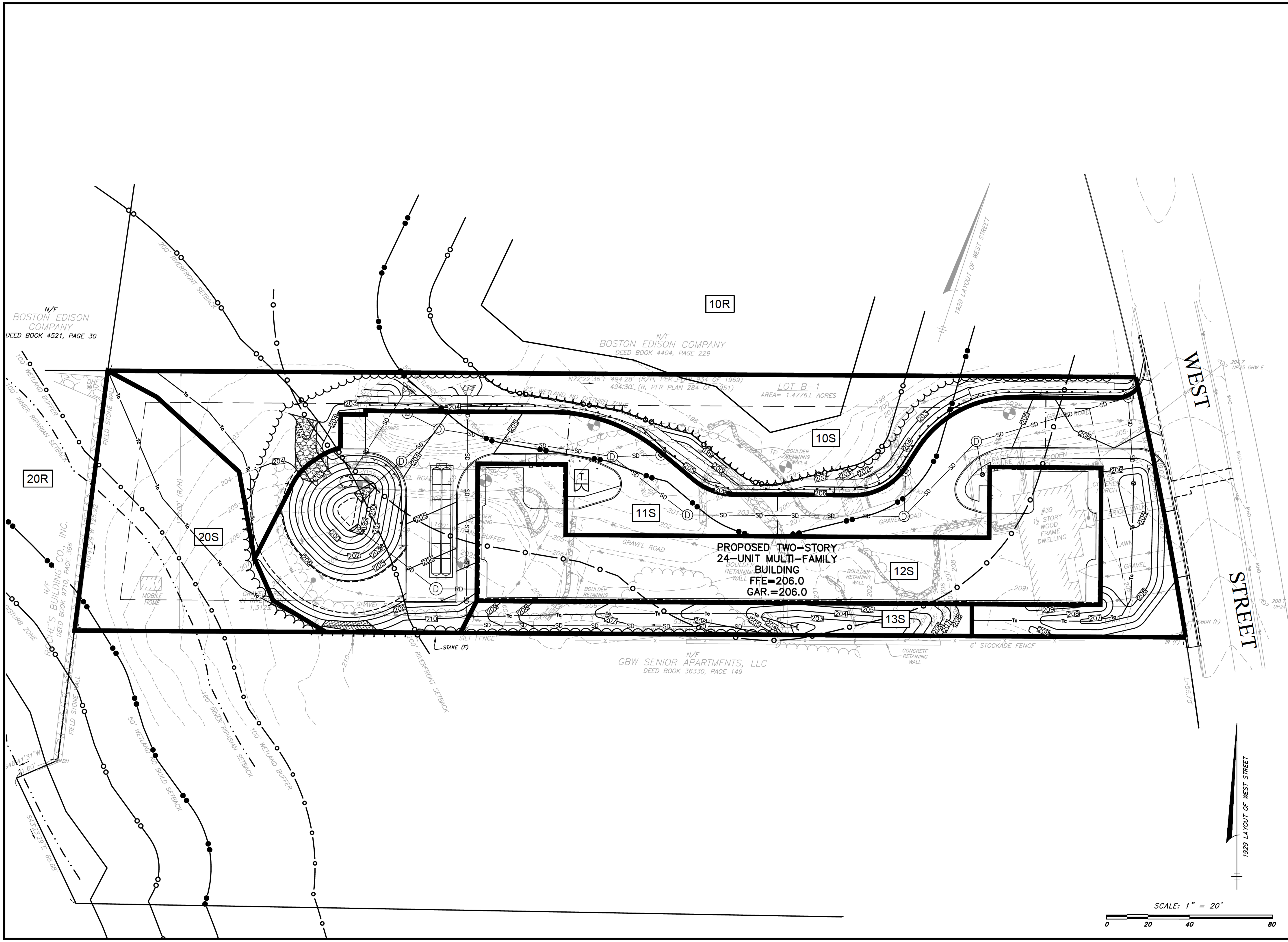
PRE-DEVELOPMENT WATERSHED PLAN

PLOT DATE: Aug 08, 2025 3:58 pm
PATH: V:\Jobs\25xx 3D Projects\25337S - Brody - Medway\civil\DWG\

DWG:	25337SP.dwg
LAYOUT:	PRE
SHEET:	1 OF 2

PRE

PROJECT NO.: 25337



PERMIT SITE PLAN

39 West Street
Medway, MA 02053

ASSESSORS:

MAP	PARCEL
55	51

PREPARED FOR:

STEVEN G. BRODY

39 West Street
Medway, MA 02053

HANCOCK ASSOCIATES

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315 ELM STREET, MARLBOROUGH, MA 01752
VOICE (508) 460-1111, FAX (508) 460-1121
WWW.HANCOCKASSOCIATES.COM

NO.	BY	APP	DATE	ISSUE/REVISION DESCRIPTION

DATE:	8/11/25	DESIGN BY:	DJR
SCALE:	1"=20'	DRAWN BY:	DJR
APPRVD. BY:	JP	CHECK BY:	JTL

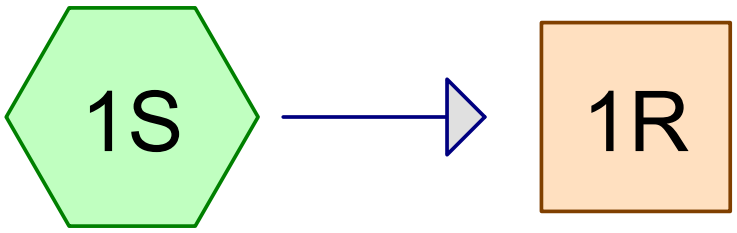
POST-DEVELOPMENT WATERSHED PLAN

PLOT DATE: Aug 08, 2025 2:36 pm

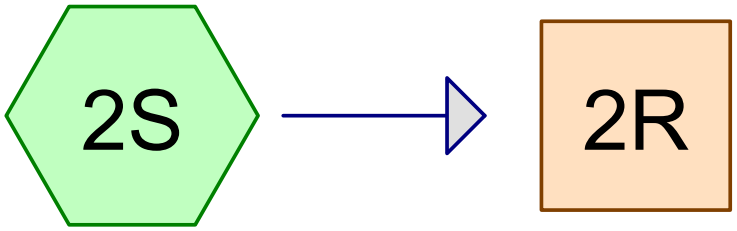
DWG:	25337SP.dwg	POST
LAYOUT:	POST	
SHEET:	2 OF 2	
PROJECT NO.:		25337

Appendix V HydroCAD Output

Pre-Development



Site (East) North Wetland



Site (West) Hopping Brook

Subcat Reach Pond Link

Routing Diagram for 25337-HydroCAD-3
Prepared by Hancock Associates, Printed 7/28/2025

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
19,980	39	>75% Grass cover, Good, HSG A (1S)
10,560	96	Gravel surface, HSG A (1S)
950	98	Paved parking, HSG A (1S)
1,960	98	Roofs, HSG A (1S, 2S)
30,910	30	Woods, Good, HSG A (1S, 2S)
64,360	**47**	**TOTAL AREA**

Summary for Subcatchment 1S: Site (East)

Runoff = 0.11 cfs @ 12.39 hrs, Volume= 966 cf, Depth> 0.21"
Routed to Reach 1R : North Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.84"

Area (sf)	CN	Description
1,890	98	Roofs, HSG A
950	98	Paved parking, HSG A
10,560	96	Gravel surface, HSG A
19,980	39	>75% Grass cover, Good, HSG A
21,700	30	Woods, Good, HSG A
55,080	49	Weighted Average
52,240		94.84% Pervious Area
2,840		5.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	35	0.0460	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.84"
0.1	15	0.0670	1.67		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.84"
0.2	60	0.0920	4.88		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	50	0.0900	2.10		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	10	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.5	30	0.0430	1.04		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.4	200	Total			

Summary for Subcatchment 2S: Site (West)

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach 2R : Hopping Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.84"

Area (sf)	CN	Description
70	98	Roofs, HSG A
9,210	30	Woods, Good, HSG A
9,280	31	Weighted Average
9,210		99.25% Pervious Area
70		0.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0540	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.84"
1.3	95	0.0560	1.18		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.9	145	Total			

Summary for Reach 1R: North Wetland

Inflow Area = 55,080 sf, 5.16% Impervious, Inflow Depth > 0.21" for 2-Year event
Inflow = 0.11 cfs @ 12.39 hrs, Volume= 966 cf
Outflow = 0.11 cfs @ 12.39 hrs, Volume= 966 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach 2R: Hopping Brook

Inflow Area = 9,280 sf, 0.75% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Subcatchment 1S: Site (East)

Runoff = 1.14 cfs @ 12.14 hrs, Volume= 4,436 cf, Depth> 0.97"
Routed to Reach 1R : North Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=6.04"

Area (sf)	CN	Description
1,890	98	Roofs, HSG A
950	98	Paved parking, HSG A
10,560	96	Gravel surface, HSG A
19,980	39	>75% Grass cover, Good, HSG A
21,700	30	Woods, Good, HSG A
55,080	49	Weighted Average
52,240		94.84% Pervious Area
2,840		5.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	35	0.0460	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.84"
0.1	15	0.0670	1.67		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.84"
0.2	60	0.0920	4.88		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	50	0.0900	2.10		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	10	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.5	30	0.0430	1.04		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.4	200	Total			

Summary for Subcatchment 2S: Site (West)

Runoff = 0.00 cfs @ 15.12 hrs, Volume= 57 cf, Depth> 0.07"
Routed to Reach 2R : Hopping Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=6.04"

Area (sf)	CN	Description
70	98	Roofs, HSG A
9,210	30	Woods, Good, HSG A
9,280	31	Weighted Average
9,210		99.25% Pervious Area
70		0.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0540	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.84"
1.3	95	0.0560	1.18		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.9	145	Total			

Summary for Reach 1R: North Wetland

Inflow Area = 55,080 sf, 5.16% Impervious, Inflow Depth > 0.97" for 10-Year event
Inflow = 1.14 cfs @ 12.14 hrs, Volume= 4,436 cf
Outflow = 1.14 cfs @ 12.14 hrs, Volume= 4,436 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach 2R: Hopping Brook

Inflow Area = 9,280 sf, 0.75% Impervious, Inflow Depth > 0.07" for 10-Year event
Inflow = 0.00 cfs @ 15.12 hrs, Volume= 57 cf
Outflow = 0.00 cfs @ 15.12 hrs, Volume= 57 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Subcatchment 1S: Site (East)

Runoff = 3.60 cfs @ 12.12 hrs, Volume= 11,529 cf, Depth> 2.51"
Routed to Reach 1R : North Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=9.00"

Area (sf)	CN	Description
1,890	98	Roofs, HSG A
950	98	Paved parking, HSG A
10,560	96	Gravel surface, HSG A
19,980	39	>75% Grass cover, Good, HSG A
21,700	30	Woods, Good, HSG A
55,080	49	Weighted Average
52,240		94.84% Pervious Area
2,840		5.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	35	0.0460	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.84"
0.1	15	0.0670	1.67		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.84"
0.2	60	0.0920	4.88		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	50	0.0900	2.10		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	10	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.5	30	0.0430	1.04		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.4	200	Total			

Summary for Subcatchment 2S: Site (West)

Runoff = 0.07 cfs @ 12.36 hrs, Volume= 504 cf, Depth> 0.65"
Routed to Reach 2R : Hopping Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=9.00"

Area (sf)	CN	Description
70	98	Roofs, HSG A
9,210	30	Woods, Good, HSG A
9,280	31	Weighted Average
9,210		99.25% Pervious Area
70		0.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0540	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.84"
1.3	95	0.0560	1.18		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.9	145	Total			

Summary for Reach 1R: North Wetland

Inflow Area = 55,080 sf, 5.16% Impervious, Inflow Depth > 2.51" for 50-Year event
Inflow = 3.60 cfs @ 12.12 hrs, Volume= 11,529 cf
Outflow = 3.60 cfs @ 12.12 hrs, Volume= 11,529 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach 2R: Hopping Brook

Inflow Area = 9,280 sf, 0.75% Impervious, Inflow Depth > 0.65" for 50-Year event
Inflow = 0.07 cfs @ 12.36 hrs, Volume= 504 cf
Outflow = 0.07 cfs @ 12.36 hrs, Volume= 504 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Subcatchment 1S: Site (East)

Runoff = 5.18 cfs @ 12.11 hrs, Volume= 16,175 cf, Depth> 3.52"
Routed to Reach 1R : North Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=10.62"

Area (sf)	CN	Description
1,890	98	Roofs, HSG A
950	98	Paved parking, HSG A
10,560	96	Gravel surface, HSG A
19,980	39	>75% Grass cover, Good, HSG A
21,700	30	Woods, Good, HSG A
55,080	49	Weighted Average
52,240		94.84% Pervious Area
2,840		5.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	35	0.0460	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.84"
0.1	15	0.0670	1.67		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.84"
0.2	60	0.0920	4.88		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	50	0.0900	2.10		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	10	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.5	30	0.0430	1.04		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.4	200	Total			

Summary for Subcatchment 2S: Site (West)

Runoff = 0.17 cfs @ 12.20 hrs, Volume= 898 cf, Depth> 1.16"
Routed to Reach 2R : Hopping Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=10.62"

Area (sf)	CN	Description
70	98	Roofs, HSG A
9,210	30	Woods, Good, HSG A
9,280	31	Weighted Average
9,210		99.25% Pervious Area
70		0.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0540	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.84"
1.3	95	0.0560	1.18		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.9	145	Total			

Summary for Reach 1R: North Wetland

Inflow Area = 55,080 sf, 5.16% Impervious, Inflow Depth > 3.52" for 100-Year event
Inflow = 5.18 cfs @ 12.11 hrs, Volume= 16,175 cf
Outflow = 5.18 cfs @ 12.11 hrs, Volume= 16,175 cf, Atten= 0%, Lag= 0.0 min

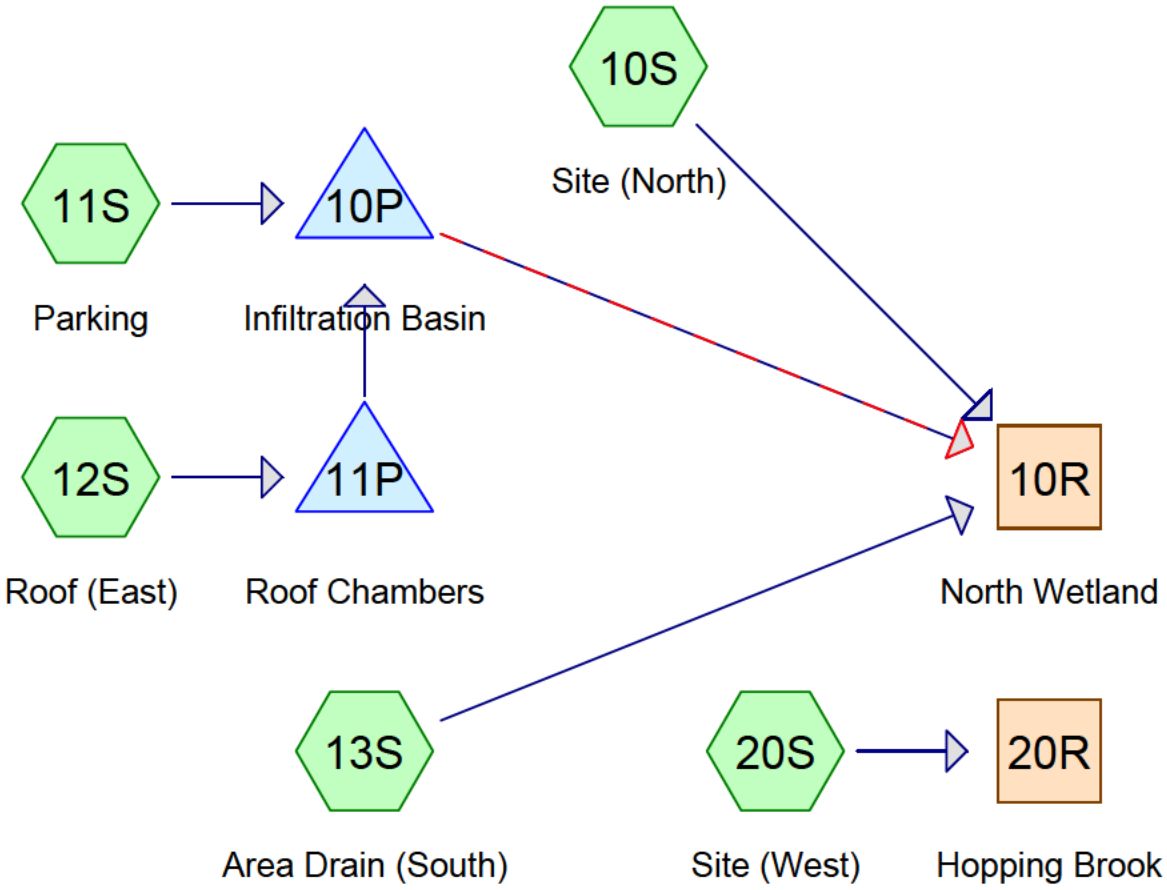
Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach 2R: Hopping Brook

Inflow Area = 9,280 sf, 0.75% Impervious, Inflow Depth > 1.16" for 100-Year event
Inflow = 0.17 cfs @ 12.20 hrs, Volume= 898 cf
Outflow = 0.17 cfs @ 12.20 hrs, Volume= 898 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Post-Development



Subcat Reach Pond Link

Routing Diagram for 25337-HydroCAD-3
Prepared by Hancock Associates, Printed 7/28/2025

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
18,930	39	>75% Grass cover, Good, HSG A (10S, 11S, 13S)
2,730	30	Brush, Good, HSG A (11S)
13,090	98	Paved parking, HSG A (11S)
12,860	98	Roofs, HSG A (12S)
16,750	30	Woods, Good, HSG A (10S, 20S)
64,360	**60**	**TOTAL AREA**

Summary for Subcatchment 10S: Site (North)

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach 10R : North Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.84"

Area (sf)	CN	Description
7,010	39	>75% Grass cover, Good, HSG A
8,370	30	Woods, Good, HSG A
15,380	34	Weighted Average
15,380		100.00% Pervious Area

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

Summary for Subcatchment 11S: Parking

Runoff = 0.74 cfs @ 12.10 hrs, Volume= 2,233 cf, Depth> 1.12"
Routed to Pond 10P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.84"

Area (sf)	CN	Description
13,090	98	Paved parking, HSG A
2,730	30	Brush, Good, HSG A
8,200	39	>75% Grass cover, Good, HSG A
24,020	70	Weighted Average
10,930		45.50% Pervious Area
13,090		54.50% Impervious Area

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

Summary for Subcatchment 12S: Roof (East)

Runoff = 1.08 cfs @ 12.09 hrs, Volume= 3,601 cf, Depth> 3.36"
Routed to Pond 11P : Roof Chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.84"

Area (sf)	CN	Description
12,860	98	Roofs, HSG A
12,860		100.00% Impervious Area

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

Summary for Subcatchment 13S: Area Drain (South)

Runoff = 0.00 cfs @ 16.95 hrs, Volume= 6 cf, Depth> 0.02"
Routed to Reach 10R : North Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.84"

Area (sf)	CN	Description
3,720	39	>75% Grass cover, Good, HSG A
3,720		100.00% Pervious Area

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

Summary for Subcatchment 20S: Site (West)

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach 20R : Hopping Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.84"

Area (sf)	CN	Description
8,380	30	Woods, Good, HSG A
8,380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0540	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.84"
1.3	95	0.0560	1.18		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.9	145	Total			

Summary for Reach 10R: North Wetland

Inflow Area = 55,980 sf, 46.36% Impervious, Inflow Depth > 0.11" for 2-Year event
Inflow = 0.10 cfs @ 12.62 hrs, Volume= 509 cf
Outflow = 0.10 cfs @ 12.62 hrs, Volume= 509 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach 20R: Hopping Brook

Inflow Area = 8,380 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 10P: Infiltration Basin

Inflow Area = 36,880 sf, 70.36% Impervious, Inflow Depth > 0.73" for 2-Year event
Inflow = 0.74 cfs @ 12.10 hrs, Volume= 2,233 cf
Outflow = 0.14 cfs @ 12.62 hrs, Volume= 1,505 cf, Atten= 81%, Lag= 31.1 min
Discarded = 0.04 cfs @ 12.62 hrs, Volume= 1,001 cf
Primary = 0.10 cfs @ 12.62 hrs, Volume= 504 cf
Routed to Reach 10R : North Wetland
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Routed to Reach 10R : North Wetland

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 200.12' @ 12.62 hrs Surf.Area= 657 sf Storage= 962 cf

Plug-Flow detention time= 160.6 min calculated for 1,500 cf (67% of inflow)
Center-of-Mass det. time= 86.5 min (905.6 - 819.1)

Volume	Invert	Avail.Storage	Storage Description
#1	197.20'	6,184 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
197.20	80	0	0
198.00	186	106	106
199.00	375	281	387
200.00	621	498	885
201.00	923	772	1,657
202.00	1,283	1,103	2,760
203.00	1,698	1,491	4,250
204.00	2,170	1,934	6,184

Device	Routing	Invert	Outlet Devices
#1	Primary	201.90'	**8.0" Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Primary	199.93'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	203.30'	**10.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#4	Discarded	197.20'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 12.62 hrs HW=200.12' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.10 cfs @ 12.62 hrs HW=200.12' TW=0.00' (Dynamic Tailwater)
├**1=Orifice/Grate** (Controls 0.00 cfs)
└**2=Orifice/Grate** (Orifice Controls 0.10 cfs @ 1.48 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=197.20' TW=0.00' (Dynamic Tailwater)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 11P: Roof Chambers

Inflow Area = 12,860 sf,100.00% Impervious, Inflow Depth > 3.36" for 2-Year event
Inflow = 1.08 cfs @ 12.09 hrs, Volume= 3,601 cf
Outflow = 0.19 cfs @ 12.54 hrs, Volume= 3,607 cf, Atten= 82%, Lag= 27.2 min
Discarded = 0.19 cfs @ 12.54 hrs, Volume= 3,607 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Routed to Pond 10P : Infiltration Basin

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 201.66' @ 12.54 hrs Surf.Area= 601 sf Storage= 1,083 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 39.1 min (776.0 - 736.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	198.80'	623 cf	**11.00'W x 53.46'L x 3.75'H Field A** 2,205 cf Overall - 647 cf Embedded = 1,558 cf x 40.0% Voids
#2A	199.55'	647 cf	**ADS_StormTech DC-780 +Cap** x 14 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 14 Chambers in 2 Rows
#3	198.80'	90 cf	**4.00'D x 7.15'H Vertical Cone/Cylinder**
		1,360 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	198.80'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	202.05'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.19 cfs @ 12.54 hrs HW=201.66' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=198.80' TW=197.20' (Dynamic Tailwater)
↑—**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Subcatchment 10S: Site (North)

Runoff = 0.01 cfs @ 12.51 hrs, Volume= 215 cf, Depth> 0.17"
Routed to Reach 10R : North Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=6.04"

Area (sf)	CN	Description
7,010	39	>75% Grass cover, Good, HSG A
8,370	30	Woods, Good, HSG A
15,380	34	Weighted Average
15,380		100.00% Pervious Area

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

Summary for Subcatchment 11S: Parking

Runoff = 1.79 cfs @ 12.09 hrs, Volume= 5,260 cf, Depth> 2.63"
Routed to Pond 10P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=6.04"

Area (sf)	CN	Description
13,090	98	Paved parking, HSG A
2,730	30	Brush, Good, HSG A
8,200	39	>75% Grass cover, Good, HSG A
24,020	70	Weighted Average
10,930		45.50% Pervious Area
13,090		54.50% Impervious Area

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

Summary for Subcatchment 12S: Roof (East)

Runoff = 1.71 cfs @ 12.09 hrs, Volume= 5,750 cf, Depth> 5.37"
Routed to Pond 11P : Roof Chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=6.04"

Area (sf)	CN	Description
12,860	98	Roofs, HSG A
12,860		100.00% Impervious Area

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

Summary for Subcatchment 13S: Area Drain (South)

Runoff = 0.02 cfs @ 12.34 hrs, Volume= 119 cf, Depth> 0.38"
Routed to Reach 10R : North Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=6.04"

Area (sf)	CN	Description
3,720	39	>75% Grass cover, Good, HSG A
3,720		100.00% Pervious Area

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

Summary for Subcatchment 20S: Site (West)

Runoff = 0.00 cfs @ 15.49 hrs, Volume= 35 cf, Depth> 0.05"
Routed to Reach 20R : Hopping Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=6.04"

Area (sf)	CN	Description
8,380	30	Woods, Good, HSG A
8,380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0540	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.84"
1.3	95	0.0560	1.18		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.9	145	Total			

Summary for Reach 10R: North Wetland

Inflow Area = 55,980 sf, 46.36% Impervious, Inflow Depth > 0.95" for 10-Year event
Inflow = 1.07 cfs @ 12.38 hrs, Volume= 4,415 cf
Outflow = 1.07 cfs @ 12.38 hrs, Volume= 4,415 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach 20R: Hopping Brook

Inflow Area = 8,380 sf, 0.00% Impervious, Inflow Depth > 0.05" for 10-Year event
Inflow = 0.00 cfs @ 15.49 hrs, Volume= 35 cf
Outflow = 0.00 cfs @ 15.49 hrs, Volume= 35 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 10P: Infiltration Basin

Inflow Area = 36,880 sf, 70.36% Impervious, Inflow Depth > 1.99" for 10-Year event
Inflow = 3.19 cfs @ 12.15 hrs, Volume= 6,128 cf
Outflow = 1.11 cfs @ 12.36 hrs, Volume= 5,267 cf, Atten= 65%, Lag= 12.8 min
Discarded = 0.06 cfs @ 12.36 hrs, Volume= 1,186 cf
Primary = 1.05 cfs @ 12.36 hrs, Volume= 4,081 cf
Routed to Reach 10R : North Wetland
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Routed to Reach 10R : North Wetland

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 201.42' @ 12.36 hrs Surf.Area= 1,074 sf Storage= 2,074 cf

Plug-Flow detention time= 69.2 min calculated for 5,267 cf (86% of inflow)
Center-of-Mass det. time= 28.6 min (819.4 - 790.8)

Volume	Invert	Avail.Storage	Storage Description
#1	197.20'	6,184 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
197.20	80	0	0
198.00	186	106	106
199.00	375	281	387
200.00	621	498	885
201.00	923	772	1,657
202.00	1,283	1,103	2,760
203.00	1,698	1,491	4,250
204.00	2,170	1,934	6,184

Device	Routing	Invert	Outlet Devices
#1	Primary	201.90'	**8.0" Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Primary	199.93'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	203.30'	**10.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#4	Discarded	197.20'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.06 cfs @ 12.36 hrs HW=201.42' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=1.05 cfs @ 12.36 hrs HW=201.42' TW=0.00' (Dynamic Tailwater)
├**1=Orifice/Grate** (Controls 0.00 cfs)
└**2=Orifice/Grate** (Orifice Controls 1.05 cfs @ 5.35 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=197.20' TW=0.00' (Dynamic Tailwater)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 11P: Roof Chambers

Inflow Area = 12,860 sf,100.00% Impervious, Inflow Depth > 5.37" for 10-Year event
Inflow = 1.71 cfs @ 12.09 hrs, Volume= 5,750 cf
Outflow = 1.94 cfs @ 12.15 hrs, Volume= 5,748 cf, Atten= 0%, Lag= 4.1 min
Discarded = 0.21 cfs @ 12.16 hrs, Volume= 4,880 cf
Primary = 1.73 cfs @ 12.15 hrs, Volume= 868 cf
Routed to Pond 10P : Infiltration Basin

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 202.32' @ 12.16 hrs Surf.Area= 601 sf Storage= 1,260 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 37.6 min (771.7 - 734.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	198.80'	623 cf	**11.00'W x 53.46'L x 3.75'H Field A** 2,205 cf Overall - 647 cf Embedded = 1,558 cf x 40.0% Voids
#2A	199.55'	647 cf	**ADS_StormTech DC-780 +Cap** x 14 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 14 Chambers in 2 Rows
#3	198.80'	90 cf	**4.00'D x 7.15'H Vertical Cone/Cylinder**
		1,360 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	198.80'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	202.05'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.21 cfs @ 12.16 hrs HW=202.28' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.21 cfs)

Primary OutFlow Max=1.59 cfs @ 12.15 hrs HW=202.30' TW=200.97' (Dynamic Tailwater)
↑**2=Sharp-Crested Rectangular Weir** (Weir Controls 1.59 cfs @ 1.63 fps)

Summary for Subcatchment 10S: Site (North)

Runoff = 0.23 cfs @ 12.15 hrs, Volume= 1,184 cf, Depth> 0.92"
Routed to Reach 10R : North Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=9.00"

Area (sf)	CN	Description
7,010	39	>75% Grass cover, Good, HSG A
8,370	30	Woods, Good, HSG A
15,380	34	Weighted Average
15,380		100.00% Pervious Area

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

Summary for Subcatchment 11S: Parking

Runoff = 3.38 cfs @ 12.09 hrs, Volume= 9,985 cf, Depth> 4.99"
Routed to Pond 10P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=9.00"

Area (sf)	CN	Description
13,090	98	Paved parking, HSG A
2,730	30	Brush, Good, HSG A
8,200	39	>75% Grass cover, Good, HSG A
24,020	70	Weighted Average
10,930		45.50% Pervious Area
13,090		54.50% Impervious Area

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

Summary for Subcatchment 12S: Roof (East)

Runoff = 2.55 cfs @ 12.09 hrs, Volume= 8,628 cf, Depth> 8.05"
Routed to Pond 11P : Roof Chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=9.00"

Area (sf)	CN	Description
12,860	98	Roofs, HSG A
12,860		100.00% Impervious Area

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

Summary for Subcatchment 13S: Area Drain (South)

Runoff = 0.12 cfs @ 12.11 hrs, Volume= 440 cf, Depth> 1.42"
Routed to Reach 10R : North Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=9.00"

Area (sf)	CN	Description
3,720	39	>75% Grass cover, Good, HSG A
3,720		100.00% Pervious Area

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

Summary for Subcatchment 20S: Site (West)

Runoff = 0.05 cfs @ 12.39 hrs, Volume= 396 cf, Depth> 0.57"
Routed to Reach 20R : Hopping Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=9.00"

Area (sf)	CN	Description
8,380	30	Woods, Good, HSG A
8,380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0540	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.84"
1.3	95	0.0560	1.18		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.9	145	Total			

Summary for Reach 10R: North Wetland

Inflow Area = 55,980 sf, 46.36% Impervious, Inflow Depth > 2.51" for 50-Year event
Inflow = 3.59 cfs @ 12.20 hrs, Volume= 11,722 cf
Outflow = 3.59 cfs @ 12.20 hrs, Volume= 11,722 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach 20R: Hopping Brook

Inflow Area = 8,380 sf, 0.00% Impervious, Inflow Depth > 0.57" for 50-Year event
Inflow = 0.05 cfs @ 12.39 hrs, Volume= 396 cf
Outflow = 0.05 cfs @ 12.39 hrs, Volume= 396 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 10P: Infiltration Basin

Inflow Area = 36,880 sf, 70.36% Impervious, Inflow Depth > 4.05" for 50-Year event
Inflow = 5.65 cfs @ 12.09 hrs, Volume= 12,441 cf
Outflow = 3.38 cfs @ 12.20 hrs, Volume= 11,544 cf, Atten= 40%, Lag= 6.7 min
Discarded = 0.08 cfs @ 12.20 hrs, Volume= 1,447 cf
Primary = 3.29 cfs @ 12.20 hrs, Volume= 10,097 cf
Routed to Reach 10R : North Wetland
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Routed to Reach 10R : North Wetland

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 202.53' @ 12.20 hrs Surf.Area= 1,503 sf Storage= 3,497 cf

Plug-Flow detention time= 47.8 min calculated for 11,544 cf (93% of inflow)
Center-of-Mass det. time= 23.4 min (798.4 - 775.0)

Volume	Invert	Avail.Storage	Storage Description
#1	197.20'	6,184 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
197.20	80	0	0
198.00	186	106	106
199.00	375	281	387
200.00	621	498	885
201.00	923	772	1,657
202.00	1,283	1,103	2,760
203.00	1,698	1,491	4,250
204.00	2,170	1,934	6,184

Device	Routing	Invert	Outlet Devices
#1	Primary	201.90'	**8.0" Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Primary	199.93'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	203.30'	**10.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#4	Discarded	197.20'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.08 cfs @ 12.20 hrs HW=202.53' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=3.29 cfs @ 12.20 hrs HW=202.53' TW=0.00' (Dynamic Tailwater)
├**1=Orifice/Grate** (Orifice Controls 1.84 cfs @ 2.70 fps)
└**2=Orifice/Grate** (Orifice Controls 1.45 cfs @ 7.38 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=197.20' TW=0.00' (Dynamic Tailwater)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 11P: Roof Chambers

Inflow Area = 12,860 sf,100.00% Impervious, Inflow Depth > 8.05" for 50-Year event
Inflow = 2.55 cfs @ 12.09 hrs, Volume= 8,628 cf
Outflow = 2.49 cfs @ 12.08 hrs, Volume= 8,627 cf, Atten= 2%, Lag= 0.0 min
Discarded = 0.22 cfs @ 12.25 hrs, Volume= 6,172 cf
Primary = 2.28 cfs @ 12.08 hrs, Volume= 2,455 cf
Routed to Pond 10P : Infiltration Basin

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 202.54' @ 12.25 hrs Surf.Area= 601 sf Storage= 1,316 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 35.5 min (768.2 - 732.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	198.80'	623 cf	**11.00'W x 53.46'L x 3.75'H Field A** 2,205 cf Overall - 647 cf Embedded = 1,558 cf x 40.0% Voids
#2A	199.55'	647 cf	**ADS_StormTech DC-780 +Cap** x 14 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 14 Chambers in 2 Rows
#3	198.80'	90 cf	**4.00'D x 7.15'H Vertical Cone/Cylinder**
		1,360 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	198.80'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	202.05'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.22 cfs @ 12.25 hrs HW=202.54' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=2.23 cfs @ 12.08 hrs HW=202.36' TW=201.92' (Dynamic Tailwater)
↑**2=Sharp-Crested Rectangular Weir** (Weir Controls 2.23 cfs @ 1.82 fps)

Summary for Subcatchment 10S: Site (North)

Runoff = 0.51 cfs @ 12.12 hrs, Volume= 1,963 cf, Depth> 1.53"
Routed to Reach 10R : North Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=10.62"

Area (sf)	CN	Description
7,010	39	>75% Grass cover, Good, HSG A
8,370	30	Woods, Good, HSG A
15,380	34	Weighted Average
15,380		100.00% Pervious Area

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

Summary for Subcatchment 11S: Parking

Runoff = 4.27 cfs @ 12.09 hrs, Volume= 12,737 cf, Depth> 6.36"
Routed to Pond 10P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=10.62"

Area (sf)	CN	Description
13,090	98	Paved parking, HSG A
2,730	30	Brush, Good, HSG A
8,200	39	>75% Grass cover, Good, HSG A
24,020	70	Weighted Average
10,930		45.50% Pervious Area
13,090		54.50% Impervious Area

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

Summary for Subcatchment 12S: Roof (East)

Runoff = 3.01 cfs @ 12.09 hrs, Volume= 10,200 cf, Depth> 9.52"
Routed to Pond 11P : Roof Chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=10.62"

Area (sf)	CN	Description
12,860	98	Roofs, HSG A
12,860		100.00% Impervious Area

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

Summary for Subcatchment 13S: Area Drain (South)

Runoff = 0.21 cfs @ 12.11 hrs, Volume= 675 cf, Depth> 2.18"
Routed to Reach 10R : North Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=10.62"

Area (sf)	CN	Description
3,720	39	>75% Grass cover, Good, HSG A
3,720		100.00% Pervious Area

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

Summary for Subcatchment 20S: Site (West)

Runoff = 0.12 cfs @ 12.22 hrs, Volume= 728 cf, Depth> 1.04"
Routed to Reach 20R : Hopping Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=10.62"

Area (sf)	CN	Description
8,380	30	Woods, Good, HSG A
8,380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0540	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.84"
1.3	95	0.0560	1.18		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.9	145	Total			

Summary for Reach 10R: North Wetland

Inflow Area = 55,980 sf, 46.36% Impervious, Inflow Depth > 3.50" for 100-Year event
Inflow = 4.98 cfs @ 12.17 hrs, Volume= 16,315 cf
Outflow = 4.98 cfs @ 12.17 hrs, Volume= 16,315 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach 20R: Hopping Brook

Inflow Area = 8,380 sf, 0.00% Impervious, Inflow Depth > 1.04" for 100-Year event
Inflow = 0.12 cfs @ 12.22 hrs, Volume= 728 cf
Outflow = 0.12 cfs @ 12.22 hrs, Volume= 728 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 10P: Infiltration Basin

Inflow Area = 36,880 sf, 70.36% Impervious, Inflow Depth > 5.26" for 100-Year event
Inflow = 7.03 cfs @ 12.09 hrs, Volume= 16,161 cf
Outflow = 4.46 cfs @ 12.19 hrs, Volume= 15,251 cf, Atten= 37%, Lag= 6.4 min
Discarded = 0.09 cfs @ 12.19 hrs, Volume= 1,574 cf
Primary = 4.36 cfs @ 12.19 hrs, Volume= 13,677 cf
Routed to Reach 10R : North Wetland
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Routed to Reach 10R : North Wetland

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 202.93' @ 12.19 hrs Surf.Area= 1,667 sf Storage= 4,125 cf

Plug-Flow detention time= 41.9 min calculated for 15,251 cf (94% of inflow)
Center-of-Mass det. time= 21.9 min (791.5 - 769.7)

Volume	Invert	Avail.Storage	Storage Description
#1	197.20'	6,184 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
197.20	80	0	0
198.00	186	106	106
199.00	375	281	387
200.00	621	498	885
201.00	923	772	1,657
202.00	1,283	1,103	2,760
203.00	1,698	1,491	4,250
204.00	2,170	1,934	6,184

Device	Routing	Invert	Outlet Devices
#1	Primary	201.90'	**8.0" Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Primary	199.93'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	203.30'	**10.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#4	Discarded	197.20'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.09 cfs @ 12.19 hrs HW=202.92' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=4.35 cfs @ 12.19 hrs HW=202.92' TW=0.00' (Dynamic Tailwater)
├**1=Orifice/Grate** (Orifice Controls 2.78 cfs @ 3.99 fps)
└**2=Orifice/Grate** (Orifice Controls 1.56 cfs @ 7.97 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=197.20' TW=0.00' (Dynamic Tailwater)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 11P: Roof Chambers

Inflow Area = 12,860 sf,100.00% Impervious, Inflow Depth > 9.52" for 100-Year event
Inflow = 3.01 cfs @ 12.09 hrs, Volume= 10,200 cf
Outflow = 2.98 cfs @ 12.08 hrs, Volume= 10,205 cf, Atten= 1%, Lag= 0.0 min
Discarded = 0.22 cfs @ 12.24 hrs, Volume= 6,781 cf
Primary = 2.77 cfs @ 12.08 hrs, Volume= 3,424 cf
Routed to Pond 10P : Infiltration Basin

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 202.93' @ 12.24 hrs Surf.Area= 601 sf Storage= 1,322 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 35.5 min (767.9 - 732.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	198.80'	623 cf	**11.00'W x 53.46'L x 3.75'H Field A** 2,205 cf Overall - 647 cf Embedded = 1,558 cf x 40.0% Voids
#2A	199.55'	647 cf	**ADS_StormTech DC-780 +Cap** x 14 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 14 Chambers in 2 Rows
#3	198.80'	90 cf	**4.00'D x 7.15'H Vertical Cone/Cylinder**
		1,360 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	198.80'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	202.05'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.22 cfs @ 12.24 hrs HW=202.92' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=0.00 cfs @ 12.08 hrs HW=202.41' TW=202.49' (Dynamic Tailwater)
↑—**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Subcatchment 10S: Site (North)

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach 10R : North Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ Rainfall=2.81"

Area (sf)	CN	Description
7,010	39	>75% Grass cover, Good, HSG A
8,370	30	Woods, Good, HSG A
15,380	34	Weighted Average
15,380		100.00% Pervious Area

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

Summary for Subcatchment 11S: Parking

Runoff = 0.33 cfs @ 12.11 hrs, Volume= 1,096 cf, Depth> 0.55"
Routed to Pond 10P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ Rainfall=2.81"

Area (sf)	CN	Description
13,090	98	Paved parking, HSG A
2,730	30	Brush, Good, HSG A
8,200	39	>75% Grass cover, Good, HSG A
24,020	70	Weighted Average
10,930		45.50% Pervious Area
13,090		54.50% Impervious Area

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

Summary for Subcatchment 12S: Roof (East)

Runoff = 0.78 cfs @ 12.09 hrs, Volume= 2,589 cf, Depth> 2.42"
Routed to Pond 11P : Roof Chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ Rainfall=2.81"

Area (sf)	CN	Description
12,860	98	Roofs, HSG A
12,860		100.00% Impervious Area

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

Summary for Subcatchment 13S: Area Drain (South)

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach 10R : North Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ Rainfall=2.81"

Area (sf)	CN	Description
3,720	39	>75% Grass cover, Good, HSG A
3,720		100.00% Pervious Area

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

Summary for Subcatchment 20S: Site (West)

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach 20R : Hopping Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ Rainfall=2.81"

Area (sf)	CN	Description
8,380	30	Woods, Good, HSG A
8,380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0540	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.84"
1.3	95	0.0560	1.18		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.9	145	Total			

Summary for Reach 10R: North Wetland

Inflow Area = 55,980 sf, 46.36% Impervious, Inflow Depth = 0.00" for WQ event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach 20R: Hopping Brook

Inflow Area = 8,380 sf, 0.00% Impervious, Inflow Depth = 0.00" for WQ event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 10P: Infiltration Basin

Inflow Area = 36,880 sf, 70.36% Impervious, Inflow Depth > 0.36" for WQ event
Inflow = 0.33 cfs @ 12.11 hrs, Volume= 1,096 cf
Outflow = 0.03 cfs @ 15.19 hrs, Volume= 699 cf, Atten= 92%, Lag= 185.0 min
Discarded = 0.03 cfs @ 15.19 hrs, Volume= 699 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Routed to Reach 10R : North Wetland
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Routed to Reach 10R : North Wetland

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 199.39' @ 15.19 hrs Surf.Area= 470 sf Storage= 550 cf

Plug-Flow detention time= 205.8 min calculated for 697 cf (64% of inflow)
Center-of-Mass det. time= 123.4 min (959.5 - 836.1)

Volume	Invert	Avail.Storage	Storage Description
#1	197.20'	6,184 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
197.20	80	0	0
198.00	186	106	106
199.00	375	281	387
200.00	621	498	885
201.00	923	772	1,657
202.00	1,283	1,103	2,760
203.00	1,698	1,491	4,250
204.00	2,170	1,934	6,184

Device	Routing	Invert	Outlet Devices
#1	Primary	201.90'	**8.0" Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Primary	199.93'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	203.30'	**10.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#4	Discarded	197.20'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.03 cfs @ 15.19 hrs HW=199.39' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=197.20' TW=0.00' (Dynamic Tailwater)
├**1=Orifice/Grate** (Controls 0.00 cfs)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=197.20' TW=0.00' (Dynamic Tailwater)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 11P: Roof Chambers

Inflow Area = 12,860 sf,100.00% Impervious, Inflow Depth > 2.42" for WQ event
Inflow = 0.78 cfs @ 12.09 hrs, Volume= 2,589 cf
Outflow = 0.16 cfs @ 12.50 hrs, Volume= 2,595 cf, Atten= 79%, Lag= 24.9 min
Discarded = 0.16 cfs @ 12.50 hrs, Volume= 2,595 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Routed to Pond 10P : Infiltration Basin

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 200.65' @ 12.50 hrs Surf.Area= 601 sf Storage= 686 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 25.5 min (765.5 - 739.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	198.80'	623 cf	**11.00'W x 53.46'L x 3.75'H Field A** 2,205 cf Overall - 647 cf Embedded = 1,558 cf x 40.0% Voids
#2A	199.55'	647 cf	**ADS_StormTech DC-780 +Cap** x 14 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 14 Chambers in 2 Rows
#3	198.80'	90 cf	**4.00'D x 7.15'H Vertical Cone/Cylinder**
		1,360 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	198.80'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	202.05'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.16 cfs @ 12.50 hrs HW=200.65' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=198.80' TW=197.20' (Dynamic Tailwater)
↑—**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Appendix VI HydroCAD Output for Recharge Volume

Stage-Area-Storage for Pond 11P: Roof Chambers

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
198.80	601	0
198.90	615	25
199.00	629	50
199.10	643	74
199.20	657	99
199.30	671	124
199.40	685	149
199.50	700	173
199.60	714	210
199.70	728	257
199.80	742	304
199.90	756	350
200.00	770	397
200.10	785	443
200.20	799	488
200.30	813	533
200.40	827	578
200.50	841	622
200.60	855	666
200.70	869	709
200.80	884	752
200.90	898	794
201.00	912	835
201.10	926	876
201.20	940	915
201.30	954	954
201.40	968	991
201.50	983	1,028
201.60	997	1,063
201.70	1,011	1,096
201.80	1,025	1,127
201.90	1,039	1,155
202.00	1,053	1,181
202.10	1,067	1,206
202.20	1,082	1,231
202.30	1,096	1,256
202.40	1,110	1,280
202.50	1,124	1,305
202.60	1,132	1,318
202.70	1,133	1,319
202.80	1,134	1,321
202.90	1,136	1,322
203.00	1,137	1,323
203.10	1,138	1,324
203.20	1,139	1,326
203.30	1,141	1,327
203.40	1,142	1,328
203.50	1,143	1,330
203.60	1,144	1,331
203.70	1,146	1,332
203.80	1,147	1,333
203.90	1,148	1,335
204.00	1,149	1,336
204.10	1,151	1,337
204.20	1,152	1,338
204.30	1,153	1,340
204.40	1,154	1,341
204.50	1,156	1,342
204.60	1,157	1,343
204.70	1,158	1,345
204.80	1,159	1,346
204.90	1,161	1,347
205.00	1,162	1,348
205.10	1,163	1,350
205.20	1,164	1,351
205.30	1,166	1,352
205.40	1,167	1,353
205.50	1,168	1,355
205.60	1,169	1,356
205.70	1,171	1,357
205.80	1,172	1,358
205.90	**1,173**	**1,360**

Stage-Area-Storage for Pond 10P: Infiltration Basin (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
199.32	454	519	199.85	584	795
199.33	456	524	199.86	587	800
199.34	459	529	199.87	589	806
199.35	461	533	199.88	591	812
199.36	464	538	199.89	594	818
199.37	466	542	199.90	596	824
199.38	468	547	199.91	599	830
199.39	471	552	199.92	601	836
199.40	473	557	199.93	604	842
199.41	476	561	199.94	606	848
199.42	478	566	199.95	609	854
199.43	481	571	199.96	611	860
199.44	483	576	199.97	614	866
199.45	486	581	199.98	616	873
199.46	488	585	199.99	619	879
199.47	491	590	200.00	621	885
199.48	493	595	200.01	624	891
199.49	496	600	200.02	627	897
199.50	498	605	200.03	630	904
199.51	500	610	200.04	633	910
199.52	503	615	200.05	636	916
199.53	505	620	200.06	639	923
199.54	508	625	200.07	642	929
199.55	510	630	200.08	645	936
199.56	513	635	200.09	648	942
199.57	515	641	200.10	651	949
199.58	518	646	200.11	654	955
199.59	520	651	200.12	657	962
199.60	523	656	200.13	660	968
199.61	525	661	200.14	663	975
199.62	528	667	200.15	666	981
199.63	530	672	200.16	669	988
199.64	532	677	200.17	672	995
199.65	535	683	200.18	675	1,002
199.66	537	688	200.19	678	1,008
199.67	540	693	200.20	681	1,015
199.68	542	699	200.21	684	1,022
199.69	545	704	200.22	687	1,029
199.70	547	710	200.23	690	1,036
199.71	550	715	200.24	693	1,043
199.72	552	721	200.25	697	1,050
199.73	555	726	200.26	700	1,057
199.74	557	732	200.27	703	1,064
199.75	560	737	200.28	706	1,071
199.76	562	743	200.29	709	1,078
199.77	564	749	200.30	712	1,085
199.78	567	754	200.31	715	1,092
199.79	569	760	200.32	718	1,099
199.80	572	766	200.33	721	1,106
199.81	574	771	200.34	724	1,113
199.82	577	777	200.35	727	1,121
199.83	579	783	200.36	730	1,128
199.84	582	789	200.37	733	1,135

Appendix VII Operations and Maintenance Plan and Log

Long Term Operations and Maintenance Plan

The information provided herein is intended to provide the base information for operation and maintenance of the site in perpetuity subject to updates and revisions as required at a future date. As such all future property owners must be notified in writing of this plan and be provided with a copy of this plan, a complete set of the design drawings and/or a completed as-built plan showing all the drainage features as they were constructed, which are considered part of this document. Please see the attached Operations and Maintenance Log (Appendix IX).

Stormwater management system owner: Steven Brody
The party responsible for operation and maintenance: Steven Brody

Preliminary Stormwater Operation and Maintenance Budget
Quarterly Inspection and Maintenance x $2,500 per visit = $10,000 annually

Illicit Discharge - Practices to Minimize Storm Water Contamination

- All waste materials will be collected and stored in a securely lidded metal dumpster.
- All trash and debris from the site will be deposited in the dumpster. The dumpster will be emptied on a regular schedule prior to being over full.
- All personnel will be instructed regarding the correct procedure for waste disposal.
- Good housekeeping and spill control practices will be followed to minimize storm water contamination from petroleum products, paints, and cleaning products.
- All site vehicles will be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage.
- Spill kits will be provided with any activity that could provide contamination.
- All paint containers and curing compounds will be tightly sealed and stored when not required for use. Excess paint will not be discharged to the storm sewers, but will be properly disposed according to the manufacturer's instructions.
- All spills will be cleaned up immediately upon discovery. Spills large enough to reach the storm sewers will be reported to the Massachusetts Department of Environmental Protection Northeast Regional Office at 1-888-304-1133.

Deep Sump Hooded Catch Basins
Inspect deep sump catch basins four times per year including the end of the foliage and snow removal seasons. Sediments must also be removed four times per year or when the depth of deposits is greater than or equal to one half the depth of the sump. Vacuum trucks are to be used to remove trapped sediment and supernatant.

Although catch basin debris often contains concentrations of oil and hazardous materials such as petroleum hydrocarbons and metals, MassDEP classifies them as solid waste. Any contaminated materials must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.00, and handled as hazardous waste. MassDEP regulations prohibit landfills from accepting materials that contain free draining liquids.

Contech VortSentry HS
The VortSentry HS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site

activities than the size of the unit, i.e., unstable soils or heavy winter sanding will cause the treatment chamber to fill more quickly, but regular sweeping will slow accumulation.

Inspection
Inspection is the key to effective maintenance and is easily performed. Pollutant deposition and transport may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (i.e. spring and fall) however more frequent inspections may be necessary in equipment washdown areas and in climates where winter sanding operations may lead to rapid accumulations of a large volume of sediment. It is useful and often required as part of a permit to keep a record of each inspection. A simple inspection and maintenance log form for doing so is available for download at www.ContechES.com/stormwater

The VortSentry HS should be cleaned when the sediment has accumulated to a depth of two feet in the treatment chamber. This determination can be made by taking two measurements with a stadia rod or similar measuring device; one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the distance given in Table 2, the VortSentry HS should be maintained to ensure effective treatment.

Cleaning
Cleaning of the VortSentry HS should be done during dry weather conditions when no flow is entering the system. Cleanout of the VortSentry HS with a vacuum truck is generally the most effective and convenient method of excavating pollutants from the system. Simply remove the manhole cover and insert the vacuum hose into the sump. All pollutants can be removed from this one access point from the surface with no requirements for Confined Space Entry.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use adsorbent pads, which solidify the oils. These are usually much easier to remove from the unit individually, and less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Floating trash can be netted out if you wish to separate it from the other pollutants.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure proper safety precautions. If anyone physically enters the unit, Confined Space Entry procedures need to be followed.

Disposal of all material removed from the VortSentry HS should be done is accordance with local regulations. In many locations, disposal of evacuated sediments may be handled in the same manner as disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.

<u>Stormtech DC-780 Infiltration Chambers</u>
Infiltration chambers shall be inspected after every major storm for the first few months to ensure it is stabilized and functioning properly. If necessary, corrective action shall be taken until the system functions properly. Adjust the inspection interval based on pervious observations of sediment accumulation and high water elevations. Inspectors should note how long water remains standing in the inspection port 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. Thereafter, inspect the isolator row at least twice per year.

The JetVac process should be used to clean the chambers when the average depth of sediment exceeds three inches or annually. All sediments and hydrocarbons should be properly handled and disposed offsite in accordance with local, state, and federal regulations.

Infiltration Basin

The infiltration basin should be inspected and maintained at least twice a year, and after every time drainage discharges through the high outlet orifice. The Plan must require inspecting the pretreatment BMPs in accordance with the minimal requirements specified for those practices and after every major storm event. A major storm event is defined as a storm that is equal to or greater than the 2-year, 24-hour storm (generally 2.9 to 3.6 inches in a 24-hour period, depending in geographic location in Massachusetts).

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

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

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

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

Roof Drain Leaders

Routine roof inspections shall be performed two times per year. The roof shall be kept clean and free of debris, and the roof drainage systems shall be kept clear. Gutters and downspouts shall be cleaned at least twice per year, or more frequently as necessary.

Vegetated Areas Maintenance

Although not a structural component of the drainage system, the maintenance of vegetated areas may affect the functioning of stormwater management practices. This includes the health/density of vegetative cover and activities such as the application and disposal of lawn and garden care products, disposal of leaves and yard trimmings.

Initial Post-Construction Inspection

During the initial period of vegetation establishment pruning and weeding are required twice in first year by contractor or owner. Any dead vegetation/plantings found after the first year will be replaced. Proper mulching is mandatory and regular watering may be required initially to ensure proper establishment of new vegetation.

Long-Term Maintenance

The planted areas shall be inspected on a semi-annual basis and any litter removed. Weeds and invasive plant species shall be removed by hand. Maintain planted areas adjacent to pavement to prevent soil washout. Immediately clean any soil deposits on pavement. Leaf litter and other detritus shall be removed twice per year. If needed to maintain aesthetic appearance, perennial plantings may be trimmed at the end of the growing season.

Trees and shrubs shall be inspected twice per year to evaluate health and attended to as necessary. Seeded ground cover or grass areas shall not receive mulching. Re-seed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming. Plant alternative mixtures of grass species in the event of unsuccessful establishment. The grass vegetation should not be cut to a height less than four inches.

Snow Storage

Snow shall be removed from all paved surfaces and deposited in the designated snow storage areas. In addition snow may be stored along the perimeter of the site provided that care is taken to avoid damage to the landscape plantings. Snow may not be stockpiled in the infiltration/detention areas. Owner shall ensure that guardrails and fences are not damaged during the moving of snow.

Pesticide/Herbicide Usage

No pesticides are to be used unless a single spot treatment is required for a specific control application.

Illicit Discharge Compliance Statement

To the best of my knowledge no illicit discharges currently exist on the site and no future illicit discharge will be allowed, including wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease.

Signature

Date

HANCOCK ASSOCIATES

39 West Street

Operations and Maintenance Log

Inspections for Year:_____

Structural Best Management Practice	Action	Date Completed	Completed By	Comments
Deep Sump Hooded Catch Basin– Inspect/clean four times per year. Clean when sump is 50% full.	Inspect/ Clean			
	Inspect/ Clean			
	Inspect/ Clean			
	Inspect/ Clean			
	Inspect/ Clean			
Stormtech Chambers – Inspect twice per year. Clean as required.	Inspect			
	Inspect			
Infiltration Basin – Inspect twice per year. Clean as required.	Inspect			
	Inspect			
Roof Drain Leaders – Inspect/clean twice per year.	Inspect/Clean			
	Inspect/Clean			
Vegetated Areas Maintenance – Inspect twice per year. Maintain as required.	Inspect			
	Inspect			

Appendix VIII Stormwater Pollution Prevention Plan

Background

In 1972, Congress passed the Federal Water Pollution Control Act (FWPCA), also known as the Clean Water Act (CWA), to restore and maintain the quality of the nation's waterways. The ultimate goal was to make sure that rivers and streams were fishable, swimmable, and drinkable. In 1987, the Water Quality Act (WQA) added provisions to the CWA that allowed the EPA to govern storm water discharges from construction sites. EPA signed its 2022 Construction General Permit (CGP) for stormwater discharges from construction activities on January 18, 2022. The 2022 CGP, which became effective on February 17, 2022, replaces the 2017 CGP. In 2022, EPA published the final notice for the General Permit for Stormwater Discharges From Construction Activities (Volume 87 No. 15 Federal Register, January 24, 2022). The general permit includes provisions for development of a Storm Water Pollution Prevention Plan (SWPPP) to maximize the potential benefits of pollution prevention and sediment and erosion control measures at construction sites.

General Permit for Stormwater Discharges from Construction Activities Link:
https://www.epa.gov/npdes/2022-construction-general-permit-cgp

This project will disturb over one acre of ground cover and/or meets other thresholds related to permit criteria for USEPA National Pollutant Discharge Elimination System (NPDES) compliance. The site contractor is responsible for development and implementation of a Stormwater Pollution Prevention Plan (SWPPP), submission of a Notice of Intent (NOI) to USEPA, inspection and maintenance of sediment control measures, documentation of maintenance activities, and submission of a Notice of Termination (NOT) to USEPA. The Site Contractor is also responsible to comply with all other federal, state, and local stormwater or NPDES requirements includes the local Order of Conditions issued by the Medford Conservation Commission.

General

Development, implementation, and maintenance of the SWPPP will provide the Developer with the framework for reducing soil erosion and minimizing pollutants in storm water during construction of the project.

The SWPPP will:

- Define the characteristics of the site and the type of construction which will be occurring;
- Describe the site plan for the development to be constructed;
- Describe the practices that will be implemented to control erosion and the release of pollutants in stormwater;
- Create an implementation schedule to ensure that the practices described in this SWPPP are in fact implemented and to evaluate the plan's effectiveness in reducing erosion, sediment, and pollutant levels in storm water discharged from the site; and
- Describe the final stabilization/termination design to minimize erosion and prevent storm water impacts after construction is complete.

SWPPP Content

This SWPPP includes the following:

- Identification of the SWPPP coordinator with a description of this person's duties;
- Identification of the stormwater pollution prevention team that will assist in implementation of the SWPPP during construction.
- Identification of the body of water(s) which will receive runoff from the construction site, including the ultimate body of water that receives the storm water;

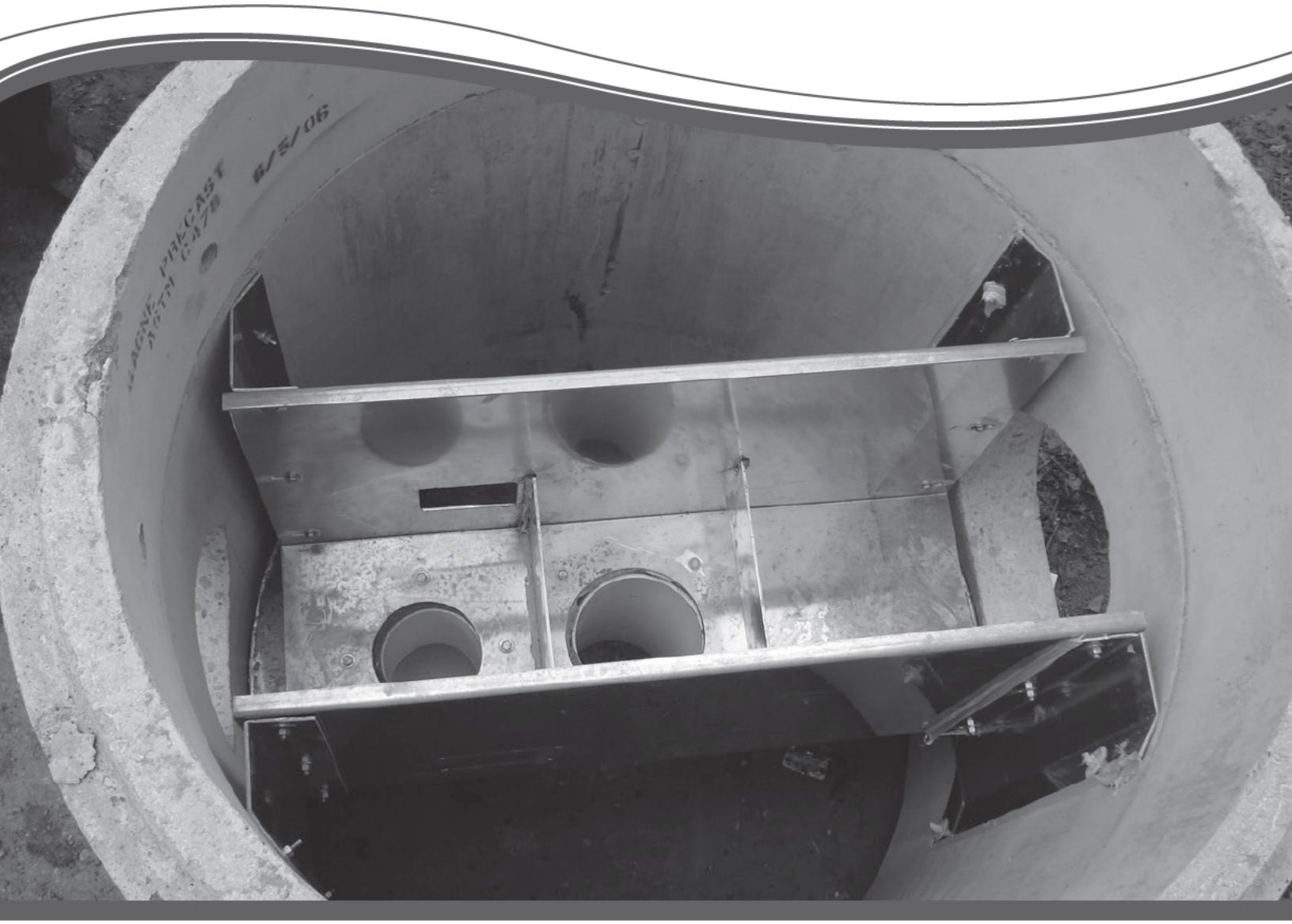
- Identification of endangered species habitats;
- Identification of historic properties;
- Identification of drainage areas and potential stormwater contaminants;
- Description of storm water management controls and various Best Management Practices (BMPs) necessary to reduce erosion, sediment and pollutants in storm water discharge;
- Description of the project's monitoring plan and how controls will be coordinated with construction activities; and a
- Description of the implementation schedule and provisions for amendment of the plan.

Once a General Contractor is selected, a SWPPP will be provided. An NOI will be submitted through the EPA for coverage under the NPDES Construction General permit at least 14 days prior to earth disturbing activities.

Appendix IX VortSentry HS Guide Operation, Design, Performance and Maintenance

CONTECH®
ENGINEERED SOLUTIONS

VortSentry® HS Guide
Operation, Design, Performance and Maintenance



VortSentry® HS

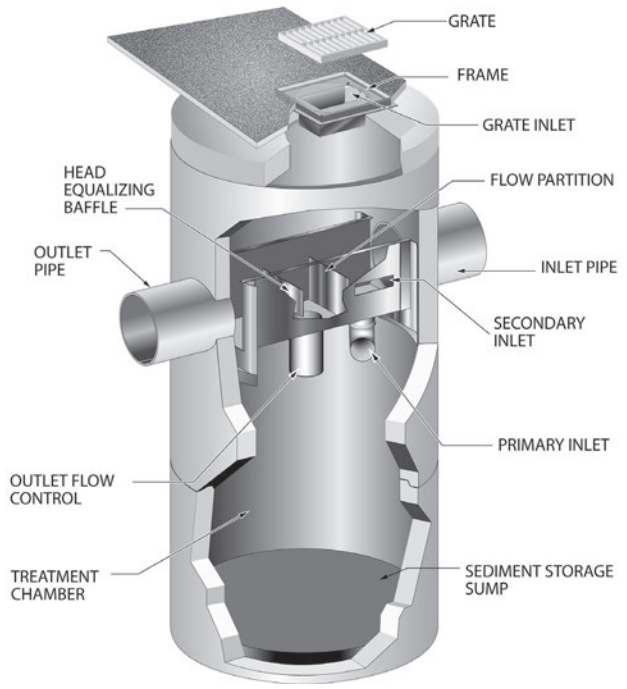
The VortSentry HS is a compact, below grade stormwater treatment system that employs helical flow technology to enhance gravitational separation of floating and settling pollutants from stormwater flows. With the ability to accept a wide range of pipe sizes, the VortSentry HS can treat and convey flows from small to large sites. A unique internal bypass design means higher flows can be diverted without the use of external bypass structures. The VortSentry HS is also available in a grate inlet configuration, which is ideal for retrofit installations.

Operation Overview

Low, frequently occurring storm flows are directed into the treatment chamber through the primary inlet. The tangentially oriented downward pipe induces a swirling motion in the treatment chamber that increases capture and containment abilities. Moderate storm flows are directed into the treatment chamber through the secondary inlet, which allows for capture of floating trash and debris. The secondary inlet also provides for treatment of higher flows without significantly increasing the velocity or turbulence in the treatment chamber. This allows for a more quiescent separation environment. Settleable solids and floating pollutants are captured and contained in the treatment chamber.

Flow exits the treatment chamber through the outlet flow control, which manages the amount of flow that is treated and helps maintain the helical flow patterns developed within the treatment chamber.

Flows exceeding the system's rated treatment flow are diverted away from the treatment chamber by the flow partition. Internal diversion of high flows eliminates the need for external bypass structures. During bypass, the head equalizing baffle applies head on the outlet flow control to limit the flow through the treatment chamber. This helps prevent re-suspension of previously captured pollutants.



Design Basics

There are two primary methods of sizing a VortSentry HS system. The Water Quality Flow Rate Method determines which model size provides the desired removal efficiency at a given flow for a defined particle size. The summation process of the Rational Rainfall Method is used when a specific removal efficiency of the net annual sediment load is required.

Typically, VortSentry HS systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a particle gradation with an average particle size (d_{50}) of 240-microns (μm).

Water Quality Flow Rate Method

In many cases, regulations require that a specific flow rate, often referred to as the water quality design flow (WQQ), be treated. This WQQ represents the peak flow rate from either an event with a specific recurrence interval (i.e. the six-month storm) or a water quality depth (i.e. 1/2-inch of rainfall).

The VortSentry HS is designed to treat all flows up to the WQQ. Due to its internal bypass weir configuration, flow rates in the treatment chamber only increase minimally once the WQQ is surpassed. At influent rates higher than the WQQ, the flow partition will allow most flow exceeding the treatment flow rate to bypass the treatment chamber. This allows removal efficiency to remain relatively constant in the treatment chamber and reduces the risk of washout during bypass flows regardless of influent flow rates.

Treatment flow rates are defined as the rate at which the VortSentry HS will remove a specific gradation of sediment at a specific removal efficiency. Therefore they are variable based on the gradation and removal efficiency specified by the design engineer and the unit size is scaled according to the project goal.

Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. The Rational Rainfall Method is a sizing program Contech uses to estimate a net annual sediment load reduction for a particular VortSentry HS model based on site size, site runoff coefficient, regional rainfall intensity distribution, and anticipated pollutant characteristics. For more information on the Rational Rainfall Method, see *Vortechs Technical Bulletin 4: Modeling Long Term Load Reduction: The Rational Rainfall Method*, available at **www.ContechES.com/stormwater**

Treatment Flow Rate

The outlet flow control is sized to allow the WQQ to pass entirely through the treatment chamber at a water surface elevation equal to the crest of the flow partition. The head equalizing baffle applies head on the outlet flow control to limit the flow through the treatment chamber when bypass occurs, thus helping to prevent re-suspension or re-entrainment of previously captured particles.

Hydraulic Capacity

The VortSentry HS is available in three standard configurations: inline (with inlet and outlet pipes at 180° to each other), grated inlet, and a combination of grate and pipe inlets. All three configurations are available in 36-inch (900-mm) through 96-inch (2400-mm) diameter manholes.

The configuration of the system is determined by the suffix of the model name:

- A model name without a suffix denotes a standard pipe inlet (Example HS48).
- A "G" at the end of the model designation denotes a grate inlet (Example HS48G).
- A "GP" at the end of the model designation denotes a combination of grate and pipe inlets (Example HS48GP).

Performance

Full-Scale Laboratory Test Results

Laboratory testing of the VortSentry HS was conducted using F-55 Silica, a commercially available sand product with an average particle size of 240-μm (Table 1). This material was metered into a model HS48 VortSentry HS at an average concentration of between 250-mg/L and 300-mg/L at flow rates ranging from 0.50-cfs to 1.5-cfs (14-L/s to 56-L/s).

US Standard Sieve Size	Particle Size Micron (μm)	Cumulative Passing %
30	600	99.7%
40	425	95.7%
50	300	74.7%
70	212	33.7%
100	150	6.7%
140	106	0.7%

Table 1 : US Silica F-55 Particle Size Distribution

Removal efficiencies at each flow rate were calculated based on net sediment loads passing the influent and effluent sampling points. Results are illustrated in Figure 1.

Assuming that sediment in the inlet chamber is ideally mixed, removal rates through the system will decay according to the percentage of flow bypassed. This effect has been observed in the laboratory where the test system is designed to produce a

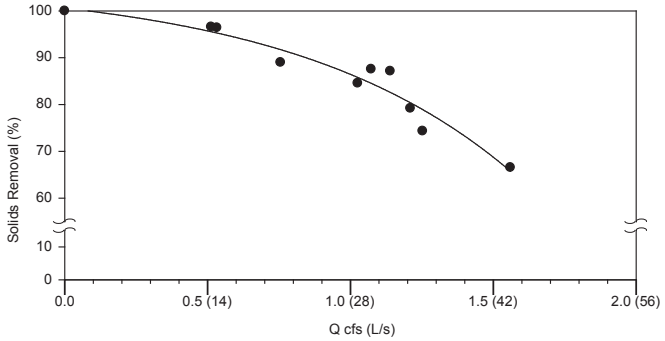


Figure 1: VortSentry HS Removal Efficiencies for 240-μm Particle Gradation

thoroughly mixed inlet stream. All VortSentry HS models have the same aspect ratio regardless of system diameter (i.e. an increase in diameter results in a corresponding increase in depth). Operating rates are expressed volumetrically.

Removal efficiency at each operating rate is calculated according to the average of volumetric and Froude scaling methods and is described by Equation 1.

$$\text{Equation 1:} \quad \left(\frac{\text{Diameter Prototype}}{\text{Diameter Model}}\right)^{2.75} = \left(\frac{\text{Flow Rate Prototype}}{\text{Flow Rate Model}}\right)$$

Equation 1 and actual laboratory test results were used to determine the flow rate which would be required for the various VortSentry HS models to remove 80% of solids.

View report at **www.ContechES.com/stormwater**

Maintenance

The VortSentry HS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit, i.e., unstable soils or heavy winter sanding will cause the treatment chamber to fill more quickly, but regular sweeping will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant deposition and transport may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (i.e. spring and fall) however more frequent inspections may be necessary in equipment washdown areas and in climates where winter sanding operations may lead to rapid accumulations of a large volume of sediment. It is useful and often required as part of a permit to keep a record of each inspection. A simple inspection and maintenance log form for doing so is available for download at **www.ContechES.com/stormwater**

The VortSentry HS should be cleaned when the sediment has accumulated to a depth of two feet in the treatment chamber. This determination can be made by taking two measurements with a stadia rod or similar measuring device; one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the distance given in Table 2, the VortSentry HS should be maintained to ensure effective treatment.

Cleaning

Cleaning of the VortSentry HS should be done during dry weather conditions when no flow is entering the system. Cleanout of the VortSentry HS with a vacuum truck is generally the most effective and convenient method of excavating pollutants from the system. Simply remove the manhole cover and insert the vacuum hose into the sump. All pollutants can be removed from this one access point from the surface with no requirements for Confined Space Entry.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use adsorbent pads, which solidify the oils. These are usually much easier to remove from the unit individually, and less expensive to dispose than the oil/water emulsion that may be

created by vacuuming the oily layer. Floating trash can be netted out if you wish to separate it from the other pollutants.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure proper safety precautions. If anyone physically enters the unit, Confined Space Entry procedures need to be followed.

Disposal of all material removed from the VortSentry HS should be done is accordance with local regulations. In many locations, disposal of evacuated sediments may be handled in the same manner as disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.

VortSentry HS Model	Diameter		Distance Between Water Surface and Top of Storage Sump		Sediment Storage		Oil Spill Storage	
	in.	m	ft.	m	yd^3	m^3	gal.	liter
HS36	36	0.9	3.6	1.1	0.5	0.4	83	314
HS48	48	1.2	4.7	1.4	0.9	0.7	158	598
HS60	60	1.5	6.0	1.8	1.5	1.1	258	978
HS72	72	1.8	7.1	2.2	2.1	1.6	372	1409
HS84	84	2.1	8.4	2.6	2.9	2.2	649	2458
HS96	96	2.4	9.5	2.9	3.7	2.8	845	3199

Table 2: VortSentry HS Maintenance Indicators and Sediment Storage Capacities.

Note: To avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile. Finer, silty particles at the top of the pile may be more difficult to feel with the measuring stick. These finer particles typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.

Logon to **www.ContechES.com/stormwater** to download the VortSentry HS Inspection and Maintenance Log.

For assistance with maintaining your VortSentry HS, contact us regarding the Contech Maintenance compliance certification program.

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Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater and earth stabilization products. For information on other Contech division offerings, visit ContechES.com or call 800.338.1122

The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; 7,296,692; 7,297,266; related foreign patents or other patents pending.

Support

- Drawings and specifications are available at contechstormwater.com.
- Site-specific design support is available from our engineers.