Littleton Water Resource Recovery Facility

Stormwater Management Report

1.0 Introduction

This report addresses stormwater management associated with the Town of Littleton's proposed Water Resource Recovery Facility (WRRF). Stormwater management for Littleton's WRRF has been designed based on the 2008 *Massachusetts Stormwater Handbook.*

2.0 Existing Conditions

The WRRF site is located in a former agricultural field surrounded by a wooded area at the north of 242 King Street. The site is bounded by Interstate 495 (I-495) to the west and by Beaver Brook to the east. An existing residential house, barn, dilapidated pool and pool house are located on the site, with the back of the lot undeveloped. The topography slopes down from King Street to wetlands and Beaver Brook and rises in elevation to I-495. General surface grades range from El 210 to El. 220 ft within the proposed WRRF layout. Topography rises to about El. 232 ft near I-495. Stormwater runoff from a portion of I-495, the southeast access ramp and the clover leaf within the southeast access ramp discharges to the proposed site through a 36-inch culvert that crosses King Street. Stormwater runoff from King Street also discharges to the proposed site through a 12-inch pipe. Flow from these outfalls is conveyed through a man-made ditch to an existing low-lying area that periodically fills and overtops towards Beaver Brook. All stormwater runoff from the site discharges to Beaver Brook. A portion of the site is located within the 100-year floodplain for Beaver Brook, with a 100-year flood elevation of 211 ft (NAVD 88). Figures 1 and 2 provide the existing drainage area maps. The total modelled drainage area is approximately 15.77 ac, with approximately 2.45 ac of impervious area. Most of that impervious area is associated with the off-site drainage; approximately 0.35 ac of impervious area is at the proposed site.

3.0 Proposed Conditions

The proposed WRRF will consist of a subsurface flow equalization tank, biological tanks, membrane process building, waste sludge tank, effluent pumping station, entrance driveway with a turn-around area, and concrete pads for ancillary equipment. The existing barn will be demolished to provide space for the entrance driveway and an infiltration basin. The house will be sold as a private residential property. The site has been laid out to avoid construction within the 50-ft no disturb zone from the Bordering Vegetated Wetlands associated with Beaver Brook. Stormwater runoff from the I-495 southeast access ramp and King Street will continue to discharge on-site as it does under existing conditions and flow into the existing low-lying area. This low-lying area will be reconfigured to provide peak attenuation at the site. A sediment forebay will be added to the downstream end of the existing man-made ditch prior to flow entering the low-lying area to provide water quality treatment to the off-site highway stormwater runoff. All stormwater runoff will continue to discharge to Beaver Brook. The total proposed impervious area within the drainage basin under proposed conditions is 2.99 ac, an increase of 0.53 ac (23,100 sf) from existing conditions. This increase is entirely due to the construction of the WRRF and site improvements. Figures 3 and 4 provide the proposed drainage area maps.

This project is considered a new development project per the 2008 *Massachusetts Stormwater Handbook* because there will be an increase in impervious area. Stormwater runoff from the WRRF will be directed to one of three infiltration basins that will provide groundwater recharge and water quality treatment. Two of the three infiltration basins will overtop into the reconfigured low-lying area where peak attenuation will be provided.

Minimum Control Measure #5, "Stormwater Management in New Development and Redevelopment", in the NPDES Phase II MS4 General Permit (MS4 Permit) requires compliance with the MA Stormwater Management Standards for projects that result in total earth disturbance equal to or greater than 1 acre, which applies to this project. Based on the MS4 permit, the Littleton WRRF is considered a new development project because it will be constructed on land that is currently undeveloped. As a project subject to the requirements of the MS4 permit, the project must meet an average annual pollutant removal of 60% of the average annual load of total phosphorus related to the total post-construction impervious surface area, in addition to 90% total suspended solids. This requirement will be met by retaining the volume of runoff equivalent to 1.0 inch times the total impervious area via the infiltration basins.

4.0 Drainage Analysis

CDM Smith performed drainage analyses for the WRRF under existing and proposed conditions. The drainage analyses determined peak rates of runoff during 2-, 10-, and 100-year, 24-hour storm events using HydroCAD, version 10.0. This computer model simulates stormwater runoff flows through drainage areas and stormwater management facilities, and is based on the Natural Resources Soil Conservation Service (NRCS) Method.

Following is a summary of the methodology used to perform the drainage analyses.

- Precipitation data for standard storms used in the models were taken from NOAA Atlas 14, Volume 10. The estimated precipitation depths during the 2-, 10-, and 100-year 24-hour storms are 3.18, 4.91, and 7.65 inches, respectively (see Appendix A).

- To evaluate future resiliency at the WRRF, the RMAT Climate Resilience Design Standards Tool (Tool) was used. With regard to extreme precipitation, the Tool indicated that the 2070, 50-year, 24-hour storm should be considered. Per NOAA Atlas 14, Volume 10, the present-day 50-year, 24-hour precipitation depth is 6.79 inches. Using the RMAT Total Precipitation Depth and Peak Intensity Design Criteria, Tier 2 Methodology, the percent increase for a late century (2070/2090) more frequent design storm is 20 percent. Thus, the 2070, 50-year, 24-hour storm precipitation depth is 8.15 inches (see Appendix A).

- The NRCS Web Soil Survey was consulted to determine the hydrologic soil groups (HSG) at the project site and off-site areas. For the project site, the NRCS has classified the soils as "Scarboro mucky fine sandy loam," "Hinckley loamy sand," and "Udorthents -Urban land complex." For the off-site area, the NRCS has classified the soils as "Charlton-Hollis-Rock outcrop complex," "Udorthents," and "Udorthents-Urban land complex." CDM Smith conservatively assigns Urban Land and Udorthents to HSG "C". The NRCS has assigned Charlton-Hollis-Rock outcrop complex and Hinckley loamy sand to HSG "A" soils and Scarboro muck fine sandy loam to HSG "A/D".

For this soil, CDM Smith used HSG "D" because the soil is in its undrained, natural condition. NRCS Web Soil Survey information can be found in Appendix B

- Between August 13 and 18, 2021, CDM Smith advanced six borings at the site. The soils were found to be generally sand and gravel with silt. Borings B-02, B-03, B-05 and B-06 were selected to be representative of the soils under the proposed infiltration basins. CDM Smith estimated the USDA soil texture classification of samples from these borings. Samples from borings B-03 and B-06 were classified as "sandy loam" and have an infiltration rate of 1.02 inches/hours using Table 2.3.3 in Volume 3, Chapter 1 of Massachusetts Stormwater Handbook. Samples B-02 and B-05 were classified as "loam" and "loamy sand," respectively, and have infiltration rates of 0.52 and 2.41 inches/hour, respectively. The infiltration rate for borings B-03 and B-06 were applied to infiltration basin DB2, which is located adjacent to the subsurface flow equalization tank. The infiltration rate for B-02 was applied to infiltration basin DB3, which is located at the entrance driveway. The infiltration rate for B-05 was applied to infiltration basin BB2, which is adjacent to the membrane process building. Two groundwater monitoring wells were installed at the site. Groundwater elevations from February 18, 2022, for monitoring wells B.MW-4 and B.MW-07 were El. 208.7 ft and 209.5 ft, respectively. Based on these readings, seasonal high groundwater for the site was set at El. 209.5. Geotechnical data are provided in Appendix B.
- The design analysis point for existing and proposed conditions is Beaver Brook because all stormwater ultimately discharges to the brook.
- Curve Numbers (CNs) for the different land uses on the site were selected based on HSG "A", "C" amd "D" soils for existing and proposed conditions. Land uses included grass cover, woods, buildings, gravel, and paved areas. Weighted CNs were calculated in HydroCAD.
- Times of concentration (Tc) were calculated in HydroCAD and were based on the Velocity Method in the NRCS National Engineering Handbook (May 2010). A minimum Tc of 6 minutes was used for all drainage areas.

HydroCAD was used to generate peak discharge rates and runoff volumes for existing and proposed conditions. Table 1 provides a summary of modeling results for existing and proposed conditions at the Beaver Brook design point. As Table 1 shows, peak discharge rates for proposed conditions are equal to or less than those for existing conditions during the 10- and 100-year storm events at the Beaver Brook design point. During the 2-year storm event, there is a minor increase in the peak discharge rate over existing conditions. This increase in the peak discharge rate comes entirely from the proposed "Beaver Brook 1" drainage area, which is not tributary to any of the infiltration basins. The WRRF does not generate any stormwater runoff to Beaver Brook during the 2-year storm event. The existing mostly wooded "Beaver Brook" drainage area, which is comprised of 82 percent HSG "A" soils and has a weighted CN of 39, generates no runoff during the 2-year storm event. The remaining existing drainage areas are tributary to the existing low-lying area, which does not overtop and flow towards Beaver Brook during the 2-year storm event. Thus, existing total runoff to the Beaver Brook design point during the 2-year storm event is zero.

For proposed conditions, the "Beaver Brook" drainage area is significantly reduced in area to include the existing house and a strip of land along the edge of the entrance driveway and infiltration basin BB2 (collectively identified as the "Beaver Brook 1" drainage area). This drainage area has a weighted

CN of 56 with 62 percent HSG "A" soils. This higher weighted CN generates 0.1 cfs of runoff during the 2-year storm event. The grassed strip of land along the entrance driveway slopes down towards Beaver Brook and is located adjacent to the 50-ft no disturb zone, resulting in no opportunity to construct stormwater management facilities that provide peak attenuation. Most of the remaining area in the "Beaver Brook 1" drainage area is the residential area, which will be sold as a private single family residential property, and in the long term will no longer be part of the WRRF property, thus eliminating the opportunity to provide stormwater management facilities on this section of the site. It is also noted that the Stormwater Management Standards do not apply to single family houses. The HydroCAD modeling input and output can be found in Appendix C.

Table 1
Littleton WRRF – Littleton, Massachusetts
HydroCAD Modeling Results

Storm Event	*Existing Conditions*	*Proposed Conditions*
	Peak Discharge Rate (cfs)	*Peak Discharge Rate (cfs)*
2-Year, 24-Hour	0.0	0.1
10-Year, 24-Hour	2.9	2.1
100-Year, 24-Hour	32.4	21.2
2070, 50-Year, 24-Hour	37.5	25.8

Table 1 also presents the modeling results for the 2070, 50-year storm event. As shown in the table, peak discharge rates are attenuated under proposed conditions. The HydroCAD model indicates that the peak water surface elevation in the low-lying area is elevation 211.4 ft during this storm, which is less than the elevations of the proposed entrance driveway and WRRF facilities.

Since the low-lying area fills to elevation 211.0 ft during a 100-year flood, a HydroCAD model scenario assuming a starting water surface elevation of 211.0 ft in the low-lying area and a tailwater elevation of 211.0 ft was considered for existing and proposed conditions. Table 2 presents the modeling results for existing and proposed conditions at the Beaver Brook design point. As this table shows, peak discharge rates for proposed conditions are equal to or less than those for existing conditions during all storm events at the Beaver Brook design point, including the 2070, 50-year storm. The proposed conditions modeling results demonstrate that there is sufficient storage in the low-lying area above 100-year flood elevation of 211.0 ft to provide peak attenuation. Peak water surface elevations for proposed conditions do not exceed elevation 212.0 ft.

Table 2
Littleton WRRF – Littleton, Massachusetts
HydroCAD Modeling Results for 100-Year Flood

Storm Event	*Existing Conditions*	*Proposed Conditions*
	Peak Discharge Rate (cfs)	*Peak Discharge Rate (cfs)*
2-Year, 24-Hour	4.3	3.9
10-Year, 24-Hour	14.2	12.2
100-Year, 24-Hour	34.7	30.2
2070, 50-Year, 24-Hour	38.8	33.9

The site was also analyzed for compliance with the recharge volume (Rv) and water quality volume (WQv) requirements in the *Massachusetts Stormwater Handbook*. Since most of the soils in the impervious areas are located on HSG "A" soils, the recharge target depth factor of 0.6 inches was applied to all impervious areas within the WRRF. The total corresponding Rv for the WRRF is 1,680 cf. All required groundwater recharge for the WRRF is provided in the infiltration basins.

The project site is located within a Zone II public water supply; therefore, the water quality volume is based on 1 inch times the total impervious area, with a total corresponding WQv of 2,820 cf. Table 3 summarizes the impervious area, the calculated required recharge and water quality volumes, along with the total storage volume provided in each stormwater management facility. As shown in this table, the infiltration basins provide the total required recharge volume and water quality volume for the site.

Table 3
Summary of Overall Impervious Area, Rv and WQv
Littleton WRRF

Stormwater Management Facility	*Impervious Area (sf)*	*Recharge Volume (cf)*	*Water Quality Volume (cf)*	*Volume Provided (cf)*
Infiltration Basin BB2	10,700	530	890	930
Infiltration Basin DB2	16,000	800	1,340	1,470
Infiltration Basin DB3	7,000	350	590	800
Total	33,700	1,680	2,820	3,200

The drawdown times of the water in the infiltration basins were calculated using the total storage volume provided below the outlet and the total bottom surface area of the infiltration basin. The drawdown calculations indicate that stormwater will infiltrate within the required 72 hours, based on the infiltration rates assigned to the infiltration basins. Appendix D provides the recharge volume, water quality volume, and drawdown calculations.

Stormwater management systems must be designed to remove 80 percent of the average annual load (post-construction conditions) of Total Suspended Solids (TSS). All impervious areas at the WRRF are tributary to one of the three infiltration basins, where stormwater runoff from the impervious area will receive 80% TSS removal. Stormwater runoff will receive pretreatment in sediment forebays located just upstream of the infiltration basins. The TSS worksheets are provided in Appendix E.

Compliance with the MS4 is met with the retention of 1 inch of runoff from impervious areas within the infiltration basins.

5.0 Floodplain Culvert

Under existing conditions, the low-lying area serves as part of the 100-year floodplain. As water rises from Beaver Brook, once the water surface elevation reaches approximately elevation 210.5 ft, water starts to flow into the low-lying area. The proposed entrance driveway cuts through this area and would prevent the flow of water from Beaver Brook into the low-lying area. To maintain this hydraulic connectivity and keep this area as part of the floodplain, which will be expanded to provided floodplain compensation, a culvert is proposed under the entrance driveway. The culvert is designed to equal or exceed the estimated existing flow into the low-lying area.

For existing conditions, the connection between Beaver Brook and the low-lying area was assumed to be a broad-crested weir with a weir elevation set at 210.5 ft. Since the 100-year flood elevation is 211.0 ft, it was assumed the head of the weir is 0.5 ft. The length of the weir between the 211.0 ft contours was estimated to be 67 ft. Using these variables, the flow capacity of the weir was calculated to be 64 cfs. The high point of the entrance driveway was set at the location of the culvert. Culvert options were considered that minimized the vertical profile of the entrance driveway, while also providing the required flow at an elevation close to existing weir elevation. A 6-ft-wide by 3-ft-high box culvert embedded 18 inches into the subgrade was selected. The invert at the top of the embedment is elevation 210.25 ft. The length of the culvert is 55 ft, with a downstream elevation of 209.5 ft (S = 0.0136). The 6-ft-wide by 1.5-ft-high culvert has a capacity of 85 cfs. Appendix F provides the existing weir and proposed culvert calculations.

6.0 Compliance with Stormwater Standards

The proposed Littleton WRRF is a new development project, and it must fully meet the Massachusetts Stormwater Management Standards. The following summary below describes compliance with each of the stormwater standards. The Stormwater Checklist is provided at the end of this section.

6.1 Stormwater Standard No. 1 – No New Untreated Discharges

The proposed project fully meets the requirement of Stormwater Standard No. 1, as there are no new untreated discharges. Stormwater runoff from the WRRF is directed to one of three infiltration basins where treatment is provided prior to discharge.

6.2 Stormwater Standard No. 2 – Peak Rate Attenuation

As shown in Table 1, peak discharge rates for proposed conditions are equal to or less than those for existing conditions for the 10- and 100-year storm events. During the 2-year storm event, there is a minor increase in the peak discharge rate over existing conditions. Therefore, this standard is partially met. As discussed in Section 4.0, this minor increase in the peak discharge rate is due a higher overall weighted CN for the drainage area that includes the strip of land along the entrance driveway and along infiltration basin BB2, and the future private single family residential property. Within this drainage area, there is no opportunity to construct stormwater management facilities to provide peak attenuation. It is also noted that single family homes are not subject to the Massachusetts Stormwater Standards.

For the 2070, 50-year storm event, peak discharge rates for proposed conditions are less than those for existing conditions. For the scenario assuming a 100-year flood elevation of 211 ft in the low-lying area, peak discharge rates for proposed conditions are less than those for existing conditions for all storm events.

6.3 Stormwater Standard No. 3- Recharge

Recharge to groundwater for the impervious area is fully met through three infiltration basins. Since most of the soils in the impervious areas are located on HSG "A" soils, the recharge target depth factor is 0.6 inches. Calculations demonstrate that the infiltration basins will drain within 72 hours.

6.4 Stormwater Standard No. 4 – Water Quality

The required water quality volume is based 1.0 inches times the total impervious area because the WRRF is located within a Zone II public water supply. This standard is fully met; all stormwater runoff from impervious areas at the WRRF receive 80% TSS removal in the infiltration basins.

6.5 Stormwater Standard No. 5 – Land Uses With Higher Potential Pollutant Loads

This standard is not applicable to this project. There are no Land Uses with Higher Potential Pollutant Loads (LUHPPLs) in the project area.

6.6 Stormwater Standard No. 6 – Critical Areas

The WRRF is located in a critical area, a Zone II public water supply. This standard is fully met; all stormwater runoff from impervious areas at the WRRF receive 80% TSS removal in the infiltration basins.

6.7 Stormwater Standard No. 7 – Redevelopment

This is not a redevelopment project as defined by the Massachusetts Stormwater Handbook and, therefore this standard does not apply.

6.8 Stormwater Standard No. 8 – Construction Period Pollution Prevention and Erosion and Sedimentation Control

The project is subject to a NPDES General Construction Permit, which will be obtained by the Contractor. A copy of the Stormwater Pollution Prevention Plan (SWPPP) will be developed by the Contractor prior to construction.

6.9 Stormwater Standard No. 9 – Operation and Maintenance Plans

An Operation and Maintenance Plan and Long-Term Pollution Prevention Plan are included with this submittal in Appendix G.

6.10 Stormwater Standard No. 10 – Prohibition of Illicit Discharges

The proposed project fully meets the requirement of Stormwater Standard No. 10 as there are no illicit discharges.

Legend
Stormwater Delineation Boundary

PL
NP

Figure 1
Existing Drainage Area Map
Route I-495 and King Street
March 2022

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Beaver Brook
Total Area: 93,700SF

242 King St. House
Total Area: 156,600SF

WETLAND FLAGS 1–22, 1–24, 1–30, 1–31, 1–33, 1–34, 1–35, 1–36, 1–38, 1–40 & 1–42 AND FLAGS AHW 13, 17–20, 23 & 25 WERE NOT FOUND

SCALE: 1" = 30'

Legend
Stormwater Delineation Boundary

Figure 2
Existing Drainage Area Map
Littleton WRRF Site
March 2022

CDM Smith
listen. think. deliver.

Legend
Stormwater Delineation Boundary

PL

NP

Figure 3
Proposed Drainage Area Map
Route I-495 and King Street
March 2022

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CDM Smith
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Beaver Brook 2
Total Area: 24,400SF

Infiltration Basin BB2

Detention Basin 2
Total Area: 48,900SF

Infiltration Basin DB2

242 King St. House
Total Area: 120,200SF

Infiltration Basin DB3

Detention Basin 3
Total Area: 20,200SF

Beaver Brook 1
Total Area: 36,600

SCALE: 1" = 20'

Legend
Stormwater Delineation Boundary

Figure 4
Proposed Drainage Area Map
Littleton WRRF Site
March 2022

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Stormwater Checklist

CDM Smith

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

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

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

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

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

Diane E. Velardocchia 4/1/22
Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Partially met - does not meet 2-year peak attenuation as described in Section 4.0 of the Stormwater Report.

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) Not applicable

☐ 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 Not applicable

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☐ An Illicit Discharge Compliance Statement is attached;

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

Appendix A
Rainfall Data

NOAA Atlas 14, Volume 10, Version 3
Location name: Littleton, Massachusetts, USA*
Latitude: 42.5383°, Longitude: -71.4896°
Elevation: 210.35 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.323 (0.254-0.407)	0.385 (0.302-0.485)	0.485 (0.379-0.613)	0.568 (0.442-0.721)	0.682 (0.514-0.903)	0.768 (0.566-1.04)	0.859 (0.615-1.20)	0.964 (0.651-1.37)	1.12 (0.726-1.64)	1.25 (0.789-1.86)
10-min	0.458 (0.360-0.577)	0.545 (0.428-0.686)	0.687 (0.537-0.868)	0.805 (0.626-1.02)	0.967 (0.728-1.28)	1.09 (0.802-1.47)	1.22 (0.871-1.70)	1.37 (0.922-1.94)	1.59 (1.03-2.32)	1.77 (1.12-2.64)
15-min	0.539 (0.424-0.678)	0.641 (0.503-0.808)	0.808 (0.632-1.02)	0.946 (0.735-1.20)	1.14 (0.856-1.51)	1.28 (0.944-1.73)	1.43 (1.02-2.00)	1.61 (1.09-2.28)	1.86 (1.21-2.73)	2.08 (1.32-3.10)
30-min	0.733 (0.576-0.923)	0.873 (0.685-1.10)	1.10 (0.862-1.39)	1.29 (1.00-1.64)	1.55 (1.17-2.05)	1.75 (1.29-2.36)	1.96 (1.40-2.73)	2.19 (1.48-3.12)	2.55 (1.65-3.73)	2.84 (1.80-4.24)
60-min	0.927 (0.729-1.17)	1.11 (0.867-1.39)	1.40 (1.09-1.76)	1.64 (1.27-2.08)	1.97 (1.48-2.60)	2.22 (1.63-2.99)	2.48 (1.78-3.47)	2.78 (1.88-3.95)	3.23 (2.10-4.74)	3.60 (2.28-5.38)
2-hr	1.17 (0.928-1.46)	1.42 (1.12-1.77)	1.82 (1.43-2.28)	2.15 (1.68-2.71)	2.60 (1.98-3.43)	2.94 (2.19-3.96)	3.31 (2.40-4.63)	3.75 (2.54-5.29)	4.42 (2.88-6.43)	5.00 (3.17-7.40)
3-hr	1.35 (1.07-1.67)	1.64 (1.30-2.03)	2.11 (1.67-2.63)	2.50 (1.97-3.14)	3.05 (2.32-4.00)	3.45 (2.58-4.62)	3.88 (2.83-5.42)	4.42 (3.00-6.20)	5.24 (3.41-7.58)	5.95 (3.78-8.76)
6-hr	1.72 (1.38-2.11)	2.09 (1.68-2.58)	2.71 (2.16-3.35)	3.22 (2.55-4.00)	3.92 (3.01-5.11)	4.44 (3.34-5.91)	5.01 (3.67-6.94)	5.71 (3.89-7.94)	6.78 (4.44-9.74)	7.72 (4.92-11.3)
12-hr	2.17 (1.76-2.66)	2.64 (2.14-3.24)	3.41 (2.75-4.19)	4.05 (3.24-5.00)	4.93 (3.82-6.37)	5.58 (4.23-7.36)	6.29 (4.63-8.62)	7.15 (4.90-9.87)	8.47 (5.56-12.1)	9.61 (6.15-13.9)
24-hr	2.61 (2.13-3.16)	3.18 (2.59-3.86)	4.13 (3.35-5.02)	4.91 (3.96-6.01)	5.99 (4.66-7.66)	6.79 (5.17-8.87)	7.65 (5.66-10.4)	8.71 (5.99-11.9)	10.3 (6.81-14.6)	11.7 (7.53-16.8)
2-day	2.96 (2.43-3.56)	3.65 (3.00-4.39)	4.78 (3.91-5.76)	5.71 (4.64-6.93)	7.00 (5.49-8.89)	7.95 (6.10-10.3)	8.98 (6.70-12.1)	10.3 (7.09-13.9)	12.3 (8.10-17.1)	14.0 (9.00-19.9)
3-day	3.23 (2.67-3.87)	3.97 (3.28-4.76)	5.18 (4.26-6.22)	6.18 (5.05-7.46)	7.56 (5.96-9.56)	8.58 (6.61-11.1)	9.69 (7.25-13.0)	11.1 (7.66-14.9)	13.2 (8.73-18.3)	15.0 (9.69-21.3)
4-day	3.49 (2.90-4.16)	4.26 (3.53-5.08)	5.51 (4.54-6.59)	6.55 (5.36-7.87)	7.97 (6.30-10.0)	9.03 (6.97-11.6)	10.2 (7.62-13.6)	11.6 (8.04-15.6)	13.8 (9.13-19.1)	15.6 (10.1-22.0)
7-day	4.21 (3.51-4.98)	5.01 (4.18-5.94)	6.33 (5.25-7.52)	7.42 (6.11-8.86)	8.92 (7.08-11.1)	10.0 (7.77-12.8)	11.2 (8.42-14.8)	12.7 (8.84-16.9)	14.8 (9.88-20.4)	16.7 (10.8-23.4)
10-day	4.89 (4.10-5.76)	5.71 (4.78-6.74)	7.07 (5.89-8.36)	8.19 (6.78-9.74)	9.73 (7.75-12.0)	10.9 (8.45-13.7)	12.1 (9.07-15.8)	13.5 (9.48-18.0)	15.7 (10.5-21.4)	17.4 (11.3-24.3)
20-day	6.89 (5.82-8.05)	7.78 (6.57-9.10)	9.23 (7.76-10.8)	10.4 (8.72-12.3)	12.1 (9.69-14.8)	13.4 (10.4-16.6)	14.7 (11.0-18.8)	16.0 (11.3-21.1)	17.9 (12.0-24.3)	19.4 (12.6-26.8)
30-day	8.54 (7.26-9.93)	9.49 (8.05-11.0)	11.0 (9.32-12.9)	12.3 (10.3-14.4)	14.1 (11.3-17.0)	15.4 (12.0-19.0)	16.8 (12.5-21.2)	18.1 (12.8-23.7)	19.9 (13.4-26.8)	21.2 (13.8-29.1)
45-day	10.6 (9.06-12.3)	11.6 (9.91-13.5)	13.3 (11.3-15.4)	14.6 (12.3-17.1)	16.5 (13.3-19.8)	18.0 (14.1-22.0)	19.4 (14.5-24.3)	20.7 (14.7-26.9)	22.4 (15.1-30.0)	23.5 (15.3-32.1)
60-day	12.4 (10.6-14.2)	13.4 (11.5-15.5)	15.2 (12.9-17.5)	16.6 (14.0-19.3)	18.6 (15.0-22.2)	20.2 (15.8-24.5)	21.7 (16.2-26.9)	23.0 (16.4-29.7)	24.5 (16.6-32.7)	25.6 (16.7-34.8)

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

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

Please refer to NOAA Atlas 14 document for more information.

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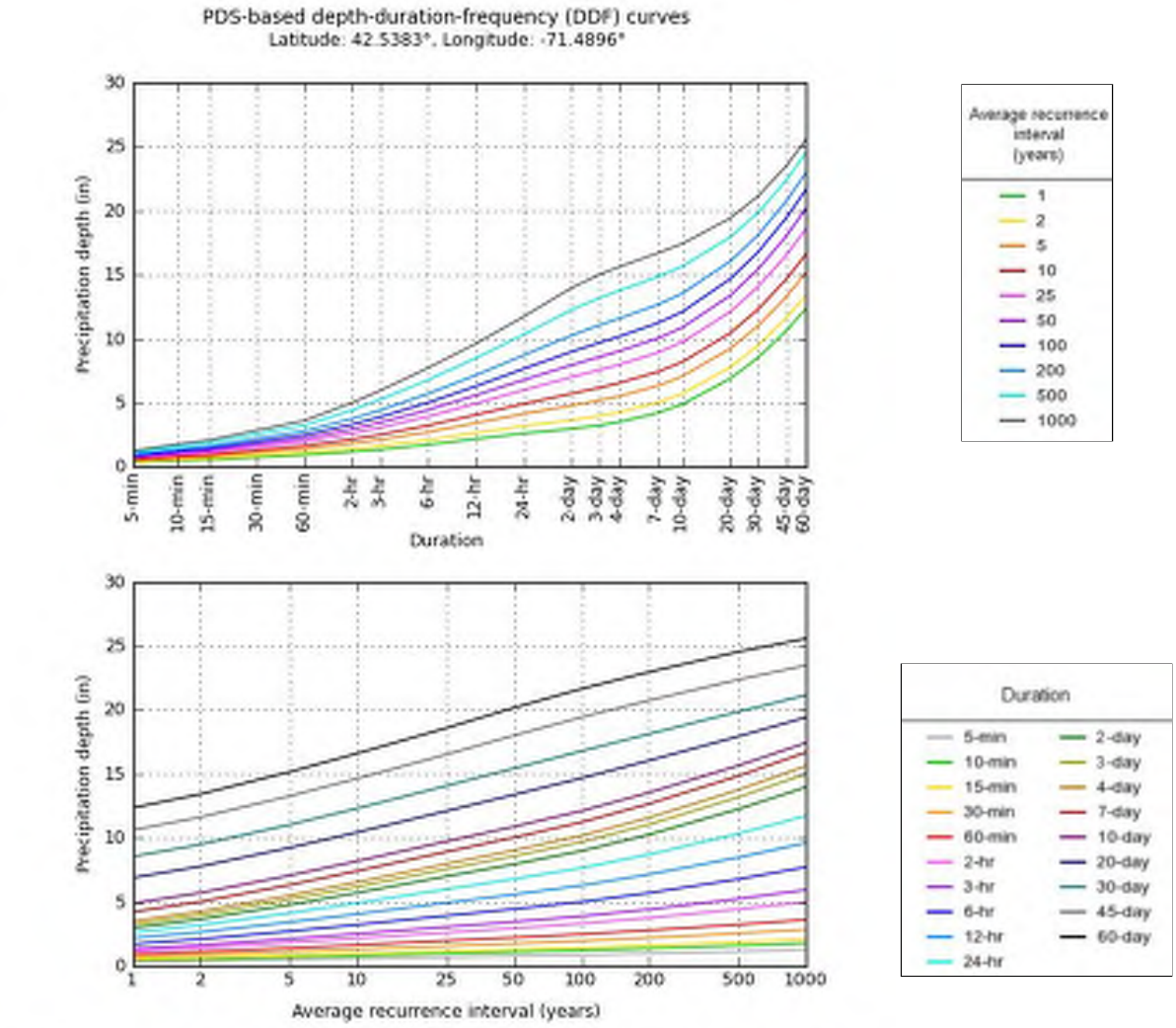
PF graphical



NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Wed Mar 16 14:42:06 2022

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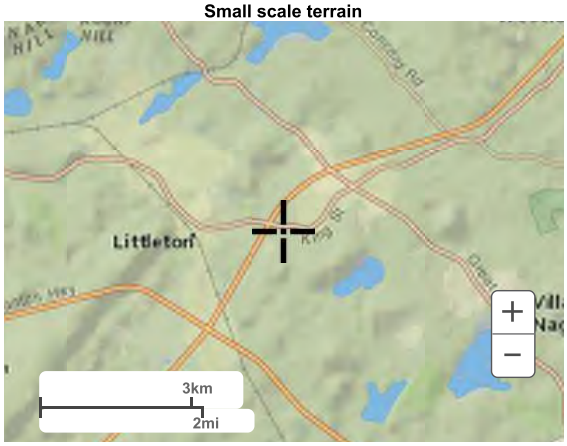
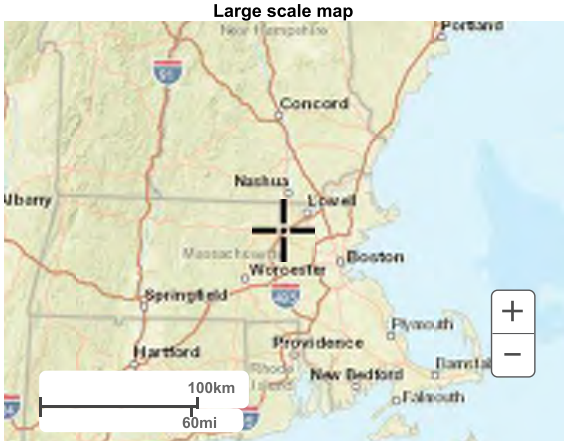
Maps & aerials

Small scale terrain

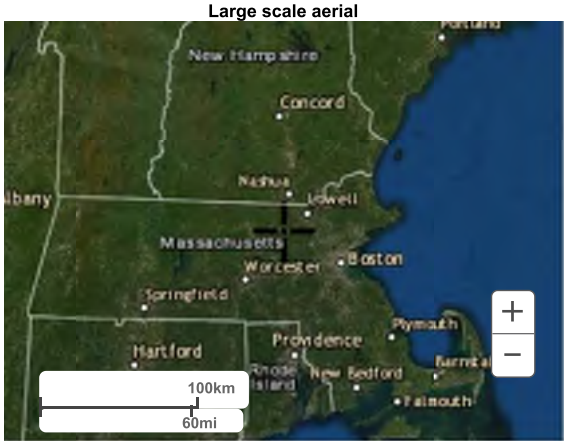


Large scale terrain

Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

RMAT Tiered Methodology to Assess 24-hr Precipitation Storm Depth and Peak Intensity - Tier 2 Projects (Medium Level of Effort)

Given Standards Output from Tool: Planning Horizon (2030, 2050, 2070, 2090); Recurrence Interval (5-yr, 10-yr, 25-yr, 50-yr, 100-yr, 500-yr)

Step 1: Go to NOAA Atlas 14 website.
Input Project Area based on Project Location

Step 2: Select NOAA Atlas-14[1] median value for each given 24-hr design storm depth

Step 3: Apply percent increase[2] to NOAA median values based on given planning horizon for each given 24-hr design storm depth

Location	Design Storm	Mid-Century (2030/2050)	Late Century (2070/2090)
Massachusetts (all counties except Hampden)	More Frequent Design Storm*	8%	20%
	100-yr Design Storm	11%	27%
	Extreme Design Storm**	15%	36%
Hampden County	More Frequent Design Storm*	15%	36%
	100-yr Design Storm	Perform Tier 3 Analysis	
	Extreme Design Storm**	Perform Tier 3 Analysis	

* More Frequent includes 2-yr, 5-yr, 10-yr, 25-yr, 50-yr design storms
** Extreme includes 200-yr, 500-yr design storms

Step 4: 24-hr design storm depths for given planning horizon and design storm

Step 5: Use SCS Type III/NOAA Atlas 14[1] distribution to estimate hourly/sub-hourly peak intensities

Step 6: Design storm hyetograph and peak intensity for given design storm depths

Legends
Data Gathering
Calculation steps
Design Criteria
Existing practice

REFERENCES
1. NOAA Atlas 14 Point Precipitation Frequency Estimates: Northeastern States; NOAA Atlas 14, Volume 10, Version 3
2. USGCRP, 2017: Climate Science Special Report: Fourth National Climate Assessment (Fig: 7.7; RCP 8.5 Scenario; Page 220)

VERSION 1.0 METHODOLOGY
12/4/2020

Appendix B
Geotechnical Information

Soil Map—Middlesex County, Massachusetts
(Littleton WRRF)

Map Scale: 1:4,270 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 21, Sep 2, 2021

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

Date(s) aerial images were photographed: Sep 9, 2020—Oct 15, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	9.0	22.1%
103B	Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes	2.6	6.3%
253B	Hinckley loamy sand, 3 to 8 percent slopes	5.8	14.2%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	2.7	6.7%
655	Udorthents, wet substratum	1.7	4.1%
656	Udorthents-Urban land complex	18.9	46.6%
Totals for Area of Interest		**40.7**	**100.0%**

Hydrologic Soil Group—Middlesex County, Massachusetts
(Littleton WRRF)

Map Scale: 1:4,270 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 Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 21, Sep 2, 2021

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

Date(s) aerial images were photographed: Sep 9, 2020—Oct 15, 2020

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	A/D	9.0	22.1%
103B	Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes	A	2.6	6.3%
253B	Hinckley loamy sand, 3 to 8 percent slopes	A	5.8	14.2%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	B	2.7	6.7%
655	Udorthents, wet substratum		1.7	4.1%
656	Udorthents-Urban land complex		18.9	46.6%
Totals for Area of Interest			**40.7**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Boring/Monitoring Well Locations - WRRF

Legend

- Boring Location
- Boring/ Monitoring Well Location

Littleton Sewer System Expansion – Littleton Common Area
Proposed Water Resource Recovery Facility
Boring Locations
Figure 1

CDM Smith Geotechnical Laboratory Testing Summary Sheet

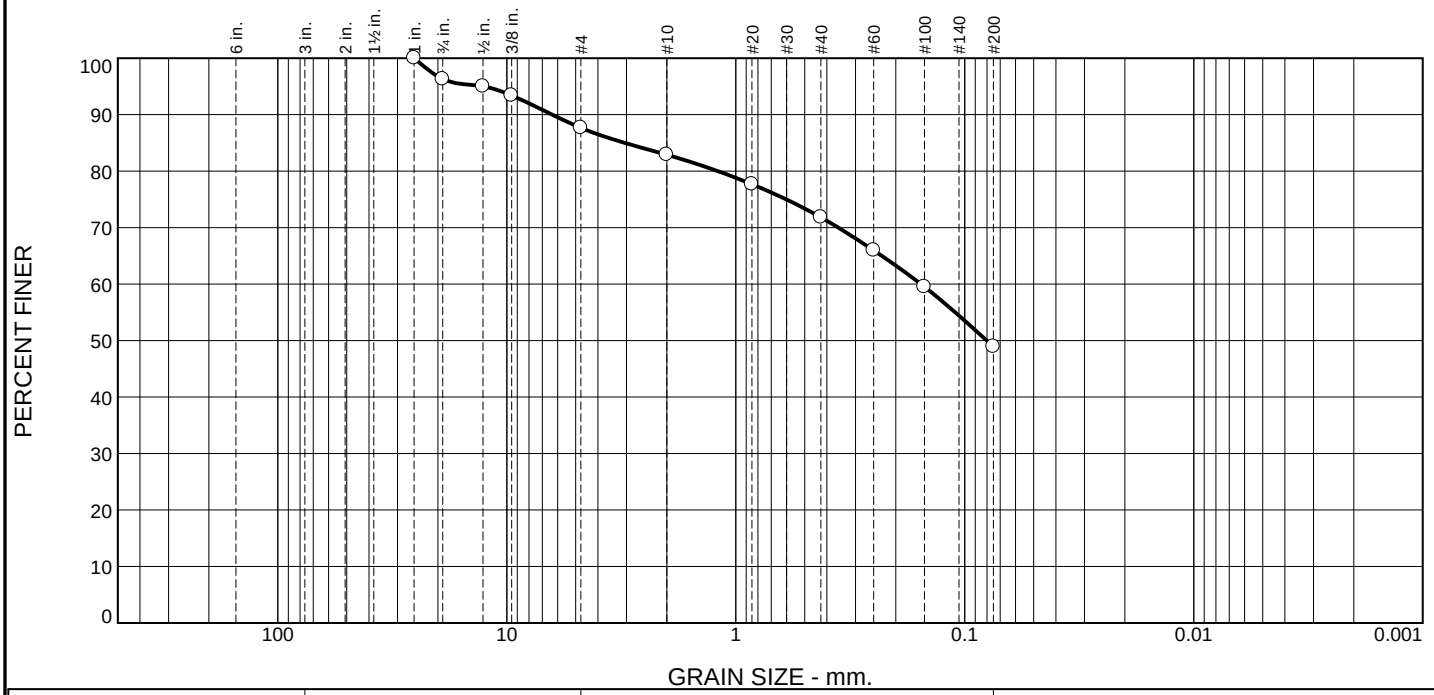
Client: Littleton Light and Sewer | Project Number: 263387-261886 | Reviewed By: M. Polsky - Lab Manager

Project Name: Littleton Sewer Extension | Task: TASK 1.02

Project Location: Littleton, MA | Assigned By: A. Recio/T. Dunn | Date Reviewed: 10/6/2021

Sample Date	Boring Number	Sample	Depth (ft)	Identification Tests								Strength Tests			
				Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	Dry unit wt. pcf	$\bar{\sigma}_c$ psi	Failure Criteria (CIU)	Compr. Ratio	Soil Description
8/18/21	B-02	S-3	4-6	17.5			12.3	38.8	48.9						Brown silty sand
8/16/21	B-03	S-4	9-11	12.1			44.9	42.0	13.1						Brown silty gravel with sand
8/18/21	B-05	S-5	14-16	12.1			34.2	55.1	10.7						Brown poorly graded sand with silt and gravel
8/17/21	B-06	S-5	14-16	11.0			26.2	54.7	19.1						Gray-brown silty sand with gravel
8/17/21	B-06	S-6	19-21	15.3			11.0	68.2	20.8						Brown silty sand
8/11/21	B.MW-01	S-5	14-16	18.4			0.8	93.7	5.5						Brown poorly graded sand with silt
8/11/2021	B.MW-01	S-7	24-26	19.7			0.7	90.1	9.2						Brown poorly graded sand with silt
8/13/21	B.MW-04	S-5	14-16	14.7			56.8	30.3	12.9						Brown silty gravel with sand
8/17/2021	B.MW-07	S-4	9-11	9.3			32.7	48.0	19.3						Gray-brown silty sand with gravel
8/17/21	B.MW-07	S-6	19-21	11.0			30.7	47.9	21.4						Brown silty sand with gravel

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.7	8.6	4.8	11.1	22.9	48.9	

Test Results (ASTM D6913 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	96.3		
0.5"	95.0		
0.375"	93.4		
#4	87.7		
#10	82.9		
#20	77.7		
#40	71.8		
#60	66.0		
#100	59.5		
#200	48.9		

* (no specification provided)

Material Description

Brown silty sand

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 6.3301 D_{85}= 3.0570 D_{60}= 0.1553
D_{50}= 0.0801 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

As received MC = 17.5%

Date Received: 10/4/21 **Date Tested:** 10/6/21

Tested By: MP

Checked By: MP

Title: Laboratory Manager

Source of Sample: B-02 **Depth:** 4-6'
Sample Number: S-3

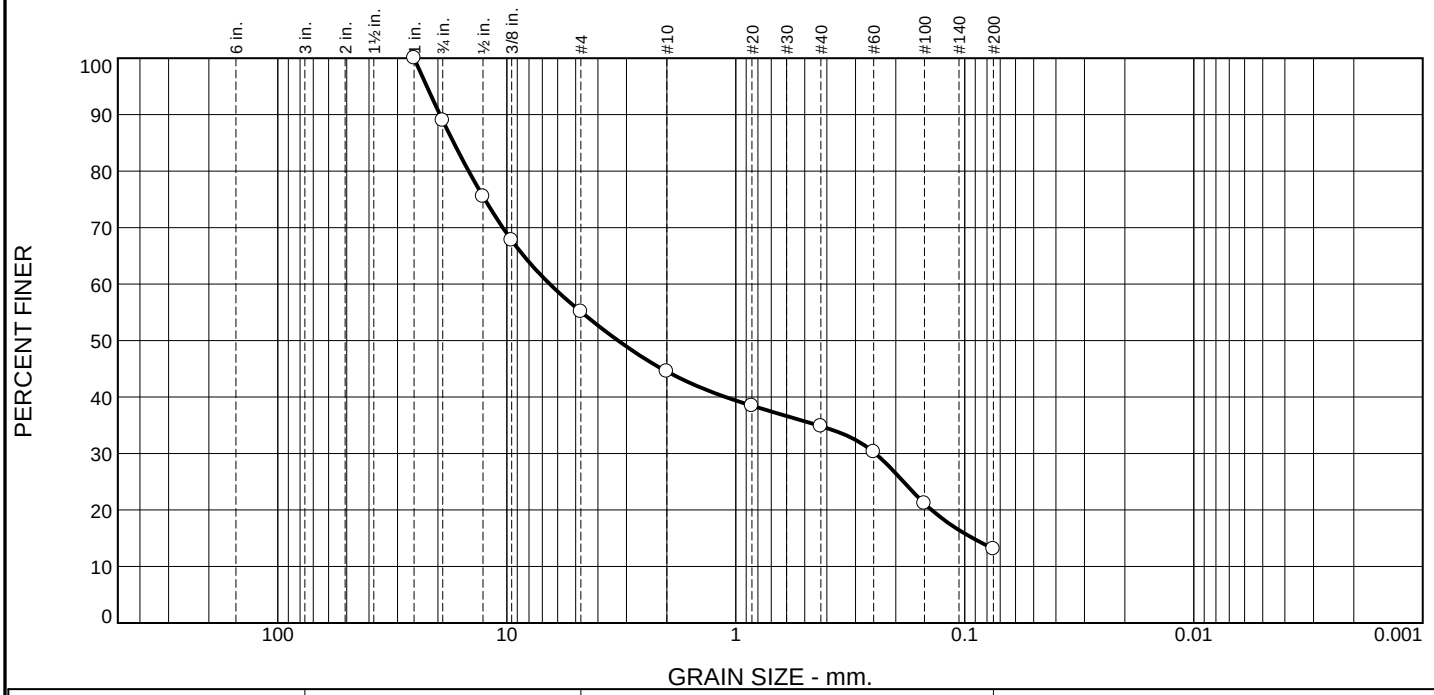
Date Sampled: 8/18/21

CDM Smith

Boston, Massachusetts

Client: Littleton Light and Sewer
Project: Littleton Sewer Extension
Littleton, MA
Project No: 263387.261886

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	11.0	33.9	10.6	9.7	21.7	13.1	

Test Results (ASTM D6913 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	89.0		
0.5"	75.5		
0.375"	67.8		
#4	55.1		
#10	44.5		
#20	38.5		
#40	34.8		
#60	30.3		
#100	21.2		
#200	13.1		

* (no specification provided)

Material Description

Brown silty gravel with sand

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= GM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 19.5862 D_{85}= 17.0414 D_{60}= 6.4900
D_{50}= 3.2663 D_{30}= 0.2454 D_{15}= 0.0920
D_{10}= C_u= C_c=

Remarks

As received MC = 12.1%

Date Received: 10/4/21 **Date Tested:** 10/6/21

Tested By: MP

Checked By: MP

Title: Laboratory Manager

Source of Sample: B-03 **Depth:** 9-11'
Sample Number: S-4

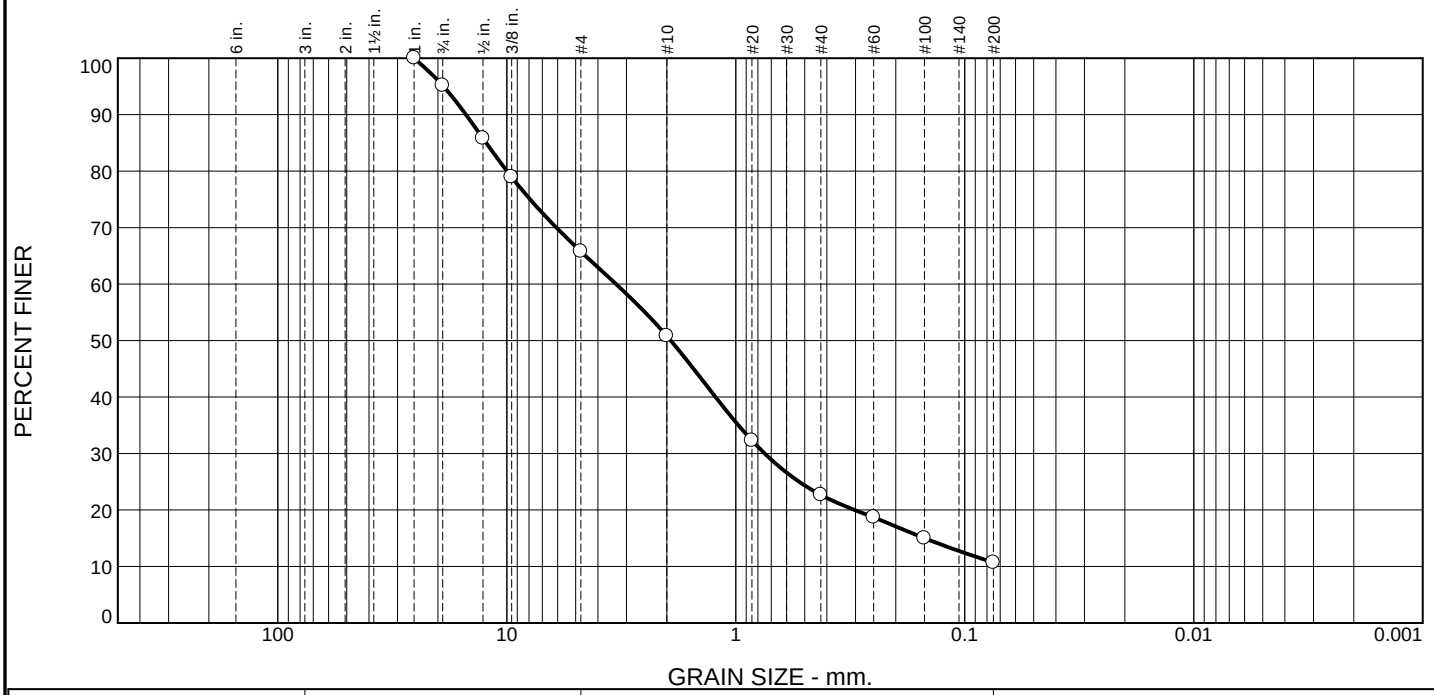
Date Sampled: 8/16/21

CDM Smith

Boston, Massachusetts

Client: Littleton Light and Sewer
Project: Littleton Sewer Extension
Littleton, MA
Project No: 263387.261886

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.8	29.4	15.0	28.1	12.0	10.7	

Test Results (ASTM D6913 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	95.2		
0.5"	85.8		
0.375"	78.9		
#4	65.8		
#10	50.8		
#20	32.3		
#40	22.7		
#60	18.7		
#100	15.0		
#200	10.7		

* (no specification provided)

Material Description

Brown poorly graded sand with silt and gravel

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 15.0820 D_{85}= 12.3010 D_{60}= 3.3343
D_{50}= 1.9230 D_{30}= 0.7481 D_{15}= 0.1498
D_{10}= C_u= C_c=

Remarks

As received MC = 12.1%

Date Received: 10/4/21 **Date Tested:** 10/6/21

Tested By: MP

Checked By: MP

Title: Laboratory Manager

Source of Sample: B-05 **Depth:** 14-16
Sample Number: S-5

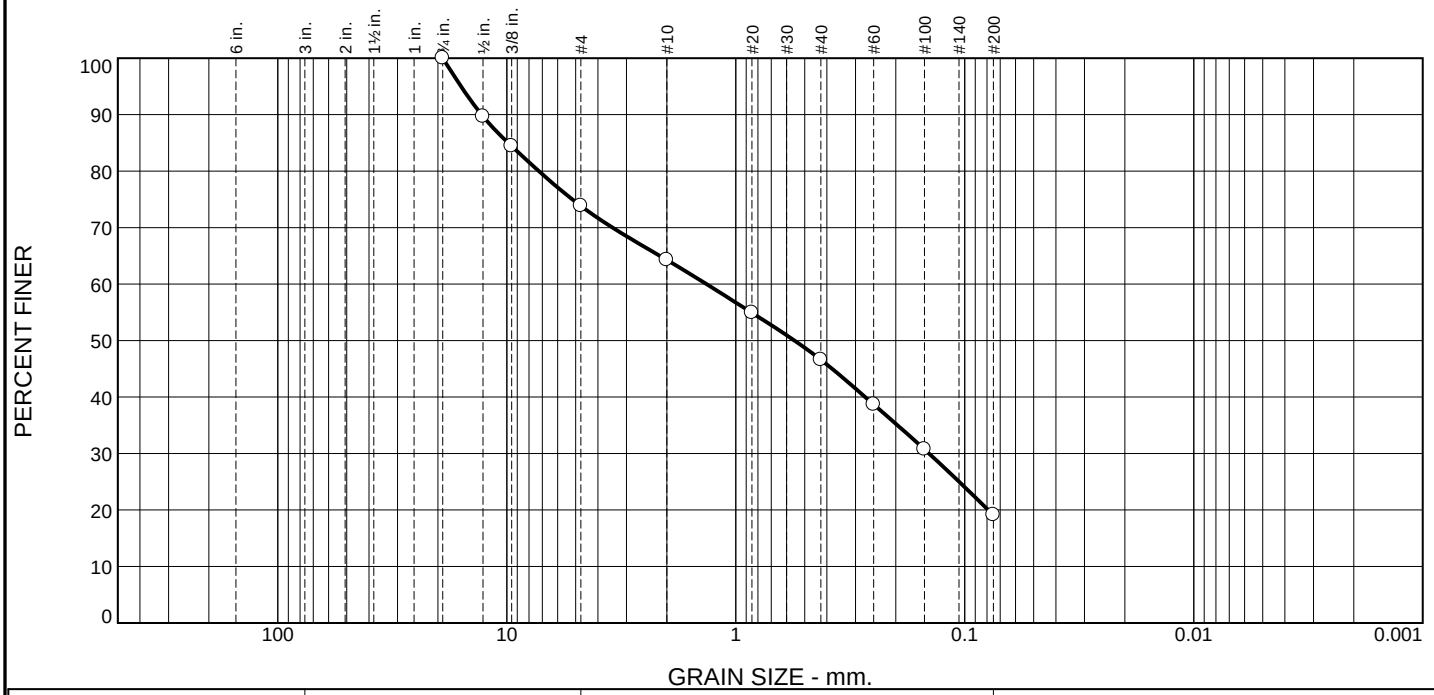
Date Sampled: 8/18/21

CDM Smith

Boston, Massachusetts

Client: Littleton Light and Sewer
Project: Littleton Sewer Extension
Littleton, MA
Project No: 263387.261886

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	26.2	9.5	17.7	27.5	19.1	

Test Results (ASTM D6913 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	89.7		
0.375"	84.4		
#4	73.8		
#10	64.3		
#20	54.9		
#40	46.6		
#60	38.7		
#100	30.7		
#200	19.1		

* (no specification provided)

Material Description

Gray-brown silty sand with gravel

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 12.8945 D_{85}= 9.8567 D_{60}= 1.3433
D_{50}= 0.5543 D_{30}= 0.1432 D_{15}=
D_{10}= C_u= C_c=

Remarks

As received MC = 11.0%

Date Received: 10/4/21 **Date Tested:** 10/6/21

Tested By: MP

Checked By: MP

Title: Laboratory Manager

Source of Sample: B-06 **Depth:** 14-16'
Sample Number: S-5

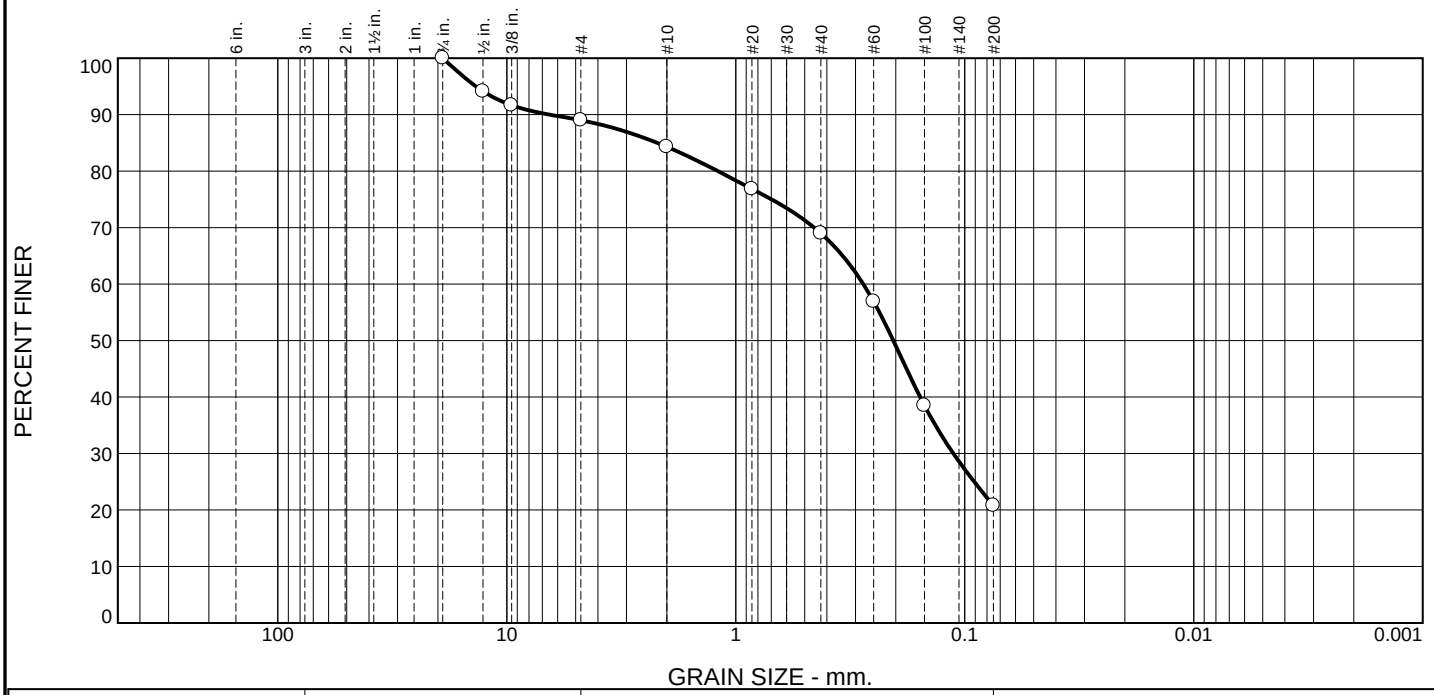
Date Sampled: 8/17/21

CDM Smith

Boston, Massachusetts

Client: Littleton Light and Sewer
Project: Littleton Sewer Extension
Littleton, MA
Project No: 263387.261886

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	11.0	4.7	15.3	48.2	20.8	

Test Results (ASTM D6913 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	94.1		
0.375"	91.7		
#4	89.0		
#10	84.3		
#20	76.8		
#40	69.0		
#60	56.9		
#100	38.5		
#200	20.8		

* (no specification provided)

Material Description

Brown silty sand

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 6.5133 D_{85}= 2.2022 D_{60}= 0.2772
D_{50}= 0.2051 D_{30}= 0.1121 D_{15}=
D_{10}= C_u= C_c=

Remarks

As received MC = 15.3%

Date Received: 10/4/21 **Date Tested:** 10/6/21

Tested By: MP

Checked By: MP

Title: Laboratory Manager

Source of Sample: B-06 **Depth:** 19-21'
Sample Number: S-6

Date Sampled: 8/17/21

CDM Smith

Boston, Massachusetts

Client: Littleton Light and Sewer
Project: Littleton Sewer Extension
Littleton, MA
Project No: 263387.261886

Boring Number: B-02

Client: Littleton Electric Light & Water Dept.
Project Name: Littleton Phase 1A WRRF and Collection System Expansion
Project Location: Littleton, MA
Project Number: 261886

Drilling Contractor/Driller: New England Boring Contractors/W. Hoeckele
Drilling Method/Bore Hole Diameter: Drive and Wash/4 in.
Hammer Style/Weight/Drop Height/Spoon Size: Automatic/140 lb/30 in./2 in.
Bore Hole Location:
N: 258778.00 **E:** 3021737.00
Drilling Date: **Start:** 8/18/2021 **End:** 8/18/2021

Surface Elevation (ft): 217.5
Total Depth (ft): 18.0
Depth to Initial Water Level (ft):

Depth	Date	Time
8.0	8/18/2021	14:03

Abandonment Method: Backfilled with soil cuttings and asphalt patch.
Logged By: A. Recio

Elev. (ft)	Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
	0								ASPHALT	Top 6": ASPHALT.	
		SS	S-1	18	8 8 9	9	17		SAND	Dry, loose, brown, fine to medium SAND, trace coarse gravel, (SP).	
		SS	S-2	24	6 7 10 6	9	17			Moist, medium dense, dark brown, fine to coarse SAND, little silt, trace fine to coarse gravel, (SW-SM) .	
213.0	5	SS	S-3	24	5 3 5 11	11	8		SILTY SAND	Moist, loose, light brown, fine to medium SAND and SILT, little fine to coarse gravel, (SM).	
208.0	10	SS	S-4	5	50/5"	3	>		SAND & GRAVEL	Wet, very dense, gray, fine GRAVEL, little silt, (GP).	
										See next page for rock material descriptions.	
203.0											

Sample Types

AS - Auger/Grab Sample
CS - California Sampler
NQ - 1.9" Rock Core
NX - 2.2" Rock Core
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
GP - Geoprobe

Consistency vs Blowcount/Foot

Granular (Sand):

V. Loose:	0-4	Dense:	30-50
Loose:	4-10	V. Dense:	>50
M. Dense:	10-30		

Fine Grained (Clay):

V. Soft:	<2	Stiff:	8-15
Soft:	2-4	V. Stiff:	15-30
M. Stiff:	4-8	Hard:	>30

Burmister Classification

and	50 - 35%
some	35 - 20%
little	20 - 10%
trace	< 10%

moisture, density, color

Reviewed by: T. Dunn **Date:** 11/2/2021 **Boring Number:** B-02

Boring Number: B-02

Client: Littleton Electric Light & Water Dept.
Project Name: Littleton Phase 1A WRRF and Collection System Expansion
Project Location: Littleton, MA
Project Number: 261886

Elev. (ft) / Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Recovery (%)	RQD (%)	Drill Rate (min/ft)	Down Press. (psi)	Graphic Log	Strata	Material Description	Remarks
0										*See previous page for soil material descriptions.*	
213.0 / 5											
208.0 / 10											
203.0 / 15	NX	C-1	60	75	17	3.5 2.0 5.0 3.2 4.2	100 100 100 100 100		GNEISS	Hard, moderately weathered, moderately fractured, dark gray/white, medium grained GNEISS; primary joint set: shallow dipping, planar, rough, open, discolored.	
198.0										Test boring terminated at 18.0 feet bgs.	

Boring Number: B-03

Client: Littleton Electric Light & Water Dept.
Project Name: Littleton Phase 1A WRRF and Collection System Expansion
Project Location: Littleton, MA
Project Number: 261886

Drilling Contractor/Driller: New England Boring Contractors/W. Hoeckele
Surface Elevation (ft): 211.5
Drilling Method/Bore Hole Diameter: Drive and Wash/4 in.
Total Depth (ft): 39.1
Hammer Style/Weight/Drop Height/Spoon Size: Automatic/140 lb/30 in./2 in.
Depth to Initial Water Level (ft):

Depth	Date	Time
7.1	8/16/2021	10:02

Bore Hole Location:
N: 3021928.78 **E:** 658590.82
Abandonment Method: Backfilled with soil cuttings.
Drilling Date: **Start:** 8/13/2021 **End:** 8/16/2021
Logged By: A. Recio

Elev. (ft)	Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
	0								TOPSOIL	Top 7": TOPSOIL .	
		SS	S-1	24	WOH 1 2 4	11	3			Bot 4":Moist, loose, brown, fine to medium SAND, trace fine to coarse gravel, (SP).	
		SS	S-2	24	1 3 4 9	7	7			Moist to wet, loose, brown/gray, fine to coarse SAND, some fine to coarse gravel, trace silt, (SP).	
207.0	5	SS	S-3	24	14 15 12 8	7	27		SAND	Wet, medium dense, brown/gray, fine to medium SAND, little coarse gravel, little silt, (SP-SM).	
202.0	10	SS	S-4	24	11 18 36 27	9	54		SAND & GRAVEL	Wet, dense, dark gray/brown, fine to coarse GRAVEL and fine to coarse SAND, little silt, (GM) .	
197.0										Wet, medium dense, gray, fine to medium SAND and fine GRAVEL, little silt, (SP-SM).	

Sample Types

AS - Auger/Grab Sample
CS - California Sampler
NQ - 1.9" Rock Core
NX - 2.2" Rock Core
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
GP - Geoprobe

Consistency vs Blowcount/Foot

Granular (Sand):

V. Loose:	0-4	Dense:	30-50
Loose:	4-10	V. Dense:	>50
M. Dense:	10-30		

Fine Grained (Clay):

V. Soft:	<2	Stiff:	8-15
Soft:	2-4	V. Stiff:	15-30
M. Stiff:	4-8	Hard:	>30

Burmister Classification

and	50 - 35%
some	35 - 20%
little	20 - 10%
trace	< 10%

moisture, density, color

Reviewed by: T. Dunn **Date:** 11/2/2021 **Boring Number:** B-03

Boring Number: B-03

Client: Littleton Electric Light & Water Dept.
Project Name: Littleton Phase 1A WRRF and Collection System Expansion
Project Location: Littleton, MA
Project Number: 261886

Elev. (ft)	Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
	15	SS	S-5	24	9 12 12 16	13	24		SAND & GRAVEL	Wet, medium dense, gray, fine to medium SAND and fine GRAVEL, little silt, (SP-SM).	
192.0	20	SS	S-6	24	27 16 9 18	6	25		SAND	Wet, medium dense, gray, fine to medium SAND, little silt, trace fine gravel, (SP-SM) .	
187.0	25	SS	S-7	17	48 33 75/5"	13	>33		SAND & GRAVEL	Wet, very dense, gray, fine to coarse SAND and fine to coarse GRAVEL, little silt, (SP-SM).	
182.0	30	SS	S-8	1	50/1"	1	>		WEATHERED ROCK	Wet, very dense, dark gray, fine GRAVEL, some fine to coarse sand, (partially weathered rock).	
177.0		SS	S-9	1	50/1"	0	>			NO RECOVERY.	

Boring Number: B-03

Client: Littleton Electric Light & Water Dept.

Project Name: Littleton Phase 1A WRRF and Collection System Expansion

Project Location: Littleton, MA

Project Number: 261886

Elev. (ft)	Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
	35								WEATHERED ROCK		
172.0	40	SS	S-10	1	50/1"	1	>			Wet, very dense, gray, fine GRAVEL, some medium to coarse sand, trace silt, (partially weathered rock). Test boring terminated at 39.1 feet bgs.	
167.0	45										
162.0	50										
157.0											

Boring Number: B-05

Client: Littleton Electric Light & Water Dept.
Project Name: Littleton Phase 1A WRRF and Collection System Expansion
Project Location: Littleton, MA
Project Number: 261886

Drilling Contractor/Driller: New England Boring Contractors/W. Hoeckele
Drilling Method/Bore Hole Diameter: Drive and Wash/4 in.
Hammer Style/Weight/Drop Height/Spoon Size: Automatic/140 lb/30 in./2 in.
Bore Hole Location:
N: 3022049.72 **E:** 658756.25
Drilling Date: **Start:** 8/17/2021 **End:** 8/18/2021

Surface Elevation (ft): 210.3
Total Depth (ft): 41.0
Depth to Initial Water Level (ft):

Depth	Date	Time
8.4	8/18/2021	10:08

Abandonment Method: Backfilled with soil cuttings.
Logged By: A. Recio

Elev. (ft)	Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
	0								TOPSOIL	Top 10": TOPSOIL.	
		SS	S-1	24	1 1 2 2	18	3		SILTY SAND	Bot 8":Moist, loose, brown, fine SAND, some silt, (SM).	
		SS	S-2	24	3 3 7 16	17	10			Moist to wet, medium dense, gray/light brown , fine to medium SAND, little silt, trace fire gravel, (SM).	
206.0											
	5	SS	S-3	24	19 32 30 27	20	62		SAND	Wet, very dense , gray, fine to coarse SAND, some fine gravel, (SW).	
	▼										
201.0											
	10	SS	S-4	24	13 13 13 15	13	26			Wet, medium dense, light brown/gray/orange, fine to coarse SAND, little silt, little fine gravel, (SP-SM) .	
196.0										Wet, medium dense, brown/gray, fine to coarse SAND, some fine to coarse gravel, little silt, (SP-SM) .	

Sample Types

AS - Auger/Grab Sample
CS - California Sampler
NQ - 1.9" Rock Core
NX - 2.2" Rock Core
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
GP - Geoprobe

Consistency vs Blowcount/Foot

Granular (Sand):

V. Loose:	0-4	Dense:	30-50
Loose:	4-10	V. Dense:	>50
M. Dense:	10-30		

Fine Grained (Clay):

V. Soft:	<2	Stiff:	8-15
Soft:	2-4	V. Stiff:	15-30
M. Stiff:	4-8	Hard:	>30

Burmister Classification

and	50 - 35%
some	35 - 20%
little	20 - 10%
trace	< 10%

moisture, density, color

Reviewed by: T. Dunn **Date:** 11/2/2021 **Boring Number:** B-05

Boring Number: B-05

Client: Littleton Electric Light & Water Dept.
Project Name: Littleton Phase 1A WRRF and Collection System Expansion
Project Location: Littleton, MA
Project Number: 261886

Elev. (ft)	Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
	15	SS	S-5	24	9 8 8 5	8	16		SAND	Wet, medium dense, brown/gray, fine to coarse SAND, some fine to coarse gravel, little silt, (SP-SM) .	
191.0											
	20	SS	S-6	24	5 3 5 20	13	8		SILTY SAND	Wet, loose , light brown/gray, fine SAND and SILT, (SM).	
186.0											
	25	SS	S-7	24	18 12 10 10	8	22		SAND	Wet, medium dense , light brown/gray, fine to coarse SAND, little fine gravel, trace silt, (SW).	
181.0											
	30	SS	S-8	24	23 15 46 26	9	61		SAND & GRAVEL	Wet, very dense, light brown/gray, fine to medium SAND and fine to coarse GRAVEL , trace silt, (SP).	
176.0									WEATHERED ROCK	Moist to wet, medium dense, white/orange/light brown, fine to coarse SAND, little silt, trace fine gravel, (partially to highly weathered rock).	

Boring Number: B-05

Client: Littleton Electric Light & Water Dept.
Project Name: Littleton Phase 1A WRRF and Collection System Expansion
Project Location: Littleton, MA
Project Number: 261886

Elev. (ft)	Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
	35	SS	S-9	24	12 15 24 33	13	39		WEATHERED ROCK	Moist to wet, medium dense, white/orange/light brown, fine to coarse SAND, little silt, trace fine gravel, (partially to highly weathered rock).	
171.0	40	SS	S-10	24	8 13 18 27	16	31			Moist to wet, medium dense, orange/light brown, fine to coarse SAND, little fine gravel, little silt, (partially to highly weathered rock).	
166.0	45									Test boring terminated at 41.0 feet bgs.	
161.0	50										
156.0											

Boring Number: B-06

Client: Littleton Electric Light & Water Dept.
Project Name: Littleton Phase 1A WRRF and Collection System Expansion
Project Location: Littleton, MA
Project Number: 261886

Drilling Contractor/Driller: New England Boring Contractors/W. Hoeckele
Surface Elevation (ft): 220.4
Drilling Method/Bore Hole Diameter: Drive and Wash/4 in.
Total Depth (ft): 30.0
Hammer Style/Weight/Drop Height/Spoon Size: Automatic/140 lb/30 in./2 in.
Depth to Initial Water Level (ft):

Depth	Date	Time
5.8	8/17/2021	12:34

Bore Hole Location:
N: 3022009.69 **E:** 658577.96
Abandonment Method: Backfilled with soil cuttings.
Drilling Date: **Start:** 8/17/2021 **End:** 8/17/2021
Logged By: A. Recio

Elev. (ft)	Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
	0								TOP SOIL	Top 6": TOPSOIL.	
		SS	S-1	24	WOH 1 2 3	10	3		SILTY SAND	Bot 4":Moist, very loose, light to dark brown, fine SAND, some silt, trace organics, (SM).	
		SS	S-2	24	1 3 4 5	16	7			Moist to wet, medium dense, light brown, fine to medium SAND, little silt, (SM).	
216.0	5	SS	S-3	24	8 8 11 19	14	19			Wet, medium dense, light brown, fine to coarse SAND , little silt, (SP-SM).	
211.0	10	SS	S-4	24	6 5 8 12	0	13		SAND & GRAVEL	Wet, medium dense, light brown/gray, fine to coarse SAND and fine GRAVEL, trace silt, (SP).	Rock in tip. Advance 3" spoon with 2" recovery.
206.0										Wet, medium dense , gray, fine to coarse SAND , some fine gravel, little silt, (SM).	

Sample Types

AS - Auger/Grab Sample
CS - California Sampler
NQ - 1.9" Rock Core
NX - 2.2" Rock Core
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
GP - Geoprobe

Consistency vs Blowcount/Foot

Granular (Sand):

V. Loose:	0-4	Dense:	30-50
Loose:	4-10	V. Dense:	>50
M. Dense:	10-30		

Fine Grained (Clay):

V. Soft:	<2	Stiff:	8-15
Soft:	2-4	V. Stiff:	15-30
M. Stiff:	4-8	Hard:	>30

Burmister Classification

and	50 - 35%
some	35 - 20%
little	20 - 10%
trace	< 10%

moisture, density, color

Reviewed by: T. Dunn **Date:** 11/2/2021 **Boring Number:** B-06

Boring Number: B-06

Client: Littleton Electric Light & Water Dept.
Project Name: Littleton Phase 1A WRRF and Collection System Expansion
Project Location: Littleton, MA
Project Number: 261886

Elev. (ft)	Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
	15	SS	S-5	24	11 10 14 15	7	24		SAND & GRAVEL	Wet, medium dense , gray, fine to coarse SAND , some fine gravel, little silt, (SM).	
201.0	20	SS	S-6	24	11 6 8 8	9	14		SAND	Wet, medium dense, gray/light brown, fine to medium SAND, some silt, little fine gravel, (SM).	
196.0	25									*See next page for rock material descriptions.*	
191.0	30										
186.0											

Boring Number: B-06

Client: Littleton Electric Light & Water Dept.
Project Name: Littleton Phase 1A WRRF and Collection System Expansion
Project Location: Littleton, MA
Project Number: 261886

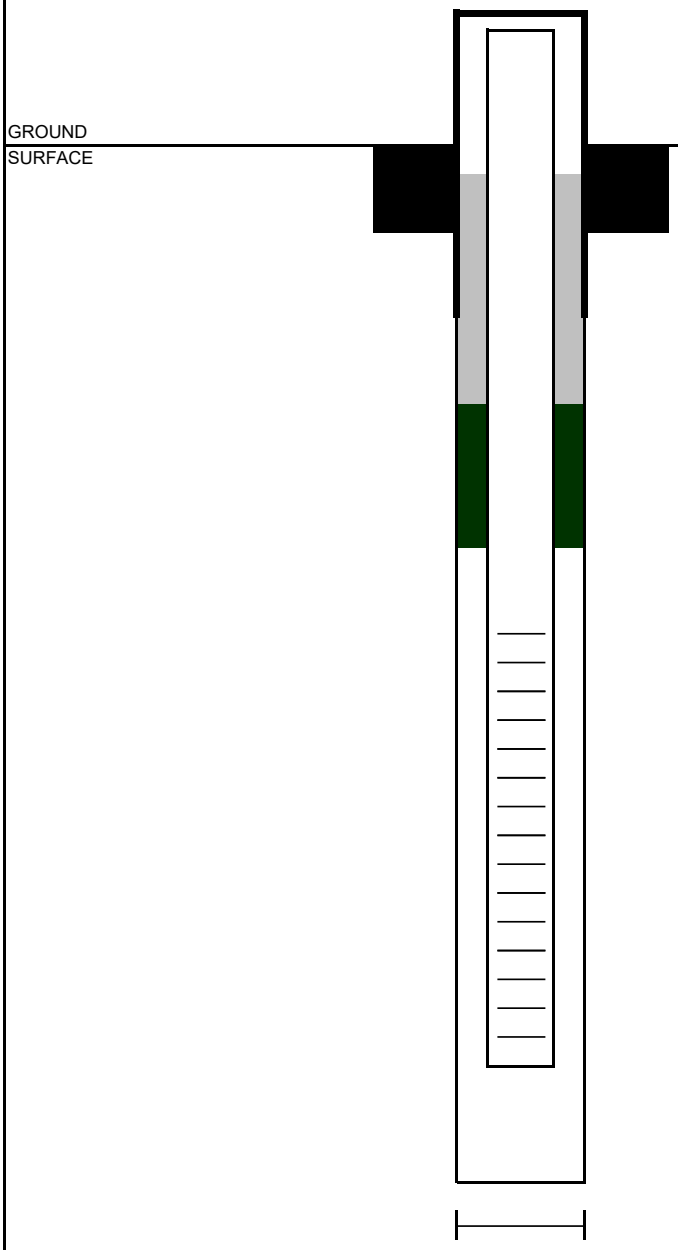
Elev. (ft) / Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Recovery (%)	RQD (%)	Drill Rate (min/ft)	Down Press. (psi)	Graphic Log	Strata	Material Description	Remarks
15										*See previous page for soil material descriptions.*	
201.0 / 20											
196.0 / 25	NX	C-1	60	97	82	4.0 4.0 2.5 3.3 3.5	100 100 100 100 100		GNEISS	Hard, fresh, sound to moderately fractured, dark gray/white, medium grained GNEISS; primary joint set: shallow dipping, planar, smooth, tight, fresh.	
191.0 / 30										Test boring terminated at 30.0 feet bgs.	
186.0											

CDM Smith

75 State Street
Boston, MA 02109
(617) 452-6000

Monitoring Well Installation Log

Client:	Littleton Light & Sewer	Contractor:	NEBC	Boring/Well No.:	B.MW-04
Project Name:	Littleton Sewer Extension	Driller:	W. Hoeckele	Date Installed:	2021-08-13
Project Location:	Littleton, MA	Ground EL:	208.9	Logged By:	A. Recio
Project Number:	263387-261886	Riser EL:	211.4	Page:	1 of 1



30 in. Riser

LOCKED PROTECTIVE CASING

SURFACE SEAL: 0.5 ft Concrete
(Thickness & Type)

BACKFILL MATERIAL: Soil Cuttings and Sand
(Type)

TOP OF SEAL: 3.1 ft bgs

SEAL CONSTRUCTION: Bentonite Chips
(Thickness & Type)

TOP OF SANDPACK: 4.5 ft bgs

RISER CONSTRUCTION: 2" Diameter PVC
(Type, Diameter & Material)

TOP OF SCREEN: 5 ft bgs

SANDPACK TYPE: 2S Holliston Silica Sand

SCREEN MATERIAL: 2" Diameter Slotted PVC
(Type, Slot, Diameter & Material)

BOTTOM OF SCREEN: 15 ft bgs

BOTTOM OF BOREHOLE: 23 ft bgs

BOREHOLE DIAMETER: 4 in.

NOTE: All depths are in feet below ground surface, unless noted otherwise.

Remarks:

Updated On: 04/09/01

CDM Smith

75 State Street
Boston, MA 02109
(617) 452-6000

Monitoring Well Report

Client:	Littleton Light & Sewer				
Project Name:	Littleton Sewer Extension	Ground Surface EL:	208.9	Boring/Well No.	B.MW-04
Project Lo.:	Littleton, MA	Riser EL:	211.4	Page: 1 of 1	
Project No.:	263387-261886				

Date	Time	Elapsed Time from Installation (days)	Depth of Water From Top of Riser (ft)	Elevation of Water (ft)	Remarks	Read By
2021-08-13	12:43	0	5.2	206.2	Depth and El. corrections by STC on 2/18/2022.	AR
2022-02-18	10:45	189	2.7	208.7	Rain event morning of reading	STC

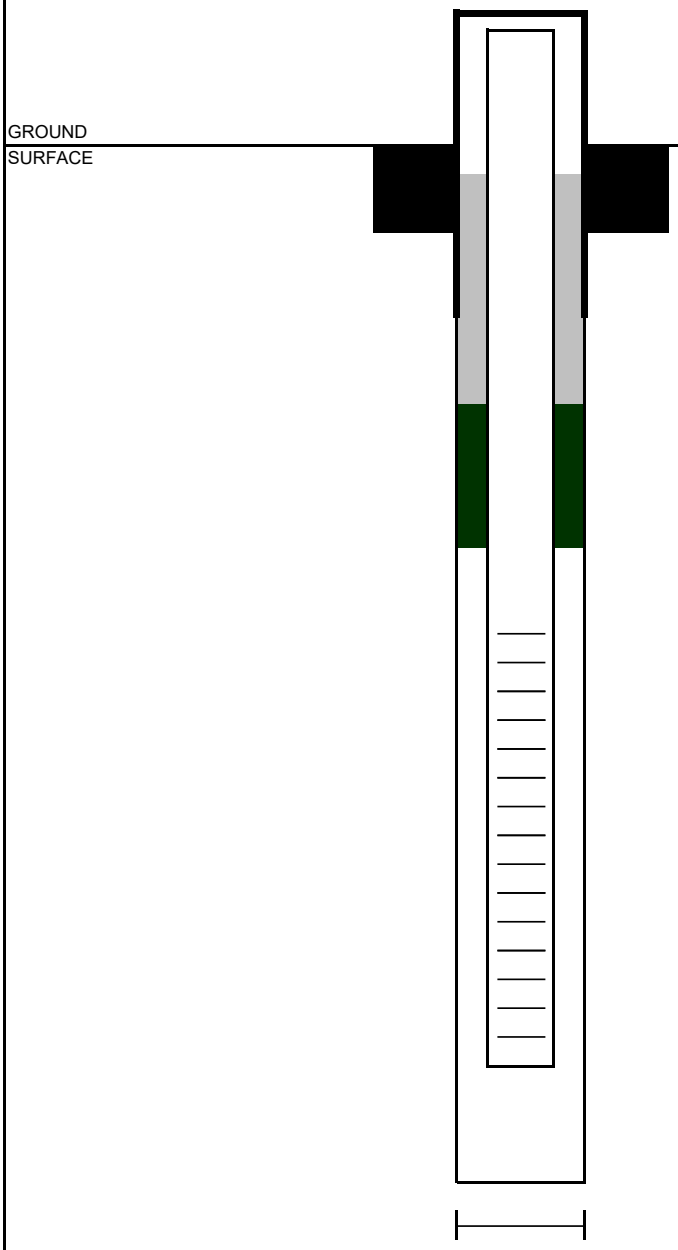
Remarks:

CDM Smith

75 State Street
Boston, MA 02109
(617) 452-6000

Monitoring Well Installation Log

Client:	Littleton Light & Sewer	Contractor:	NEBC	Boring/Well No.:	B.MW-07
Project Name:	Littleton Sewer Extension	Driller:	W. Hoeckele	Date Installed:	2021-08-17
Project Location:	Littleton, MA	Ground EL:	211.2	Logged By:	A. Recio
Project Number:	263387-261886	Riser EL:	213.7	Page:	1 of 1



30 in. Riser

LOCKED PROTECTIVE CASING

SURFACE SEAL: 0.5 ft Concrete
(Thickness & Type)

BACKFILL MATERIAL: Soil Cuttings and Sand
(Type)

TOP OF SEAL: 3.1 ft bgs

SEAL CONSTRUCTION: Bentonite Chips
(Thickness & Type)

TOP OF SANDPACK: 4.5 ft bgs

RISER CONSTRUCTION: 2" Diameter PVC
(Type, Diameter & Material)

TOP OF SCREEN: 5 ft bgs

SANDPACK TYPE: 2S Holliston Silica Sand

SCREEN MATERIAL: 2" Diameter Slotted PVC
(Type, Slot, Diameter & Material)

BOTTOM OF SCREEN: 15 ft bgs

BOTTOM OF BOREHOLE: 41 ft bgs

BOREHOLE DIAMETER: 4 in.

NOTE: All depths are in feet below ground surface, unless noted otherwise.

Remarks:

Updated On: 04/09/01

CDM Smith

75 State Street
Boston, MA 02109
(617) 452-6000

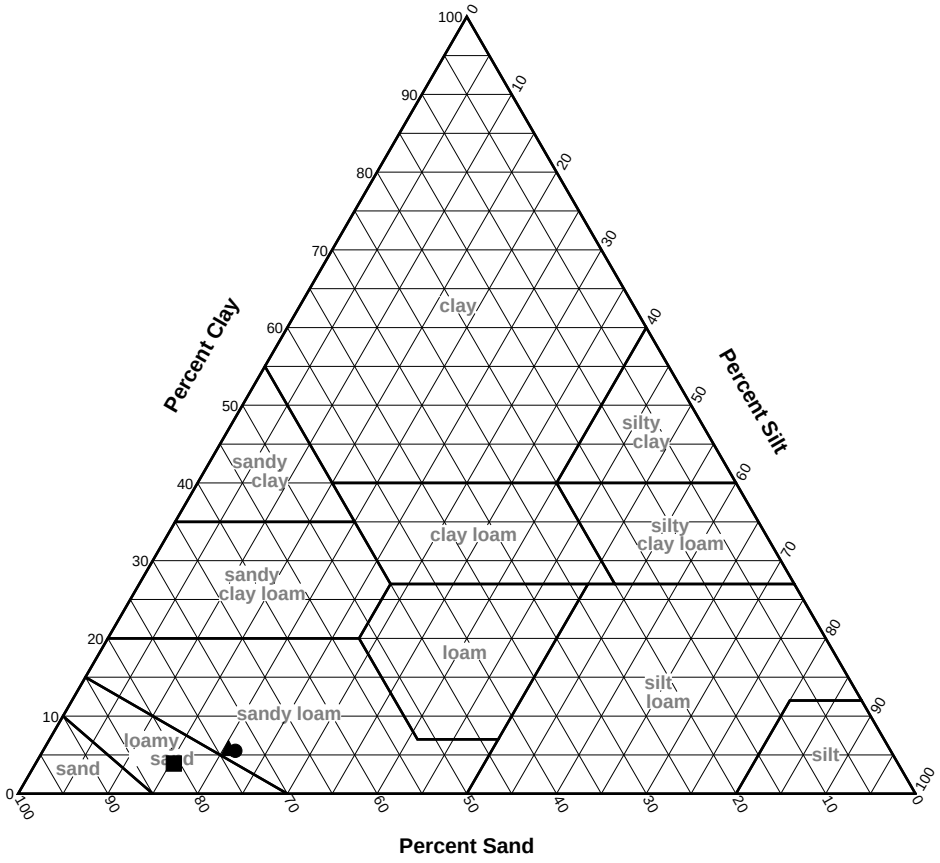
Monitoring Well Report

Client:	Littleton Light & Sewer				
Project Name:	Littleton Sewer Extension	Ground Surface EL:	211.2	Boring/Well No.	B.MW-07
Project Lo.:	Littleton, MA	Riser EL:	213.7	Page: 1 of 1	
Project No.:	263387-261886				

Date	Time	Elapsed Time (days)	Depth of Water From Top of Riser (ft)	Elevation of Water (ft)	Remarks	Read By
2021-08-17	7:32	0	6.8	206.9	Depth and El. corrections by STC on 2/18/2022.	AR
2022-02-18	10:55	185	4.2	209.5	Rain event morning of reading	STC

Remarks:

USDA Soil Classification



SOIL DATA

	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve			Classification
				Sand	Silt	Clay	
●	B-03	S-4	9-11'	73.0	21.6	5.4	Sandy loam
■	B-05	S-5	14-16	80.7	15.4	3.9	Loamy sand
▲	B-06	S-5	14-16'	73.6	20.5	5.9	Sandy loam

CDM Smith

Boston, Massachusetts

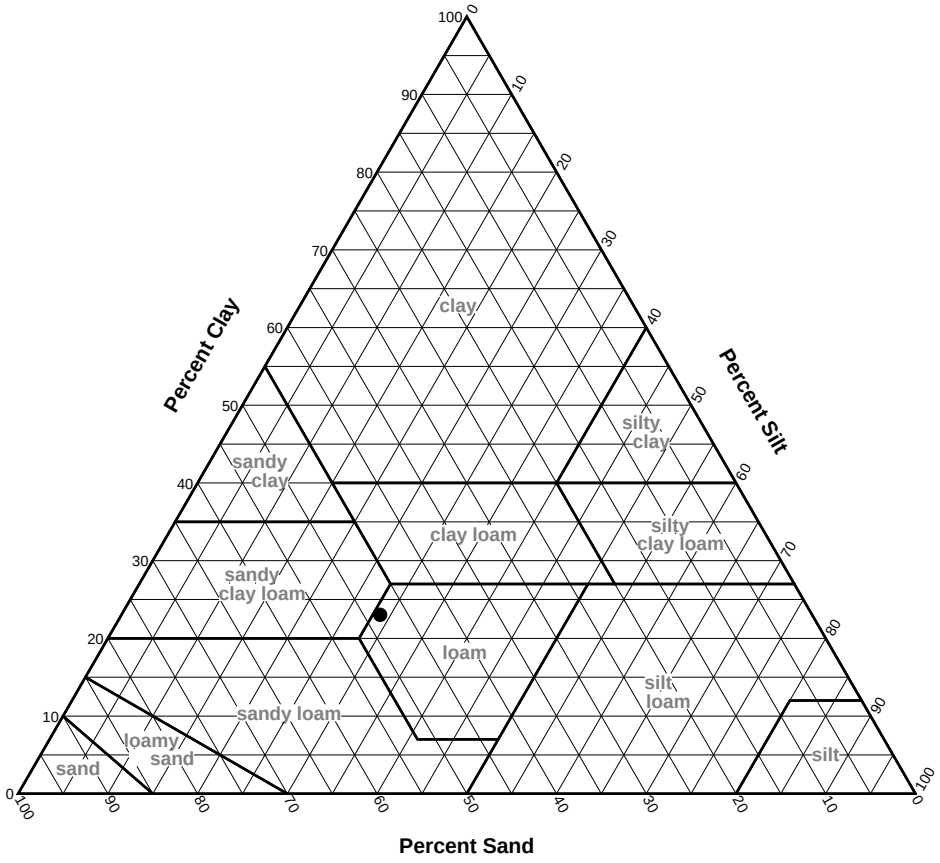
Client: Littleton Light and Sewer

Project: Littleton Sewer Extension
Littleton, MA

Project No.: 263387.261886

Checked By: MP

USDA Soil Classification



SOIL DATA

	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve			Classification
				Sand	Silt	Clay	
●	B-02	S-3	4-6'	48.1	29.0	22.9	Loam

CDM Smith

Boston, Massachusetts

Client: Littleton Light and Sewer

Project: Littleton Sewer Extension
Littleton, MA

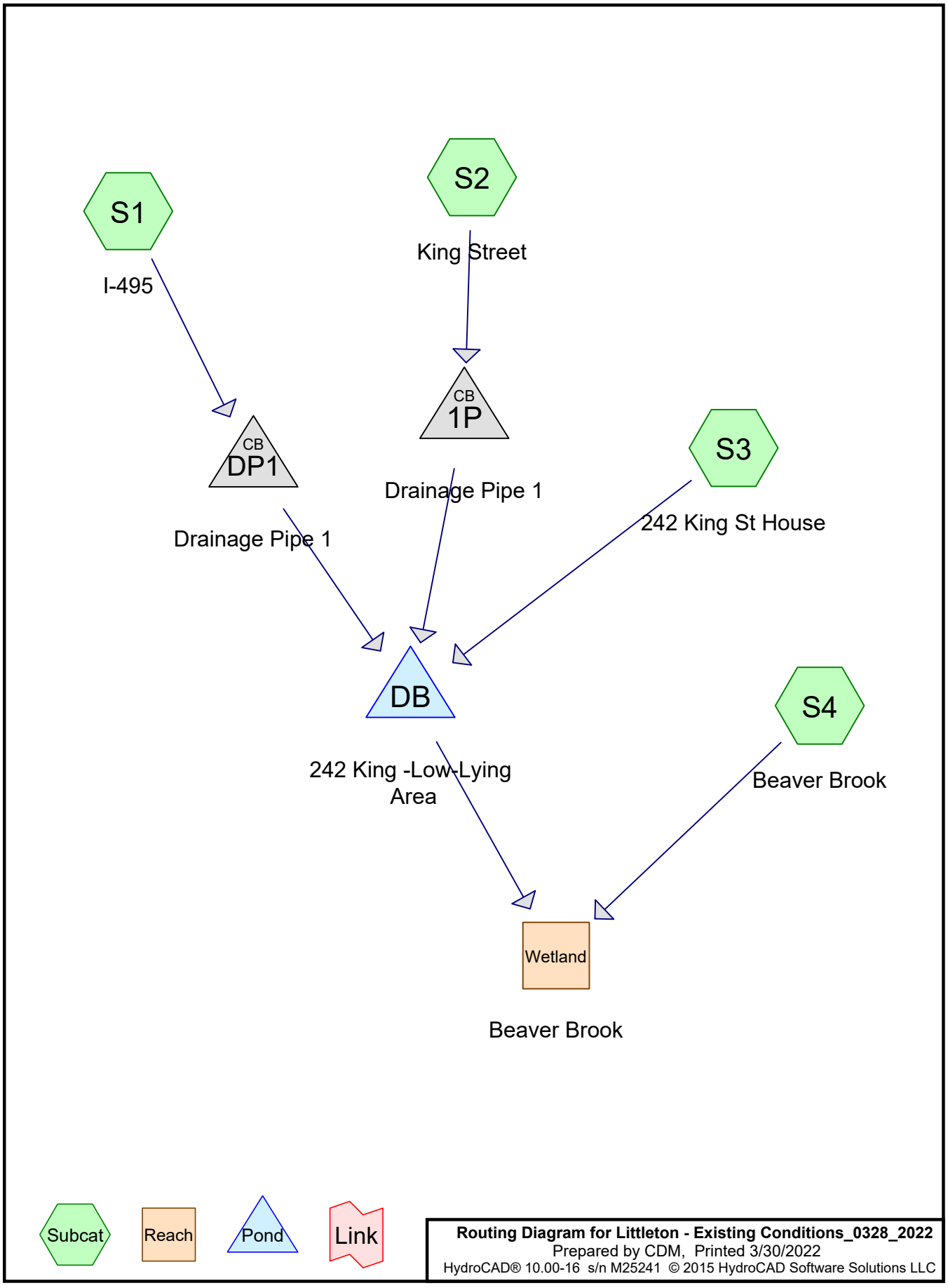
Project No.: 263387.261886

Checked By: MP

Appendix C

Existing and Proposed HydroCAD Model

Existing HydroCAD Model



Routing Diagram for Littleton - Existing Conditions_0328_2022
Prepared by CDM, Printed 3/30/2022

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: I-495 Runoff Area=431,000 sf 19.95% Impervious Runoff Depth=0.63"
Flow Length=600' Tc=19.6 min CN=66 Runoff=4.00 cfs 0.522 af

SubcatchmentS2: King Street Runoff Area=5,700 sf 100.00% Impervious Runoff Depth=2.95"
Flow Length=230' Tc=6.0 min CN=98 Runoff=0.40 cfs 0.032 af

SubcatchmentS3: 242 King St House Runoff Area=156,600 sf 9.26% Impervious Runoff Depth=0.17"
Flow Length=265' Tc=6.0 min CN=52 Runoff=0.18 cfs 0.050 af

SubcatchmentS4: Beaver Brook Runoff Area=93,700 sf 0.85% Impervious Runoff Depth=0.00"
Flow Length=401' Tc=30.3 min CN=39 Runoff=0.00 cfs 0.000 af

Reach Wetland: Beaver Brook Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Pond 1P: Drainage Pipe 1 Peak Elev=235.31' Inflow=0.40 cfs 0.032 af
12.0" Round Culvert n=0.013 L=152.0' S=0.1382 '/' Outflow=0.40 cfs 0.032 af

Pond DB: 242 King -Low-Lying Area Peak Elev=210.19' Storage=26,330 cf Inflow=4.30 cfs 0.604 af
Outflow=0.00 cfs 0.000 af

Pond DP1: Drainage Pipe 1 Peak Elev=216.73' Inflow=4.00 cfs 0.522 af
36.0" Round Culvert n=0.013 L=152.0' S=0.0132 '/' Outflow=4.00 cfs 0.522 af

Total Runoff Area = 15.771 ac Runoff Volume = 0.605 af Average Runoff Depth = 0.46"
84.43% Pervious = 13.315 ac 15.57% Impervious = 2.456 ac

Summary for Subcatchment S1: I-495

Runoff = 4.00 cfs @ 12.33 hrs, Volume= 0.522 af, Depth= 0.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
239,500	70	Woods, Good, HSG C
86,000	98	Paved parking, HSG C
105,500	30	Woods, Good, HSG A
431,000	66	Weighted Average
345,000		80.05% Pervious Area
86,000		19.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
13.3	550	0.0190	0.69		**Shallow Concentrated Flow, 495 Inner Ramp** Woodland Kv= 5.0 fps
19.6	600	Total			

Summary for Subcatchment S2: King Street

Runoff = 0.40 cfs @ 12.08 hrs, Volume= 0.032 af, Depth= 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
5,700	98	Paved parking, HSG C
5,700		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.19		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.9	180	0.0280	3.40		**Shallow Concentrated Flow, Subcatchment 2** Paved Kv= 20.3 fps
1.6	230	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S3: 242 King St House

Runoff = 0.18 cfs @ 12.41 hrs, Volume= 0.050 af, Depth= 0.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
86,500	30	Woods, Good, HSG A
14,500	98	Paved parking, HSG A
39,800	77	Woods, Good, HSG D
15,800	70	Woods, Good, HSG C
156,600	52	Weighted Average
142,100		90.74% Pervious Area
14,500		9.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	50	0.3600	0.32		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.18"
2.8	215	0.0650	1.27		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.4	265	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S4: Beaver Brook

Runoff = 0.00 cfs @ 24.14 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
75,700	30	Woods, Good, HSG A
800	98	Paved parking, HSG A
5,400	70	Woods, Good, HSG C
11,800	77	Woods, Good, HSG D
93,700	39	Weighted Average
92,900		99.15% Pervious Area
800		0.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.6	50	0.0040	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
2.1	160	0.0640	1.26		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.6	191	0.0190	0.69		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
30.3	401	Total			

Summary for Reach Wetland: Beaver Brook

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 15.771 ac, 15.57% Impervious, Inflow Depth = 0.00" for 2 Yr 24 Hr event
Inflow = 0.00 cfs @ 24.14 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 24.14 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: Drainage Pipe 1

Inflow Area = 0.131 ac,100.00% Impervious, Inflow Depth = 2.95" for 2 Yr 24 Hr event
Inflow = 0.40 cfs @ 12.08 hrs, Volume= 0.032 af
Outflow = 0.40 cfs @ 12.08 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min
Primary = 0.40 cfs @ 12.08 hrs, Volume= 0.032 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 235.31' @ 12.08 hrs
Flood Elev= 239.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Catch Basin** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 235.00' / 214.00' S= 0.1382 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=0.40 cfs @ 12.08 hrs HW=235.31' (Free Discharge)
↑—**1=Catch Basin** (Inlet Controls 0.40 cfs @ 1.91 fps)

Summary for Pond DB: 242 King -Low-Lying Area

Inflow Area = 13.620 ac, 17.90% Impervious, Inflow Depth = 0.53" for 2 Yr 24 Hr event
Inflow = 4.30 cfs @ 12.33 hrs, Volume= 0.604 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 210.19' @ 25.14 hrs Surf.Area= 21,326 sf Storage= 26,330 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	208.50'	45,400 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.50	5,300	0	0
209.00	14,500	4,950	4,950
210.00	20,200	17,350	22,300
211.00	26,000	23,100	45,400

Device	Routing	Invert	Outlet Devices
#1	Primary	210.50'	**67.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65

2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=208.50' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond DP1: Drainage Pipe 1

Inflow Area = 9.894 ac, 19.95% Impervious, Inflow Depth = 0.63" for 2 Yr 24 Hr event
Inflow = 4.00 cfs @ 12.33 hrs, Volume= 0.522 af
Outflow = 4.00 cfs @ 12.33 hrs, Volume= 0.522 af, Atten= 0%, Lag= 0.0 min
Primary = 4.00 cfs @ 12.33 hrs, Volume= 0.522 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 216.73' @ 12.33 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	216.00'	**36.0" Round Culvert** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 214.00' S= 0.0132 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=3.89 cfs @ 12.33 hrs HW=216.73' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 3.89 cfs @ 2.91 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: I-495 Runoff Area=431,000 sf 19.95% Impervious Runoff Depth=1.67"
Flow Length=600' Tc=19.6 min CN=66 Runoff=12.47 cfs 1.374 af

SubcatchmentS2: King Street Runoff Area=5,700 sf 100.00% Impervious Runoff Depth=4.67"
Flow Length=230' Tc=6.0 min CN=98 Runoff=0.63 cfs 0.051 af

SubcatchmentS3: 242 King St House Runoff Area=156,600 sf 9.26% Impervious Runoff Depth=0.76"
Flow Length=265' Tc=6.0 min CN=52 Runoff=2.22 cfs 0.229 af

SubcatchmentS4: Beaver Brook Runoff Area=93,700 sf 0.85% Impervious Runoff Depth=0.18"
Flow Length=401' Tc=30.3 min CN=39 Runoff=0.06 cfs 0.033 af

Reach Wetland: Beaver Brook Inflow=2.91 cfs 0.926 af
Outflow=2.91 cfs 0.926 af

Pond 1P: Drainage Pipe 1 Peak Elev=235.40' Inflow=0.63 cfs 0.051 af
12.0" Round Culvert n=0.013 L=152.0' S=0.1382 '/' Outflow=0.63 cfs 0.051 af

Pond DB: 242 King -Low-Lying Area Peak Elev=210.57' Storage=34,729 cf Inflow=14.25 cfs 1.654 af
Outflow=2.86 cfs 0.893 af

Pond DP1: Drainage Pipe 1 Peak Elev=217.36' Inflow=12.47 cfs 1.374 af
36.0" Round Culvert n=0.013 L=152.0' S=0.0132 '/' Outflow=12.47 cfs 1.374 af

Total Runoff Area = 15.771 ac Runoff Volume = 1.687 af Average Runoff Depth = 1.28"
84.43% Pervious = 13.315 ac 15.57% Impervious = 2.456 ac

Summary for Subcatchment S1: I-495

Runoff = 12.47 cfs @ 12.30 hrs, Volume= 1.374 af, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
239,500	70	Woods, Good, HSG C
86,000	98	Paved parking, HSG C
105,500	30	Woods, Good, HSG A
431,000	66	Weighted Average
345,000		80.05% Pervious Area
86,000		19.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
13.3	550	0.0190	0.69		**Shallow Concentrated Flow, 495 Inner Ramp** Woodland Kv= 5.0 fps
19.6	600	Total			

Summary for Subcatchment S2: King Street

Runoff = 0.63 cfs @ 12.08 hrs, Volume= 0.051 af, Depth= 4.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
5,700	98	Paved parking, HSG C
5,700		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.19		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.9	180	0.0280	3.40		**Shallow Concentrated Flow, Subcatchment 2** Paved Kv= 20.3 fps
1.6	230	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S3: 242 King St House

Runoff = 2.22 cfs @ 12.12 hrs, Volume= 0.229 af, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
86,500	30	Woods, Good, HSG A
14,500	98	Paved parking, HSG A
39,800	77	Woods, Good, HSG D
15,800	70	Woods, Good, HSG C
156,600	52	Weighted Average
142,100		90.74% Pervious Area
14,500		9.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	50	0.3600	0.32		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.18"
2.8	215	0.0650	1.27		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.4	265	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S4: Beaver Brook

Runoff = 0.06 cfs @ 13.91 hrs, Volume= 0.033 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
75,700	30	Woods, Good, HSG A
800	98	Paved parking, HSG A
5,400	70	Woods, Good, HSG C
11,800	77	Woods, Good, HSG D
93,700	39	Weighted Average
92,900		99.15% Pervious Area
800		0.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.6	50	0.0040	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
2.1	160	0.0640	1.26		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.6	191	0.0190	0.69		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
30.3	401	Total			

Summary for Reach Wetland: Beaver Brook

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 15.771 ac, 15.57% Impervious, Inflow Depth = 0.70" for 10 Yr 24 Hr event
Inflow = 2.91 cfs @ 13.16 hrs, Volume= 0.926 af
Outflow = 2.91 cfs @ 13.16 hrs, Volume= 0.926 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: Drainage Pipe 1

Inflow Area = 0.131 ac,100.00% Impervious, Inflow Depth = 4.67" for 10 Yr 24 Hr event
Inflow = 0.63 cfs @ 12.08 hrs, Volume= 0.051 af
Outflow = 0.63 cfs @ 12.08 hrs, Volume= 0.051 af, Atten= 0%, Lag= 0.0 min
Primary = 0.63 cfs @ 12.08 hrs, Volume= 0.051 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 235.40' @ 12.08 hrs
Flood Elev= 239.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Catch Basin** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 235.00' / 214.00' S= 0.1382 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=0.63 cfs @ 12.08 hrs HW=235.40' (Free Discharge)
↑**1=Catch Basin** (Inlet Controls 0.63 cfs @ 2.15 fps)

Summary for Pond DB: 242 King -Low-Lying Area

Inflow Area = 13.620 ac, 17.90% Impervious, Inflow Depth = 1.46" for 10 Yr 24 Hr event
Inflow = 14.25 cfs @ 12.28 hrs, Volume= 1.654 af
Outflow = 2.86 cfs @ 13.16 hrs, Volume= 0.893 af, Atten= 80%, Lag= 52.6 min
Primary = 2.86 cfs @ 13.16 hrs, Volume= 0.893 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 210.57' @ 13.16 hrs Surf.Area= 23,499 sf Storage= 34,729 cf

Plug-Flow detention time= 259.5 min calculated for 0.893 af (54% of inflow)
Center-of-Mass det. time= 129.6 min (1,002.5 - 873.0)

Volume	Invert	Avail.Storage	Storage Description
#1	208.50'	45,400 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.50	5,300	0	0
209.00	14,500	4,950	4,950
210.00	20,200	17,350	22,300
211.00	26,000	23,100	45,400

Device	Routing	Invert	Outlet Devices
#1	Primary	210.50'	**67.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65

2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=2.83 cfs @ 13.16 hrs HW=210.57' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 2.83 cfs @ 0.61 fps)

Summary for Pond DP1: Drainage Pipe 1

Inflow Area = 9.894 ac, 19.95% Impervious, Inflow Depth = 1.67" for 10 Yr 24 Hr event
Inflow = 12.47 cfs @ 12.30 hrs, Volume= 1.374 af
Outflow = 12.47 cfs @ 12.30 hrs, Volume= 1.374 af, Atten= 0%, Lag= 0.0 min
Primary = 12.47 cfs @ 12.30 hrs, Volume= 1.374 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 217.36' @ 12.30 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	216.00'	**36.0" Round Culvert** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 214.00' S= 0.0132 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=12.43 cfs @ 12.30 hrs HW=217.36' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 12.43 cfs @ 3.98 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: I-495 Runoff Area=431,000 sf 19.95% Impervious Runoff Depth=3.72"
Flow Length=600' Tc=19.6 min CN=66 Runoff=29.18 cfs 3.069 af

SubcatchmentS2: King Street Runoff Area=5,700 sf 100.00% Impervious Runoff Depth=7.41"
Flow Length=230' Tc=6.0 min CN=98 Runoff=0.98 cfs 0.081 af

SubcatchmentS3: 242 King St House Runoff Area=156,600 sf 9.26% Impervious Runoff Depth=2.24"
Flow Length=265' Tc=6.0 min CN=52 Runoff=8.75 cfs 0.671 af

SubcatchmentS4: Beaver Brook Runoff Area=93,700 sf 0.85% Impervious Runoff Depth=1.01"
Flow Length=401' Tc=30.3 min CN=39 Runoff=0.96 cfs 0.182 af

Reach Wetland: Beaver Brook Inflow=32.37 cfs 3.243 af
Outflow=32.37 cfs 3.243 af

Pond 1P: Drainage Pipe 1 Peak Elev=235.51' Inflow=0.98 cfs 0.081 af
12.0" Round Culvert n=0.013 L=152.0' S=0.1382 '/' Outflow=0.98 cfs 0.081 af

Pond DB: 242 King -Low-Lying Area Peak Elev=210.83' Storage=41,176 cf Inflow=34.47 cfs 3.821 af
Outflow=31.75 cfs 3.061 af

Pond DP1: Drainage Pipe 1 Peak Elev=218.26' Inflow=29.18 cfs 3.069 af
36.0" Round Culvert n=0.013 L=152.0' S=0.0132 '/' Outflow=29.18 cfs 3.069 af

Total Runoff Area = 15.771 ac Runoff Volume = 4.003 af Average Runoff Depth = 3.05"
84.43% Pervious = 13.315 ac 15.57% Impervious = 2.456 ac

Summary for Subcatchment S1: I-495

Runoff = 29.18 cfs @ 12.27 hrs, Volume= 3.069 af, Depth= 3.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
239,500	70	Woods, Good, HSG C
86,000	98	Paved parking, HSG C
105,500	30	Woods, Good, HSG A
431,000	66	Weighted Average
345,000		80.05% Pervious Area
86,000		19.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
13.3	550	0.0190	0.69		**Shallow Concentrated Flow, 495 Inner Ramp** Woodland Kv= 5.0 fps
19.6	600	Total			

Summary for Subcatchment S2: King Street

Runoff = 0.98 cfs @ 12.08 hrs, Volume= 0.081 af, Depth= 7.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
5,700	98	Paved parking, HSG C
5,700		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.19		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.9	180	0.0280	3.40		**Shallow Concentrated Flow, Subcatchment 2** Paved Kv= 20.3 fps
1.6	230	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S3: 242 King St House

Runoff = 8.75 cfs @ 12.10 hrs, Volume= 0.671 af, Depth= 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
86,500	30	Woods, Good, HSG A
14,500	98	Paved parking, HSG A
39,800	77	Woods, Good, HSG D
15,800	70	Woods, Good, HSG C
156,600	52	Weighted Average
142,100		90.74% Pervious Area
14,500		9.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	50	0.3600	0.32		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.18"
2.8	215	0.0650	1.27		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.4	265	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S4: Beaver Brook

Runoff = 0.96 cfs @ 12.56 hrs, Volume= 0.182 af, Depth= 1.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
75,700	30	Woods, Good, HSG A
800	98	Paved parking, HSG A
5,400	70	Woods, Good, HSG C
11,800	77	Woods, Good, HSG D
93,700	39	Weighted Average
92,900		99.15% Pervious Area
800		0.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.6	50	0.0040	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
2.1	160	0.0640	1.26		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.6	191	0.0190	0.69		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
30.3	401	Total			

Summary for Reach Wetland: Beaver Brook

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 15.771 ac, 15.57% Impervious, Inflow Depth = 2.47" for 100 Yr 24 Hr event
Inflow = 32.37 cfs @ 12.35 hrs, Volume= 3.243 af
Outflow = 32.37 cfs @ 12.35 hrs, Volume= 3.243 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: Drainage Pipe 1

Inflow Area = 0.131 ac,100.00% Impervious, Inflow Depth = 7.41" for 100 Yr 24 Hr event
Inflow = 0.98 cfs @ 12.08 hrs, Volume= 0.081 af
Outflow = 0.98 cfs @ 12.08 hrs, Volume= 0.081 af, Atten= 0%, Lag= 0.0 min
Primary = 0.98 cfs @ 12.08 hrs, Volume= 0.081 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 235.51' @ 12.08 hrs
Flood Elev= 239.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Catch Basin** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 235.00' / 214.00' S= 0.1382 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=0.98 cfs @ 12.08 hrs HW=235.51' (Free Discharge)
↑**1=Catch Basin** (Inlet Controls 0.98 cfs @ 2.43 fps)

Summary for Pond DB: 242 King -Low-Lying Area

Inflow Area = 13.620 ac, 17.90% Impervious, Inflow Depth = 3.37" for 100 Yr 24 Hr event
Inflow = 34.47 cfs @ 12.26 hrs, Volume= 3.821 af
Outflow = 31.75 cfs @ 12.35 hrs, Volume= 3.061 af, Atten= 8%, Lag= 5.3 min
Primary = 31.75 cfs @ 12.35 hrs, Volume= 3.061 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 210.83' @ 12.35 hrs Surf.Area= 25,040 sf Storage= 41,176 cf

Plug-Flow detention time= 124.5 min calculated for 3.061 af (80% of inflow)
Center-of-Mass det. time= 45.0 min (894.3 - 849.3)

Volume	Invert	Avail.Storage	Storage Description
#1	208.50'	45,400 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.50	5,300	0	0
209.00	14,500	4,950	4,950
210.00	20,200	17,350	22,300
211.00	26,000	23,100	45,400

Device	Routing	Invert	Outlet Devices
#1	Primary	210.50'	**67.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65

2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=31.72 cfs @ 12.35 hrs HW=210.83' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 31.72 cfs @ 1.42 fps)

Summary for Pond DP1: Drainage Pipe 1

Inflow Area = 9.894 ac, 19.95% Impervious, Inflow Depth = 3.72" for 100 Yr 24 Hr event
Inflow = 29.18 cfs @ 12.27 hrs, Volume= 3.069 af
Outflow = 29.18 cfs @ 12.27 hrs, Volume= 3.069 af, Atten= 0%, Lag= 0.0 min
Primary = 29.18 cfs @ 12.27 hrs, Volume= 3.069 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 218.26' @ 12.27 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	216.00'	**36.0" Round Culvert** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 214.00' S= 0.0132 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=29.18 cfs @ 12.27 hrs HW=218.26' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 29.18 cfs @ 5.12 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: I-495 Runoff Area=431,000 sf 19.95% Impervious Runoff Depth=4.13"
Flow Length=600' Tc=19.6 min CN=66 Runoff=32.46 cfs 3.406 af

SubcatchmentS2: King Street Runoff Area=5,700 sf 100.00% Impervious Runoff Depth=7.91"
Flow Length=230' Tc=6.0 min CN=98 Runoff=1.05 cfs 0.086 af

SubcatchmentS3: 242 King St House Runoff Area=156,600 sf 9.26% Impervious Runoff Depth=2.56"
Flow Length=265' Tc=6.0 min CN=52 Runoff=10.15 cfs 0.766 af

SubcatchmentS4: Beaver Brook Runoff Area=93,700 sf 0.85% Impervious Runoff Depth=1.22"
Flow Length=401' Tc=30.3 min CN=39 Runoff=1.24 cfs 0.219 af

Reach Wetland: Beaver Brook Inflow=37.50 cfs 3.717 af
Outflow=37.50 cfs 3.717 af

Pond 1P: Drainage Pipe 1 Peak Elev=235.53' Inflow=1.05 cfs 0.086 af
12.0" Round Culvert n=0.013 L=152.0' S=0.1382 '/' Outflow=1.05 cfs 0.086 af

Pond DB: 242 King -Low-Lying Area Peak Elev=210.87' Storage=41,968 cf Inflow=38.47 cfs 4.259 af
Outflow=36.71 cfs 3.498 af

Pond DP1: Drainage Pipe 1 Peak Elev=218.43' Inflow=32.46 cfs 3.406 af
36.0" Round Culvert n=0.013 L=152.0' S=0.0132 '/' Outflow=32.46 cfs 3.406 af

Total Runoff Area = 15.771 ac Runoff Volume = 4.477 af Average Runoff Depth = 3.41"
84.43% Pervious = 13.315 ac 15.57% Impervious = 2.456 ac

Summary for Subcatchment S1: I-495

Runoff = 32.46 cfs @ 12.27 hrs, Volume= 3.406 af, Depth= 4.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070, 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
239,500	70	Woods, Good, HSG C
86,000	98	Paved parking, HSG C
105,500	30	Woods, Good, HSG A
431,000	66	Weighted Average
345,000		80.05% Pervious Area
86,000		19.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
13.3	550	0.0190	0.69		**Shallow Concentrated Flow, 495 Inner Ramp** Woodland Kv= 5.0 fps
19.6	600	Total			

Summary for Subcatchment S2: King Street

Runoff = 1.05 cfs @ 12.08 hrs, Volume= 0.086 af, Depth= 7.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070, 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
5,700	98	Paved parking, HSG C
5,700		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.19		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.9	180	0.0280	3.40		**Shallow Concentrated Flow, Subcatchment 2** Paved Kv= 20.3 fps
1.6	230	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S3: 242 King St House

Runoff = 10.15 cfs @ 12.10 hrs, Volume= 0.766 af, Depth= 2.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070, 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
86,500	30	Woods, Good, HSG A
14,500	98	Paved parking, HSG A
39,800	77	Woods, Good, HSG D
15,800	70	Woods, Good, HSG C
156,600	52	Weighted Average
142,100		90.74% Pervious Area
14,500		9.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	50	0.3600	0.32		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.18"
2.8	215	0.0650	1.27		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.4	265	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S4: Beaver Brook

Runoff = 1.24 cfs @ 12.56 hrs, Volume= 0.219 af, Depth= 1.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070, 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
75,700	30	Woods, Good, HSG A
800	98	Paved parking, HSG A
5,400	70	Woods, Good, HSG C
11,800	77	Woods, Good, HSG D
93,700	39	Weighted Average
92,900		99.15% Pervious Area
800		0.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.6	50	0.0040	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
2.1	160	0.0640	1.26		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.6	191	0.0190	0.69		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
30.3	401	Total			

Summary for Reach Wetland: Beaver Brook

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 15.771 ac, 15.57% Impervious, Inflow Depth = 2.83" for 2070, 50 Yr 24 Hr event
Inflow = 37.50 cfs @ 12.33 hrs, Volume= 3.717 af
Outflow = 37.50 cfs @ 12.33 hrs, Volume= 3.717 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: Drainage Pipe 1

Inflow Area = 0.131 ac,100.00% Impervious, Inflow Depth = 7.91" for 2070, 50 Yr 24 Hr event
Inflow = 1.05 cfs @ 12.08 hrs, Volume= 0.086 af
Outflow = 1.05 cfs @ 12.08 hrs, Volume= 0.086 af, Atten= 0%, Lag= 0.0 min
Primary = 1.05 cfs @ 12.08 hrs, Volume= 0.086 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 235.53' @ 12.08 hrs
Flood Elev= 239.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Catch Basin** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 235.00' / 214.00' S= 0.1382 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=1.04 cfs @ 12.08 hrs HW=235.53' (Free Discharge)
1=Catch Basin (Inlet Controls 1.04 cfs @ 2.48 fps)

Summary for Pond DB: 242 King -Low-Lying Area

Inflow Area = 13.620 ac, 17.90% Impervious, Inflow Depth = 3.75" for 2070, 50 Yr 24 Hr event
Inflow = 38.47 cfs @ 12.26 hrs, Volume= 4.259 af
Outflow = 36.71 cfs @ 12.32 hrs, Volume= 3.498 af, Atten= 5%, Lag= 3.8 min
Primary = 36.71 cfs @ 12.32 hrs, Volume= 3.498 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 210.87' @ 12.32 hrs Surf.Area= 25,223 sf Storage= 41,968 cf

Plug-Flow detention time= 114.7 min calculated for 3.498 af (82% of inflow)
Center-of-Mass det. time= 40.8 min (887.0 - 846.3)

Volume	Invert	Avail.Storage	Storage Description
#1	208.50'	45,400 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.50	5,300	0	0
209.00	14,500	4,950	4,950
210.00	20,200	17,350	22,300
211.00	26,000	23,100	45,400

Device	Routing	Invert	Outlet Devices
#1	Primary	210.50'	**67.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65

2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=36.67 cfs @ 12.32 hrs HW=210.87' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 36.67 cfs @ 1.50 fps)

Summary for Pond DP1: Drainage Pipe 1

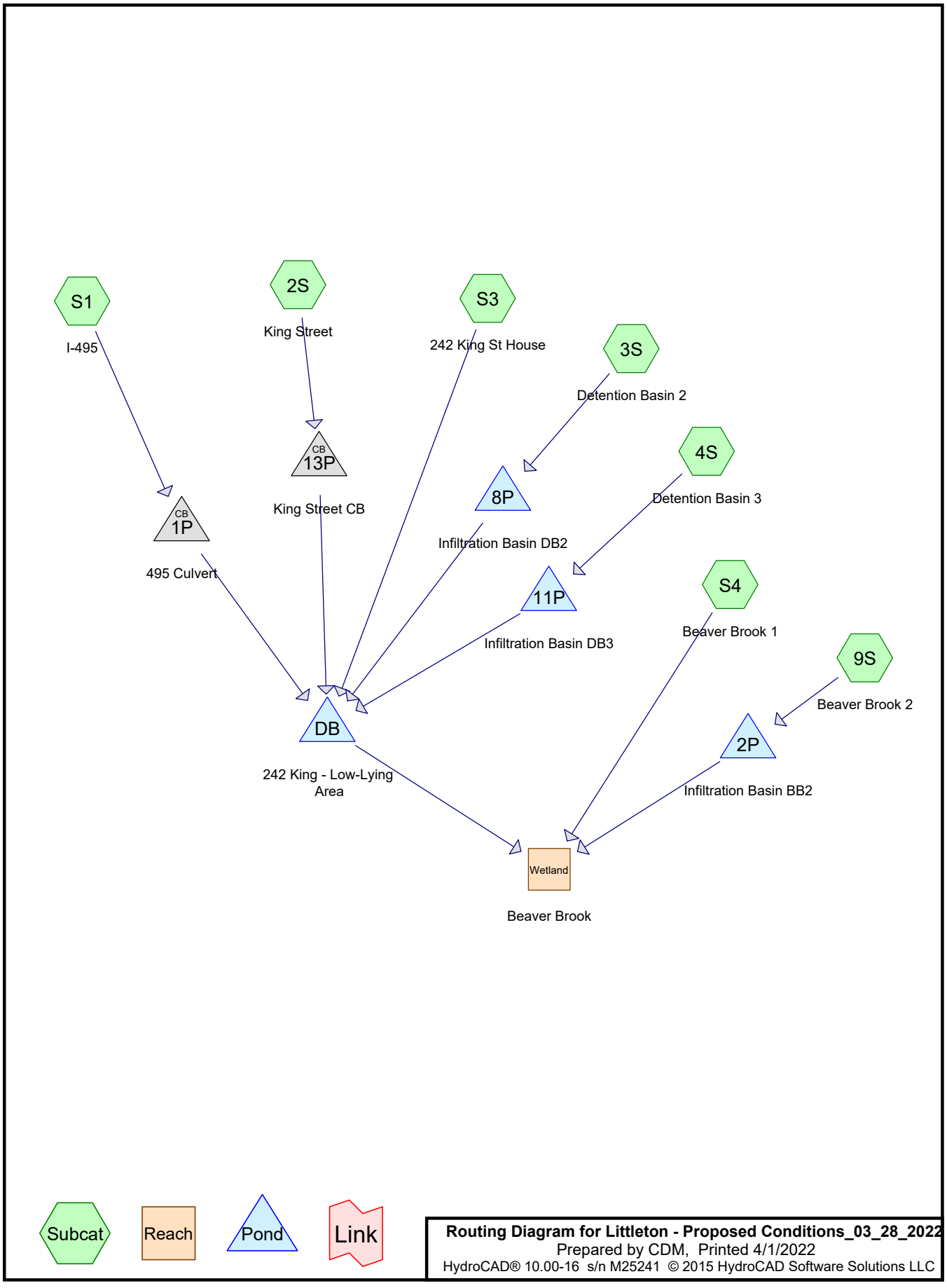
Inflow Area = 9.894 ac, 19.95% Impervious, Inflow Depth = 4.13" for 2070, 50 Yr 24 Hr event
Inflow = 32.46 cfs @ 12.27 hrs, Volume= 3.406 af
Outflow = 32.46 cfs @ 12.27 hrs, Volume= 3.406 af, Atten= 0%, Lag= 0.0 min
Primary = 32.46 cfs @ 12.27 hrs, Volume= 3.406 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 218.43' @ 12.27 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	216.00'	**36.0" Round Culvert** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 214.00' S= 0.0132 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=32.49 cfs @ 12.27 hrs HW=218.43' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 32.49 cfs @ 5.30 fps)

Proposed HydroCAD Model



Routing Diagram for Littleton - Proposed Conditions_03_28_2022
Prepared by CDM, Printed 4/1/2022

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2S: King Street Runoff Area=5,700 sf 100.00% Impervious Runoff Depth=2.95"
Flow Length=230' Tc=6.0 min CN=98 Runoff=0.40 cfs 0.032 af

Subcatchment3S: Detention Basin 2 Runoff Area=48,900 sf 32.92% Impervious Runoff Depth=0.44"
Flow Length=263' Tc=10.1 min CN=61 Runoff=0.30 cfs 0.041 af

Subcatchment4S: Detention Basin 3 Runoff Area=20,200 sf 36.14% Impervious Runoff Depth=0.87"
Flow Length=182' Tc=6.0 min CN=71 Runoff=0.43 cfs 0.033 af

Subcatchment9S: Beaver Brook 2 Runoff Area=24,400 sf 43.85% Impervious Runoff Depth=1.32"
Flow Length=190' Tc=6.0 min CN=79 Runoff=0.85 cfs 0.062 af

SubcatchmentS1: I-495 Runoff Area=431,000 sf 19.95% Impervious Runoff Depth=0.63"
Flow Length=600' Tc=19.6 min CN=66 Runoff=4.00 cfs 0.522 af

SubcatchmentS3: 242 King St House Runoff Area=120,200 sf 0.00% Impervious Runoff Depth=0.03"
Flow Length=126' Tc=6.0 min CN=44 Runoff=0.01 cfs 0.007 af

SubcatchmentS4: Beaver Brook 1 Runoff Area=36,600 sf 12.30% Impervious Runoff Depth=0.27"
Flow Length=153' Tc=6.1 min CN=56 Runoff=0.10 cfs 0.019 af

Reach Wetland: Beaver Brook Inflow=0.10 cfs 0.019 af
Outflow=0.10 cfs 0.019 af

Pond 1P: 495 Culvert Peak Elev=216.73' Inflow=4.00 cfs 0.522 af
36.0" Round Culvert n=0.013 L=152.0' S=0.0132 '/' Outflow=4.00 cfs 0.522 af

Pond 2P: Infiltration Basin BB2 Peak Elev=212.07' Storage=851 cf Inflow=0.85 cfs 0.062 af
Discarded=0.17 cfs 0.062 af Primary=0.00 cfs 0.000 af Outflow=0.17 cfs 0.062 af

Pond 8P: Infiltration Basin DB2 Peak Elev=211.83' Storage=442 cf Inflow=0.30 cfs 0.041 af
Discarded=0.07 cfs 0.041 af Primary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.041 af

Pond 11P: Infiltration Basin DB3 Peak Elev=212.05' Storage=674 cf Inflow=0.43 cfs 0.033 af
Discarded=0.03 cfs 0.033 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.033 af

Pond 13P: King Street CB Peak Elev=235.31' Inflow=0.40 cfs 0.032 af
12.0" Round Culvert n=0.013 L=68.0' S=0.3088 '/' Outflow=0.40 cfs 0.032 af

Pond DB: 242 King - Low-Lying Area Peak Elev=209.98' Storage=24,434 cf Inflow=4.15 cfs 0.561 af
72.0" x 18.0" Box Culvert n=0.011 L=55.0' S=0.0136 '/' Outflow=0.00 cfs 0.000 af

Total Runoff Area = 15.771 ac Runoff Volume = 0.716 af Average Runoff Depth = 0.54"
81.03% Pervious = 12.780 ac 18.97% Impervious = 2.991 ac

Summary for Subcatchment 2S: King Street

Runoff = 0.40 cfs @ 12.08 hrs, Volume= 0.032 af, Depth= 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
5,700	98	Paved parking, HSG C
5,700		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.19		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.9	180	0.0280	3.40		**Shallow Concentrated Flow, Subcatchment 2** Paved Kv= 20.3 fps
1.6	230	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3S: Detention Basin 2

Runoff = 0.30 cfs @ 12.19 hrs, Volume= 0.041 af, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
500	76	Gravel roads, HSG A
14,900	98	Paved parking, HSG A
1,200	98	Paved parking, HSG D
21,600	39	>75% Grass cover, Good, HSG A
5,900	30	Woods, Good, HSG A
900	80	>75% Grass cover, Good, HSG D
3,900	70	Woods, Good, HSG C
48,900	61	Weighted Average
32,800		67.08% Pervious Area
16,100		32.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	23	0.0220	0.32		**Sheet Flow,** Fallow n= 0.050 P2= 3.18"
5.2	27	0.0070	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.18"
3.7	213	0.0040	0.95		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
10.1	263	Total			

Summary for Subcatchment 4S: Detention Basin 3

Runoff = 0.43 cfs @ 12.10 hrs, Volume= 0.033 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
7,100	39	>75% Grass cover, Good, HSG A
1,800	70	Woods, Good, HSG C
4,000	80	>75% Grass cover, Good, HSG D
3,200	98	Paved parking, HSG A
1,300	98	Paved parking, HSG C
2,800	98	Paved parking, HSG D
20,200	71	Weighted Average
12,900		63.86% Pervious Area
7,300		36.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0300	1.40		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.5	102	0.0340	3.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	30	0.1500	5.81		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.2	182	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 9S: Beaver Brook 2

Runoff = 0.85 cfs @ 12.09 hrs, Volume= 0.062 af, Depth= 1.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
4,700	39	>75% Grass cover, Good, HSG A
6,200	98	Paved parking, HSG A
500	76	Gravel roads, HSG A
1,900	70	Woods, Good, HSG C
6,600	80	>75% Grass cover, Good, HSG D
4,500	98	Paved parking, HSG D
24,400	79	Weighted Average
13,700		56.15% Pervious Area
10,700		43.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.2300	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
0.2	20	0.0750	1.37		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	120	0.0320	2.68		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
5.6	190	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S1: I-495

Runoff = 4.00 cfs @ 12.33 hrs, Volume= 0.522 af, Depth= 0.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
239,500	70	Woods, Good, HSG C
86,000	98	Paved parking, HSG C
105,500	30	Woods, Good, HSG A
431,000	66	Weighted Average
345,000		80.05% Pervious Area
86,000		19.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
13.3	550	0.0190	0.69		**Shallow Concentrated Flow, 495 Inner Ramp** Woodland Kv= 5.0 fps
19.6	600	Total			

Summary for Subcatchment S3: 242 King St House

Runoff = 0.01 cfs @ 16.70 hrs, Volume= 0.007 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
67,200	30	Woods, Good, HSG A
18,200	39	>75% Grass cover, Good, HSG A
16,800	80	>75% Grass cover, Good, HSG D
18,000	70	Woods, Good, HSG C
120,200	44	Weighted Average
120,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	50	0.3800	0.22		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
1.6	76	0.1050	0.81		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
5.4	126	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S4: Beaver Brook 1

Runoff = 0.10 cfs @ 12.31 hrs, Volume= 0.019 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
16,200	30	Woods, Good, HSG A
2,500	70	Woods, Good, HSG C
6,000	77	Woods, Good, HSG D
4,500	98	Paved parking, HSG A
2,000	39	>75% Grass cover, Good, HSG A
5,400	77	Woods, Good, HSG D
36,600	56	Weighted Average
32,100		87.70% Pervious Area
4,500		12.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.2300	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
1.4	103	0.0580	1.20		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.1	153	Total			

Summary for Reach Wetland: Beaver Brook

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 15.771 ac, 18.97% Impervious, Inflow Depth = 0.01" for 2 Yr 24 Hr event
Inflow = 0.10 cfs @ 12.31 hrs, Volume= 0.019 af
Outflow = 0.10 cfs @ 12.31 hrs, Volume= 0.019 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: 495 Culvert

Inflow Area = 9.894 ac, 19.95% Impervious, Inflow Depth = 0.63" for 2 Yr 24 Hr event
Inflow = 4.00 cfs @ 12.33 hrs, Volume= 0.522 af
Outflow = 4.00 cfs @ 12.33 hrs, Volume= 0.522 af, Atten= 0%, Lag= 0.0 min
Primary = 4.00 cfs @ 12.33 hrs, Volume= 0.522 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 216.73' @ 12.33 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	216.00'	**36.0" Round Culvert** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 214.00' S= 0.0132 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=3.89 cfs @ 12.33 hrs HW=216.73' (Free Discharge)
1=Culvert (Inlet Controls 3.89 cfs @ 2.91 fps)

Summary for Pond 2P: Infiltration Basin BB2

Inflow Area = 0.560 ac, 43.85% Impervious, Inflow Depth = 1.32" for 2 Yr 24 Hr event
Inflow = 0.85 cfs @ 12.09 hrs, Volume= 0.062 af
Outflow = 0.17 cfs @ 12.56 hrs, Volume= 0.062 af, Atten= 80%, Lag= 27.8 min
Discarded = 0.17 cfs @ 12.56 hrs, Volume= 0.062 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.07' @ 12.56 hrs Surf.Area= 2,701 sf Storage= 851 cf
Flood Elev= 213.00' Surf.Area= 3,578 sf Storage= 3,763 cf

Plug-Flow detention time= 46.9 min calculated for 0.062 af (100% of inflow)
Center-of-Mass det. time= 46.9 min (893.2 - 846.3)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	3,763 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	2,632	658	658
213.00	3,578	3,105	3,763

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**2.410 in/hr Exfiltration over Horizontal area**

Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.17 cfs @ 12.56 hrs HW=212.07' (Free Discharge)
2=Exfiltration (Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=211.50' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 8P: Infiltration Basin DB2

Inflow Area = 1.123 ac, 32.92% Impervious, Inflow Depth = 0.44" for 2 Yr 24 Hr event
Inflow = 0.30 cfs @ 12.19 hrs, Volume= 0.041 af
Outflow = 0.07 cfs @ 13.38 hrs, Volume= 0.041 af, Atten= 77%, Lag= 71.0 min
Discarded = 0.07 cfs @ 13.38 hrs, Volume= 0.041 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 211.83' @ 13.38 hrs Surf.Area= 2,718 sf Storage= 442 cf
Flood Elev= 213.00' Surf.Area= 5,128 sf Storage= 5,696 cf

Plug-Flow detention time= 78.6 min calculated for 0.041 af (100% of inflow)
Center-of-Mass det. time= 78.5 min (997.9 - 919.4)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	5,696 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	4,176	1,044	1,044
213.00	5,128	4,652	5,696

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**1.020 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.07 cfs @ 13.38 hrs HW=211.83' (Free Discharge)
2=Exfiltration (Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=211.50' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 11P: Infiltration Basin DB3

Inflow Area = 0.464 ac, 36.14% Impervious, Inflow Depth = 0.87" for 2 Yr 24 Hr event
Inflow = 0.43 cfs @ 12.10 hrs, Volume= 0.033 af
Outflow = 0.03 cfs @ 14.90 hrs, Volume= 0.033 af, Atten= 93%, Lag= 167.9 min
Discarded = 0.03 cfs @ 14.90 hrs, Volume= 0.033 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.05' @ 14.90 hrs Surf.Area= 2,303 sf Storage= 674 cf
Flood Elev= 213.00' Surf.Area= 2,932 sf Storage= 3,170 cf

Plug-Flow detention time= 275.4 min calculated for 0.033 af (100% of inflow)
Center-of-Mass det. time= 275.4 min (1,148.1 - 872.7)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	3,170 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	2,272	568	568
213.00	2,932	2,602	3,170

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**0.520 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.03 cfs @ 14.90 hrs HW=212.05' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=211.50' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 13P: King Street CB

Inflow Area = 0.131 ac,100.00% Impervious, Inflow Depth = 2.95" for 2 Yr 24 Hr event
Inflow = 0.40 cfs @ 12.08 hrs, Volume= 0.032 af
Outflow = 0.40 cfs @ 12.08 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min
Primary = 0.40 cfs @ 12.08 hrs, Volume= 0.032 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 235.31' @ 12.08 hrs
Flood Elev= 239.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Culvert** L= 68.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 235.00' / 214.00' S= 0.3088 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=0.40 cfs @ 12.08 hrs HW=235.31' (Free Discharge)
1=Culvert (Inlet Controls 0.40 cfs @ 1.91 fps)

Summary for Pond DB: 242 King - Low-Lying Area

Inflow Area = 14.371 ac, 18.39% Impervious, Inflow Depth = 0.47" for 2 Yr 24 Hr event
Inflow = 4.15 cfs @ 12.33 hrs, Volume= 0.561 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 209.98' @ 25.14 hrs Surf.Area= 21,552 sf Storage= 24,434 cf
Flood Elev= 212.00' Surf.Area= 29,293 sf Storage= 75,633 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	208.50'	75,633 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.50	4,120	0	0
209.00	17,266	5,347	5,347
210.00	21,624	19,445	24,792
211.00	25,383	23,504	48,295
212.00	29,293	27,338	75,633

Device	Routing	Invert	Outlet Devices
#1	Primary	210.25'	**72.0" W x 18.0" H Box Culvert** L= 55.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 210.25' / 209.50' S= 0.0136 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 9.00 sf

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=208.50' (Free Discharge)
1=Culvert (Controls 0.00 cfs)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2S: King Street Runoff Area=5,700 sf 100.00% Impervious Runoff Depth=4.67"
Flow Length=230' Tc=6.0 min CN=98 Runoff=0.63 cfs 0.051 af

Subcatchment3S: Detention Basin 2 Runoff Area=48,900 sf 32.92% Impervious Runoff Depth=1.32"
Flow Length=263' Tc=10.1 min CN=61 Runoff=1.35 cfs 0.123 af

Subcatchment4S: Detention Basin 3 Runoff Area=20,200 sf 36.14% Impervious Runoff Depth=2.05"
Flow Length=182' Tc=6.0 min CN=71 Runoff=1.10 cfs 0.079 af

Subcatchment9S: Beaver Brook 2 Runoff Area=24,400 sf 43.85% Impervious Runoff Depth=2.72"
Flow Length=190' Tc=6.0 min CN=79 Runoff=1.79 cfs 0.127 af

SubcatchmentS1: I-495 Runoff Area=431,000 sf 19.95% Impervious Runoff Depth=1.67"
Flow Length=600' Tc=19.6 min CN=66 Runoff=12.47 cfs 1.374 af

SubcatchmentS3: 242 King St House Runoff Area=120,200 sf 0.00% Impervious Runoff Depth=0.37"
Flow Length=126' Tc=6.0 min CN=44 Runoff=0.41 cfs 0.085 af

SubcatchmentS4: Beaver Brook 1 Runoff Area=36,600 sf 12.30% Impervious Runoff Depth=1.00"
Flow Length=153' Tc=6.1 min CN=56 Runoff=0.79 cfs 0.070 af

Reach Wetland: Beaver Brook Inflow=2.12 cfs 0.968 af
Outflow=2.12 cfs 0.968 af

Pond 1P: 495 Culvert Peak Elev=217.36' Inflow=12.47 cfs 1.374 af
36.0" Round Culvert n=0.013 L=152.0' S=0.0132 '/' Outflow=12.47 cfs 1.374 af

Pond 2P: Infiltration Basin BB2 Peak Elev=212.22' Storage=1,264 cf Inflow=1.79 cfs 0.127 af
Discarded=0.19 cfs 0.097 af Primary=0.99 cfs 0.030 af Outflow=1.18 cfs 0.127 af

Pond 8P: Infiltration Basin DB2 Peak Elev=212.16' Storage=1,713 cf Inflow=1.35 cfs 0.123 af
Discarded=0.12 cfs 0.102 af Primary=0.32 cfs 0.021 af Outflow=0.44 cfs 0.123 af

Pond 11P: Infiltration Basin DB3 Peak Elev=212.18' Storage=990 cf Inflow=1.10 cfs 0.079 af
Discarded=0.03 cfs 0.046 af Primary=0.54 cfs 0.033 af Outflow=0.58 cfs 0.079 af

Pond 13P: King Street CB Peak Elev=235.40' Inflow=0.63 cfs 0.051 af
12.0" Round Culvert n=0.013 L=68.0' S=0.3088 '/' Outflow=0.63 cfs 0.051 af

Pond DB: 242 King - Low-Lying Area Peak Elev=210.47' Storage=35,425 cf Inflow=13.65 cfs 1.564 af
72.0" x 18.0" Box Culvert n=0.011 L=55.0' S=0.0136 '/' Outflow=2.02 cfs 0.868 af

Total Runoff Area = 15.771 ac Runoff Volume = 1.909 af Average Runoff Depth = 1.45"
81.03% Pervious = 12.780 ac 18.97% Impervious = 2.991 ac

Summary for Subcatchment 2S: King Street

Runoff = 0.63 cfs @ 12.08 hrs, Volume= 0.051 af, Depth= 4.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
5,700	98	Paved parking, HSG C
5,700		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.19		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.9	180	0.0280	3.40		**Shallow Concentrated Flow, Subcatchment 2** Paved Kv= 20.3 fps
1.6	230	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3S: Detention Basin 2

Runoff = 1.35 cfs @ 12.16 hrs, Volume= 0.123 af, Depth= 1.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
500	76	Gravel roads, HSG A
14,900	98	Paved parking, HSG A
1,200	98	Paved parking, HSG D
21,600	39	>75% Grass cover, Good, HSG A
5,900	30	Woods, Good, HSG A
900	80	>75% Grass cover, Good, HSG D
3,900	70	Woods, Good, HSG C
48,900	61	Weighted Average
32,800		67.08% Pervious Area
16,100		32.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	23	0.0220	0.32		**Sheet Flow,** Fallow n= 0.050 P2= 3.18"
5.2	27	0.0070	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.18"
3.7	213	0.0040	0.95		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
10.1	263	Total			

Summary for Subcatchment 4S: Detention Basin 3

Runoff = 1.10 cfs @ 12.09 hrs, Volume= 0.079 af, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
7,100	39	>75% Grass cover, Good, HSG A
1,800	70	Woods, Good, HSG C
4,000	80	>75% Grass cover, Good, HSG D
3,200	98	Paved parking, HSG A
1,300	98	Paved parking, HSG C
2,800	98	Paved parking, HSG D
20,200	71	Weighted Average
12,900		63.86% Pervious Area
7,300		36.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0300	1.40		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.5	102	0.0340	3.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	30	0.1500	5.81		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.2	182	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 9S: Beaver Brook 2

Runoff = 1.79 cfs @ 12.09 hrs, Volume= 0.127 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
4,700	39	>75% Grass cover, Good, HSG A
6,200	98	Paved parking, HSG A
500	76	Gravel roads, HSG A
1,900	70	Woods, Good, HSG C
6,600	80	>75% Grass cover, Good, HSG D
4,500	98	Paved parking, HSG D
24,400	79	Weighted Average
13,700		56.15% Pervious Area
10,700		43.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.2300	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
0.2	20	0.0750	1.37		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	120	0.0320	2.68		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
5.6	190	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S1: I-495

Runoff = 12.47 cfs @ 12.30 hrs, Volume= 1.374 af, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
239,500	70	Woods, Good, HSG C
86,000	98	Paved parking, HSG C
105,500	30	Woods, Good, HSG A
431,000	66	Weighted Average
345,000		80.05% Pervious Area
86,000		19.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
13.3	550	0.0190	0.69		**Shallow Concentrated Flow, 495 Inner Ramp** Woodland Kv= 5.0 fps
19.6	600	Total			

Summary for Subcatchment S3: 242 King St House

Runoff = 0.41 cfs @ 12.34 hrs, Volume= 0.085 af, Depth= 0.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
67,200	30	Woods, Good, HSG A
18,200	39	>75% Grass cover, Good, HSG A
16,800	80	>75% Grass cover, Good, HSG D
18,000	70	Woods, Good, HSG C
120,200	44	Weighted Average
120,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	50	0.3800	0.22		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
1.6	76	0.1050	0.81		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
5.4	126	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S4: Beaver Brook 1

Runoff = 0.79 cfs @ 12.11 hrs, Volume= 0.070 af, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
16,200	30	Woods, Good, HSG A
2,500	70	Woods, Good, HSG C
6,000	77	Woods, Good, HSG D
4,500	98	Paved parking, HSG A
2,000	39	>75% Grass cover, Good, HSG A
5,400	77	Woods, Good, HSG D
36,600	56	Weighted Average
32,100		87.70% Pervious Area
4,500		12.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.2300	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
1.4	103	0.0580	1.20		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.1	153	Total			

Summary for Reach Wetland: Beaver Brook

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 15.771 ac, 18.97% Impervious, Inflow Depth = 0.74" for 10 Yr 24 Hr event
Inflow = 2.12 cfs @ 13.79 hrs, Volume= 0.968 af
Outflow = 2.12 cfs @ 13.79 hrs, Volume= 0.968 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: 495 Culvert

Inflow Area = 9.894 ac, 19.95% Impervious, Inflow Depth = 1.67" for 10 Yr 24 Hr event
Inflow = 12.47 cfs @ 12.30 hrs, Volume= 1.374 af
Outflow = 12.47 cfs @ 12.30 hrs, Volume= 1.374 af, Atten= 0%, Lag= 0.0 min
Primary = 12.47 cfs @ 12.30 hrs, Volume= 1.374 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 217.36' @ 12.30 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	216.00'	**36.0" Round Culvert** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 214.00' S= 0.0132 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=12.43 cfs @ 12.30 hrs HW=217.36' (Free Discharge)
1=Culvert (Inlet Controls 12.43 cfs @ 3.98 fps)

Summary for Pond 2P: Infiltration Basin BB2

Inflow Area = 0.560 ac, 43.85% Impervious, Inflow Depth = 2.72" for 10 Yr 24 Hr event
Inflow = 1.79 cfs @ 12.09 hrs, Volume= 0.127 af
Outflow = 1.18 cfs @ 12.18 hrs, Volume= 0.127 af, Atten= 34%, Lag= 5.5 min
Discarded = 0.19 cfs @ 12.18 hrs, Volume= 0.097 af
Primary = 0.99 cfs @ 12.18 hrs, Volume= 0.030 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.22' @ 12.18 hrs Surf.Area= 2,842 sf Storage= 1,264 cf
Flood Elev= 213.00' Surf.Area= 3,578 sf Storage= 3,763 cf

Plug-Flow detention time= 43.7 min calculated for 0.127 af (100% of inflow)
Center-of-Mass det. time= 43.7 min (869.0 - 825.3)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	3,763 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	2,632	658	658
213.00	3,578	3,105	3,763

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**2.410 in/hr Exfiltration over Horizontal area**

Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.19 cfs @ 12.18 hrs HW=212.22' (Free Discharge)
↑**2=Exfiltration** (Controls 0.19 cfs)

Primary OutFlow Max=0.99 cfs @ 12.18 hrs HW=212.22' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 0.99 cfs @ 0.82 fps)

Summary for Pond 8P: Infiltration Basin DB2

Inflow Area = 1.123 ac, 32.92% Impervious, Inflow Depth = 1.32" for 10 Yr 24 Hr event
Inflow = 1.35 cfs @ 12.16 hrs, Volume= 0.123 af
Outflow = 0.44 cfs @ 12.58 hrs, Volume= 0.123 af, Atten= 67%, Lag= 25.7 min
Discarded = 0.12 cfs @ 12.58 hrs, Volume= 0.102 af
Primary = 0.32 cfs @ 12.58 hrs, Volume= 0.021 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.16' @ 12.58 hrs Surf.Area= 4,326 sf Storage= 1,713 cf
Flood Elev= 213.00' Surf.Area= 5,128 sf Storage= 5,696 cf

Plug-Flow detention time= 136.3 min calculated for 0.123 af (100% of inflow)
Center-of-Mass det. time= 136.3 min (1,013.8 - 877.4)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	5,696 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	4,176	1,044	1,044
213.00	5,128	4,652	5,696

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**1.020 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.12 cfs @ 12.58 hrs HW=212.16' (Free Discharge)
↑**2=Exfiltration** (Controls 0.12 cfs)

Primary OutFlow Max=0.32 cfs @ 12.58 hrs HW=212.16' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 0.32 cfs @ 0.56 fps)

Summary for Pond 11P: Infiltration Basin DB3

Inflow Area = 0.464 ac, 36.14% Impervious, Inflow Depth = 2.05" for 10 Yr 24 Hr event
Inflow = 1.10 cfs @ 12.09 hrs, Volume= 0.079 af
Outflow = 0.58 cfs @ 12.25 hrs, Volume= 0.079 af, Atten= 48%, Lag= 9.6 min
Discarded = 0.03 cfs @ 12.25 hrs, Volume= 0.046 af
Primary = 0.54 cfs @ 12.25 hrs, Volume= 0.033 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.18' @ 12.25 hrs Surf.Area= 2,392 sf Storage= 990 cf
Flood Elev= 213.00' Surf.Area= 2,932 sf Storage= 3,170 cf

Plug-Flow detention time= 196.1 min calculated for 0.079 af (100% of inflow)
Center-of-Mass det. time= 196.2 min (1,042.3 - 846.1)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	3,170 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	2,272	568	568
213.00	2,932	2,602	3,170

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**0.520 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.03 cfs @ 12.25 hrs HW=212.18' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.54 cfs @ 12.25 hrs HW=212.18' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.54 cfs @ 0.67 fps)

Summary for Pond 13P: King Street CB

Inflow Area = 0.131 ac,100.00% Impervious, Inflow Depth = 4.67" for 10 Yr 24 Hr event
Inflow = 0.63 cfs @ 12.08 hrs, Volume= 0.051 af
Outflow = 0.63 cfs @ 12.08 hrs, Volume= 0.051 af, Atten= 0%, Lag= 0.0 min
Primary = 0.63 cfs @ 12.08 hrs, Volume= 0.051 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 235.40' @ 12.08 hrs
Flood Elev= 239.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Culvert** L= 68.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 235.00' / 214.00' S= 0.3088 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=0.63 cfs @ 12.08 hrs HW=235.40' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 0.63 cfs @ 2.15 fps)

Summary for Pond DB: 242 King - Low-Lying Area

Inflow Area = 14.371 ac, 18.39% Impervious, Inflow Depth = 1.31" for 10 Yr 24 Hr event
Inflow = 13.65 cfs @ 12.29 hrs, Volume= 1.564 af
Outflow = 2.02 cfs @ 13.81 hrs, Volume= 0.868 af, Atten= 85%, Lag= 91.2 min
Primary = 2.02 cfs @ 13.81 hrs, Volume= 0.868 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 210.47' @ 13.81 hrs Surf.Area= 23,400 sf Storage= 35,425 cf
Flood Elev= 212.00' Surf.Area= 29,293 sf Storage= 75,633 cf

Plug-Flow detention time= 288.6 min calculated for 0.868 af (56% of inflow)
Center-of-Mass det. time= 163.2 min (1,032.8 - 869.6)

Volume	Invert	Avail.Storage	Storage Description
#1	208.50'	75,633 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.50	4,120	0	0
209.00	17,266	5,347	5,347
210.00	21,624	19,445	24,792
211.00	25,383	23,504	48,295
212.00	29,293	27,338	75,633

Device	Routing	Invert	Outlet Devices
#1	Primary	210.25'	**72.0" W x 18.0" H Box Culvert** L= 55.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 210.25' / 209.50' S= 0.0136 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 9.00 sf

Primary OutFlow Max=2.02 cfs @ 13.81 hrs HW=210.47' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 2.02 cfs @ 1.51 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2S: King Street Runoff Area=5,700 sf 100.00% Impervious Runoff Depth=7.41"
Flow Length=230' Tc=6.0 min CN=98 Runoff=0.98 cfs 0.081 af

Subcatchment3S: Detention Basin 2 Runoff Area=48,900 sf 32.92% Impervious Runoff Depth=3.18"
Flow Length=263' Tc=10.1 min CN=61 Runoff=3.58 cfs 0.297 af

Subcatchment4S: Detention Basin 3 Runoff Area=20,200 sf 36.14% Impervious Runoff Depth=4.28"
Flow Length=182' Tc=6.0 min CN=71 Runoff=2.33 cfs 0.165 af

Subcatchment9S: Beaver Brook 2 Runoff Area=24,400 sf 43.85% Impervious Runoff Depth=5.18"
Flow Length=190' Tc=6.0 min CN=79 Runoff=3.37 cfs 0.242 af

SubcatchmentS1: I-495 Runoff Area=431,000 sf 19.95% Impervious Runoff Depth=3.72"
Flow Length=600' Tc=19.6 min CN=66 Runoff=29.18 cfs 3.069 af

SubcatchmentS3: 242 King St House Runoff Area=120,200 sf 0.00% Impervious Runoff Depth=1.46"
Flow Length=126' Tc=6.0 min CN=44 Runoff=3.73 cfs 0.336 af

SubcatchmentS4: Beaver Brook 1 Runoff Area=36,600 sf 12.30% Impervious Runoff Depth=2.65"
Flow Length=153' Tc=6.1 min CN=56 Runoff=2.50 cfs 0.186 af

Reach Wetland: Beaver Brook Inflow=21.24 cfs 3.346 af
Outflow=21.24 cfs 3.346 af

Pond 1P: 495 Culvert Peak Elev=218.26' Inflow=29.18 cfs 3.069 af
36.0" Round Culvert n=0.013 L=152.0' S=0.0132 '/' Outflow=29.18 cfs 3.069 af

Pond 2P: Infiltration Basin BB2 Peak Elev=212.34' Storage=1,610 cf Inflow=3.37 cfs 0.242 af
Discarded=0.20 cfs 0.141 af Primary=2.81 cfs 0.101 af Outflow=3.01 cfs 0.242 af

Pond 8P: Infiltration Basin DB2 Peak Elev=212.34' Storage=2,501 cf Inflow=3.58 cfs 0.297 af
Discarded=0.13 cfs 0.139 af Primary=2.72 cfs 0.159 af Outflow=2.85 cfs 0.297 af

Pond 11P: Infiltration Basin DB3 Peak Elev=212.30' Storage=1,273 cf Inflow=2.33 cfs 0.165 af
Discarded=0.04 cfs 0.055 af Primary=2.05 cfs 0.110 af Outflow=2.09 cfs 0.165 af

Pond 13P: King Street CB Peak Elev=235.51' Inflow=0.98 cfs 0.081 af
12.0" Round Culvert n=0.013 L=68.0' S=0.3088 '/' Outflow=0.98 cfs 0.081 af

Pond DB: 242 King - Low-Lying Area Peak Elev=211.28' Storage=55,508 cf Inflow=35.98 cfs 3.755 af
72.0" x 18.0" Box Culvert n=0.011 L=55.0' S=0.0136 '/' Outflow=20.08 cfs 3.059 af

Total Runoff Area = 15.771 ac Runoff Volume = 4.377 af Average Runoff Depth = 3.33"
81.03% Pervious = 12.780 ac 18.97% Impervious = 2.991 ac

Summary for Subcatchment 2S: King Street

Runoff = 0.98 cfs @ 12.08 hrs, Volume= 0.081 af, Depth= 7.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
5,700	98	Paved parking, HSG C
5,700		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.19		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.9	180	0.0280	3.40		**Shallow Concentrated Flow, Subcatchment 2** Paved Kv= 20.3 fps
1.6	230	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3S: Detention Basin 2

Runoff = 3.58 cfs @ 12.15 hrs, Volume= 0.297 af, Depth= 3.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
500	76	Gravel roads, HSG A
14,900	98	Paved parking, HSG A
1,200	98	Paved parking, HSG D
21,600	39	>75% Grass cover, Good, HSG A
5,900	30	Woods, Good, HSG A
900	80	>75% Grass cover, Good, HSG D
3,900	70	Woods, Good, HSG C
48,900	61	Weighted Average
32,800		67.08% Pervious Area
16,100		32.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	23	0.0220	0.32		**Sheet Flow,** Fallow n= 0.050 P2= 3.18"
5.2	27	0.0070	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.18"
3.7	213	0.0040	0.95		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
10.1	263	Total			

Summary for Subcatchment 4S: Detention Basin 3

Runoff = 2.33 cfs @ 12.09 hrs, Volume= 0.165 af, Depth= 4.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
7,100	39	>75% Grass cover, Good, HSG A
1,800	70	Woods, Good, HSG C
4,000	80	>75% Grass cover, Good, HSG D
3,200	98	Paved parking, HSG A
1,300	98	Paved parking, HSG C
2,800	98	Paved parking, HSG D
20,200	71	Weighted Average
12,900		63.86% Pervious Area
7,300		36.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0300	1.40		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.5	102	0.0340	3.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	30	0.1500	5.81		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.2	182	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 9S: Beaver Brook 2

Runoff = 3.37 cfs @ 12.09 hrs, Volume= 0.242 af, Depth= 5.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
4,700	39	>75% Grass cover, Good, HSG A
6,200	98	Paved parking, HSG A
500	76	Gravel roads, HSG A
1,900	70	Woods, Good, HSG C
6,600	80	>75% Grass cover, Good, HSG D
4,500	98	Paved parking, HSG D
24,400	79	Weighted Average
13,700		56.15% Pervious Area
10,700		43.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.2300	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
0.2	20	0.0750	1.37		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	120	0.0320	2.68		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
5.6	190	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S1: I-495

Runoff = 29.18 cfs @ 12.27 hrs, Volume= 3.069 af, Depth= 3.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
239,500	70	Woods, Good, HSG C
86,000	98	Paved parking, HSG C
105,500	30	Woods, Good, HSG A
431,000	66	Weighted Average
345,000		80.05% Pervious Area
86,000		19.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
13.3	550	0.0190	0.69		**Shallow Concentrated Flow, 495 Inner Ramp** Woodland Kv= 5.0 fps
19.6	600	Total			

Summary for Subcatchment S3: 242 King St House

Runoff = 3.73 cfs @ 12.11 hrs, Volume= 0.336 af, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
67,200	30	Woods, Good, HSG A
18,200	39	>75% Grass cover, Good, HSG A
16,800	80	>75% Grass cover, Good, HSG D
18,000	70	Woods, Good, HSG C
120,200	44	Weighted Average
120,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	50	0.3800	0.22		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
1.6	76	0.1050	0.81		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
5.4	126	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S4: Beaver Brook 1

Runoff = 2.50 cfs @ 12.10 hrs, Volume= 0.186 af, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
16,200	30	Woods, Good, HSG A
2,500	70	Woods, Good, HSG C
6,000	77	Woods, Good, HSG D
4,500	98	Paved parking, HSG A
2,000	39	>75% Grass cover, Good, HSG A
5,400	77	Woods, Good, HSG D
36,600	56	Weighted Average
32,100		87.70% Pervious Area
4,500		12.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.2300	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
1.4	103	0.0580	1.20		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.1	153	Total			

Summary for Reach Wetland: Beaver Brook

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 15.771 ac, 18.97% Impervious, Inflow Depth = 2.55" for 100 Yr 24 Hr event
Inflow = 21.24 cfs @ 12.54 hrs, Volume= 3.346 af
Outflow = 21.24 cfs @ 12.54 hrs, Volume= 3.346 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: 495 Culvert

Inflow Area = 9.894 ac, 19.95% Impervious, Inflow Depth = 3.72" for 100 Yr 24 Hr event
Inflow = 29.18 cfs @ 12.27 hrs, Volume= 3.069 af
Outflow = 29.18 cfs @ 12.27 hrs, Volume= 3.069 af, Atten= 0%, Lag= 0.0 min
Primary = 29.18 cfs @ 12.27 hrs, Volume= 3.069 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 218.26' @ 12.27 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	216.00'	**36.0" Round Culvert** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 214.00' S= 0.0132 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=29.18 cfs @ 12.27 hrs HW=218.26' (Free Discharge)
1=Culvert (Inlet Controls 29.18 cfs @ 5.12 fps)

Summary for Pond 2P: Infiltration Basin BB2

Inflow Area = 0.560 ac, 43.85% Impervious, Inflow Depth = 5.18" for 100 Yr 24 Hr event
Inflow = 3.37 cfs @ 12.09 hrs, Volume= 0.242 af
Outflow = 3.01 cfs @ 12.13 hrs, Volume= 0.242 af, Atten= 11%, Lag= 2.4 min
Discarded = 0.20 cfs @ 12.13 hrs, Volume= 0.141 af
Primary = 2.81 cfs @ 12.13 hrs, Volume= 0.101 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.34' @ 12.13 hrs Surf.Area= 2,954 sf Storage= 1,610 cf
Flood Elev= 213.00' Surf.Area= 3,578 sf Storage= 3,763 cf

Plug-Flow detention time= 37.9 min calculated for 0.242 af (100% of inflow)
Center-of-Mass det. time= 37.9 min (844.8 - 806.9)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	3,763 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	2,632	658	658
213.00	3,578	3,105	3,763

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**2.410 in/hr Exfiltration over Horizontal area**

Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.20 cfs @ 12.13 hrs HW=212.34' (Free Discharge)
2=Exfiltration (Controls 0.20 cfs)

Primary OutFlow Max=2.80 cfs @ 12.13 hrs HW=212.34' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 2.80 cfs @ 1.16 fps)

Summary for Pond 8P: Infiltration Basin DB2

Inflow Area = 1.123 ac, 32.92% Impervious, Inflow Depth = 3.18" for 100 Yr 24 Hr event
Inflow = 3.58 cfs @ 12.15 hrs, Volume= 0.297 af
Outflow = 2.85 cfs @ 12.23 hrs, Volume= 0.297 af, Atten= 20%, Lag= 5.3 min
Discarded = 0.13 cfs @ 12.23 hrs, Volume= 0.139 af
Primary = 2.72 cfs @ 12.23 hrs, Volume= 0.159 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.34' @ 12.23 hrs Surf.Area= 4,496 sf Storage= 2,501 cf
Flood Elev= 213.00' Surf.Area= 5,128 sf Storage= 5,696 cf

Plug-Flow detention time= 86.6 min calculated for 0.297 af (100% of inflow)
Center-of-Mass det. time= 86.7 min (936.8 - 850.1)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	5,696 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	4,176	1,044	1,044
213.00	5,128	4,652	5,696

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**1.020 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.13 cfs @ 12.23 hrs HW=212.34' (Free Discharge)
2=Exfiltration (Controls 0.13 cfs)

Primary OutFlow Max=2.72 cfs @ 12.23 hrs HW=212.34' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 2.72 cfs @ 1.15 fps)

Summary for Pond 11P: Infiltration Basin DB3

Inflow Area = 0.464 ac, 36.14% Impervious, Inflow Depth = 4.28" for 100 Yr 24 Hr event
Inflow = 2.33 cfs @ 12.09 hrs, Volume= 0.165 af
Outflow = 2.09 cfs @ 12.13 hrs, Volume= 0.165 af, Atten= 10%, Lag= 2.4 min
Discarded = 0.04 cfs @ 12.13 hrs, Volume= 0.055 af
Primary = 2.05 cfs @ 12.13 hrs, Volume= 0.110 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.30' @ 12.13 hrs Surf.Area= 2,468 sf Storage= 1,273 cf
Flood Elev= 213.00' Surf.Area= 2,932 sf Storage= 3,170 cf

Plug-Flow detention time= 118.1 min calculated for 0.165 af (100% of inflow)
Center-of-Mass det. time= 118.2 min (942.9 - 824.7)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	3,170 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	2,272	568	568
213.00	2,932	2,602	3,170

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**0.520 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.04 cfs @ 12.13 hrs HW=212.30' (Free Discharge)
↑**2=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=2.05 cfs @ 12.13 hrs HW=212.30' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 2.05 cfs @ 1.04 fps)

Summary for Pond 13P: King Street CB

Inflow Area = 0.131 ac,100.00% Impervious, Inflow Depth = 7.41" for 100 Yr 24 Hr event
Inflow = 0.98 cfs @ 12.08 hrs, Volume= 0.081 af
Outflow = 0.98 cfs @ 12.08 hrs, Volume= 0.081 af, Atten= 0%, Lag= 0.0 min
Primary = 0.98 cfs @ 12.08 hrs, Volume= 0.081 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 235.51' @ 12.08 hrs
Flood Elev= 239.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Culvert** L= 68.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 235.00' / 214.00' S= 0.3088 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=0.98 cfs @ 12.08 hrs HW=235.51' (Free Discharge)
↑**1=Culvert** (Inlet Controls 0.98 cfs @ 2.43 fps)

Summary for Pond DB: 242 King - Low-Lying Area

Inflow Area = 14.371 ac, 18.39% Impervious, Inflow Depth = 3.14" for 100 Yr 24 Hr event
Inflow = 35.98 cfs @ 12.26 hrs, Volume= 3.755 af
Outflow = 20.08 cfs @ 12.57 hrs, Volume= 3.059 af, Atten= 44%, Lag= 18.5 min
Primary = 20.08 cfs @ 12.57 hrs, Volume= 3.059 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 211.28' @ 12.57 hrs Surf.Area= 26,471 sf Storage= 55,508 cf
Flood Elev= 212.00' Surf.Area= 29,293 sf Storage= 75,633 cf

Plug-Flow detention time= 141.4 min calculated for 3.059 af (81% of inflow)
Center-of-Mass det. time= 67.5 min (912.9 - 845.4)

Volume	Invert	Avail.Storage	Storage Description
#1	208.50'	75,633 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.50	4,120	0	0
209.00	17,266	5,347	5,347
210.00	21,624	19,445	24,792
211.00	25,383	23,504	48,295
212.00	29,293	27,338	75,633

Device	Routing	Invert	Outlet Devices
#1	Primary	210.25'	**72.0" W x 18.0" H Box Culvert** L= 55.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 210.25' / 209.50' S= 0.0136 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 9.00 sf

Primary OutFlow Max=20.08 cfs @ 12.57 hrs HW=211.28' (Free Discharge)
↑**1=Culvert** (Inlet Controls 20.08 cfs @ 3.25 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2S: King Street Runoff Area=5,700 sf 100.00% Impervious Runoff Depth=7.91"
Flow Length=230' Tc=6.0 min CN=98 Runoff=1.05 cfs 0.086 af

Subcatchment3S: Detention Basin 2 Runoff Area=48,900 sf 32.92% Impervious Runoff Depth=3.56"
Flow Length=263' Tc=10.1 min CN=61 Runoff=4.03 cfs 0.333 af

Subcatchment4S: Detention Basin 3 Runoff Area=20,200 sf 36.14% Impervious Runoff Depth=4.71"
Flow Length=182' Tc=6.0 min CN=71 Runoff=2.56 cfs 0.182 af

Subcatchment9S: Beaver Brook 2 Runoff Area=24,400 sf 43.85% Impervious Runoff Depth=5.65"
Flow Length=190' Tc=6.0 min CN=79 Runoff=3.66 cfs 0.264 af

SubcatchmentS1: I-495 Runoff Area=431,000 sf 19.95% Impervious Runoff Depth=4.13"
Flow Length=600' Tc=19.6 min CN=66 Runoff=32.46 cfs 3.406 af

SubcatchmentS3: 242 King St House Runoff Area=120,200 sf 0.00% Impervious Runoff Depth=1.71"
Flow Length=126' Tc=6.0 min CN=44 Runoff=4.59 cfs 0.394 af

SubcatchmentS4: Beaver Brook 1 Runoff Area=36,600 sf 12.30% Impervious Runoff Depth=3.00"
Flow Length=153' Tc=6.1 min CN=56 Runoff=2.85 cfs 0.210 af

Reach Wetland: Beaver Brook Inflow=25.78 cfs 3.831 af
Outflow=25.78 cfs 3.831 af

Pond 1P: 495 Culvert Peak Elev=218.43' Inflow=32.46 cfs 3.406 af
36.0" Round Culvert n=0.013 L=152.0' S=0.0132 '/' Outflow=32.46 cfs 3.406 af

Pond 2P: Infiltration Basin BB2 Peak Elev=212.36' Storage=1,655 cf Inflow=3.66 cfs 0.264 af
Discarded=0.21 cfs 0.148 af Primary=3.09 cfs 0.116 af Outflow=3.30 cfs 0.264 af

Pond 8P: Infiltration Basin DB2 Peak Elev=212.36' Storage=2,625 cf Inflow=4.03 cfs 0.333 af
Discarded=0.13 cfs 0.144 af Primary=3.23 cfs 0.189 af Outflow=3.37 cfs 0.333 af

Pond 11P: Infiltration Basin DB3 Peak Elev=212.31' Storage=1,307 cf Inflow=2.56 cfs 0.182 af
Discarded=0.04 cfs 0.056 af Primary=2.28 cfs 0.126 af Outflow=2.32 cfs 0.182 af

Pond 13P: King Street CB Peak Elev=235.53' Inflow=1.05 cfs 0.086 af
12.0" Round Culvert n=0.013 L=68.0' S=0.3088 '/' Outflow=1.05 cfs 0.086 af

Pond DB: 242 King - Low-Lying Area Peak Elev=211.42' Storage=59,231 cf Inflow=40.30 cfs 4.201 af
72.0" x 18.0" Box Culvert n=0.011 L=55.0' S=0.0136 '/' Outflow=24.30 cfs 3.505 af

Total Runoff Area = 15.771 ac Runoff Volume = 4.875 af Average Runoff Depth = 3.71"
81.03% Pervious = 12.780 ac 18.97% Impervious = 2.991 ac

Summary for Subcatchment 2S: King Street

Runoff = 1.05 cfs @ 12.08 hrs, Volume= 0.086 af, Depth= 7.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
5,700	98	Paved parking, HSG C
5,700		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.19		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.9	180	0.0280	3.40		**Shallow Concentrated Flow, Subcatchment 2** Paved Kv= 20.3 fps
1.6	230	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3S: Detention Basin 2

Runoff = 4.03 cfs @ 12.15 hrs, Volume= 0.333 af, Depth= 3.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
500	76	Gravel roads, HSG A
14,900	98	Paved parking, HSG A
1,200	98	Paved parking, HSG D
21,600	39	>75% Grass cover, Good, HSG A
5,900	30	Woods, Good, HSG A
900	80	>75% Grass cover, Good, HSG D
3,900	70	Woods, Good, HSG C
48,900	61	Weighted Average
32,800		67.08% Pervious Area
16,100		32.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	23	0.0220	0.32		**Sheet Flow,** Fallow n= 0.050 P2= 3.18"
5.2	27	0.0070	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.18"
3.7	213	0.0040	0.95		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
10.1	263	Total			

Summary for Subcatchment 4S: Detention Basin 3

Runoff = 2.56 cfs @ 12.09 hrs, Volume= 0.182 af, Depth= 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
7,100	39	>75% Grass cover, Good, HSG A
1,800	70	Woods, Good, HSG C
4,000	80	>75% Grass cover, Good, HSG D
3,200	98	Paved parking, HSG A
1,300	98	Paved parking, HSG C
2,800	98	Paved parking, HSG D
20,200	71	Weighted Average
12,900		63.86% Pervious Area
7,300		36.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0300	1.40		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.5	102	0.0340	3.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	30	0.1500	5.81		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.2	182	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 9S: Beaver Brook 2

Runoff = 3.66 cfs @ 12.09 hrs, Volume= 0.264 af, Depth= 5.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
4,700	39	>75% Grass cover, Good, HSG A
6,200	98	Paved parking, HSG A
500	76	Gravel roads, HSG A
1,900	70	Woods, Good, HSG C
6,600	80	>75% Grass cover, Good, HSG D
4,500	98	Paved parking, HSG D
24,400	79	Weighted Average
13,700		56.15% Pervious Area
10,700		43.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.2300	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
0.2	20	0.0750	1.37		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	120	0.0320	2.68		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
5.6	190	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S1: I-495

Runoff = 32.46 cfs @ 12.27 hrs, Volume= 3.406 af, Depth= 4.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
239,500	70	Woods, Good, HSG C
86,000	98	Paved parking, HSG C
105,500	30	Woods, Good, HSG A
431,000	66	Weighted Average
345,000		80.05% Pervious Area
86,000		19.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
13.3	550	0.0190	0.69		**Shallow Concentrated Flow, 495 Inner Ramp** Woodland Kv= 5.0 fps
19.6	600	Total			

Summary for Subcatchment S3: 242 King St House

Runoff = 4.59 cfs @ 12.10 hrs, Volume= 0.394 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
67,200	30	Woods, Good, HSG A
18,200	39	>75% Grass cover, Good, HSG A
16,800	80	>75% Grass cover, Good, HSG D
18,000	70	Woods, Good, HSG C
120,200	44	Weighted Average
120,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	50	0.3800	0.22		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
1.6	76	0.1050	0.81		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
5.4	126	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S4: Beaver Brook 1

Runoff = 2.85 cfs @ 12.10 hrs, Volume= 0.210 af, Depth= 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
16,200	30	Woods, Good, HSG A
2,500	70	Woods, Good, HSG C
6,000	77	Woods, Good, HSG D
4,500	98	Paved parking, HSG A
2,000	39	>75% Grass cover, Good, HSG A
5,400	77	Woods, Good, HSG D
36,600	56	Weighted Average
32,100		87.70% Pervious Area
4,500		12.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.2300	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
1.4	103	0.0580	1.20		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.1	153	Total			

Summary for Reach Wetland: Beaver Brook

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 15.771 ac, 18.97% Impervious, Inflow Depth = 2.91" for 2070 50 Yr 24 Hr event
Inflow = 25.78 cfs @ 12.51 hrs, Volume= 3.831 af
Outflow = 25.78 cfs @ 12.51 hrs, Volume= 3.831 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: 495 Culvert

Inflow Area = 9.894 ac, 19.95% Impervious, Inflow Depth = 4.13" for 2070 50 Yr 24 Hr event
Inflow = 32.46 cfs @ 12.27 hrs, Volume= 3.406 af
Outflow = 32.46 cfs @ 12.27 hrs, Volume= 3.406 af, Atten= 0%, Lag= 0.0 min
Primary = 32.46 cfs @ 12.27 hrs, Volume= 3.406 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 218.43' @ 12.27 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	216.00'	**36.0" Round Culvert** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 214.00' S= 0.0132 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=32.49 cfs @ 12.27 hrs HW=218.43' (Free Discharge)
1=Culvert (Inlet Controls 32.49 cfs @ 5.30 fps)

Summary for Pond 2P: Infiltration Basin BB2

Inflow Area = 0.560 ac, 43.85% Impervious, Inflow Depth = 5.65" for 2070 50 Yr 24 Hr event
Inflow = 3.66 cfs @ 12.09 hrs, Volume= 0.264 af
Outflow = 3.30 cfs @ 12.13 hrs, Volume= 0.264 af, Atten= 10%, Lag= 2.3 min
Discarded = 0.21 cfs @ 12.13 hrs, Volume= 0.148 af
Primary = 3.09 cfs @ 12.13 hrs, Volume= 0.116 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.36' @ 12.13 hrs Surf.Area= 2,969 sf Storage= 1,655 cf
Flood Elev= 213.00' Surf.Area= 3,578 sf Storage= 3,763 cf

Plug-Flow detention time= 37.1 min calculated for 0.264 af (100% of inflow)
Center-of-Mass det. time= 37.1 min (841.6 - 804.5)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	3,763 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	2,632	658	658
213.00	3,578	3,105	3,763

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**2.410 in/hr Exfiltration over Horizontal area**

Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.21 cfs @ 12.13 hrs HW=212.36' (Free Discharge)
2=Exfiltration (Controls 0.21 cfs)

Primary OutFlow Max=3.08 cfs @ 12.13 hrs HW=212.36' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 3.08 cfs @ 1.21 fps)

Summary for Pond 8P: Infiltration Basin DB2

Inflow Area = 1.123 ac, 32.92% Impervious, Inflow Depth = 3.56" for 2070 50 Yr 24 Hr event
Inflow = 4.03 cfs @ 12.15 hrs, Volume= 0.333 af
Outflow = 3.37 cfs @ 12.22 hrs, Volume= 0.333 af, Atten= 16%, Lag= 4.4 min
Discarded = 0.13 cfs @ 12.22 hrs, Volume= 0.144 af
Primary = 3.23 cfs @ 12.22 hrs, Volume= 0.189 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.36' @ 12.22 hrs Surf.Area= 4,522 sf Storage= 2,625 cf
Flood Elev= 213.00' Surf.Area= 5,128 sf Storage= 5,696 cf

Plug-Flow detention time= 81.8 min calculated for 0.333 af (100% of inflow)
Center-of-Mass det. time= 81.8 min (928.6 - 846.8)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	5,696 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	4,176	1,044	1,044
213.00	5,128	4,652	5,696

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**1.020 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.13 cfs @ 12.22 hrs HW=212.36' (Free Discharge)
2=Exfiltration (Controls 0.13 cfs)

Primary OutFlow Max=3.23 cfs @ 12.22 hrs HW=212.36' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 3.23 cfs @ 1.23 fps)

Summary for Pond 11P: Infiltration Basin DB3

Inflow Area = 0.464 ac, 36.14% Impervious, Inflow Depth = 4.71" for 2070 50 Yr 24 Hr event
Inflow = 2.56 cfs @ 12.09 hrs, Volume= 0.182 af
Outflow = 2.32 cfs @ 12.13 hrs, Volume= 0.182 af, Atten= 9%, Lag= 2.3 min
Discarded = 0.04 cfs @ 12.13 hrs, Volume= 0.056 af
Primary = 2.28 cfs @ 12.13 hrs, Volume= 0.126 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.31' @ 12.13 hrs Surf.Area= 2,477 sf Storage= 1,307 cf
Flood Elev= 213.00' Surf.Area= 2,932 sf Storage= 3,170 cf

Plug-Flow detention time= 109.5 min calculated for 0.182 af (100% of inflow)
Center-of-Mass det. time= 109.5 min (931.4 - 821.9)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	3,170 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	2,272	568	568
213.00	2,932	2,602	3,170

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**0.520 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.04 cfs @ 12.13 hrs HW=212.31' (Free Discharge)
↑**2=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=2.28 cfs @ 12.13 hrs HW=212.31' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 2.28 cfs @ 1.08 fps)

Summary for Pond 13P: King Street CB

Inflow Area = 0.131 ac,100.00% Impervious, Inflow Depth = 7.91" for 2070 50 Yr 24 Hr event
Inflow = 1.05 cfs @ 12.08 hrs, Volume= 0.086 af
Outflow = 1.05 cfs @ 12.08 hrs, Volume= 0.086 af, Atten= 0%, Lag= 0.0 min
Primary = 1.05 cfs @ 12.08 hrs, Volume= 0.086 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 235.53' @ 12.08 hrs
Flood Elev= 239.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Culvert** L= 68.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 235.00' / 214.00' S= 0.3088 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=1.04 cfs @ 12.08 hrs HW=235.53' (Free Discharge)
└**1=Culvert** (Inlet Controls 1.04 cfs @ 2.48 fps)

Summary for Pond DB: 242 King - Low-Lying Area

Inflow Area = 14.371 ac, 18.39% Impervious, Inflow Depth = 3.51" for 2070 50 Yr 24 Hr event
Inflow = 40.30 cfs @ 12.26 hrs, Volume= 4.201 af
Outflow = 24.30 cfs @ 12.53 hrs, Volume= 3.505 af, Atten= 40%, Lag= 16.5 min
Primary = 24.30 cfs @ 12.53 hrs, Volume= 3.505 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 211.42' @ 12.53 hrs Surf.Area= 27,015 sf Storage= 59,231 cf
Flood Elev= 212.00' Surf.Area= 29,293 sf Storage= 75,633 cf

Plug-Flow detention time= 131.2 min calculated for 3.505 af (83% of inflow)
Center-of-Mass det. time= 62.3 min (904.9 - 842.6)

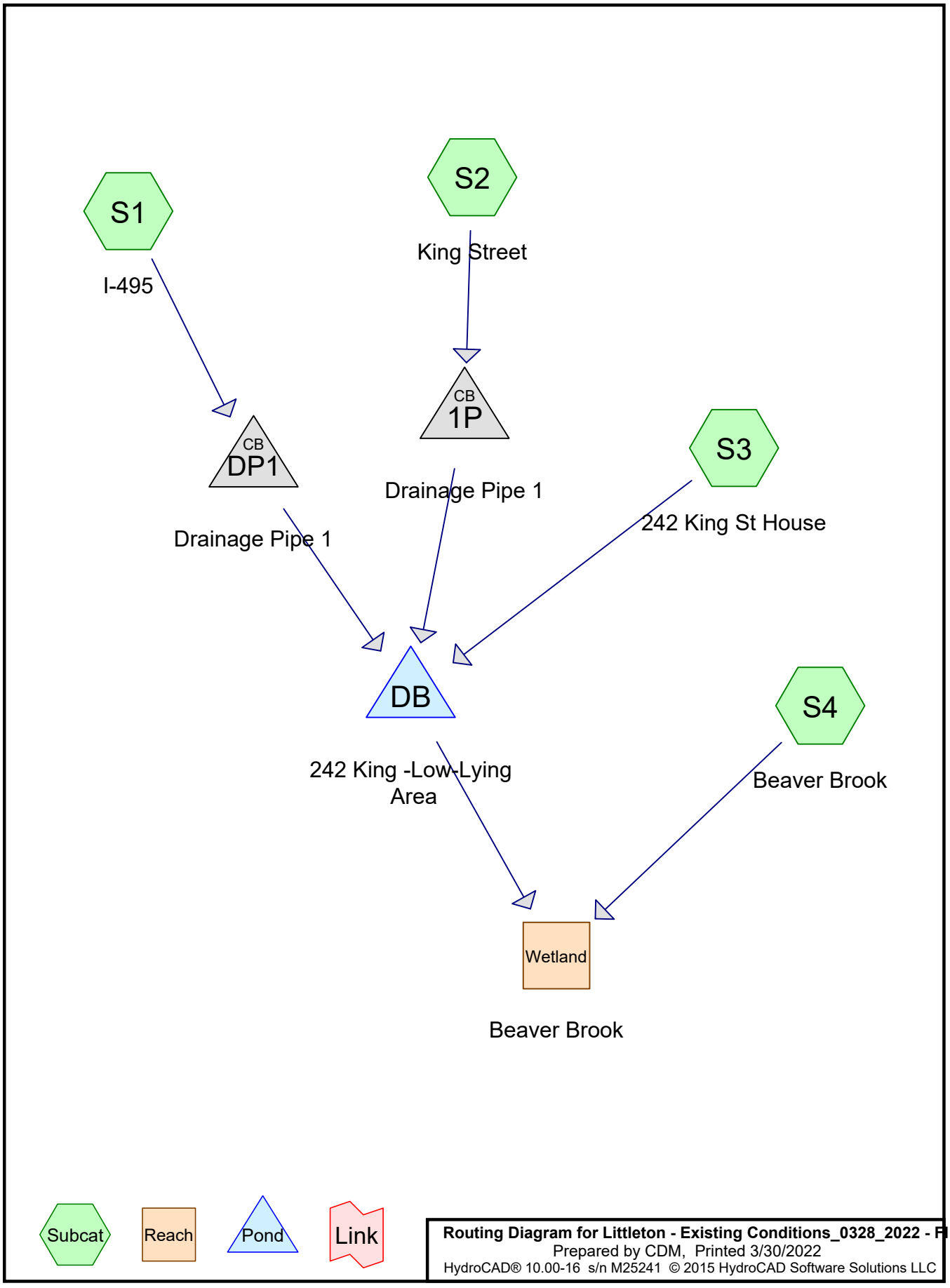
Volume	Invert	Avail.Storage	Storage Description
#1	208.50'	75,633 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.50	4,120	0	0
209.00	17,266	5,347	5,347
210.00	21,624	19,445	24,792
211.00	25,383	23,504	48,295
212.00	29,293	27,338	75,633

Device	Routing	Invert	Outlet Devices
#1	Primary	210.25'	**72.0" W x 18.0" H Box Culvert** L= 55.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 210.25' / 209.50' S= 0.0136 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 9.00 sf

Primary OutFlow Max=24.29 cfs @ 12.53 hrs HW=211.42' (Free Discharge)
└**1=Culvert** (Inlet Controls 24.29 cfs @ 3.47 fps)

Existing HydroCAD Model with 100-Year Flood



Routing Diagram for Littleton - Existing Conditions_0328_2022 - Fi
Prepared by CDM, Printed 3/30/2022

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: I-495 Runoff Area=431,000 sf 19.95% Impervious Runoff Depth=0.63"
Flow Length=600' Tc=19.6 min CN=66 Runoff=4.00 cfs 0.522 af

SubcatchmentS2: King Street Runoff Area=5,700 sf 100.00% Impervious Runoff Depth=2.95"
Flow Length=230' Tc=6.0 min CN=98 Runoff=0.40 cfs 0.032 af

SubcatchmentS3: 242 King St House Runoff Area=156,600 sf 9.26% Impervious Runoff Depth=0.17"
Flow Length=265' Tc=6.0 min CN=52 Runoff=0.18 cfs 0.050 af

SubcatchmentS4: Beaver Brook Runoff Area=93,700 sf 0.85% Impervious Runoff Depth=0.00"
Flow Length=401' Tc=30.3 min CN=39 Runoff=0.00 cfs 0.000 af

Reach Wetland: Beaver Brook Inflow=4.30 cfs 0.605 af
Outflow=4.30 cfs 0.605 af

Pond 1P: Drainage Pipe 1 Peak Elev=235.31' Inflow=0.40 cfs 0.032 af
12.0" Round Culvert n=0.013 L=152.0' S=0.1382 '/' Outflow=0.40 cfs 0.032 af

Pond DB: 242 King -Low-Lying Area Peak Elev=211.00' Storage=45,502 cf Inflow=4.30 cfs 0.604 af
Outflow=4.30 cfs 0.604 af

Pond DP1: Drainage Pipe 1 Peak Elev=216.73' Inflow=4.00 cfs 0.522 af
36.0" Round Culvert n=0.013 L=152.0' S=0.0132 '/' Outflow=4.00 cfs 0.522 af

Total Runoff Area = 15.771 ac Runoff Volume = 0.605 af Average Runoff Depth = 0.46"
84.43% Pervious = 13.315 ac 15.57% Impervious = 2.456 ac

Summary for Subcatchment S1: I-495

Runoff = 4.00 cfs @ 12.33 hrs, Volume= 0.522 af, Depth= 0.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
239,500	70	Woods, Good, HSG C
86,000	98	Paved parking, HSG C
105,500	30	Woods, Good, HSG A
431,000	66	Weighted Average
345,000		80.05% Pervious Area
86,000		19.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
13.3	550	0.0190	0.69		**Shallow Concentrated Flow, 495 Inner Ramp** Woodland Kv= 5.0 fps
19.6	600	Total			

Summary for Subcatchment S2: King Street

Runoff = 0.40 cfs @ 12.08 hrs, Volume= 0.032 af, Depth= 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
5,700	98	Paved parking, HSG C
5,700		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.19		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.9	180	0.0280	3.40		**Shallow Concentrated Flow, Subcatchment 2** Paved Kv= 20.3 fps
1.6	230	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S3: 242 King St House

Runoff = 0.18 cfs @ 12.41 hrs, Volume= 0.050 af, Depth= 0.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
86,500	30	Woods, Good, HSG A
14,500	98	Paved parking, HSG A
39,800	77	Woods, Good, HSG D
15,800	70	Woods, Good, HSG C
156,600	52	Weighted Average
142,100		90.74% Pervious Area
14,500		9.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	50	0.3600	0.32		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.18"
2.8	215	0.0650	1.27		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.4	265	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S4: Beaver Brook

Runoff = 0.00 cfs @ 24.14 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
75,700	30	Woods, Good, HSG A
800	98	Paved parking, HSG A
5,400	70	Woods, Good, HSG C
11,800	77	Woods, Good, HSG D
93,700	39	Weighted Average
92,900		99.15% Pervious Area
800		0.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.6	50	0.0040	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
2.1	160	0.0640	1.26		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.6	191	0.0190	0.69		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
30.3	401	Total			

Summary for Reach Wetland: Beaver Brook

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 15.771 ac, 15.57% Impervious, Inflow Depth = 0.46" for 2 Yr 24 Hr event
Inflow = 4.30 cfs @ 12.34 hrs, Volume= 0.605 af
Outflow = 4.30 cfs @ 12.34 hrs, Volume= 0.605 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: Drainage Pipe 1

Inflow Area = 0.131 ac,100.00% Impervious, Inflow Depth = 2.95" for 2 Yr 24 Hr event
Inflow = 0.40 cfs @ 12.08 hrs, Volume= 0.032 af
Outflow = 0.40 cfs @ 12.08 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min
Primary = 0.40 cfs @ 12.08 hrs, Volume= 0.032 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 235.31' @ 12.08 hrs
Flood Elev= 239.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Catch Basin** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 235.00' / 214.00' S= 0.1382 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=0.40 cfs @ 12.08 hrs HW=235.31' (Free Discharge)
↑—**1=Catch Basin** (Inlet Controls 0.40 cfs @ 1.91 fps)

Summary for Pond DB: 242 King -Low-Lying Area

Inflow Area = 13.620 ac, 17.90% Impervious, Inflow Depth = 0.53" for 2 Yr 24 Hr event
Inflow = 4.30 cfs @ 12.33 hrs, Volume= 0.604 af
Outflow = 4.30 cfs @ 12.34 hrs, Volume= 0.604 af, Atten= 0%, Lag= 0.4 min
Primary = 4.30 cfs @ 12.34 hrs, Volume= 0.604 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Starting Elev= 211.00' Surf.Area= 26,000 sf Storage= 45,400 cf
Peak Elev= 211.00' @ 12.34 hrs Surf.Area= 26,029 sf Storage= 45,502 cf (102 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 0.4 min (903.7 - 903.3)

Volume	Invert	Avail.Storage	Storage Description
#1	208.50'	75,040 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.50	5,300	0	0
209.00	14,500	4,950	4,950
210.00	20,200	17,350	22,300
211.00	26,000	23,100	45,400
212.00	33,280	29,640	75,040

Device	Routing	Invert	Outlet Devices
#1	Primary	210.50'	**67.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00

2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65
2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=11.25 cfs @ 12.34 hrs HW=211.00' TW=211.00' (Fixed TW Elev= 211.00')
↳**1=Broad-Crested Rectangular Weir** (Weir Controls 11.25 cfs @ 0.33 fps)

Summary for Pond DP1: Drainage Pipe 1

Inflow Area = 9.894 ac, 19.95% Impervious, Inflow Depth = 0.63" for 2 Yr 24 Hr event
Inflow = 4.00 cfs @ 12.33 hrs, Volume= 0.522 af
Outflow = 4.00 cfs @ 12.33 hrs, Volume= 0.522 af, Atten= 0%, Lag= 0.0 min
Primary = 4.00 cfs @ 12.33 hrs, Volume= 0.522 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 216.73' @ 12.33 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	216.00'	**36.0" Round Culvert** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 214.00' S= 0.0132 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=3.89 cfs @ 12.33 hrs HW=216.73' (Free Discharge)
↳**1=Culvert** (Inlet Controls 3.89 cfs @ 2.91 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: I-495 Runoff Area=431,000 sf 19.95% Impervious Runoff Depth=1.67"
Flow Length=600' Tc=19.6 min CN=66 Runoff=12.47 cfs 1.374 af

SubcatchmentS2: King Street Runoff Area=5,700 sf 100.00% Impervious Runoff Depth=4.67"
Flow Length=230' Tc=6.0 min CN=98 Runoff=0.63 cfs 0.051 af

SubcatchmentS3: 242 King St House Runoff Area=156,600 sf 9.26% Impervious Runoff Depth=0.76"
Flow Length=265' Tc=6.0 min CN=52 Runoff=2.22 cfs 0.229 af

SubcatchmentS4: Beaver Brook Runoff Area=93,700 sf 0.85% Impervious Runoff Depth=0.18"
Flow Length=401' Tc=30.3 min CN=39 Runoff=0.06 cfs 0.033 af

Reach Wetland: Beaver Brook Inflow=14.24 cfs 1.687 af
Outflow=14.24 cfs 1.687 af

Pond 1P: Drainage Pipe 1 Peak Elev=235.40' Inflow=0.63 cfs 0.051 af
12.0" Round Culvert n=0.013 L=152.0' S=0.1382 '/' Outflow=0.63 cfs 0.051 af

Pond DB: 242 King -Low-Lying Area Peak Elev=211.01' Storage=45,739 cf Inflow=14.25 cfs 1.654 af
Outflow=14.24 cfs 1.654 af

Pond DP1: Drainage Pipe 1 Peak Elev=217.36' Inflow=12.47 cfs 1.374 af
36.0" Round Culvert n=0.013 L=152.0' S=0.0132 '/' Outflow=12.47 cfs 1.374 af

Total Runoff Area = 15.771 ac Runoff Volume = 1.687 af Average Runoff Depth = 1.28"
84.43% Pervious = 13.315 ac 15.57% Impervious = 2.456 ac

Summary for Subcatchment S1: I-495

Runoff = 12.47 cfs @ 12.30 hrs, Volume= 1.374 af, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
239,500	70	Woods, Good, HSG C
86,000	98	Paved parking, HSG C
105,500	30	Woods, Good, HSG A
431,000	66	Weighted Average
345,000		80.05% Pervious Area
86,000		19.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
13.3	550	0.0190	0.69		**Shallow Concentrated Flow, 495 Inner Ramp** Woodland Kv= 5.0 fps
19.6	600	Total			

Summary for Subcatchment S2: King Street

Runoff = 0.63 cfs @ 12.08 hrs, Volume= 0.051 af, Depth= 4.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
5,700	98	Paved parking, HSG C
5,700		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.19		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.9	180	0.0280	3.40		**Shallow Concentrated Flow, Subcatchment 2** Paved Kv= 20.3 fps
1.6	230	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S3: 242 King St House

Runoff = 2.22 cfs @ 12.12 hrs, Volume= 0.229 af, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
86,500	30	Woods, Good, HSG A
14,500	98	Paved parking, HSG A
39,800	77	Woods, Good, HSG D
15,800	70	Woods, Good, HSG C
156,600	52	Weighted Average
142,100		90.74% Pervious Area
14,500		9.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	50	0.3600	0.32		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.18"
2.8	215	0.0650	1.27		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.4	265	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S4: Beaver Brook

Runoff = 0.06 cfs @ 13.91 hrs, Volume= 0.033 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
75,700	30	Woods, Good, HSG A
800	98	Paved parking, HSG A
5,400	70	Woods, Good, HSG C
11,800	77	Woods, Good, HSG D
93,700	39	Weighted Average
92,900		99.15% Pervious Area
800		0.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.6	50	0.0040	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
2.1	160	0.0640	1.26		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.6	191	0.0190	0.69		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
30.3	401	Total			

Summary for Reach Wetland: Beaver Brook

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 15.771 ac, 15.57% Impervious, Inflow Depth = 1.28" for 10 Yr 24 Hr event
Inflow = 14.24 cfs @ 12.29 hrs, Volume= 1.687 af
Outflow = 14.24 cfs @ 12.29 hrs, Volume= 1.687 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: Drainage Pipe 1

Inflow Area = 0.131 ac,100.00% Impervious, Inflow Depth = 4.67" for 10 Yr 24 Hr event
Inflow = 0.63 cfs @ 12.08 hrs, Volume= 0.051 af
Outflow = 0.63 cfs @ 12.08 hrs, Volume= 0.051 af, Atten= 0%, Lag= 0.0 min
Primary = 0.63 cfs @ 12.08 hrs, Volume= 0.051 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 235.40' @ 12.08 hrs
Flood Elev= 239.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Catch Basin** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 235.00' / 214.00' S= 0.1382 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=0.63 cfs @ 12.08 hrs HW=235.40' (Free Discharge)
↑—**1=Catch Basin** (Inlet Controls 0.63 cfs @ 2.15 fps)

Summary for Pond DB: 242 King -Low-Lying Area

Inflow Area = 13.620 ac, 17.90% Impervious, Inflow Depth = 1.46" for 10 Yr 24 Hr event
Inflow = 14.25 cfs @ 12.28 hrs, Volume= 1.654 af
Outflow = 14.24 cfs @ 12.29 hrs, Volume= 1.654 af, Atten= 0%, Lag= 0.4 min
Primary = 14.24 cfs @ 12.29 hrs, Volume= 1.654 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Starting Elev= 211.00' Surf.Area= 26,000 sf Storage= 45,400 cf
Peak Elev= 211.01' @ 12.29 hrs Surf.Area= 26,095 sf Storage= 45,739 cf (339 cf above start)

Plug-Flow detention time= 345.2 min calculated for 0.612 af (37% of inflow)
Center-of-Mass det. time= 0.4 min (873.4 - 873.0)

Volume	Invert	Avail.Storage	Storage Description
#1	208.50'	75,040 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.50	5,300	0	0
209.00	14,500	4,950	4,950
210.00	20,200	17,350	22,300
211.00	26,000	23,100	45,400
212.00	33,280	29,640	75,040

Device	Routing	Invert	Outlet Devices
#1	Primary	210.50'	**67.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00

2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65
2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=18.24 cfs @ 12.29 hrs HW=211.01' TW=211.00' (Fixed TW Elev= 211.00')
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 18.24 cfs @ 0.53 fps)

Summary for Pond DP1: Drainage Pipe 1

Inflow Area = 9.894 ac, 19.95% Impervious, Inflow Depth = 1.67" for 10 Yr 24 Hr event
Inflow = 12.47 cfs @ 12.30 hrs, Volume= 1.374 af
Outflow = 12.47 cfs @ 12.30 hrs, Volume= 1.374 af, Atten= 0%, Lag= 0.0 min
Primary = 12.47 cfs @ 12.30 hrs, Volume= 1.374 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 217.36' @ 12.30 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	216.00'	**36.0" Round Culvert** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 214.00' S= 0.0132 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=12.43 cfs @ 12.30 hrs HW=217.36' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 12.43 cfs @ 3.98 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: I-495 Runoff Area=431,000 sf 19.95% Impervious Runoff Depth=3.72"
Flow Length=600' Tc=19.6 min CN=66 Runoff=29.18 cfs 3.069 af

SubcatchmentS2: King Street Runoff Area=5,700 sf 100.00% Impervious Runoff Depth=7.41"
Flow Length=230' Tc=6.0 min CN=98 Runoff=0.98 cfs 0.081 af

SubcatchmentS3: 242 King St House Runoff Area=156,600 sf 9.26% Impervious Runoff Depth=2.24"
Flow Length=265' Tc=6.0 min CN=52 Runoff=8.75 cfs 0.671 af

SubcatchmentS4: Beaver Brook Runoff Area=93,700 sf 0.85% Impervious Runoff Depth=1.01"
Flow Length=401' Tc=30.3 min CN=39 Runoff=0.96 cfs 0.182 af

Reach Wetland: Beaver Brook Inflow=34.69 cfs 4.003 af
Outflow=34.69 cfs 4.003 af

Pond 1P: Drainage Pipe 1 Peak Elev=235.51' Inflow=0.98 cfs 0.081 af
12.0" Round Culvert n=0.013 L=152.0' S=0.1382 '/' Outflow=0.98 cfs 0.081 af

Pond DB: 242 King -Low-Lying Area Peak Elev=211.05' Storage=46,792 cf Inflow=34.47 cfs 3.821 af
Outflow=34.27 cfs 3.821 af

Pond DP1: Drainage Pipe 1 Peak Elev=218.26' Inflow=29.18 cfs 3.069 af
36.0" Round Culvert n=0.013 L=152.0' S=0.0132 '/' Outflow=29.18 cfs 3.069 af

Total Runoff Area = 15.771 ac Runoff Volume = 4.003 af Average Runoff Depth = 3.05"
84.43% Pervious = 13.315 ac 15.57% Impervious = 2.456 ac

Summary for Subcatchment S1: I-495

Runoff = 29.18 cfs @ 12.27 hrs, Volume= 3.069 af, Depth= 3.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
239,500	70	Woods, Good, HSG C
86,000	98	Paved parking, HSG C
105,500	30	Woods, Good, HSG A
431,000	66	Weighted Average
345,000		80.05% Pervious Area
86,000		19.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
13.3	550	0.0190	0.69		**Shallow Concentrated Flow, 495 Inner Ramp** Woodland Kv= 5.0 fps
19.6	600	Total			

Summary for Subcatchment S2: King Street

Runoff = 0.98 cfs @ 12.08 hrs, Volume= 0.081 af, Depth= 7.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
5,700	98	Paved parking, HSG C
5,700		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.19		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.9	180	0.0280	3.40		**Shallow Concentrated Flow, Subcatchment 2** Paved Kv= 20.3 fps
1.6	230	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S3: 242 King St House

Runoff = 8.75 cfs @ 12.10 hrs, Volume= 0.671 af, Depth= 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
86,500	30	Woods, Good, HSG A
14,500	98	Paved parking, HSG A
39,800	77	Woods, Good, HSG D
15,800	70	Woods, Good, HSG C
156,600	52	Weighted Average
142,100		90.74% Pervious Area
14,500		9.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	50	0.3600	0.32		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.18"
2.8	215	0.0650	1.27		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.4	265	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S4: Beaver Brook

Runoff = 0.96 cfs @ 12.56 hrs, Volume= 0.182 af, Depth= 1.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
75,700	30	Woods, Good, HSG A
800	98	Paved parking, HSG A
5,400	70	Woods, Good, HSG C
11,800	77	Woods, Good, HSG D
93,700	39	Weighted Average
92,900		99.15% Pervious Area
800		0.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.6	50	0.0040	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
2.1	160	0.0640	1.26		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.6	191	0.0190	0.69		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
30.3	401	Total			

Summary for Reach Wetland: Beaver Brook

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 15.771 ac, 15.57% Impervious, Inflow Depth = 3.05" for 100 Yr 24 Hr event
Inflow = 34.69 cfs @ 12.28 hrs, Volume= 4.003 af
Outflow = 34.69 cfs @ 12.28 hrs, Volume= 4.003 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: Drainage Pipe 1

Inflow Area = 0.131 ac,100.00% Impervious, Inflow Depth = 7.41" for 100 Yr 24 Hr event
Inflow = 0.98 cfs @ 12.08 hrs, Volume= 0.081 af
Outflow = 0.98 cfs @ 12.08 hrs, Volume= 0.081 af, Atten= 0%, Lag= 0.0 min
Primary = 0.98 cfs @ 12.08 hrs, Volume= 0.081 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 235.51' @ 12.08 hrs
Flood Elev= 239.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Catch Basin** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 235.00' / 214.00' S= 0.1382 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=0.98 cfs @ 12.08 hrs HW=235.51' (Free Discharge)
↑**1=Catch Basin** (Inlet Controls 0.98 cfs @ 2.43 fps)

Summary for Pond DB: 242 King -Low-Lying Area

Inflow Area = 13.620 ac, 17.90% Impervious, Inflow Depth = 3.37" for 100 Yr 24 Hr event
Inflow = 34.47 cfs @ 12.26 hrs, Volume= 3.821 af
Outflow = 34.27 cfs @ 12.28 hrs, Volume= 3.821 af, Atten= 1%, Lag= 1.1 min
Primary = 34.27 cfs @ 12.28 hrs, Volume= 3.821 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Starting Elev= 211.00' Surf.Area= 26,000 sf Storage= 45,400 cf
Peak Elev= 211.05' @ 12.28 hrs Surf.Area= 26,387 sf Storage= 46,792 cf (1,392 cf above start)

Plug-Flow detention time= 148.3 min calculated for 2.779 af (73% of inflow)
Center-of-Mass det. time= 0.5 min (849.7 - 849.3)

Volume	Invert	Avail.Storage	Storage Description
#1	208.50'	75,040 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.50	5,300	0	0
209.00	14,500	4,950	4,950
210.00	20,200	17,350	22,300
211.00	26,000	23,100	45,400
212.00	33,280	29,640	75,040

Device	Routing	Invert	Outlet Devices
#1	Primary	210.50'	**67.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00

2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65
2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=34.36 cfs @ 12.28 hrs HW=211.05' TW=211.00' (Fixed TW Elev= 211.00')
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 34.36 cfs @ 0.93 fps)

Summary for Pond DP1: Drainage Pipe 1

Inflow Area = 9.894 ac, 19.95% Impervious, Inflow Depth = 3.72" for 100 Yr 24 Hr event
Inflow = 29.18 cfs @ 12.27 hrs, Volume= 3.069 af
Outflow = 29.18 cfs @ 12.27 hrs, Volume= 3.069 af, Atten= 0%, Lag= 0.0 min
Primary = 29.18 cfs @ 12.27 hrs, Volume= 3.069 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 218.26' @ 12.27 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	216.00'	**36.0" Round Culvert** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 214.00' S= 0.0132 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=29.18 cfs @ 12.27 hrs HW=218.26' (Free Discharge)
↑**1=Culvert** (Inlet Controls 29.18 cfs @ 5.12 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: I-495 Runoff Area=431,000 sf 19.95% Impervious Runoff Depth=4.13"
Flow Length=600' Tc=19.6 min CN=66 Runoff=32.46 cfs 3.406 af

SubcatchmentS2: King Street Runoff Area=5,700 sf 100.00% Impervious Runoff Depth=7.91"
Flow Length=230' Tc=6.0 min CN=98 Runoff=1.05 cfs 0.086 af

SubcatchmentS3: 242 King St House Runoff Area=156,600 sf 9.26% Impervious Runoff Depth=2.56"
Flow Length=265' Tc=6.0 min CN=52 Runoff=10.15 cfs 0.766 af

SubcatchmentS4: Beaver Brook Runoff Area=93,700 sf 0.85% Impervious Runoff Depth=1.22"
Flow Length=401' Tc=30.3 min CN=39 Runoff=1.24 cfs 0.219 af

Reach Wetland: Beaver Brook Inflow=38.80 cfs 4.477 af
Outflow=38.80 cfs 4.477 af

Pond 1P: Drainage Pipe 1 Peak Elev=235.53' Inflow=1.05 cfs 0.086 af
12.0" Round Culvert n=0.013 L=152.0' S=0.1382 '/' Outflow=1.05 cfs 0.086 af

Pond DB: 242 King -Low-Lying Area Peak Elev=211.07' Storage=47,121 cf Inflow=38.47 cfs 4.259 af
Outflow=38.17 cfs 4.259 af

Pond DP1: Drainage Pipe 1 Peak Elev=218.43' Inflow=32.46 cfs 3.406 af
36.0" Round Culvert n=0.013 L=152.0' S=0.0132 '/' Outflow=32.46 cfs 3.406 af

Total Runoff Area = 15.771 ac Runoff Volume = 4.477 af Average Runoff Depth = 3.41"
84.43% Pervious = 13.315 ac 15.57% Impervious = 2.456 ac

Summary for Subcatchment S1: I-495

Runoff = 32.46 cfs @ 12.27 hrs, Volume= 3.406 af, Depth= 4.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070, 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
239,500	70	Woods, Good, HSG C
86,000	98	Paved parking, HSG C
105,500	30	Woods, Good, HSG A
431,000	66	Weighted Average
345,000		80.05% Pervious Area
86,000		19.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
13.3	550	0.0190	0.69		**Shallow Concentrated Flow, 495 Inner Ramp** Woodland Kv= 5.0 fps
19.6	600	Total			

Summary for Subcatchment S2: King Street

Runoff = 1.05 cfs @ 12.08 hrs, Volume= 0.086 af, Depth= 7.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070, 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
5,700	98	Paved parking, HSG C
5,700		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.19		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.9	180	0.0280	3.40		**Shallow Concentrated Flow, Subcatchment 2** Paved Kv= 20.3 fps
1.6	230	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S3: 242 King St House

Runoff = 10.15 cfs @ 12.10 hrs, Volume= 0.766 af, Depth= 2.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070, 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
86,500	30	Woods, Good, HSG A
14,500	98	Paved parking, HSG A
39,800	77	Woods, Good, HSG D
15,800	70	Woods, Good, HSG C
156,600	52	Weighted Average
142,100		90.74% Pervious Area
14,500		9.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	50	0.3600	0.32		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.18"
2.8	215	0.0650	1.27		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.4	265	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S4: Beaver Brook

Runoff = 1.24 cfs @ 12.56 hrs, Volume= 0.219 af, Depth= 1.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070, 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
75,700	30	Woods, Good, HSG A
800	98	Paved parking, HSG A
5,400	70	Woods, Good, HSG C
11,800	77	Woods, Good, HSG D
93,700	39	Weighted Average
92,900		99.15% Pervious Area
800		0.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.6	50	0.0040	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
2.1	160	0.0640	1.26		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.6	191	0.0190	0.69		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
30.3	401	Total			

Summary for Reach Wetland: Beaver Brook

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 15.771 ac, 15.57% Impervious, Inflow Depth = 3.41" for 2070, 50 Yr 24 Hr event
Inflow = 38.80 cfs @ 12.29 hrs, Volume= 4.477 af
Outflow = 38.80 cfs @ 12.29 hrs, Volume= 4.477 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: Drainage Pipe 1

Inflow Area = 0.131 ac,100.00% Impervious, Inflow Depth = 7.91" for 2070, 50 Yr 24 Hr event
Inflow = 1.05 cfs @ 12.08 hrs, Volume= 0.086 af
Outflow = 1.05 cfs @ 12.08 hrs, Volume= 0.086 af, Atten= 0%, Lag= 0.0 min
Primary = 1.05 cfs @ 12.08 hrs, Volume= 0.086 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 235.53' @ 12.08 hrs
Flood Elev= 239.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Catch Basin** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 235.00' / 214.00' S= 0.1382 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=1.04 cfs @ 12.08 hrs HW=235.53' (Free Discharge)
↑—**1=Catch Basin** (Inlet Controls 1.04 cfs @ 2.48 fps)

Summary for Pond DB: 242 King -Low-Lying Area

Inflow Area = 13.620 ac, 17.90% Impervious, Inflow Depth = 3.75" for 2070, 50 Yr 24 Hr event
Inflow = 38.47 cfs @ 12.26 hrs, Volume= 4.259 af
Outflow = 38.17 cfs @ 12.28 hrs, Volume= 4.259 af, Atten= 1%, Lag= 1.3 min
Primary = 38.17 cfs @ 12.28 hrs, Volume= 4.259 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Starting Elev= 211.00' Surf.Area= 26,000 sf Storage= 45,400 cf
Peak Elev= 211.07' @ 12.28 hrs Surf.Area= 26,477 sf Storage= 47,121 cf (1,721 cf above start)

Plug-Flow detention time= 135.9 min calculated for 3.216 af (76% of inflow)
Center-of-Mass det. time= 0.5 min (846.8 - 846.3)

Volume	Invert	Avail.Storage	Storage Description
#1	208.50'	75,040 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.50	5,300	0	0
209.00	14,500	4,950	4,950
210.00	20,200	17,350	22,300
211.00	26,000	23,100	45,400
212.00	33,280	29,640	75,040

Device	Routing	Invert	Outlet Devices
#1	Primary	210.50'	**67.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00

2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65
2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=38.29 cfs @ 12.28 hrs HW=211.07' TW=211.00' (Fixed TW Elev= 211.00')
└**1=Broad-Crested Rectangular Weir** (Weir Controls 38.29 cfs @ 1.01 fps)

Summary for Pond DP1: Drainage Pipe 1

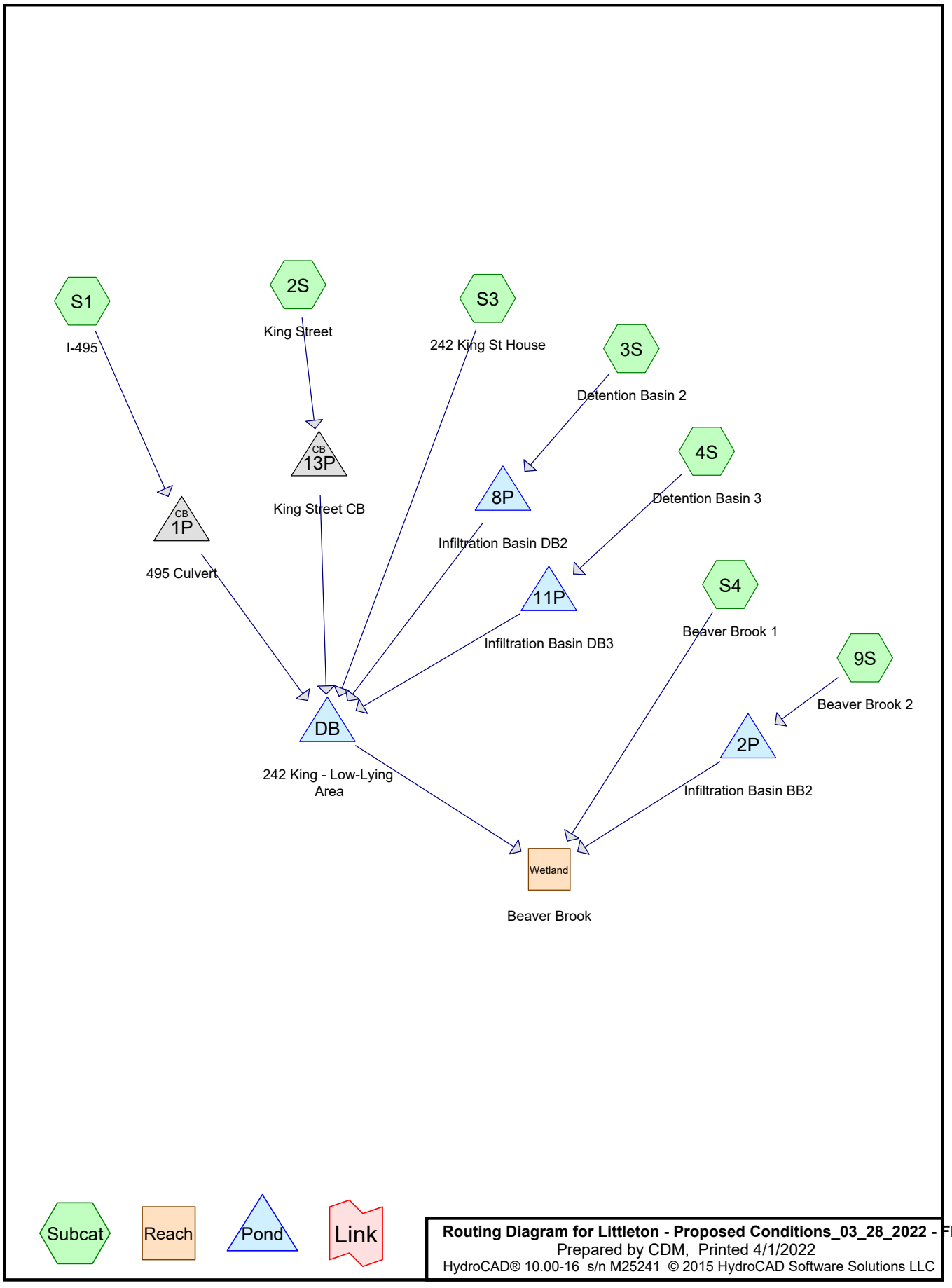
Inflow Area = 9.894 ac, 19.95% Impervious, Inflow Depth = 4.13" for 2070, 50 Yr 24 Hr event
Inflow = 32.46 cfs @ 12.27 hrs, Volume= 3.406 af
Outflow = 32.46 cfs @ 12.27 hrs, Volume= 3.406 af, Atten= 0%, Lag= 0.0 min
Primary = 32.46 cfs @ 12.27 hrs, Volume= 3.406 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 218.43' @ 12.27 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	216.00'	**36.0" Round Culvert** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 214.00' S= 0.0132 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=32.49 cfs @ 12.27 hrs HW=218.43' (Free Discharge)
└**1=Culvert** (Inlet Controls 32.49 cfs @ 5.30 fps)

Proposed HydroCAD Model with 100-Year Flood



Routing Diagram for Littleton - Proposed Conditions_03_28_2022 - Fl
Prepared by CDM, Printed 4/1/2022

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2S: King Street Runoff Area=5,700 sf 100.00% Impervious Runoff Depth=2.95"
Flow Length=230' Tc=6.0 min CN=98 Runoff=0.40 cfs 0.032 af

Subcatchment3S: Detention Basin 2 Runoff Area=48,900 sf 32.92% Impervious Runoff Depth=0.44"
Flow Length=263' Tc=10.1 min CN=61 Runoff=0.30 cfs 0.041 af

Subcatchment4S: Detention Basin 3 Runoff Area=20,200 sf 36.14% Impervious Runoff Depth=0.87"
Flow Length=182' Tc=6.0 min CN=71 Runoff=0.43 cfs 0.033 af

Subcatchment9S: Beaver Brook 2 Runoff Area=24,400 sf 43.85% Impervious Runoff Depth=1.32"
Flow Length=190' Tc=6.0 min CN=79 Runoff=0.85 cfs 0.062 af

SubcatchmentS1: I-495 Runoff Area=431,000 sf 19.95% Impervious Runoff Depth=0.63"
Flow Length=600' Tc=19.6 min CN=66 Runoff=4.00 cfs 0.522 af

SubcatchmentS3: 242 King St House Runoff Area=120,200 sf 0.00% Impervious Runoff Depth=0.03"
Flow Length=126' Tc=6.0 min CN=44 Runoff=0.01 cfs 0.007 af

SubcatchmentS4: Beaver Brook 1 Runoff Area=36,600 sf 12.30% Impervious Runoff Depth=0.27"
Flow Length=153' Tc=6.1 min CN=56 Runoff=0.10 cfs 0.019 af

Reach Wetland: Beaver Brook Inflow=3.88 cfs 0.580 af
Outflow=3.88 cfs 0.580 af

Pond 1P: 495 Culvert Peak Elev=216.73' Inflow=4.00 cfs 0.522 af
36.0" Round Culvert n=0.013 L=152.0' S=0.0132 '/' Outflow=4.00 cfs 0.522 af

Pond 2P: Infiltration Basin BB2 Peak Elev=212.07' Storage=851 cf Inflow=0.85 cfs 0.062 af
Discarded=0.17 cfs 0.062 af Primary=0.00 cfs 0.000 af Outflow=0.17 cfs 0.062 af

Pond 8P: Infiltration Basin DB2 Peak Elev=211.83' Storage=442 cf Inflow=0.30 cfs 0.041 af
Discarded=0.07 cfs 0.041 af Primary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.041 af

Pond 11P: Infiltration Basin DB3 Peak Elev=212.05' Storage=674 cf Inflow=0.43 cfs 0.033 af
Discarded=0.03 cfs 0.033 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.033 af

Pond 13P: King Street CB Peak Elev=235.31' Inflow=0.40 cfs 0.032 af
12.0" Round Culvert n=0.013 L=68.0' S=0.3088 '/' Outflow=0.40 cfs 0.032 af

Pond DB: 242 King - Low-Lying Area Peak Elev=211.04' Storage=49,244 cf Inflow=4.15 cfs 0.561 af
72.0" x 18.0" Box Culvert n=0.011 L=55.0' S=0.0136 '/' Outflow=3.79 cfs 0.561 af

Total Runoff Area = 15.771 ac Runoff Volume = 0.716 af Average Runoff Depth = 0.54"
81.03% Pervious = 12.780 ac 18.97% Impervious = 2.991 ac

Summary for Subcatchment 2S: King Street

Runoff = 0.40 cfs @ 12.08 hrs, Volume= 0.032 af, Depth= 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
5,700	98	Paved parking, HSG C
5,700		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.19		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.9	180	0.0280	3.40		**Shallow Concentrated Flow, Subcatchment 2** Paved Kv= 20.3 fps
1.6	230	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3S: Detention Basin 2

Runoff = 0.30 cfs @ 12.19 hrs, Volume= 0.041 af, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
500	76	Gravel roads, HSG A
14,900	98	Paved parking, HSG A
1,200	98	Paved parking, HSG D
21,600	39	>75% Grass cover, Good, HSG A
5,900	30	Woods, Good, HSG A
900	80	>75% Grass cover, Good, HSG D
3,900	70	Woods, Good, HSG C
48,900	61	Weighted Average
32,800		67.08% Pervious Area
16,100		32.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	23	0.0220	0.32		**Sheet Flow,** Fallow n= 0.050 P2= 3.18"
5.2	27	0.0070	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.18"
3.7	213	0.0040	0.95		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
10.1	263	Total			

Summary for Subcatchment 4S: Detention Basin 3

Runoff = 0.43 cfs @ 12.10 hrs, Volume= 0.033 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
7,100	39	>75% Grass cover, Good, HSG A
1,800	70	Woods, Good, HSG C
4,000	80	>75% Grass cover, Good, HSG D
3,200	98	Paved parking, HSG A
1,300	98	Paved parking, HSG C
2,800	98	Paved parking, HSG D
20,200	71	Weighted Average
12,900		63.86% Pervious Area
7,300		36.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0300	1.40		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.5	102	0.0340	3.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	30	0.1500	5.81		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.2	182	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 9S: Beaver Brook 2

Runoff = 0.85 cfs @ 12.09 hrs, Volume= 0.062 af, Depth= 1.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
4,700	39	>75% Grass cover, Good, HSG A
6,200	98	Paved parking, HSG A
500	76	Gravel roads, HSG A
1,900	70	Woods, Good, HSG C
6,600	80	>75% Grass cover, Good, HSG D
4,500	98	Paved parking, HSG D
24,400	79	Weighted Average
13,700		56.15% Pervious Area
10,700		43.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.2300	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
0.2	20	0.0750	1.37		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	120	0.0320	2.68		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
5.6	190	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S1: I-495

Runoff = 4.00 cfs @ 12.33 hrs, Volume= 0.522 af, Depth= 0.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
239,500	70	Woods, Good, HSG C
86,000	98	Paved parking, HSG C
105,500	30	Woods, Good, HSG A
431,000	66	Weighted Average
345,000		80.05% Pervious Area
86,000		19.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
13.3	550	0.0190	0.69		**Shallow Concentrated Flow, 495 Inner Ramp** Woodland Kv= 5.0 fps
19.6	600	Total			

Summary for Subcatchment S3: 242 King St House

Runoff = 0.01 cfs @ 16.70 hrs, Volume= 0.007 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
67,200	30	Woods, Good, HSG A
18,200	39	>75% Grass cover, Good, HSG A
16,800	80	>75% Grass cover, Good, HSG D
18,000	70	Woods, Good, HSG C
120,200	44	Weighted Average
120,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	50	0.3800	0.22		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
1.6	76	0.1050	0.81		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
5.4	126	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S4: Beaver Brook 1

Runoff = 0.10 cfs @ 12.31 hrs, Volume= 0.019 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Yr 24 Hr Rainfall=3.18"

Area (sf)	CN	Description
16,200	30	Woods, Good, HSG A
2,500	70	Woods, Good, HSG C
6,000	77	Woods, Good, HSG D
4,500	98	Paved parking, HSG A
2,000	39	>75% Grass cover, Good, HSG A
5,400	77	Woods, Good, HSG D
36,600	56	Weighted Average
32,100		87.70% Pervious Area
4,500		12.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.2300	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
1.4	103	0.0580	1.20		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.1	153	Total			

Summary for Reach Wetland: Beaver Brook

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 15.771 ac, 18.97% Impervious, Inflow Depth = 0.44" for 2 Yr 24 Hr event
Inflow = 3.88 cfs @ 12.43 hrs, Volume= 0.580 af
Outflow = 3.88 cfs @ 12.43 hrs, Volume= 0.580 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: 495 Culvert

Inflow Area = 9.894 ac, 19.95% Impervious, Inflow Depth = 0.63" for 2 Yr 24 Hr event
Inflow = 4.00 cfs @ 12.33 hrs, Volume= 0.522 af
Outflow = 4.00 cfs @ 12.33 hrs, Volume= 0.522 af, Atten= 0%, Lag= 0.0 min
Primary = 4.00 cfs @ 12.33 hrs, Volume= 0.522 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 216.73' @ 12.33 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	216.00'	**36.0" Round Culvert** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 214.00' S= 0.0132 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=3.89 cfs @ 12.33 hrs HW=216.73' (Free Discharge)
1=Culvert (Inlet Controls 3.89 cfs @ 2.91 fps)

Summary for Pond 2P: Infiltration Basin BB2

Inflow Area = 0.560 ac, 43.85% Impervious, Inflow Depth = 1.32" for 2 Yr 24 Hr event
Inflow = 0.85 cfs @ 12.09 hrs, Volume= 0.062 af
Outflow = 0.17 cfs @ 12.56 hrs, Volume= 0.062 af, Atten= 80%, Lag= 27.8 min
Discarded = 0.17 cfs @ 12.56 hrs, Volume= 0.062 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.07' @ 12.56 hrs Surf.Area= 2,701 sf Storage= 851 cf
Flood Elev= 213.00' Surf.Area= 3,578 sf Storage= 3,763 cf

Plug-Flow detention time= 46.9 min calculated for 0.062 af (100% of inflow)
Center-of-Mass det. time= 46.9 min (893.2 - 846.3)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	3,763 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	2,632	658	658
213.00	3,578	3,105	3,763

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**2.410 in/hr Exfiltration over Horizontal area**

Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.17 cfs @ 12.56 hrs HW=212.07' (Free Discharge)
2=Exfiltration (Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=211.50' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 8P: Infiltration Basin DB2

Inflow Area = 1.123 ac, 32.92% Impervious, Inflow Depth = 0.44" for 2 Yr 24 Hr event
Inflow = 0.30 cfs @ 12.19 hrs, Volume= 0.041 af
Outflow = 0.07 cfs @ 13.38 hrs, Volume= 0.041 af, Atten= 77%, Lag= 71.0 min
Discarded = 0.07 cfs @ 13.38 hrs, Volume= 0.041 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 211.83' @ 13.38 hrs Surf.Area= 2,718 sf Storage= 442 cf
Flood Elev= 213.00' Surf.Area= 5,128 sf Storage= 5,696 cf

Plug-Flow detention time= 78.6 min calculated for 0.041 af (100% of inflow)
Center-of-Mass det. time= 78.5 min (997.9 - 919.4)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	5,696 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	4,176	1,044	1,044
213.00	5,128	4,652	5,696

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**1.020 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.07 cfs @ 13.38 hrs HW=211.83' (Free Discharge)
2=Exfiltration (Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=211.50' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 11P: Infiltration Basin DB3

Inflow Area = 0.464 ac, 36.14% Impervious, Inflow Depth = 0.87" for 2 Yr 24 Hr event
Inflow = 0.43 cfs @ 12.10 hrs, Volume= 0.033 af
Outflow = 0.03 cfs @ 14.90 hrs, Volume= 0.033 af, Atten= 93%, Lag= 167.9 min
Discarded = 0.03 cfs @ 14.90 hrs, Volume= 0.033 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.05' @ 14.90 hrs Surf.Area= 2,303 sf Storage= 674 cf
Flood Elev= 213.00' Surf.Area= 2,932 sf Storage= 3,170 cf

Plug-Flow detention time= 275.4 min calculated for 0.033 af (100% of inflow)
Center-of-Mass det. time= 275.4 min (1,148.1 - 872.7)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	3,170 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	2,272	568	568
213.00	2,932	2,602	3,170

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**0.520 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.03 cfs @ 14.90 hrs HW=212.05' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=211.50' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 13P: King Street CB

Inflow Area = 0.131 ac,100.00% Impervious, Inflow Depth = 2.95" for 2 Yr 24 Hr event
Inflow = 0.40 cfs @ 12.08 hrs, Volume= 0.032 af
Outflow = 0.40 cfs @ 12.08 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min
Primary = 0.40 cfs @ 12.08 hrs, Volume= 0.032 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 235.31' @ 12.08 hrs
Flood Elev= 239.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Culvert** L= 68.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 235.00' / 214.00' S= 0.3088 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=0.40 cfs @ 12.08 hrs HW=235.31' (Free Discharge)
1=Culvert (Inlet Controls 0.40 cfs @ 1.91 fps)

Summary for Pond DB: 242 King - Low-Lying Area

Inflow Area = 14.371 ac, 18.39% Impervious, Inflow Depth = 0.47" for 2 Yr 24 Hr event
Inflow = 4.15 cfs @ 12.33 hrs, Volume= 0.561 af
Outflow = 3.79 cfs @ 12.44 hrs, Volume= 0.561 af, Atten= 9%, Lag= 6.7 min
Primary = 3.79 cfs @ 12.44 hrs, Volume= 0.561 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Starting Elev= 211.00' Surf.Area= 25,383 sf Storage= 48,295 cf
Peak Elev= 211.04' @ 12.44 hrs Surf.Area= 25,529 sf Storage= 49,244 cf (949 cf above start)
Flood Elev= 212.00' Surf.Area= 29,293 sf Storage= 75,633 cf (27,338 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 3.3 min (902.0 - 898.8)

Volume	Invert	Avail.Storage	Storage Description
#1	208.50'	75,633 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.50	4,120	0	0
209.00	17,266	5,347	5,347
210.00	21,624	19,445	24,792
211.00	25,383	23,504	48,295
212.00	29,293	27,338	75,633

Device	Routing	Invert	Outlet Devices
#1	Primary	210.25'	**72.0" W x 18.0" H Box Culvert** L= 55.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 210.25' / 209.50' S= 0.0136 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 9.00 sf

Primary OutFlow Max=3.88 cfs @ 12.44 hrs HW=211.04' TW=211.00' (Fixed TW Elev= 211.00')
1=Culvert (Outlet Controls 3.88 cfs @ 1.10 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2S: King Street Runoff Area=5,700 sf 100.00% Impervious Runoff Depth=4.67"
Flow Length=230' Tc=6.0 min CN=98 Runoff=0.63 cfs 0.051 af

Subcatchment3S: Detention Basin 2 Runoff Area=48,900 sf 32.92% Impervious Runoff Depth=1.32"
Flow Length=263' Tc=10.1 min CN=61 Runoff=1.35 cfs 0.123 af

Subcatchment4S: Detention Basin 3 Runoff Area=20,200 sf 36.14% Impervious Runoff Depth=2.05"
Flow Length=182' Tc=6.0 min CN=71 Runoff=1.10 cfs 0.079 af

Subcatchment9S: Beaver Brook 2 Runoff Area=24,400 sf 43.85% Impervious Runoff Depth=2.72"
Flow Length=190' Tc=6.0 min CN=79 Runoff=1.79 cfs 0.127 af

SubcatchmentS1: I-495 Runoff Area=431,000 sf 19.95% Impervious Runoff Depth=1.67"
Flow Length=600' Tc=19.6 min CN=66 Runoff=12.47 cfs 1.374 af

SubcatchmentS3: 242 King St House Runoff Area=120,200 sf 0.00% Impervious Runoff Depth=0.37"
Flow Length=126' Tc=6.0 min CN=44 Runoff=0.41 cfs 0.085 af

SubcatchmentS4: Beaver Brook 1 Runoff Area=36,600 sf 12.30% Impervious Runoff Depth=1.00"
Flow Length=153' Tc=6.1 min CN=56 Runoff=0.79 cfs 0.070 af

Reach Wetland: Beaver Brook Inflow=12.15 cfs 1.664 af
Outflow=12.15 cfs 1.664 af

Pond 1P: 495 Culvert Peak Elev=217.36' Inflow=12.47 cfs 1.374 af
36.0" Round Culvert n=0.013 L=152.0' S=0.0132 '/' Outflow=12.47 cfs 1.374 af

Pond 2P: Infiltration Basin BB2 Peak Elev=212.22' Storage=1,264 cf Inflow=1.79 cfs 0.127 af
Discarded=0.19 cfs 0.097 af Primary=0.99 cfs 0.030 af Outflow=1.18 cfs 0.127 af

Pond 8P: Infiltration Basin DB2 Peak Elev=212.16' Storage=1,713 cf Inflow=1.35 cfs 0.123 af
Discarded=0.12 cfs 0.102 af Primary=0.32 cfs 0.021 af Outflow=0.44 cfs 0.123 af

Pond 11P: Infiltration Basin DB3 Peak Elev=212.18' Storage=990 cf Inflow=1.10 cfs 0.079 af
Discarded=0.03 cfs 0.046 af Primary=0.54 cfs 0.033 af Outflow=0.58 cfs 0.079 af

Pond 13P: King Street CB Peak Elev=235.40' Inflow=0.63 cfs 0.051 af
12.0" Round Culvert n=0.013 L=68.0' S=0.3088 '/' Outflow=0.63 cfs 0.051 af

Pond DB: 242 King - Low-Lying Area Peak Elev=211.20' Storage=53,573 cf Inflow=13.65 cfs 1.564 af
72.0" x 18.0" Box Culvert n=0.011 L=55.0' S=0.0136 '/' Outflow=11.30 cfs 1.564 af

Total Runoff Area = 15.771 ac Runoff Volume = 1.909 af Average Runoff Depth = 1.45"
81.03% Pervious = 12.780 ac 18.97% Impervious = 2.991 ac

Summary for Subcatchment 2S: King Street

Runoff = 0.63 cfs @ 12.08 hrs, Volume= 0.051 af, Depth= 4.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
5,700	98	Paved parking, HSG C
5,700		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.19		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.9	180	0.0280	3.40		**Shallow Concentrated Flow, Subcatchment 2** Paved Kv= 20.3 fps
1.6	230	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3S: Detention Basin 2

Runoff = 1.35 cfs @ 12.16 hrs, Volume= 0.123 af, Depth= 1.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
500	76	Gravel roads, HSG A
14,900	98	Paved parking, HSG A
1,200	98	Paved parking, HSG D
21,600	39	>75% Grass cover, Good, HSG A
5,900	30	Woods, Good, HSG A
900	80	>75% Grass cover, Good, HSG D
3,900	70	Woods, Good, HSG C
48,900	61	Weighted Average
32,800		67.08% Pervious Area
16,100		32.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	23	0.0220	0.32		**Sheet Flow,** Fallow n= 0.050 P2= 3.18"
5.2	27	0.0070	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.18"
3.7	213	0.0040	0.95		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
10.1	263	Total			

Summary for Subcatchment 4S: Detention Basin 3

Runoff = 1.10 cfs @ 12.09 hrs, Volume= 0.079 af, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
7,100	39	>75% Grass cover, Good, HSG A
1,800	70	Woods, Good, HSG C
4,000	80	>75% Grass cover, Good, HSG D
3,200	98	Paved parking, HSG A
1,300	98	Paved parking, HSG C
2,800	98	Paved parking, HSG D
20,200	71	Weighted Average
12,900		63.86% Pervious Area
7,300		36.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0300	1.40		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.5	102	0.0340	3.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	30	0.1500	5.81		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.2	182	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 9S: Beaver Brook 2

Runoff = 1.79 cfs @ 12.09 hrs, Volume= 0.127 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
4,700	39	>75% Grass cover, Good, HSG A
6,200	98	Paved parking, HSG A
500	76	Gravel roads, HSG A
1,900	70	Woods, Good, HSG C
6,600	80	>75% Grass cover, Good, HSG D
4,500	98	Paved parking, HSG D
24,400	79	Weighted Average
13,700		56.15% Pervious Area
10,700		43.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.2300	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
0.2	20	0.0750	1.37		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	120	0.0320	2.68		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
5.6	190	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S1: I-495

Runoff = 12.47 cfs @ 12.30 hrs, Volume= 1.374 af, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
239,500	70	Woods, Good, HSG C
86,000	98	Paved parking, HSG C
105,500	30	Woods, Good, HSG A
431,000	66	Weighted Average
345,000		80.05% Pervious Area
86,000		19.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
13.3	550	0.0190	0.69		**Shallow Concentrated Flow, 495 Inner Ramp** Woodland Kv= 5.0 fps
19.6	600	Total			

Summary for Subcatchment S3: 242 King St House

Runoff = 0.41 cfs @ 12.34 hrs, Volume= 0.085 af, Depth= 0.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
67,200	30	Woods, Good, HSG A
18,200	39	>75% Grass cover, Good, HSG A
16,800	80	>75% Grass cover, Good, HSG D
18,000	70	Woods, Good, HSG C
120,200	44	Weighted Average
120,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	50	0.3800	0.22		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
1.6	76	0.1050	0.81		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
5.4	126	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S4: Beaver Brook 1

Runoff = 0.79 cfs @ 12.11 hrs, Volume= 0.070 af, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Yr 24 Hr Rainfall=4.91"

Area (sf)	CN	Description
16,200	30	Woods, Good, HSG A
2,500	70	Woods, Good, HSG C
6,000	77	Woods, Good, HSG D
4,500	98	Paved parking, HSG A
2,000	39	>75% Grass cover, Good, HSG A
5,400	77	Woods, Good, HSG D
36,600	56	Weighted Average
32,100		87.70% Pervious Area
4,500		12.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.2300	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
1.4	103	0.0580	1.20		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.1	153	Total			

Summary for Reach Wetland: Beaver Brook

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 15.771 ac, 18.97% Impervious, Inflow Depth = 1.27" for 10 Yr 24 Hr event
Inflow = 12.15 cfs @ 12.42 hrs, Volume= 1.664 af
Outflow = 12.15 cfs @ 12.42 hrs, Volume= 1.664 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: 495 Culvert

Inflow Area = 9.894 ac, 19.95% Impervious, Inflow Depth = 1.67" for 10 Yr 24 Hr event
Inflow = 12.47 cfs @ 12.30 hrs, Volume= 1.374 af
Outflow = 12.47 cfs @ 12.30 hrs, Volume= 1.374 af, Atten= 0%, Lag= 0.0 min
Primary = 12.47 cfs @ 12.30 hrs, Volume= 1.374 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 217.36' @ 12.30 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	216.00'	**36.0" Round Culvert** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 214.00' S= 0.0132 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=12.43 cfs @ 12.30 hrs HW=217.36' (Free Discharge)
1=Culvert (Inlet Controls 12.43 cfs @ 3.98 fps)

Summary for Pond 2P: Infiltration Basin BB2

Inflow Area = 0.560 ac, 43.85% Impervious, Inflow Depth = 2.72" for 10 Yr 24 Hr event
Inflow = 1.79 cfs @ 12.09 hrs, Volume= 0.127 af
Outflow = 1.18 cfs @ 12.18 hrs, Volume= 0.127 af, Atten= 34%, Lag= 5.5 min
Discarded = 0.19 cfs @ 12.18 hrs, Volume= 0.097 af
Primary = 0.99 cfs @ 12.18 hrs, Volume= 0.030 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.22' @ 12.18 hrs Surf.Area= 2,842 sf Storage= 1,264 cf
Flood Elev= 213.00' Surf.Area= 3,578 sf Storage= 3,763 cf

Plug-Flow detention time= 43.7 min calculated for 0.127 af (100% of inflow)
Center-of-Mass det. time= 43.7 min (869.0 - 825.3)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	3,763 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	2,632	658	658
213.00	3,578	3,105	3,763

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**2.410 in/hr Exfiltration over Horizontal area**

Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.19 cfs @ 12.18 hrs HW=212.22' (Free Discharge)
2=Exfiltration (Controls 0.19 cfs)

Primary OutFlow Max=0.99 cfs @ 12.18 hrs HW=212.22' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.99 cfs @ 0.82 fps)

Summary for Pond 8P: Infiltration Basin DB2

Inflow Area = 1.123 ac, 32.92% Impervious, Inflow Depth = 1.32" for 10 Yr 24 Hr event
Inflow = 1.35 cfs @ 12.16 hrs, Volume= 0.123 af
Outflow = 0.44 cfs @ 12.58 hrs, Volume= 0.123 af, Atten= 67%, Lag= 25.7 min
Discarded = 0.12 cfs @ 12.58 hrs, Volume= 0.102 af
Primary = 0.32 cfs @ 12.58 hrs, Volume= 0.021 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.16' @ 12.58 hrs Surf.Area= 4,326 sf Storage= 1,713 cf
Flood Elev= 213.00' Surf.Area= 5,128 sf Storage= 5,696 cf

Plug-Flow detention time= 136.3 min calculated for 0.123 af (100% of inflow)
Center-of-Mass det. time= 136.3 min (1,013.8 - 877.4)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	5,696 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	4,176	1,044	1,044
213.00	5,128	4,652	5,696

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**1.020 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.12 cfs @ 12.58 hrs HW=212.16' (Free Discharge)
2=Exfiltration (Controls 0.12 cfs)

Primary OutFlow Max=0.32 cfs @ 12.58 hrs HW=212.16' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.32 cfs @ 0.56 fps)

Summary for Pond 11P: Infiltration Basin DB3

Inflow Area = 0.464 ac, 36.14% Impervious, Inflow Depth = 2.05" for 10 Yr 24 Hr event
Inflow = 1.10 cfs @ 12.09 hrs, Volume= 0.079 af
Outflow = 0.58 cfs @ 12.25 hrs, Volume= 0.079 af, Atten= 48%, Lag= 9.6 min
Discarded = 0.03 cfs @ 12.25 hrs, Volume= 0.046 af
Primary = 0.54 cfs @ 12.25 hrs, Volume= 0.033 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.18' @ 12.25 hrs Surf.Area= 2,392 sf Storage= 990 cf
Flood Elev= 213.00' Surf.Area= 2,932 sf Storage= 3,170 cf

Plug-Flow detention time= 196.1 min calculated for 0.079 af (100% of inflow)
Center-of-Mass det. time= 196.2 min (1,042.3 - 846.1)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	3,170 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	2,272	568	568
213.00	2,932	2,602	3,170

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**0.520 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.03 cfs @ 12.25 hrs HW=212.18' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.54 cfs @ 12.25 hrs HW=212.18' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.54 cfs @ 0.67 fps)

Summary for Pond 13P: King Street CB

Inflow Area = 0.131 ac,100.00% Impervious, Inflow Depth = 4.67" for 10 Yr 24 Hr event
Inflow = 0.63 cfs @ 12.08 hrs, Volume= 0.051 af
Outflow = 0.63 cfs @ 12.08 hrs, Volume= 0.051 af, Atten= 0%, Lag= 0.0 min
Primary = 0.63 cfs @ 12.08 hrs, Volume= 0.051 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 235.40' @ 12.08 hrs
Flood Elev= 239.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Culvert** L= 68.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 235.00' / 214.00' S= 0.3088 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=0.63 cfs @ 12.08 hrs HW=235.40' (Free Discharge)
└**1=Culvert** (Inlet Controls 0.63 cfs @ 2.15 fps)

Summary for Pond DB: 242 King - Low-Lying Area

Inflow Area = 14.371 ac, 18.39% Impervious, Inflow Depth = 1.31" for 10 Yr 24 Hr event
Inflow = 13.65 cfs @ 12.29 hrs, Volume= 1.564 af
Outflow = 11.30 cfs @ 12.45 hrs, Volume= 1.564 af, Atten= 17%, Lag= 9.4 min
Primary = 11.30 cfs @ 12.45 hrs, Volume= 1.564 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Starting Elev= 211.00' Surf.Area= 25,383 sf Storage= 48,295 cf
Peak Elev= 211.20' @ 12.45 hrs Surf.Area= 26,183 sf Storage= 53,573 cf (5,278 cf above start)
Flood Elev= 212.00' Surf.Area= 29,293 sf Storage= 75,633 cf (27,338 cf above start)

Plug-Flow detention time= 397.5 min calculated for 0.455 af (29% of inflow)
Center-of-Mass det. time= 4.7 min (874.4 - 869.6)

Volume	Invert	Avail.Storage	Storage Description
#1	208.50'	75,633 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.50	4,120	0	0
209.00	17,266	5,347	5,347
210.00	21,624	19,445	24,792
211.00	25,383	23,504	48,295
212.00	29,293	27,338	75,633

Device	Routing	Invert	Outlet Devices
#1	Primary	210.25'	**72.0" W x 18.0" H Box Culvert** L= 55.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 210.25' / 209.50' S= 0.0136 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 9.00 sf

Primary OutFlow Max=11.30 cfs @ 12.45 hrs HW=211.20' TW=211.00' (Fixed TW Elev= 211.00')
└**1=Culvert** (Outlet Controls 11.30 cfs @ 2.63 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2S: King Street Runoff Area=5,700 sf 100.00% Impervious Runoff Depth=7.41"
Flow Length=230' Tc=6.0 min CN=98 Runoff=0.98 cfs 0.081 af

Subcatchment3S: Detention Basin 2 Runoff Area=48,900 sf 32.92% Impervious Runoff Depth=3.18"
Flow Length=263' Tc=10.1 min CN=61 Runoff=3.58 cfs 0.297 af

Subcatchment4S: Detention Basin 3 Runoff Area=20,200 sf 36.14% Impervious Runoff Depth=4.28"
Flow Length=182' Tc=6.0 min CN=71 Runoff=2.33 cfs 0.165 af

Subcatchment9S: Beaver Brook 2 Runoff Area=24,400 sf 43.85% Impervious Runoff Depth=5.18"
Flow Length=190' Tc=6.0 min CN=79 Runoff=3.37 cfs 0.242 af

SubcatchmentS1: I-495 Runoff Area=431,000 sf 19.95% Impervious Runoff Depth=3.72"
Flow Length=600' Tc=19.6 min CN=66 Runoff=29.18 cfs 3.069 af

SubcatchmentS3: 242 King St House Runoff Area=120,200 sf 0.00% Impervious Runoff Depth=1.46"
Flow Length=126' Tc=6.0 min CN=44 Runoff=3.73 cfs 0.336 af

SubcatchmentS4: Beaver Brook 1 Runoff Area=36,600 sf 12.30% Impervious Runoff Depth=2.65"
Flow Length=153' Tc=6.1 min CN=56 Runoff=2.50 cfs 0.186 af

Reach Wetland: Beaver Brook Inflow=30.24 cfs 4.042 af
Outflow=30.24 cfs 4.042 af

Pond 1P: 495 Culvert Peak Elev=218.26' Inflow=29.18 cfs 3.069 af
36.0" Round Culvert n=0.013 L=152.0' S=0.0132 '/' Outflow=29.18 cfs 3.069 af

Pond 2P: Infiltration Basin BB2 Peak Elev=212.34' Storage=1,610 cf Inflow=3.37 cfs 0.242 af
Discarded=0.20 cfs 0.141 af Primary=2.81 cfs 0.101 af Outflow=3.01 cfs 0.242 af

Pond 8P: Infiltration Basin DB2 Peak Elev=212.34' Storage=2,501 cf Inflow=3.58 cfs 0.297 af
Discarded=0.13 cfs 0.139 af Primary=2.72 cfs 0.159 af Outflow=2.85 cfs 0.297 af

Pond 11P: Infiltration Basin DB3 Peak Elev=212.30' Storage=1,273 cf Inflow=2.33 cfs 0.165 af
Discarded=0.04 cfs 0.055 af Primary=2.05 cfs 0.110 af Outflow=2.09 cfs 0.165 af

Pond 13P: King Street CB Peak Elev=235.51' Inflow=0.98 cfs 0.081 af
12.0" Round Culvert n=0.013 L=68.0' S=0.3088 '/' Outflow=0.98 cfs 0.081 af

Pond DB: 242 King - Low-Lying Area Peak Elev=211.67' Storage=66,158 cf Inflow=35.98 cfs 3.755 af
72.0" x 18.0" Box Culvert n=0.011 L=55.0' S=0.0136 '/' Outflow=28.27 cfs 3.755 af

Total Runoff Area = 15.771 ac Runoff Volume = 4.377 af Average Runoff Depth = 3.33"
81.03% Pervious = 12.780 ac 18.97% Impervious = 2.991 ac

Summary for Subcatchment 2S: King Street

Runoff = 0.98 cfs @ 12.08 hrs, Volume= 0.081 af, Depth= 7.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
5,700	98	Paved parking, HSG C
5,700		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.19		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.9	180	0.0280	3.40		**Shallow Concentrated Flow, Subcatchment 2** Paved Kv= 20.3 fps
1.6	230	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3S: Detention Basin 2

Runoff = 3.58 cfs @ 12.15 hrs, Volume= 0.297 af, Depth= 3.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
500	76	Gravel roads, HSG A
14,900	98	Paved parking, HSG A
1,200	98	Paved parking, HSG D
21,600	39	>75% Grass cover, Good, HSG A
5,900	30	Woods, Good, HSG A
900	80	>75% Grass cover, Good, HSG D
3,900	70	Woods, Good, HSG C
48,900	61	Weighted Average
32,800		67.08% Pervious Area
16,100		32.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	23	0.0220	0.32		**Sheet Flow,** Fallow n= 0.050 P2= 3.18"
5.2	27	0.0070	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.18"
3.7	213	0.0040	0.95		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
10.1	263	Total			

Summary for Subcatchment 4S: Detention Basin 3

Runoff = 2.33 cfs @ 12.09 hrs, Volume= 0.165 af, Depth= 4.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
7,100	39	>75% Grass cover, Good, HSG A
1,800	70	Woods, Good, HSG C
4,000	80	>75% Grass cover, Good, HSG D
3,200	98	Paved parking, HSG A
1,300	98	Paved parking, HSG C
2,800	98	Paved parking, HSG D
20,200	71	Weighted Average
12,900		63.86% Pervious Area
7,300		36.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0300	1.40		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.5	102	0.0340	3.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	30	0.1500	5.81		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.2	182	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 9S: Beaver Brook 2

Runoff = 3.37 cfs @ 12.09 hrs, Volume= 0.242 af, Depth= 5.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
4,700	39	>75% Grass cover, Good, HSG A
6,200	98	Paved parking, HSG A
500	76	Gravel roads, HSG A
1,900	70	Woods, Good, HSG C
6,600	80	>75% Grass cover, Good, HSG D
4,500	98	Paved parking, HSG D
24,400	79	Weighted Average
13,700		56.15% Pervious Area
10,700		43.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.2300	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
0.2	20	0.0750	1.37		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	120	0.0320	2.68		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
5.6	190	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S1: I-495

Runoff = 29.18 cfs @ 12.27 hrs, Volume= 3.069 af, Depth= 3.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
239,500	70	Woods, Good, HSG C
86,000	98	Paved parking, HSG C
105,500	30	Woods, Good, HSG A
431,000	66	Weighted Average
345,000		80.05% Pervious Area
86,000		19.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
13.3	550	0.0190	0.69		**Shallow Concentrated Flow, 495 Inner Ramp** Woodland Kv= 5.0 fps
19.6	600	Total			

Summary for Subcatchment S3: 242 King St House

Runoff = 3.73 cfs @ 12.11 hrs, Volume= 0.336 af, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
67,200	30	Woods, Good, HSG A
18,200	39	>75% Grass cover, Good, HSG A
16,800	80	>75% Grass cover, Good, HSG D
18,000	70	Woods, Good, HSG C
120,200	44	Weighted Average
120,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	50	0.3800	0.22		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
1.6	76	0.1050	0.81		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
5.4	126	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S4: Beaver Brook 1

Runoff = 2.50 cfs @ 12.10 hrs, Volume= 0.186 af, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Yr 24 Hr Rainfall=7.65"

Area (sf)	CN	Description
16,200	30	Woods, Good, HSG A
2,500	70	Woods, Good, HSG C
6,000	77	Woods, Good, HSG D
4,500	98	Paved parking, HSG A
2,000	39	>75% Grass cover, Good, HSG A
5,400	77	Woods, Good, HSG D
36,600	56	Weighted Average
32,100		87.70% Pervious Area
4,500		12.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.2300	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
1.4	103	0.0580	1.20		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.1	153	Total			

Summary for Reach Wetland: Beaver Brook

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 15.771 ac, 18.97% Impervious, Inflow Depth = 3.08" for 100 Yr 24 Hr event
Inflow = 30.24 cfs @ 12.41 hrs, Volume= 4.042 af
Outflow = 30.24 cfs @ 12.41 hrs, Volume= 4.042 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: 495 Culvert

Inflow Area = 9.894 ac, 19.95% Impervious, Inflow Depth = 3.72" for 100 Yr 24 Hr event
Inflow = 29.18 cfs @ 12.27 hrs, Volume= 3.069 af
Outflow = 29.18 cfs @ 12.27 hrs, Volume= 3.069 af, Atten= 0%, Lag= 0.0 min
Primary = 29.18 cfs @ 12.27 hrs, Volume= 3.069 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 218.26' @ 12.27 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	216.00'	**36.0" Round Culvert** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 214.00' S= 0.0132 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=29.18 cfs @ 12.27 hrs HW=218.26' (Free Discharge)
1=Culvert (Inlet Controls 29.18 cfs @ 5.12 fps)

Summary for Pond 2P: Infiltration Basin BB2

Inflow Area = 0.560 ac, 43.85% Impervious, Inflow Depth = 5.18" for 100 Yr 24 Hr event
Inflow = 3.37 cfs @ 12.09 hrs, Volume= 0.242 af
Outflow = 3.01 cfs @ 12.13 hrs, Volume= 0.242 af, Atten= 11%, Lag= 2.4 min
Discarded = 0.20 cfs @ 12.13 hrs, Volume= 0.141 af
Primary = 2.81 cfs @ 12.13 hrs, Volume= 0.101 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.34' @ 12.13 hrs Surf.Area= 2,954 sf Storage= 1,610 cf
Flood Elev= 213.00' Surf.Area= 3,578 sf Storage= 3,763 cf

Plug-Flow detention time= 37.9 min calculated for 0.242 af (100% of inflow)
Center-of-Mass det. time= 37.9 min (844.8 - 806.9)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	3,763 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	2,632	658	658
213.00	3,578	3,105	3,763

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**2.410 in/hr Exfiltration over Horizontal area**

Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.20 cfs @ 12.13 hrs HW=212.34' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.20 cfs)

Primary OutFlow Max=2.80 cfs @ 12.13 hrs HW=212.34' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 2.80 cfs @ 1.16 fps)

Summary for Pond 8P: Infiltration Basin DB2

Inflow Area =	1.123 ac,	32.92% Impervious,	Inflow Depth =	3.18"	for 100 Yr 24 Hr event
Inflow =	3.58 cfs @	12.15 hrs,	Volume=	0.297 af	
Outflow =	2.85 cfs @	12.23 hrs,	Volume=	0.297 af,	Atten= 20%, Lag= 5.3 min
Discarded =	0.13 cfs @	12.23 hrs,	Volume=	0.139 af	
Primary =	2.72 cfs @	12.23 hrs,	Volume=	0.159 af	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.34' @ 12.23 hrs Surf.Area= 4,496 sf Storage= 2,501 cf
Flood Elev= 213.00' Surf.Area= 5,128 sf Storage= 5,696 cf

Plug-Flow detention time= 86.6 min calculated for 0.297 af (100% of inflow)
Center-of-Mass det. time= 86.7 min (936.8 - 850.1)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	5,696 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	4,176	1,044	1,044
213.00	5,128	4,652	5,696

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**1.020 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.13 cfs @ 12.23 hrs HW=212.34' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.13 cfs)

Primary OutFlow Max=2.72 cfs @ 12.23 hrs HW=212.34' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 2.72 cfs @ 1.15 fps)

Summary for Pond 11P: Infiltration Basin DB3

Inflow Area = 0.464 ac, 36.14% Impervious, Inflow Depth = 4.28" for 100 Yr 24 Hr event
Inflow = 2.33 cfs @ 12.09 hrs, Volume= 0.165 af
Outflow = 2.09 cfs @ 12.13 hrs, Volume= 0.165 af, Atten= 10%, Lag= 2.4 min
Discarded = 0.04 cfs @ 12.13 hrs, Volume= 0.055 af
Primary = 2.05 cfs @ 12.13 hrs, Volume= 0.110 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.30' @ 12.13 hrs Surf.Area= 2,468 sf Storage= 1,273 cf
Flood Elev= 213.00' Surf.Area= 2,932 sf Storage= 3,170 cf

Plug-Flow detention time= 118.1 min calculated for 0.165 af (100% of inflow)
Center-of-Mass det. time= 118.2 min (942.9 - 824.7)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	3,170 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	2,272	568	568
213.00	2,932	2,602	3,170

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**0.520 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.04 cfs @ 12.13 hrs HW=212.30' (Free Discharge)
↑**2=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=2.05 cfs @ 12.13 hrs HW=212.30' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 2.05 cfs @ 1.04 fps)

Summary for Pond 13P: King Street CB

Inflow Area = 0.131 ac,100.00% Impervious, Inflow Depth = 7.41" for 100 Yr 24 Hr event
Inflow = 0.98 cfs @ 12.08 hrs, Volume= 0.081 af
Outflow = 0.98 cfs @ 12.08 hrs, Volume= 0.081 af, Atten= 0%, Lag= 0.0 min
Primary = 0.98 cfs @ 12.08 hrs, Volume= 0.081 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 235.51' @ 12.08 hrs
Flood Elev= 239.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Culvert** L= 68.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 235.00' / 214.00' S= 0.3088 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=0.98 cfs @ 12.08 hrs HW=235.51' (Free Discharge)
1=Culvert (Inlet Controls 0.98 cfs @ 2.43 fps)

Summary for Pond DB: 242 King - Low-Lying Area

Inflow Area = 14.371 ac, 18.39% Impervious, Inflow Depth = 3.14" for 100 Yr 24 Hr event
Inflow = 35.98 cfs @ 12.26 hrs, Volume= 3.755 af
Outflow = 28.27 cfs @ 12.43 hrs, Volume= 3.755 af, Atten= 21%, Lag= 10.0 min
Primary = 28.27 cfs @ 12.43 hrs, Volume= 3.755 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Starting Elev= 211.00' Surf.Area= 25,383 sf Storage= 48,295 cf
Peak Elev= 211.67' @ 12.43 hrs Surf.Area= 28,000 sf Storage= 66,158 cf (17,863 cf above start)
Flood Elev= 212.00' Surf.Area= 29,293 sf Storage= 75,633 cf (27,338 cf above start)

Plug-Flow detention time= 158.8 min calculated for 2.646 af (70% of inflow)
Center-of-Mass det. time= 6.6 min (852.0 - 845.4)

Volume	Invert	Avail.Storage	Storage Description
#1	208.50'	75,633 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.50	4,120	0	0
209.00	17,266	5,347	5,347
210.00	21,624	19,445	24,792
211.00	25,383	23,504	48,295
212.00	29,293	27,338	75,633

Device	Routing	Invert	Outlet Devices
#1	Primary	210.25'	**72.0" W x 18.0" H Box Culvert** L= 55.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 210.25' / 209.50' S= 0.0136 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 9.00 sf

Primary OutFlow Max=28.27 cfs @ 12.43 hrs HW=211.67' TW=211.00' (Fixed TW Elev= 211.00')
1=Culvert (Inlet Controls 28.27 cfs @ 3.32 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2S: King Street Runoff Area=5,700 sf 100.00% Impervious Runoff Depth=7.91"
Flow Length=230' Tc=6.0 min CN=98 Runoff=1.05 cfs 0.086 af

Subcatchment3S: Detention Basin 2 Runoff Area=48,900 sf 32.92% Impervious Runoff Depth=3.56"
Flow Length=263' Tc=10.1 min CN=61 Runoff=4.03 cfs 0.333 af

Subcatchment4S: Detention Basin 3 Runoff Area=20,200 sf 36.14% Impervious Runoff Depth=4.71"
Flow Length=182' Tc=6.0 min CN=71 Runoff=2.56 cfs 0.182 af

Subcatchment9S: Beaver Brook 2 Runoff Area=24,400 sf 43.85% Impervious Runoff Depth=5.65"
Flow Length=190' Tc=6.0 min CN=79 Runoff=3.66 cfs 0.264 af

SubcatchmentS1: I-495 Runoff Area=431,000 sf 19.95% Impervious Runoff Depth=4.13"
Flow Length=600' Tc=19.6 min CN=66 Runoff=32.46 cfs 3.406 af

SubcatchmentS3: 242 King St House Runoff Area=120,200 sf 0.00% Impervious Runoff Depth=1.71"
Flow Length=126' Tc=6.0 min CN=44 Runoff=4.59 cfs 0.394 af

SubcatchmentS4: Beaver Brook 1 Runoff Area=36,600 sf 12.30% Impervious Runoff Depth=3.00"
Flow Length=153' Tc=6.1 min CN=56 Runoff=2.85 cfs 0.210 af

Reach Wetland: Beaver Brook Inflow=33.88 cfs 4.527 af
Outflow=33.88 cfs 4.527 af

Pond 1P: 495 Culvert Peak Elev=218.43' Inflow=32.46 cfs 3.406 af
36.0" Round Culvert n=0.013 L=152.0' S=0.0132 '/' Outflow=32.46 cfs 3.406 af

Pond 2P: Infiltration Basin BB2 Peak Elev=212.36' Storage=1,655 cf Inflow=3.66 cfs 0.264 af
Discarded=0.21 cfs 0.148 af Primary=3.09 cfs 0.116 af Outflow=3.30 cfs 0.264 af

Pond 8P: Infiltration Basin DB2 Peak Elev=212.36' Storage=2,625 cf Inflow=4.03 cfs 0.333 af
Discarded=0.13 cfs 0.144 af Primary=3.23 cfs 0.189 af Outflow=3.37 cfs 0.333 af

Pond 11P: Infiltration Basin DB3 Peak Elev=212.31' Storage=1,307 cf Inflow=2.56 cfs 0.182 af
Discarded=0.04 cfs 0.056 af Primary=2.28 cfs 0.126 af Outflow=2.32 cfs 0.182 af

Pond 13P: King Street CB Peak Elev=235.53' Inflow=1.05 cfs 0.086 af
12.0" Round Culvert n=0.013 L=68.0' S=0.3088 '/' Outflow=1.05 cfs 0.086 af

Pond DB: 242 King - Low-Lying Area Peak Elev=211.76' Storage=68,753 cf Inflow=40.30 cfs 4.201 af
72.0" x 18.0" Box Culvert n=0.011 L=55.0' S=0.0136 '/' Outflow=31.67 cfs 4.201 af

Total Runoff Area = 15.771 ac Runoff Volume = 4.875 af Average Runoff Depth = 3.71"
81.03% Pervious = 12.780 ac 18.97% Impervious = 2.991 ac

Summary for Subcatchment 2S: King Street

Runoff = 1.05 cfs @ 12.08 hrs, Volume= 0.086 af, Depth= 7.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
5,700	98	Paved parking, HSG C
5,700		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.19		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.9	180	0.0280	3.40		**Shallow Concentrated Flow, Subcatchment 2** Paved Kv= 20.3 fps
1.6	230	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3S: Detention Basin 2

Runoff = 4.03 cfs @ 12.15 hrs, Volume= 0.333 af, Depth= 3.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
500	76	Gravel roads, HSG A
14,900	98	Paved parking, HSG A
1,200	98	Paved parking, HSG D
21,600	39	>75% Grass cover, Good, HSG A
5,900	30	Woods, Good, HSG A
900	80	>75% Grass cover, Good, HSG D
3,900	70	Woods, Good, HSG C
48,900	61	Weighted Average
32,800		67.08% Pervious Area
16,100		32.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	23	0.0220	0.32		**Sheet Flow,** Fallow n= 0.050 P2= 3.18"
5.2	27	0.0070	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.18"
3.7	213	0.0040	0.95		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
10.1	263	Total			

Summary for Subcatchment 4S: Detention Basin 3

Runoff = 2.56 cfs @ 12.09 hrs, Volume= 0.182 af, Depth= 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
7,100	39	>75% Grass cover, Good, HSG A
1,800	70	Woods, Good, HSG C
4,000	80	>75% Grass cover, Good, HSG D
3,200	98	Paved parking, HSG A
1,300	98	Paved parking, HSG C
2,800	98	Paved parking, HSG D
20,200	71	Weighted Average
12,900		63.86% Pervious Area
7,300		36.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0300	1.40		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.18"
0.5	102	0.0340	3.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	30	0.1500	5.81		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.2	182	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 9S: Beaver Brook 2

Runoff = 3.66 cfs @ 12.09 hrs, Volume= 0.264 af, Depth= 5.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
4,700	39	>75% Grass cover, Good, HSG A
6,200	98	Paved parking, HSG A
500	76	Gravel roads, HSG A
1,900	70	Woods, Good, HSG C
6,600	80	>75% Grass cover, Good, HSG D
4,500	98	Paved parking, HSG D
24,400	79	Weighted Average
13,700		56.15% Pervious Area
10,700		43.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.2300	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
0.2	20	0.0750	1.37		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	120	0.0320	2.68		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
5.6	190	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S1: I-495

Runoff = 32.46 cfs @ 12.27 hrs, Volume= 3.406 af, Depth= 4.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
239,500	70	Woods, Good, HSG C
86,000	98	Paved parking, HSG C
105,500	30	Woods, Good, HSG A
431,000	66	Weighted Average
345,000		80.05% Pervious Area
86,000		19.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
13.3	550	0.0190	0.69		**Shallow Concentrated Flow, 495 Inner Ramp** Woodland Kv= 5.0 fps
19.6	600	Total			

Summary for Subcatchment S3: 242 King St House

Runoff = 4.59 cfs @ 12.10 hrs, Volume= 0.394 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
67,200	30	Woods, Good, HSG A
18,200	39	>75% Grass cover, Good, HSG A
16,800	80	>75% Grass cover, Good, HSG D
18,000	70	Woods, Good, HSG C
120,200	44	Weighted Average
120,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	50	0.3800	0.22		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
1.6	76	0.1050	0.81		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
5.4	126	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S4: Beaver Brook 1

Runoff = 2.85 cfs @ 12.10 hrs, Volume= 0.210 af, Depth= 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2070 50 Yr 24 Hr Rainfall=8.15"

Area (sf)	CN	Description
16,200	30	Woods, Good, HSG A
2,500	70	Woods, Good, HSG C
6,000	77	Woods, Good, HSG D
4,500	98	Paved parking, HSG A
2,000	39	>75% Grass cover, Good, HSG A
5,400	77	Woods, Good, HSG D
36,600	56	Weighted Average
32,100		87.70% Pervious Area
4,500		12.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.2300	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.18"
1.4	103	0.0580	1.20		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.1	153	Total			

Summary for Reach Wetland: Beaver Brook

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 15.771 ac, 18.97% Impervious, Inflow Depth = 3.44" for 2070 50 Yr 24 Hr event
Inflow = 33.88 cfs @ 12.40 hrs, Volume= 4.527 af
Outflow = 33.88 cfs @ 12.40 hrs, Volume= 4.527 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: 495 Culvert

Inflow Area = 9.894 ac, 19.95% Impervious, Inflow Depth = 4.13" for 2070 50 Yr 24 Hr event
Inflow = 32.46 cfs @ 12.27 hrs, Volume= 3.406 af
Outflow = 32.46 cfs @ 12.27 hrs, Volume= 3.406 af, Atten= 0%, Lag= 0.0 min
Primary = 32.46 cfs @ 12.27 hrs, Volume= 3.406 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 218.43' @ 12.27 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	216.00'	**36.0" Round Culvert** L= 152.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 214.00' S= 0.0132 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf

Primary OutFlow Max=32.49 cfs @ 12.27 hrs HW=218.43' (Free Discharge)
1=Culvert (Inlet Controls 32.49 cfs @ 5.30 fps)

Summary for Pond 2P: Infiltration Basin BB2

Inflow Area = 0.560 ac, 43.85% Impervious, Inflow Depth = 5.65" for 2070 50 Yr 24 Hr event
Inflow = 3.66 cfs @ 12.09 hrs, Volume= 0.264 af
Outflow = 3.30 cfs @ 12.13 hrs, Volume= 0.264 af, Atten= 10%, Lag= 2.3 min
Discarded = 0.21 cfs @ 12.13 hrs, Volume= 0.148 af
Primary = 3.09 cfs @ 12.13 hrs, Volume= 0.116 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.36' @ 12.13 hrs Surf.Area= 2,969 sf Storage= 1,655 cf
Flood Elev= 213.00' Surf.Area= 3,578 sf Storage= 3,763 cf

Plug-Flow detention time= 37.1 min calculated for 0.264 af (100% of inflow)
Center-of-Mass det. time= 37.1 min (841.6 - 804.5)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	3,763 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	2,632	658	658
213.00	3,578	3,105	3,763

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**2.410 in/hr Exfiltration over Horizontal area**

Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.21 cfs @ 12.13 hrs HW=212.36' (Free Discharge)
2=Exfiltration (Controls 0.21 cfs)

Primary OutFlow Max=3.08 cfs @ 12.13 hrs HW=212.36' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 3.08 cfs @ 1.21 fps)

Summary for Pond 8P: Infiltration Basin DB2

Inflow Area = 1.123 ac, 32.92% Impervious, Inflow Depth = 3.56" for 2070 50 Yr 24 Hr event
Inflow = 4.03 cfs @ 12.15 hrs, Volume= 0.333 af
Outflow = 3.37 cfs @ 12.22 hrs, Volume= 0.333 af, Atten= 16%, Lag= 4.4 min
Discarded = 0.13 cfs @ 12.22 hrs, Volume= 0.144 af
Primary = 3.23 cfs @ 12.22 hrs, Volume= 0.189 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.36' @ 12.22 hrs Surf.Area= 4,522 sf Storage= 2,625 cf
Flood Elev= 213.00' Surf.Area= 5,128 sf Storage= 5,696 cf

Plug-Flow detention time= 81.8 min calculated for 0.333 af (100% of inflow)
Center-of-Mass det. time= 81.8 min (928.6 - 846.8)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	5,696 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	4,176	1,044	1,044
213.00	5,128	4,652	5,696

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**1.020 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.13 cfs @ 12.22 hrs HW=212.36' (Free Discharge)
2=Exfiltration (Controls 0.13 cfs)

Primary OutFlow Max=3.23 cfs @ 12.22 hrs HW=212.36' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 3.23 cfs @ 1.23 fps)

Summary for Pond 11P: Infiltration Basin DB3

Inflow Area = 0.464 ac, 36.14% Impervious, Inflow Depth = 4.71" for 2070 50 Yr 24 Hr event
Inflow = 2.56 cfs @ 12.09 hrs, Volume= 0.182 af
Outflow = 2.32 cfs @ 12.13 hrs, Volume= 0.182 af, Atten= 9%, Lag= 2.3 min
Discarded = 0.04 cfs @ 12.13 hrs, Volume= 0.056 af
Primary = 2.28 cfs @ 12.13 hrs, Volume= 0.126 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 212.31' @ 12.13 hrs Surf.Area= 2,477 sf Storage= 1,307 cf
Flood Elev= 213.00' Surf.Area= 2,932 sf Storage= 3,170 cf

Plug-Flow detention time= 109.5 min calculated for 0.182 af (100% of inflow)
Center-of-Mass det. time= 109.5 min (931.4 - 821.9)

Volume	Invert	Avail.Storage	Storage Description
#1	211.50'	3,170 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
211.50	0	0	0
212.00	2,272	568	568
213.00	2,932	2,602	3,170

Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	211.50'	**0.520 in/hr Exfiltration over Horizontal area** Conductivity to Groundwater Elevation = 209.50' Phase-In= 0.01'

Discarded OutFlow Max=0.04 cfs @ 12.13 hrs HW=212.31' (Free Discharge)
↑**2=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=2.28 cfs @ 12.13 hrs HW=212.31' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 2.28 cfs @ 1.08 fps)

Summary for Pond 13P: King Street CB

Inflow Area = 0.131 ac,100.00% Impervious, Inflow Depth = 7.91" for 2070 50 Yr 24 Hr event
Inflow = 1.05 cfs @ 12.08 hrs, Volume= 0.086 af
Outflow = 1.05 cfs @ 12.08 hrs, Volume= 0.086 af, Atten= 0%, Lag= 0.0 min
Primary = 1.05 cfs @ 12.08 hrs, Volume= 0.086 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 235.53' @ 12.08 hrs
Flood Elev= 239.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Culvert** L= 68.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 235.00' / 214.00' S= 0.3088 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=1.04 cfs @ 12.08 hrs HW=235.53' (Free Discharge)
└**1=Culvert** (Inlet Controls 1.04 cfs @ 2.48 fps)

Summary for Pond DB: 242 King - Low-Lying Area

Inflow Area = 14.371 ac, 18.39% Impervious, Inflow Depth = 3.51" for 2070 50 Yr 24 Hr event
Inflow = 40.30 cfs @ 12.26 hrs, Volume= 4.201 af
Outflow = 31.67 cfs @ 12.42 hrs, Volume= 4.201 af, Atten= 21%, Lag= 9.8 min
Primary = 31.67 cfs @ 12.42 hrs, Volume= 4.201 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Starting Elev= 211.00' Surf.Area= 25,383 sf Storage= 48,295 cf
Peak Elev= 211.76' @ 12.42 hrs Surf.Area= 28,360 sf Storage= 68,753 cf (20,458 cf above start)
Flood Elev= 212.00' Surf.Area= 29,293 sf Storage= 75,633 cf (27,338 cf above start)

Plug-Flow detention time= 146.1 min calculated for 3.092 af (74% of inflow)
Center-of-Mass det. time= 6.8 min (849.4 - 842.6)

Volume	Invert	Avail.Storage	Storage Description
#1	208.50'	75,633 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.50	4,120	0	0
209.00	17,266	5,347	5,347
210.00	21,624	19,445	24,792
211.00	25,383	23,504	48,295
212.00	29,293	27,338	75,633

Device	Routing	Invert	Outlet Devices
#1	Primary	210.25'	**72.0" W x 18.0" H Box Culvert** L= 55.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 210.25' / 209.50' S= 0.0136 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 9.00 sf

Primary OutFlow Max=31.67 cfs @ 12.42 hrs HW=211.76' TW=211.00' (Fixed TW Elev= 211.00')
└**1=Culvert** (Inlet Controls 31.67 cfs @ 3.52 fps)

Appendix D

Recharge Volume and Water Quality Volume Compliance

Littleton WRRF
WQv and Rv Calculations

Water Quality Volume - Infiltration Basin BB2

Impervious Area:	10,673	sf
WQV Target:	1.0	in
WQv Required:	**889**	**cf**
WQv Required:	**0.020**	**af**
WQv Provided:	**926**	**cf**

Recharge Volume - Infiltration Basin BB2

Impervious Area:	10,673	sf
Rv Target:	0.60	in
Rv Required:	**534**	**cf**
Rv Required:	**0.012**	**af**
Total Volume Provided	**926**	**cf**

Drawdown Time -Infiltration Basin BB2

2.41	in/hr infiltration rate	
2,632	sf, bottom area	
926	cf, total volume provided	
1.8	hours	<72 hours, ok

Water Quality Volume -Infiltration Basin DB2

Impervious Area:	16,031	sf
WQV Target:	1.0	in
WQv Required:	**1,336**	**cf**
WQv Required:	**0.031**	**af**
WQv Provided:	**1,466**	**cf**

Recharge Volume - Infiltration Basin DB2

Impervious Area:	16,031	sf
Rv Target:	0.60	in
Rv Required:	**802**	**cf**
Rv Required:	**0.018**	**af**
Total Volume Provided	**1,466**	**cf**

Drawdown Time -Infiltration Basin DB2

1.02	in/hr infiltration rate	
4,176	sf, bottom area	
1,466	cf, total volume provided	
4.1	hours	<72 hours, ok

Water Quality Volume - Infiltration Basin DB3

Impervious Area:	7,031	sf
WQV Target:	1.0	in
WQv Required:	**586**	**cf**
WQv Required:	**0.013**	**af**
WQv Provided:	**798**	**cf**

Recharge Volume - Infiltration Basin DB3

Impervious Area:	7,031	sf
Rv Target:	0.60	in
Rv Required:	**352**	**cf**
Rv Required:	**0.008**	**af**
Total Volume Provided	**798**	**cf**

Drawdown Time -Infiltration Basin DB3

0.52	in/hr infiltration rate	
2,272	sf, bottom area	
798	cf, total volume provided	
8.1	hours	<72 hours, ok

Stage-Area-Storage for Pond 2P: Infiltration Basin BB2

Elevation (feet)	Surface (sq-ft)	Horizontal (sq-ft)	Storage (cubic-feet)
211.50	0	0	0
211.55	263	263	7
211.60	526	526	26
211.65	790	790	59
211.70	1,053	1,053	105
211.75	1,316	1,316	165
211.80	1,579	1,579	237
211.85	1,842	1,842	322
211.90	2,106	2,106	421
211.95	2,369	2,369	533
212.00	2,632	2,632	658
212.05	2,679	2,679	791
212.10	2,727	2,727	926
212.15	2,774	2,774	1,063
212.20	2,821	2,821	1,203
212.25	2,869	2,869	1,346
212.30	2,916	2,916	1,490
212.35	2,963	2,963	1,637
212.40	3,010	3,010	1,786
212.45	3,058	3,058	1,938
212.50	3,105	3,105	2,092
212.55	3,152	3,152	2,249
212.60	3,200	3,200	2,407
212.65	3,247	3,247	2,569
212.70	3,294	3,294	2,732
212.75	3,342	3,342	2,898
212.80	3,389	3,389	3,066
212.85	3,436	3,436	3,237
212.90	3,483	3,483	3,410
212.95	3,531	3,531	3,585
213.00	**3,578**	**3,578**	**3,763**

Stage-Area-Storage for Pond 8P: Infiltration Basin DB2

Elevation (feet)	Surface (sq-ft)	Horizontal (sq-ft)	Storage (cubic-feet)
211.50	0	0	0
211.55	418	418	10
211.60	835	835	42
211.65	1,253	1,253	94
211.70	1,670	1,670	167
211.75	2,088	2,088	261
211.80	2,506	2,506	376
211.85	2,923	2,923	512
211.90	3,341	3,341	668
211.95	3,758	3,758	846
212.00	4,176	4,176	1,044
212.05	4,224	4,224	1,254
212.10	4,271	4,271	1,466
212.15	4,319	4,319	1,681
212.20	4,366	4,366	1,898
212.25	4,414	4,414	2,118
212.30	4,462	4,462	2,340
212.35	4,509	4,509	2,564
212.40	4,557	4,557	2,791
212.45	4,604	4,604	3,020
212.50	4,652	4,652	3,251
212.55	4,700	4,700	3,485
212.60	4,747	4,747	3,721
212.65	4,795	4,795	3,960
212.70	4,842	4,842	4,200
212.75	4,890	4,890	4,444
212.80	4,938	4,938	4,689
212.85	4,985	4,985	4,938
212.90	5,033	5,033	5,188
212.95	5,080	5,080	5,441
213.00	**5,128**	**5,128**	**5,696**

Stage-Area-Storage for Pond 11P: Infiltration Basin DB3

Elevation (feet)	Surface (sq-ft)	Horizontal (sq-ft)	Storage (cubic-feet)
211.50	0	0	0
211.55	227	227	6
211.60	454	454	23
211.65	682	682	51
211.70	909	909	91
211.75	1,136	1,136	142
211.80	1,363	1,363	204
211.85	1,590	1,590	278
211.90	1,818	1,818	364
211.95	2,045	2,045	460
212.00	2,272	2,272	568
212.05	2,305	2,305	682
212.10	2,338	2,338	798
212.15	2,371	2,371	916
212.20	2,404	2,404	1,036
212.25	2,437	2,437	1,157
212.30	2,470	2,470	1,279
212.35	2,503	2,503	1,404
212.40	2,536	2,536	1,530
212.45	2,569	2,569	1,657
212.50	2,602	2,602	1,787
212.55	2,635	2,635	1,917
212.60	2,668	2,668	2,050
212.65	2,701	2,701	2,184
212.70	2,734	2,734	2,320
212.75	2,767	2,767	2,458
212.80	2,800	2,800	2,597
212.85	2,833	2,833	2,738
212.90	2,866	2,866	2,880
212.95	2,899	2,899	3,024
213.00	**2,932**	**2,932**	**3,170**

Appendix E

TSS Removal Spreadsheets

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Littleton WRRF - Infiltration Basin BB2

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Infiltration Basin	**0.80**	**1.00**	**0.80**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**

Total TSS Removal = **80%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: Littleton WRRF
Prepared By: DEV
Date: 3/25/2022

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Littleton WRRF - Infiltration Basin DB2

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Infiltration Basin	**0.80**	**1.00**	**0.80**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**

Total TSS Removal = **80%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: Littleton WRRF
Prepared By: DEV
Date: 3/25/2022

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location: Littleton WRRF - Infiltration Basin DB3

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Infiltration Basin	**0.80**	**1.00**	**0.80**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**

Total TSS Removal = **80%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: Littleton WRRF

Prepared By: DEV

Date: 3/25/2022

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

Appendix F

Floodplain Culvert Calculations

N

1" = 20'
10 0 20

FLOODPLAIN ELEVATION 211

LIMIT OF 200-FT RIVERFRONT AREA

Existing low-lying area

100-FT BUFFER ZONE

50-FT NO DISTURBANCE ZONE

UTILITY EASEMENT

PARCEL U36-7-0

66.8'

Existing weir at elevation 210.5 ft, L =67 ft

100-year floodplain elevation 211.0 ft

EXISTING BARN

EXISTING HOUSE

EXISTING POOL AND POOL HOUSE

MEAN ANNUAL HIGH WATER

BORING-2
BORING-3
BORING-5
BORING-6
B-MW-04
B-MW-07

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: M.DODSON
DRAWN BY: J. BRONENKANT
SHEET CHK'D BY: M.DODSON
CROSS CHK'D BY:
APPROVED BY: X
DATE: FEBRUARY 2022

CDM Smith
75 State Street, Suite 701
Boston, MA 02109
Tel: (617) 452-6000

LITTLETON
WATER DEPARTMENT

KING STREET WATER RESOURCE
RECOVERY FACILITY

CIVIL EXISTING CONDITIONS PLAN

PROJECT NO. 263387-261886
FILE NAME: C025STPL.dwg

SHEET NO.
C-2

60% SUBMITTAL - NOT FOR CONSTRUCTION

Existing Floodplain Weir

Project Description

Solve For	Discharge

Input Data

Headwater Elevation		211.00	ft
Crest Elevation		210.50	ft
Tailwater Elevation		210.50	ft
Crest Surface Type	Gravel		
Crest Breadth		5.00	ft
Crest Length		67.00	ft

Results

Discharge		63.80	ft³/s
Headwater Height Above Crest		0.50	ft
Tailwater Height Above Crest		0.00	ft
Weir Coefficient		2.69	US
Submergence Factor		1.00	
Adjusted Weir Coefficient		2.69	US
Flow Area		33.50	ft²
Velocity		1.90	ft/s
Wetted Perimeter		68.00	ft
Top Width		67.00	ft

Proposed 6 x 3 Box Culvert

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01360	ft/ft
Normal Depth	1.50	ft
Height	1.50	ft
Bottom Width	6.00	ft
Discharge	85.34	ft³/s

Results

Flow Area	9.00	ft²
Wetted Perimeter	15.00	ft
Hydraulic Radius	0.60	ft
Top Width	6.00	ft
Critical Depth	1.85	ft
Percent Full	100.0	%
Critical Slope	0.00380	ft/ft
Velocity	9.48	ft/s
Velocity Head	1.40	ft
Specific Energy	2.90	ft
Froude Number	1.36	
Discharge Full	85.34	ft³/s
Slope Full	0.01360	ft/ft
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s

Proposed 6 x 3 Box Culvert

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.50	ft
Critical Depth	1.85	ft
Channel Slope	0.01360	ft/ft
Critical Slope	0.00380	ft/ft

Appendix G

Operation and Maintenance Plan/ Long-Term Pollution Prevention Plan

Post-Construction Operation and Maintenance Plan

Project: King Street Water Resource Recovery Facility
Location: 242 King Street, Littleton, MA

Owner/Responsible Party: Littleton Water Department

This document describes the operation and maintenance activities for the proposed stormwater management facilities associated with the King Street Water Resource Recovery Facility (WRRF).

Sediment Forebay

Sediment forebays are located in the infiltration basins. Maintenance activities include the following:

- Inspect the sediment forebay monthly for sediment depth and signs of rilling and gullying, with repair being performed as needed.
- Clean out the sediment forebay at least two times per year and when sediment depth is 3 inches.
- Repair any vegetation damaged after removing the sediment. Damaged vegetation should be replaced by either reseeding or resodding. When reseeding, hydroseeding should be accompanied with a tackifier, blanket, or similar practice to ensure that no scour occurs in the forebay, while the seeds germinate and develop roots.

Infiltration Basin

The infiltration basins are located at northern end of the WRRF near the membrane process building, adjacent to the influent equalization tank, and at the entrance driveway. Maintenance activities include the following:

- Inspect the infiltration basins after every major storm (a storm equal to or greater than the 2-year, 24-hour storm) for the first three months when the infiltration basins are first put into use to ensure they are stabilized and functioning properly. If necessary, corrective action should be taken. Thereafter, the infiltration basins should be inspected at least twice per year for the following conditions:
    - Signs of differential settlement
    - Evidence of cracking or erosion,
    - Tree growth on the embankments,
    - Condition of riprap, and
    - Accumulation of sediment in the basin.
- Mow the interior side slopes and bottom at least twice a year. When mowing grasses, the grass height should be no greater than 6 inches, and no lower than 3 to 4 inches.
- Remove grass clippings, accumulated organic matter, and trash and debris at the time of mowing.
- If any surfaces are clogged, use deep tilling to break up clogged surfaces, and then the area revegetated immediately.
- Revegetate barren or eroded areas immediately after inspection to prevent additional erosion.

- Remove sediment from the basins when the depth of sediment is 3 inches. Removal should not occur until the floor of the basin is thoroughly dry. Light equipment should be used to remove the top layer so as to not compact the underlying soil. The remaining soil should be deeply tilled and revegetated as soon as possible.
- Do not use the infiltration basin for stockpiling of plowed snow and ice, compost, or any other material.

Stormwater Management Facility Inspection Form

Location: King Street Water Resource Recovery Facility
242 King Street, Littleton, MA

Inspected By:_____

Inspection Date:_____

BMP Measure	Status/Inspection	Action Taken
Sediment Forebay		
Infiltration Basin At Membrane Process Building		
Infiltration Basin At Influent Equalization Tank		
Infiltration Basin At Entrance Driveway		

Long-Term Pollution Prevention Plan

The following practices will be employed at the King Street Water Resource Recovery Facility to provide source control and pollution prevention:

1. The entrance driveway and the parking lot/loop area in front of the Membrane Process Building will be periodically swept to remove trash and debris.

2. The sediment forebays and infiltration basins will be inspected periodically to remove trash and debris.

3. No hazardous materials shall be stored outside at the site.

4. Salt and de-icing chemicals shall be used sparingly on the entrance driveway and parking lot/loop area.

5. Any spills that occur at the site shall be contained and cleaned up in a timely manner to prevent the spilled product from entering the infiltration basins.

All personnel who provide regular maintenance at the King Street Water Resource Recovery Facility shall be trained annually on the pollution prevention measures described above.