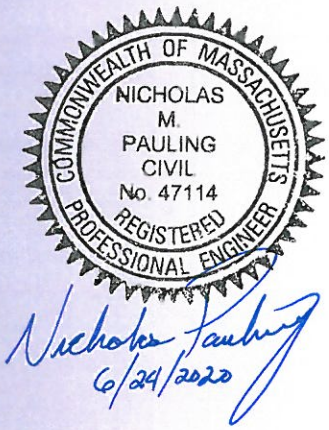
Stormwater Management Report

Hager Homestead
336 King Street
Littleton, MA

April 2020
Revised June 2020

Submitted to:
Littleton Planning Board &
Conservation Commission
37 Shattuck Street
Littleton, MA 01460



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Project No:
191096

GPR Engineering Solutions for Land & Structures

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Section 1

Introduction and Methodology

Introduction and Methodology

This Stormwater Management Report is intended to accompany plans for the proposed residential development known as Hager Homestead at 336-338 King Street, Littleton, MA. Included in this report are calculations that support a final engineering design as required by the state's Wetlands Protection Act Regulations and the Town of Littleton's ordinances and regulations. Site specific information is presented under two scenarios, "pre-development" and "post-development" conditions, so that potential impacts due to the project can be identified, quantified and, as necessary, mitigated.

The final design intent seeks to meet the following interrelated goals:

1. Limit stormwater runoff rates for the 2- and 10-year storm events to existing (pre-development) levels;

2. Evaluate potential on- and off-site flooding during the 100-year storm event due to proposed development;

3. Maintain or increase the volume of stormwater recharged per storm event to those of existing (pre-development) levels;

4. Prevent appreciable sediment and other suspended solids and contaminants transport by trapping them on site via Best Management Practices;

5. Provide adequate drainage for new surfaces;

6. Maintain existing drainage patterns while providing a cost-effective engineering solution that addresses regulatory as well as real-world constraints.

Site Description

The proposed project is a senior residential development located off King Street in Littleton. The project area is comprised of two parcels with a total area of 15.16± Ac. designated as U19-38-0 and U19-38-1 by the Town of Littleton Assessor. The project site consists primarily woods and grass ground cover with wetlands covering the northwest portion of the size. There are three existing buildings on the project site shown on the Existing Conditions Plan. The three existing buildings are shown as #336, #338 and an existing storage building. The limit of disturbance will be limited within the southeast portion of the project site up to outside of the 50-ft wetland buffer limit. The project area / limit of disturbance is approximately 133,541 SF of the total project site, which will also be limit of drainage catchment for analysis purpose.

Available NCRS online soils mapping shows the soils within the project area to be Wareham loamy fine sand, 0 to 5 percent slopes in the northwest portion of the site, Hinckley loam sand, 15 to 25 percent slopes in the northern portion of the site, and Merrimac-Urban land complex, 0 to 8

percent slopes running alone King street. Generally, the Hydraulic Soil Group (HSG) on site is a type A soil group.

GPR has performed soil testing on 12/16/19 (See attached soil testing logs). Deep hole soil test pits shown that the soil within the project area is generally Fine Sand, which should be considered under HSG A for the purpose of drainage analysis. A Hydraulic Soil Group A was used for the design and analysis of the project site.

Under the pre-development scenario, as shown on the plan entitled “PRE-DEVELOPMENT WATERSHED MAP”, included within the attached Appendix. The Subcatchment 1.1 (SC-1.1) describes the portion of the project site outside of the wetland area with runoff flowing northwest into the existing wetland on site, which will be the analysis point AP-1.

Project Description

The purpose of this project is to create a senior residential development known as Hager Homestead. The proposed project will construct a total of 24 residential dwelling units and provide 42 parking spaces for the residents and guests. The proposed project will construct 3 two-family dwelling units, 3 townhouse dwelling units and 15 independent living units. The existing building shown as #336 on the east portion of the project area will be partially demolished, renovated and used as a base for the construction of a common area for the proposed 15 independent living units. The existing building shown as #338 located on the north portion of the project area will also be renovated and incorporated as part of the senior residential development as a two-family dwelling unit. The existing barn building will be renovated and moved northwest outside of the 50’ wetland buffer limit. 3 new residential buildings will be constructed west of the existing #336 building that will provide 7 dwelling units.

The 42 parking spaces will be constructed to serve the proposed development, which will include 2 handicap accessible parking spaces. 14 of the 42 total parking spaces are under a car port as required by the Town of Littleton Zoning bylaw. The 42 parking spaces are spread out in 3 separate parking areas. 17 parking spaces will be located on the parking lot shown on the south portion of the project area with new curb cut access on King Street. A second proposed curb cut access on king street will be located approximately 180 feet north of the south parking area. The north side curb cut access will provide access for the 21 spaces parking area located on the north east portion of the project area, and the 4 spaces parking area located adjacent to the main entrance.

To collect and treat stormwater runoff on site Impervious areas are being directed to proposed BMP’s on site prior to discharging into the existing wetland. The proposed parking areas will each have a deep sump catch basin fitted with a Silt Prison set to pre-treat and discharge into the Infiltration Basin (IB) or Wet Water Quality Swale (WQS) for stormwater attenuation and further treatment prior to discharging into the wetland outside of the project area. In order to provide recharge to the groundwater, clean roof runoff will be collected and conveyed to subsurface Infiltration Chambers (IC) set under the southern parking area. The Infiltration Basin will also provide additional groundwater recharge as well as attenuate stormwater. The proposed BMP’s have been designed in accordance with the Massachusetts Stormwater Standards to attenuate

peak flows, treat runoff from impervious surfaces and maintain groundwater recharge to those of pre-development conditions.

Under the post-development scenario, the project has been divided into a total of 17 subcatchment areas, shown on the plan entitled “POST-DEVELOPMENT WATERSHED MAP”, and included in the attached Appendix, outlining runoff to the development’s analysis point.

SC-1.1, SC-1.2, SC-1.6, SC-1.7, SC-1.8 and SC-2.2 outline stormwater runoff from the proposed roof, lawn area and some unconnected paved walkway being conveyed into the Infiltration Chambers. The Infiltration Chambers will have an overflow pipe flowing to DMH-1.

SC-2.1 outlines runoff from proposed lawn area and car port roof south of the project area flowing directly into the Wet Water Quality Swale.

SC-2.5 outlines runoff from the north side parking area to be collected by a deep sump Silt Prison catch basin to meet the 44% TSS removal and conveyed to the Sediment Forebay / Infiltration Basin prior to discharging into the wetland on site.

SC-2.7 outlines runoff from the east paved parking area and SC-2.6 outlines runoff from the south paved parking area. Both subcatchment areas are to be collected by deep sump Silt Prison catch basins to meet the 44% Total Suspended Solid (TSS) removal requirement and conveyed to the Wet Water Quality Swale (WQS) in order to meet the 80% TSS removal prior to discharging into the wetland on site.

SC-2.8 outlines runoff from the lawn area and wooded area flowing directly into the Sediment Forebay / Infiltration Basin.

SC-1.3, SC-1.4 and SC-1.5 outline stormwater runoff from the proposed clean roof through roof drains and into the Sediment Forebay / Infiltration Basin.

SC-2.3, SC-2.4 and SC-2.9 outline stormwater runoff from the proposed clean roof, lawn area and some unconnected pave walkway flowing through grass ground cover area before flowing into the wetland on site.

Infiltration Chambers and Infiltration Basin are set 2 feet above Estimate Seasonal High Ground Water Table (ESHGW) in order to infiltrate stormwater runoff to meet the requirement stormwater recharge volume of 1,117 CF. Infiltration Chambers, Infiltration Basin and Water Quality Swale will attenuate stormwater runoff onsite, in order to meet or reduce peak stormwater runoff for the 2 and 10-year storm as required by the MassDEP Stormwater Regulations.

Hydrologic and Hydraulic Computation Methodology

Runoff rates were computed using the Soil Conservation Service TR-20 Method entitled “Urban Hydrology for Small Watersheds” within the HydroCAD Stormwater Modeling software platform.

The following 24-hour rainfall events from the Northeast Regional Climate Center (NRCC) Extreme Precipitation Tables database were analyzed:

Frequency (years): 2, 10 and 100

As outlined above, runoff from the site has been analyzed at one point under the pre-development and post-development conditions. As a standard for comparison AP-1 is represented in both the pre and the post development cases.

Summary of Results

Peak discharge rates and volumes of the calculated runoff for both conditions analyzed are displayed in the HYDROLOGY SUMMARY that follows. As shown within the summary, the peak discharge rates for the 2 and 10-year storm events are less than or equal to the pre-development conditions.

The deep sump hooded catch basins fitted with Silt Prison provided Total Suspended Solids (TSS) removal of 63% to meet the pre-treatment requirement of 44%. Sediment Forebay, Infiltration Basin and Water Quality Swale provided additional TSS removal to meet the required 80% TSS Removal per MassDEP Stormwater management standard. The Infiltration Basin and Infiltration Chambers retain and infiltrate 3,515 cubic feet of runoff prior to discharging, well in excess of the minimum required 1,117 cubic feet occurring under existing conditions and displaced by the proposed development.

The wetland on the project site is a small part of a network of wetlands and streams that is contributing runoff into Beaver Brook and ultimately flowing into Forge Pond. The peak discharge rate for the 100-year storm event will have an increase in peak runoff rate of 1.8 cfs of stormwater into AP-1. The peak volume for the 100-year storm event will have an increase in peak volume of 627± cf of stormwater into AP-1. The increase in peak stormwater runoff rate and volume in the 100-year storm event should not increase the potential flooding downstream based on the size of the receiving wetland area. The receiving wetland consists of 248,000± sf (conservatively). Adding an additional 627± cf to the 248,000± sf wetland will increase the water level by 0.03 inches.

The proposed development meets the MassDEP Stormwater Management Standards through the use of Best Management Practices that address groundwater recharge, water quality (first flush) retention, and suspended solids removal within sustainable BMP's. See Appendix for computed solids quantities / removal process trains, and water quality runoff volumes.

Section 2

Hydrology Summary for 24-hour Storm

HYDROLOGY SUMMARY FOR 24-HOUR STORM

Mass co. Housing
336-338 King Street, Littleton, MA
Project No. 191096

PEAK DISCHARGE RATE

Pre-Development (cfs)

Analysis Point	2-YR	10-YR	100-YR
AP-1	0.0	0.9	7.9

Development (cfs)

Analysis Point	2-YR	10-YR	100-YR
AP-1	0.0	0.8	9.7

Pre-Development vs. Developed (cfs)

Analysis Point	2-YR	10-YR	100-YR
AP-1	**0.0**	**-0.1**	**1.8**

Section 3

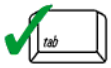
Mass DEP Stormwater Management Report Checklist

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.

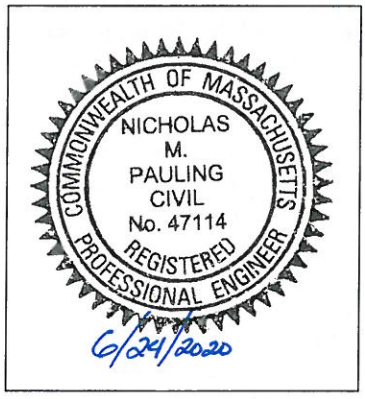
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



Nicholas Pauling 6/24/2020
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): Disconnected Roof Recharge

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;

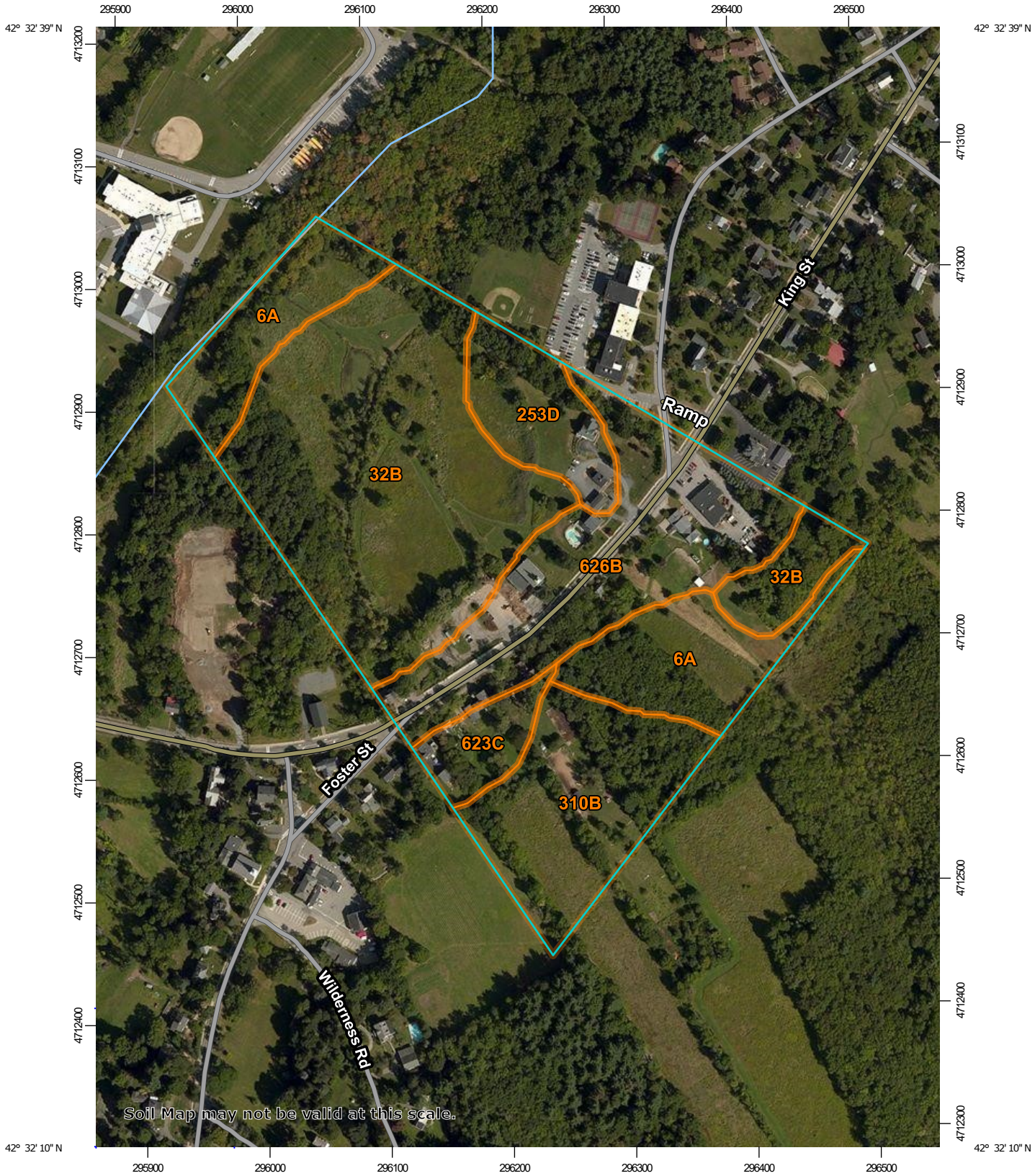
☐ An Illicit Discharge Compliance Statement is attached;

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

Section 4

Appendix

Soil Map—Middlesex County, Massachusetts



Map Scale: 1:4,450 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 19, Sep 12, 2019

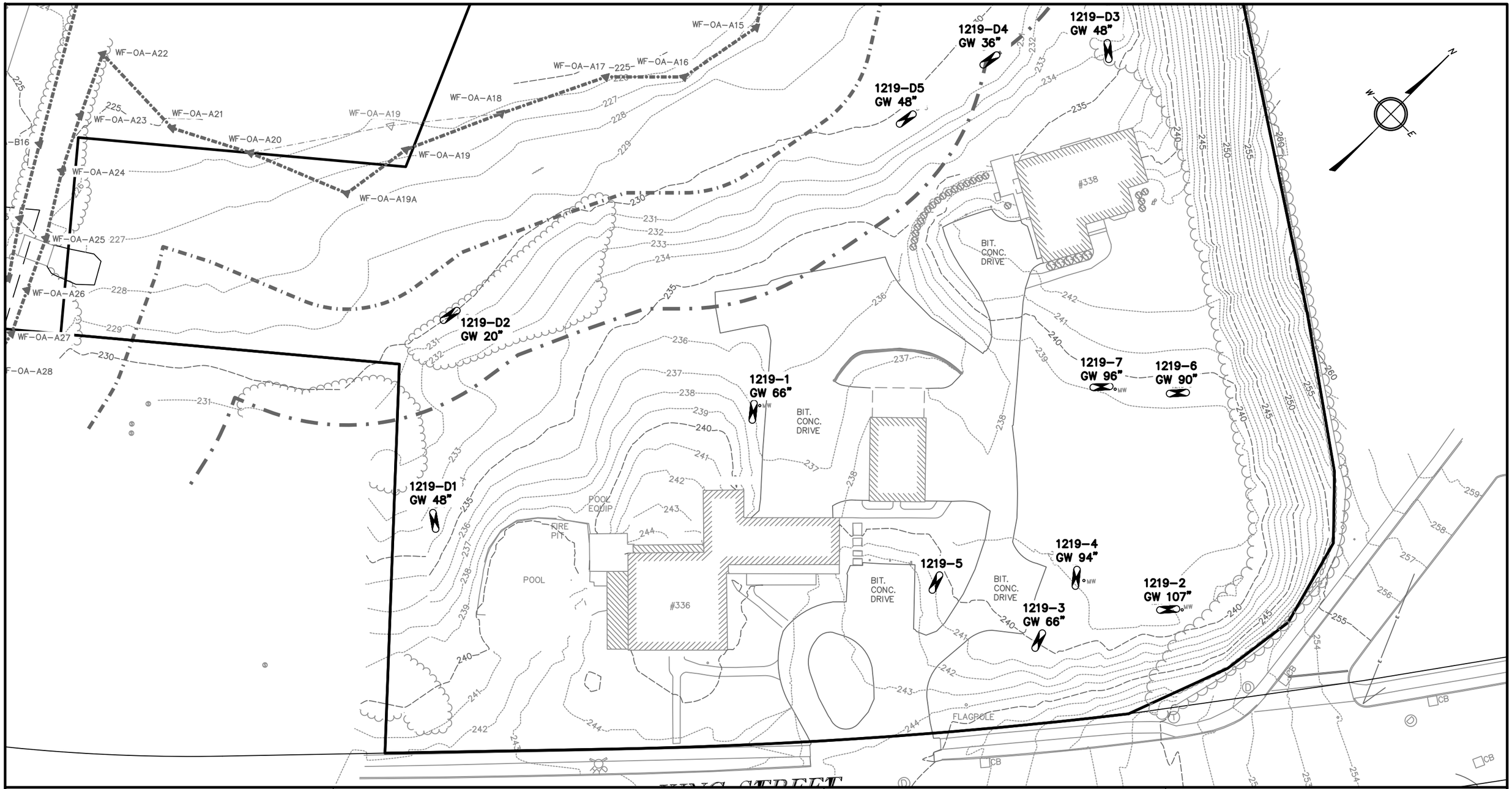
Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 29, 2014—Sep 19, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	6.3	15.9%
32B	Wareham loamy fine sand, 0 to 5 percent slopes	15.0	37.8%
253D	Hinckley loamy sand, 15 to 25 percent slopes	2.7	6.8%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	5.7	14.4%
623C	Woodbridge-Urban land complex, 3 to 15 percent slopes	1.5	3.7%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	8.5	21.4%
Totals for Area of Interest		**39.8**	**100.0%**



GRAPHIC SCALE

40 0 20 40 80

(IN FEET)

1 INCH = 40 FEET

GPR

Engineering Solutions for Land & Structures

GOLDSMITH, PREST & RINGWALL, INC.

39 MAIN ST., SUITE 301, AYER, MA 01432

CIVIL ENGINEERING • LAND SURVEYING • LAND PLANNING

VOICE: 978.772.1590 FAX: 978.772.1591

www.gpr-inc.com

PREPARED FOR:

MASSACHUSETTS COHOUSING, LLC
200 SUMMIT DRIVE, SUITE 210
BURLINGTON, MA 01803

SOIL TESTING LOCUS

336–338 KING STREET
LITTLETON, MA

DES'D BY: LT	CHK'D BY: NMP	
DATE: MARCH 2020	PROJECT: 191096	1 OF 1

P:\19---\191096\DWG\PERMIT\DRAINAGE (2020).DWG 04-01-20 2:07:21 PM – LAYOUT SOIL TESTING LOCUS

FORM 11 - SOIL EVALUATOR FORM

No. 191096 Date: 1/10/20

Commonwealth of Massachusetts
Littleton, Massachusetts

Soil Suitability Assessment for On-Site Sewage Disposal

Performed by: Bruce Ringwall, GPR Inc Date: 12/16/19
Witnessed by: Jim Garreffi , RS NABH

Location Address: or Lot No. 336-338 King St. Littleton, MA 01460	Owner's Name: Massachusetts CoHousing, LLC Address: 200 Summit Drive Suite 210 Burlington, MA 01803 Telephone No.

New Construction ☑ Upgrade ☐ Repai☐

Office Review

Published Soil Survey Available: No ☐ Yes ☑

Year Published WebSoilSurvey, 2019 Publication Scale na Soil Map Unit 626B/253D
Soil Name Merrimac Urban Land Complex Soil Limitations well drained
Soil Name Hinkley Loamy Sand Soil Limitations well drained
Soil Name Soil Limitations

Surficial Geologic Report Available: No ☑ Yes ☑

Year Published MASS GIS Publication Scale
Geologic Material(Map Unit) Proglacial outwash
Landform Outwash Plain

Flood Insurance Rate Map: 25017C0236F

Above 500 Year Flood Boundary	No ☐	Yes ☑
Within 500 Year Flood Boundary	No ☑	Yes ☐
Within 100 Year Flood Boundary	No ☑	Yes ☐
Within Velocity Zone	No ☑	Yes ☐

Wetland Area:

National Wetlands Inventory Map (map unit) MA DEP Oliver
Wetlands Conservancy Program Map (map unit)

Current Water Resource Conditions (USGS): Month

Range: Above Normal ☐ Normal ☑ Below Normal ☐
Other Reference Reviewed USGS

Site Info.

FORM 11 - SOIL EVALUATOR FORM

Location Address or Lot #: 336-338 King St.
Littleton, MA 01460

On-Site Review

Deep Hole #: 1219-1 Date: 12/16/19 Time: 8:00 AM Weather: Sunny 30°
Location (identify on site plan) See attached Sketch
Land Use Open Field/Yard Slope (%) 2% Surfaces Stones none
(eg woodland, agricultural field, vacant lot etc…)
Vegatation lawn
Landform Outwash plain
Position on landscape See attached Sketch
Distances from:

Open Water Body	>100 feet	Drainage Way	>100 feet
Possible Wet Area	>100 feet	Property Line	140± feet
Drinking Water Well	>100 feet	Other:	
			feet

Deep Observation Hole Log

Hole # 1219-1 NB 29/71 Suface El. 237.0

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (MUNSELL)	Soil Mottling	Other (Stucture, Stones, Boulders, Consistency, % Gravel)
0-20	FILL				
20-30	BB	FSL	10YR5/6		
30-120	C	VFS	2.5Y6/4	@66" 10Y5/8 2.5Y6/2	

*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Proglacial outwash Depth to Bedrock: >120"
Depth to Groundwater: Standing Water in the Hole None Weeping from Pit Face: 96"
Estimated Seasonal High Groundwater in the Hole 66"
Aditional Notes: GWMP Observed 3/5/20 @ 71"

FORM 11 - SOIL EVALUATOR FORM

Location Address or Lot #: 336-338 King St.
Littleton, MA 01460

On-Site Review

Deep Hole #: 1219-2 Date: 12/16/19 Time: 8:30 AM Weather: Sunny 30°
Location (identify on site plan) See attached Sketch
Land Use Open Field/Yard Slope (%) 2% Surfaces Stones none
(eg woodland, agricultural field, vacant lot etc…)
Vegatation lawn
Landform Outwash plain
Position on landscape See attached Sketch
Distances from:

Open Water Body	>100 feet	Drainage Way	>100 feet
Possible Wet Area	>100 feet	Property Line	35± feet
Drinking Water Well	>100 feet	Other:	
			feet

Deep Observation Hole Log

Hole # 1219-2 NB 29/71 Suface El. 239.0

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (MUNSELL)	Soil Mottling	Other (Stucture, Stones, Boulders, Consistency, % Gravel)
0-8	A	FSL	10YR3/3		
8-24	B	LFS	10YR5/6		
24-40	Bc	LFS	2.5Y6/6		
40-116	C1	FS	2.5Y6/3		
116-126	C2	VFS	2.5Y6/4	@116" 10YR6/8 2.5Y6/3	

*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Proglacial outwash Depth to Bedrock: >126"
Depth to Groundwater: Standing Water in the Hole None Weeping from Pit Face: None
Estimated Seasonal High Groundwater in the Hole 107"
Aditional Notes: GWMP Observed 3/5/20 @ 107""

FORM 11 - SOIL EVALUATOR FORM

Location Address or Lot #: 336-338 King St.
Littleton, MA 01460

On-Site Review

Deep Hole #: 1219-3 Date: 12/16/19 Time: 9:00 AM Weather: Sunny 30°
Location (identify on site plan) See attached Sketch
Land Use Open Field/Yard Slope (%) 2% Surfaces Stones none
(eg woodland, agricultural field, vacant lot etc…)
Vegatation lawn
Landform Outwash plain
Position on landscape See attached Sketch
Distances from:

Open Water Body	>100 feet	Drainage Way	>100 feet
Possible Wet Area	>100 feet	Property Line	35± feet
Drinking Water Well	>100 feet	Other:	
			feet

Deep Observation Hole Log

Hole # 1219-3 NB 29/71 Suface El. 240.0

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (MUNSELL)	Soil Mottling	Other (Stucture, Stones, Boulders, Consistency, % Gravel)
0-32	FILL				
32-40	BA	FSL	10YR3/3		
40-56	BB	LFS	10YR5/8	@66"	
56-120	C	S/Gr		10YR5/8 2.5Y6/2	

*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Proglacial outwash Depth to Bedrock: >120"
Depth to Groundwater: Standing Water in the Hole 97" Weeping from Pit Face: 97"
Estimated Seasonal High Groundwater in the Hole 66"
Aditional Notes:

FORM 11 - SOIL EVALUATOR FORM

Location Address or Lot #: 336-338 King St.
Littleton, MA 01460

On-Site Review

Deep Hole #: 1219-4 Date: 12/16/19 Time: 9:30 AM Weather: Sunny 30°
Location (identify on site plan) See attached Sketch
Land Use Open Field/Yard Slope (%) 2% Surfaces Stones none
(eg woodland, agricultural field, vacant lot etc…)
Vegatation lawn
Landform Outwash plain
Position on landscape See attached Sketch
Distances from:

Open Water Body	>100 feet	Drainage Way	>100 feet
Possible Wet Area	>100 feet	Property Line	60± feet
Drinking Water Well	>100 feet	Other:	
			feet

Deep Observation Hole Log

Hole # 1219-4 NB 29/71 Suface El. 239.0

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (MUNSELL)	Soil Mottling	Other (Stucture, Stones, Boulders, Consistency, % Gravel)
0-64	FILL				
54-132	C1	FS	2.5Y6/4		

*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Proglacial outwash Depth to Bedrock: >132"
Depth to Groundwater: Standing Water in the Hole n/a Weeping from Pit Face: n/a
Estimated Seasonal High Groundwater in the Hole 94"
Aditional Notes: GWMP Observed 3/5/20 @ 94"

FORM 11 - SOIL EVALUATOR FORM

Location Address or Lot #: 336-338 King St.
Littleton, MA 01460

On-Site Review

Deep Hole #: 1219-5 Date: 12/16/19 Time: 10:00 AM Weather: Sunny 30°
Location (identify on site plan) See attached Sketch
Land Use Open Field/Yard Slope (%) 2% Surfaces Stones none
(eg woodland, agricultural field, vacant lot etc…)
Vegatation landscape bed
Landform Outwash plain
Position on landscape See attached Sketch
Distances from:

Open Water Body	>100 feet	Drainage Way	>100 feet
Possible Wet Area	>100 feet	Property Line	60± feet
Drinking Water Well	>100 feet	Other:	
			feet

Deep Observation Hole Log

Hole # 1219-5 NB 29/77 Suface El. 240.5

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (MUNSELL)	Soil Mottling	Other (Stucture, Stones, Boulders, Consistency, % Gravel)
0-120	FILL				

*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Proglacial outwash Depth to Bedrock: >120"
Depth to Groundwater: Standing Water in the Hole none Weeping from Pit Face: none
Estimated Seasonal High Groundwater in the Hole n/a
Aditional Notes: Avoid area without additional testing.

FORM 11 - SOIL EVALUATOR FORM

Location Address or Lot #: 336-338 King St.
Littleton, MA 01460

On-Site Review

Deep Hole #: 1219-6 Date: 12/16/19 Time: 10:30 AM Weather: Sunny 30°
Location (identify on site plan) See attached Sketch
Land Use Open Field/Yard Slope (%) 2% Surfaces Stones none
(eg woodland, agricultural field, vacant lot etc…)
Vegatation lawn
Landform Outwash plain
Position on landscape See attached Sketch
Distances from:

Open Water Body	>100 feet	Drainage Way	>100 feet
Possible Wet Area	>100 feet	Property Line	60± feet
Drinking Water Well	>100 feet	Other:	
			feet

Deep Observation Hole Log

Hole # 1219-6 NB 29/77 Suface El. 239.2

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (MUNSELL)	Soil Mottling	Other (Stucture, Stones, Boulders, Consistency, % Gravel)
0-40	FILL				
40-96	C1	FS	2.5Y6/3		
96-144	C2	VFS	2.5Y6/4	@90" 2.5Y6/2 2.5Y6/6	

*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Proglacial outwash Depth to Bedrock: >144"
Depth to Groundwater: Standing Water in the Hole None Weeping from Pit Face: None
Estimated Seasonal High Groundwater in the Hole 90"
Aditional Notes:

FORM 11 - SOIL EVALUATOR FORM

Location Address or Lot #: 336-338 King St.
Littleton, MA 01460

On-Site Review

Deep Hole #: 1219-7 Date: 12/16/19 Time: 11:00 AM Weather: Sunny 30°
Location (identify on site plan) See attached Sketch
Land Use Open Field/Yard Slope (%) 2% Surfaces Stones none
(eg woodland, agricultural field, vacant lot etc…)
Vegatation lawn
Landform Outwash plain
Position on landscape See attached Sketch
Distances from:

Open Water Body	>100 feet	Drainage Way	>100 feet
Possible Wet Area	>100 feet	Property Line	95± feet
Drinking Water Well	>100 feet	Other:	
			feet

Deep Observation Hole Log

Hole # 1219-7 NB 29/77 Suface El. 237.2

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (MUNSELL)	Soil Mottling	Other (Stucture, Stones, Boulders, Consistency, % Gravel)
0-36	FILL				
36-72	C1	FS	2.5Y6/3		
72-134	C2	VFS	2.5Y6/4	@96" 2.5Y6/2 2.5Y6/6	

*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Proglacial outwash Depth to Bedrock: >134"
Depth to Groundwater: Standing Water in the Hole None Weeping from Pit Face: 104"
Estimated Seasonal High Groundwater in the Hole 96"
Aditional Notes: GWMP Observed 3/5/20 @ 96"

FORM 11 - SOIL EVALUATOR FORM

Location Address or Lot #: 336-338 King St.
Littleton, MA 01460

On-Site Review

Deep Hole #: 1219-D1 Date: 12/16/19 Time: 11:30 AM Weather: Sunny 30°
Location (identify on site plan) See attached Sketch
Land Use Open Field/Yard Slope (%) 2% Surfaces Stones none
(eg woodland, agricultural field, vacant lot etc…)
Vegatation lawn
Landform Outwash plain
Position on landscape See attached Sketch
Distances from:

Open Water Body	>100 feet	Drainage Way	>100 feet
Possible Wet Area	>100 feet	Property Line	20± feet
Drinking Water Well	>100 feet	Other:	
			feet

Deep Observation Hole Log

Hole # 1219-D1 NB 29/73 Suface El. 233.8

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (MUNSELL)	Soil Mottling	Other (Stucture, Stones, Boulders, Consistency, % Gravel)
0-16	FILL				
16-20	BA	FSL	10YR3/3		
20-32	BB	LFS	10YR5/6		
32-80	C1	FS	2.5Y6/4	@48"	
80-96	C2	Gr		10YR5/6 2.5Y6/2	cobbles

*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Proglacial outwash Depth to Bedrock: >96"
Depth to Groundwater: Standing Water in the Hole None Weeping from Pit Face: 60"
Estimated Seasonal High Groundwater in the Hole 48"
Aditional Notes: Not Witnessed

FORM 11 - SOIL EVALUATOR FORM

Location Address or Lot #: 336-338 King St.
Littleton, MA 01460

On-Site Review

Deep Hole #: 1219-D2 Date: 12/16/19 Time: 12:00 PM Weather: Sunny 30°
Location (identify on site plan) See attached Sketch
Land Use Open Field/Yard Slope (%) 2% Surfaces Stones none
(eg woodland, agricultural field, vacant lot etc…)
Vegatation lawn
Landform Outwash plain
Position on landscape See attached Sketch
Distances from:

Open Water Body >100 feet
Drainage Way >100 feet
25±
Possible Wet Area >100 feet
Property Line feet
Drinking Water Well >100 feet
Other:
feet

Deep Observation Hole Log

Hole # 1219-D2 NB 29/73 Suface El. 230.0

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (MUNSELL)	Soil Mottling	Other (Stucture, Stones, Boulders, Consistency, % Gravel)
0-8	A	FSL	10YR3/3		
8-17	BA	LFS	10YR5/6	@20"	
17-90	BB	FS	2.5YR6/4	10YR5/6 2.5Y6/2	

*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Proglacial outwash Depth to Bedrock: >90"
Depth to Groundwater: Standing Water in the Hole None Weeping from Pit Face: 72"
Estimated Seasonal High Groundwater in the Hole 20"
Aditional Notes: Not Witnessed

FORM 11 - SOIL EVALUATOR FORM

Location Address or Lot #: 336-338 King St.
Littleton, MA 01460

On-Site Review

Deep Hole #: 1219-D3 Date: 12/16/19 Time: 12:30 PM Weather: Sunny 30°
Location (identify on site plan) See attached Sketch
Land Use Open Field/Yard Slope (%) 2% Surfaces Stones none
(eg woodland, agricultural field, vacant lot etc…)
Vegatation lawn
Landform Outwash plain
Position on landscape See attached Sketch
Distances from:

Open Water Body	>100 feet	Drainage Way	>100 feet
Possible Wet Area	>100 feet	Property Line	60± feet
Drinking Water Well	>100 feet	Other:	
			feet

Deep Observation Hole Log

Hole # 1219-D3 NB 29/73 Suface El. 234.0

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (MUNSELL)	Soil Mottling	Other (Stucture, Stones, Boulders, Consistency, % Gravel)
0-8	A	FSL	10YR4/4		
8-16	B	LFS	10YR5/3	@70"	
16-126	C	VFS	2.5YR6/3	10YR5/8	friable
				2.5Y6/2	friable-massive

*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Proglacial outwash Depth to Bedrock: >126"
Depth to Groundwater: Standing Water in the Hole None Weeping from Pit Face: 48"
Estimated Seasonal High Groundwater in the Hole 48"
Aditional Notes: Not Witnessed

FORM 11 - SOIL EVALUATOR FORM

Location Address or Lot #: 336-338 King St.
Littleton, MA 01460

On-Site Review

Deep Hole #: 1219-D4 Date: 12/16/19 Time: 1:00 PM Weather: Sunny 30°
Location (identify on site plan) See attached Sketch
Land Use Open Field/Yard Slope (%) 2% Surfaces Stones none
(eg woodland, agricultural field, vacant lot etc…)
Vegatation lawn
Landform Outwash plain
Position on landscape See attached Sketch
Distances from:

Open Water Body	>100 feet	Drainage Way	>100 feet
Possible Wet Area	>100 feet	Property Line	110± feet
Drinking Water Well	>100 feet	Other:	
			feet

Deep Observation Hole Log

Hole # 1219-D4 NB 20/73 Suface El. 230.8

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (MUNSELL)	Soil Mottling	Other (Stucture, Stones, Boulders, Consistency, % Gravel)
0-4	A	FSL	10YR4/4		
4-10	B	LFS	10YR5/3	@36"	
10-110	C	VFS	2.5YR6/3	10YR5/8	
				2.5Y6/1	

*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Proglacial outwash Depth to Bedrock: >110"
Depth to Groundwater: Standing Water in the Hole None Weeping from Pit Face: 36"
Estimated Seasonal High Groundwater in the Hole 36"
Aditional Notes: Not Witnessed

FORM 11 - SOIL EVALUATOR FORM

Location Address or Lot #: 336-338 King St.
Littleton, MA 01460

On-Site Review

Deep Hole #: 1219-D5 Date: 12/16/19 Time: 1:30 PM Weather: Sunny 30°
Location (identify on site plan) See attached Sketch
Land Use Open Field/Yard Slope (%) 2% Surfaces Stones none
(eg woodland, agricultural field, vacant lot etc…)
Vegatation laawn
Landform Outwash plain
Position on landscape See attached Sketch
Distances from:

Open Water Body	>100 feet	Drainage Way	>100 feet
Possible Wet Area	>100 feet	Property Line	150± feet
Drinking Water Well	>100 feet	Other:	
			feet

Deep Observation Hole Log

Hole # 1219-D5 NB 29/75 Suface El. 230.5

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (MUNSELL)	Soil Mottling	Other (Stucture, Stones, Boulders, Consistency, % Gravel)
0-32	FILL				
32-38	BA	FSL	10YR4/4		
38-48	BB	LFS	10YR5/3		
48-112	C1	VFS	2.5YR6/2	@86" 10YR5/6 2.5Y6/1	

*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Proglacial outwash Depth to Bedrock: >112"
Depth to Groundwater: Standing Water in the Hole None Weeping from Pit Face: 48"
Estimated Seasonal High Groundwater in the Hole 48"
Aditional Notes: Not Witnessed

FORM 11 - SOIL EVALUATOR FORM

Location Address or Lot#: 336-338 King St.
Littleton, MA 01460

Determination for Seasonal High Water Table

Method Used:

☐	Depth observed standing in observation hole	____ inches	____
☐	Depth weeping from side of observation hole	____ inches	____
☑	Depth to soil mottles	* inches	See individual Reports
☐	Ground water adjustment	____ feet	____

Index Well Number ____ Reading Date ____ Index Well Level ____

Adjustment Factor ____ Adjusted Ground Water Level ____

Depth of Naturally Occuring Pervious Material

Does at least four feet of naturally occuring pervious material exist in all areas observed throughout the area proposed for the soil absorption system? Yes

If not, what is the depth of naturally occuring pervious material? ____ Feet

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated, on the attached soil evaluation form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature _____ Date 1/10/20

Notes: _____

Signature

National Flood Hazard Layer FIRMette

FEMA

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

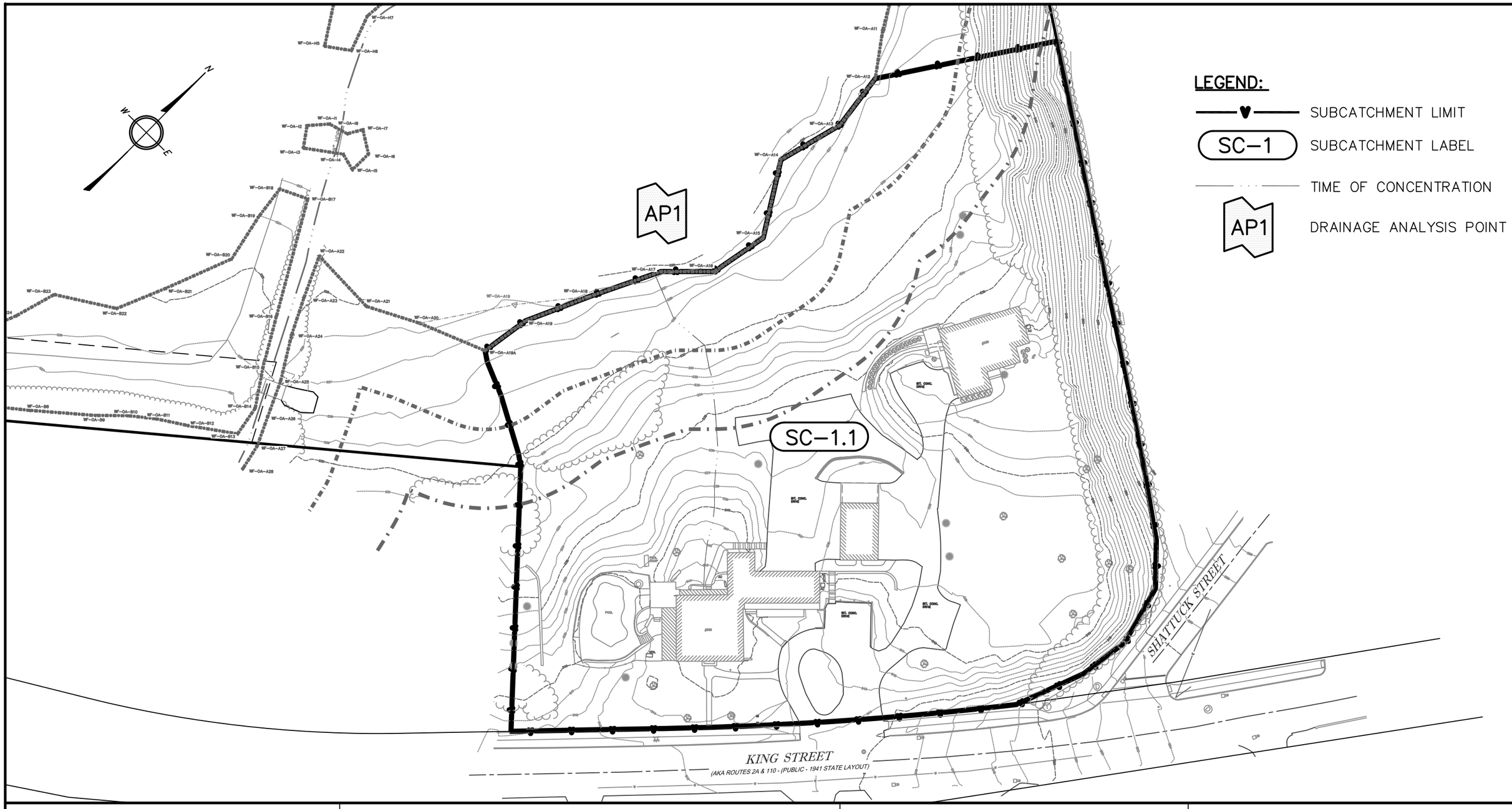
N

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 11/15/2019 at 11:05:43 AM 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.



GRAPHIC SCALE

60 0 30 60 120

(IN FEET)

1 INCH = 60 FEET

GPR

Engineering Solutions for Land & Structures

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CIVIL ENGINEERING • LAND SURVEYING • LAND PLANNING
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www.gpr-inc.com

PREPARED FOR:

MASSACHUSETTS CoHOUSING, LLC
200 SUMMIT DRIVE, SUITE 210
BURLINGTON, MA 01803

DES'D BY: LT | CHK'D BY: NMP

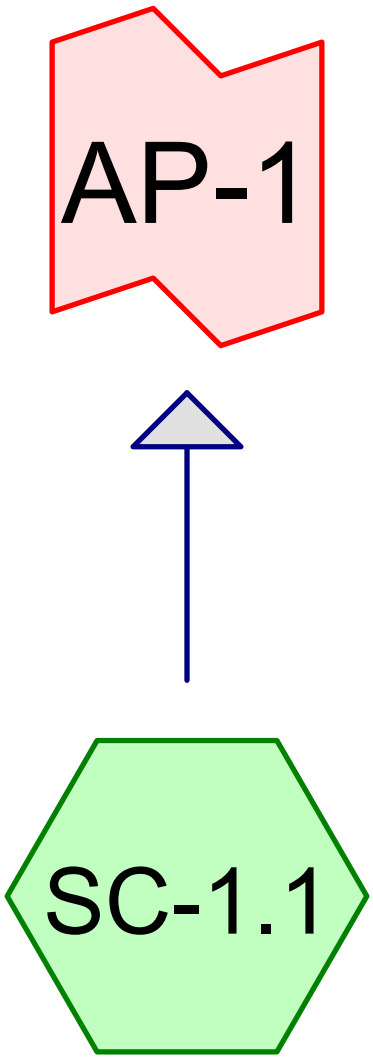
DATE: JUNE 2020

PRE–DEVELOPMENT WATERSHED MAP

336–338 KING STREET
LITTLETON, MA

PROJECT: 191096 | 1 OF 1

P:\19---\191096\DWG\PERMIT\DRAINAGE (2020)_REV1.DWG 06-24-20 12:36:23 PM - LAYOUT PRE



Subcat Reach Pond Link

Routing Diagram for PRE-DEV
Prepared by Goldsmith, Prest & Ringwall, Inc., Printed 3/26/2020

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
85,388	39	>75% Grass cover, Good, HSG A (SC-1.1)
17,800	98	Paved parking, HSG A (SC-1.1)
7,682	98	Roofs, HSG A (SC-1.1)
22,671	30	Woods, Good, HSG A (SC-1.1)
133,541	**49**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.04 hrs, 601 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment SC-1.1: Runoff Area=133,541 sf 19.08% Impervious Runoff Depth>0.09"
Flow Length=213' Tc=5.0 min CN=49 Runoff=0.0 cfs 986 cf

Link AP-1: Inflow=0.0 cfs 986 cf
Primary=0.0 cfs 986 cf

Total Runoff Area = 133,541 sf Runoff Volume = 986 cf Average Runoff Depth = 0.09"
80.92% Pervious = 108,059 sf 19.08% Impervious = 25,482 sf

Summary for Subcatchment SC-1.1:

Runoff = 0.0 cfs @ 14.53 hrs, Volume= 986 cf, Depth> 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
85,388	39	>75% Grass cover, Good, HSG A
22,671	30	Woods, Good, HSG A
17,800	98	Paved parking, HSG A
7,682	98	Roofs, HSG A
133,541	49	Weighted Average
108,059		80.92% Pervious Area
25,482		19.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0800	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
1.3	163	0.0859	2.05		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.6	213	Total, Increased to minimum Tc = 5.0 min			

Summary for Link AP-1:

Inflow Area = 133,541 sf, 19.08% Impervious, Inflow Depth > 0.09" for 2-Year event
Inflow = 0.0 cfs @ 14.53 hrs, Volume= 986 cf
Primary = 0.0 cfs @ 14.53 hrs, Volume= 986 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs

Time span=0.00-24.00 hrs, dt=0.04 hrs, 601 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment SC-1.1: Runoff Area=133,541 sf 19.08% Impervious Runoff Depth>0.51"
Flow Length=213' Tc=5.0 min CN=49 Runoff=0.9 cfs 5,642 cf

Link AP-1: Inflow=0.9 cfs 5,642 cf
Primary=0.9 cfs 5,642 cf

Total Runoff Area = 133,541 sf Runoff Volume = 5,642 cf Average Runoff Depth = 0.51"
80.92% Pervious = 108,059 sf 19.08% Impervious = 25,482 sf

Summary for Subcatchment SC-1.1:

Runoff = 0.9 cfs @ 12.14 hrs, Volume= 5,642 cf, Depth> 0.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
85,388	39	>75% Grass cover, Good, HSG A
22,671	30	Woods, Good, HSG A
17,800	98	Paved parking, HSG A
7,682	98	Roofs, HSG A
133,541	49	Weighted Average
108,059		80.92% Pervious Area
25,482		19.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0800	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
1.3	163	0.0859	2.05		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.6	213	Total, Increased to minimum Tc = 5.0 min			

Summary for Link AP-1:

Inflow Area = 133,541 sf, 19.08% Impervious, Inflow Depth > 0.51" for 10-Year event
Inflow = 0.9 cfs @ 12.14 hrs, Volume= 5,642 cf
Primary = 0.9 cfs @ 12.14 hrs, Volume= 5,642 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs

Time span=0.00-24.00 hrs, dt=0.04 hrs, 601 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment SC-1.1: Runoff Area=133,541 sf 19.08% Impervious Runoff Depth>2.36"
Flow Length=213' Tc=5.0 min CN=49 Runoff=7.9 cfs 26,241 cf

Link AP-1: Inflow=7.9 cfs 26,241 cf
Primary=7.9 cfs 26,241 cf

Total Runoff Area = 133,541 sf Runoff Volume = 26,241 cf Average Runoff Depth = 2.36"
80.92% Pervious = 108,059 sf 19.08% Impervious = 25,482 sf

Summary for Subcatchment SC-1.1:

Runoff = 7.9 cfs @ 12.12 hrs, Volume= 26,241 cf, Depth> 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
85,388	39	>75% Grass cover, Good, HSG A
22,671	30	Woods, Good, HSG A
17,800	98	Paved parking, HSG A
7,682	98	Roofs, HSG A
133,541	49	Weighted Average
108,059		80.92% Pervious Area
25,482		19.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0800	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
1.3	163	0.0859	2.05		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.6	213	Total, Increased to minimum Tc = 5.0 min			

Summary for Link AP-1:

Inflow Area = 133,541 sf, 19.08% Impervious, Inflow Depth > 2.36" for 100-Year event
Inflow = 7.9 cfs @ 12.12 hrs, Volume= 26,241 cf
Primary = 7.9 cfs @ 12.12 hrs, Volume= 26,241 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs

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POST-DEVELOPMENT WATERSHED MAP

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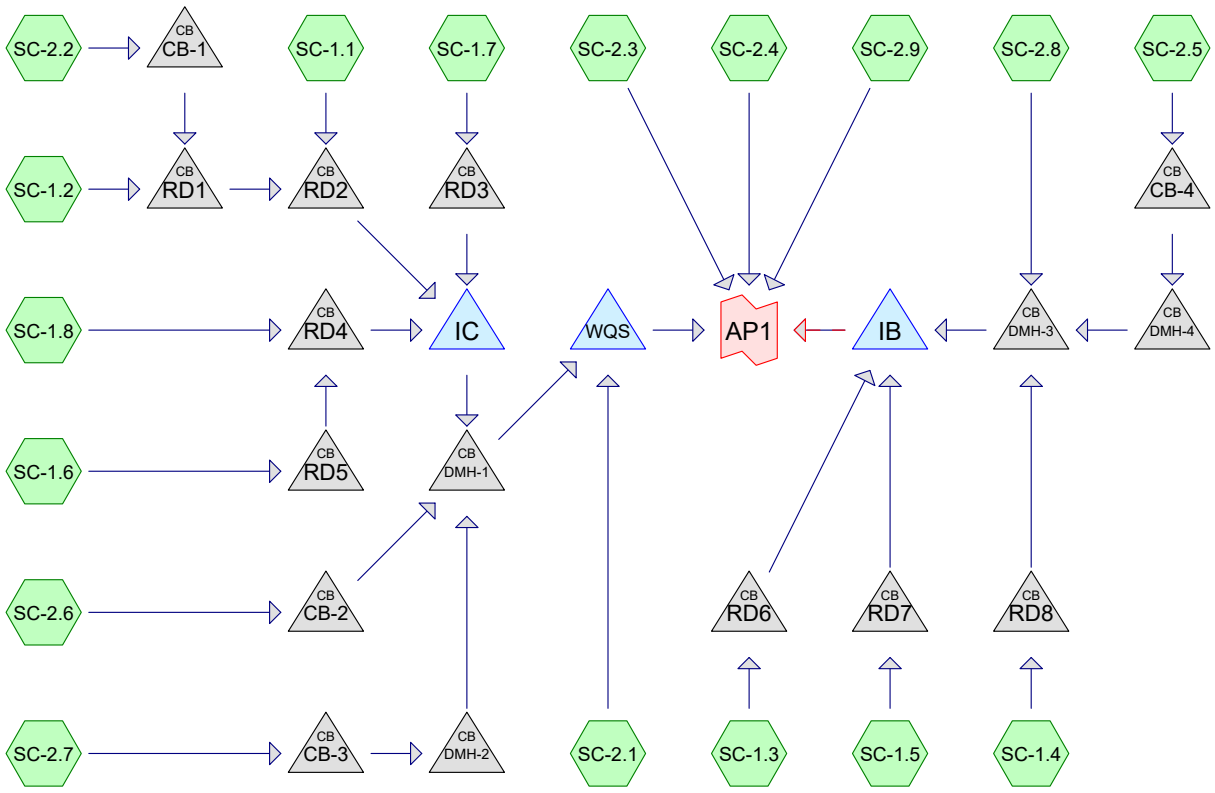
PREPARED FOR:
MASSACHUSETTS COHOUSING, LLC
200 SUMMIT DRIVE, SUITE 210
BURLINGTON, MA 01803

DES. BY: LT	DATE: JUNE 2020	JOB 191096	1 OF 1
CHK. BY: NMP			



Subcat Reach Pond Link

Routing Diagram for POST-DEV_Rev1

Prepared by Goldsmith, Prest & Ringwall, Inc., Printed 6/24/2020

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NRCC 24-hr	D	Default	24.00	1	3.09	2
2	10-Year	NRCC 24-hr	D	Default	24.00	1	4.65	2
3	100-Year	NRCC 24-hr	D	Default	24.00	1	8.36	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
72,570	39	>75% Grass cover, Good, HSG A (SC-1.5, SC-1.7, SC-2.1, SC-2.2, SC-2.3, SC-2.4, SC-2.5, SC-2.6, SC-2.7, SC-2.8, SC-2.9)
14,348	98	Paved parking, HSG A (SC-2.5, SC-2.6, SC-2.7)
27,867	98	Roofs, HSG A (SC-1.1, SC-1.2, SC-1.3, SC-1.4, SC-1.5, SC-1.6, SC-1.7, SC-1.8, SC-2.1, SC-2.3, SC-2.5, SC-2.7, SC-2.8)
5,604	98	Unconnected pavement, HSG A (SC-2.2, SC-2.3, SC-2.4, SC-2.5, SC-2.6, SC-2.7, SC-2.8)
13,151	30	Woods, Good, HSG A (SC-1.5, SC-2.5, SC-2.8, SC-2.9)
133,541	**59**	**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	CB-1	235.50	235.42	4.0	0.0200	0.013	12.0	0.0	0.0
2	CB-2	236.20	236.00	5.0	0.0400	0.013	12.0	0.0	0.0
3	CB-3	240.14	237.30	142.0	0.0200	0.013	12.0	0.0	0.0
4	CB-4	236.00	234.50	83.0	0.0181	0.013	12.0	0.0	0.0
5	DMH-1	235.90	234.00	30.0	0.0633	0.013	12.0	0.0	0.0
6	DMH-2	237.20	236.00	60.0	0.0200	0.013	12.0	0.0	0.0
7	DMH-3	232.40	232.00	24.0	0.0167	0.013	12.0	0.0	0.0
8	DMH-4	234.40	232.50	106.0	0.0179	0.013	12.0	0.0	0.0
9	IB	230.50	230.00	20.0	0.0250	0.013	12.0	0.0	0.0
10	IC	236.75	236.00	25.0	0.0300	0.013	12.0	0.0	0.0
11	RD1	235.42	234.82	29.0	0.0207	0.013	12.0	0.0	0.0
12	RD2	234.82	233.50	63.0	0.0210	0.013	12.0	0.0	0.0
13	RD3	237.50	236.75	20.0	0.0375	0.013	8.0	0.0	0.0
14	RD4	243.05	236.75	90.0	0.0700	0.013	6.0	0.0	0.0
15	RD5	244.00	243.05	95.0	0.0100	0.013	6.0	0.0	0.0
16	RD6	231.00	230.00	31.0	0.0323	0.013	6.0	0.0	0.0
17	RD7	232.00	231.00	27.0	0.0370	0.013	6.0	0.0	0.0
18	RD8	234.00	232.50	38.0	0.0395	0.013	6.0	0.0	0.0

Summary for Subcatchment SC-1.1:

Runoff = 0.2 cfs @ 12.11 hrs, Volume= 844 cf, Depth> 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
3,546	98	Roofs, HSG A
3,546		100.00% Impervious Area

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

Summary for Subcatchment SC-1.2:

Runoff = 0.2 cfs @ 12.11 hrs, Volume= 667 cf, Depth> 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
2,804	98	Roofs, HSG A
2,804		100.00% Impervious Area

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

Summary for Subcatchment SC-1.3:

Runoff = 0.2 cfs @ 12.11 hrs, Volume= 760 cf, Depth> 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
3,194	98	Roofs, HSG A
3,194		100.00% Impervious Area

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

Summary for Subcatchment SC-1.4:

Runoff = 0.1 cfs @ 12.11 hrs, Volume= 518 cf, Depth> 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
2,179	98	Roofs, HSG A
2,179		100.00% Impervious Area

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

Summary for Subcatchment SC-1.5:

Runoff = 0.1 cfs @ 12.11 hrs, Volume= 208 cf, Depth> 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
872	98	Roofs, HSG A
3	30	Woods, Good, HSG A
1	39	>75% Grass cover, Good, HSG A
876	98	Weighted Average
4		0.46% Pervious Area
872		99.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	50	0.4200	0.34		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.09"
0.3	73	0.0680	3.91		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	43	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
3.1	166	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment SC-1.6:

Runoff = 0.2 cfs @ 12.11 hrs, Volume= 636 cf, Depth> 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
2,671	98	Roofs, HSG A
2,671		100.00% Impervious Area

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

Summary for Subcatchment SC-1.7:

Runoff = 0.4 cfs @ 12.11 hrs, Volume= 1,274 cf, Depth> 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
6	39	>75% Grass cover, Good, HSG A
5,347	98	Roofs, HSG A
5,353	98	Weighted Average
6		0.11% Pervious Area
5,347		99.89% Impervious Area

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

Summary for Subcatchment SC-1.8:

Runoff = 0.1 cfs @ 12.06 hrs, Volume= 226 cf, Depth> 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
950	98	Roofs, HSG A
950		100.00% Impervious Area

Summary for Subcatchment SC-2.1:

Runoff = 0.0 cfs @ 13.04 hrs, Volume= 102 cf, Depth> 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
1,981	98	Roofs, HSG A
7,742	39	>75% Grass cover, Good, HSG A
9,723	51	Weighted Average
7,742		79.63% Pervious Area
1,981		20.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
1.1	117	0.0684	1.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.4	167	Total			

Summary for Subcatchment SC-2.2:

Runoff = 0.0 cfs @ 24.00 hrs, Volume= 16 cf, Depth> 0.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Adj	Description
3,309	39		>75% Grass cover, Good, HSG A
1,065	98		Unconnected pavement, HSG A
4,374	53	46	Weighted Average, UI Adjusted
3,309			75.65% Pervious Area
1,065			24.35% Impervious Area
1,065			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.5	110	0.0318	3.62		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.2	160	Total			

Summary for Subcatchment SC-2.3:

Runoff = 0.0 cfs @ 24.00 hrs, Volume= 19 cf, Depth> 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Adj	Description
14,704	39		>75% Grass cover, Good, HSG A
876	98		Roofs, HSG A
608	98		Unconnected pavement, HSG A
16,189	44	43	Weighted Average, UI Adjusted
14,704			90.83% Pervious Area
1,484			9.17% Impervious Area
608			40.95% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0300	1.38		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.09"
0.1	30	0.0400	4.06		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.6	84	0.1250	2.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.3	164	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment SC-2.4:

Runoff = 0.0 cfs @ 24.00 hrs, Volume= 11 cf, Depth> 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Adj	Description
8,747	39		>75% Grass cover, Good, HSG A
1,463	98		Unconnected pavement, HSG A
10,210	47	43	Weighted Average, UI Adjusted
8,747			85.67% Pervious Area
1,463			14.33% Impervious Area
1,463			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0190	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.2	13	0.0190	0.96		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	11	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.9	170	0.0765	0.32		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
15.0	244	Total			

Summary for Subcatchment SC-2.5:

Runoff = 0.4 cfs @ 12.12 hrs, Volume= 1,248 cf, Depth> 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
7,250	39	>75% Grass cover, Good, HSG A
1,688	30	Woods, Good, HSG A
532	98	Unconnected pavement, HSG A
7,950	98	Paved parking, HSG A
2,206	98	Roofs, HSG A
19,625	70	Weighted Average
8,937		45.54% Pervious Area
10,688		54.46% Impervious Area
532		4.98% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.4	30	0.0367	1.34		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	50	0.0130	2.31		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.1	130	Total			

Summary for Subcatchment SC-2.6:

Runoff = 0.2 cfs @ 12.12 hrs, Volume= 616 cf, Depth> 0.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
596	98	Unconnected pavement, HSG A
4,328	98	Paved parking, HSG A
4,190	39	>75% Grass cover, Good, HSG A
9,114	71	Weighted Average
4,190		45.97% Pervious Area
4,924		54.03% Impervious Area
596		12.10% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	36	0.1000	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.2	14	0.0320	1.10		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.09"
0.3	74	0.0320	3.63		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.8	124	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment SC-2.7:

Runoff = 0.1 cfs @ 12.12 hrs, Volume= 351 cf, Depth> 0.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
2,128	39	>75% Grass cover, Good, HSG A
671	98	Unconnected pavement, HSG A
2,070	98	Paved parking, HSG A
21	98	Roofs, HSG A
4,890	72	Weighted Average
2,128		43.51% Pervious Area
2,762		56.49% Impervious Area
671		24.28% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	47	0.0300	1.37		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.09"
0.6	47	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment SC-2.8:

Runoff = 0.0 cfs @ 24.00 hrs, Volume= 1 cf, Depth> 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Adj	Description
11,411	39		>75% Grass cover, Good, HSG A
7,746	30		Woods, Good, HSG A
1,220	98		Roofs, HSG A
670	98		Unconnected pavement, HSG A
21,047	41	40	Weighted Average, UI Adjusted
19,157			91.02% Pervious Area
1,890			8.98% Impervious Area
670			35.45% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	48	0.3600	0.31		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.09"
0.2	50	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.6	80	0.0875	2.07		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.3	178	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment SC-2.9:

Runoff = 0.0 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 2-Year Rainfall=3.09"

Area (sf)	CN	Description
3,715	30	Woods, Good, HSG A
13,082	39	>75% Grass cover, Good, HSG A
16,797	37	Weighted Average
16,797		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	50	0.4000	0.22		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.09"
1.1	118	0.0680	1.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.9	168	Total, Increased to minimum Tc = 5.0 min			

Summary for Pond CB-1:

Inflow Area = 4,374 sf, 24.35% Impervious, Inflow Depth > 0.04" for 2-Year event
Inflow = 0.0 cfs @ 24.00 hrs, Volume= 16 cf
Outflow = 0.0 cfs @ 24.00 hrs, Volume= 16 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.0 cfs @ 24.00 hrs, Volume= 16 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 235.62' @ 12.08 hrs
Flood Elev= 239.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.50'	**12.0" Round Culvert** L= 4.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.50' / 235.42' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.0 cfs @ 24.00 hrs HW=235.51' TW=235.45' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.0 cfs @ 0.45 fps)

Summary for Pond CB-2:

Inflow Area = 9,114 sf, 54.03% Impervious, Inflow Depth > 0.81" for 2-Year event
Inflow = 0.2 cfs @ 12.12 hrs, Volume= 616 cf
Outflow = 0.2 cfs @ 12.12 hrs, Volume= 616 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.2 cfs @ 12.12 hrs, Volume= 616 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 236.43' @ 12.12 hrs
Flood Elev= 239.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	236.20'	**12.0" Round Culvert** L= 5.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 236.20' / 236.00' S= 0.0400 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.2 cfs @ 12.12 hrs HW=236.43' TW=236.20' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 0.2 cfs @ 1.30 fps)

Summary for Pond CB-3:

Inflow Area = 4,890 sf, 56.49% Impervious, Inflow Depth > 0.86" for 2-Year event
Inflow = 0.1 cfs @ 12.12 hrs, Volume= 351 cf
Outflow = 0.1 cfs @ 12.12 hrs, Volume= 351 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.1 cfs @ 12.12 hrs, Volume= 351 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 240.32' @ 12.12 hrs
Flood Elev= 244.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	240.14'	**12.0" Round Culvert** L= 142.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.14' / 237.30' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.1 cfs @ 12.12 hrs HW=240.32' TW=237.38' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 0.1 cfs @ 1.13 fps)

Summary for Pond CB-4:

Double Grated Inlet

Inflow Area = 19,625 sf, 54.46% Impervious, Inflow Depth > 0.76" for 2-Year event
Inflow = 0.4 cfs @ 12.12 hrs, Volume= 1,248 cf
Outflow = 0.4 cfs @ 12.12 hrs, Volume= 1,248 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.4 cfs @ 12.12 hrs, Volume= 1,248 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2

Peak Elev= 236.34' @ 12.12 hrs
Flood Elev= 240.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	236.00'	**12.0" Round Culvert** L= 83.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 236.00' / 234.50' S= 0.0181 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.4 cfs @ 12.12 hrs HW=236.33' TW=234.73' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 0.4 cfs @ 1.55 fps)

Summary for Pond DMH-1:

Inflow Area = 33,702 sf, 71.42% Impervious, Inflow Depth > 0.34" for 2-Year event
Inflow = 0.3 cfs @ 12.12 hrs, Volume= 967 cf
Outflow = 0.3 cfs @ 12.12 hrs, Volume= 967 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.3 cfs @ 12.12 hrs, Volume= 967 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 236.20' @ 12.12 hrs
Flood Elev= 239.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.90'	**12.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.90' / 234.00' S= 0.0633 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.3 cfs @ 12.12 hrs HW=236.20' TW=230.31' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 0.3 cfs @ 1.46 fps)

Summary for Pond DMH-2:

Inflow Area = 4,890 sf, 56.49% Impervious, Inflow Depth > 0.86" for 2-Year event
Inflow = 0.1 cfs @ 12.12 hrs, Volume= 351 cf
Outflow = 0.1 cfs @ 12.12 hrs, Volume= 351 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.1 cfs @ 12.12 hrs, Volume= 351 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 237.38' @ 12.12 hrs
Flood Elev= 241.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	237.20'	**12.0" Round Culvert** L= 60.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 237.20' / 236.00' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.1 cfs @ 12.12 hrs HW=237.38' TW=236.20' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 0.1 cfs @ 1.13 fps)

Summary for Pond DMH-3:

Inflow Area = 42,851 sf, 34.44% Impervious, Inflow Depth > 0.50" for 2-Year event
Inflow = 0.5 cfs @ 12.12 hrs, Volume= 1,768 cf
Outflow = 0.5 cfs @ 12.12 hrs, Volume= 1,768 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.5 cfs @ 12.12 hrs, Volume= 1,768 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 232.80' @ 12.12 hrs
Flood Elev= 235.10'

Device	Routing	Invert	Outlet Devices
#1	Primary	232.40'	**12.0" Round Culvert** L= 24.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.40' / 232.00' S= 0.0167 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.5 cfs @ 12.12 hrs HW=232.80' TW=230.80' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 0.5 cfs @ 1.70 fps)

Summary for Pond DMH-4:

Inflow Area = 19,625 sf, 54.46% Impervious, Inflow Depth > 0.76" for 2-Year event
Inflow = 0.4 cfs @ 12.12 hrs, Volume= 1,248 cf
Outflow = 0.4 cfs @ 12.12 hrs, Volume= 1,248 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.4 cfs @ 12.12 hrs, Volume= 1,248 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 234.74' @ 12.12 hrs
Flood Elev= 243.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	234.40'	**12.0" Round Culvert** L= 106.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 234.40' / 232.50' S= 0.0179 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.4 cfs @ 12.12 hrs HW=234.73' TW=232.80' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 0.4 cfs @ 1.55 fps)

Summary for Pond IB:

Inflow Area = 46,920 sf, 40.11% Impervious, Inflow Depth > 0.70" for 2-Year event
Inflow = 0.8 cfs @ 12.12 hrs, Volume= 2,736 cf
Outflow = 0.1 cfs @ 13.68 hrs, Volume= 2,472 cf, Atten= 93%, Lag= 93.5 min
Discarded = 0.1 cfs @ 13.68 hrs, Volume= 2,472 cf
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf
Secondary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 231.37' @ 13.68 hrs Surf.Area= 1,025 sf Storage= 964 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 128.3 min (958.3 - 830.0)

Volume	Invert	Avail.Storage	Storage Description
#1	230.00'	3,417 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)
230.00	445	97.5	0	0	445
231.00	815	126.4	621	621	972
232.00	1,431	162.0	1,109	1,729	1,802
233.00	1,958	184.3	1,688	3,417	2,440

Device	Routing	Invert	Outlet Devices
#1	Discarded	230.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	230.50'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 230.50' / 230.00' S= 0.0250 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	232.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	231.50'	**12.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	232.00'	**6.0' long x 26.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.1 cfs @ 13.68 hrs HW=231.37' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=230.00' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Controls 0.0 cfs)
  └**3=Orifice/Grate** (Controls 0.0 cfs)
  └**4=Orifice/Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=0.0 cfs @ 0.00 hrs HW=230.00' TW=0.00' (Dynamic Tailwater)
└**5=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Pond IC:

Inflow Area = 19,699 sf, 83.17% Impervious, Inflow Depth > 2.23" for 2-Year event
Inflow = 1.0 cfs @ 12.11 hrs, Volume= 3,663 cf
Outflow = 0.0 cfs @ 10.52 hrs, Volume= 2,767 cf, Atten= 96%, Lag= 0.0 min
Discarded = 0.0 cfs @ 10.52 hrs, Volume= 2,767 cf
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 234.93' @ 14.70 hrs Surf.Area= 763 sf Storage= 1,538 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 124.5 min (885.8 - 761.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	232.00'	1,323 cf	**19.42'W x 39.32'L x 6.75'H Field A** 5,153 cf Overall - 1,847 cf Embedded = 3,306 cf x 40.0% Voids
#2A	232.75'	1,847 cf	**ADS_StormTech MC-4500 +Cap** x 16 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 16 Chambers in 2 Rows Cap Storage= +35.7 cf x 2 x 2 rows = 142.8 cf
		3,169 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	236.75'	**12.0" Round Culvert** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 236.75' / 236.00' S= 0.0300 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Discarded	232.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.0 cfs @ 10.52 hrs HW=232.07' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=232.00' TW=235.90' (Dynamic Tailwater)
↑—**1=Culvert** (Controls 0.0 cfs)

Summary for Pond RD1:

Inflow Area = 7,178 sf, 53.90% Impervious, Inflow Depth > 1.14" for 2-Year event
Inflow = 0.2 cfs @ 12.11 hrs, Volume= 683 cf
Outflow = 0.2 cfs @ 12.11 hrs, Volume= 683 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.2 cfs @ 12.11 hrs, Volume= 683 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 235.66' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	235.42'	**12.0" Round Culvert** L= 29.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.42' / 234.82' S= 0.0207 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.2 cfs @ 12.11 hrs HW=235.65' TW=235.18' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.2 cfs @ 1.30 fps)

Summary for Pond RD2:

Inflow Area = 10,724 sf, 69.14% Impervious, Inflow Depth > 1.71" for 2-Year event
Inflow = 0.4 cfs @ 12.11 hrs, Volume= 1,527 cf
Outflow = 0.4 cfs @ 12.11 hrs, Volume= 1,527 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.4 cfs @ 12.11 hrs, Volume= 1,527 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 235.18' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	234.82'	**12.0" Round Culvert** L= 63.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 234.82' / 233.50' S= 0.0210 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.4 cfs @ 12.11 hrs HW=235.18' TW=233.74' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.4 cfs @ 1.61 fps)

Summary for Pond RD3:

Inflow Area = 5,353 sf, 99.89% Impervious, Inflow Depth > 2.86" for 2-Year event
Inflow = 0.4 cfs @ 12.11 hrs, Volume= 1,274 cf
Outflow = 0.4 cfs @ 12.11 hrs, Volume= 1,274 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.4 cfs @ 12.11 hrs, Volume= 1,274 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 237.89' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	237.50'	**8.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 237.50' / 236.75' S= 0.0375 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.3 cfs @ 12.11 hrs HW=237.88' TW=233.74' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.3 cfs @ 1.66 fps)

Summary for Pond RD4:

Inflow Area = 3,621 sf,100.00% Impervious, Inflow Depth > 2.86" for 2-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 862 cf
Outflow = 0.2 cfs @ 12.08 hrs, Volume= 862 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.2 cfs @ 12.08 hrs, Volume= 862 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 243.39' @ 12.08 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	243.05'	**6.0" Round Culvert** L= 90.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 243.05' / 236.75' S= 0.0700 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.2 cfs @ 12.08 hrs HW=243.39' TW=233.58' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.2 cfs @ 1.56 fps)

Summary for Pond RD5:

Inflow Area = 2,671 sf,100.00% Impervious, Inflow Depth > 2.86" for 2-Year event
Inflow = 0.2 cfs @ 12.11 hrs, Volume= 636 cf
Outflow = 0.2 cfs @ 12.11 hrs, Volume= 636 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.2 cfs @ 12.11 hrs, Volume= 636 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 244.29' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	244.00'	**6.0" Round Culvert** L= 95.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 244.00' / 243.05' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.2 cfs @ 12.11 hrs HW=244.29' TW=243.37' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.2 cfs @ 1.45 fps)

Summary for Pond RD6:

Inflow Area = 3,194 sf,100.00% Impervious, Inflow Depth > 2.86" for 2-Year event
Inflow = 0.2 cfs @ 12.11 hrs, Volume= 760 cf
Outflow = 0.2 cfs @ 12.11 hrs, Volume= 760 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.2 cfs @ 12.11 hrs, Volume= 760 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 231.37' @ 13.67 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	231.00'	**6.0" Round Culvert**

L= 31.0' CPP, projecting, no headwall, Ke= 0.900
Inlet / Outlet Invert= 231.00' / 230.00' S= 0.0323 '/' Cc= 0.900
n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.2 cfs @ 12.11 hrs HW=231.32' TW=230.78' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.2 cfs @ 1.53 fps)

Summary for Pond RD7:

Inflow Area = 876 sf, 99.54% Impervious, Inflow Depth > 2.86" for 2-Year event
Inflow = 0.1 cfs @ 12.11 hrs, Volume= 208 cf
Outflow = 0.1 cfs @ 12.11 hrs, Volume= 208 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.1 cfs @ 12.11 hrs, Volume= 208 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 232.16' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	232.00'	**6.0" Round Culvert**
			L= 27.0' CPP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 232.00' / 231.00' S= 0.0370 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.1 cfs @ 12.11 hrs HW=232.16' TW=230.78' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.1 cfs @ 1.07 fps)

Summary for Pond RD8:

Inflow Area = 2,179 sf,100.00% Impervious, Inflow Depth > 2.86" for 2-Year event
Inflow = 0.1 cfs @ 12.11 hrs, Volume= 518 cf
Outflow = 0.1 cfs @ 12.11 hrs, Volume= 518 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.1 cfs @ 12.11 hrs, Volume= 518 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 234.26' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	234.00'	**6.0" Round Culvert**
			L= 38.0' CPP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 234.00' / 232.50' S= 0.0395 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.1 cfs @ 12.11 hrs HW=234.26' TW=232.80' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.1 cfs @ 1.37 fps)

Summary for Pond WQS:

Inflow Area = 43,425 sf, 59.99% Impervious, Inflow Depth > 0.30" for 2-Year event
Inflow = 0.3 cfs @ 12.12 hrs, Volume= 1,069 cf
Outflow = 0.0 cfs @ 17.15 hrs, Volume= 325 cf, Atten= 95%, Lag= 301.6 min
Primary = 0.0 cfs @ 17.15 hrs, Volume= 325 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 231.51' @ 17.15 hrs Surf.Area= 688 sf Storage= 746 cf

Plug-Flow detention time= 486.9 min calculated for 325 cf (30% of inflow)
Center-of-Mass det. time= 290.0 min (1,212.4 - 922.3)

Volume	Invert	Avail.Storage	Storage Description
#1	229.00'	1,129 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)
229.00	8	23.0	0	0	8
230.00	214	86.3	88	88	561
231.00	513	112.2	353	441	982
232.00	880	132.2	688	1,129	1,390

Device	Routing	Invert	Outlet Devices
#1	Primary	231.50'	**6.0' long x 22.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.0 cfs @ 17.15 hrs HW=231.51' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.0 cfs @ 0.27 fps)

Summary for Link AP1:

Inflow Area = 133,541 sf, 35.81% Impervious, Inflow Depth > 0.03" for 2-Year event
Inflow = 0.0 cfs @ 17.17 hrs, Volume= 355 cf
Primary = 0.0 cfs @ 17.17 hrs, Volume= 355 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs

Summary for Subcatchment SC-1.1:

Runoff = 0.4 cfs @ 12.11 hrs, Volume= 1,303 cf, Depth> 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
3,546	98	Roofs, HSG A
3,546		100.00% Impervious Area

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

Summary for Subcatchment SC-1.2:

Runoff = 0.3 cfs @ 12.11 hrs, Volume= 1,030 cf, Depth> 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
2,804	98	Roofs, HSG A
2,804		100.00% Impervious Area

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

Summary for Subcatchment SC-1.3:

Runoff = 0.3 cfs @ 12.11 hrs, Volume= 1,174 cf, Depth> 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
3,194	98	Roofs, HSG A
3,194		100.00% Impervious Area

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

Summary for Subcatchment SC-1.4:

Runoff = 0.2 cfs @ 12.11 hrs, Volume= 801 cf, Depth> 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
2,179	98	Roofs, HSG A
2,179		100.00% Impervious Area

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

Summary for Subcatchment SC-1.5:

Runoff = 0.1 cfs @ 12.11 hrs, Volume= 322 cf, Depth> 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
872	98	Roofs, HSG A
3	30	Woods, Good, HSG A
1	39	>75% Grass cover, Good, HSG A
876	98	Weighted Average
4		0.46% Pervious Area
872		99.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	50	0.4200	0.34		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.09"
0.3	73	0.0680	3.91		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	43	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
3.1	166	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment SC-1.6:

Runoff = 0.3 cfs @ 12.11 hrs, Volume= 982 cf, Depth> 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
2,671	98	Roofs, HSG A
2,671		100.00% Impervious Area

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

Summary for Subcatchment SC-1.7:

Runoff = 0.5 cfs @ 12.11 hrs, Volume= 1,967 cf, Depth> 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
6	39	>75% Grass cover, Good, HSG A
5,347	98	Roofs, HSG A
5,353	98	Weighted Average
6		0.11% Pervious Area
5,347		99.89% Impervious Area

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

Summary for Subcatchment SC-1.8:

Runoff = 0.1 cfs @ 12.06 hrs, Volume= 349 cf, Depth> 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
950	98	Roofs, HSG A
950		100.00% Impervious Area

Summary for Subcatchment SC-2.1:

Runoff = 0.1 cfs @ 12.14 hrs, Volume= 488 cf, Depth> 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
1,981	98	Roofs, HSG A
7,742	39	>75% Grass cover, Good, HSG A
9,723	51	Weighted Average
7,742		79.63% Pervious Area
1,981		20.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
1.1	117	0.0684	1.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.4	167	Total			

Summary for Subcatchment SC-2.2:

Runoff = 0.0 cfs @ 12.19 hrs, Volume= 137 cf, Depth> 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Adj	Description
3,309	39		>75% Grass cover, Good, HSG A
1,065	98		Unconnected pavement, HSG A
4,374	53	46	Weighted Average, UI Adjusted
3,309			75.65% Pervious Area
1,065			24.35% Impervious Area
1,065			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.5	110	0.0318	3.62		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.2	160	Total			

Summary for Subcatchment SC-2.3:

Runoff = 0.0 cfs @ 12.52 hrs, Volume= 352 cf, Depth> 0.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Adj	Description
14,704	39		>75% Grass cover, Good, HSG A
876	98		Roofs, HSG A
608	98		Unconnected pavement, HSG A
16,189	44	43	Weighted Average, UI Adjusted
14,704			90.83% Pervious Area
1,484			9.17% Impervious Area
608			40.95% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0300	1.38		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.09"
0.1	30	0.0400	4.06		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.6	84	0.1250	2.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.3	164	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment SC-2.4:

Runoff = 0.0 cfs @ 12.94 hrs, Volume= 220 cf, Depth> 0.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Adj	Description
8,747	39		>75% Grass cover, Good, HSG A
1,463	98		Unconnected pavement, HSG A
10,210	47	43	Weighted Average, UI Adjusted
8,747			85.67% Pervious Area
1,463			14.33% Impervious Area
1,463			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0190	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.2	13	0.0190	0.96		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	11	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.9	170	0.0765	0.32		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
15.0	244	Total			

Summary for Subcatchment SC-2.5:

Runoff = 0.9 cfs @ 12.12 hrs, Volume= 2,908 cf, Depth> 1.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
7,250	39	>75% Grass cover, Good, HSG A
1,688	30	Woods, Good, HSG A
532	98	Unconnected pavement, HSG A
7,950	98	Paved parking, HSG A
2,206	98	Roofs, HSG A
19,625	70	Weighted Average
8,937		45.54% Pervious Area
10,688		54.46% Impervious Area
532		4.98% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.4	30	0.0367	1.34		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	50	0.0130	2.31		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.1	130	Total			

Summary for Subcatchment SC-2.6:

Runoff = 0.4 cfs @ 12.12 hrs, Volume= 1,407 cf, Depth> 1.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
596	98	Unconnected pavement, HSG A
4,328	98	Paved parking, HSG A
4,190	39	>75% Grass cover, Good, HSG A
9,114	71	Weighted Average
4,190		45.97% Pervious Area
4,924		54.03% Impervious Area
596		12.10% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	36	0.1000	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.2	14	0.0320	1.10		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.09"
0.3	74	0.0320	3.63		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.8	124	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment SC-2.7:

Runoff = 0.2 cfs @ 12.12 hrs, Volume= 786 cf, Depth> 1.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
2,128	39	>75% Grass cover, Good, HSG A
671	98	Unconnected pavement, HSG A
2,070	98	Paved parking, HSG A
21	98	Roofs, HSG A
4,890	72	Weighted Average
2,128		43.51% Pervious Area
2,762		56.49% Impervious Area
671		24.28% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	47	0.0300	1.37		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.09"
0.6	47	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment SC-2.8:

Runoff = 0.0 cfs @ 14.24 hrs, Volume= 286 cf, Depth> 0.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Adj	Description
11,411	39		>75% Grass cover, Good, HSG A
7,746	30		Woods, Good, HSG A
1,220	98		Roofs, HSG A
670	98		Unconnected pavement, HSG A
21,047	41	40	Weighted Average, UI Adjusted
19,157			91.02% Pervious Area
1,890			8.98% Impervious Area
670			35.45% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	48	0.3600	0.31		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.09"
0.2	50	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.6	80	0.0875	2.07		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.3	178	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment SC-2.9:

Runoff = 0.0 cfs @ 22.03 hrs, Volume= 118 cf, Depth> 0.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 10-Year Rainfall=4.65"

Area (sf)	CN	Description
3,715	30	Woods, Good, HSG A
13,082	39	>75% Grass cover, Good, HSG A
16,797	37	Weighted Average
16,797		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	50	0.4000	0.22		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.09"
1.1	118	0.0680	1.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.9	168	Total, Increased to minimum Tc = 5.0 min			

Summary for Pond CB-1:

Inflow Area = 4,374 sf, 24.35% Impervious, Inflow Depth > 0.38" for 10-Year event
Inflow = 0.0 cfs @ 12.19 hrs, Volume= 137 cf
Outflow = 0.0 cfs @ 12.19 hrs, Volume= 136 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.0 cfs @ 12.19 hrs, Volume= 136 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 236.90' @ 13.31 hrs
Flood Elev= 239.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.50'	**12.0" Round Culvert** L= 4.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.50' / 235.42' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.0 cfs @ 12.19 hrs HW=235.66' TW=235.64' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.0 cfs @ 0.55 fps)

Summary for Pond CB-2:

Inflow Area = 9,114 sf, 54.03% Impervious, Inflow Depth > 1.85" for 10-Year event
Inflow = 0.4 cfs @ 12.12 hrs, Volume= 1,407 cf
Outflow = 0.4 cfs @ 12.12 hrs, Volume= 1,407 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.4 cfs @ 12.12 hrs, Volume= 1,407 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 236.58' @ 12.12 hrs
Flood Elev= 239.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	236.20'	**12.0" Round Culvert** L= 5.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 236.20' / 236.00' S= 0.0400 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.4 cfs @ 12.12 hrs HW=236.58' TW=236.38' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.4 cfs @ 2.42 fps)

Summary for Pond CB-3:

Inflow Area = 4,890 sf, 56.49% Impervious, Inflow Depth > 1.93" for 10-Year event
Inflow = 0.2 cfs @ 12.12 hrs, Volume= 786 cf
Outflow = 0.2 cfs @ 12.12 hrs, Volume= 786 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.2 cfs @ 12.12 hrs, Volume= 786 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 240.42' @ 12.12 hrs
Flood Elev= 244.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	240.14'	**12.0" Round Culvert** L= 142.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.14' / 237.30' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.2 cfs @ 12.12 hrs HW=240.41' TW=237.47' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.2 cfs @ 1.41 fps)

Summary for Pond CB-4:

Double Grated Inlet

Inflow Area = 19,625 sf, 54.46% Impervious, Inflow Depth > 1.78" for 10-Year event
Inflow = 0.9 cfs @ 12.12 hrs, Volume= 2,908 cf
Outflow = 0.9 cfs @ 12.12 hrs, Volume= 2,908 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.9 cfs @ 12.12 hrs, Volume= 2,908 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2

Peak Elev= 236.56' @ 12.12 hrs
Flood Elev= 240.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	236.00'	**12.0" Round Culvert** L= 83.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 236.00' / 234.50' S= 0.0181 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.9 cfs @ 12.12 hrs HW=236.56' TW=234.96' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 0.9 cfs @ 2.01 fps)

Summary for Pond DMH-1:

Inflow Area = 33,702 sf, 71.42% Impervious, Inflow Depth > 0.94" for 10-Year event
Inflow = 0.7 cfs @ 12.12 hrs, Volume= 2,637 cf
Outflow = 0.7 cfs @ 12.12 hrs, Volume= 2,637 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.7 cfs @ 12.12 hrs, Volume= 2,637 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 236.38' @ 12.12 hrs
Flood Elev= 239.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.90'	**12.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.90' / 234.00' S= 0.0633 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.7 cfs @ 12.12 hrs HW=236.38' TW=231.24' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 0.7 cfs @ 1.86 fps)

Summary for Pond DMH-2:

Inflow Area = 4,890 sf, 56.49% Impervious, Inflow Depth > 1.93" for 10-Year event
Inflow = 0.2 cfs @ 12.12 hrs, Volume= 786 cf
Outflow = 0.2 cfs @ 12.12 hrs, Volume= 786 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.2 cfs @ 12.12 hrs, Volume= 786 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 237.48' @ 12.12 hrs
Flood Elev= 241.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	237.20'	**12.0" Round Culvert** L= 60.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 237.20' / 236.00' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.2 cfs @ 12.12 hrs HW=237.47' TW=236.38' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.2 cfs @ 1.41 fps)

Summary for Pond DMH-3:

Inflow Area = 42,851 sf, 34.44% Impervious, Inflow Depth > 1.12" for 10-Year event
Inflow = 1.1 cfs @ 12.12 hrs, Volume= 3,994 cf
Outflow = 1.1 cfs @ 12.12 hrs, Volume= 3,994 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.1 cfs @ 12.12 hrs, Volume= 3,994 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 233.03' @ 12.12 hrs
Flood Elev= 235.10'

Device	Routing	Invert	Outlet Devices
#1	Primary	232.40'	**12.0" Round Culvert** L= 24.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.40' / 232.00' S= 0.0167 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.1 cfs @ 12.12 hrs HW=233.03' TW=231.56' (Dynamic Tailwater)
1=Culvert (Inlet Controls 1.1 cfs @ 2.14 fps)

Summary for Pond DMH-4:

Inflow Area = 19,625 sf, 54.46% Impervious, Inflow Depth > 1.78" for 10-Year event
Inflow = 0.9 cfs @ 12.12 hrs, Volume= 2,908 cf
Outflow = 0.9 cfs @ 12.12 hrs, Volume= 2,908 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.9 cfs @ 12.12 hrs, Volume= 2,908 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 234.96' @ 12.12 hrs
Flood Elev= 243.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	234.40'	**12.0" Round Culvert** L= 106.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 234.40' / 232.50' S= 0.0179 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.9 cfs @ 12.12 hrs HW=234.96' TW=233.03' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.9 cfs @ 2.01 fps)

Summary for Pond IB:

Inflow Area = 46,920 sf, 40.11% Impervious, Inflow Depth > 1.40" for 10-Year event
Inflow = 1.5 cfs @ 12.12 hrs, Volume= 5,489 cf
Outflow = 0.6 cfs @ 12.26 hrs, Volume= 4,691 cf, Atten= 62%, Lag= 8.4 min
Discarded = 0.1 cfs @ 12.26 hrs, Volume= 3,239 cf
Primary = 0.5 cfs @ 12.26 hrs, Volume= 1,452 cf
Secondary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 231.79' @ 12.26 hrs Surf.Area= 1,290 sf Storage= 1,448 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 63.6 min (899.9 - 836.3)

Volume	Invert	Avail.Storage	Storage Description
#1	230.00'	3,417 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)
230.00	445	97.5	0	0	445
231.00	815	126.4	621	621	972
232.00	1,431	162.0	1,109	1,729	1,802
233.00	1,958	184.3	1,688	3,417	2,440

Device	Routing	Invert	Outlet Devices
#1	Discarded	230.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	230.50'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 230.50' / 230.00' S= 0.0250 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	232.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	231.50'	**12.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	232.00'	**6.0' long x 26.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.1 cfs @ 12.26 hrs HW=231.79' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.5 cfs @ 12.26 hrs HW=231.79' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.5 cfs of 2.7 cfs potential flow)
  ├**3=Orifice/Grate** (Controls 0.0 cfs)
  └**4=Orifice/Grate** (Orifice Controls 0.5 cfs @ 1.73 fps)

Secondary OutFlow Max=0.0 cfs @ 0.00 hrs HW=230.00' TW=0.00' (Dynamic Tailwater)
└**5=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Pond IC:

Inflow Area = 19,699 sf, 83.17% Impervious, Inflow Depth > 3.51" for 10-Year event
Inflow = 1.5 cfs @ 12.11 hrs, Volume= 5,769 cf
Outflow = 0.1 cfs @ 13.27 hrs, Volume= 3,540 cf, Atten= 92%, Lag= 69.4 min
Discarded = 0.0 cfs @ 8.96 hrs, Volume= 3,097 cf
Primary = 0.1 cfs @ 13.27 hrs, Volume= 444 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 236.90' @ 13.27 hrs Surf.Area= 763 sf Storage= 2,555 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 74.1 min (830.3 - 756.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	232.00'	1,323 cf	**19.42'W x 39.32'L x 6.75'H Field A** 5,153 cf Overall - 1,847 cf Embedded = 3,306 cf x 40.0% Voids
#2A	232.75'	1,847 cf	**ADS_StormTech MC-4500 +Cap** x 16 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 16 Chambers in 2 Rows Cap Storage= +35.7 cf x 2 x 2 rows = 142.8 cf
		3,169 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	236.75'	**12.0" Round Culvert** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 236.75' / 236.00' S= 0.0300 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Discarded	232.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.0 cfs @ 8.96 hrs HW=232.07' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 13.27 hrs HW=236.90' TW=236.11' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.1 cfs @ 1.05 fps)

Summary for Pond RD1:

Inflow Area = 7,178 sf, 53.90% Impervious, Inflow Depth > 1.95" for 10-Year event
Inflow = 0.3 cfs @ 12.12 hrs, Volume= 1,167 cf
Outflow = 0.3 cfs @ 12.12 hrs, Volume= 1,167 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.3 cfs @ 12.12 hrs, Volume= 1,167 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 236.90' @ 13.31 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	235.42'	**12.0" Round Culvert** L= 29.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.42' / 234.82' S= 0.0207 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.3 cfs @ 12.12 hrs HW=235.71' TW=235.33' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.3 cfs @ 1.46 fps)

Summary for Pond RD2:

Inflow Area = 10,724 sf, 69.14% Impervious, Inflow Depth > 2.76" for 10-Year event
Inflow = 0.6 cfs @ 12.12 hrs, Volume= 2,470 cf
Outflow = 0.6 cfs @ 12.12 hrs, Volume= 2,470 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.6 cfs @ 12.12 hrs, Volume= 2,470 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 236.90' @ 13.27 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	234.82'	**12.0" Round Culvert** L= 63.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 234.82' / 233.50' S= 0.0210 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.6 cfs @ 12.12 hrs HW=235.32' TW=234.94' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.6 cfs @ 2.36 fps)

Summary for Pond RD3:

Inflow Area = 5,353 sf, 99.89% Impervious, Inflow Depth > 4.41" for 10-Year event
Inflow = 0.5 cfs @ 12.11 hrs, Volume= 1,967 cf
Outflow = 0.5 cfs @ 12.11 hrs, Volume= 1,967 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.5 cfs @ 12.11 hrs, Volume= 1,967 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 238.00' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	237.50'	**8.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 237.50' / 236.75' S= 0.0375 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.5 cfs @ 12.11 hrs HW=237.99' TW=234.93' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.5 cfs @ 1.89 fps)

Summary for Pond RD4:

Inflow Area = 3,621 sf,100.00% Impervious, Inflow Depth > 4.41" for 10-Year event
Inflow = 0.3 cfs @ 12.08 hrs, Volume= 1,331 cf
Outflow = 0.3 cfs @ 12.08 hrs, Volume= 1,331 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.3 cfs @ 12.08 hrs, Volume= 1,331 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 243.50' @ 12.08 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	243.05'	**6.0" Round Culvert** L= 90.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 243.05' / 236.75' S= 0.0700 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.3 cfs @ 12.08 hrs HW=243.50' TW=234.67' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.3 cfs @ 1.80 fps)

Summary for Pond RD5:

Inflow Area = 2,671 sf,100.00% Impervious, Inflow Depth > 4.41" for 10-Year event
Inflow = 0.3 cfs @ 12.11 hrs, Volume= 982 cf
Outflow = 0.3 cfs @ 12.11 hrs, Volume= 982 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.3 cfs @ 12.11 hrs, Volume= 982 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 244.38' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	244.00'	**6.0" Round Culvert** L= 95.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 244.00' / 243.05' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.3 cfs @ 12.11 hrs HW=244.37' TW=243.47' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.3 cfs @ 1.65 fps)

Summary for Pond RD6:

Inflow Area = 3,194 sf,100.00% Impervious, Inflow Depth > 4.41" for 10-Year event
Inflow = 0.3 cfs @ 12.11 hrs, Volume= 1,174 cf
Outflow = 0.3 cfs @ 12.11 hrs, Volume= 1,174 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.3 cfs @ 12.11 hrs, Volume= 1,174 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 231.82' @ 12.21 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	231.00'	**6.0" Round Culvert**

L= 31.0' CPP, projecting, no headwall, Ke= 0.900
Inlet / Outlet Invert= 231.00' / 230.00' S= 0.0323 '/' Cc= 0.900
n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.3 cfs @ 12.11 hrs HW=231.71' TW=231.54' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.3 cfs @ 1.59 fps)

Summary for Pond RD7:

Inflow Area = 876 sf, 99.54% Impervious, Inflow Depth > 4.41" for 10-Year event
Inflow = 0.1 cfs @ 12.11 hrs, Volume= 322 cf
Outflow = 0.1 cfs @ 12.11 hrs, Volume= 322 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.1 cfs @ 12.11 hrs, Volume= 322 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 232.20' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	232.00'	**6.0" Round Culvert** L= 27.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.00' / 231.00' S= 0.0370 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.1 cfs @ 12.11 hrs HW=232.20' TW=231.54' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.1 cfs @ 1.19 fps)

Summary for Pond RD8:

Inflow Area = 2,179 sf,100.00% Impervious, Inflow Depth > 4.41" for 10-Year event
Inflow = 0.2 cfs @ 12.11 hrs, Volume= 801 cf
Outflow = 0.2 cfs @ 12.11 hrs, Volume= 801 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.2 cfs @ 12.11 hrs, Volume= 801 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 234.33' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	234.00'	**6.0" Round Culvert** L= 38.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 234.00' / 232.50' S= 0.0395 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.2 cfs @ 12.11 hrs HW=234.33' TW=233.02' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.2 cfs @ 1.54 fps)

Summary for Pond WQS:

Inflow Area = 43,425 sf, 59.99% Impervious, Inflow Depth > 0.86" for 10-Year event
Inflow = 0.8 cfs @ 12.12 hrs, Volume= 3,124 cf
Outflow = 0.3 cfs @ 12.28 hrs, Volume= 2,377 cf, Atten= 60%, Lag= 9.2 min
Primary = 0.3 cfs @ 12.28 hrs, Volume= 2,377 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 231.57' @ 12.28 hrs Surf.Area= 711 sf Storage= 789 cf

Plug-Flow detention time= 154.2 min calculated for 2,377 cf (76% of inflow)
Center-of-Mass det. time= 57.6 min (943.5 - 885.9)

Volume	Invert	Avail.Storage	Storage Description
#1	229.00'	1,129 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)
229.00	8	23.0	0	0	8
230.00	214	86.3	88	88	561
231.00	513	112.2	353	441	982
232.00	880	132.2	688	1,129	1,390

Device	Routing	Invert	Outlet Devices
#1	Primary	231.50'	**6.0' long x 22.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.3 cfs @ 12.28 hrs HW=231.57' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.3 cfs @ 0.72 fps)

Summary for Link AP1:

Inflow Area = 133,541 sf, 35.81% Impervious, Inflow Depth > 0.41" for 10-Year event
Inflow = 0.8 cfs @ 12.27 hrs, Volume= 4,519 cf
Primary = 0.8 cfs @ 12.27 hrs, Volume= 4,519 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs

Summary for Subcatchment SC-1.1:

Runoff = 0.6 cfs @ 12.11 hrs, Volume= 2,397 cf, Depth> 8.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
3,546	98	Roofs, HSG A
3,546		100.00% Impervious Area

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

Summary for Subcatchment SC-1.2:

Runoff = 0.5 cfs @ 12.11 hrs, Volume= 1,896 cf, Depth> 8.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
2,804	98	Roofs, HSG A
2,804		100.00% Impervious Area

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

Summary for Subcatchment SC-1.3:

Runoff = 0.6 cfs @ 12.11 hrs, Volume= 2,159 cf, Depth> 8.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
3,194	98	Roofs, HSG A
3,194		100.00% Impervious Area

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

Summary for Subcatchment SC-1.4:

Runoff = 0.4 cfs @ 12.11 hrs, Volume= 1,473 cf, Depth> 8.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
2,179	98	Roofs, HSG A
2,179		100.00% Impervious Area

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

Summary for Subcatchment SC-1.5:

Runoff = 0.2 cfs @ 12.11 hrs, Volume= 592 cf, Depth> 8.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
872	98	Roofs, HSG A
3	30	Woods, Good, HSG A
1	39	>75% Grass cover, Good, HSG A
876	98	Weighted Average
4		0.46% Pervious Area
872		99.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	50	0.4200	0.34		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.09"
0.3	73	0.0680	3.91		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	43	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
3.1	166	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment SC-1.6:

Runoff = 0.5 cfs @ 12.11 hrs, Volume= 1,806 cf, Depth> 8.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
2,671	98	Roofs, HSG A
2,671		100.00% Impervious Area

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

Summary for Subcatchment SC-1.7:

Runoff = 1.0 cfs @ 12.11 hrs, Volume= 3,619 cf, Depth> 8.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
6	39	>75% Grass cover, Good, HSG A
5,347	98	Roofs, HSG A
5,353	98	Weighted Average
6		0.11% Pervious Area
5,347		99.89% Impervious Area

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

Summary for Subcatchment SC-1.8:

Runoff = 0.2 cfs @ 12.06 hrs, Volume= 643 cf, Depth> 8.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
950	98	Roofs, HSG A
950		100.00% Impervious Area

Summary for Subcatchment SC-2.1:

Runoff = 0.6 cfs @ 12.13 hrs, Volume= 2,089 cf, Depth> 2.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
1,981	98	Roofs, HSG A
7,742	39	>75% Grass cover, Good, HSG A
9,723	51	Weighted Average
7,742		79.63% Pervious Area
1,981		20.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
1.1	117	0.0684	1.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.4	167	Total			

Summary for Subcatchment SC-2.2:

Runoff = 0.2 cfs @ 12.14 hrs, Volume= 740 cf, Depth> 2.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Adj	Description
3,309	39		>75% Grass cover, Good, HSG A
1,065	98		Unconnected pavement, HSG A
4,374	53	46	Weighted Average, UI Adjusted
3,309			75.65% Pervious Area
1,065			24.35% Impervious Area
1,065			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.5	110	0.0318	3.62		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.2	160	Total			

Summary for Subcatchment SC-2.3:

Runoff = 0.6 cfs @ 12.13 hrs, Volume= 2,314 cf, Depth> 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Adj	Description
14,704	39		>75% Grass cover, Good, HSG A
876	98		Roofs, HSG A
608	98		Unconnected pavement, HSG A
16,189	44	43	Weighted Average, UI Adjusted
14,704			90.83% Pervious Area
1,484			9.17% Impervious Area
608			40.95% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0300	1.38		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.09"
0.1	30	0.0400	4.06		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.6	84	0.1250	2.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.3	164	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment SC-2.4:

Runoff = 0.3 cfs @ 12.25 hrs, Volume= 1,451 cf, Depth> 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Adj	Description
8,747	39		>75% Grass cover, Good, HSG A
1,463	98		Unconnected pavement, HSG A
10,210	47	43	Weighted Average, UI Adjusted
8,747			85.67% Pervious Area
1,463			14.33% Impervious Area
1,463			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0190	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.2	13	0.0190	0.96		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	11	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.9	170	0.0765	0.32		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
15.0	244	Total			

Summary for Subcatchment SC-2.5:

Runoff = 2.4 cfs @ 12.12 hrs, Volume= 7,799 cf, Depth> 4.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
7,250	39	>75% Grass cover, Good, HSG A
1,688	30	Woods, Good, HSG A
532	98	Unconnected pavement, HSG A
7,950	98	Paved parking, HSG A
2,206	98	Roofs, HSG A
19,625	70	Weighted Average
8,937		45.54% Pervious Area
10,688		54.46% Impervious Area
532		4.98% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.4	30	0.0367	1.34		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	50	0.0130	2.31		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.1	130	Total			

Summary for Subcatchment SC-2.6:

Runoff = 1.2 cfs @ 12.12 hrs, Volume= 3,712 cf, Depth> 4.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
596	98	Unconnected pavement, HSG A
4,328	98	Paved parking, HSG A
4,190	39	>75% Grass cover, Good, HSG A
9,114	71	Weighted Average
4,190		45.97% Pervious Area
4,924		54.03% Impervious Area
596		12.10% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	36	0.1000	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.09"
0.2	14	0.0320	1.10		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.09"
0.3	74	0.0320	3.63		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.8	124	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment SC-2.7:

Runoff = 0.6 cfs @ 12.12 hrs, Volume= 2,040 cf, Depth> 5.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
2,128	39	>75% Grass cover, Good, HSG A
671	98	Unconnected pavement, HSG A
2,070	98	Paved parking, HSG A
21	98	Roofs, HSG A
4,890	72	Weighted Average
2,128		43.51% Pervious Area
2,762		56.49% Impervious Area
671		24.28% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	47	0.0300	1.37		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.09"
0.6	47	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment SC-2.8:

Runoff = 0.6 cfs @ 12.13 hrs, Volume= 2,469 cf, Depth> 1.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Adj	Description
11,411	39		>75% Grass cover, Good, HSG A
7,746	30		Woods, Good, HSG A
1,220	98		Roofs, HSG A
670	98		Unconnected pavement, HSG A
21,047	41	40	Weighted Average, UI Adjusted
19,157			91.02% Pervious Area
1,890			8.98% Impervious Area
670			35.45% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	48	0.3600	0.31		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.09"
0.2	50	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.6	80	0.0875	2.07		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.3	178	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment SC-2.9:

Runoff = 0.3 cfs @ 12.13 hrs, Volume= 1,559 cf, Depth> 1.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
NRCC 24-hr D 100-Year Rainfall=8.36"

Area (sf)	CN	Description
3,715	30	Woods, Good, HSG A
13,082	39	>75% Grass cover, Good, HSG A
16,797	37	Weighted Average
16,797		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	50	0.4000	0.22		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.09"
1.1	118	0.0680	1.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.9	168	Total, Increased to minimum Tc = 5.0 min			

Summary for Pond CB-1:

Inflow Area = 4,374 sf, 24.35% Impervious, Inflow Depth > 2.03" for 100-Year event
Inflow = 0.2 cfs @ 12.14 hrs, Volume= 740 cf
Outflow = 0.2 cfs @ 12.14 hrs, Volume= 738 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.2 cfs @ 12.14 hrs, Volume= 738 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 239.50' @ 12.22 hrs
Flood Elev= 239.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.50'	**12.0" Round Culvert** L= 4.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.50' / 235.42' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.0 cfs @ 12.14 hrs HW=238.27' TW=238.89' (Dynamic Tailwater)
↑—**1=Culvert** (Controls 0.0 cfs)

Summary for Pond CB-2:

Inflow Area = 9,114 sf, 54.03% Impervious, Inflow Depth > 4.89" for 100-Year event
Inflow = 1.2 cfs @ 12.12 hrs, Volume= 3,712 cf
Outflow = 1.2 cfs @ 12.12 hrs, Volume= 3,712 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.2 cfs @ 12.12 hrs, Volume= 3,712 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 239.71' @ 12.14 hrs
Flood Elev= 239.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	236.20'	**12.0" Round Culvert** L= 5.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 236.20' / 236.00' S= 0.0400 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.8 cfs @ 12.12 hrs HW=239.18' TW=237.52' (Dynamic Tailwater)
1=Culvert (Inlet Controls 3.8 cfs @ 4.90 fps)

Summary for Pond CB-3:

Inflow Area = 4,890 sf, 56.49% Impervious, Inflow Depth > 5.01" for 100-Year event
Inflow = 0.6 cfs @ 12.12 hrs, Volume= 2,040 cf
Outflow = 0.6 cfs @ 12.12 hrs, Volume= 2,040 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.6 cfs @ 12.12 hrs, Volume= 2,040 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 240.60' @ 12.12 hrs
Flood Elev= 244.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	240.14'	**12.0" Round Culvert** L= 142.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.14' / 237.30' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.6 cfs @ 12.12 hrs HW=240.60' TW=239.08' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.6 cfs @ 1.81 fps)

Summary for Pond CB-4:

Double Grated Inlet

Inflow Area = 19,625 sf, 54.46% Impervious, Inflow Depth > 4.77" for 100-Year event
Inflow = 2.4 cfs @ 12.12 hrs, Volume= 7,799 cf
Outflow = 2.4 cfs @ 12.12 hrs, Volume= 7,799 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.4 cfs @ 12.12 hrs, Volume= 7,799 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2

Peak Elev= 237.17' @ 12.12 hrs
Flood Elev= 240.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	236.00'	**12.0" Round Culvert** L= 83.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 236.00' / 234.50' S= 0.0181 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.4 cfs @ 12.12 hrs HW=237.16' TW=235.56' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 2.4 cfs @ 3.08 fps)

Summary for Pond DMH-1:

Inflow Area = 33,702 sf, 71.42% Impervious, Inflow Depth > 3.86" for 100-Year event
Inflow = 5.1 cfs @ 12.16 hrs, Volume= 10,851 cf
Outflow = 5.1 cfs @ 12.16 hrs, Volume= 10,851 cf, Atten= 0%, Lag= 0.0 min
Primary = 5.1 cfs @ 12.16 hrs, Volume= 10,851 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 239.32' @ 12.16 hrs
Flood Elev= 239.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.90'	**12.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.90' / 234.00' S= 0.0633 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=5.0 cfs @ 12.16 hrs HW=239.21' TW=231.95' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 5.0 cfs @ 6.37 fps)

Summary for Pond DMH-2:

Inflow Area = 4,890 sf, 56.49% Impervious, Inflow Depth > 5.01" for 100-Year event
Inflow = 0.6 cfs @ 12.12 hrs, Volume= 2,040 cf
Outflow = 0.6 cfs @ 12.12 hrs, Volume= 2,040 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.6 cfs @ 12.12 hrs, Volume= 2,040 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 239.52' @ 12.14 hrs
Flood Elev= 241.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	237.20'	**12.0" Round Culvert** L= 60.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 237.20' / 236.00' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.5 cfs @ 12.12 hrs HW=239.08' TW=237.52' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 3.5 cfs @ 4.46 fps)

Summary for Pond DMH-3:

Inflow Area = 42,851 sf, 34.44% Impervious, Inflow Depth > 3.29" for 100-Year event
Inflow = 3.4 cfs @ 12.12 hrs, Volume= 11,742 cf
Outflow = 3.4 cfs @ 12.12 hrs, Volume= 11,742 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.4 cfs @ 12.12 hrs, Volume= 11,742 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 234.23' @ 12.12 hrs
Flood Elev= 235.10'

Device	Routing	Invert	Outlet Devices
#1	Primary	232.40'	**12.0" Round Culvert** L= 24.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.40' / 232.00' S= 0.0167 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.4 cfs @ 12.12 hrs HW=234.22' TW=232.17' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 3.4 cfs @ 4.37 fps)

Summary for Pond DMH-4:

Inflow Area = 19,625 sf, 54.46% Impervious, Inflow Depth > 4.77" for 100-Year event
Inflow = 2.4 cfs @ 12.12 hrs, Volume= 7,799 cf
Outflow = 2.4 cfs @ 12.12 hrs, Volume= 7,799 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.4 cfs @ 12.12 hrs, Volume= 7,799 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 235.57' @ 12.12 hrs
Flood Elev= 243.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	234.40'	**12.0" Round Culvert** L= 106.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 234.40' / 232.50' S= 0.0179 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.4 cfs @ 12.12 hrs HW=235.56' TW=234.21' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 2.4 cfs @ 3.08 fps)

Summary for Pond IB:

Inflow Area = 46,920 sf, 40.11% Impervious, Inflow Depth > 3.71" for 100-Year event
Inflow = 4.2 cfs @ 12.12 hrs, Volume= 14,493 cf
Outflow = 4.0 cfs @ 12.14 hrs, Volume= 13,347 cf, Atten= 5%, Lag= 1.1 min
Discarded = 0.1 cfs @ 12.14 hrs, Volume= 3,988 cf
Primary = 2.7 cfs @ 12.14 hrs, Volume= 8,623 cf
Secondary = 1.2 cfs @ 12.14 hrs, Volume= 736 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 232.18' @ 12.14 hrs Surf.Area= 1,519 sf Storage= 1,992 cf

Plug-Flow detention time= 68.6 min calculated for 13,347 cf (92% of inflow)
Center-of-Mass det. time= 24.6 min (854.8 - 830.2)

Volume	Invert	Avail.Storage	Storage Description
#1	230.00'	3,417 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)
230.00	445	97.5	0	0	445
231.00	815	126.4	621	621	972
232.00	1,431	162.0	1,109	1,729	1,802
233.00	1,958	184.3	1,688	3,417	2,440

Device	Routing	Invert	Outlet Devices
#1	Discarded	230.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	230.50'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 230.50' / 230.00' S= 0.0250 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	232.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	231.50'	**12.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	232.00'	**6.0' long x 26.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.1 cfs @ 12.14 hrs HW=232.17' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=2.6 cfs @ 12.14 hrs HW=232.17' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 2.6 cfs of 3.2 cfs potential flow)
  ├**3=Orifice/Grate** (Weir Controls 1.5 cfs @ 1.36 fps)
  └**4=Orifice/Grate** (Orifice Controls 1.1 cfs @ 3.41 fps)

Secondary OutFlow Max=1.2 cfs @ 12.14 hrs HW=232.17' TW=0.00' (Dynamic Tailwater)
└**5=Broad-Crested Rectangular Weir** (Weir Controls 1.2 cfs @ 1.11 fps)

Summary for Pond IC:

Inflow Area = 19,699 sf, 83.17% Impervious, Inflow Depth > 6.76" for 100-Year event
Inflow = 2.8 cfs @ 12.11 hrs, Volume= 11,099 cf
Outflow = 3.7 cfs @ 12.17 hrs, Volume= 8,593 cf, Atten= 0%, Lag= 3.4 min
Discarded = 0.0 cfs @ 4.28 hrs, Volume= 3,493 cf
Primary = 3.7 cfs @ 12.17 hrs, Volume= 5,100 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 240.84' @ 12.15 hrs Surf.Area= 763 sf Storage= 3,169 cf

Plug-Flow detention time= 145.0 min calculated for 8,578 cf (77% of inflow)
Center-of-Mass det. time= 41.4 min (793.3 - 751.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	232.00'	1,323 cf	**19.42'W x 39.32'L x 6.75'H Field A** 5,153 cf Overall - 1,847 cf Embedded = 3,306 cf x 40.0% Voids
#2A	232.75'	1,847 cf	**ADS_StormTech MC-4500 +Cap** x 16 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 16 Chambers in 2 Rows Cap Storage= +35.7 cf x 2 x 2 rows = 142.8 cf
		3,169 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	236.75'	**12.0" Round Culvert** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 236.75' / 236.00' S= 0.0300 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Discarded	232.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.0 cfs @ 4.28 hrs HW=232.07' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=3.3 cfs @ 12.17 hrs HW=240.20' TW=239.01' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 3.3 cfs @ 4.14 fps)

Summary for Pond RD1:

Inflow Area = 7,178 sf, 53.90% Impervious, Inflow Depth > 4.40" for 100-Year event
Inflow = 0.7 cfs @ 12.12 hrs, Volume= 2,634 cf
Outflow = 0.7 cfs @ 12.12 hrs, Volume= 2,633 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.7 cfs @ 12.12 hrs, Volume= 2,634 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 240.93' @ 12.19 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	235.42'	**12.0" Round Culvert** L= 29.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.42' / 234.82' S= 0.0207 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.0 cfs @ 12.12 hrs HW=238.30' TW=238.55' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.0 cfs)

Summary for Pond RD2:

Inflow Area = 10,724 sf, 69.14% Impervious, Inflow Depth > 5.63" for 100-Year event
Inflow = 1.3 cfs @ 12.12 hrs, Volume= 5,032 cf
Outflow = 1.3 cfs @ 12.12 hrs, Volume= 5,031 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.3 cfs @ 12.12 hrs, Volume= 5,031 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 239.48' @ 12.19 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	234.82'	**12.0" Round Culvert** L= 63.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 234.82' / 233.50' S= 0.0210 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.0 cfs @ 12.12 hrs HW=238.50' TW=239.26' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.0 cfs)

Summary for Pond RD3:

Inflow Area = 5,353 sf, 99.89% Impervious, Inflow Depth > 8.11" for 100-Year event
Inflow = 1.0 cfs @ 12.11 hrs, Volume= 3,619 cf
Outflow = 1.0 cfs @ 12.11 hrs, Volume= 3,619 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.0 cfs @ 12.11 hrs, Volume= 3,619 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 239.59' @ 12.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	237.50'	**8.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 237.50' / 236.75' S= 0.0375 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.0 cfs @ 12.11 hrs HW=238.77' TW=239.15' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.0 cfs)

Summary for Pond RD4:

Inflow Area = 3,621 sf,100.00% Impervious, Inflow Depth > 8.11" for 100-Year event
Inflow = 0.6 cfs @ 12.08 hrs, Volume= 2,449 cf
Outflow = 0.6 cfs @ 12.08 hrs, Volume= 2,449 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.6 cfs @ 12.08 hrs, Volume= 2,449 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 243.96' @ 12.08 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	243.05'	**6.0" Round Culvert** L= 90.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 243.05' / 236.75' S= 0.0700 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.6 cfs @ 12.08 hrs HW=243.95' TW=238.18' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.6 cfs @ 3.06 fps)

Summary for Pond RD5:

Inflow Area = 2,671 sf,100.00% Impervious, Inflow Depth > 8.11" for 100-Year event
Inflow = 0.5 cfs @ 12.11 hrs, Volume= 1,806 cf
Outflow = 0.5 cfs @ 12.11 hrs, Volume= 1,806 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.5 cfs @ 12.11 hrs, Volume= 1,806 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 244.68' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	244.00'	**6.0" Round Culvert** L= 95.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 244.00' / 243.05' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.5 cfs @ 12.11 hrs HW=244.67' TW=243.84' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.5 cfs @ 2.38 fps)

Summary for Pond RD6:

Inflow Area = 3,194 sf,100.00% Impervious, Inflow Depth > 8.11" for 100-Year event
Inflow = 0.6 cfs @ 12.11 hrs, Volume= 2,159 cf
Outflow = 0.6 cfs @ 12.11 hrs, Volume= 2,159 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.6 cfs @ 12.11 hrs, Volume= 2,159 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 232.76' @ 12.12 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	231.00'	**6.0" Round Culvert**

L= 31.0' CPP, projecting, no headwall, Ke= 0.900
Inlet / Outlet Invert= 231.00' / 230.00' S= 0.0323 '/' Cc= 0.900
n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.6 cfs @ 12.11 hrs HW=232.73' TW=232.17' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.6 cfs @ 2.86 fps)

Summary for Pond RD7:

Inflow Area = 876 sf, 99.54% Impervious, Inflow Depth > 8.11" for 100-Year event
Inflow = 0.2 cfs @ 12.11 hrs, Volume= 592 cf
Outflow = 0.2 cfs @ 12.11 hrs, Volume= 592 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.2 cfs @ 12.11 hrs, Volume= 592 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 232.33' @ 12.12 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	232.00'	**6.0" Round Culvert**
			L= 27.0' CPP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 232.00' / 231.00' S= 0.0370 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.2 cfs @ 12.11 hrs HW=232.33' TW=232.17' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.2 cfs @ 1.59 fps)

Summary for Pond RD8:

Inflow Area = 2,179 sf,100.00% Impervious, Inflow Depth > 8.11" for 100-Year event
Inflow = 0.4 cfs @ 12.11 hrs, Volume= 1,473 cf
Outflow = 0.4 cfs @ 12.11 hrs, Volume= 1,473 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.4 cfs @ 12.11 hrs, Volume= 1,473 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 234.55' @ 12.12 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	234.00'	**6.0" Round Culvert**
			L= 38.0' CPP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 234.00' / 232.50' S= 0.0395 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.4 cfs @ 12.11 hrs HW=234.54' TW=234.17' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.4 cfs @ 2.04 fps)

Summary for Pond WQS:

Inflow Area = 43,425 sf, 59.99% Impervious, Inflow Depth > 3.58" for 100-Year event
Inflow = 5.7 cfs @ 12.16 hrs, Volume= 12,940 cf
Outflow = 5.1 cfs @ 12.18 hrs, Volume= 12,185 cf, Atten= 10%, Lag= 1.0 min
Primary = 5.1 cfs @ 12.18 hrs, Volume= 12,185 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 231.96' @ 12.18 hrs Surf.Area= 864 sf Storage= 1,096 cf

Plug-Flow detention time= 46.5 min calculated for 12,185 cf (94% of inflow)
Center-of-Mass det. time= 15.5 min (855.9 - 840.4)

Volume	Invert	Avail.Storage	Storage Description
#1	229.00'	1,129 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)
229.00	8	23.0	0	0	8
230.00	214	86.3	88	88	561
231.00	513	112.2	353	441	982
232.00	880	132.2	688	1,129	1,390

Device	Routing	Invert	Outlet Devices
#1	Primary	231.50'	**6.0' long x 22.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=4.9 cfs @ 12.18 hrs HW=231.95' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 4.9 cfs @ 1.81 fps)

Summary for Link AP1:

Inflow Area = 133,541 sf, 35.81% Impervious, Inflow Depth > 2.41" for 100-Year event
Inflow = 9.7 cfs @ 12.16 hrs, Volume= 26,868 cf
Primary = 9.7 cfs @ 12.16 hrs, Volume= 26,868 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs

Stormwater Management Standard 3
GROUNDWATER RECHARGE

Pre-Development Conditions

Mass co. Housing
336-338 King Street, Littleton, MA
Project No. 191096

		Area (sf)	Area (Ac)
Total Subcatchment Areas		133,541	3.1
Total Subcatchment Areas On-Site		133,541	3.1
Total Area of Hydrolic Soil Groups On-Site		133,541	3.1
Surface Type Areas			
Grass Cover, Good	A	85,388	2.0
Pave Parking	A	17,800	0.4
Roofs	A	7,682	0.2
Woods, Good	A	22,671	0.5
Total Impervious Area		25,482	0.6

Infiltration Volume

Inches of Recharge per Storm Event	A	0.60

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

Infiltration Volume	**5,403**	**CF**

Stormwater Management Standard 3
GROUNDWATER RECHARGE

Post Development Conditions

Mass co. Housing
336-338 King Street, Littleton, MA
Project No. 191096

		Area (sf)	Area (Ac)
Total Subcatchment Areas		133,541	3.1
Total Subcatchment Areas On-Site		133,541	3.1
Total Area of Hydrolic Soil Groups On-Site		133,541	3.1
Surface Type Areas			
Grass Cover, Good	A	72,571	1.7
Paved Parking	A	14,348	0.3
Unconnected Pavement / Walkway	A	5,604	0.1
Roofs	A	27,867	0.6
Woods	A	13,151	0.3
Total Impervious Area		47,819	1.1

Infiltration Volume

Inches of Recharge per Storm Event A 0.60

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

Natural Infiltration Volume	4,286	CF	
Pre-Development Infiltration Volume	5,403	CF	
Required Infiltration Volume (Unadjusted)	1,117	CF	
Total Site Impervious Capture Area	35,044	SF	(73% Site Impervious Area Captured)
Impervious Area Capture Adjustment Rate	1.00		
Required Infiltration Volume	**1,117**	**CF**	[Req Infiltration Vol. Unadjusted x Imp. Area Capture Adjustment Rate]

Provided Infiltration Volume

Infiltration Basin (IB)	1,098	CF	Volume below 231.50' Orifice
Infiltration Chambers (IC)	2,417	CF	Volume below 236.75' Orifice
Total Provided Inilteation Volume	**3,515**	**CF**	

Stormwater Management Standard 3
GROUNDWATER RECHARGE

Infiltration Area Requirements

Mass co. Housing
336-338 King Street, Littleton, MA
Project No. 191096

Drawdown Time

(Per Massachusetts Stormwater regulations, infiltration areas must completely drain within 72 hours)

		Infiltration Basin (IB)	Infiltration Chambers (IC)
Infiltration Area Storage Volume	cf	1,098	2,417
Design infiltration Rate	in/hr	2.41	2.41
Infiltration Bottom Area	sf	445	764

Drawdown Time = Infiltration Area Storage Volume / [Design Infiltration Rate x Infiltration Area Bottom Area]

Drawdown Time (Hrs)	**12.3**	**15.8**

Mounding Analysis

Per the Massachusetts Stormwater Handbook, mounding analysis is required when ".. The vertical separation from the bottom of an exfiltration system to seasonal high groundwater is less than four (4) feet and the recharge system is proposed to attenuate the peak discharge from a 10-year or higher 24-hour storm." The mounding analysis "... must show that the REQUIRED RECHARGE VOLUME is fully dewatered within 72 hours..."

			Infiltration Basin (IB)	Infiltration Chambers (IC)
Hydraulic Conductivity	(K)	ft/day	16	16
			Lower Range Standard Value for "Medium Sand" material	
Specific Yield	(Sy)		0.28	0.28
			Standard Value for "Medium Sand" material	
Initial Saturated Thickness	(h)	ft	10	10
			Depth to bedrock	
Infiltration Rate	(q)	ft/day	4.82	4.82
Design Recharge Rate	(Q)	cf/day	2145	3682
Time		days	3	3
			Minimum 72 hr evaluation period	
Bottom Infiltrating Area		sf	445	764
Length of Infiltration Area		ft	38.5	39.3
Width of Infiltration Area		ft	11.6	19.4
Time when Infiltration Stops	(t)	days	0.51	0.66
			Calculated Drawdown Time (see Above)	
Maximum Water table rise at 72 hours[1]	(s)	**ft**	**0.19**	**0.44**
		in	**2 3/8**	**5 2/8**

- Resulting mound will not interfere with the full draining of the infiltration area in accordance with Mass Stormwater Standards -

[1] - mounding analysis calculated using the MOUNDSOLV Wizaard, Groundwater Mounding Analysis For A Sloping Water-Table Aquifer, Zlotnik Et Al. (2017) Solution.

Stormwater Management Standard 4
WATER QUALITY RETENTION VOLUME

Mass co. Housing
336-338 King Street, Littleton, MA
Project No. 191096

Parameter	Unit	Quantity	Remarks
Watershed area	sf	133,541	
Predevelopment impervious area	sf	25,482	
Total impervious area added	sf	22,337	
Total impervious area	sf	47,819	
Total impervious area required for retention	sf	22,337	
Runoff depth over impervious area	IN	1.0	
Required Water Quality Volume	**CF**	**1,861**	

Provided Water Quality Volume

Infiltration Basin (IB)	1,098	CF	Volume below 231.50' Orifice
Infiltration Chambers (IC)	2,417	CF	Volume below 236.75' Orifice

DESIGN VOLUME PROVIDED	**CF**	**3,515**

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MASTEP Technology Review

Technology Name: Stormwater Buffer Zone

Studies Reviewed: Verification Testing of a 4-ft Stormwater Buffer Zone Stormwater Catch Basin Treatment Unit, Alden Laboratory 2012

Date: 1/7/2013

Reviewer: Jerry Schoen

Rating: 2

Brief rationale for rating: This laboratory study in general followed New Jersey protocols for laboratory testing, but only test 7 runs were performed (15 or more recommended). The report lacks details on quality control procedures.

Other Comments:

- ASTM 3977, the Suspended Sediment Concentration method was used.
- Influent sediment concentration generally 200 mg/l range, within NJCAT guidelines.
- Sediment mix used had a mean particle size of 70 microns, within NJCAT guidelines.
- 5 flow rates tested, ranging from < 10% to 125% of system design flow.
- Scour test was performed according to NJCAT guidelines. No scour found.
- Sediment removal efficiency ranged from 41% - 77%, depending on flow rates tested. Overall removal efficiency of 62.6% reported.

Stormwater Management Standard 4
TSS REMOVAL

Mass co. Housing
336-338 King Street, Littleton, MA
Project No. 191096

Process Train No.	Impervious Area (SF)	BMP Type	TSS Removal Rate	TSS Remaining at Discharge	TSS Removed at Discharge
SC-2.5	9,832	SP	63%	37%	**63%**
		FB / INF	80%	7%	**93%**
SC-2.6	4,925	SP	63%	37%	**63%**
		WQS	70%	11%	**89%**
SC-2.7	2,455	SP	63%	37%	**63%**
		WQS	70%	11%	**89%**

* - Impervious areas within the remaining Subcatchments on site are limited to proposed dwelling roofs and walkways which will not accumulate or produce sediment. Any runoff produced by these areas must flow through long stretches of existing grass or captured and discharging directly into the proposed Infiltration Basin/Infiltration Chambers/Water Quality Swale prior to reaching a design analysis point and have been considered as clean runoff for the above calculations.

ABBREVIATIONS:
TSS=total suspended solids; SF=square feet; SC=subcatchment; GC=grassed channel; BMP=best management practices; CB=deep sump hooded catch basin; FB = Sediment Forebay; INF=infiltration basin; WB=wet basin; SP=Silt Prison Catch Basin WQS= Water Quality Swale; IC= Infiltration Chambers