Stormwater Management Report

81 River Street
Acton, MA

April, 2008

COMMONWEALTH OF MASSACHUSETTS
DOUGLAS E. MILLER
CIVIL
No. 33965
REGISTERED PROFESSIONAL ENGINEER

4/30/08

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Project No:
071033A

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Section 1

Introduction and Methodology

Introduction and Methodology

This report is intended to accompany site plans for a proposed redevelopment project at 81 River Street, Acton, MA. Included in this report are stormwater management calculations that support final engineering design as required by the Wetlands Protection Act, and the Town of Acton Rules and Regulations for Site Plan Special Permits. Comparison of the redevelopment is summarized and presented by means of "pre-development" and "post-development" scenarios. This allows the project's potential impacts to be identified, quantified and, as necessary, mitigated.

The design intent seeks to meet the following interrelated goals:

1. Limit post development stormwater runoff rates for the 2-, 10- and 100-year storms to pre-development levels.

2. Limit post development stormwater runoff volumes for the 2-, 10- and 100-year storms to pre-development levels.

3. Apply Stormwater Management Standards through the implementation of Best Management Practices (BMP's) that address Total Suspended Solids (TSS) removal, groundwater recharge, and prevent appreciable sediment transport by trapping sediment on site;

4. Provide adequate drainage for new surfaces;

5. Provide a cost-effective engineering solution that addresses regulatory as well as real-world constraints.

Site Description

The existing watershed under study covers approximately 1.68± acres. The subject property contains 2.9± acres of land. A portion of the site, including Fort Pond Brook and adjacent wetland area, as well as the respective Riverfront and Buffer Zone remain unaltered throughout construction and therefore for simplification, were not addressed within the stormwater management analysis. The current use of the site is an abandoned mill building with a great deal of construction debris such as abandoned trailers, pipe, demo debris, etc. There are at least two historically used entrances from River Street to the subject site. The majority of the site is densely compacted gravel parking that has been traversed for many years. Small areas within the gravel parking have grown in with invasive underbrush, but the underlying material is basically impervious. The site ranges in elevation from 169 feet at the northern property line to elevation 155 feet at the bank of Fort Pond Brook. Soils within the watershed under study are predominantly classified as Scituate Fine Sandy Loam (317B) of hydraulic soil group "C" with lesser amounts of Charlton Hollis Outcrop (103D) adjacent to the river.

Stormwater Quality

When viewed as a whole, the development meets the MDEP Stormwater Management Standards for a redevelopment project through the employment of Best Management Practices that address groundwater recharge, water quality (first flush) retention, and suspended solids removal. See Appendix for calculated quantities and volumes.

Section 2

Hydrology Summary for 24-hour Storm

HYDROLOGY SUMMARY FOR 24-HOUR STORM

81 River Stre
Acton, MA
Project No. 071033A

PEAK RATE OF FLOW OFF-SITE

Storm Event	2-year			10-year		
	(CFS)	(CFS)	(CFS)	(CFS)	(CFS)	(CFS)
	Existing	Developed	Difference	Existing	Developed	Difference
AP-1	1.1	0.6	**-0.6**	1.7	1.0	**-0.7**
AP-2	3.9	1.1	**-2.8**	6.0	3.6	**-2.4**

Storm Event	100-year		
	(CFS)	(CFS)	(CFS)
	Existing	Developed	Difference
AP-1	2.6	1.7	**-0.9**
AP-2	8.9	7.0	**-1.9**

VOLUME OF FLOW OFF-SITE

Storm Event	2-year			10-year		
	(CF)	(CF)	(CF)	(CF)	(CF)	(CF)
	Existing	Developed	Difference	Existing	Developed	Difference
AP-1	3659	1916	**-1743**	5706	3354	**-2352**
AP-2	12632	5532	**-7100**	19906	11804	**-8102**

Storm Event	100-year		
	(CF)	(CF)	(CF)
	Existing	Developed	Difference
AP-1	8624	5576	**-3048**
AP-2	29838	21518	**-8320**

Section 3

Mass DEP - Stormwater Checklist and Certification

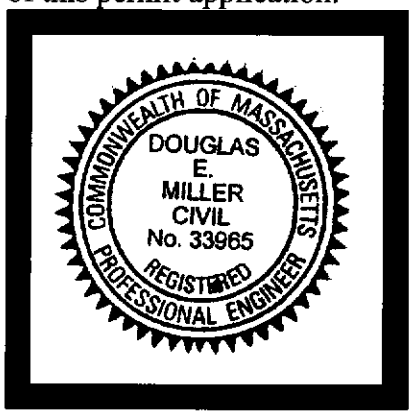
Stormwater Checklist and Certification

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 to comprise 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 Douglas E. Miller 4/30/08
Signature, Date

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

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 Vegetated Filter Strip with stone diaphragm

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.

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: Circle 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.
- ☐ 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;

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

- 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.

☐ 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.

N/A **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.

N/A

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.

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.
  - ☐ 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.

☐ 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.

Section 4

Bioretention Pond Summary for 24-hour Storm

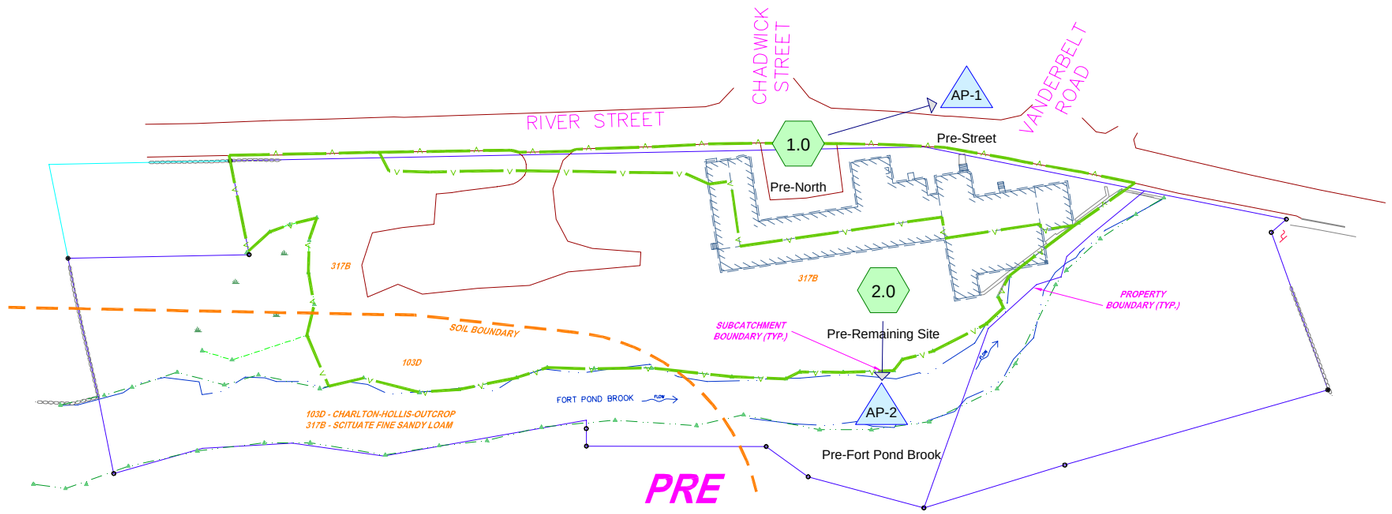
BIORETENTION POND SUMMARY FOR 24-HOUR STORM

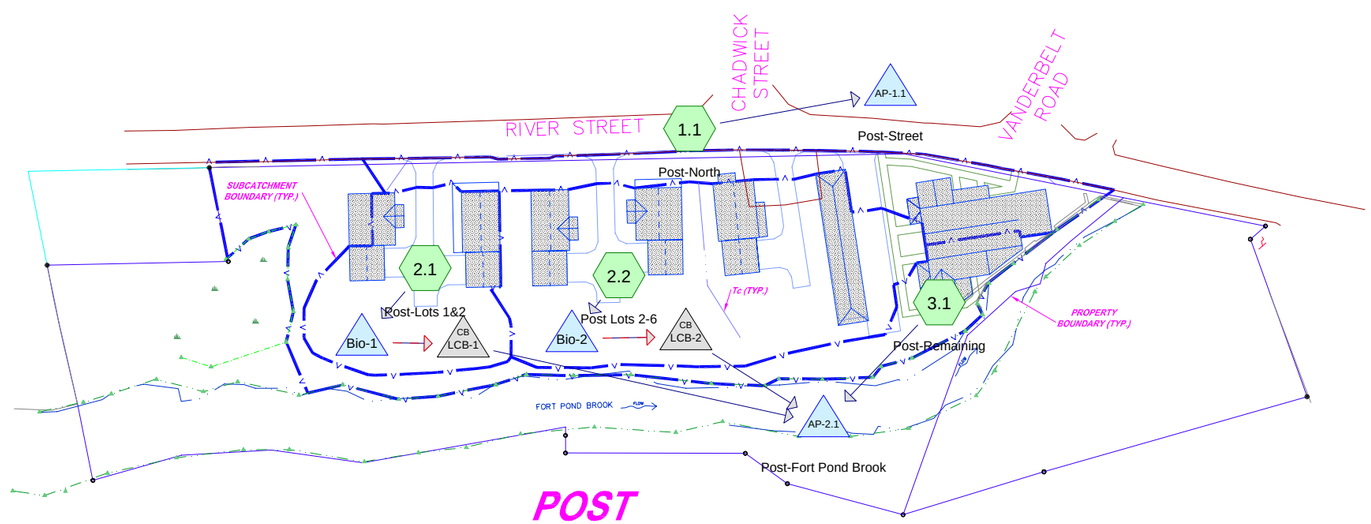
81 River Street
Acton, MA
Project No. 071033A

Basin Characteristics	Bioretention #1	Bioretention #2
Top of Berm El.	163.25	158.25
Bottom of Basin El.	162.00	157.00
Low Level Outlet El.	162.50	157.50
Spillway El.	162.75	157.75
2 Year Storm		
Peak storage El.	162.53	157.62
Peak storage (CF)	905	1,289
Depth of peak storage (FT)	0.53	0.62
Freeboard available (FT)	0.72	0.63
10 Year Storm		
Peak storage El.	162.62	157.71
Peak storage (CF)	1,066	1,513
Depth of peak storage (FT)	0.62	0.71
Freeboard available (FT)	0.63	0.54
100 Year Storm		
Peak storage El.	162.68	157.80
Peak storage (CF)	1,198	1,605
Depth of peak storage (FT)	0.68	0.80
Freeboard available (FT)	0.57	0.45

Section 5

Appendix





Subcat Reach Pond Link

Drainage Diagram for Pre_Post_1

Prepared by Goldsmith, Prest & Ringwall, Inc., Printed 4/30/2008

HydroCAD® 8.50 s/n 001036 © 2007 HydroCAD Software Solutions LLC

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1.0: Pre-North Runoff Area=17,910 sf 85.00% Impervious Runoff Depth>2.45"
Tc=5.0 min CN=94 Runoff=1.14 cfs 0.084 af

Subcatchment 1.1: Post-North Runoff Area=14,333 sf 42.35% Impervious Runoff Depth>1.60"
Flow Length=485' Tc=7.1 min CN=84 Runoff=0.59 cfs 0.044 af

Subcatchment 2.0: Pre-Remaining Site Runoff Area=61,886 sf 85.00% Impervious Runoff Depth>2.45"
Tc=5.0 min CN=94 Runoff=3.94 cfs 0.290 af

Subcatchment 2.1: Post-Lots 1&2 Runoff Area=14,515 sf 35.48% Impervious Runoff Depth>1.53"
Tc=5.0 min CN=83 Runoff=0.60 cfs 0.042 af

Subcatchment 2.2: Post Lots 2-6 Runoff Area=32,937 sf 39.53% Impervious Runoff Depth>1.53"
Flow Length=115' Tc=8.2 min CN=83 Runoff=1.23 cfs 0.096 af

Subcatchment 3.1: Post-Remaining Runoff Area=18,011 sf 19.43% Impervious Runoff Depth>1.08"
Tc=5.0 min CN=76 Runoff=0.51 cfs 0.037 af

Pond AP-1: Pre-Street Inflow=1.14 cfs 0.084 af
Primary=1.14 cfs 0.084 af

Pond AP-1.1: Post-Street Inflow=0.59 cfs 0.044 af
Primary=0.59 cfs 0.044 af

Pond AP-2: Pre-Fort Pond Brook Inflow=3.94 cfs 0.290 af
Primary=3.94 cfs 0.290 af

Pond AP-2.1: Post-Fort Pond Brook Inflow=1.10 cfs 0.127 af
Primary=1.10 cfs 0.127 af

Pond Bio-1: Peak Elev=162.53' Storage=905 cf Inflow=0.60 cfs 0.042 af
Discarded=0.00 cfs 0.003 af Primary=0.13 cfs 0.020 af Secondary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.023 af

Pond Bio-2: Peak Elev=157.62' Storage=1,289 cf Inflow=1.23 cfs 0.096 af
Discarded=0.00 cfs 0.003 af Primary=0.83 cfs 0.069 af Secondary=0.00 cfs 0.000 af Outflow=0.84 cfs 0.072 af

Pond LCB-1: Peak Elev=161.69' Inflow=0.13 cfs 0.020 af
12.0" x 10.0' Culvert Outflow=0.13 cfs 0.020 af

Pond LCB-2: Peak Elev=157.04' Inflow=0.83 cfs 0.069 af
12.0" x 10.0' Culvert Outflow=0.83 cfs 0.069 af

Total Runoff Area = 3.664 ac Runoff Volume = 0.593 af Average Runoff Depth = 1.94"
40.12% Pervious = 1.470 ac 59.88% Impervious = 2.194 ac

Summary for Subcatchment 1.0: Pre-North

Runoff = 1.14 cfs @ 12.07 hrs, Volume= 0.084 af, Depth> 2.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
17,910	94	Urban commercial, 85% imp, HSG C
2,687		Pervious Area
15,224		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, from roof to street gutter**

Summary for Subcatchment 1.1: Post-North

Runoff = 0.59 cfs @ 12.11 hrs, Volume= 0.044 af, Depth> 1.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
6,070	98	Paved parking & roofs
8,263	74	>75% Grass cover, Good, HSG C
14,333	84	Weighted Average
8,263		Pervious Area
6,070		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	30	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
3.3	455	0.0132	2.33		**Shallow Concentrated Flow, street** Paved Kv= 20.3 fps
7.1	485	Total			

Summary for Subcatchment 2.0: Pre-Remaining Site

Runoff = 3.94 cfs @ 12.07 hrs, Volume= 0.290 af, Depth> 2.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
61,886	94	Urban commercial, 85% imp, HSG C
9,283		Pervious Area
52,603		Impervious Area

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

Summary for Subcatchment 2.1: Post-Lots 1&2

Runoff = 0.60 cfs @ 12.08 hrs, Volume= 0.042 af, Depth> 1.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
5,150	98	Paved parking & roofs
9,365	74	>75% Grass cover, Good, HSG C
14,515	83	Weighted Average
9,365		Pervious Area
5,150		Impervious Area

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

Summary for Subcatchment 2.2: Post Lots 2-6

Runoff = 1.23 cfs @ 12.12 hrs, Volume= 0.096 af, Depth> 1.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
13,021	98	Paved parking & roofs
19,916	74	>75% Grass cover, Good, HSG C
32,937	83	Weighted Average
19,916		Pervious Area
13,021		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0260	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
0.7	65	0.0540	1.63		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.2	115	Total			

Summary for Subcatchment 3.1: Post-Remaining

Runoff = 0.51 cfs @ 12.09 hrs, Volume= 0.037 af, Depth> 1.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
3,500	98	Paved parking & roofs
3,796	74	>75% Grass cover, Good, HSG C
10,715	70	Brush, Fair, HSG C
18,011	76	Weighted Average
14,511		Pervious Area
3,500		Impervious Area

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

Summary for Pond AP-1: Pre-Street

Inflow Area = 0.411 ac, 85.00% Impervious, Inflow Depth > 2.45" for 2-yr event
Inflow = 1.14 cfs @ 12.07 hrs, Volume= 0.084 af
Primary = 1.14 cfs @ 12.07 hrs, Volume= 0.084 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Pond AP-1.1: Post-Street

Inflow Area = 0.329 ac, 42.35% Impervious, Inflow Depth > 1.60" for 2-yr event
Inflow = 0.59 cfs @ 12.11 hrs, Volume= 0.044 af
Primary = 0.59 cfs @ 12.11 hrs, Volume= 0.044 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Pond AP-2: Pre-Fort Pond Brook

Inflow Area = 1.421 ac, 85.00% Impervious, Inflow Depth > 2.45" for 2-yr event
Inflow = 3.94 cfs @ 12.07 hrs, Volume= 0.290 af
Primary = 3.94 cfs @ 12.07 hrs, Volume= 0.290 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Pond AP-2.1: Post-Fort Pond Brook

Inflow Area = 1.503 ac, 33.10% Impervious, Inflow Depth > 1.01" for 2-yr event
Inflow = 1.10 cfs @ 12.23 hrs, Volume= 0.127 af
Primary = 1.10 cfs @ 12.23 hrs, Volume= 0.127 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Pond Bio-1:

Inflow Area = 0.333 ac, 35.48% Impervious, Inflow Depth > 1.53" for 2-yr event
Inflow = 0.60 cfs @ 12.08 hrs, Volume= 0.042 af
Outflow = 0.13 cfs @ 12.52 hrs, Volume= 0.023 af, Atten= 78%, Lag= 26.3 min
Discarded = 0.00 cfs @ 12.52 hrs, Volume= 0.003 af
Primary = 0.13 cfs @ 12.52 hrs, Volume= 0.020 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 162.53' @ 12.52 hrs Surf.Area= 1,927 sf Storage= 905 cf
Flood Elev= 162.75' Surf.Area= 2,100 sf Storage= 1,340 cf

Plug-Flow detention time= 224.0 min calculated for 0.023 af (54% of inflow)
Center-of-Mass det. time= 109.6 min (942.7 - 833.1)

Volume	Invert	Avail.Storage	Storage Description
#1	162.00'	1,340 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
162.00	1,470	280.0	0	0	1,470
162.50	1,900	288.0	840	840	1,858
162.75	2,100	295.0	500	1,340	2,191

Device	Routing	Invert	Outlet Devices
#1	Primary	162.50'	**24.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#2	Secondary	162.75'	**6.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#3	Discarded	162.00'	**0.270 in/hr Exfiltration over Wetted area above invert** Excluded Wetted area = 1,470 sf

Discarded OutFlow Max=0.00 cfs @ 12.52 hrs HW=162.53' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.13 cfs @ 12.52 hrs HW=162.53' TW=161.69' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Weir Controls 0.13 cfs @ 0.60 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=162.00' TW=161.50' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond Bio-2:

Inflow Area =	0.756 ac, 39.53% Impervious, Inflow Depth > 1.53" for 2-yr event				
Inflow =	1.23 cfs @	12.12 hrs,	Volume=	0.096 af	
Outflow =	0.84 cfs @	12.25 hrs,	Volume=	0.072 af,	Atten= 32%, Lag= 7.7 min
Discarded =	0.00 cfs @	12.25 hrs,	Volume=	0.003 af	
Primary =	0.83 cfs @	12.25 hrs,	Volume=	0.069 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 157.62' @ 12.25 hrs Surf.Area= 2,341 sf Storage= 1,289 cf
Flood Elev= 157.75' Surf.Area= 2,450 sf Storage= 1,605 cf

Plug-Flow detention time= 138.9 min calculated for 0.072 af (75% of inflow)
Center-of-Mass det. time= 50.7 min (886.4 - 835.6)

Volume	Invert	Avail.Storage	Storage Description
#1	157.00'	1,605 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
157.00	1,837	401.0	0	0	1,837
157.50	2,245	408.0	1,019	1,019	2,331
157.75	2,450	411.0	587	1,605	2,552

Device	Routing	Invert	Outlet Devices
#1	Primary	157.50'	**24.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#2	Secondary	157.75'	**12.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#3	Discarded	157.00'	**0.270 in/hr Exfiltration over Wetted area above invert** Excluded Wetted area = 1,837 sf

Discarded OutFlow Max=0.00 cfs @ 12.25 hrs HW=157.62' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.83 cfs @ 12.25 hrs HW=157.62' TW=157.03' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Weir Controls 0.83 cfs @ 1.12 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=157.00' TW=156.50' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond LCB-1:

Inflow Area =	0.333 ac, 35.48% Impervious, Inflow Depth > 0.73" for 2-yr event				
Inflow =	0.13 cfs @	12.52 hrs,	Volume=	0.020 af	
Outflow =	0.13 cfs @	12.52 hrs,	Volume=	0.020 af,	Atten= 0%, Lag= 0.0 min
Primary =	0.13 cfs @	12.52 hrs,	Volume=	0.020 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 161.69' @ 12.52 hrs
Flood Elev= 162.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	161.50'	**12.0" x 10.0' long Culvert** CPP, square edge headwall, Ke= 0.500 Outlet Invert= 161.40' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.13 cfs @ 12.52 hrs HW=161.69' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 0.13 cfs @ 1.85 fps)

Summary for Pond LCB-2:

Inflow Area = 0.756 ac, 39.53% Impervious, Inflow Depth > 1.10" for 2-yr event
Inflow = 0.83 cfs @ 12.25 hrs, Volume= 0.069 af
Outflow = 0.83 cfs @ 12.25 hrs, Volume= 0.069 af, Atten= 0%, Lag= 0.0 min
Primary = 0.83 cfs @ 12.25 hrs, Volume= 0.069 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 157.04' @ 12.25 hrs
Flood Elev= 157.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	156.50'	**12.0" x 10.0' long Culvert** CPP, square edge headwall, Ke= 0.500 Outlet Invert= 156.40' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.83 cfs @ 12.25 hrs HW=157.03' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 0.83 cfs @ 2.82 fps)

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1.0: Pre-North Runoff Area=17,910 sf 85.00% Impervious Runoff Depth>3.81"
Tc=5.0 min CN=94 Runoff=1.73 cfs 0.131 af

Subcatchment 1.1: Post-North Runoff Area=14,333 sf 42.35% Impervious Runoff Depth>2.81"
Flow Length=485' Tc=7.1 min CN=84 Runoff=1.03 cfs 0.077 af

Subcatchment 2.0: Pre-Remaining Site Runoff Area=61,886 sf 85.00% Impervious Runoff Depth>3.81"
Tc=5.0 min CN=94 Runoff=5.99 cfs 0.451 af

Subcatchment 2.1: Post-Lots 1&2 Runoff Area=14,515 sf 35.48% Impervious Runoff Depth>2.72"
Tc=5.0 min CN=83 Runoff=1.06 cfs 0.076 af

Subcatchment 2.2: Post Lots 2-6 Runoff Area=32,937 sf 39.53% Impervious Runoff Depth>2.72"
Flow Length=115' Tc=8.2 min CN=83 Runoff=2.21 cfs 0.172 af

Subcatchment 3.1: Post-Remaining Runoff Area=18,011 sf 19.43% Impervious Runoff Depth>2.13"
Tc=5.0 min CN=76 Runoff=1.03 cfs 0.073 af

Pond AP-1: Pre-Street Inflow=1.73 cfs 0.131 af
Primary=1.73 cfs 0.131 af

Pond AP-1.1: Post-Street Inflow=1.03 cfs 0.077 af
Primary=1.03 cfs 0.077 af

Pond AP-2: Pre-Fort Pond Brook Inflow=5.99 cfs 0.451 af
Primary=5.99 cfs 0.451 af

Pond AP-2.1: Post-Fort Pond Brook Inflow=3.57 cfs 0.271 af
Primary=3.57 cfs 0.271 af

Pond Bio-1: Peak Elev=162.62' Storage=1,066 cf Inflow=1.06 cfs 0.076 af
Discarded=0.00 cfs 0.003 af Primary=0.81 cfs 0.053 af Secondary=0.00 cfs 0.000 af Outflow=0.82 cfs 0.056 af

Pond Bio-2: Peak Elev=157.71' Storage=1,513 cf Inflow=2.21 cfs 0.172 af
Discarded=0.00 cfs 0.004 af Primary=2.00 cfs 0.144 af Secondary=0.00 cfs 0.000 af Outflow=2.01 cfs 0.148 af

Pond LCB-1: Peak Elev=162.03' Inflow=0.81 cfs 0.053 af
12.0" x 10.0' Culvert Outflow=0.81 cfs 0.053 af

Pond LCB-2: Peak Elev=157.42' Inflow=2.00 cfs 0.144 af
12.0" x 10.0' Culvert Outflow=2.00 cfs 0.144 af

Total Runoff Area = 3.664 ac Runoff Volume = 0.980 af Average Runoff Depth = 3.21"
40.12% Pervious = 1.470 ac 59.88% Impervious = 2.194 ac

Summary for Subcatchment 1.0: Pre-North

Runoff = 1.73 cfs @ 12.07 hrs, Volume= 0.131 af, Depth> 3.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
17,910	94	Urban commercial, 85% imp, HSG C
2,687		Pervious Area
15,224		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, from roof to street gutter**

Summary for Subcatchment 1.1: Post-North

Runoff = 1.03 cfs @ 12.10 hrs, Volume= 0.077 af, Depth> 2.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
6,070	98	Paved parking & roofs
8,263	74	>75% Grass cover, Good, HSG C
14,333	84	Weighted Average
8,263		Pervious Area
6,070		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	30	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
3.3	455	0.0132	2.33		**Shallow Concentrated Flow, street** Paved Kv= 20.3 fps
7.1	485	Total			

Summary for Subcatchment 2.0: Pre-Remaining Site

Runoff = 5.99 cfs @ 12.07 hrs, Volume= 0.451 af, Depth> 3.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
61,886	94	Urban commercial, 85% imp, HSG C
9,283		Pervious Area
52,603		Impervious Area

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

Summary for Subcatchment 2.1: Post-Lots 1&2

Runoff = 1.06 cfs @ 12.08 hrs, Volume= 0.076 af, Depth> 2.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
5,150	98	Paved parking & roofs
9,365	74	>75% Grass cover, Good, HSG C
14,515	83	Weighted Average
9,365		Pervious Area
5,150		Impervious Area

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

Summary for Subcatchment 2.2: Post Lots 2-6

Runoff = 2.21 cfs @ 12.12 hrs, Volume= 0.172 af, Depth> 2.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
13,021	98	Paved parking & roofs
19,916	74	>75% Grass cover, Good, HSG C
32,937	83	Weighted Average
19,916		Pervious Area
13,021		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0260	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
0.7	65	0.0540	1.63		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.2	115	Total			

Summary for Subcatchment 3.1: Post-Remaining

Runoff = 1.03 cfs @ 12.08 hrs, Volume= 0.073 af, Depth> 2.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
3,500	98	Paved parking & roofs
3,796	74	>75% Grass cover, Good, HSG C
10,715	70	Brush, Fair, HSG C
18,011	76	Weighted Average
14,511		Pervious Area
3,500		Impervious Area

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

Summary for Pond AP-1: Pre-Street

Inflow Area = 0.411 ac, 85.00% Impervious, Inflow Depth > 3.81" for 10-yr event
Inflow = 1.73 cfs @ 12.07 hrs, Volume= 0.131 af
Primary = 1.73 cfs @ 12.07 hrs, Volume= 0.131 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Pond AP-1.1: Post-Street

Inflow Area = 0.329 ac, 42.35% Impervious, Inflow Depth > 2.81" for 10-yr event
Inflow = 1.03 cfs @ 12.10 hrs, Volume= 0.077 af
Primary = 1.03 cfs @ 12.10 hrs, Volume= 0.077 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Pond AP-2: Pre-Fort Pond Brook

Inflow Area = 1.421 ac, 85.00% Impervious, Inflow Depth > 3.81" for 10-yr event
Inflow = 5.99 cfs @ 12.07 hrs, Volume= 0.451 af
Primary = 5.99 cfs @ 12.07 hrs, Volume= 0.451 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Pond AP-2.1: Post-Fort Pond Brook

Inflow Area = 1.503 ac, 33.10% Impervious, Inflow Depth > 2.16" for 10-yr event
Inflow = 3.57 cfs @ 12.14 hrs, Volume= 0.271 af
Primary = 3.57 cfs @ 12.14 hrs, Volume= 0.271 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Pond Bio-1:

Inflow Area =	0.333 ac, 35.48% Impervious, Inflow Depth > 2.72" for 10-yr event				
Inflow =	1.06 cfs @	12.08 hrs,	Volume=	0.076 af	
Outflow =	0.82 cfs @	12.16 hrs,	Volume=	0.056 af,	Atten= 23%, Lag= 4.8 min
Discarded =	0.00 cfs @	12.16 hrs,	Volume=	0.003 af	
Primary =	0.81 cfs @	12.16 hrs,	Volume=	0.053 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 162.62' @ 12.16 hrs Surf.Area= 1,992 sf Storage= 1,066 cf
Flood Elev= 162.75' Surf.Area= 2,100 sf Storage= 1,340 cf

Plug-Flow detention time= 141.6 min calculated for 0.056 af (74% of inflow)
Center-of-Mass det. time= 53.6 min (870.0 - 816.4)

Volume	Invert	Avail.Storage	Storage Description
#1	162.00'	1,340 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
162.00	1,470	280.0	0	0	1,470
162.50	1,900	288.0	840	840	1,858
162.75	2,100	295.0	500	1,340	2,191

Device	Routing	Invert	Outlet Devices
#1	Primary	162.50'	**24.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#2	Secondary	162.75'	**6.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#3	Discarded	162.00'	**0.270 in/hr Exfiltration over Wetted area above invert** Excluded Wetted area = 1,470 sf

Discarded OutFlow Max=0.00 cfs @ 12.16 hrs HW=162.62' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.80 cfs @ 12.16 hrs HW=162.62' TW=162.02' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Weir Controls 0.80 cfs @ 1.11 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=162.00' TW=161.50' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond Bio-2:

Inflow Area =	0.756 ac, 39.53% Impervious, Inflow Depth > 2.72" for 10-yr event				
Inflow =	2.21 cfs @	12.12 hrs,	Volume=	0.172 af	
Outflow =	2.01 cfs @	12.17 hrs,	Volume=	0.148 af,	Atten= 9%, Lag= 2.9 min
Discarded =	0.00 cfs @	12.17 hrs,	Volume=	0.004 af	
Primary =	2.00 cfs @	12.17 hrs,	Volume=	0.144 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 157.71' @ 12.17 hrs Surf.Area= 2,418 sf Storage= 1,513 cf
Flood Elev= 157.75' Surf.Area= 2,450 sf Storage= 1,605 cf

Plug-Flow detention time= 92.5 min calculated for 0.147 af (86% of inflow)
Center-of-Mass det. time= 32.2 min (851.2 - 819.0)

Volume	Invert	Avail.Storage	Storage Description
#1	157.00'	1,605 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
157.00	1,837	401.0	0	0	1,837
157.50	2,245	408.0	1,019	1,019	2,331
157.75	2,450	411.0	587	1,605	2,552

Device	Routing	Invert	Outlet Devices
#1	Primary	157.50'	**24.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#2	Secondary	157.75'	**12.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#3	Discarded	157.00'	**0.270 in/hr Exfiltration over Wetted area above invert** Excluded Wetted area = 1,837 sf

Discarded OutFlow Max=0.00 cfs @ 12.17 hrs HW=157.71' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=1.96 cfs @ 12.17 hrs HW=157.71' TW=157.40' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Weir Controls 1.96 cfs @ 1.49 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=157.00' TW=156.50' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond LCB-1:

Inflow Area =	0.333 ac, 35.48% Impervious, Inflow Depth > 1.92" for 10-yr event				
Inflow =	0.81 cfs @	12.16 hrs,	Volume=	0.053 af	
Outflow =	0.81 cfs @	12.16 hrs,	Volume=	0.053 af,	Atten= 0%, Lag= 0.0 min
Primary =	0.81 cfs @	12.16 hrs,	Volume=	0.053 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 162.03' @ 12.16 hrs
Flood Elev= 162.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	161.50'	**12.0" x 10.0' long Culvert** CPP, square edge headwall, Ke= 0.500 Outlet Invert= 161.40' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.80 cfs @ 12.16 hrs HW=162.02' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 0.80 cfs @ 2.80 fps)

Summary for Pond LCB-2:

Inflow Area = 0.756 ac, 39.53% Impervious, Inflow Depth > 2.29" for 10-yr event
Inflow = 2.00 cfs @ 12.17 hrs, Volume= 0.144 af
Outflow = 2.00 cfs @ 12.17 hrs, Volume= 0.144 af, Atten= 0%, Lag= 0.0 min
Primary = 2.00 cfs @ 12.17 hrs, Volume= 0.144 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 157.42' @ 12.17 hrs
Flood Elev= 157.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	156.50'	**12.0" x 10.0' long Culvert** CPP, square edge headwall, Ke= 0.500 Outlet Invert= 156.40' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.96 cfs @ 12.17 hrs HW=157.40' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 1.96 cfs @ 3.46 fps)

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1.0: Pre-North Runoff Area=17,910 sf 85.00% Impervious Runoff Depth>5.79"
Tc=5.0 min CN=94 Runoff=2.57 cfs 0.198 af

Subcatchment 1.1: Post-North Runoff Area=14,333 sf 42.35% Impervious Runoff Depth>4.66"
Flow Length=485' Tc=7.1 min CN=84 Runoff=1.68 cfs 0.128 af

Subcatchment 2.0: Pre-Remaining Site Runoff Area=61,886 sf 85.00% Impervious Runoff Depth>5.79"
Tc=5.0 min CN=94 Runoff=8.88 cfs 0.685 af

Subcatchment 2.1: Post-Lots 1&2 Runoff Area=14,515 sf 35.48% Impervious Runoff Depth>4.55"
Tc=5.0 min CN=83 Runoff=1.76 cfs 0.126 af

Subcatchment 2.2: Post Lots 2-6 Runoff Area=32,937 sf 39.53% Impervious Runoff Depth>4.55"
Flow Length=115' Tc=8.2 min CN=83 Runoff=3.64 cfs 0.287 af

Subcatchment 3.1: Post-Remaining Runoff Area=18,011 sf 19.43% Impervious Runoff Depth>3.81"
Tc=5.0 min CN=76 Runoff=1.85 cfs 0.131 af

Pond AP-1: Pre-Street Inflow=2.57 cfs 0.198 af
Primary=2.57 cfs 0.198 af

Pond AP-1.1: Post-Street Inflow=1.68 cfs 0.128 af
Primary=1.68 cfs 0.128 af

Pond AP-2: Pre-Fort Pond Brook Inflow=8.88 cfs 0.685 af
Primary=8.88 cfs 0.685 af

Pond AP-2.1: Post-Fort Pond Brook Inflow=7.01 cfs 0.494 af
Primary=7.01 cfs 0.494 af

Pond Bio-1: Peak Elev=162.68' Storage=1,198 cf Inflow=1.76 cfs 0.126 af
Discarded=0.00 cfs 0.003 af Primary=1.59 cfs 0.104 af Secondary=0.00 cfs 0.000 af Outflow=1.59 cfs 0.107 af

Pond Bio-2: Peak Elev=158.02' Storage=1,605 cf Inflow=3.64 cfs 0.287 af
Discarded=0.00 cfs 0.004 af Primary=3.31 cfs 0.247 af Secondary=1.52 cfs 0.012 af Outflow=3.72 cfs 0.263 af

Pond LCB-1: Peak Elev=162.29' Inflow=1.59 cfs 0.104 af
12.0" x 10.0' Culvert Outflow=1.59 cfs 0.104 af

Pond LCB-2: Peak Elev=158.04' Inflow=3.71 cfs 0.259 af
12.0" x 10.0' Culvert Outflow=3.71 cfs 0.259 af

Total Runoff Area = 3.664 ac Runoff Volume = 1.556 af Average Runoff Depth = 5.10"
40.12% Pervious = 1.470 ac 59.88% Impervious = 2.194 ac

Summary for Subcatchment 1.0: Pre-North

Runoff = 2.57 cfs @ 12.07 hrs, Volume= 0.198 af, Depth> 5.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
17,910	94	Urban commercial, 85% imp, HSG C
2,687		Pervious Area
15,224		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, from roof to street gutter**

Summary for Subcatchment 1.1: Post-North

Runoff = 1.68 cfs @ 12.10 hrs, Volume= 0.128 af, Depth> 4.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
6,070	98	Paved parking & roofs
8,263	74	>75% Grass cover, Good, HSG C
14,333	84	Weighted Average
8,263		Pervious Area
6,070		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	30	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
3.3	455	0.0132	2.33		**Shallow Concentrated Flow, street** Paved Kv= 20.3 fps
7.1	485	Total			

Summary for Subcatchment 2.0: Pre-Remaining Site

Runoff = 8.88 cfs @ 12.07 hrs, Volume= 0.685 af, Depth> 5.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
61,886	94	Urban commercial, 85% imp, HSG C
9,283		Pervious Area
52,603		Impervious Area

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

Summary for Subcatchment 2.1: Post-Lots 1&2

Runoff = 1.76 cfs @ 12.07 hrs, Volume= 0.126 af, Depth> 4.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
5,150	98	Paved parking & roofs
9,365	74	>75% Grass cover, Good, HSG C
14,515	83	Weighted Average
9,365		Pervious Area
5,150		Impervious Area

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

Summary for Subcatchment 2.2: Post Lots 2-6

Runoff = 3.64 cfs @ 12.12 hrs, Volume= 0.287 af, Depth> 4.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
13,021	98	Paved parking & roofs
19,916	74	>75% Grass cover, Good, HSG C
32,937	83	Weighted Average
19,916		Pervious Area
13,021		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0260	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
0.7	65	0.0540	1.63		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.2	115	Total			

Summary for Subcatchment 3.1: Post-Remaining

Runoff = 1.85 cfs @ 12.08 hrs, Volume= 0.131 af, Depth> 3.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
3,500	98	Paved parking & roofs
3,796	74	>75% Grass cover, Good, HSG C
10,715	70	Brush, Fair, HSG C
18,011	76	Weighted Average
14,511		Pervious Area
3,500		Impervious Area

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

Summary for Pond AP-1: Pre-Street

Inflow Area = 0.411 ac, 85.00% Impervious, Inflow Depth > 5.79" for 100-yr event
Inflow = 2.57 cfs @ 12.07 hrs, Volume= 0.198 af
Primary = 2.57 cfs @ 12.07 hrs, Volume= 0.198 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Pond AP-1.1: Post-Street

Inflow Area = 0.329 ac, 42.35% Impervious, Inflow Depth > 4.66" for 100-yr event
Inflow = 1.68 cfs @ 12.10 hrs, Volume= 0.128 af
Primary = 1.68 cfs @ 12.10 hrs, Volume= 0.128 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Pond AP-2: Pre-Fort Pond Brook

Inflow Area = 1.421 ac, 85.00% Impervious, Inflow Depth > 5.79" for 100-yr event
Inflow = 8.88 cfs @ 12.07 hrs, Volume= 0.685 af
Primary = 8.88 cfs @ 12.07 hrs, Volume= 0.685 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Pond AP-2.1: Post-Fort Pond Brook

Inflow Area = 1.503 ac, 33.10% Impervious, Inflow Depth > 3.94" for 100-yr event
Inflow = 7.01 cfs @ 12.11 hrs, Volume= 0.494 af
Primary = 7.01 cfs @ 12.11 hrs, Volume= 0.494 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Pond Bio-1:

Inflow Area =	0.333 ac, 35.48% Impervious, Inflow Depth > 4.55" for 100-yr event				
Inflow =	1.76 cfs @	12.07 hrs,	Volume=	0.126 af	
Outflow =	1.59 cfs @	12.12 hrs,	Volume=	0.107 af,	Atten= 10%, Lag= 2.5 min
Discarded =	0.00 cfs @	12.12 hrs,	Volume=	0.003 af	
Primary =	1.59 cfs @	12.12 hrs,	Volume=	0.104 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 162.68' @ 12.12 hrs Surf.Area= 2,044 sf Storage= 1,198 cf
Flood Elev= 162.75' Surf.Area= 2,100 sf Storage= 1,340 cf

Plug-Flow detention time= 103.0 min calculated for 0.107 af (84% of inflow)
Center-of-Mass det. time= 38.0 min (839.9 - 801.9)

Volume	Invert	Avail.Storage	Storage Description
#1	162.00'	1,340 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
162.00	1,470	280.0	0	0	1,470
162.50	1,900	288.0	840	840	1,858
162.75	2,100	295.0	500	1,340	2,191

Device	Routing	Invert	Outlet Devices
#1	Primary	162.50'	**24.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#2	Secondary	162.75'	**6.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#3	Discarded	162.00'	**0.270 in/hr Exfiltration over Wetted area above invert** Excluded Wetted area = 1,470 sf

Discarded OutFlow Max=0.00 cfs @ 12.12 hrs HW=162.68' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=1.55 cfs @ 12.12 hrs HW=162.68' TW=162.28' (Dynamic Tailwater)
└**1=Orifice/Grate** (Weir Controls 1.55 cfs @ 1.38 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=162.00' TW=161.50' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond Bio-2:

Inflow Area =	0.756 ac, 39.53% Impervious, Inflow Depth > 4.55" for 100-yr event				
Inflow =	3.64 cfs @	12.12 hrs,	Volume=	0.287 af	
Outflow =	3.72 cfs @	12.12 hrs,	Volume=	0.263 af,	Atten= 0%, Lag= 0.3 min
Discarded =	0.00 cfs @	12.10 hrs,	Volume=	0.004 af	
Primary =	3.31 cfs @	12.10 hrs,	Volume=	0.247 af	
Secondary =	1.52 cfs @	12.16 hrs,	Volume=	0.012 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 158.02' @ 12.16 hrs Surf.Area= 2,450 sf Storage= 1,605 cf
Flood Elev= 157.75' Surf.Area= 2,450 sf Storage= 1,605 cf

Plug-Flow detention time= 67.6 min calculated for 0.263 af (92% of inflow)
Center-of-Mass det. time= 25.5 min (829.9 - 804.5)

Volume	Invert	Avail.Storage	Storage Description
#1	157.00'	1,605 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
157.00	1,837	401.0	0	0	1,837
157.50	2,245	408.0	1,019	1,019	2,331
157.75	2,450	411.0	587	1,605	2,552

Device	Routing	Invert	Outlet Devices
#1	Primary	157.50'	**24.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#2	Secondary	157.75'	**12.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#3	Discarded	157.00'	**0.270 in/hr Exfiltration over Wetted area above invert** Excluded Wetted area = 1,837 sf

Discarded OutFlow Max=0.00 cfs @ 12.10 hrs HW=157.80' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 12.10 hrs HW=157.79' TW=157.96' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=2.84 cfs @ 12.16 hrs HW=157.99' TW=157.87' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 2.84 cfs @ 0.98 fps)

Summary for Pond LCB-1:

Inflow Area =	0.333 ac, 35.48% Impervious, Inflow Depth > 3.74" for 100-yr event				
Inflow =	1.59 cfs @	12.12 hrs,	Volume=	0.104 af	
Outflow =	1.59 cfs @	12.12 hrs,	Volume=	0.104 af,	Atten= 0%, Lag= 0.0 min
Primary =	1.59 cfs @	12.12 hrs,	Volume=	0.104 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 162.29' @ 12.12 hrs
Flood Elev= 162.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	161.50'	**12.0" x 10.0' long Culvert** CPP, square edge headwall, Ke= 0.500 Outlet Invert= 161.40' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.55 cfs @ 12.12 hrs HW=162.28' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 1.55 cfs @ 3.26 fps)

Summary for Pond LCB-2:

Inflow Area = 0.756 ac, 39.53% Impervious, Inflow Depth > 4.11" for 100-yr event
Inflow = 3.71 cfs @ 12.12 hrs, Volume= 0.259 af
Outflow = 3.71 cfs @ 12.12 hrs, Volume= 0.259 af, Atten= 0%, Lag= 0.0 min
Primary = 3.71 cfs @ 12.12 hrs, Volume= 0.259 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 158.04' @ 12.12 hrs
Flood Elev= 157.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	156.50'	**12.0" x 10.0' long Culvert** CPP, square edge headwall, Ke= 0.500 Outlet Invert= 156.40' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=3.52 cfs @ 12.12 hrs HW=157.97' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 3.52 cfs @ 4.49 fps)

Stormwater Management Standard 3
GROUNDWATER RECHARGE

Pre-Development Conditions

81 River Street
Acton, MA
Project No. 071033A

			Area (sf)	Area (Ac)
Total Subcatchment Areas			79,796	1.83
Total Area of Hydrolic Soil Groups		C	79,796	1.83
Surface Type Areas				
	Impervious	C	67,827	1.56
	Pervious	C	11,969	0.27
Total Impervious Area		C	67,827	1.56

Infiltration Volume

Inches of Recharge per Storm Event	C	0.25

Infiltration Volume = ∑ {[(Total Subcatchment Area within HSG) - (Total Impervious Area within HSG)] x (inches of Recharge Per Storm)}

Infiltration Volume **249 CF**

Stormwater Management Standard 3
GROUNDWATER RECHARGE

Post-Development Conditions

81 River Street
Acton, MA
Project No. 071033A

			Area (sf)	Area (Ac)
Total Subcatchment Areas			79,796	1.83
Total Area of Hydrolic Soil Groups		C	79,796	1.83
Surface Type Areas				
	Impervious	C	27,741	0.64
	Pervious	C	52,055	1.20
Total Impervious Area		C	27,741	0.64

Infiltration Volume

Inches of Recharge per Storm Event	C	0.25

Infiltration Volume = ∑ {[(Total Subcatchment Area within HSG) - (Total Impervious Area within HSG)] x (inches of Recharge Per Storm)}

Infiltration Volume **1,084 CF**

Stormwater Management Standard 4
WATER QUALITY RETENTION VOLUME

81 River Street
Acton, MA
Project No. 071033A

Parameter	Unit	Quantity	Remarks
Watershed area	AC	1.83	
Predevelopment impervious area	AC	1.56	
Total impervious area added	AC	-0.92	**Net Reduction in impervious area**
Total Postdevelopment impervious area	AC	0.64	
Total impervious area required for recharg	AC	0.64	
Area of Higher Potential Pollutant Load?		0	1=yes; 0=no (if yes, see note 2 below)
Runoff to Critical Area?		0	1=yes; 0=no
Runoff depth over impervious area	IN	0.5	
REQUIRED WATER QUALITY RETENTION VOLUME			**VOLUME PROVIDED BY:**
	AC-FT	**0.027**	
	CF	**1,156**	
DESIGN VOLUME PROVIDED	**CF**	**1,864**	**Bioretention Cells**
	CF	**1,864**	
	AC-FT	**0.043**	

Stormwater Management Standard 4
TSS REMOVAL

81 River Street
Acton, MA
Project No. 071033A

Process Train No.	Subcatchment Area (SF)	BMP Type	TSS Removal Rate	TSS Remaining at Discharge	TSS Removed at Discharge
AP-1.1	14,333	SS	5%	95%	5%
AP-2.1	65,463	SS	5%	95%	5%
		Bioretention w/ vegetated filter strip	90%	10%	91%
Total	79,796		Total TSS Removed on Site		**75%**

ABBREVIATIONS:

TSS=total suspended solids; SS=street sweeping; DCB=deep sump catch basin; DB=detention basin; WQI=water quality inlet; WQS=water quality swale; IT=infiltration trench; IB=infiltration basin; DW=dry well; SF=sand filter; SFB=sediment forebay; DC=drainage channel; OF=organic filter

COMPENSATORY FLOOD STORAGE COMPUTATIONS

Site Location: 81 River Street, Acton, MA

Project No. 071033A

By: MS

Floodplain Filled

Elevation FT	Surface Area SF	Incremental Depth FT	Incremental Volume CF	Cumulative Volume CF
157.0	225			
		1.0	113	
158.0	0			113

Compensatory Storage Provided

Elevation FT	Surface Area SF	Incremental Depth FT	Incremental Volume CF	Cumulative Volume CF
157.0	2696			
		1.0	1348	
158.0	0			1348

Notes

[1] As shown, compensatory volume provided at el. 157.0 is 1200% of volume filled.